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Rocky Mountain
Forest and Range
Experiment Station

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General Technical
Report RM-226

Riparian Management:
Common Threads and Shared Interests

February 4-6, 1993
Albuquerque, New Mexico

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The purpose of this conference was to bring federal, state, and local agencies together with private sector interests to discuss strategies for an integrated approach to management of riparian areas that cross jurisdictional boundaries. The agenda combined a mixture of major speakers and panel discussions, with provision for audience participation in smaller concurrent sessions. Legal and social concerns were addressed, along with the scientific and technical.

Note

As part of the planning for this conference, we decided to process and deliver these proceedings to potential users as quickly as possible. To do this, we asked each author to assume full responsibility for submitting reviewed manuscripts in electronic format within tight deadlines. The views expressed in each paper are those of the authors, and do not necessarily reflect the views of the Water Resource Research Center, University of Arizona, or the USDA Forest Service. Trade names are occasionally used for the information and convenience of the reader, and do not imply endorsement or preferential treatment by the USDA Forest Service or other sponsoring organizations.

USDA Forest Service
General Technical Report RM-226

1993

Riparian Management: Common Threads and Shared Interests

A Western Regional Conference on River Management Strategies

February 4-6, 1993
Albuquerque, New Mexico

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Contents

Preface

Not too long ago, riparian vegetation was viewed as an enemy that must be defeated. For example, in the 1950s and 1960s water management in the Southwest emphasized water augmentation, and riparian vegetation was often viewed as wasting large quantities of water that would better be saved for human use. This concept has, however, changed radically during the past 20 years, and today it is recognized that water flowing in the stream is part of a delicate ecosystem that supports a host of ecological and social functions. Scientific and social perspectives on the values represented by riparian resources have fundamentally and radically changed.

As our values have changed so have our approaches to resource management. It is increasingly recognized that we need to think holistically, be interdisciplinary, and include both natural and human components in our definitions of ecosystems. Both the spatial and the temporal scales involved in management of riparian areas must be expanded. Working closely with all interests and the public, we need to create the conditions that will sustain the use and enjoyment of riparian systems for the benefit of future generations of humans, wildlife populations, and vegetative communities.

The successful long-term implementation of a holistic approach to riparian ecosystem management will require collaboration among different agencies and levels of government (including Indian nations) and between private and public stakeholders to define shared interests in the ecosystem. The rancher, the agency official, the scientist, the recreationist, and anyone else who shares a concern for the river will need to weave the common threads of their interests into a sturdy fabric of river management. In most cases, the new management design that will emerge will be a blend of laws, regulatory incentives, market mechanisms, and voluntary efforts. What has worked in the past will need to be replicated and augmented with bold experimental institutional designs.

Looking to share both successful and unsuccessful river management experiences and to build the foundation for creative riparian management, the riparian management conference brought together land managers, user groups, conservationists, scientists, and others interested in rivers from throughout the western US and Canada, and from Sonora, Mexico. While the primary focus for the conference sessions was on management and the social and institutional aspects of riparian management, it was also recognized that good policy design and management strategies must build upon sound science. Poster presentations highlighted the technical expertise that is currently available to riparian managers. A field trip to the Bosque del Apache Wildlife Refuge, a major stop on the North American flyway, provided an opportunity to move from theory to experience.

Participants witnessed thousands of birds, including sandhill and whooping cranes, arriving at the refuge for the evening.

Another key part of the conference was the interweaving of cultural and artistic expressions, portraying the relationships among lands, rivers, and peoples. These Interpretative Interludes recognized that values are formed and expressed by the myths, symbols, rituals and artistic expressions of particular groups. Such groups may be as specific as an agency, a business, a special interest, a river preservation group, a specific ethnic group, or as general as society as a whole. Through the Interpretive Interludes, conference attendees experienced a variety of cultural perspectives toward the land, focused upon agency views, native American expressions, and the western "cowboy" culture. The interpretive vignettes, including music, storytelling, and poetry, opened and closed each day's session and some of the major presentations.

While the Interpretive Interludes were entertaining, inspiring and educational, that was not their major purpose. They were intended to build and sustain a sense of interconnection with others and with the land and water. They provided a reflective time to consider individual and collective roles in this process and demonstrated the role that interpretation can play in communicating resource values. Throughout the Proceedings we have attempted to integrate Interpretative Interludes with the more technical materials, but it will remain impossible to capture the impact of the voices and visual images as they connected with the individual participant. In this Proceedings most of the Interludes are those which were presented at the conference. Others have, however, been substituted for ones that could not be reproduced, keeping the spirit of those Interludes.

The Interpretive Interludes were organized for the conference by Rita Cantu an Interpretive Education Specialist at the Prescott National Forest in Arizona. Joining Ms. Cantu in developing and presenting the interludes were: Arnold Rice, a Sundancer, Ceremonial Leader, and Pipe Carrier with the Yavapai Prescott Tribe, who does workshops across the country relating to cross cultural communication; Marshall Trimble, Director of Southwest Studies at Maricopa Community Colleges in Arizona as well as an entertainer and performer of cowboy songs and poems; and Hal Salwasser, Boone and Crockett Professor at the University of Montana School of Forestry.

The Water Resources Research Center (WRRC) at the University of Arizona had primary responsibility for program development and conference organization. But it was also recognized that to get a truly westwide focus and to develop the most attractive and informative program, a regional steering group would be needed. The Steering Committee met in Phoenix in April of 1992 to provide advice to the WRRC on program content and structure, and to suggest potential speakers, panelists, and sponsors. (The members of the Steering Committee are listed on page 412.) Their advice and input on several iterations of the program were integral to the ultimate interest the conference generated and to the high quality of the presentations.

In addition to the Steering Committee, we would like to thank the panelists, speakers, and poster presenters for extending and enhancing the dialogue over riparian management, and the financial and supporting cosponsors (listed on page 411) for making the conference possible.

Water Resources Research Center
Hanna J. Cortner
Barbara Tellman
Mary G. Wallace

USDA Forest Service
Leonard DeBano
Bob Hamre


Approximate general locations of watercourses discussed in this publication
1. Bluewater Creek
2. Bosque del Apache
3. Boulder Creek
4. Bridge Creek
5. Deschutes River
6. Duck Creek
7. Feather River
8. Grande Ronde River
9. Happy Valley
10 Modoc-Washoe
11. Little Bear River
12. Little Colorado River
13. Malheur Wildlife Refuge
14. Mono Lake
15. Mt. Shasta
16. Nichols Meadow
17. North Raven River
18. Oldman River
19. Pecos River
20. Rio Yaqui
21. Ruby River
22. Sacatone Spring
23. San Juan River
24. San Pedro River River
25. Santa Clara Slough
26. Santa Cruz River
27. Santa Margarita
28. Sevier River
29. Six Rivers
30. Skagit River
31. Skykomish River
32. Spencer Creek
33. Sweetwater River
34. Tanque Verde Creek
35. Tijuana
36. Verde River
37. Virgin River
Columbia River
Snake River
Sacramento River
Colorado River
Gila River
Rio Grande River

CHAPTER ONE

OVERVIEW OF RIVERS

Eventually All Things Merge Into One, and a River Runs Through It

Overview of the Rivers of the West

GREAT FATHER MEND THE HOOP OF YOUR PEOPLE

IN THE BEGINNING was the Heart Beat, the rhythm of the Universe, the Voice of the Creator, the strength and hope of the people. We are taught that this rhythm, this Voice is in all creation, and in all created are the four Sacred Powers; The Fire; Rock, Water, and Air.

IN THE BEGINNING THE CREATOR spoke and the universe came from Darkness. THE CREATOR spoke and light was separated from darkness. THE CREATOR spoke and land came up out of the waters. THE CREATOR reached to the EARTH MOTHER and from her the people were made. People of all colors; black, red, yellow and white and those colors in between. And THE CREATOR breathed life into them ... and the SACRED HOOP OF THE PEOPLE was strong.

But through the ages the people became ungrateful. They allowed themselves to become ignorant and greedy. The Hoop of the People became weak. No longer did they respect one another, nor did they care for the Earth, our Mother.

LISTEN to the Drum, the rhythm of the Universe, the Heart Beat of our Mother, the Voice of our GrandFather. And REMEMBER ... WE ARE RELATED!!

LISTEN to the Drum. This Voice is our voice. Through this Voice we will remember. We are as this corn. All Colors, All Life, All Knowledge, All Understanding, All health and Hope of the people are in the Corn. This Hoop is complete and is sacred. No one owns this Corn, no one owns the Breath of God, it is given and shared by all.

The corn was received without understanding, and the Hoop of the People was scattered. The corn given --- the corn received ---- the Hoop scattered.

The Voice of a divided people is heard - "Grandfather pity us so we can live. Because we are divided, our generation is dying. Breathe on us once again, pity us so our generation and those unborn can live. CREATOR, HEAL THE HOOP OF THE PEOPLE! MEND AND HEAL THE HOOP OF YOUR PEOPLE.

How do we mend the Hoop of the People broken by ignorance - is it solely God's responsibility - is it ours?

Arnold Rice, Yavapai-Prescott Tribe

Eventually All Things Merge Into One And A River Runs Through It

Hal Salwasser and Rita Cantu

Rivers as Allegories of Life

We are here to sing and hear the songs of rivers; to tell and listen to their stories; and to learn the lessons about how to care for the streams in our lives. There will be much discussion of the practical, the scientific, and the technical. But before we begin all this, let us pause to reflect upon why such things are important in the first place and what our obligations are as stewards of rivers and of lands that have rivers in them.

In his essay on *Song of the Gavilan*, Aldo Leopold spoke of rivers and the difference between science and ethics in understanding them. Permit us to read from the close of this short piece.

"There are men charged with the duty of examining the construction of the plants, animals, and soils which are the instruments of the great orchestra. These men are called professors. Each selects one instrument and spends his life taking it apart and describing its strings and sounding boards. This process of dismemberment is called research. The place for dismemberment is called a university.

> ***"Rivers shape our lives, the forms of our recreation, our industries, and the character and locations of our major cities. They give life to us and they take our wastes. Thus, their conditions reflect what we think about ourselves and the land"***

"A professor may pluck the strings of his own instrument, but never that of another, and if he listens for music he must never admit it to his fellows or to his students. For all are restrained by an ironbound taboo which decrees that the construction of instruments is the domain of science, while the detection of harmony is the domain of poets.

"Professors serve science and science serves progress. It serves progress so well that many of the more intricate instruments are stepped upon and broken in the rush to spread progress to all backward lands. One by one the parts are thus stricken from the song of songs. If the professor is able to classify each instrument before it is broken, he is well content.

"Science contributes moral as well as material blessings to the world. Its great moral contribution is objectivity, or the scientific point of view. This means doubting everything except facts; it means hewing to the facts, let the chips fall where they may. One of the facts hewn to by science is that every river needs more people, and all people need more inventions, and hence more science; the good life depends on the indefinite extension of this chain of logic. That the good life on any river may likewise depend on the perception of its music, and the preservation of some music to perceive, is a form of doubt not yet entertained by science.

"Science has not yet arrived on the Gavilan, so the otter plays tag in its pools and riffles and chases the fat rainbows from under its mossy banks, with never a thought for the flood that one day will scour the bank into the Pacific, or for the sportsman who will one day dispute his title to the trout. Like the scientist, he has no doubts about his own design for living. He assumes that for him the Gavilan will sing forever."

Now, certainly not all scientists and professors are like the extreme painted by Leopold. And, of course, not all scientists are men or practice their art in universities. And universities harbor people who put things together as well as those who just take things apart. But hear his essential point: one does not comprehend a river just by taking it apart or restricting its natural rhythms to those things we deem important.

So, we are here to pluck the strings of the instruments, and more. We are here to understand how the instruments fit into the orchestra, and more. We are also here to learn how to conduct the orchestra within a score transcribed by nature's rhythms and beats. We would like to learn this conducting in ways that keep all the instruments and their melodies part of the symphony.

We begin with an allegory to give context to how we think about rivers. We could have described all of this in scientific and technical terms, but we suspect it would not have had sufficient color to help us feel the message as well as hear it.

Let us turn to another, more current, allegory. Several years ago Norman MacLean wrote of a family from Montana that loved flyfishing, rivers, and life. The closing line from his book (and the recent movie of the same name) captures the essence of our conference: "Eventually, all things merge into one. And a river runs through it." Think of the symbolism behind these words. "All things merge into one" is a marvelous description of a watershed-scale ecosystem. "A river runs through it" could mean streams as integrators of all that occurs in landscapes. Or it could mean all that runs through our lives. Or it could mean the combination of our lives and the lands we live in and with. We think this latter is what MacLean had in mind. It's a rich allegory. "Eventually all things merge into one. And a river runs through it." Let us keep this in mind as we move through the conference.

Hal Salwasser is the Boone and Crockett Professor of Wildlife Conservation at the University of Montana School of Forestry in Missoula. He formerly was Director of the U.S.D.A. Forest Service's New Perspectives program in Washington D.C. He has held numerous other Forest Service positions in the area of wildlife biology. He is an active leader in the Boone and Crockett Society. His PhD is in Wildland Resource Science from the University of California at Berkeley.

Rivers anchor us to places. In fact, the names of our places are often the names of the rivers that shape the landscape: San Joaquin, Rio Grande, Bitterroot, Missouri, Madison, Snake. The list could go on.

Rivers shape our lives, the forms of our recreation, our industries, and the character and locations of our major cities. They give life to us and they take our wastes. Thus, their conditions reflect what we think about ourselves and the land. These conditions are manifestations of our land ethic. Where rivers are healthy and free flowing, full of life and energy, you can bet that the people of that place love the land and show those traits. Where rivers are fouled, dammed, dead, or tamed it probably means the people do not much care about or understand the land. And it may even show what they think about themselves and their outlook on life. Think about these points. Are they more or less true than we have suggested?

We think that they are more true than not. Thus, we will suggest that it might be useful to employ three levels of thinking about rivers and their meaning in our lives: ethics, politics, and technology. But first let us understand that all challenges we face in the stewardship of rivers and the use of their many benefits to life lie in one thing: continued growth of the human population and the need to satisfy its livelihood and well being. All else about rivers and the rest of the biosphere derives from this driving force. More people trying to achieve a higher standard of living can mean only one thing: more resources, including water, will be appropriated by humans. It is likely, as a corollary to this, that more wastes will also be produced that can foul the land and the waters. We can temper these realities through conservation and better efficiency in our use and recycling of resources. But we cannot stem the tide until there is some temperance in population growth itself. It is not our purpose to dwell on this subject here, but we cannot go forward without an explicit mention of where the challenges come from.

Now, to how we think about rivers.

A Land Ethic: The Earth's Share

On one level, we can think about how much of rivers, their flow of water, the quality of that water, the natural processes of flooding, meanders, and diversity of life should be reserved for the health of the land; the earth's share of the river if you will. Before we even begin to think about how to share in the human uses of water, land, and riverine vegetation, the earth's share should be determined, unless we don't care about rivers as part of nature's future.

Humans haven't routinely thought this way before as a society. So, this is going to be hard for some to accept. Aldo Leopold thought like this. Countless generations of Native Americans thought like this. Our Western, law-driven culture tends not to think like this. As a result some societies have already taken all the water from some rivers: the Owens in California by Los Angeles communities, the Colorado near its delta by farmers and communities. We can only surmise that this means humans have decided in these cases that the earth's share of these rivers is zero. We hope that people don't want to make many more decisions like this.

One crucial issue in determining the earth's share is a question: How can people determine this? Is it in-stream flows sufficient for the viability of native fish? Is it flows related to channel maintenance? Is it flows and quality of water related to health and diversity of aquatic and riparian ecosystems? Is it related to things unseen that scientists are just beginning to comprehend? Probably the earth's share is related to all these things.

The next question is: Who determines the answers to these questions? Public policy makers? Free markets? Scientists? Citizen advocacy groups? Private landowners? This one is not so clear. Perhaps all of these entities must participate in determining the answers, which must ultimately become public policy goals with attached mechanisms - laws, policies, regulations, institutions, incentives - for their implementation.

This last point begs a question: How are the answers specified so that people know what to do? During the past several decades the United States used laws, regulations, and a legal sledgehammer to compel people to follow environmental goals. Success was minimal in many cases. The heavy hand of government does not motivate people to positive action. Often, it only results in malicious compliance and evasion of responsibility. On the other hand, mere education without a good set of incentives for desired behavior is also likely to miss the mark. Is it time to set aside the old models of more laws and regulations enforced by a legion of lawyers and citizen zealots trained to find winners and losers and turn to some new and old ways of reaching community consensus on tough issues that affect all? We'll hear more about the use of markets and common ground approaches this week.

The bottom line of first level thinking about rivers is that the earth and future generations of people deserve a share of these precious resources. This is an ethical issue.

Rita Cantu is an Interpretive/Environmental Education Specialist at the Prescott National Forest in Arizona. She is an interpreter, teacher, song writer, author and performer. Her career has included experience as an interpretive and special events coordinator for the National Park Service and the Forest Service, and independent consulting. She is the author of two publications and has produced three albums of original music interpreting regional lands and cultures.

Leopold gave us the term for it: - "land ethics." Before we move on to shared uses and technologies for management, let us learn to allow the earth its share of the water.

Shared Uses and the Politics of Rivers

A second level of thinking could be about how people share in the uses of water and lands, and resources that affect water. This is often where discussions on rivers start. In fact, even when people try to determine the earth's share they tend to couch it in terms of channel maintenance, or flood control to serve human needs.

The mechanisms for determining how to share the uses of water and riparian areas are clearer than those for determining the earth's share. But they are not without controversy. Indian treaty rights, prior appropriation doctrine, riparian rights, public trust doctrine, free markets, public agency resource plans, and common-ground community plans are all examples. Some of these may work against shared uses, i.e., prior appropriation doctrine; some could work well for shared uses if all had equal access, i.e., free markets; while yet others are explicitly intended to determine shared uses, i.e., community plans.

To the degree that shared uses touch on ethics, it is usually human ethics rather than land ethics. The principle question is equity: how is a fair share determined and how are the people injured by the result compensated for their loss?

One concern in shared use that impinges on the earth's share is the amount and quality of water that returns to streams, rivers, or lakes after humans share their uses. Does the water return with a load of contaminants, toxins, nutrients, or a pH level that impacts the earth's share?

Here is just a short list of issues that are important in level two thinking about rivers:

- Ownership of water and land;
- Diversion of water from channels for industry, agriculture, towns;
- Dams for irrigation, flood control, power, drinking water;
- Recreational uses in and on water;
- Land disturbances in watersheds: logging, mining, roadbuilding;
- Activities in or near water: grazing, mining, logging;
- Pollutants from point and non-point sources;
- Exotic species of plants, animals, and invertebrates.

Stewardship Tools

A third level of thinking about rivers has to do with tools and methods for reaching goals for river uses and values. We lump them under the category of stewardship tools. They include protection, enhancement, management, conservation, restoration, and so forth. These tools are necessary for both determining and carrying out aims for the earth's share and shared uses of waters and related lands and resources by people.

Included in the list of stewardship tools are laws, regulations, policies, protocols, incentives, subsidies, best management practices, rewards, training, research, technical assistance, and conservation.

The case studies presented in these proceedings show how stewardship tools are being used to resolve problems.

Summary

We have seconded Aldo Leopold's notion that people must think about rivers as more than just collections of parts and processes of value and use only to humans, that there is a harmony about rivers that plays out only over the long term and that humans can only partially comprehend. People should reserve the essence of rivers to that harmony. We suggested that such a land ethic about rivers should constitute our first level of thinking on what to do about rivers. In closing his essay on Land Health and the A-B Cleavage, Leopold talks about the tensions in this ethical level of thinking as a cleavage between

> "man the conqueror versus man the biotic citizen; science the sharpener of his sword versus science the searchlight on his universe; land the slave and servant versus land the collective organism."

Robinson's injunction to Tristam may well be applied, at this juncture, to Homo sapiens as a species in geological time:

Whether you will or not
You are a King, Tristam,
for you are one
Of the time-tested few
that leave the world,
When they are gone,
not the same place it was.
Mark what you leave."

He further offered in unpublished notes that people should exercise a "voluntary decency in land use exercised by every citizen and land owner, out of a sense of love and obligation to that great biota ...the land." (Leopold unpublished). This is our first level of thinking about rivers. A river ethic is about marking what we leave so that rivers continue to sing their songs.

We suggested that a second level of thinking on rivers is political, about sharing the uses and values of rivers among fellow humans. And we suggested that a third level is where science and technology come in, to help people know how best to achieve goals for both the earth's share and the people's share of rivers.

The technical papers and case studies in this conference are heavy to level-2 and level-3 thinking, politics and technology. The interpretive interludes were mostly about level-1 thinking, river ethics. We scientists and technicians must work at not forgetting about level-1 thinking. Remember the allegories. When we meet to discuss rivers and our political, scientific, economic, and technical mechanisms for their care, remember to invite the poets, storytellers, singers, and artists. They keep us in touch with the river's songs

Rivers run through our lands and through our lives. They reflect our values, our sense of self, and our concern for fellow beings. They tell us and others what we stand for and what we think about our grandchildren.

Mark well what we leave.

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Overview of the Rivers in the West

David L. Rosgen

Introduction

The free spirit and the strong,independent nature of the people who settled and developed the West epitomizes the Western tradition. However, these traditions have become the way of doing business and have thus been ingrained into a rigor of standardization. We have found that due to our stubborn and proud nature, change is difficult at best. This is not necessarily bad unless it leads to actions that lead to the deterioration of our Western rivers.

Rivers change over time, in response to both climate change and to man's impacts. It is important to be able to distinguish between natural stability and instability created by man's actions. One of our most serious problems is the lack of a universal recognition and understanding of the many problems we have created for the river.

These river problems become our problems! The adjustment of the river often results in increased bank erosion, flooding, downstream sedimentation, land loss, etc. When the competing and conflicting uses of our rivers leads to adverse adjustments of natural systems, we all lose. We have been trying to "fool the river" since we developed the West. However, when these works run contrary to the natural tendencies of the river, the river eventually wins. This often creates a hard lesson, however, we respond to this "education" by not making many new mistakes...we just continue to make the same ones...over and over!

The Problem

Let me be a little more specific. We have changed our rivers more in the last 60 years than most countries have done in the last 600 years. We have tried to eliminate flooding and direct where we want the river to be, not where it wants to be! Is this really possible in the long run? How long will it be before the reservoirs fill with sediment? Who will pay the bill to clean them out? How high will we need to continue to build the levees to keep up with the aggrading bed of the channelized river? If we do work on a river, what will be the downstream impacts? Unfortunately, rivers are not respecters of political boundaries! How much change can the watershed absorb above us? How much can the rivers absorb as the recipients of such change? It is not the intent of any group or individual to cause the demise of the river, yet the cumulative effects of the impacts from the very headwaters to the mouth of the river are taking their toll! We often look at the symptoms of the river problems on an individual reach basis rather than looking farther upstream into the watershed for the cause of the problem.

The problems will be discussed in the following major categories:

- Streamflow
- Sedimentation
- River and Riparian Modifications.

David Rosgen is a professional hydrologist and owner of Wildland Hydrology Consultants in Pagosa Springs Colorado. Dr. Rosgen has been a consultant for six years doing stream restoration, short courses in fluvial geomorphology, channel maintenance flow, cumulative watershed analysis and other topics. Prior to this work he worked for 21 years as a hydrologist with the USDA Forest Service in Idaho, Montana and Colorado.

Streamflow

We have created increases in the magnitude and duration of runoff peaks due to logging, grazing, mining, sub-divisions, agricultural drainage (channelization, wetland conversions,etc.) and storm drain systems that rapidly remove runoff from municipalities downstream to accelerate potential flood hazard. Some of the processes affected involve changes in vegetation type and density; soil compaction and composition that leads to infiltration reduction; changes in surface and sub-surface routing mechanisms; diversions which dewater one river while increasing flow in another; storm drains which circumvent normal water routing processes; river channelization; riparian area degradation and abandonment; and wetland conversions just to mention a few!

> "Rivers are self-formed and are self-maintained. They have to meander to be stable!"

The changes in the streamflow or the energy regime of the system often leads to increased frequency and magnitude of flooding. This causes increased bank erosion, channel aggradation and or degradation, land loss, etc.

In several irrigation projects in the West, rivers have been dammed, dewatered then flooded with excess water bypasses. This also has resulted in fishery losses, bank erosion and associated deterioration of the river. Many diversions in the West take ALL of the flow into a major lateral canal, dewater the river below the diversion structure, then return the flow that is not used back to the river often within a mile downstream of the diversion. To prevent the resource damage, diversions structures should be designed to divert only the water that will be utilized in irrigation. Temporary diversions or "sacrificial berms" are used throughout the West to divert water from the river into canals. These frequently washout each storm and have to be replaced by digging more material from the channel bed and banks. These are not only high maintenance problems but cause on-site and downstream damage.

Trans-basin diversions which have dewatered many streams have resulted in adverse river adjustments. These adjustments cause reduced channel capacity of the dewatered streams due to sediment transport of the unregulated tributaries into the regulated river. This results in flood conditions with less than a floodflow discharge. Channel instability results due to reduced capacity to accommodate the normal high flows that the diversion cannot.

Sedimentation

We have increased the amount of sediment that the river normally transports due to increased erosion, increased duration of bankfull and the frequency and magnitude of peak flows and associated channel erosion. Streambanks have been weakened by poor streamside vegetation and deteriorated riparian conditions which have led to extreme bank erosion rates in much of the West. Actual measurements that I have conducted show that over half of the total sediment produced in large watersheds is being contributed by accelerated bank erosion processes.

Streambank erosion rates can be reduced by several orders of magnitude if riparian vegetation is maintained. Rooting depth and density becomes a major key in streambank stability. Grazing strategies that change the density and composition of species with good rooting characteristics have an exponential impact on bank erosion. Large-scale changes in riparian species and corresponding adverse channel adjustments have been well documented.

Direct introduction of sediment from roads, in-channel gravel mining, surface erosion, gulley erosion from deteriorated rangelands, all contribute to increased sediment deposition rates in downstream reservoirs. This serves to reduce the effectiveness and life of these reservoirs.

Not all of the erosional debris that is introduced is routed through the system. Sediment deposition that occurs creates many types of bars. These bars direct stress to the

Table 1

Derived empirical equations for river-meander and channel-size features (A = bankfull cross-sectional area, W = bankfull width, D = bankfull mean depth, L_m = meander wavelength, L_b = along-channel bend length, B = meander belt width, R_c = loop radius of curvature, K = channel sinuosity, m = meters)

Equation number	Equation	Standard deviation of residuals, in percent +	Standard deviation of residuals, in percent −	Sample correlation coefficient	Number of data points	Applicable range
Interrelations between meander features						
2	$L_m = 1.25L_b$	32	24	0.99	102	$5.5 \leq L_b \leq 13{,}300$ m
3	$L_m = 1.63B$	31	24	0.99	155	$3.7 \leq B \leq 13{,}700$ m
4	$L_m = 4.53R_c$	21	17	0.99	78	$2.6 \leq R_c \leq 3{,}600$ m
5	$L_b = 0.80L_m$	32	24	0.99	102	$8 \leq L_m \leq 16{,}500$ m
6	$L_b = 1.29B$	31	24	0.99	102	$3.7 \leq B \leq 10{,}000$ m
7	$L_b = 3.77R_c$	35	26	0.98	78	$2.6 \leq R_c \leq 3{,}600$ m
8	$B = 0.61L_m$	31	24	0.99	155	$8 \leq L_m \leq 23{,}200$ m
9	$B = 0.78L_b$	31	24	0.99	102	$5.5 \leq L_b \leq 13{,}300$ m
10	$B = 2.88R_c$	42	29	0.98	78	$2.6 \leq R_c \leq 3{,}600$ m
11	$R_c = 0.22L_m$	21	17	0.99	78	$10 \leq L_m \leq 16{,}500$ m
12	$R_c = 0.26L_b$	35	26	0.98	78	$6.8 \leq L_b \leq 13{,}300$ m
13	$R_c = 0.35B$	42	29	0.98	78	$5 \leq B \leq 10{,}000$ m
Relations of channel size to meander features						
14	$A = 0.0054L_m^{1.53}$	103	51	0.96	66	$10 \leq L_m \leq 23{,}200$ m
15	$A = 0.0085L_b^{1.53}$	140	58	0.95	41	$6 \leq L_b \leq 13{,}300$ m
16	$A = 0.012B^{1.53}$	97	49	0.97	63	$5 \leq B \leq 11{,}600$ m
17	$A = 0.067R_c^{1.53}$	138	58	0.97	28	$2 \leq R_c \leq 3{,}600$ m
18	$W = 0.17L_m^{0.89}$	56	36	0.96	191	$8 \leq L_m \leq 23{,}200$ m
19	$W = 0.23L_b^{0.89}$	56	36	0.97	102	$5 \leq L_b \leq 13{,}300$ m
20	$W = 0.27B^{0.89}$	63	39	0.96	153	$3 \leq B \leq 13{,}700$ m
21	$W = 0.71R_c^{0.89}$	48	32	0.97	79	$2.6 \leq R_c \leq 3{,}600$ m
22	$D = 0.027L_m^{0.66}$	79	44	0.86	66	$10 \leq L_m \leq 23{,}200$ m
23	$D = 0.036L_b^{0.66}$	72	42	0.90	41	$7 \leq L_b \leq 13{,}300$ m
24	$D = 0.037B^{0.66}$	66	40	0.90	63	$5 \leq B \leq 11{,}600$ m
25	$D = 0.085R_c^{0.66}$	90	47	0.90	28	$2.6 \leq R_c \leq 3{,}600$ m
Relations of meander features to channel size						
26	$L_m = 30A^{0.65}$	59	37	0.96	66	$0.04 \leq A \leq 20{,}900$ m^2
27	$L_b = 22A^{0.65}$	77	43	0.95	41	$0.04 \leq A \leq 20{,}900$ m^2
28	$B = 18A^{0.65}$	56	36	0.97	63	$0.04 \leq A \leq 20{,}900$ m^2
29	$R_c = 5.8A^{0.65}$	76	43	0.97	28	$0.04 \leq A \leq 20{,}900$ m^2
30	$L_m = 7.5W^{1.12}$	65	39	0.96	191	$1.5 \leq W \leq 4{,}000$ m
31	$L_b = 5.1W^{1.12}$	65	39	0.97	102	$1.5 \leq W \leq 2{,}000$ m
32	$B = 4.3W^{1.12}$	74	42	0.96	153	$1.5 \leq W \leq 4{,}000$ m
33	$R_c = 1.5W^{1.12}$	55	35	0.97	79	$1.5 \leq W \leq 2{,}000$ m
34	$L_m = 240D^{1.52}$	142	59	0.86	66	$0.03 \leq D \leq 18$ m
35	$L_b = 160D^{1.52}$	128	56	0.90	41	$0.03 \leq D \leq 17.6$ m
36	$B = 148D^{1.52}$	115	53	0.90	63	$0.03 \leq D \leq 18$ m
37	$R_c = 42D^{1.52}$	165	62	0.90	28	$0.03 \leq D \leq 17.6$ m
Relations between channel width, channel depth, and channel sinuosity						
38	$W = 21.3D^{1.45}$	160	62	0.81	67	$0.03 \leq D \leq 18$ m
39	$D = 0.12W^{0.69}$	94	48	0.81	67	$1.5 \leq W \leq 4{,}000$ m
40	$W = 96D^{1.23}K^{-2.35}$	121	55	0.87	66	$0.03 \leq D \leq 18$ m and $1.20 \leq K \leq 2.60$
41	$D = 0.09W^{0.69}K^{1.46}$	73	42	0.86	66	$1.5 \leq W \leq 4{,}000$ m and $1.20 \leq K \leq 2.60$

streambank rather than "flush" the depositional features away with the next high flow. The sediment contributed by the accelerated bank erosion often becomes much larger than that of the initial deposit. This "domino" effect contributes to land loss and channel instability.

River and Riparian Modification

Our history in the development of the West has been directed for various reasons to "straighten things out." The winding roads and the winding river have been straightened by engineers at costs second to no other nation. Not only has this been expensive, but we are learning that the river is not a willing recipient of such works!

Rivers are self-formed and are self-maintained. They have to meander to be stable! Their historic curves dissipate the excess energy of the system. When the flow and sediment regime of the river are changed, the dimensions and pattern will adjust to accommodate such change. If the dimensions (width and depth) of the river are changed due to encroachment, bank erosion, etc, then the pattern of the river will change. The pattern of theriver is expressed in meander geometry terms that describe mathematical relations of meander length, amplitude and meander radius of curvature as a function of bankfull width as shown in Figure 1. These relations were initially presented by Leopold and Wolman(1960) and Langbein and Leopold (1966). Recent documentation by Williams (1986) have verified these relations for rivers throughout the world and is shown in Table 1.

The important concepts learned many years ago, but not very often applied is that to have a stable river you must maintain the natural stable tendencies. The natural, stable features of the river including it's dimensions, and pattern have been violated time and again. Many large rivers have been channelized, straightened, widened, lined with concrete or other revetment and leveed to cutoff the floodplain and riparian areas integral to the river.

The results of such works are now starting to be observed in this country. Before we embarked on such a venture, we should have gone to China where similar works on the Yellow River have been undertaken for hundreds of years. To prevent the unthinkable condition of flooding on a floodplain, levees were constructed to contain all of the flows in one straightened, over-width channel. This

Figure 1

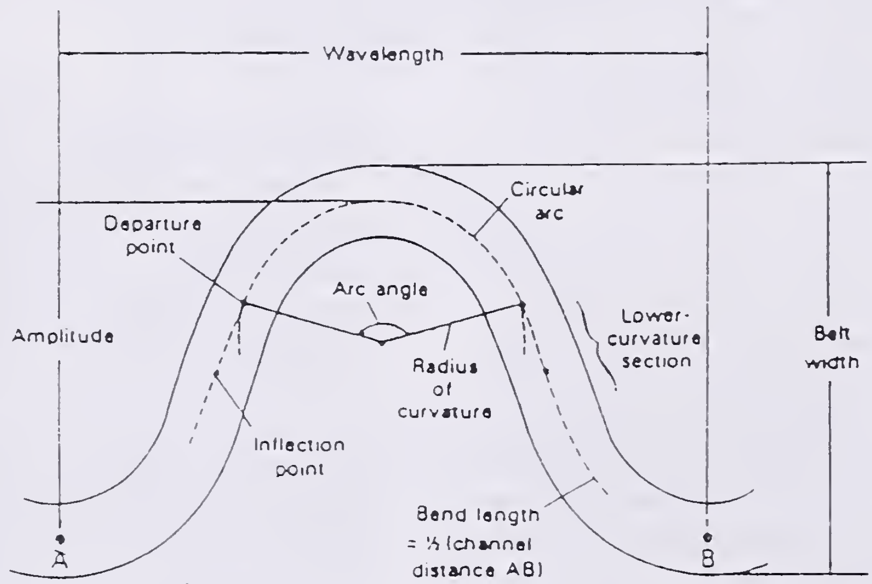

FIGURE 1. SCHEMATIC MEANDER GEOMETRY DESCRIPTIONS. (WILLIAMS,1986)

resulted in sediment deposition or channel aggradation. In other words the bed elevation of the river increased to over 90 meters above it's previous level. This requires ongoing maintenance of the levees which have to be reinforced from erosion and raised to deep up with the raising streambed.

This has already been observed now in less than 40 years, where the bed elevation of the river is higher than the floodplain. The Mississippi and Sacramento rivers have this problem as well as many other rivers subjected to the same river engineering works. An example of the "design" channel vs the natural stable channel plan view and cross-section is shown in Figure 2. When the engineering solution is not compatible with the natural stable form of rivers, the rivers will let you know!

Part of the stable river is that of it's floodplain that has been "built by the river in the modern climate" (Leopold et al, 1964). When the works of man change this feature, it becomes difficult to maintain the river as well. If the river cannot disperse the flood waters that over-top it's banks for flows greater than the normal frequent high flow (bankfull discharge), then adverse adjustments occur within the channel. These adjustments lead to serious problems in channel stability.

What ever we do to rivers we should not take away the self-maintenance tendencies of the river. When we take over the maintenance for the river, the cost and consequence is astronomical!

If one travels along our rivers you will observe a curious and complex arrangement of "structures" to control, enhance, direct, and disperse the river. These structures occur regardless of morphologically similar reaches, but seem to be related more to jurisdictional or political boundaries. The result appears to be a fluvial amusement park.

The Solution

Now comes the challenge! Once the problem is recognized, what can we do about it? From a general concept of our human tendencies we have to depart from our independent nature and gather up the collective expertise necessary to solve these problems.
We cannot do it alone. We need to put sound river principles into practice! We cannot continue to use the same "hard engineering" solutions. We have to treat the watersheds as well as the reaches in such a manner to maintain their natural function.

This is not to say that we cannot utilize the water resources, but we have to develop

Figure 2

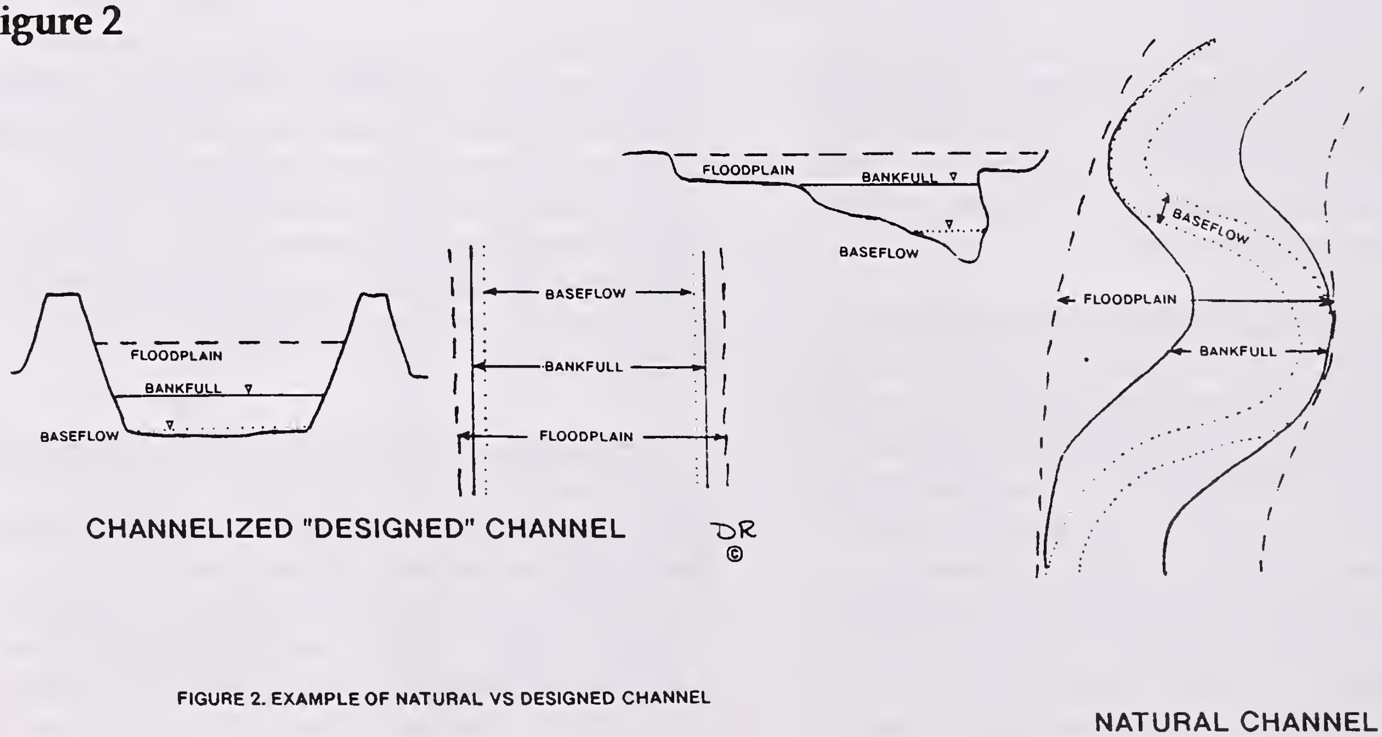

FIGURE 2. EXAMPLE OF NATURAL VS DESIGNED CHANNEL

innovative measures so that such utilization is not at the expense of the river.

Streamflow

An understanding of the cumulative effects of watershed development on the streamflow regime is essential. Mitigation and or restoration of disturbed lands will help maintain a better stormflow and snowmelt runoff response. Revegetation of the watershed and improved vegetation management of rangelands and riparian systems is a positive direction. Grazing management strategies which respond to utilization and grazing season standards that create upward trends in range and riparian conditions will demonstrate the capability of these lands under good grazing practices.

> *"Even though it is unusual and may draw some criticism from your peers you have to listen to the river! Know what is wrong, why it's wrong and design a solution which matches the natural stable tendencies."*

Diversion structures and flow regulation need to allow streams the capability to transport the annual sediment produced by its watershed. There is a certain amount of maintenance flow necessary to maintain the natural stability. Excess water due to reservoir releases and trans-basin diversion needs to be balanced with the erodibility potential of the receiving streams.

Stormwater drainage designs should be shifted to a new direction of dispersing rather than concentrating runoff. Infiltration surfaces, creation of natural vegetation filter areas, and vegetating draws rather than concrete will help restore sub-surface routing as well as improved water quality. In other words we need to re-establish the riparian function in these developed basins. This not only improves function, but the wildlife and aesthetic values are also improved.

Sedimentation

Sediment sources from direct disturbance due to surface erosion, gulley erosion, mass wasting, etc. can be effectively reduced by sound land management practices. Vegetation again is better than concrete as it allows for natural flow regulation reducing downstream channel erosion while protecting surfaces from erosion. Rooting characteristics have been demonstrated to be critical in maintaining the internal strength necessary to keep mass wasting erosional process at a natural level. Good vegetative cover on rangelands not only improves the magnitude and timing of flow, but also protects the land surface from erosional processes.

Since bank erosion is a major contributor to the sediment problem, restoration and management of streamside vegetation and a healthy riparian corridor are very cost effective. We need to minimize the "fence line" contrast between riparian conditions due to differing grazing management practices.

It has been demonstrated that grazing management strategies have to be adjusted based on the sensitivity of the various streams in a watershed. The use of stream types (Rosgen, 1985) based on morphological similarities (Figure 3) allows resource managers the ability to predict river behavior from it's appearance, extrapolate data from rivers of similar character and be able to communicate about rivers among a diverse group of people working with rivers.

River and Riparian Modification

We need to put the river back! Floodplains and riparian areas need to be restored to their proper function. Fortunately, there is a rising awareness of the need for "environmental engineering." The Corps of Engineers and others are actively pursuing technical expertise to incorporate into river design works. Damaged rivers such as Ashley Creek in Utah and the Alamosa River in Colorado that

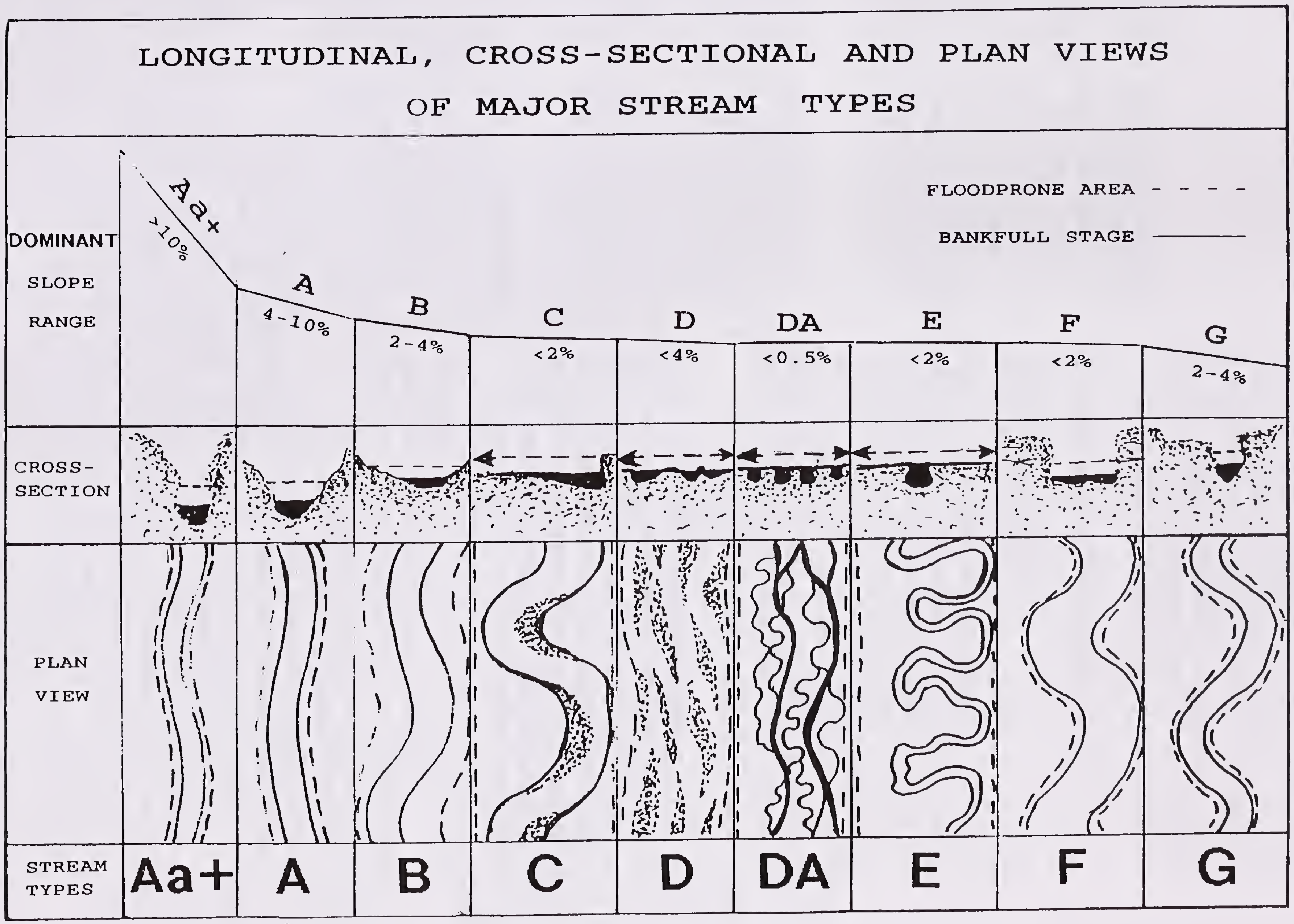

Figure 3. Longitudinal, cross-section and plan views of major stream types.

resulted due to Corps projects are being considered by the Corps to be restored to their natural stability. Recent restoration work by the author in Colorado, California and Nevada on relatively large rivers has demonstrated the effectiveness of restoring the dimension, patterns and profiles of the natural, stable river form.

Wetland and riparian restoration has been a focus to try to turn around the losses of such features from past development. Once these systems are restored, their management to maintain their function is an on-going challenge. It has been demonstrated that good grazing practices can actually improve the stream and riparian condition. The technology has advanced far beyond that of the rate of applications of the technology! We have to put the fundamental concepts on the ground!

Summary

Change is difficult. It is easier for an engineer to get approval of a design by using the same one that their boss used or the one that is in the "manual" than to depart from the standard. There is risk in being innovative! But therein lies the challenge! Even though it is unusual and may draw some criticism from your peers you have to listen to the river! Know what is wrong, why it's wrong and design a solution which matches the natural stable tendencies.

To make this happen we need to rely on one another! We have to have a common set of goals and the ability to integrate the knowledge of rivers into the design solutions. I am certain that the collective efforts of everyone and all of the experience and diverse backgrounds represented here could come together toward a common goal for the river. We need to keep focused on how to provide those innovative solutions so that the river systems can maintain their function and provide the resource values upon which we all depend.

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CHAPTER TWO

VIEWING RIVERS THROUGH DIFFERENT LENSES

Managing for Integrated Use

Governmental Lenses
- Local
- State
- Indian
- Federal

User Lenses
- Wildlife
- Ranching
- Recreation
- Timber
- Power

Mitakoyasin

"There is a Native American saying: "If the songs are not sung and the tales are not told, then the land will die."

One of our roles as land managers is to reveal the songs and tales of the land and its inhabitants - even while dealing with the complexities of politics, science and the constant cycles of change.

But to reveal the stories and songs of the land, we must first listen ... open our hearts to the rhythms of our own inner music and imagery. We must listen to our hearts, to the land, and to each other.

At the conference this week we will experience, through the Interpretive Interludes, some of the ways in which the symbols, myths and rituals of our land and culture reach out to us in the mind to touch us to bind us - and to remind us of who we are and why we are here.

There is a term used by the Oglala Sioux as a greeting - and many native American ceremonials use it - it is "Mitakoyasin" - all my relations. It is an acknowledgement to our surroundings - the land and its creatures, who teach us. "All thing are connected" is another translation. In that spirit may this conference take place "Mitakoyasin."

Rita Cantu

yes

Managing for Integrated Use

Sherman Swanson and Tom Myers

Just as riparian areas are the transition from upland to aquatic, they are also the linkage connecting deserts and mountains. We have witnessed the similarity and diversity of the West's rivers and their associated riparian influences. For each of them we can also recollect or imagine their headwaters. The character and even the existence of these rivers is dependent on the lower order but higher elevation tributaries.

Terrain analysis has taught us that a great many first order-streams feed a much smaller number of second order streams and so on down through the watershed with increasingly fewer miles in each consequent stream order. In mountain watersheds, it's the high country that catches the orographic precipitation. Most of these rivers are exotic, with downstream reaches actually losing water due to natural and anthropogenic causes.

As we have learned from the River Continuum model (Vannote, et al. 1980), the lower the stream order the greater the influence of riparian vegetation. However from stream classification (Rosgen 1985) we have learned that not all streams and rivers of the same order are equally dependent on riparian vegetation and its stabilizing influence. Certainly wherever streams depend on riparian vegetation to stabilize banks and stabilize meanders, the priority for proper management increases (Swanson 1990).

Therefore, if we want to release riparian vegetation to perform its not insignificant functions, we must consider the scale of the processes presenting the opportunity. A river at any point is the sum of its upstream parts. To best manage a river's riparian zone, we should look first to the headwaters. But we better be prepared to hike many miles and deliberate extensive and diverse land types and land uses. As streams flow out of the mountains we have learned to put them to use. Many of our fiercest battles have and will deliberate these water uses. Their riparian influence is most direct and locally significant. In many cases the scale of the decisions expand to a district, state, or interstate region. Downstream, we find the biggest cities and the most people to add their diversity of mandates. Some urban riparian management is quite local, in the realm of landscape architecture. However, collectively, the rural areas perceive urban values to be eating their lunch, sometime prohibiting the land uses that sustain their economy and life style.

We all want a sustainable society that provides for the economic needs of its diverse communities. We value the free market for its capacity to adjust our economy and we value our freedom to pursue our own pleasures. Part of that freedom is visible on the map as public land, including the beds of navigable rivers. We also value our governments for their capacity to provide what a free market alone can not. As the world population grows, our need for government grows in large part because the slack in the natural

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Tom Myers is a Research Associate and graduate student working on a PhD in the Range, Wildlife and Forestry Department at the University of Nevada.

system becomes taken up. The commons becomes increasing occupied (Hardin 1968).

When I was young it occurred to me that the solution to water pollution was to require that all effluent be put into a river upstream of the water take-out. That seemed a simple way to internalize an externality, using words I later learned in Economics 101.

"A river at any point is the sum of its upstream parts."

One of the recurrent themes or undercurrents in this conference will be the pervasive nature of costs and benefits external to a market system and the diversity of mechanisms by which we use government to optimize a sociobiophysical system. One of the reasons we have overflow attendance at this conference is the great downstream interest in upstream riparian management that contributes positively or negatively to a sense of well being. Conversely, there is great upstream interest in the external controls that downstream water users may wish to impose on upstream land users, without so much as a check in the mail.

We have government of the people, by the people, and for the people, but, which people? We form government to serve the needs of people at a variety of levels. Each governmental entity is formed to serve the needs of its constituency. It is entirely necessary and insufficient that each level of government pursue a geographically defined mission. Therefore, we must have them all, and nongovernmental organizations too, formal and informal, public and private. Beyond that we depend on those organizations becoming effective at communication with their constituencies and with other levels of the hierarchy.

The key to integrated use is open communication along with overlapping authority. When any level or viewpoint becomes too strong, it impinges on the will of others. When any becomes too weak, the vision from its vantage becomes lost.

Similarly, Coordinated Resource Management is a process by which land managers, land owners, and interested citizens come together to mutually plan the use and management of appropriate planning areas. I won't say much about that process as it will be featured later in the conference, but it is an example wherein resource management becomes truly participatory for citizens and may involve multiple levels of government.

At a watershed symposium in Seattle a couple of years ago I was struck by a recurring theme; to conserve natural resources we must conserve natural resources conservation institutions. Such institutions include governmental as well as nongovernmental organizations, even families such as ranch families. They each must develop and maintain an institutional memory, complete with plans, records and photographs. Furthermore they must each have a part in the play. Riparian management is far too complex for any one visionary to adequately incorporate the intricacies and diverse values of all of society.

The following panel will present a snapshot of the perspectives held by various levels of government. The speakers will enrich our intellectual diet with ideas and perspectives concerning:

- How regulations and riparian protection look from different levels of government;

- Their perception of a national approach vs. a local approach, including the value and problems with federal laws and policy;

- Do these laws and policies provide an appropriate big stick?

- Do they provide appropriate levels of funding?

- Are they flexible enough to be sensitive to local needs?

Many of their themes will recur throughout the conference.

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A County Government Perspective

Julia Fonseca

Pima County, Arizona is a medium-sized Western county where only 25% of the land is privately held. Like many Western counties, private land is often found along the larger floodplains. Many of the towns in Pima County, including Tucson, originated along these floodplains. Since 1974, federal regulations have set the framework for how Pima County manages floodplain development.

Since the floodplain regulations went into effect, the population in the unincorporated County has tripled in size, and a great deal of the riparian habitat that was in the floodplain has been lost to housing, businesses and roadways. That rapid growth has sparked the desire among environmental and neighborhood groups to see riparian habitat preserved during development. These groups often believe that we floodplain managers can prevent floodplains from being developed, and hence protect streamside vegetation. This just isn't so. We only specify how floodplains may be modified. We can't prevent anyone from relocating or modifying the channel if it's done is a manner that won't directly affect adjacent properties. And of course, we can't prevent anyone from removing riparian vegetation from his property.

From my perspective both as hydrologist and as resident of Tucson, existing floodplain regulations have not protected riparian habitat. Federal and local floodplain policy statements may seem to encourage preservation, but actual floodplain regulations don't give us those powers. That's why last year we tried to amend our local floodplain management ordinance to require mitigation of riparian habitat losses due to development in the floodplain. Our County Board did not support the amendment, but directed us to explore placing regulations in the zoning code.

While floodplain regulations don't protect riparian habitats, land acquisition can. Many counties in the West have vigorously opposed federal land purchases, particularly along streams. But Pima County has supported federal acquisition of floodplains on a variety of grounds. We think that keeping floodplains natural upstream of Tucson makes sense. Why? Because broad, well-vegetated floodplains act somewhat like dams. They slow down the velocity of water and allow floods to spread out harmlessly on undeveloped public land before hitting downstream urban areas. If the upper watersheds were channelized, flood peaks downstream would increase. Upper watersheds also recharge the urban aquifer downstream--an ecosystem service that often goes unrecognized. In addition, Pima County residents seem to like the recreation and natural open space that public land can provide.

For example, Pima County tried to muster up millions of dollars to buy the 75,000 acre Empire Ranch, located upstream of Tucson. The Empire Ranch has one of Pima County's few perennial streams and is home to the Gila Topminnow, an endangered fish. In 1987, Anamax (a large mining corporation) began

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to market this land for "ranchette" development. When the County failed to strike a deal with Anamax, our Board of Supervisors got the Congressional delegation involved; the result was that the BLM acquired the Empire Ranch through a land exchange. We're now working with the BLM to encourage them to acquire additional riparian land.

"In some areas, we've found that it's cheaper to buy floodprone structures than it is to build levees and excavate channels to protect them."

Pima County has its own acquisition program, which has been very successful in preventing or removing development in floodplains. We have spent $34 million buying flood and erosion- prone land along seven principal watercourses. Acquisitions have been financed through two bond elections and a secondary tax on real property. In some areas, we've found that it's cheaper to buy floodprone structures than it is to build levees and excavate channels to protect them.

Acquisition of floodplain property is an innovative technique of proven effectiveness in reducing flood losses. Purchased areas provide natural flood storage which reduces flood peaks downstream. One District study estimated flood-peaks would increase 40% if upstream floodplains were developed using conventional structural flood-control measures. Increased erosion of channel beds and banks resulting from structural flood-control projects can also be lessened by establishing areas where natural erosion processes can continue unabated.

Pima County's acquisition program has been a locally-initiated effort; it got started in 1984, following a series of four Presidentially-declared flood disasters in Tucson. (We just had a fifth one this January.) These floods have taught us that federal disaster relief efforts are slow and cumbersome. Also, federal relocation programs won't pay to relocate those who don't suffer damage, but are clearly at risk from future flooding or erosion. And federal programs won't usually pay to acquire undeveloped land either.

One of the unusual features of our acquisition program is that we can buy undeveloped land. About a thousand acres of mesquite bosques, cottonwood-willow forests, and xeroriparian habitat have been acquired specifically to protect these plant communities. For instance, we purchased a rare desert marshland and its associated mesquite forest along the San Pedro River. This area, known as Bingham Swamp, is managed for us by the Nature Conservancy. It lies adjacent to other lands along the San Pedro River that the BLM hopes to purchase. Another is located just downstream of the Empire Ranch along Cienega Creek.

Together with the BLM Empire Ranch trade, we've brought over thirty miles of Cienega Creek into public ownership. And we have taken our management responsibilities for these natural areas very seriously: we have reduced or eliminated off-road vehicular access and grazing along these areas, and have filed for instream flows.

We don't just buy perennial streams; more often we purchase ephemeral streams with limited streamside vegetation. You have to understand that in our community, the trails that are used by both wildlife and people are in dry streambeds, and there's a big constituency that sees value in bringing watercourses, even dry ones, into public ownership. That constituency comes into play during some zoning issues, with the result that the developer sometimes turns natural areas along the channels over to the County.

Federal agencies, acting through the Section 404 of the Clean Water Act, have been important in encouraging acquisition, by providing legal and financial disincentives for levees and channels. Although it wasn't the main intent, Section 404 mitigation requirements have doubled the cost of flood control structures. Section 404 hasn't stopped a single project of ours but has certainly provided us incentives to avoid riparian habitat losses. Another way Section 404 has helped save riparian areas is through restricting dredging of channels to remove sediment and vegetation.

For instance, we've created a wonderful riparian habitat by discharging effluent into the Santa Cruz River. It's a great place for birds and local bird-watchers. But the vegetation sustained by the effluent also helps to clog the channel, so some of the floodplain farmers downstream want us to remove the plants. Again, the main reason it hasn't been done is Section 404. On the other hand, other sections of the Clean Water Act that regulate the quality of effluent may force us to dry up this habitat by diverting the effluent to other uses.

To sum up, I'd say that the federal government would have a hard time encouraging riparian habitat protection measures in an unwilling local community. On the other hand, there's no end to what communities can accomplish through good local leadership, even if no consensus exists. It's important to recognize that Pima County's accomplishments have occurred in a community which has been and still is divided on issues like the use of public funds for acquiring and managing of riparian lands.

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The State Role in Riparian Management

Jo Clark

When you were a child, did you ever play with the wooden puzzles that would be shaped like a ball or cube or pyramid? You may remember that once you took the puzzles apart, they could only be put back together in the right order and that order wasn't always easy to find.

Think of state riparian management as one of those puzzles. There is a piece for each use of riparian areas. There is one for parks, another for greenways. Also ones for beaches, boat access, effluent outlets, dumps, boat docking, fishermen, residential uses, commercial buildings, grazing, logging, mining, highways and railroads, bike paths and campsites.

Now imagine that those pieces are owned by a number of different people. Some work for the federal government and build dams or manage parks or control forests or protect wildlife or run military bases. Others are owned by people who work for state agencies -- school lands, state-owned lands, and state parks. Some pieces are owned by local governments and others by tribal governments. And most are owned by private individuals.

But in addition, before you can start putting your puzzle together, you learn that you have to follow the rules -- rules called the Clean Water Act, the Endangered Species Act, NEPA, FERC licensing, instream flow provisions, swampbuster, sodbuster, the Conservation Reserve Program, reclamation rules, flood control, navigation, and stream channelization. And to top it off, the people who own the pieces can't agree on what they think the shape should look like when the puzzle is completed. Should it be for fishing, hunting, habitat, water retention, soil retention, water cleansing, water supply, aesthetics, transportation corridors, or recreation?

When I began thinking about state riparian management for this conference, my first reaction was that there really isn't any -- because of all the complications I just mentioned and a few others besides. Riparian areas have historically fallen through the cracks -- they aren't really water, and therefore water managers didn't worry about them. And land managers saw them either for their commercial value or ignored them.

Once their ecological and other values were recognized, they were still almost impossible to manage. For one thing the fragmented ownership by various governments and various individuals is a problem. Second, there are property and other rights to riparian stretches -- private ownership, various permits, historic uses, rights of way, easements, and the like. Third, there are incidental but sometimes conflicting regulations -- dredge and fill, non-point source, habitat for endangered species, conditions on FERC licenses, shoreline access, instream flow standards, navigation channels, flood plain insurance mandates, and others. A fourth problem is that even if those problems didn't exist, it isn't clear which agency should be in charge -- water, fish and wildlife, environmental quality, transportation, or agriculture. And finally there is a fifth problem -- research, data, and

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other critical information. Are riparian areas important corridors linking ecosystems to promote biodiversity? Or are they pathways for cats, dogs, and invading species to attack new ecosystems? Does the entire riparian corridor need protection or just key blocks of it? How do soils, vegetation, and water levels relate to ensure the healthiest system? What are the variables that must be factored in for effective restoration? And finally, how do you define healthy for an ecosystem that is inherently unstable?

After having given you all the reasons state riparian management has been almost non- existent, I'm pleased to say that is changing, and changing rapidly. If states are "laboratories of democracy," they are also laboratories of riparian protection. A number of states are looking at riparian management as part of new planning approaches -- Kansas, Missouri, Oregon, and California. Others are drawing up regulations including a variety of facets -- stream access, business and residential setbacks, shoreline zoning, mandates to local governments to protect riparian areas, mitigation banking, drainage requirements, and grazing practices. Still others are collecting information and/or starting to build public support.

But what is exciting is that virtually all states are paying attention and starting to try various strategies. It is perhaps instructive to look briefly at the most recent state riparian law -- Arizona's Senate Bill 1030, signed in December. That law directs three different departments to complete tasks by December 1, 1993. The Arizona Game and Fish Department is to undertake studies regarding identification and protection of riparian areas and instream flows, including mapping and classifying riparian areas in the state. The Arizona Department of Water Resources will evaluate the effect of groundwater pumping and surface water diversions on riparian areas and will evaluate alternative regulatory programs. DEQ will evaluate a broad range of activities that impact riparian areas. The law builds in consideration of existing users and creates a Riparian Area Advisory Committee which ensures broad user representation.

Two things strike me about this law: one is the good faith effort to recognize the complexities and take a system approach to the issue. The second is what appears to be the current lack of even baseline information on the state's riparian resources.

Now, what is it going to take to put our puzzle together? Using a phrase that is rapidly becoming a cliche - "partnership"

- Among those who own or manage a piece of the puzzle.
- Among those who have or are developing information on how to do it right.
- Among those who write the rules of the game.
- And among those who have different visions of what the final product should look like.

Watersheds, joining land and water, appear to be the clear choice as the organizing logic for addressing riparian management.

Our completed puzzle, after all, is a kind of system. Bruce Hawkinson in a draft of a book entitled *The Next Millenia* describes a system as a whole that cannot be divided into independent parts. Every part has properties that it loses when separated from the system and every system has properties that none of its parts do. Hawkinson quotes Russell Ackoff in the book, *Creating the Corporate Future*, "If each part of a system, considered separately, is made to operate as efficiently as possible, the system as a whole will not operate as effectively." That statement contains a lot of wisdom about reining in the parts in the interest of the whole. Nowhere is that more true than with riparian management.

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A View From the Hualapai Tribe

Mario Bravo

The Hualapai Indian Reservation is located in northwest Arizona along the South Rim of the Grand Canyon. The northern boundary includes 108 miles along the Colorado River which consists of some of the most pristine riparian habitat found in the Grand Canyon.

The Hualapai Tribe is a Cooperating Agency member in the Glen Canyon Dam - Environmental Impact Statement (GCES) and has been since 1990. We presently have four on-going studies though the Glen Canyon Environmental Studies office located in Flagstaff, Arizona.

Some of the Threatened and Endangered Species issues which currently face the tribe revolve around the western willow flycatcher, Hualapai Mexican vole and the Mexican spotted owl. Through the GCES Riparian Study the Tribe is currently surveying the western willow fly-catcher. The National Park Service has the lead on this study and only five birds have been found on Park Service land to date. The fly-catcher problem seems to be parasitism of nests by cow birds. One would think the easiest solution would be to remove a portion of cowbirds for a time to allow the fly-catcher to come back, but this is against overall Park Service policy. This problem probably would not exist if the birds were found on the reservation lands. The Tribe could work with the U.S. Fish and Wildlife Service to develop a recovery plan.

The Hualapai Tribe has approximately 500,000 acres of potential Mexican Spotted Owl habitat. Reports, protocol and survey routes have been established for this species and await a funding source to implement once the species is listed. Funding and capital are always major problems in Indian country.

About one year ago the Hualapai Tribe signed a Memorandum of Understanding with the Arizona Game and Fish Department (AG&F) to work together on various projects. The Tribe is currently working with AG&F on surveying for Mexican Hualapai voles on the reservation. Two specimens were collected and we await DNA results to verify what subspecies they are. Once again the Tribe has yet to receive any funding for its efforts or cooperation with this technical study.

Management of riparian habitat and endangered species issues are very important to the Hualapai Tribe. Each issue is handled on a case by case basis dependent upon the best interests of the Tribe as whole.

At the present time, the Hualapai Tribe has an Independent Contractor, S.W.C.A., along with several Hualapai technicians studying the riparian habitat along the river corridor in the Grand Canyon. Also, BIO/WEST, another independent contractor out of Logan, Utah, is studying the effects of Interim flows from Glen Canyon Dam on the aquatic resources of the Lower Colorado River from Diamond Creek to Lake Mead. In addition we have recreation studies monitoring camping beaches usability and non-use values and a Cultural Resource Study. All of these studies are integrated into the GCES-GIS data base to monitor the long term effects of the Glen Canyon Dam operations on

Mario Bravo is a wildlife technician with the Hualapai Tribe. He grew up along the Colorado River in Arizona and has served as a hunting guide and as a river guide. He is a participant in the Glen Canyon Environmental Studies Group.

Hualapai natural resources.

The Tribe has an established M.O.U with the Bureau of Reclamation (B.O.R) ,and other Cooperators in the EIS. Currently the Tribe is working towards a Adaptive Management and Long-Term Monitoring Policy with these agencies to be able to manage the Grand Canyon Corridor once a Record of Decision is made by the Secretary of the Interior. At a Cooperating Agency meeting last week B.O.R. and the Park service presented a plan where as they would serve as the lead agencies for this program. The Hualapai Tribe presented an alternate plan whereby the Secretary of the Interior would serve as the lead with a Cooperating Agency below him to make decisions.

"They do and will manage their resources for the future of their Tribal members now and yet unborn."

There will be a meeting in Phoenix February 11, 1993 with a outside facilitator to try and resolve this Long Term Monitoring and Adaptive Management Policy. The Hualapai Tribe only hopes to be treated as an equal in the Grand Canyon. They do and will manage their resources for the future of their Tribal members now and yet unborn.

A View From the Federal Government

Mary Butterwick

Introduction

The U.S. Environmental Protection Agency (EPA) administers a variety of Clean Water Act programs whose overall goal is to maintain and restore the physical, chemical, and biological integrity of the Nation's waters. The maintenance and restoration of riparian areas associated with Western tributary waters is a Regional priority due to the rarity, the extent of historic and ongoing losses, and the significant functional value of these systems. EPA's water programs provide several regulatory and non-regulatory tools for addressing water quality and habitat degradation issues in ways that can enhance riparian resources. This paper briefly describes EPA's Watershed Protection Approach which uses an integrated approach to protecting water resources, including riparian areas, on a watershed basis. The Santa Margarita River watershed, in California, is also discussed as an example of a recently initiated watershed project in EPA Region IX.

Watershed Protection Approach

While the Watershed Protection Approach (WPA) is by no means a new program, it has received considerable attention within EPA over the past couple of years. The WPA typically involves a refocusing of existing programs within EPA and other federal, State, and local agencies to address pollution and habitat degradation problems in a more comprehensive and coordinated manner (EPA, 1991a). The basic elements of the WPA are:

Risk-Based Geographic Targeting The target watersheds should be those where pollution and/or habitat degradation pose the greatest risk to human health, ecological resources, desirable uses of the water, or a combination of these.

Stakeholder Involvement The interested and affected parties within the watershed reach consensus on goals and approaches for addressing a watershed's problems, the specific actions to be taken, and how they will be coordinated and evaluated.

Integrated Solutions The selected tools are applied to the watershed's problems, according to the plans and roles established through stakeholder consensus.

The WPA provides a flexible framework for making progress in protecting natural habitats from physical alteration and degradation. Working at a landscape scale, such as a watershed, allows one to assess cumulative and secondary impacts and to consider these impacts in permit and planning decisions. Institutional benefits to be gained through watershed approaches are:

- Improved communication among all levels of government, private organizations, and citizens;
- Increased efficiency through resource sharing; and
- Increased opportunities for establishing risk-based priorities.

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EPA's Office of Wetlands, Oceans & Watersheds (OWOW) actively supports the WPA through development of program guidance (1991b) and public outreach materials (1991a, 1992). In addition, EPA publishes Watershed Events, a quarterly newsletter intended to update interested parties on the development and use of watershed protection approaches. EPA also provides resource support for watershed protection projects under a variety of water programs and has recently completed a matrix summarizing information on these potential funding sources. Over the past couple of years, EPA Region IX has funded several watershed and stream restoration projects, particularly under the Nonpoint Source, Wetlands Protection, and Near Coastal Waters grant programs.

EPA is committed to developing technical assistance in the following areas:

- Numeric ecological criteria that States can use in adopting standards for ecology-based pollution prevention and control programs;

- Assessment and problem diagnosis methods including models for calculating water quality-based controls;

- Methods for watershed characterization;

- Environmental indicators that best reflect the ecological integrity of ecosystems and the effectiveness of protection activities;

- Implementation of technology-based best management practices for nonpoint source pollution; and

- New or refined monitoring methods, including biological monitoring techniques.

The watershed approach is a relatively new program for EPA Region IX. The Santa Margarita River watershed has been identified as a pilot watershed project because of: 1) the area's important resource values, 2) the impacts to the aquatic ecosystem, and 3) local interest in developing a coordinated management plan for the watershed. Given the number of water quality-related activities on-going in the watershed, an integrated watershed approach is needed to enhance the environmental effectiveness of all the water programs in the watershed.

Santa Margarita River Watershed

Physical Setting The Santa Margarita River watershed, in San Diego and Riverside counties, California, comprises an area of about 740 square miles. The watershed is one of the larger river basins in the southern California coastal plain. The Santa Margarita River forms with the union of Temecula and Murrieta Creeks. From this juncture, the river descends toward the ocean shore twenty-seven miles away.

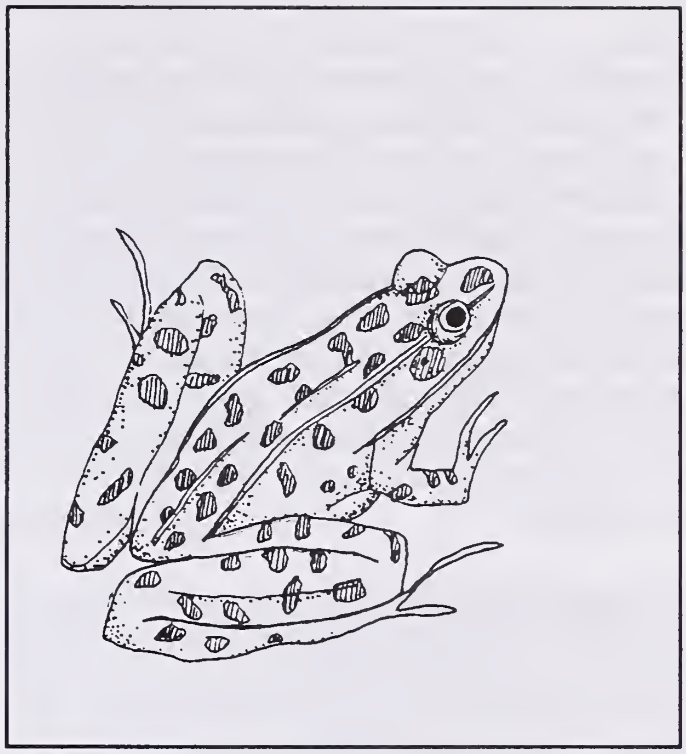
Resource Values The vernal pools and riparian communities associated with the Santa Margarita River and its tributaries provide high quality habitat for a diversity of plant and wildlife species, including 70 special status species. The bird densities and diversities observed in the Santa Margarita River watershed are among the highest reported for southern California in similar habitats. The Santa Margarita River provides breeding habitat for one of the two premier populations of least Bell's vireo remaining in California. The coastal wetlands at the river mouth support 200 bird species including several federal and/or state-listed and candidate species. The endangered California least tern, Beldings' savannah sparrow, and light-footed clapper rail have been the focus of protective measures at the Santa Margarita River estuary. The northern barrier beach and salt flats of these wetlands are reportedly the largest nesting area for the California least tern within its range.

Several of the plant communities associated with tributaries or other waters in the watershed have been identified as communities of special concern by the County of Riverside or by the Natural Diversity Data Base (CFGD). A partial listing includes Riversidian Alluvial Scrub, Mulefat Scrub, Southern Sycamore-Alder Riparian Woodland, Southern Cottonwood/Willow Riparian Forest, Coastal and Valley Freshwater Marsh, Freshwater Seeps, Vernal Pools, Engelmann

Oak Woodland, and Coast Live Oak Woodland. Several of these plant communities not only provide important habitat but also perform various hydrologic functions such as flood attenuation, sediment retention, and bank stabilization.

Water Quality Impacts/Issues Much of the upper watershed is in private ownership and subject to significant development pressures. The area is within commuting distance of Riverside and San Diego and is projected to undergo a threefold increase in population over the next twenty years. At particular risk are the tributary streams within the "sphere of influence" of the cities of Murrieta, Temecula, and Fallbrook. According to Army Corps of Engineers data, thirty-eight Section 404 permits have been issued since 1987 on the Santa Margarita River and the Murrieta, Temecula, Tucalota, Warm Springs, and Wilson Creeks with cumulative impacts to greater than 179 acres of waters of the United States. Most of the fill activities involved stream channelization for development/flood control projects. Thus far, the Section 404 permit review process has not been able to adequately address the cumulative impact of these projects on the Santa Margarita River and its tributaries. Given the extent of existing and projected development in the watershed, it is important that an effective storm water NPDES permit program for controlling pollutants in storm water runoff be implemented.

Existing water quality monitoring data indicate that water quality objectives for Dissolved Oxygen, Nutrients, Total Dissolved Solids, and the minerals Boron, Manganese, and Iron are exceeded or appear likely to be exceeded in the Santa Margarita River. The various pollutants are from nonpoint sources associated with agricultural operations and septic systems and from point sources, such as wastewater treatment facilities. Of particular concern is the Santa Margarita Estuary which is on the State list of impaired water bodies (i.e., water quality limited segments) due to nutrient loadings. To the extent that the estuary acts as a sediment trap it is susceptible to nutrient loading from upstream. The amount of loading, and the potential for degradation, will depend in part on the total mass of nutrients available upstream and the



frequency with which the estuary is open to tidal flushing. Consequently, Camp Pendleton's illegal wastewater discharges and Eastern Municipal Water District's and Rancho California Water District's proposed wastewater discharges are priority NPDES issues.

Groundwater recharge is an important issue in the upper part of the watershed and on Camp Pendleton, along the lower reaches of the Santa Margarita River. Murrieta Water District depends exclusively on groundwater for its water supply. Camp Pendleton also relies on groundwater for much of its drinking water.

The federal Superfund Site on Camp Pendleton includes several sites within the Santa Margarita River floodplain. Known or suspected hazardous wastes generated at these sites include hydrocarbons, paints, thinners, solvents, and pesticides. These substances have potentially flowed into the Santa Margarita River or leached into groundwater. Definitive information about the nature and extent of contamination at Camp Pendleton will not be available until the Remedial Investigation reports are completed.

County Planning Project The county planning project was initiated by members of the Board of Supervisors of San Diego and Riverside Counties under the mandate of a joint resolution passed in 1989. The resolution recognized the need for interjurisdictional planning and management of the stream-related uses and resources of the Santa Margarita River system and stated the intent of the two counties to cooperate for that purpose. The National Park Service's (NPS) Rivers, Trails and Conservation Assistance Program is facilitating the development of a coordinated management plan for the watershed. Through a scoping process involving representatives of 31 federal, state, and local agencies, and citizen groups, a draft mission statement, objectives, and a scope of work has been prepared.

EPA's Santa Margarita Watershed Strategy A watershed approach is being used to: 1) gain an understanding of the role of the tributaries in maintaining the physical, chemical, and biological integrity of the watershed; and 2) more effectively address the cumulative effects of multiple pollution sources to waters within the watershed. An EPA Region IX Santa Margarita workgroup, representing the pertinent water programs and Superfund, has developed a draft strategy for implementing the watershed project. The overall project goals are to:

- Implement a fully integrated approach to water quality assessment and management incorporating the applicable water program and Superfund activities.

- Augment Riverside and San Diego Counties' efforts to develop a comprehensive watershed management plan that is consistent with the CWA goals of maintaining and restoring the physical, chemical, and biological integrity of the watershed.

The Santa Margarita workgroup has identified the following specific objectives from the summary of program issues. The objectives represent specific projects or outputs deemed necessary to achieve the two watershed project goals stated above.

- Implement an Advanced Identification (ADID) and investigate permitting options (e.g. general permit, 404(c), rescind nationwide permit program in watershed).

- Assist in development of San Diego/Riverside Counties' coordinated management plan.

- Implement a public outreach program focusing on the CWA tools that are available to maintain and restore the integrity of the watershed.

- Work with the State, County, and local entities to implement effective controls of point source and nonpoint source discharges (i.e. storm water and agricultural runoff, wastewater treatment facilities).

- Assure that State adopted water quality standards are adequate to restore and maintain the integrity of the watershed.

- Assist the Regional Water Quality Control Board in participating in the Counties' management plan for the watershed.

- Develop a database and tracking system for the watershed that includes a GIS component.

- Develop a Total Maximum Daily Load to control input of nutrients and total dissolved solids and to protect the natural assimilative capacity of the system.

As indicated above, a component of this watershed project is an Advanced Identification (ADID), a planning process in which EPA and the Army Corps of Engineers identify, in advance, aquatic sites as generally unsuitable or potentially suitable for discharge of dredged or fill material, pursuant to Section 404 of the Clean Water Act. The results of an ADID are informational and advisory, not regulatory. The intent of an ADID is to provide advance information on potential Section 404 permit issues and to encourage the avoidance of sensitive areas designated as unsuitable. The identification of sites is based primarily on the assessment of the functions and values associated with waters in the watershed, including wetlands and riparian areas. As technical support for the ADID, EPA contracted with the Cadmus Group to compile resource information and analyze the existing data available on the Santa Margarita River watershed and the wetlands within its boundaries.

The watershed report focuses on the following components:

- Information, data, and reports related to waters of the United States in the watershed, emphasizing their wetlands and associated riparian areas.

- Extent and potential functions and values of waters in the watershed.

- Extent and status of stressors and hazards to waters in the watershed.

- Present and projected risks to waters in the watershed.

- Data gaps for the assessment of functions and risks to waters in the watershed.

- Graphical displays and Geographical Information System (GIS) maps to assess the location and functions of waters, including wetland/riparian areas and the relative risks to these waters.

EPA intends to make the Cadmus watershed report, including the databases and electronic information, available to the County's planning group. This report provides much of the watershed characterization data identified in the NPS's scope of work for the County planning effort.

EPA is also considering funding the California State Coastal Conservancy to formulate flood control and development engineering design criteria. The criteria will focus on the maintenance of hydrologic balance and the long-term protection of wetlands and riparian habitat in the watershed. If funded, this Wetlands Protection Grant would address viable alternatives to stream channelization, a flood control activity which has been responsible for much of the riparian habitat loss in the watershed.

Conclusion

As Region IX progresses with implementation of the Santa Margarita River watershed strategy, it is important that the lessons learned from this project be applied to future watershed planning efforts. We anticipate that EPA will continue to emphasize the Watershed Protection Approach as a fundamental basis for EPA's efforts to protect water resources, including wetland and riparian areas.

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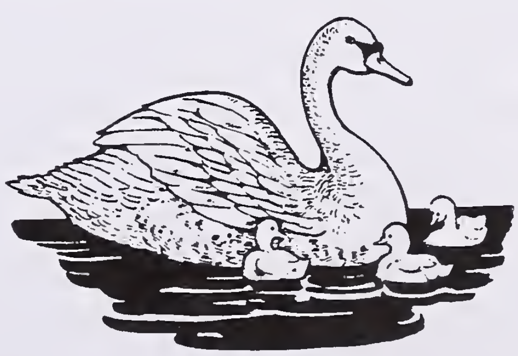

BIRDFOOT'S GRAMPA

The old man
must have stopped our car
two dozen times to climb out
and gather into his hands
the small toads blinded
by our lights and leaping,
live drops of rain.

The rain was falling,
a mist about his white hair
and I kept saying
you can't save them all,
accept it, get back in
we've got places to go.

But, leathery hands full
of wet brown life,
knee deep in the summer
roadside grass,
he just smiled and said
they have places to go too.

Joseph Bruchac

A Rancher's View of the River

Gretchen Sammis

My River--in varying degrees it is any and all rivers. But this one I know. It is the lifeblood of the Ranch. In the spring the first grass and weeds start close to the river. This is crucial time for the young plants, so the cows must go elsewhere if possible. They are moved to the irrigated pastures and fields that exist because of the river. From the irrigated pastures and fields they go to the lower hillside pastures. Water from the river flows through these pastures by means of ditches that go to the fields. Then as soon as possible the cattle are moved to the higher canyons and hills and away from the river for the summer. Now, the water from the river irrigates all that need it. The fields, the pastures, the orchards, and the lawns create feed for the remainder of the year.

In the fall as the cattle come down from the upper canyons, they first go to the lower hillside pastures, then the meadows and fields, and finally the river pastures. We try not to hit the same pastures at the same time each year, but that depends upon what kind of year it has been and where we have to be. In winter the river is the source of water for the cows, horses and all the other animals that exist in the area. Generally, it remains open all winter unless there is a bitter cold spell, so breaking ice is not a problem. However, sometimes a cow will calve too close to its edge and as the little guy struggles to get up, in he goes and that's that.

Without "my river" there would be very little livestock, no irrigation water, no irrigated pastures nor hayfields. Also, the wildlife who share the Ranch with the cows, horses and people depend upon the river for water and the riparian area for food and shelter. The turkeys and pheasants nest there, while many of the deer and elk bear their young near the river, and many other wild animals and birds live close to the river year around.

A long time ago, my great grandfather straightened part of the river's channel to create larger farming areas. They still are not very big, and ever since then part of the original river bed has become what we call a "slough." Others call it a swamp and the government a wetland (I would agree with them on this one).

This slough is home to so many birds and small animals that most of you would be amazed if you came, sat and observed. In the spring, ducks, geese, Red-Wing Blackbirds, an occasional Blue Heron and many other species stop on their way north. The reservoirs are covered with birds--the ducks, geese, and blackbirds fill the slough with conversations. Many ducks and several pairs of geese nest in my slough and actually stay all summer. The eagles are here also and harvest the ducks when they can catch them. All of this makes my river just that much more important.

Sometimes, though, the animals are not as cooperative as I think they should be. Beavers, for example: Sure, they are good to build up and improve riparian areas and I appreciate that. However, when they decide my diversion dams need improving or are in

Gretchen Sammis is a member of the Board of Directors of theNational Association of Conservation Districts. Ms. Sammis is a retired school teacher and a full-time New Mexico rancher, at Chase Ranch. She received an MS from the University of Colorado with a major in physical education and minor in science. She has run the Chase Ranch since 1954 and taught until 1972. She is a member of the Center for Holistic Range Management and the New Mexico Cattlegrowers Association.

my diversion dams need improving or are in the wrong place, or that the ditches are letting out too much water and they begin to dam them up every night, then they must go.

Also, the deer and elk enjoy the freshly growing alfalfa and oats. So far we have put up with them, but the elk are becoming a big problem. Their numbers are increasing dramatically. They compete with the cattle for everything. They cost us at least one cutting of hay from each of the fields, and the riparian areas we try to protect from the cattle are beaten into the ground by the elk.

My river, for all its goodness, can also be a monster. This river has a large watershed which reaches to the high mountains with many tributaries. If it rains hard for several days on the entire watershed, there is nothing to stop the flood waters. Dams go, fences go, channels change, and fields and crops are damaged or destroyed. However, the Ranch and all it encompasses can not live without the river, so I willingly chance its destructive powers.

I believe that the water from my river is as clean or cleaner when it leaves the Ranch as when it entered it boundaries. I also believe that all of us who are fortunate enough to have a river for a little while, must do our best to protect its watershed and riparian areas and make it a better river as it goes on its way. We all know that without rivers there would be very little agriculture, or life for that matter, so in closing I quote William Jennings Byron who said: "Burn down your cities and leave our farms, and your cities will spring up again as if by magic; but destroy our farms and the grass will grow in the streets of every city in the country."

"Burn down your cities and leave our farms, and your cities will spring up again as if by magic; but destroy our farms and the grass will grow in the streets of every city in the country."
William Jennings Byron

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Rivers from a Timber Industry Perspective

Chris Sokol

Thank you for your invitation to the Albuquerque Riparian Management Conference to comment on how streams and associated riparian management fit into the way a forest products industry, specifically Weyerhaeuser Company, plans and conducts its forestry operations.

I am a forestry operational manager, so I'll be speaking from my own perspective of making things happen.

A Historical Perspective

I'd like to give you a historic perspective, show the direction of our management practices <u>now</u> and then offer a few observations from actions taken on a watershed in southern Oregon on the east side of the Cascades.

I hope it will not be a surprise to you to think that the woods industry, and specifically Weyerhaeuser Company's view of riparian management has changed over the last several decades and our role in cooperative processes is still very young.

Our past experiences and history have shown that were good at managing our timber resources. We are world class at Ponderosa pine regeneration, timber inventories and net present value calculations - <u>but this is not enough!</u>

After more than 75 years of harvesting and grazing, before Best Management Practices and the 1971 beginning of modern forest practices in the country, prevailing practices at the times were such that there was much room for improvement of management and particularly stream protection. In fact, in the case of grazing, we were brought up to think riparian areas were supposed to look well manicured by cattle.

New Directions

Presently we have set out to formalize our changing direction of incorporating the complexities of managing for all the other resources on our forest lands. We have begun, and will strive to be, world class in the inventorying and management of such resources as water, fish and wildlife.

This course has been strengthened by senior management's development of our timberland stewardship statement and their vision of Weyerhaeuser Company's forestry. "Our charge is to protect, maintain and enhance a multitude of forest values while managing our forest for commercial timber production." The test of success will be focused on riparian areas and water quality within a given watershed.

Through coordinated resource plans we are listening and learning. One such plan is an example of more than six Coordinated Resources Management Plans (CRMP) we are working on beginning to meet specific resource objectives.

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Spencer Creek

The prime Klamath River wild trout fisheries (last stocked in 1978) has Spencer Creek as its only spawning habitat. Weyerhaeuser Company's ownership consisting of eight of the twelve miles of stream had been managed for most of 100 years, with grazing activities for 70 years. Since 1980 and before the CRMP, increased ATV-ORV numbers had accelerated the degradation of stream banks and associated areas. For ten years the Company had made much improvement by working with ATV groups and dealerships to promote the values and significance of this type of resource. While improvements were being made, we also began to understand that we could not achieve as much for the stream as we wanted - a change was needed. The Spencer Creek CRMP began to take shape in 1990.

As with all CRMPs, the process of assessment action and monitoring was begun to gain a better understanding of the stream;'s current condition and to develop actions to meet resource objectives. The combined resources of all the participants including lessees, Oregon Department of Fish and Wildlife, Bureau of Land Management, Oregon Trout, Soil Conservation Service, Pacific Power and Light, USDA Forest Service and Weyerhaeuser Company have made much headway. Many projects have taken place and continued monitoring is being done to be able to utilize the best science available to guide our future actions.

Conclusions

"What has this process meant to us?" This cooperative process in terms of balancing all resources has provided a mechanism which:

1. Establishes a clear, formalized focus for our defined values and goals.

- Eliminates bias (personal, scientific)

- Pools resources ($$, experience)

- Encourages a set of people to seek solutions through compromise who would otherwise not be talking and listening.

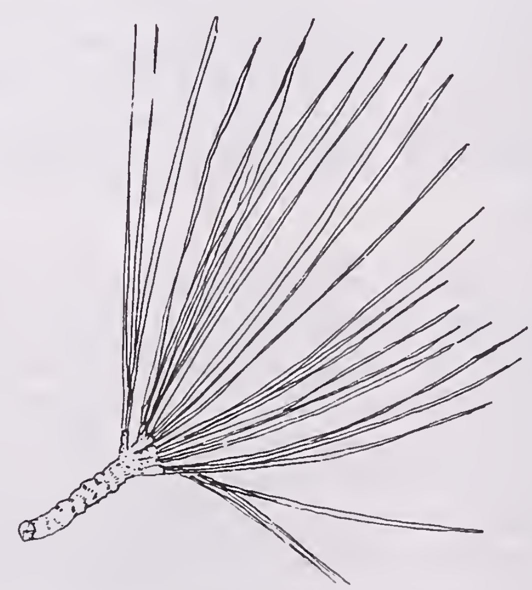
- A key lesson for us: do good assessment and monitor.

2. Develops a serious commitment of us and everyone involved and sets the task of improvement in a consensus arena.

3. Fosters relationships whereby each begins to understand and appreciate the wide variety of interest, experience and objectives of all parties, and sets in motion communication events well beyond the scope of this process.

4. Demonstrates the ability to resolve conflict and strengthen our confidence to manage all resource across our forest lands.

You ask "What's in it for us - to balance resources?" We recognize that long-term management of forest lands needs to be predictable and consistent. Without this we feel we could not manage.



Rivers from a Utility's Perspective

Donna Lindquist

State Water Issues

The demand for high quality water is steadily increasing in California in response to urban growth, agricultural expansion, and industrial, recreational and energy producing uses. Rising water values, declining water imports from outside the state, and prolonged drought have intensified competition between water users, catalyzing legal challenges to the historic water rights doctrine and increasing public pressure for legislation and standards that control water quality.

Public sensitivity and interest in improving and protecting environmental values also continue to accelerate, moving water issues into the political and social spotlight. In response, federal and state regulations are expected to increase in the next decade, further elevating the value of water as a natural resource and a commodity, and increasing the complexity of this issue.

How this will affect hydroelectric power producers is uncertain at this time, but based on recent legislation, issues surrounding water are expected to dominate California politics in the next decade.

Demand For Power

From an energy consumption perspective, people demand power. The public has become accustomed to the luxury of turning on the switch and having the lights go on, the garage door open, or the door bell ring. Consumers not only want power, but demand low-cost power that is reliable and available upon demand, regardless of season, time of day or duration. The availability and distribution of electricity have changed our world and our lives, and is a convenience most of us take for granted. But is the public willing to pay the price for that convenience?

Electricity comes to us at an economic and environmental cost with the generation technologies available today. Until cold fusion, fuel cells or some other futuristic, environmentally benign technologies are developed and commercialized, we have to make the best of what we have to provide this service. Whether you are burning fossil fuels, splitting atoms at a nuclear plant, or operating renewable technologies such as wind and solar, it is difficult to identify an energy generating technology that does not produce an environmental risk of some magnitude.

Though hydroelectric power does produce environmental impacts with respect to fish and wildlife habitat, vegetation, and water quality, many of these effects can be minimized or mitigated through careful planning and implementation of good management practices. Due to its low cost, high reliability and environmentally clean operation, hydro power continues to represent a relatively low-risk and attractive electric generation option available today which should be utilized until more advanced and efficient technologies come on line in the next century.

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Development of Hydroelectric Power

In order to better understand issues and problems on river systems from the utility industry perspective, I have provided a brief historical account of how hydroelectric power evolved in California, using Pacific Gas & Electric Company (PG&E) as an example. This will provide a context to promote a better understanding of river management through the "lens" of the utility industry.

Historical Setting

The vast water works built by the gold miners in the mid 1800s catalyzed the development of hydroelectric power in California. The first canals in the state were built in 1850 in Nevada County to support hydraulic mining operations. By 1860's, mining became big business as demand grew, resulting in 8,000 miles of ditches and flumes riddled throughout the Sierra Nevada. Systems for storage and delivery of water continued to be developed, until the mining industry began to falter in the late 1800s. Small water companies attempted to replace the lost demand from miners with an increase in consumptive uses, most notable irrigation for crops, but this fell short of offsetting loses. Water companies began to shift their focus on new hydroelectric development as a means to stay in business in the early 1900s.

California's population was booming between 1900-1910, gaining nearly 900,000 new residents (a 60% increase). There was a proportional growth in demand for gas and electric service in cities and towns far removed from the mountains and hydroelectric resources. Due to this growing demand for power and the commercialization of the electric generator by Edison and Brush that facilitated electric transmission, a new market began to emerge for power.

Up to this point, expansion of electric power was hampered by the high cost of coal, which impeded development and growth but with the introduction of water-powered generation and transmission, energy could be produced inexpensively and delivered in a reliable manner throughout the state. A new era was born.

Though small hydro projects operated in the late 1800s, the first major hydroelectric power project was built in California in 1911, amidst a flurry of growth. Dams were built throughout the Sierra by a multitude of small and large power companies, creating reservoirs to meet the power needs of commercial, industrial and residential customers. It became evident that consolidation of existing companies into one regulated monopoly was a preferred model in assuring the delivery of low cost and reliable energy to customers. PG&E was thus established in San Francisco in 1905, with the consolidation of two prominent California gas and electric companies, and later, the addition of several hundred small water and power companies, with their associated hydroelectric projects.

Present Outlook

Today, PG&E is a regulated utility that serves approximately 11 million people in a 94,000 square mile service area. It includes most of northern and central California, from Bakersfield in the south, up to the Oregon border in the north. PG&E also operates one of the largest investor-owned hydrogeneration systems in the world, consisting of 177 dams that range in age from 2-89 years, and 72 powerhouses that are located within 15 watersheds. In average years, almost half of PG&E's power is generated by renewable energy resources, including hydro, geothermal, wind and solar, representing a very diverse generation mix. Hydro accounts for 20% or about 3,900 megawatts of the total generating capacity, during a normal rainfall year. The use of hydroelectric power reduces dependency on higher cost, less environmentally compatible resources such as fossil fuels, which facilitates lower rates for customers and allows producers to be competitive in a dynamic and ever-changing electric supply market.

Regulatory Influences

Since the 1960s, gas and electric utilities have been increasingly affected by hundreds of new and revised environmental laws and regulations. Such legislation has been passed by federal, state and local governments and are enforced by dozens of regulatory agencies.

Most regulatory considerations affecting a hydropower project are included in the Federal Energy Regulatory Commission (FERC) licensing process, under the Federal Power Act (FPA). The FPA was originally enacted as the Federal Water Power Act in 1920 by Congress to regulate the development of power projects over which the federal government has jurisdiction. This act was amended in 1935 to include two additional sections: the first of which vests FERC with jurisdiction over interstate transmission of electric energy and public utility companies who engage in such activities; and secondly, new administrative procedures for licensing and regulating those activities. FERC is responsible for conducting this licensing process on each project as they come up for review. Mitigation requirements are written into the project's FERC license to operate.

Although a number of the regulatory processes are authorized under other laws, the core of the environmental considerations in the licensing process result from the FPA and the National Environmental Policy Act (NEPA) requirements for FERC to

1) license projects that provide a balance between power and non-power resource values;

2) license projects that are consistent with resource management plans;

3) assess the environmental impacts of projects under NEPA; and

4) consider the recommendations of fish and wildlife agencies for mitigation and enhancement of resources.

At the state level, the California Environmental Quality Act (CEQA) mandates that environmental impact reports be filed, and the Department of Fish and Game and the State Water Quality Control Board are routinely involved in recommending studies or mitigation options for FERC's consideration. Probably more federal and state regulatory power lies behind requirements for screening and fish passage facilities than any other mitigation measure for hydroelectric plants. Empowered by the FPA, FERC is required to give substantial weight to fish and wildlife agency recommendations for fish protection. Fisheries issues include instream flows, upstream and downstream fish passage, and water temperature. Most licenses also include requirements for instream flows, in order to mitigate, protect and enhance fish and wildlife resources. Dam owners are required to release sufficient water to keep fish below the dam in good condition. The amount to be released, though, is frequently debated which tends to pit the question of economics against environmental protection, since the vitality of a project will depend on flow available for generation. FERC appears to take economics into consideration, but as long as a project is considered economically feasible, little consideration is given to cost.

PG&E and other hydro producers are required to spend millions of dollars a year, in some cases, to implement fisheries-related mitigation measures required by FERC in the licensing process. These commonly include research studies and monitoring, flushing flow for sediment removal on spawning gravels, habitat restoration, increasing instream flows to reduce water temperature, and erosion control plans, in addition to construction of fish ladders and diversion screens.

Environmental Commitment

Historically, utility operations have often had an impact on the environment, including hydroelectric development. The past decade, though, has seen many utilities shift their stance on environmental protection from resistance to support.

In fact, PG&E has recently established a new corporate goal to increase energy efficiency, develop environmentally preferred technologies, and expand the use of clean fuels for producing power. This goal was based on the premise that the company could integrate responsible environmental policy and sound business practices to the benefit of the shareholders, customers and the environment. In this proactive trend toward environmental protection and enhancement, PG&E has been an industry leader, by committing a significant amount of time, money and employee effort not only to comply with environmental regulations, but also to enhance the quality of the natural resources under its management in a voluntary manner.

Environmental Enhancement Projects

An example of this commitment is the collaborative Erosion Control Restoration Program in California's North Fork Feather River watershed. PG&E, along with thirteen other cosponsors, joined forces in 1986 to develop a Coordinated Resource Management Program (CRM) that has contributed several million dollars to support planning and implementation of a watershed restoration program. The project was initiated in response to accelerated erosion occurring on private and public lands above PG&E hydroelectric facilities.

Historic land use practices such as timber harvesting, overgrazing, mining and road construction are largely responsible for the instability in the watershed, depleting native vegetation, and leaving barren soils vulnerable to erosional processes. For PG&E, the subsequent increase in sediment deposition in reservoirs downstream created environmental and operational concerns. This has caused an increase in equipment and maintenance-related costs for the utility, and has degraded fish and wildlife habitat and water quality for other watershed users.

Since 1988, the CRM group has implemented 33 riparian and wetland restoration projects, including an urban stream and one abandoned mine tailings Superfund site, totaling $2.5 million dollars. Initial monitoring

> ***"Whether you are operating a hydroelectric power plant, managing a river rafting enterprise, or are transforming photons into pounds of beef, economics and the environment are irreversibly connected."***

results have reported substantial increases in waterfowl and trout populations in the treated areas. The observed progress toward stabilization has emphasized to all participating organizations the power of cooperation and joint sponsorship. Many of these projects were too costly for any one organization to address alone and only by combining forces of all stakeholders has success been realized.

Collaborative efforts such as this have demonstrated that long-term economic success can not be achieved at the expense of environmental values.

Conclusion

Water is a precious resource and a valuable commodity that requires careful management to minimize the pressure of competing water users. To optimize outputs, watersheds must be managed for multiple uses at the systems or watershed level, thus avoiding fragmented approaches that commonly fail. All stakeholders must be involved in the planning and implementation process to maximize the chance for successful implementation and to insure that the integrity of the biological and physical systems are maintained in good condition.

Whether you are operating a hydroelectric power plant, managing a river rafting enterprise, or are transforming photons into pounds of beef, economics and the environment are irreversibly connected. Public and private sector interest groups on both sides of the issues need to cooperate in developing plans and programs to protect and enhance environmental resources with collaborative projects and multi-sector partnerships. Responsible environmental management makes good economic sense.

The River Through the Recreationist Lens

Stan Bradshaw

Any attempt for a single person to express the recreationist perspective is inevitably doomed to failure. The perceptions of the river and its riparian borders are diverse, often divergent, and largely defy generalization. When one queries recreationists about how to protect riparian areas, the task becomes even more hopeless.

Nonetheless, as one who canoes, fishes, rafts, watches birds, and otherwise tries to spend as much of my free time as I can on the water, I'm not above conceit of trying to present a generic recreationist's view of rivers and the problems attending any coordinated management attempt. Nonetheless, be forewarned that my presentation is heavily influenced by my own experience and personal parochialism.

The River Through My Lens

For me, the value I derive from my river-borne recreations is inextricably tied to adjacent riparian border. As an angler and floater, I need water in the river. As the legion of case studies of riparian recovery projects has shown, there is a direct link between having water in the stream and having as healthy riparian area.

The fisheries and bugs that are crucial to any kind of fishing rely on cool, clean water - water largely free of sediments, excess nutrients, pesticides, and other contaminants. Again, the verdict is already in. Healthy riparian areas are the filters that protect us from the effects of nonpoint pollution - overland runoff. Finally, most of us who gravitate to rivers - whether boaters, anglers, birdwatchers, or just people who like to mess around on rivers - seek something more subtle than simply lots of big fish, good white water, or a new notch for our life list. In my frame of reference, that includes things like some sense of escape, a sense of well-being, and some feeling of isolation from the everyday things that bind me to the civilized world. Intrinsic in those sensations is the riparian zone. For me, that band of water-dependent vegetation, with its accompanying wildlife, diversity, and lushness, is the protective barrier that sets me up to achieve those more ethereal enjoyments. Without that enveloping membrane, I might as well simply float down a gutter or an irrigation ditch.

The Recreationist in the Management Equation

Having identified all this value, I must confess that I boomerang back and forth between optimism and pessimism over our prospects for the protection and recovery of our riparian areas.

My pessimistic vision arises in part from the thing that I think drives the initiation of a conference like this - the persistent apparent inability of our institutions of government and the citizens of this country to move in

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any sort of orderly fashion towards real legal and institutional protection of these resources. Conferences on the general topic of riparian protection have been going on for years. I have the proceedings on one that looked at grazing in the riparian areas that occurred in 1979. Many of the same themes were struck there that we have here (At times I wonder whether these conferences really move us forward or whether they simply provide a forum for bureaucrats and academics to fill some more space on their resumes).

Another point of annoyance with governmental types. Many professionals in resource management tend to view the interested public as an annoying impediment to their efforts to do good works. This attitude manifests itself in two ways. The first, and perhaps most annoying, is what I call the "It can't be done" syndrome. That's when the government professional, confronted by a new or innovative idea, manages to pepper it with a barrage of reasons, usually grounded in money or manpower, insisting that your idea is impossible. The second response is to treat the interested public with benevolent condescension, as though nobody outside the agency can possibly offer anything worthwhile. If you insist on that behavior, then don't be surprised when you get hit with the backlash.

"A lasting, effective approach will arise only out of a sense of shared responsibility. This will happen only when we finally quit pounding the table and sit down at it, agree to set aside our egos and collective paranoia and get something done".

The problem with this approach is that it does not even admit of a problem, let alone any obligation to address it. In Montana, there is even a faction of landowners who actively work to subvert even voluntary self restraints such as conservation easements. And yet, we continue to hear from landowners, quite understandably,that they prefer cooperative approaches to regulatory actions.

To those of us who value the more public amenities of healthy riparian areas, this mindset can be especially frustrating. As a practical matter, there are few specific legal constraints on how people treat their riparian areas. Thus, we are left, in large part, with trying to initiate cooperative ventures with the owners of riparian areas. When our overtures to find cooperative solutions are rebuffed, we eventually find ourselves driven towards more draconian measures.

On the other hand, I think there is considerable cause for optimism. With riparian areas, we are not faced with impossibly complex technical problems. Protection and repair does not require global solutions such as global warming or the ozone problems seem to demand. Generally, as the myriad study areas have shown, riparian areas respond quickly to fairly simple solutions. And, in that regard, riparian area protection lends itself well to cooperative management approaches. Groups like Trout Unlimited or the Izaak Walton League can readily be the catalyst for specific cleanup efforts. And, while to date, those efforts have been spotty, they may still offer our most effective avenue to restoration and protection. At the very least, they result in specific, tangible change where we really need it - on the ground.

In the final analysis, riparian protection will occur on a large scale when we establish some broad institutional initiative that truly recognize the importance of these areas, and them implement them locally through a mosaic of regulatory and cooperative approaches.

No policy is worth the paper it's written on if it does not modify behavior on the ground. Any solution is going to cost money. But the burden need not fall entirely on any one sector. An example, in microcosm,of how this can work is found in Montana. In 1989, the Montana Legislature passed the River Recovery Act. The bill simply earmarked a specific amount of money from each fishing license sold in the state to be spent on projects that improve aquatic habitat. The money is available to private landowners, conservation groups, conservation districts, and anyone else who can propose a project that will improve aquatic habitat. Where has most of the money been spent? On riparian restoration projects.

Perhaps more importantly, it allows one sector of the recreating public - anglers - to put their money where their mouth is. The result has been distinctly rewarding. Many of the projects have been specific partnerships between sportsmen and landowners. The River Restoration Funds have provided matching funds that have yielded much more from other sources of money. And best of all, modest though the actual expenditures have been (the Fund yields only about $110,000 per year), streams and their riparian areas are being repaired. And that, after all, is the bottom line.

While the River Restoration Fund is a seemingly pedestrian example of this approach, it works. We need to be thinking about such programs on a larger scale, with a broader source of contribution and participation.

A lasting, effective approach will arise only out of a sense of shared responsibility. this will happen only when we finally quit pounding the table and sit down at it, agree to set aside our egos and collective paranoia and get something done.

A Wildlife Viewpoint — Southwestern Riparian-Stream Areas: Habitats for Fishes

John N. Rinne

Introduction

Riparian areas in the arid American Southwest are invaluable resource areas. Their importance is inverse to their relative area across the landscape. Although they comprise less than 2 % of total surface areas they provide critical habitat to many plant and animal species. Structurally, these areas are distinct and well-defined in an often drab-appearing, arid landscape.

Functionally, these areas are much less understood and delineated. Southwestern riparian-stream areas are unique and remnant. The activities of and uses by both private and public agencies since the late 1800s have markedly changed their nature and extent (Miller 1961). Current riparian areas have become reduced by greater than 80% compared to historic conditions. Beginning in the late 1970s, and continuing to the present, numerous symposia and workshops have been held to facilitate an understanding of these natural resource areas and provide a basis for effective management (Johnson and Jones 1977, Johnson et al.. 1985). In Region 3, the southwestern region of the U. S.D.A. Forest Service, riparian areas are presently afforded priority management. These areas are barometers of watershed condition (Debano and Schmidt 1989). Accordingly, they must be managed ecologically with respect to both natural conditions and to the different multiple uses (i.e. timber, grazing, recreation, fish and wildlife) on National Forest lands (USDA Forest Service 1992).

Riparian areas exist as a result of water that falls on the watershed and ultimately, through surface or subsurface flow, reaches valley bottoms. Water is an extremely precious and often scarce commodity in the arid Southwest. Surface flow of water is dependent upon many factors including season, land use, valley bottom characteristics, instream diversions or damming, and vegetational abundance and composition.

Aquatic Habitats

Riparian-stream areas are comprised of various components including the water influence zone (i.e. the watershed), the terrestrial or streamside, vegetation zone, and the aquatic zone. Many vertebrate species inhabit or utilize riparian areas for all or part of their life cycles. Birds use these areas as migrating, nesting, and feeding areas (Ohmart et al. 1977, Hunter et al. 1985, Szaro and Jakle 1985, Szaro and Rinne 1988). Similarly, mammals, reptiles and amphibians are attracted to these areas for food, water, and cover from the often harsh temperature and arid conditions characteristic of the Southwest.

Because they require the medium of water

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to sustain themselves, fishes are intricately linked to the aquatic zone of riparian-stream areas in the southwestern landscapes. Although few (about 2 dozen) fishes occurred naturally in southwestern rivers and streams, they were used by early native American cultures for food (Minckley and Alger 1968). Many native fish species were uniquely adapted to survive conditions of flood and drought characteristic of the aquatic zone of riparian areas (Minckley, 1973, Rinne and Minckley 1991). In addition to native fishes, many sport species have been introduced into the waters of the Southwest and are in heavy demand by anglers (Everest and Summers 1982). The surface waters or aquatic habitats in these areas are basic to the survival of all fishes, native or introduced.

The purpose of this paper is to briefly discuss:

1) the various components of riparian-stream areas and their importance as habitat from the viewpoint of fishes; and

2) the nature of change in aquatic habitats in the Southwest and its impact on fishes.

Figure 1. Change in hydrological geography of Arizona resulting from construction of dams, 1911-1960. Half circles indicate dams, dotted lines are dried river changes, cross hatching on solid line represents modified flow, and solid lines indicates perennial flows.

Vegetation

Trees and shrubs adjacent to the aquatic zone of riparian areas are important not only for structuring aquatic habitats for fishes, but in their functioning also. First, trees provide shade to surface waters which prevents stream temperatures from rising to lethal levels for fishes. It is not uncommon for stream temperatures to exceed 30 degrees C during peak summer radiation (Deacon and Minckley 1974, Naiman and Soltz 1981).

Secondly, the root systems of streams stabilize banks along the aquatic zone reducing bank erosion and silt production. In addition, root systems interacting with increased flow events produce undercut banks which provide cover and resting areas for fishes (Heede and Rinne 1990). Thirdly, dead branches and entire trees produce large woody organic debris which in addition to undercut banks, provide cover for fishes (Minckley and Rinne 1985). Debris piles also serve as the structural framework and habitat for invertebrates which serve as a food source for fishes. Finally, upon decomposition leaves, smaller twigs and branches provide nutrients and food for both terrestrial and aquatic macroinvertebrates and, in turn, fishes.

Water

As indicated above, water is the common thread between the presence and sustainability of riparian areas and habitats for fishes (Heede and Rinne 1990). In the Southwest, the quantity and quality of water in time and space vary markedly. Climate alone dictates its amount and quality (Green and Seller 1964). Stream channels can change from dry, intermittent

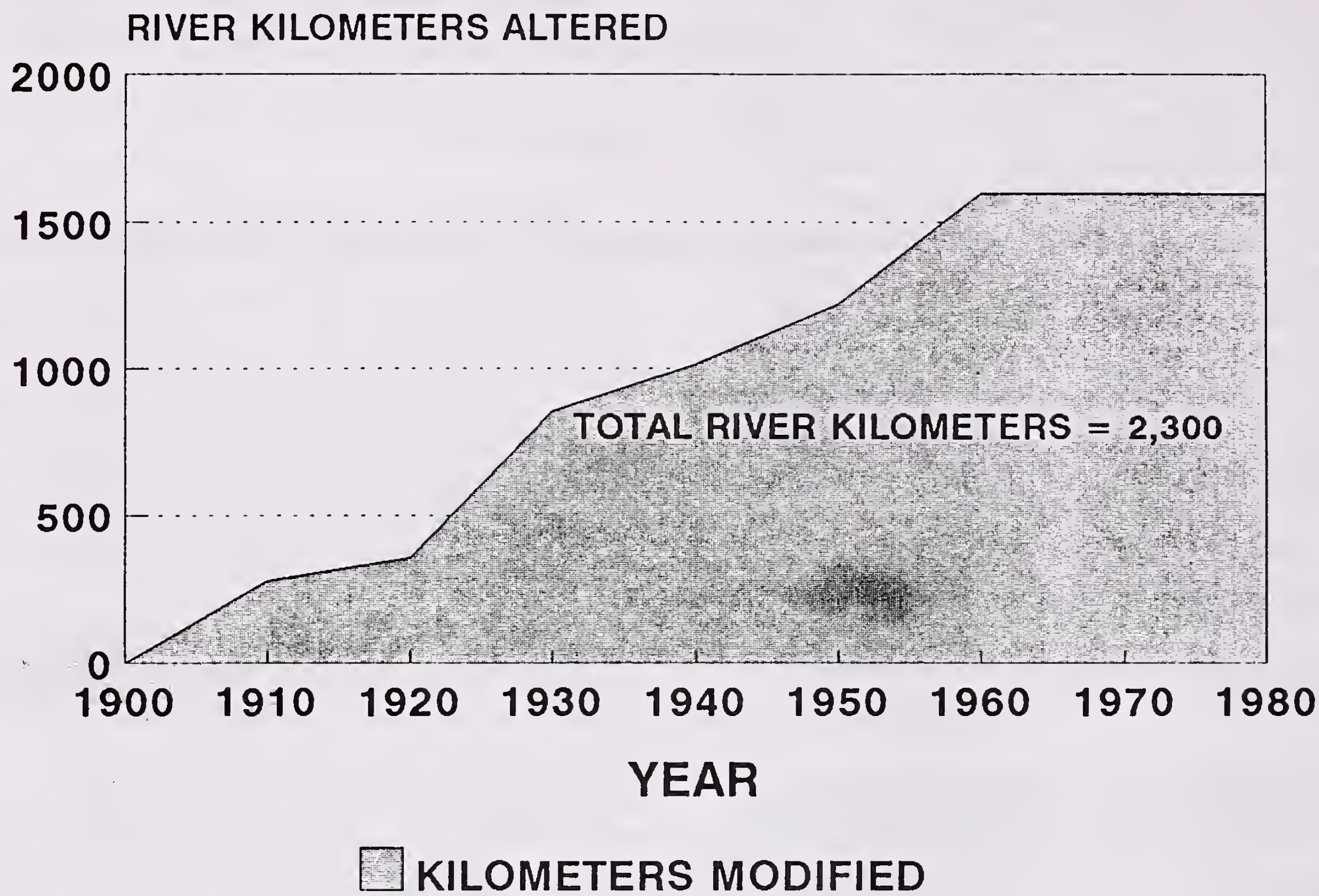

Figure 2. Loss of mainstream river habitat as a result of major dams in Arizona, 1900-1980.

conditions to those of violent floods in seconds to minutes (Rinne and Minckley 1991). Historically, fish populations peaked and subsided in the wake of these vagaries of streamflow. Nevertheless, fish populations recovered and were sustained through both active and passive movements from springs, surface water refugia associated with bedrock dikes and canyon bound reaches, or through upstream migration from perennial reaches.

Aquatic Habitat Alterations

The fluctuations of flood and drought characteristic of the Southwest were a detriment to development of the area. Accordingly, the Reclamation Act of 1902 set into motion a marked and extensive change of riparian-stream areas and their associated aquatic habitats. Major dams and diversions altered streamflow and negatively affected native fishes (Miller 1961). The first Reclamation Act dam, Roosevelt, on the Salt River northeast of Phoenix, began control and alteration of flows of that system. A series of dams below Roosevelt during the next two decades accompanied by two dams on the Verde River completely dried the channel of the Salt downstream to and beyond the Phoenix area (Rinne 1975; Figure 1). With the completion of Coolidge Dam on the Gila River, this riparian stream system was drastically altered forever downstream to the Colorado River.

On the Colorado River, Boulder Dam was completed in the 1930s and a series of dams above and below were constructed over the next 30 years culminating with Glen Canyon Dam on the Utah/Arizona border. Although flows continued from below Glen Canyon through the Grand Canyon, Lake Mead and downstream to Mexico, these were vastly altered in quantity and quality from historic flows (Figure 1). The combination of all these

Figure 3. The Colorado squawfish, *Ptyocheilus lucius*, is the largest species of North American Minnow. Records indicate that it once reached a size of 2 meters and weighed 50 kilograms. Large migrations up mainstream rivers in Arizona resulted in this large predator being called "the Colorado River Salmon." The endangered species now exists in the wild mainly through intensive hatchery rearing and reintroduction programs.

mainstream structures altered the hydrological geography of Arizona (Rinne 1991). Between 1900 and 1980, 80 % of mainstream rivers in and bordering Arizona were altered by major dams (Figure 2). The alteration of flows and their cyclic nature affected native fish populations (Minckley and Deacon 1991, Rinne and Minckley 1991). Large river species such as the Colorado squawfish (*Ptyocheilus lucius*; Figure 3), and razorback sucker (*Xyrauchen texanus*; Figure 4) which utilized these large "river highways" for spawning runs and sustaining populations in the face of drought were negatively impacted. The former was referred to as the "Colorado River salmon" because of being observed by oldtimers to run in large spawning schools up the Gila River. The razorback was so abundant around the turn of the century that it had to be pitchforked from irrigation canals to prevent clogging. The squawfish now persists naturally only in the upper Colorado River basin and the razorback sucker is present as a senile population only in one reservoir (Lake Mohave) on the lower Colorado River (Minckley 1985). The former is an endangered species; the latter is threatened. Extensive reintroduction programs have largely failed to re-establish the razorback in the lower Colorado River basin (Johnson 1985).

Many other species of native fishes in addition to the squawfish and razorback sucker have become markedly reduced in range and numbers as a result of the alteration of aquatic habitats of riparian- stream systems of the Southwest (Johnson and Rinne 1982, Rinne and Minckley 1991, Minckley and Deacon 1991). Presently, 80 % of the fishes of Arizona and 60 % throughout the Southwest are threatened, endangered, or sensitive species (Johnson and Rinne 1982, Johnson 1988, Williams et al. 1989).

In addition to direct streamflow alteration, man-induced land management activities over the past century have also affected aquatic habitats of riparian-stream areas. Livestock grazing, timber harvest, and fire management in the Southwest have altered forested and grassland landscapes and the quantity and quality of water issuing from them (Rinne 1988, 1989, 1990, Rinne and Lafayette 1991). For example, livestock frequent riparian-stream areas in the arid Southwest because of shade, water, and abundant forage. Removal of streamside vegetation for forage and streambank disturbance through hoof action in combination potentially alter the positive influences of vegetation on aquatic habitats and fishes (Platt, 1979, 1981, 1982).

Conclusion

Riparian-stream areas are critical aquatic habitats for fishes, both native and introduced, in the arid Southwest (Minckley and Brown 1980). These areas have become markedly altered through the influences of offsite land management and onsite instream alteration of flows by damming and diversion. Many aquatic ecosystems are becoming endangered in themselves

(Williams et al. 1985). To sustain fishes in these areas, future management must be on a watershed or ecosystem basis (Szaro and Rinne 1988, Rinne and Lafayette 1991, U.S.D.A. Forest Service 1992). As aquatic habitats go, so will go the fishes.

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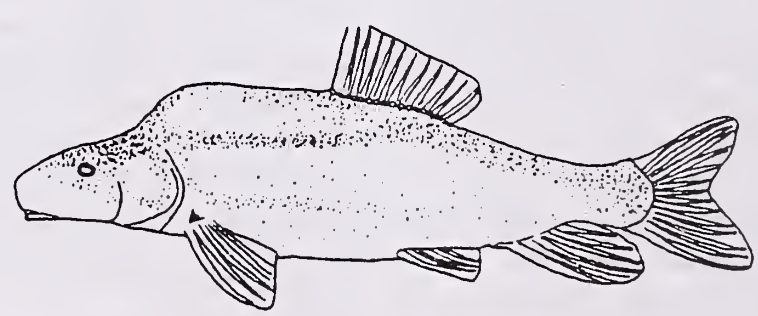

Figure 4. The razorback sucker, *Xyrauchen texanus*, was once so abundant in the Gila River that it was readily captured from irrigation canals and thrown onto fields for fertilizer. Over the past decade over 10 million of this threatened species have been reintroduced into the streams and rivers of Arizona. Fewer than 100 have been recaptured because of both a lack of suitable habitat and predation by introduced species.

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CHAPTER THREE

OPPORTUNITIES AND CONSTRAINTS

Private Property Rights Issues
Legal Factors
Financing Opportunities and Issues
Water Quality Problems
Floodplain Issues
Political Considerations
Dams and Power Issues

"There must be some force behind conservation more universal than profit, less awkward than government, less ephemeral than sport, something that reaches into all time and places where men live upon the land, something that brackets everything from rivers to raindrops, from whales to hummingbirds, from land estates to window boxes.

I can see only one such force: a respect for land as an organism; a voluntary decency in land use exercised by every citizen and every land owner, out of a sense of love and obligation to that great biota we call America.

This is the meaning of conservation and this is the task of conservation education."

Aldo Leopold (unpublished)

Private Lands River Protection: Balancing Private and Public Concerns

Elizabeth Norcross and Gabriel Calvo

Introduction - The State of our Nation's Rivers

Increasingly, scientists are coming to understand the importance of rivers and their associated riparian habitat to the nation's overall ecological health. River systems are the heart of virtually every major ecosystem on the continent. While carrying water, and transmitting soil, minerals, and other nutrients along their corridors, they serve as pathways for biological exchange and movement, as well as for the genetic mixing of plant and animal species among different eco-regions. Rivers also transport water, sediment and nutrients from the land to the sea, thereby playing a significant role in building deltas and beaches, and nourishing estuaries, freshwater wetland communities and natural lakes.

Likewise, rivers are essential to human health and safety. They carry off and disperse waste materials, filter out pollutants, and provide much of the nation's supply of water for residential, agricultural, and industrial uses. Rivers and their adjacent riparian vegetation provide natural flood control protection by first absorbing storm waters then releasing the water gradually.

Furthermore, a variety of recreational as well as economic benefits stem from our nation's rivers. Canoeing, kayaking, fishing, swimming, hiking and birdwatching are among the many activities enjoyed in or around a river, as well as a sense of aesthetic beauty and personal replenishment. Historic centers of commerce and population, the nation's rivers have provided enormous economic benefits for hundreds of years, including transportation, fisheries, commercial recreation, and energy use.

Rivers are also important environmental indicators, and unfortunately the indications are not too promising. A recent study by the Nature Conservancy shows that aquatic species are disappearing at a rate far greater than that of terrestrial species. (Master 1990) One third of all freshwater fish species are imperiled and approximately 20% of the freshwater shellfish and invertebrates are in a similar state. Similarly, a recent report by the State of Arizona indicates that it has lost 90% of its original low-elevation riparian areas (*Governor's Riparian Habitat Task Force*, 1990)

The pressure on riparian ecosystems is tremendous - from pollution, dams, development, diversion, timber, grazing, and mineral activity. Nearly 20% of the nation's 3.5 million miles of rivers are impounded by dams, and thousands more downstream miles are adversely affected. Dams inundate wild and

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natural areas killing important riparian vegetation and wildlife habitat; block the transmission of sediment and other nutrients downstream, concentrating toxic materials behind the structure; impede or prohibit fish and wildlife passage; flood wetlands; dramatically alter water temperatures; and cause serious bank erosion downstream due to wide fluctuations in flows.

Diversions draw water out of rivers and streams; cause fishery mortality; de-water and destroy streamside vegetation; diminish the streams' natural pollution flushing and assimilation capacities; limit important groundwater recharge; and ruin recreational use. Diversions have quite literally dried up hundreds of streams in the West and are devastating natural aquifers.

Channelization is a nationwide problem that is most evident and comprises the greatest river threat in the farm-belt states. In agricultural areas, rivers are islands of natural diversity in otherwise massive monocultural regimes. By curtailing erosion and thereby reducing the influx of nutrients getting into the stream, channelization makes otherwise fertile riparian soil sterile. It often causes additional flooding by increasing the speed of the natural flow and cutting off major areas of the natural flood plain.

Streamside development and commodity uses, such as timber harvesting, mining, grazing and residential construction cause additional significant harm. The denuding of the all-important immediate riparian zone caused by these activities as well as the rampant erosion by road-building associated with these activities destroys valuable fish and wildlife habitat and greatly increases the amount of sediments in the stream. The added sedimentation impedes plant growth by impairing the ability of light to get through, hampers visibility for predator species, drastically affects temperature and oxygen content of the river, and causes streams to become wider and shallower.

Fortunately, on the approximately one third of the nation's lands which are in federal ownership, a number of mechanisms exist that at the least limit, and in many cases prevent, activities which are harmful to rivers and riparian areas. However, on lands surrounded primarily by private lands, few such protections exist. The Wild and Scenic Rivers Act, the only federal legislation dedicated specifically to river protection, has protected hundreds of rivers on federal lands through its study and designation process, but has offered little protection to rivers on private lands.

The Difficulties Inherent in Managing Rivers on Private Lands

Because the country lacks a comprehensive, national policy regarding river conservation, protection efforts on rivers surrounded primarily by private lands have for the most part been piecemeal, uncoordinated and inconsistent. Dozens of different federal laws and programs, administered by a variety of agencies, and handled by an assortment of Congressional committees guide riparian management today. Adding to the confusion is a complicated panoply of state laws, as well as varied local zoning ordinances and regulations. Oftentimes these programs and legislation overlap and contradict one another.

This fragmented decision-making leads to a "tyranny of small decisions" which in turn results in incremental degradation that is difficult to trace and even more difficult to conquer. Lack of coordination and consistency is particularly damaging given the integrated nature of river systems. Local efforts to protect the aesthetic nature of a downstream segment through greenways and development setbacks are futile if a federally- authorized dam upstream is de-watering the river.

Adding to the problems created by the lack of a national riparian policy is the absence of a "national river ethic." Historically, rivers have been areas of commerce and development, and a greater understanding by the public of their ecological importance, as well as their significance to human health, safety and the economy, has simply not emerged. Consequently, decisions on private land rivers are often short-sighted, and oriented toward short-term economic gains, rather than long-term public objectives.

Perhaps the greatest impediment, however, to the prudent management of rivers surrounded by private lands is the nation's deeply-rooted belief in personal property rights and the perception by the public that river protection efforts threaten those rights. The fear of the "taking" of personal property expresses itself in two primary ways

1) the fear that a government entity, usually the federal government, will actually take away the ownership of a citizen's land; and

2) the fear that a government entity will unreasonably limit the citizen's use of his/her land.

A detailed history of personal property rights is relevant to this discussion but better left to another treatise. Suffice it to say that modern property law has its roots in feudalism where the disposition and ownership of property was the basis of wealth and authority. As it developed, our nation took steps to protect property rights through a variety of means, the most significant of which were the Fifth and Fourteenth amendments to the Constitution which ensure that property cannot be taken without due process of law and that any such taking must be compensated.

Importantly, however, the founding fathers chose not to prohibit the taking of individual property, protecting the power of eminent domain which gave the sovereign the ability to condemn property for the service of the greater good. Furthermore, since early in this century the power of individual states to regulate and zone private property has never been questioned.

Regardless, personal property still remains, within our society, a sign of personal well-being and status. It is important to remember that only within the last 150 years were those without property allowed to vote. Given the importance of personal property in our economic and social structure, it is no wonder that the taking, or the perception of taking, of personal property or any right thereto is virtually always contentious. Clearly, few property owners would concur with Rousseau, who expressed the following view:

> "The right exercised by each individual over his own particular share must always be subordinated to the overriding claim of the Community as such. Otherwise there would be no strength in the social bond, nor any real power in the exercise of sovereignty."
> (Rousseau 1747)

An important corollary to the importance of personal property rights is the protection of livelihood and lifestyle. If river protection efforts are perceived to conflict with local economic objectives for the river, thereby risking economic gains to the area and the resultant taxes and employment, resistance may follow.

Because of the country's strongly held beliefs in personal property rights and the limitation on federal restrictions of those rights, regulation of private land is carried out primarily at the State or local level of government, not by federal agencies. Accordingly, private land regulation varies dramatically by State, county, and township and is often subject to intense pressure by local economic interests.

Private landowners along a given stream or those who use the stream may feel threatened by the concept of increased zoning or regulation. However, most State and local regulatory river management plans are very respectful of current uses of the river. They seek primarily to exert some authority over new development, and even then work not to curtail growth but to limit it to sustainable levels. Kevin Coyle and Chris Brown, in *Conserving Rivers: A Handbook for State Action*, maintain that "most land-management programs in support of river conservation are little more than common-sense blueprints for conserving the most environmentally fragile and potentially hazardous areas from unwise development."

"More often than not, controversies surrounding river protection on private lands stem not so much from actual threats to personal property and livelihood, but rather the perception of such threats."

More often than not, controversies surrounding river protection on private lands stem not so much from actual threats to personal property and livelihood, but rather the perception of such threats. Accordingly, communication and involvement with those who live on the river or who use the river are imperative to successful river management programs.

Experience with securing National Wild and Scenic River designation on rivers which run through private lands has earned us hard lessons on this subject. When activists and agencies do not take the time and make the effort to explain carefully what designation will entail, and how little if any effect it will have on adjacent private lands or private uses of the river, Wild and Scenic designation will most likely fail. Lack of communication and involvement with local citizenry in river conservation efforts also invites misinformation and misconceptions often fueled by those with personal interest in ensuring that river protection does not move forward. In contrast, when actual landowner concerns are respected and resolved, and local citizens are brought into and become invested in the process, efforts to designate the river are most often successful.

Controversy surrounding private property rights is by no means limited to river conservation. In fact, these issues are being debated in the context of every significant natural resource in the nation today. These property rights battles are becoming increasingly sophisticated as activists on both sides of the issue become more skilled and experienced. One manifestation of this increasing sophistication is the advent of the so-called "Wise Use" movement, (WUM) a significant force against river conservation efforts.

An offshoot of the Sagebrush Rebellion, the WUM agenda formally emerged from the National Multiple Use Strategy Conference in Reno, Nevada. Sponsored by the Center for the Defense of Free Enterprise, (CDFE), the conference included the major constituencies holding an economic interest in the use of the nation's natural resources, including mining, timber, petroleum and agriculture groups. While the agenda is dedicated primarily to virtually unfettered commodity use of federal lands, such as opening millions of acres of designated wilderness and national park lands to mineral and energy extraction, the agenda also enumerates tenets that affect private lands, such as the significant weakening of both the Endangered Species Act and the Clean Water Act.

The WUM, its devotees and affiliated

organizations also actively oppose river conservation activities throughout the nation, particularly those at the federal level. Increasingly skilled at using the media and swaying popular opinion, the WUM has become a significant player in river protection campaigns. Specifically, in the last few years, such groups were involved in efforts to stop Wild and Scenic designations in the State of Washington, on the Niobrara River in Nebraska, and the Farmington River in Massachusetts and Connecticut. Unfortunately, the tools used included scare tactics, intimidation and inflammatory statements. Taking advantage of landowner questions and concerns about Wild and Scenic designation, these activists overstated the threat of federal presence and condemnation to influence public attitudes regarding the legislation.

River protection activities are often contentious. Pertinent concerns should be raised and discussed fully and fairly. A frank, open and honest airing of varied viewpoints serves the public good. Rhetoric, hyperbole, misinformation and deception on either side of the issue serves only to obfuscate rather than to enlighten, and provides no legitimate political purpose.

Summary of Existing and Proposed Private Lands River Protection Tools

Traditionally, rivers on private lands have been protected by a complicated array of federal and State legislation and programs, either designed specifically for river protection or for broader purposes. Each of these programs attempts to balance the public need to protect rivers with private uses and landownership. Furthermore, other effective resource protection programs, while not focussed specifically on river protection, can still offer important models which could be tailored to river protection.

Accordingly, a summary of existing river protection laws and programs, as well as other environmental laws with potential applicability to river protection, is provided below. Also included is a review of alternative river protection strategies

proposed by river advocates and others over the last several years.

The discussion below is not intended to be an exhaustive survey, but rather to emphasize those provisions which have particular applicability to the protection of rivers surrounded primarily by private lands.

The Wild and Scenic Rivers Act

The Wild and Scenic Rivers Act was passed in 1968 to protect "certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable" qualities. The National Wild and Scenic Rivers System currently includes 153 rivers, only a handful of which flow through private lands.

In enacting the Wild and Scenic Rivers Act, Congress's goal was to preserve selected rivers in their "free-flowing condition, to protect the water quality of such rivers and to fulfill other vital national conservation purposes." The Act prohibits the construction of federally-licensed hydroelectric projects on designated segments and limits the United States' participation in the permitting, licensing, funding or construction of other water resources projects which have a "direct and adverse effect" on the segment.

With the exception of the outright ban on federally-licensed hydroelectric projects and harmful water resources projects, the protections on designated wild and scenic rivers running through private lands varies significantly from the protections afforded federal lands rivers. While the Act provides that a 1/4 mile corridor on each side of a designated segment is to be protected on both federal and private segments, the authority to enforce those protections is substantially different on private lands.

While section 12 of the Act lays out specific responsibilities for the land-managing agencies for the protection of designated segments on federal lands, no specific corresponding guidance exists to manage or limit activities on private lands which border wild and scenic rivers. Rather, Congress approached the management of private lands indirectly through the provision of the Act which limits condemnation. Section 6(c) prohibits condemnation on lands which are located in an area which has a "duly adopted, valid zoning ordinance that conforms with the purposes of this Act." The Act then goes on to require the appropriate Secretary to issue guidelines for such ordinances.

It appears that the original authors of the Wild and Scenic Rivers Act believed, for the most part, that private lands rivers would enter the Wild and Scenic Rivers System through section 2(a)(ii) of the Act which provides for State management of selected rivers. To date, only 13 of the 153 designated wild and scenic rivers have come into the System through this route.

While few would argue with the premise that the Wild and Scenic Rivers Act has resulted in the protection of many of the nation's outstanding rivers, critics maintain that the Act is not well-suited to protect a broad range of important, but less significant, rivers, primarily those bordered by private lands. Among the concerns are:

1) The Act's emphasis on only "outstanding" rivers, which keeps tens of thousands of rivers from being considered for protection. Even if the breakthroughs in federal land management planning for rivers produce a ten-fold increase in the size of the Wild and Scenic Rivers System, only 3% of the nation's streams (approximately 100,000 miles), would be protected. In addition, many rivers that have great natural or cultural value do not qualify for national river designation because they have been modified by human activity.

2) The inefficiency of protecting one river or group of rivers at a time, each needing a separate act of Congress. Critics of the Wild and Scenic Rivers Act maintain that protecting one river through the study/designation process may take anywhere from five to ten years. Others say that the time frame required by the Wild and Scenic Rivers Act is not inappropriate for permanent protective management.

3) Landowner resistance to federal overlay and corresponding political fallout. When Congress passed the Wild and Scenic Rivers Act in 1968, it underestimated the political power of landowners concerned with loss of their homes and livelihoods. Organizations exploiting landowner fears have successfully blocked many wild and scenic efforts on private lands. Contributing to landowner fears is the provision within the Act calling for the preparation of a detailed management plan after designation instead of during the study process. Consequently, the agency cannot offer specific, reassuring information before a river is designated as to what landowners can expect.

4) The Act's focus on river "segments" as opposed to river system or watershed protection, and the arbitrariness of protecting only 1/4 mile on each side of the river. Scientists agree that to protect river resources, the management of the entire watershed should be addressed. Often wild and scenic rivers are only relatively short segments situated between major developments. Many significant segments have been left out due to resource conflicts. Also, the headwaters of rivers, which are the most significant indicators of downstream health, are often excluded because they do not contain sufficient water flow to meet the criteria for inclusion under the Act.

<u>Applicability to the Protection of Private Lands Rivers</u>: Despite the criticism the Wild and Scenic Rivers Act has endured, its successful protection of over 10,000 river miles, some of which are on private lands, cannot be ignored. The Wild and Scenic Rivers Act does offer some lessons for designing a new private lands river protection system.

One of the reasons for the success of the Wild and Scenic Rivers Act is that Congress and the land-managing agencies have become invested in the System and in the process. Over the last few years, the land managing agencies have found some 700 rivers eligible for inclusion in the System through their land management planning processes, which will ultimately turn into recommendations to Congress for the designation of hundreds of rivers. Congress, for its part, is enthusiastically passing wild and scenic rivers legislation at record pace.

In regard to private lands, experience with the Wild and Scenic Rivers Act has taught the importance of partnership among the administering agency (usually the National Park Service), State and local governments, and concerned citizens. The Park Service has had particular success when, during the stage in which a river is being studied for potential designation, the agency works with the public to prepare a draft management plan. This approach allays landowner fears through public understanding of wild and scenic management prior to designation. It also promotes public investment in the process and in river protection.

The Clean Water Act

As defined in the Clean Water Act of 1972, the legislation's purpose is to "restore and maintain the chemical, physical and biological integrity of the nation's waters." While the Act envisioned a much stronger and more active federal role than had earlier clean water legislation, it also reaffirmed the states' primary responsibility to control the pollution of their respective waters: "It is the policy of the Congress to recognize, preserve, and protect the primary responsibilities and rights of states to prevent, reduce and eliminate pollution, to plan the development and use . . . of land and water resources, and to consult with the Administrator (of the Environmental Protection Agency, EPA) in the exercise of his authority under this Act."

The Clean Water Act established a dual system of pollution control based on 1) water quality standards and 2) effluent discharge limitations. The Clean Water Act directed EPA to issue effluent guidelines, and states were required to set water quality standards based on federal criteria. The Act also contains a policy of non-degradation. In other words, those waters which are

already pristine are not allowed to be further degraded. Pursuant to the Act, EPA, the states, and individual citizens can enforce the Act's provisions
.
Wetlands

When Congress was considering the Clean Water Act in the early 1970s, scientists were only beginning to understand the significant value of wetlands for flood storage, water supply, sediment filtering, groundwater replenishment, pollutant removal and fish and wildlife habitat. Unfortunately, by that time, the Fish and Wildlife Service estimated that a full one-half of the wetlands which existed in the lower 48 states when settlement of the United States began had been lost. Responding to the astonishing rate of destruction, Congress included a provision in the Act that required a permit for anyone dredging or filling a wetland.

The so-called Section "404 permit" program is jointly administered by the Army Corps of Engineers and EPA, with EPA establishing guidelines for permits and the Corps issuing and enforcing them. While 404 permitting can be delegated to the states, only Michigan runs it own statewide program.

The wetlands permitting process has been fraught with controversy since its inception. Many agricultural and development interests found EPA's original wetlands definition to be too broad and ambiguous, and several legislative initiatives have been initiated to force EPA into adopting a more limited form. Earlier this year, EPA sought to fend off Congressional action by changing the wetlands definition in its "delineation manual." However, field testing found the new definition difficult to understand and to implement, and demonstrated that a significant portion of existing wetlands would be "redefined" out of existence.

While the permitting program has not stopped wetlands destruction, it has significantly slowed the loss of these valuable resources. One of the reasons for the success of the wetlands permitting process is that wetlands, unlike rivers, are generally contained in a specifically defined area. Furthermore, while some wetlands can clearly be developed, they do not come under the same development pressure as do generally upland river sites.

Outstanding National Resource Waters (ONRW)

The Clean Water Act contains no explicit statutory prohibition against degrading streams of high water quality. However, EPA has established "anti-degradation" regulations based on section 101 of the Act which declares that the purpose of the legislation is to "**restore and maintain**, [emphasis added] the chemical, physical, and biological integrity of the Nation's waters." The anti-degradation regulations provide for special protection of the nation's highest quality waters (so-called "Outstanding National Resource Waters," or ONRW): "Where high quality waters constitute an outstanding National resource, such as waters of national and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected."

Unfortunately, the effectiveness of the ONRW policy has been limited by the absence of clear criteria for eligible waters, the lack of consistency among the states in implementing the ONRW regulations, and EPA's unwillingness to provide guidance and oversight. The ONRW program could offer significant protections to pristine rivers if it were effectively implemented by the states and supported at the federal level. In its efforts to strengthen the Clean Water Act when it is reauthorized this year, the environmental community has encouraged Congress to expand the provisions within the Act relating to ONRW.

While the Clean Water Act has restrained water pollution, 30% of the nation's rivers, streams and estuaries still do not meet chemical clean water standards. EPA estimates that this percentage would rise to 50% if biological criteria, such as aquatic biodiversity, were included in the standards. In regard to river protection, the Act suffers from weaknesses in addressing threats from "non-point" sources of pollution, the absence of adequate statutory direction for non- degradation of existing pristine waters, the lack of credence given the Act's goal of restoration and maintenance of the "biological integrity of the nation's waters," its neglect of water quality issues related to land management decisions, and the absence of appropriate monitoring and enforcement.

<u>Applicability to the Protection of Private Lands Rivers</u> Despite the weaknesses inherent in the law, the Clean Water Act offers a number of important insights into resource protection which can be useful for a river protection program. The Act provides one of the few river-protection mechanisms which specifically addresses water quality, and clearly the nation's rivers are healthier because of its enactment. The Clean Water Act also successfully protects a wide range of rivers, regardless of State boundaries or agency jurisdiction. The Act is nationally known and recognized, and accordingly has a broad and diverse national constituency, which is essential for any successful resource protection program.

While its implementation has often been uneven, in concept the federal/State/local government partnership model provided in the Clean Water Act is sound. The framework within the Act that calls for the establishment of federal water quality criteria, State-defined standards based on those criteria, and both State and local implementation of a water quality program based on those standards could be adapted for river protection. Importantly, the Clean Water Act also encourages State and local implementation by providing grants, cost-sharing and technical assistance.

The Coastal Zone Management Act

The Coasal Zone Management Act of 1972 (CZMA") established a national program to manage, protect and enhance coastal resources such as wetlands, tidal areas, estuaries and beaches. Declaring that "there is a national interest in the effective management, beneficial use, protection, and development of the coastal zone," and acknowledging the significance of coastal resources for their "ecological, cultural, historic and aesthetic values," CZMA established an ambitious national partnership between federal and State government in the management of the nation's coastal zone.

The purposes of the Act as set forth in the legislation are as follows:

1) to preserve, protect, develop and restore coastal zone resources;

2) to encourage and assist the states in the development and implementation of CZMA programs which meet specified national standards;

3) to provide for reasonable coastal-dependent economic growth, improved protection of life and property in hazardous areas; and

4) to encourage the participation and cooperation of public, State and local governments, regional authorities and federal agencies in the implementation of the Act.

Administered by the Office of Coastal Zone Management of the National Oceanic and Atmospheric Administration, the Coastal Zone program establishes objectives for coastal zone management and protection then provides the states with funds, policy guidance and technical assistance to help them establish and maintain State programs which meet these objectives. State programs must be approved by the Secretary of Commerce and are regularly monitored with in depth evaluations coming at least every two years.

Federal incentives built into CZMA include federal matching grants and federal consistency. Federal consistency assures that federal activities affecting the coastal zone must to the "maximum extent practicable" not conflict with State coastal zone policies and programs. CZMA is one of a very few resource protection programs which offers such federal consistency.

While participation by the states is voluntary, all 35 coastal states and island territories have participated in the program. Of these, 29 states and territories, including 94% of the nation's coastline, have received program approval and are moving on to implementation. Individual State programs are tailored to meet specific State needs and vary significantly in their effectiveness.

<u>Applicability to the Protection of Private Lands Rivers</u>: CZMA offers a potentially good model for private lands river protection. Like rivers, coastal resources are most imminently threatened by development on private lands which must be addressed primarily at the local level. The Coastal Zone program offers a prototype for federal/State/local partnership where national standards are established and implemented through the states. The combination of incentives through federal consistency, grants and assistance is apparently attractive and workable to the states as evidenced by the overwhelming participation rate. CZMA also provides an effective monitoring and enforcement program.

While CZMA has been moderately successful in protecting the 95,000 miles of the nation's coastline, it is unclear whether the approach could be transferred to protect millions of miles of rivers and streams nationwide. One of the reasons for CZMA's success is the limited nature of the resource it seeks to protect.

National Flood Insurance

In 1968, Congress enacted the National Flood Insurance Act which provided low-cost insurance for those who resided in floodprone areas, (the "National Flood Insurance Program" or NFIP). In 1973, Congress strengthened the Act to provide that in exchange for otherwise unobtainable flood insurance, flood-prone communities were to adopt floodplain management ordinances which met minimum federal standards. The federal program is administered by the Federal Emergency Management Agency, (FEMA). States have participated by adopting statewide floodplain management regulations.

Currently over 2.4 million flood insurance policies are in effect in some 18,000 communities located in flood-prone coastal and riparian areas. While these figures indicate that NFIP has been successful in providing flood insurance which otherwise would be unavailable, the program has had less success in meeting its land management goals. While the National Flood Insurance Act clearly states that NFIP is "to encourage State and local governments to makeappropriate land-use adjustments to constrict the development of land which is exposed to flood damage and minimize the damage caused by flood losses," and "to guide the development of proposed future construction, where practicable, away from locations which are threatened by flood hazards," the Flood Insurance Administration has admitted that "what is indisputable is that the NFIP has not restricted coastal development to any measurable degree."

A 1982 GAO study found that NFIP may well provide developers with a financial "safety net" and actually encourage development in high-risk areas. This study is particularly disturbing given the ecological importance of floodplains. Floodplains, which may include wetlands, beaches, dunes and riverbanks, serve a variety of purposes from water purification, fish and wildlife habitat, groundwater replacement and sedimentation reduction.

Applicability to the Protection of Private Lands Rivers: In theory, floodplain management offers a particularly good framework for resource protection, not unlike the Coastal Zone Management Act model - federal direction, State program implementation, roots in existing federal laws, a general requirement in most states, a high level of federal consistency. Yet, the floodplain protection goals of the enabling legislation have clearly not been met. The lesson best learned from NFIP may come from an analysis of why a program which works on paper may not work as well on the ground.

The weaknesses with NFIP seem to stem primarily from the lack of appropriate agency implementation, particularly enforcement. Recent FEMA studies indicate that only about 14% of flood-prone properties are insured. Federal lending institutions have been terribly lax about enforcing the Act's requirement for mandatory flood insurance purchase (which subsequently triggers floodplain management requirements) for flood-prone properties that are mortgaged with lending institutions backed by federal deposit insurance. Another weakness in the implementation of NFIP comes from inadequate funding.

Any discussion of NFIP's weaknesses should be tempered by the fact that the program has issued over 2 million flood insurance policies nationwide. Thousands of communities throughout the nation are already familiar with and invested in flood management programs. A river management program could potentially be developed by utilizing the existing structure of NFIP and adding significant river protection provisions.

River/Resource Commissions

While not a new concept in river protection, river (or watershed) commissions continue to be brought up in the discussion of the development of a river protection program. The Pinelands Commission, while not specifically oriented to river protection, is often held up as a good example of a representative organization which effectively manages and protects a diverse natural resource area.

In 1978, Congress established the 1.1 million acre Pinelands National Reserve in southern New Jersey and called upon the State of New Jersey to create a planning agency to preserve and protect the area's significant natural resources. In 1979, the New Jersey legislature passed the Pinelands Protection Act which directed the Pinelands Commission, in partnership with all levels of government, to preserve and protect the Pinelands. The State law authorized the Commission to develop a Comprehensive Management Plan for the Reserve, and required all counties and municipalities within the Pinelands to revise Master plans and zoning ordinances to be in conformation with the plan.

The fifteen-member Commission is made up of seven members appointed by the Government, seven that represent and are appointed by each of the Pinelands counties, and one member to be appointed by the Secretary of the Interior. The Commission monitors development within the Reserve as well as implementation of the Comprehensive Plan and local planning compliance. The Pinelands Commission has received high praise for its ability to meet the federal mandate provided in federal law, while at the same time fostering and implementing a protection ethic with local zoning authorities.

Applicability to the Protection of Private Lands Rivers: The Pinelands Commission approaches resource management through an innovative partnership between the federal government, the states and the local zoning boards. One of the primary reasons for its success is that it recognizes the importance of coordination at all three levels as well as the significance of public investment and input. However, the Pinelands Commission relies heavily on State preemption of local land use authority. Such a heavy-handed top-down approach is potentially very politically contentious.

National River Registry

Responding to the concern that the National Wild and Scenic Rivers System is too exclusive to protect many of the nation's less spectacular, albeit important, rivers, many advocates favor the establishment of a National Register of Scenic and Recreational Rivers patterned after the National Register of Historic Places. The American Whitewater Affiliation has assumed a leadership role in promoting this alternative.

Under this proposal, river segments would be nominated for inclusion on the Register by a State or local government entity or by a private organization. A federal agency, most likely the Park Service, would make the final determination as to whether a river would be added to the list. To qualify for inclusion, the river need not be pristine or entirely free-flowing, but have at least one outstanding recreational, scenic or natural characteristic together with a significant local government interest in its protection and management.

The River Registry concept includes three basic provisions:

1) federal recognition of a large number of deserving rivers;

2) a requirement that federal activities cannot degrade the values of rivers on the Registry unless no feasible alternative is available, (so-called "federal consistency"), and

3) encouragement to the State and local governments to take actions to preserve the values for which the river was added to the Registry.

<u>Applicability to the Protection of Private Lands Rivers</u>: The River Registry proposal includes a number of provisions which would provide protection for private lands rivers. Prohibiting federal actions from degrading protected rivers is a particularly important concept. Currently, while a river may enjoy protection through State law, it is not necessarily protected from federal activities, the most onerous of which is a FERC-licensed hydroelectric project.

The River Registry is also attractive because it could potentially protect a large number of rivers in a very efficient manner. Congress would not have to pass a law to protect each river, as is the case with wild and scenic rivers, nor would rivers have to meet the Act's stringent criteria to be offered some protection. While rivers on the Registry would not enjoy the same level of the protection as those rivers designated wild and scenic, the potential exists for giving moderate protection to thousands of rivers.

Importantly, the River Registry would also avoid many of the pitfalls of the federal river protection tools by keeping management of protected segments at the local level. The lack of federal presence would allay landowner fears and encourage local investment in protection.

Other River Protection Mechanisms

A number of other mechanisms have been used to protect riparian areas on private lands. They can be utilized to support and implement federal and State legislation and standards. Several examples follow:

Zoning

Traditional zoning prohibits those uses within riparian corridors that would degrade streams, and permit those uses which are more compatible. Recently, more creative zoning has been utilized for stream management and protection, including "incentive zoning" which mandates that developers "proffer" or contribute to resource protection if they develop the riparian area; the transfer of development rights outside of sensitive areas; "open space set-asides" which require developers to retain a percentage of the developable land as open space; and impact zoning which prohibits incompatible uses, permits compatible uses and conditionally allows other uses on a case-by-case basis.

National Designations

As an alternative to wild and scenic designation, Congress has enacted a number of other federal designations designed to protect specific rivers. These have included national recreation areas, national rivers, wilderness designation, national ecological areas, permanent study protections, hydropower bans, dam bans, dredging bans, and special management areas. These designations allow river protection to be tailored to individual situations and are not as apt to be as contentious as wild and scenic protection.

Land Acquisition

One of the most successful mechanisms in resource protection is to simply buy the land one wants to protect. Unfortunately, traditional land acquisition is probably the most costly river protection technique and often undesirable to the local landowner. However, less expensive alternatives to traditional "fee title" acquisition do exist and can be effective management tools. For example, fee title donation, the purchase or donation of conservation easements, sale and leaseback programs, and purchase and resale with restrictive covenants are less costly acquisition alternatives. All of these acquisition alternatives can be time consuming and may be stymied by landowner reluctance to deal with government officials.

Tax Incentives/Disincentives

Tax incentives and disincentives can be applied at the federal, State or local level and can be very effective tools for river protection. Taxing uses of a river or related riparian lands which are incompatible with the health of the stream is the most obvious use, but a number of other techniques may be applied as well.

Among those that have been suggested are:

1) the "current use assessment" which evaluates lands for tax purposes based on its current use as opposed to an assessment based on potential development;

2) a tax rebate for the donation of conservation easements;

3) the exclusion of lands put aside for conservation purposes from inheritance taxes to discourage the selling off of property by heirs trying to meet the tax burden the inheritance brings; and

4) tax breaks for not developing open space and for habitat enhancement.

<u>Applicability to the Protection of Private Lands Rivers</u>: While none of these mechanisms is sufficient by itself to respond to all of the river protection issues, each of these has merit in the context of broader private lands river initiatives.

Outline of a New Private Lands River Protection Program

While each of the tools summarized above seeks to resolve specific issues relating to riparian protection, none addresses the major threats to rivers today in an integrated manner. Consequently, a more comprehensive program based around watersheds should be developed on private lands rivers. The program should protect significant riverine resources and also recognize and safeguard existing uses of the rivers whenever possible. Accordingly, we recommend the following outline of such a program:

The Proposals

Protection of the riparian area to be protected must be clearly defined.

Emphasis should be placed on the protection of entire watersheds.

Harmful federally licensed or permitted activity should be prohibited.

Non-federal activities that affect the river or river system should be managed and controlled. In determining the appropriate uses of the river, the affects of a particular activity should be evaluated using both chemical and biological criteria.

> ***"River conservation on lands primarily privately held simply will not work unless the local citizenry and local governments are invested and committed to protecting their local stream. No amount of Congressional legislation, government regulation or the like will succeed without the assistance of those who live and work along the river."***

Emphasis should be placed on protecting the most significant rivers and river systems. Criteria used to evaluate significance should include, but not be limited to, the importance of the river for:

- fish and wildlife habitat
- biodiversity
- public and commercial water supply
- recreation use
- aesthetics

B. Organization

Public involvement/investment in river protection program should be included through provisions for public input and the development of local river constituencies.

- To the extent possible, private property rights should be retained.

- To the extent possible, state and local compliance with the federal river protection program should be voluntary.

- Coordination among and within federal, state, and local agencies should be provided.

- Consistency among federal, state, and local laws, policies and programs should be provided.

- Incentives/disincentives for state/local involvement through grants, cost-sharing, recognition, tax incentives, corporate profits, and other means should be included.

- Mechanisms for monitoring and enforcement should be included.

- Mechanisms to enforce timely and appropriate agency implementation should be included.

- Existing programs, policies, funding, and expertise should be utilized wherever possible.

- Mechanisms for adequate funding at federal, state, and local levels should be included.

- Federal technical assistance should be included where appropriate.

Conclusions

River conservation efforts on private lands and federal lands alike will not be successful until the nation develops a clearer and more thorough understanding of what is at stake. Consequently, agencies, activists and individual citizens who are concerned about rivers must work together to educate the public on the importance of river systems not only to the country's ecological health but also to our collective and individual well-being.

The new Administration should assist in that effort by developing a comprehensive "State of the Nation's Rivers" report which explains the importance of rivers systems and the degradation they now face. The Administration should also develop a national riparian policy which protects the immediate streamside environment of all rivers on federal lands and establishes incentives for the protection of such riparian habitat on private lands. Moreover and most importantly, the Administration should undertake an ambitious campaign to enact a comprehensive watershed protection program on all rivers similar to the one outlined in the previous section.

However, given the contentiousness regarding river protection on private lands rivers, the old saw, "all politics are local" seems particularly applicable. River conservation on lands primarily privately held simply will not work unless the local citizenry and local governments are invested and committed to protecting their local stream. No amount of Congressional legislation, government regulation or the like will succeed without the assistance of those who live and work along the river. Fortunately, there are many examples of such individuals who have a passion and commitment to protect their river that no bureaucrat or inside-the-Beltway environmental activist could muster. Consequently, the most effective river protection programs are partnerships between various layers of government and individuals, where appropriate river protection standards are met and private property rights protected.

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The Protection of Riparian Areas: New Approaches for New Times?

Denise D. Fort

"Water, water, water....There is no shortage of water in the desert but exactly the right amount, a perfect ratio of water to rock, of water to sand, insuring that wide, free, open, generous spacing among plants and animals, homes and towns and cities, which makes the arid West so different from any other part of the nation. There is no lack of water here, unless you try to establish a city where no city should be. (1)

"All I knew was that it was pure delight to be where the land lifted in peaks and plunged in canyons, and to sniff air thin, spray-cooled, full of pine and spruce smells, and to be so close-seeming to the improbable indigo sky. I gave my heart to the mountains the minute I stood beside this river with its spray in my face and watched it thunder into foam, smooth to green glass over sunken rocks, shatter to foam again. By such a river it is impossible to believe that one will ever be tired or old." (2)

"The modern ditch is lined along its entire length with concrete to prevent the seepage of water into the soil; consequently, nothing green can take root along its banks, no trees, no sedges and reeds, no grassy meadows, no seeds or blossoms dropping lazily into a side-eddy. Nor can one find here an egret stalking frogs and salamanders, or a red-winged blackbird swaying on a stem, or a muskrat burrowing into the mud. Along the Friant-Kern Canal, as along many others like it, tall chain-link fences run on either side, sealing the ditch off from stray dogs, children, fisherman (there are no fish anyway), solitary thinkers, lovers, swimmers, loping hungry coyotes, migrating turtles, indeed from all of nature and of human life except the official managerial staff of the federal Bureau of Reclamation.(3)

Writers are better than law professors (at least this one) at conveying what is at stake in the protection of western riparian areas. The total magnitude of riparian areas lost in the West since European settlement began is variously estimated, but is widely acknowledged to have been great. Riparian protection is now beginning to be recognized as a critical aspect of environmental protection in the West, along with preservation of old growth forests, species protection (mountain lions, bears, wolves, representing a few around which campaigns have been mounted), and a myriad of other causes. As bitter as other resource struggles are, little compares to the emotions generated by water in the West, and riparian areas are dangerously close to water.

In this brief paper, an appraisal of the opportunities and barriers to riparian protection and restoration is presented. The focus is on public policy and current opportunities for riparian protection; the discussion is deliberately broad.

The dilemma of interconnectedness is that what we recognize to be true, that everything is linked to everything else, makes the formulation of policies that do justice to

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this truth impossible. The test of practicality, "what is most likely to result in on the ground improvements," gives some guidance as to where policies should be directed, but will also give varying answers with varying circumstances. Riparian areas do not fit neatly into existing regulatory programs, because they can be viewed through so many different lenses. The formulation of policies for better protection will reflect this diversity.

> ***"I stood beside this river with its spray in my face and watched it thunder into foam, smooth to green glass over sunken rocks, shatter to foam again ... By such a river it is impossible to believe that one will ever be tired or old."***
> ***Wallace Stegner***

Future Stresses

The identification of strategies to protect riparian areas must reflect the changes that are occurring in the West. Fundamental among these is the burgeoning population of the region. The Census Bureau has recently revised its national projections from an essentially flat rate of growth to a 50% increase in the next six decades. The resulting population is estimated to be 383 million people in the year 2050. (4) For the western United States, projections are even more dramatic. Of the ten states with the highest rates of population change in the next two decades, all are in the West (including Alaska and Hawaii). (5) The rates of population change are projected to range from 10.6% to 21.1%.

Population growth will increase the pressure on riparian areas in a number of ways. Intensified demands will be put on them for recreational use, commercial development, housing development, and other uses to which humans put these popular areas. Population pressure will also magnify the demand for water, which is discussed below.

Global climate change and its effect on water and, incidentally, riparian systems, has been the subject of much recent discussion. While localized effects are subject to debate, there does seem to be agreement that global warming will increase the demand for water supplies and that wildlife will be a likely loser. (6)

The increasing number of users for water, then, is a critical aspect of the changing stresses on western riparian systems. Here, large scale studies of what the future holds are difficult to find, presumably because the subject is so complex and varied by region. A study by the U.S. Water Resources Council which did look at future water demand at a river basin level is noteworthy. To understand it, however, a word about the role played by groundwater in the West is appropriate.

Western states are far more reliant on groundwater than are eastern states, using twice as much groundwater as do eastern states. (7) This use of groundwater has two important consequences for riparian areas. The first is that groundwater pumping is not sustainable for much of the West. Groundwater mining, by necessity, means that users will eventually turn to other sources to supply their water needs. The second is that the pumping of groundwater can itself affect riparian areas by reducing water levels.

The Water Resources Council estimated instream flow needs and then subtracted, among other items, groundwater overdraft, to determine if needs could be met without resorting to groundwater overdraft. The study then attempted future projections, and indicated deficits of flows in the Rio Grande Basin, the Lower Colorado, and the Great Basin. (8) This gives a rough idea of the magnitude of water demands that are masked by groundwater mining. (The increased use of groundwater in California agricultural areas during periods of drought is an example of this). Thus, new populations will come to a West which has already drawn heavily on its groundwater reserves, and where wildlife needs will be difficult to protect.

The changing legal and institutional setting.

Riparian issues are a key environmental resource in the West. In the first waves of environmental regulation the focus has been mostly on the human health aspects of environmental problems. Ecological issues have received less attention A report of EPA's Science Advisory Board, *Reducing Risk: Setting Priorities and Strategies for Environmental Protection, 1990,* identified this emphasis in EPA's activities. It is primarily a reflection of Congressionally mandated priorities in various pieces of federal legislation. Further, Western issues have often been ignored in federal legislation (albeit occasionally at the request of western legislators and interest groups). The Clean Water Act, for example, aggressively addresses industrial point source dischargers, of which there are relatively few in the west, and fails to regulate nonpoint source regulation, the primary cause of western water quality impairment.

It would be improvident to make a prediction that Congress will now focus more on western environmental issues and federal lands management. Nonetheless, much remains to be addressed within the sphere of the western environment and the public lands issues, at least, have reached a level of controversy where they are difficult to avoid.

A second aspect of the transformation in the political setting will occur at the administrative agency level. Federal land agencies are critical to riparian management because of federal ownership of western lands and administration of a number of programs which bear on riparian areas. The context in which these powers are exerted has changed with the election of a new President. Riparian values have come of age, so to speak, in an era of environmental program devolution from the national to state governments. The "New Federalism" and the general disparagement of environmental interests at the Presidential and Cabinet level meant that federal resource managers took on new environmental initiatives at some peril. While President Clinton's administration is considerably more environmentally assertive, the tenets of the new federalism have taken hold within the states. This dynamic promises conflict and perhaps the development of new paradigms in how federal initiatives are shaped. The assertions of this paragraph are admittedly deserving of further discussion. In brief, the thesis alluded to is that the widespread domination of environmental policy by the national government represented by Congressional decision-making in the 1970s and early 1980s would now face effective opposition from an alliance of commercial and state interests. This is illustrated by the unsuccessful attempts to pass national groundwater legislation. (9)

"The modern ditch is lined along its entire length with concrete to prevent the seepage of water into the soil; consequently, nothing green can take root along its banks, no trees, no sedges and reeds, no grassy meadows, no seeds or blossoms dropping lazily into a side-eddy. Nor can one find here an egret stalking frogs and salamanders, or a red-winged blackbird swaying on a stem, or a muskrat burrowing into the mud ..." Donald Worster

To point to possible conflicts with states is not to characterize the states as necessarily hostile to environmental values and riparian protection. Certain states and substate governments have been noted for their growing leadership in environmental protection and administrative capabilities. States are, of course, not monolithic with regard to environmental protection, so that there is a great deal of variation in attitudes towards environmental controls and enforcement.

Resource management issues have proven to be very contentious within the western states, and conflicts over issues such as logging, endangered species, wilderness designations, and reserved water rights, have mobilized constituencies opposed to restrictions on resource development. The "Wise Use" movement, in particular, represents a well-organized challenge to the environmental movement. The new population growth occurring within the West is not based on resource extraction and development, however, so that the environmental attitudes of the region in the future are difficult to predict. The unanswered question is whether we will see conflict between environmentally oriented federal managers and resource development oriented states, or whether there is a new commonality of values which will lessen these conflicts.

Tribal governments also have a role in the protection and restoration of riparian areas. The trend in federal environmental statutory schemes is to permit tribal administration of federal schemes, in a parallel manner to states. This will not be sufficient for riparian management, because of the absence of comprehensive federal programs for riparian protection. Tribes can and do exercise initiative in nonfederally mandated areas, but the emphasis likely to be placed on riparian protection is difficult to determine.

Policy Directions

There is little disagreement, at least among those represented at a Riparian Conference, about the need for further measures to protect and restore riparian ecosystems Nor has there been for some time (10) and there are reasons to believe that new initiatives could be successful. The vision, or goal for protection and restoration needs to be clearly identified. For purposes of this discussion, the assumption is that no further losses should be allowed to occur. The strategies which might be utilized to achieve that goal are myriad. The questions raised here are meant to assist in development of these strategies.

Is there a need for a new national initiative to protect, preserve and restore riparian areas? What would the costs of such an initiative be? A persistent theme in resource management has been the increased expense of more intensive management, at least initially The U.S. General Accounting Office (11) discusses the effect of lack of staff and resources on restoration improvements. Fencing, plantings, building check dams, and other techniques cost more than benign neglect. The personnel devoted to community meetings and negotiations can also be a costly burden on an agency. Acquisition of critical riparian areas can be expensive. There are obviously benefits to these actions, including decreased siltation in downstream dams, cleaner water (and possibly lower pollution control costs for downstream dischargers), more recreational opportunities and more wildlife. These benefits can be quantified. Nationally, infrastructure repair is justified in terms of immediate employment benefits and long-term investment in the nation's health and economy. Riparian restoration could be justified in the same terms.

Do we need statutory language for federal agencies which specifically addresses riparian management? Would it be preferable to address biodiversity protection generally, with riparian areas an included category? There are two questions here, and they are complicated. The first asks how well federal statutes now protect riparian areas. There is no comprehensive law protecting riparian areas as such, although there are various federal laws which can be used, in certain circumstances, for protection and to authorize restoration. A comprehensive cataloging of these statutes and their operation is beyond the scope of this talk. Further, state statutory provisions should also be consulted. Certain provisions cut across all forms of land ownership (such as the Section 404 permitting program of the Clean Water Act or the Endangered Species Act); others are addressed to individual forms of land ownership, such as the Federal Land Policy and Management Act. Those involved in riparian protection have already discovered the multiplicity of statutes which affect this area.

The second question is what sort of federal statutory protection might be desirable. One option is a specific mandate to federal agencies to consider and protect biodiversity in their management activities, which directs that riparian protection be elevated above other multiple use purposes One author has explored how existing statutory authorities could better be used to protect biodiversity. (12) A different approach might be modeled on the Coastal Zone Management Act, in which a federal interest in the coastal zone is recognized, and states are encouraged to enact protective measures to protect it. Another approach would be to use the pending amendment of the Clean Water Act to require protection of riparian areas. Under the framework of that Act, states could be required to adopt standards which provided protection for riparian areas, subject to federal approval Even under existing law, federal agencies may be required to undertake riparian management to prevent stream standard violations. (13)

There are some evident problems with any of these approaches, but I think a common one in everyone's thoughts would be the "takings" issue. Especially given the charged nature of Western political dynamics, it may make sense to acknowledge that private users will be powerful opponents of greater regulation unless economic injuries are somehow ameliorated, regardless of where the legal merits of a claim might lie.

Partnerships and new management models hold enormous hope for riparian protection. In these, states, local governments, citizens organizations and industries all contribute. Another set of questions is raised by asking what is needed to assist in creating and sustaining these ventures?

Improved management of water is critical to all of these efforts. Other speakers address the use of the public trust doctrine, instream flow rights, and better management by federal agencies as aspects of providing water for riparian needs. A rich literature has been developed over how Western water laws can accommodate new uses for water. (14) In contrast, groundwater is just beginning to receive recognition as a potentially important factor in riparian protection.

States, local governments, and tribal entities need assistance in improving their management of riparian areas. While ecological issues are now being accorded far more importance than in recent years, most of EPA's budget will go to statutorily established programs. For ecological priorities to receive funding commensurate with their importance, it is likely that additional program funding will need to be sought from Congress, to be passed on to states and others.

This conference provides ample testament that protection and restoration of riparian areas is possible through the hard work of many individuals and institutions. This is a time to be expansive in taking these efforts to a larger scale.

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Instream Flow Protection: Legal Constraints and Opportunities //

Tim De Young and Gregory C. Ridgley

Introduction

Western water law was designed to facilitate the private control and use of a public resource -- water. The prior appropriation doctrine, developed in the 19th Century and adopted in most of the seventeen western states,(1) was used to enable private diversions of water from riparian habitats to farms, fields, and factories. Although Western water law has played an essential role in the development of the West, the prior appropriation doctrine arguably is the primary obstacle to protecting the relatively few remaining riparian habitats.

This paper first provides a general overview of the legal factors that may impede instream flow protection. Section I disusses prior appropriation systems existing in Arizona, Nevada, Idaho, Utah, Colorado, Wyoming, New Mexico, Montana, Alaska, and Oklahoma have prior appropriation systems. California, Oregon, Washington, Nebraska, Kansas, North Dakota, South Dakota, and Texas have dual systems where prior appropriation and riparian rights both are recognized. Essential ingredients of the prior appropriation doctrine are summarized followed by a review of state laws and policies that modify the prior appropriation doctrine to protect instream flows. Section II identifies legal constraints and opportunities for instream flow protection that exist below federal, state, and private water storage facilities. Section III describes instream flow protection constraints and opportunities available under federal law.

I. Protection under state law: problems and solutions

The Prior Appropriation Problem.

A brief summary of the following essential ingredients of the prior appropriation doctrine should preface a discussion of the doctrine's impact on instream flows. The first person to divert water acquires a vested property right to the continued use of the water superior to all subsequent or junior users. This right generally cannot be taken without compensation. The water right, however, is only a right to use water because public ownership is retained in each of the Western states. Public ownership provides the basis for public welfare and public trust criteria which as we will see, may be effective tools for protecting instream flows.

To establish and retain the water right, water must be beneficially used. Beneficial use traditionally has been defined as the use of water for some economic or wealth

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generating purpose, not including leaving water in the stream. Another ingredient is the "use it or lose it" principle, operationalized by the related doctrines of abandonment and forfeiture. Penalties for non-use may provide an incentive for water rights owners to continuously divert full entitlements of water even when all of the water is not needed and even if the diversion is detrimental to riparian habitats.

In most of the Western states, water rights can be severed from a particular property and transferred to other parties provided there is no impairment to other water rights owners. Traditionally, impairment has been narrowly defined as impairing the rights of another to divert water.

The 19th century prior appropriation water rights equation therefore is relatively simple. A water right is a legally protected property right that requires a physical diversion from a stream or from the ground. Water must be beneficially used and the right can be lost through continued non-use. The prior appropriation doctrine in its pure form provides few, if any, incentives to leave water in the stream or in the ground. In fact, the doctrine expressly rejects the common law riparian notion that every person owning land on the bank of a stream possesses, by virtue of land ownership, a right to the use of the water without diminution or alteration. (2)

Four basic solutions have emerged to what might be called the prior appropriation problem. First, the system has been geographically limited to prevent environmentally harmful diversions in specified areas. Second, the prior appropriation doctrine has been modified in various ways to incorporate instream flow protection and preservation. Third, non-diversionary or instream flow water rights have been recognized which theoretically allow instream flow protection advocates equal footing with other water rights owners both to acquire water rights and to protest proposed diversions and transfers on the basis of impairment. Fourth, instream flows have been protected by cooperative arrangements made within the context of the existing system. In the following sections, each of the responses to the prior appropriation problem is briefly summarized along with problems inherent to each approach.

Geographic Limitations.

One solution is to limit the jurisdictional reach of the prior appropriation system by declaring certain streams and rivers "out- of-bounds." In 1928 Oregon became the first state to prohibit new diversions in specified stream systems or stream segments by enacting a legislative moratorium on new diversions in a specified stream.(3) More recently, both state and federal governments have designated specific segments of rivers as wild and scenic. For example, in 1972 California allowed for the preservation of rivers in their free-flowing state by prohibiting new dams and destructive diversions.(4)

The federal Wild and Scenic Rivers Act similarly allows for the designation, preservation and protection of scenic, recreational, geologic, fish and wildlife, historic, cultural and related values represented by specific river segments.(5) For example, the Rio Grande from north of the Colorado border to the Village of Rinconada, north of Española, has been designated part of the National Wild and Scenic Rivers System. This Act contains an express assertion of a federal reserved water right for the amount reasonably necessary to preserve the values to be protected. However, diversions of water are not expressly limited in the Act.(6)

The primary virtue of geographic protection of certain rivers is that the prior appropriation water law system may continue to coexist without major modifications. However, some have criticized stream designations as being too restrictive or inflexible because in certain situations, diversions are possible without detriment to riparian values. Moreover, limited legal, political, and economic resources dictate that only the best or least controversial riparian habitats will be protected.

II. Incorporation of Instream Flow Protection Measures Into the Existing Water Law System.

In most of the Western states, water rights require a valid permit. Restrictions to prevent destructive diversions, such as any diversion that would lower existing stream flow levels, have been imposed in a number of states. In addition to conditions on new permits, conditions may also be imposed when a permittee attempts to transfer or sell the water right. Proposed transfers may be protested, not only on the basis of impairment to established rights, but also when the transfer is detrimental to the public welfare or public interest. Many western states have(6) relaxed their requirements for standing to protest, making it possible for non-water rights owners to establishing standing.(7) (See Section III, infra, for additional information on federal instream flow protection.) In the majority of western states, one need not be a water rights owner to protest transfers.(8)

The primary limitation of protecting instream flows through permit conditions is that this approach does not affect existing permits or pre-permitted water rights except when such water rights are adjudicated or transferred. Because essentially all surface supplies have been appropriated or over-appropriated, new permits often are not available. Another problem is that imposition of conditions is heavily reliant on the administrative discretion of the state engineer or other water administrator who may not be aware or supportive of instream flow protection needs.

Creation of Instream Flow Water Rights.

Some believe that the most effective way to protect instream flows is to allow for the acquisition of water rights for the express purpose of leaving the water in its natural course. In 1925, the State of Idaho designated certain lakes and issued water rights to those lakes to the Governor. Public ownership of water rights to protect instream flow values nevertheless is a recent development in most states.

In order to create instream flow water rights, a state must remove the physical diversion requirement or clarify that no such requirement exists. Second, recreation and the protection of the scenic or riparian values associated with free-flowing waters must be considered a beneficial use. In a key case, again from Idaho, the Idaho Supreme Court held that its state constitution (which is quite similar to most of the Western state constitutions in this regard) had no physical diversion requirement.(9) Moreover, the court held that both recreation and the protection of scenic beauty was a recognized beneficial use.

Many, but not all, of the Western states have followed the lead of Idaho and Colorado by authorizing the creation of instream flow water rights. Generally, such rights must be owned by a public agency and such rights typically are junior to established senior water rights, even where senior diversionary rights are purchased and then transferred to instream uses.

Colorado provides a good example of a relatively effective instream flow protection program which includes instream flow water rights. In 1973, Colorado authorized its Water Conservation Board to establish water rights to maintain instream flow protection.(10) Such rights require the designation of specified minimum levels of flow in particular segments at particular times of the year. For example, a minimum flow of 10 cfs may be required during the winter in a certain stream segment. If minimum flows are not achieved, senior appropriators cannot be forced to cease making diversions. Junior appropriators, however, can be enjoined. Moreover, transfers can be protested or blocked by the Water Conservation Board on the basis that instream flow water rights may be impaired. Similar programs were adopted in Wyoming and Hawaii in the mid- 1980s.

Although the recognition of instream flow water rights became the focal point for many environmental activists, this new form of water right has created significant problems. It is becoming increasingly obvious that in comparison to diversionary water rights, instream flow water rights are costly to monitor and enforce. Part of the problem is that the water right typically only gives one a right to a certain quantity of water. However, to protect and enhance existing populations of fish and wildlife, water also must meet certain depth, quality, and temperature standards. In short, the instream flow water right is qualitatively distinct from the appropriative water right.

Another whole set of problems emerges when attempts are made to transfer, retire, or dedicate existing diversionary water rights to instream flow purposes. Arguably, allowing individuals or state agencies to purchase upstream, senior diversionary rights in order to increase existing stream flows is a voluntary, market-type solution to the problem. However, in many locales such reallocations of water rights result in a peculiar form of environmental racism or more correctly, urban exploitation of rural areas. In New Mexico, for example, upstream water rights tend to be controlled by Hispanic, subsistence farmers whose families have been using and maintaining the community ditch systems or acequias for hundreds of years. Obviously, urban-based white water rafters could enhance natural stream flows by retiring or purchasing such agricultural water rights but the economic and social impact on the affected rural areas would be great. In addition, retirement of irrigation water rights will diminish the green belts and related wildlife habitats created by irrigated agriculture.

Working Within the System.

Even without the recognition of instream flow water rights, the existing prior appropriation system provides numerous opportunities for instream flow protection. For example, leasing or purchasing water for temporary use in order to prevent the drying up of streams during drought or at other times has been used increasingly, especially during the recent drought in California and the Pacific Northwest.

Incentives for water conservation provide another opportunity. In Oregon, for example, farmers are allowed to sell salvaged water rights -- in other words, the amount of water conserved -- provided that 25% of the salvaged water is dedicated to the state for maintaining stream flows.(11) Generally, increasing conservation may decrease diversion requirements upstream but also may decrease the amount of water returned to the stream in the form of return flows or percolation. Nevertheless, conservation will play an increasingly important role in instream flow protection.

Some states have moved toward relaxation of the "use it or lose it" doctrine. In New Mexico, for example, water placed in an approved conservation program is not subject to forfeiture or abandonment. (72-5-28 and 72-12-8 NMSA 1978 (1991 Cum. Supp.)). Other states have enacted or are considering enacting similar provisions to temper any incentive to divert water unnecessarily simply to protect established water rights.

In New Mexico and most of the Western states, water rights cannot be reallocated unless there is no impairment of existing water rights and the reallocation is not detrimental to the public welfare or public interest.

Unfortunately, defining the public interest or public welfare is a controversial, if not impossible task. Although the courts have been forced to make such decisions, it is generally preferable to determine the public interest through an open, participatory, and democratic process. Accordingly, many states have begun the process of developing water plans which establish priorities for water use in particular watersheds. Opportunities to protect instream flows during the water planning process therefore are available.

Water Storage

The prior appropriation doctrine is only part of Western water law. Another important tier in Western water law concerns the storage of "project" water, i.e., water stored in countless federal, state, and private reservoirs. Such reservoirs alter riparian habitats both above and below storage facilities. For example, catfish stocked in downstream reservoirs have decimated upstream native trout populations as far as ten miles from the storage facility. More obviously, storage facilities have altered the natural hydrograph of countless rivers throughout the West by generally replacing high spring flows and low flows in winter and late summer with a regime of more even flows throughout the season.

Recently, however, the ability to manipulate releases from reservoirs has been employed increasingly to enhance instream flow values. For example, a recovery implementation program has been initiated pursuant to the Endangered Species Act for the Colorado River Squawfish and other endangered fish species in the Upper Colorado River Basin. A separate but related program has been initiated for the San Juan River. Both programs require mimicry of historic stream flows. In other words, the prior practice of steady and controlled releases from dams throughout the year is replaced with a program of releases intended to imitate the pre-dam hydrographs of high spring flows and low winter flows.(12)

More generally, cooperative solutions have been hammered out below and between a number of reservoirs throughout the West. For example, litigation was initiated by water rights owners and states downstream of the Gray Rocks Reservoir in North Dakota.(13) The downstream users, which included irrigation districts in Nebraska and Wyoming, utilized the Endangered Species Act to insure continued flows downstream of a power plant. An area that had been designated as a critical habitat for endangered whooping cranes was located approximately 250 miles downstream of the power plant. The utility claimed a substantial amount of water rights to run its coal-operated generating plant upstream. The litigation ultimately was resolved through a settlement agreement whereby the Army Corps of Engineers and other state and federal agencies resolved their differences concerning the timing and amounts of releases. Similar opportunities exist for cooperative solutions that both protect instream flows for environmental purposes and serve downstream water rights owners.

In certain situations, however, win-win solutions are not available and conflict will arise. For example, instream flow needs may not coincide with the water demands of hydroelectric facilities. A difficult trade-off may result. To protect critical habitats for endangered species by increasing or altering the timing of releases, downstream development including diversionary structures and streamside development may be damaged. Less obviously, air pollution levels may increase as fossil-fuel based electricity replaces hydroelectric power. Nevertheless, the control of releases from storage facilities is an increasingly important tool for instream flow protection.

III. Protection Under Federal Law.

Statutory Protections.

A number of protections exist under current federal law. Federal permits or licenses for water projects may directly require flow-by or flow-through of natural stream flows. For example, Forest Service storage facilities on national forest lands commonly require preservation and enhancement of natural stream flows. Issuance of §404 dredge and fill permits by the Army Corps of Engineers similarly require consideration of the potential effects on riparian habitats. The federal Office of Surface Mining is authorized to impose conditions on mining permitees to "minimize the disturbance to the prevailing hydrologic balance at the mine- site and associated off-site areas and to the quality and quantity of water in surface and ground water systems."(14) In conjunction with the National Environmental Policy Act (NEPA), significant opportunities for preventing or modifying future projects and incorporating instream flow protection into renewals or re-issuances of permits or licenses are available.

A number of federal storage facilities use water to generate electricity. The Federal Power Act requires the Federal Energy Regulatory Commission (FERC) to find that a proposed project is best adapted to a comprehensive plan for a waterway including navigation, water power, and other beneficial public uses such as recreation and fish and wildlife.(15) FERC licenses "shall" include conditions for the protection, mitigation, and enhancement of fish and wildlife affected by the development, operation, and management of the project.(16) Moreover, the U.S. Fish and Wildlife Coordination Act requires the FERC as well as other federal agencies to solicit recommendations for wildlife mitigation from the U.S. Fish and Wildlife Service.(17)

Enabling legislation for federal storage projects and other facilities also may provide for the protection of instream values. For example, one of the specific objectives of the Colorado River Storage Project is to "mitigate losses of, and improve conditions for, the propagation of fish and wildlife."(18) More generally, Congress has declared that the entire Colorado River Program should serve a number of purposes including flood control, navigation improvement, storage and delivery of water for municipal, industrial, and other beneficial purposes, improving water quality, outdoor recreation, and the generation and sale of electric power.(19)

Environmental groups have successfully used such enabling legislation in litigation to protect riparian habitats. For example, in 1976, the National Wildlife Federation, the New Mexico Wildlife Federation, and several interveners filed an action for declaratory and injunctive relief to challenge the Bureau of Reclamation's attempted construction of a power plant at the Navajo Dam in northwestern New Mexico.(20) The court affirmed that construction of the power plant was not authorized under statutes relating to either the Colorado River Storage Project or the Navajo Indian Irrigation Project. The Bureau was criticized for its failure to consider adequately the effects that construction of the hydroelectric facility might have on aquatic and other wildlife below the Navajo Dam.(21) Consequently, the Bureau was required to conduct an environmental impact statement detailing impacts on downstream fish and wildlife before proceeding with the project.

In addition to the above, there are a number of federal acts which indirectly may allow for protection of instream flows. In addition to the Endangered Species Act, discussed above in the context of the squawfish recovery plan, the Clean Water Act plays a pivotal role. Under this Act, instream flows may be needed to dilute non-point source pollution. Section 313 of the Act allows for the regulation of quality from federal facilities. Section 303 of the Act allows the EPA to review state water quality standards. For example, the EPA currently is reviewing California state water quality standards with an eye towards preservation of endangered species in the Sacramento River system.

Under the Clean Water Act, Indian tribes are recognized as states and may promulgate their own water quality standards.(22) Recently, a number of Indian tribes and Pueblos have promulgated water codes requiring both minimum flows and certain water quality. For example, the Isleta Pueblo south of Albuquerque recently has promulgated water quality standards that inevitably will require upstream dischargers, including the City of Albuquerque, to pretreat water before discharging it into the Rio Grande. However, Albuquerque has responded by suing the EPA.

Federal Reserved Water Rights.

In general, the water law of a particular state controls the appropriation and use of water within that state, including water on federally owned lands. The Desert Land Act of 1877 severed water from federal lands and gave control of that water to the various western states for the use of the public.(23) Federal reserved water rights for lands Congress withdraws from the public domain are the significant exception to this general rule.

A long series of cases has recognized that both the federal government and Indian tribes may have water rights necessary for the purposes of federal or Indian reservations.(24) Unlike state water rights where priority is determined by the initiation of beneficial use, reserved water rights are given a priority date equivalent to the date of reservation. For example, the priority date of water rights for national forests created by the Organic Act of 1897 is 1897.

In a key decision, however, the United States Supreme Court limited federal government water rights claims to the amount needed for the express purposes of the reservation.(25) Because the Organic Act did not expressly include recreation and preservation of scenic beauty as primary purposes of the reservations made by the Act, reserved water rights could not be claimed for these purposes. The Court did acknowledge, however, that one purpose of the national forests was to secure favorable conditions of water flow. Subsequently, the Forest Service as well as other federal agencies have initiated litigation in order to establish federal reserved rights for instream flow protection. Like national forests, national parks and wildlife refuges apparently do have the basis for federal reserved water rights claims. In contrast, however, no water rights have been reserved for BLM lands.(26)

Indian Reserved Water Rights and Aboriginal Claims.

Historically, demands for instream flows for fishing and religious purposes by Indian tribes provided incentives for increasing or maintaining flows in certain rivers. Because Indian reserved water rights, like federal reserved rights, are given a priority date equivalent to the date of the reservation, they generally supersede non-Indian water uses. In general, if one of the essential purposes of the reservation was to preserve the Indians' right to fish or hunt, then the tribe may have a significant claim for water rights, including instream flows, to serve these purposes.(27) Recent litigation in Wyoming has clarified the right of the tribes to use their water rights to protect instream values.(28)

In addition to tribal reserved rights, the federal government and some tribes have begun to assert a right to minimum instream flows based on tribal aboriginal title to their lands.(29) These claims are based on the "retained rights doctrine," which provides that aboriginal rights to natural resources are retained unless expressly granted to the United States.(30) Although aboriginal rights claims have not yet gained the level of acceptance achieved by the reserved rights doctrine, it may prove to be an effective tool for instream flow protection outside of established tribal reservations.

Conclusion

A panoply of federal, state, and local statutes and regulations along with an impressive body of case law constitute the legal context for instream flow protection. In order to provide a general overview, this paper admittedly simplifies, but hopefully does not misrepresent, this very complex area.

Because the prior appropriation doctrine was designed to remove water from the West's streams and rivers, it has inhibited efforts to protect instream flows, the lifeblood of riparian habitats. In response to insistent and increasing demands for instream flow protection, Western water law has been modified. Although further modifications may be needed, significant opportunities currently exist within existing state regulatory systems. In addition, federal statutes and reserved rights doctrines offer many opportunities for instream flow protection. Hopefully, cooperative solutions will be used more – and litigation less – to achieve the greatest protection possible.

References

(1) See D. Tarlock, Law of Water Rights and Resources, 5.03 (1989).

(2) See generally R. Clark (ed.), Waters and Water Rights §15.2 (1967). Numerous books and articles have been written about instream flow protection. The following are highly recommended: L. MacDonnell, et al. (eds), Instream Flow Protection in the West (1989); "Proceedings of the Western Regional Instream flow Conference" (1989) (Proceedings from the second such conference forthcoming); Tarlock, "The Recognition of Instream flow Rights: "New" Public Western Water Rights," 25 Rocky Mountain Mineral Law Institute 24-1 (1979).

(3) See e.g., Oregon Revised Statutes § 538.300; see generally S. Shupe, "Keeping the Waters Flowing: Streamflow Protection Programs, Strategies, and Issues in the West." in Instream Flow Protection, Law and Policy (1989).

(4) Cal. Pub. Res. Code § 5093.55

(5) 16 U.S.§§ 1271-1289

(6) See Section III, infra, for additional information on federal instream flow protection.

(7) See, e.g., 72-5-5(B) NMSA 1978 (1985 Rep. Pamp.); many Western states provide for public interest review before issuance of new appropriation permits or transfer of existing permits. See, e.g., Ariz. Rev. Stat. Ann. 45-142-143 (Supp. 1986).

(8) See generally Colby, et al., "Transferring Water Rights in the Western States -- A Comparison of Policies and Procedures," Univ. of Colorado, Natural Resources Law Center Occasional Paper (1989).

(9) *State Department of Parks v. Idaho Department of Water Administration*, 96 Idaho 440, 530 P.2d 924 (1974). See e.g., §72-12-3 NMSA 1978 (1991

(11) O.R.S. 537.475.Cum. Supp.)

(12) Ironically, abnormally high releases from the Navajo Dam in northwest New Mexico in Spring, 1992, destroyed the nesting habitat of Canada geese and other migratory waterfowl. Although the high releases were attributed to abnormally warm temperatures which hastened the spring thaw, it appears that the Bureau of Reclamation was retaining water prior to that time in order to mimic high spring flows for the squawfish restoration project.

(13)*Nebraska, et al. v. Ray*, CV-78-L-9 (D. Neb. 1978) and *Nebraska, et al. v. REA, et al.*, No. 78-1778 (8th Cir. 1978).

(14) Surface Mining Control and Reclamation Act of 1977, 510(b)(10), 30 U.S.C. 1260(b)(10) (1988). A recent decision, however, appears to limit OSM's authority to impose conditions to protect downstream water rights claims. *Peabody Coal Co. v. Office of Surface Mining* Reclamation and Enforcement, 123 I.B.L.A. 195, GFS (MIN) 28 (1992).

(15) 16 U.S.C. 791(c).

(16) Id. at 803(j).

(17) 16 U.S.C. 661 et seq.

(18) 43 U.S.C. 620(g).

(19) 43 U.S.C. 1501(a).

(20) *National Wildlife Federation v. Andrus*, 440 F. Supp. 1245 (D.D.C. 1977).

(21) Id. at 1251.

(22) 33 U.S.C. 1377.

(23) See *Idaho Dept. of Water Resources v. United States*, 832 P.2d 289, 296 (Idaho 1992).

(24) See, e.g., *Cappaert v. United States*, 426 U.S. 128, 138 (1976).

(25) *U.S. v. New Mexico*, 438 U.S. 696 (1978).

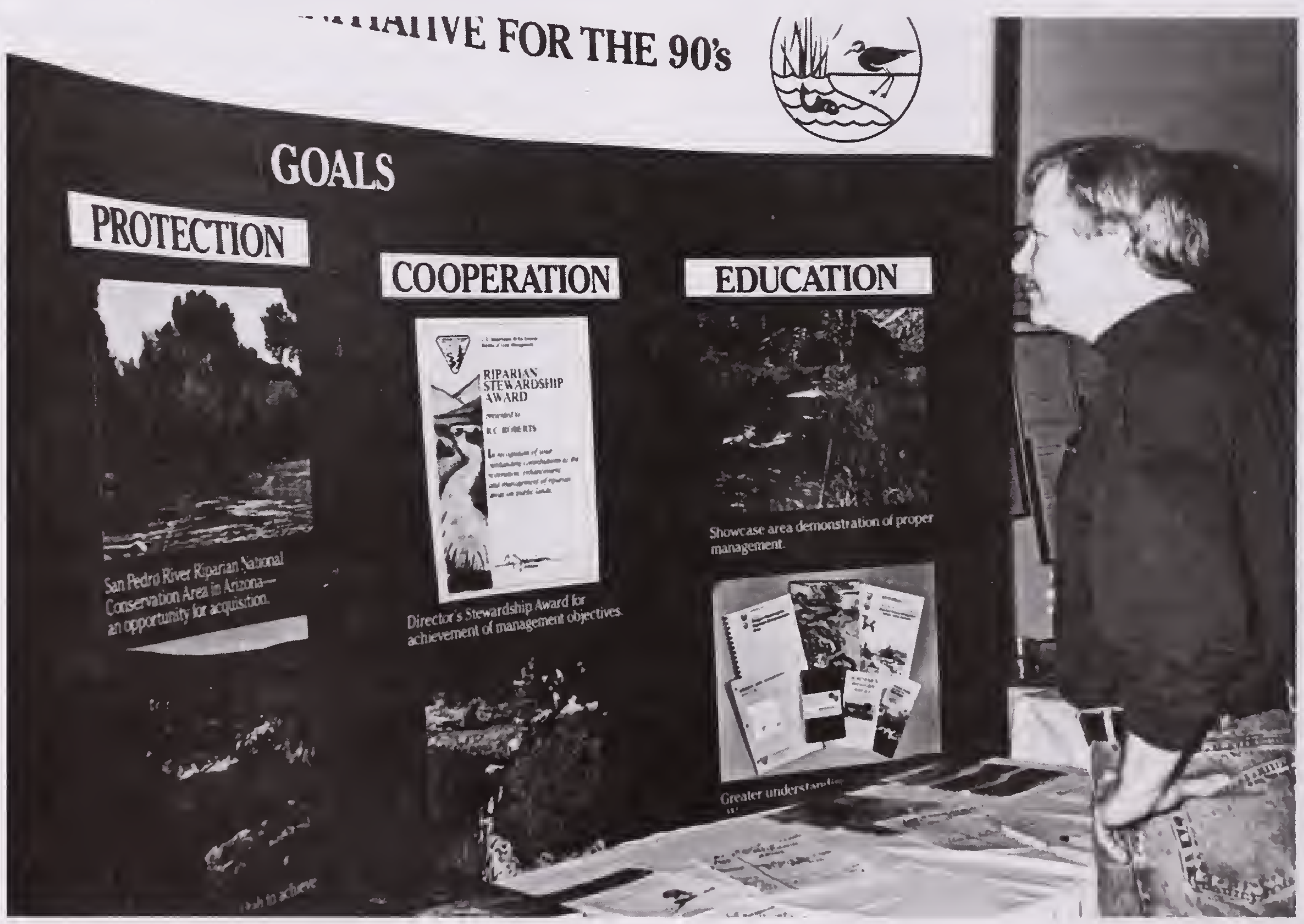
(26) *Sierra Club v. Watt*, 659 F.2d 203 (D.C. Cir. 1981).

(27) See *Winters v. United States*, 207 U.S. 564(1908).

(28) See In re General Adjudication of All Rights to Use Water in BigHorn River System, 753 P.2d 76 (Wyo. 1988), aff'd, *Wyoming v.United States*, 492 U.S. 406 (1989).

(29) See Becker, "'They Had Command of the Lands and the Water . . . All Their Beneficial Uses . . .': Indian Water Rights in the West," 2 Rivers No. 166 (1991).

(30) *United States v. Winans*, 198 U.S. 371 (1905).



The Public Trust Doctrine and River Conservation

Diana F Jacobs

The public trust doctrine governs the management and use of tidal and navigable waterways. Under this doctrine, the people have certain inalienable rights to use and enjoy public waterways, and the states are trustees over these lands to protect their resources and uses. The public trust doctrine can be an important legal tool for river conservation, including the long-term stewardship of rivers as systems.

Overview of the Public Trust Doctrine

The public trust doctrine revolves around three important issues whose definition and application are critical:

- first, tidal and navigable waterways, which are public trust lands;
- second, public trust uses; and
- third, trusteeship of those lands.

The doctrine is regarded as primarily a "common law doctrine" - a principle of law which is established through past judicial decisions, based on custom and precedent.

With United States independence, each original state was vested with many of the same powers and duties of the British crown and government, including ownership and trusteeship over natural navigable and tidal waterways. Under the "equal footing" doctrine, every state subsequently added to the union also received title to its navigable waterways. Such waterways owned by the states are often called "sovereign lands," stemming from the laws and traditions of Great Britain in which the Crown, or Sovereign, owned and administered the waterways as trustee for the benefit of the people.

The opinions expressed are those of the author and do not necessarily reflect those of the State Lands Commission.

Generally, states own the beds of waterways and tidelands if they are or were navigable or tidal (subject to the "ebb and flow of the tide") in their last natural condition after statehood. A state's ownership in present waterways is often determined by a number of highly complicated and technical issues, including hydrology, tidal influence, geomorphology, human uses, artificial influences, the terms of certain past land sales and grants, as well as legal conventions particular to a time and place.

State property interest in tidal and/or navigable waterways generally consists of fee title to the ordinary high water mark on tidal waterways. On inland rivers and lakes not subject to the tide, fee title in most states includes lands up to the ordinary high water mark, or may, as in California, extend only to the ordinary low water mark. In California, a public trust easement, also a property interest, extends between the ordinary low water

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mark and ordinary high water mark. (Additionally in California, certain lands, depending upon their history, may be subject to easement rather than fee ownership.) All such lands, whether owned in fee or easement, are subject to the public trust doctrine.

The public trust doctrine, developed from ancient Roman law and English common law, protects the people's traditional rights to use tidal and navigable waterways for navigation, commerce, and fisheries. Other trust uses of waterways accepted across the United States, and cited throughout public trust case law, include swimming, hunting, sun-bathing, shellfish gathering, and other recreational pursuits.

"The state has an affirmative duty to take the public trust into account in the planning and allocation of water resources and to protect the public trust uses whenever feasible."

In California it has been explicitly recognized that the public trust doctrine includes preservation of natural systems as a valid and important use of waterways. In 1971, the State Supreme Court held:

> "The public uses to which tidelands are subject are sufficiently flexible to encompass changing public needs. In administering the trust the state is not burdened with an outmoded classification favoring one mode of utilization over another ....There is a growing public recognition that one of the most important public uses of the tidelands - a use encompassed within the tidelands trust - is the preservation of those lands in their natural state, so that they may serve as ecological units for scientific study, as open space, and as environments which provide food and habitat for birds and marine life, and which favorably affect the scenery and climate of the area." *Marks v. Whitney* 6 Cal. 3d 251, 98 Cal.Rptr. 790, 491 P.2d 374 (1971)

The language of this particular case describes tidelands in a marine environment because it involved public trust lands of a coastal bay. However, the principles enunciated in Marks apply to all public trust lands, inland navigable waterways as well as tidelands. This decision also acknowledged that the public trust doctrine is flexible and can change with societal needs.

Under the public trust doctrine, each state government must manage sovereign lands responsibly. Sovereign lands are held in trust and are not to be sold or given away, nor should they be used in a way that is not consistent with the public trust rights of the people on the waterways. Thus, the doctrine has been frequently considered a "constraint" upon the activities of the state (Stevens 1984) with regard to waterways management.

From time to time, state governments have sold, filled, or developed their trust lands, or at least attempted to. Courts have consistently objected to these activities unless they could be shown to be beneficial on the whole to the public trust. In fact, courts are the major restraining influence upon state governments in safeguarding public trust resources (Sax, 1970). Public trust case law is filled with examples of court opinions which forcefully express the duties and responsibilities of the trustee, as in this Oregon case:

> "Because the trust is for the public benefit, the State's trustee obligation is commonly described as the protection of specified public usages, e.g. navigation, fishery and, in more recent cases, recreation. The severe restriction upon the power of the state as trustee to modify water resources is predicated not only upon the importance of the public use of such waters and lands but upon the exhaustible and irreplaceable nature of the resources and its fundamental importance to our society and to our environment. These resources, after all, can only be spent once. Therefore, the law has historically and cosistently recognized that rivers and estuaries once destroyed or diminished may never be restored to the public and, accordingly, has required the

highest degree of protection from the public trustee." *Morse v. Oregon Division of State Lands* 285 Or.197, 590 P.2d 709 (Ore. 1979)

Courts have further admonished the states to take active roles in protecting sovereign lands and their public benefits. The California Supreme Court in 1983 issued a strong statement of the trustee's job, stating about the public trust:

> "It is an affirmation of the duty of the state to protect the people's common heritage of streams, lakes, marshlands, and tidelands, surrendering that right of protection only in rare cases when the abandonment of that right is consistent with the purposes of the trust." *National Audubon Society v. Superior Court* 33 Cal. 3d 419, 189 Cal.Rptr. 346, 658 P.2d 709 (1983)

While the public trust doctrine has been held to mean that states cannot give up their sovereign lands, it has not necessarily dictated that states be completely protective of the environmental values of their waterways. In fact, public trust uses may sometimes be conflicting or mutually exclusive in any one place or at any one time, and the trustee is put in the position of balancing among competing uses to achieve the highest public benefit. Such balancing may change over time, as society changes. For example, in the past many areas of wetlands were once destroyed so that commercial shipping ports, which used to be of paramount importance, could be built. Today, a marshland might be protected and a marina for pleasure craft denied.

The Public Trust Doctrine and River Systems

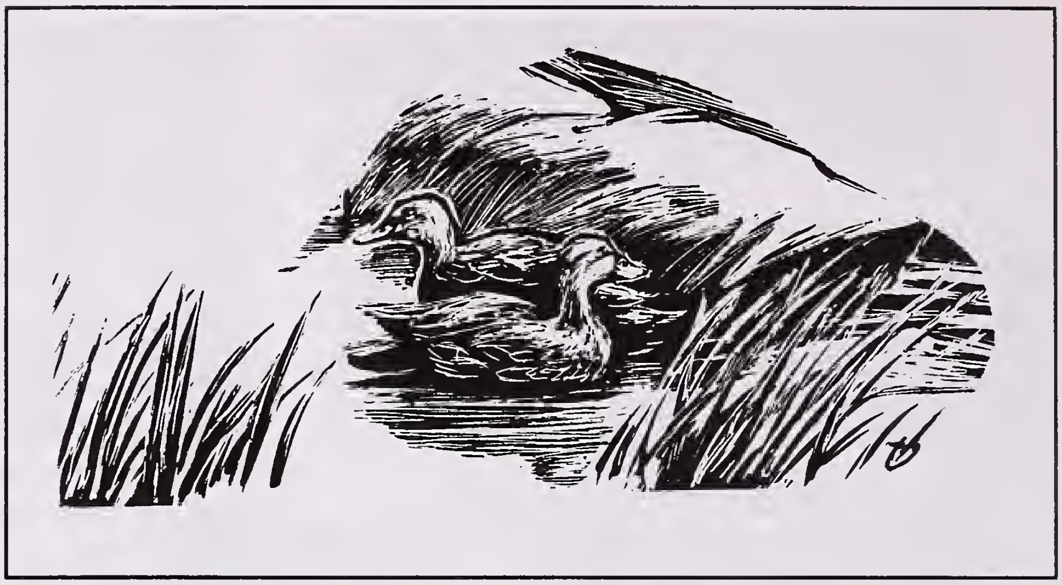
Natural scientists understand that rivers are integrated ecological systems, continuous from headwaters to mouth, encompassing channel and floodplain, and set within watersheds. Managing and restoring rivers must be based on their functions as systems (National Research Council, 1992). How does the public trust doctrine relate to the restoration and conservation of rivers, especially as natural systems?

In concept, the doctrine should compel trustees to protect in perpetuity the public's resources, rather than sacrificing them for short-term economic gain. The trustee should strive to ensure the long-term sustainability of resource systems, with most emphasis on natural ecosystems "for it is very often the case with natural resources that they have their broadest uses when they are left essentially in their natural state" (Sax 1970). The public trust doctrine therefore seems wonderfully suited to ecologically guided river management.

In addition, the public trust doctrine involves powers and duties of state governments over waterways because they are owned and held in trust, not because of police powers. Management of public trust lands does not involve a government taking and avoids problems associated with regulation (Stevens 1984). Lastly, even if government has failed to assert its public trust authority in the past, the public trust always remains over sovereign lands. Navigable rivers neglected in the past can still be protected by future governments.

Despite the great potential for the public trust doctrine, the law as it is commonly interpreted and applied has several limitations which weaken its use for ecological stewardship of rivers. A major difficulty with the public trust doctrine is that states own only those reaches of a river which are navigable, and only to the ordinary high (or low) water mark. This raises a number of questions: Which rivers are held by the states as public trust lands? What does "navigable" mean? How much of the land underlying the natural flow of the rivers does the state own? Does the public trust doctrine extend over the entire floodplain of a river? Is riparian habitat protected under the public trust doctrine?

In practical terms, rivers which are or were in a natural state useful for transportation are considered "navigable" for purposes of determining sovereign ownership. A history of commercial boat traffic is frequently regarded as evidence of navigability on rivers which are no longer in a natural condition. The definition of navigation has varied between places and over time, and has included use for the transport of logs or furs, or recreational boating, for example (Frank 1983).



Although it is generally the larger rivers of an area which are claimed as sovereign lands, this is relative. For example, rivers only seasonally boatable, as are many western rivers, may be deemed navigable for state title purposes. Nonetheless, states have typically not claimed ownership of the lands underlying smaller tributary streams or headwaters of a river.

The determination of the extent of the public trust ownership laterally over the channel and floodplain is similarly variable. Some interpretations suggest that sovereign ownership includes only the "active" channel or riverine zone (as used by Cowardin 1979; and Jensen and Platts 1989), while others may include various amounts of riparian habitat. Significant amounts of riparian, wetland and aquatic resources may be left out of public trust ownership on navigable river systems.

On large, alluvial-depositional rivers, a state's sovereign ownership does not necessarily extend over the entire natural floodplain, despite the fact that the channel may meander throughout the floodplain over time. To make matters worse, land law usually treats gradual bank erosion/point bar deposition processes of channel movement differently than a sudden meander loop cut-off, called an "avulsive" change. Trust ownership follows a gradually meandering channel, but is often said to be fixed in place with a cut-off oxbow. These two types of geomorphic change are all just parts of the same river system, a fact generally not reconciled with current property law.

The public trust doctrine, despite its limitations in recognizing natural river processes, still can be a powerful environmental legal mechanism. However, in most states it has not yet been widely applied for ecological river management. When it has been invoked, it has been used mainly to protect the public's rights of navigation and access or to provide state income from leases of sovereign lands. In those states where it is used as an environmental doctrine, the focus has been on shoreline resources of lakes and coastlines, rather than rivers (see review in Slade 1990). Today, California is a major exception, applying the public trust to protect environmental values of rivers.

The California Example

In California, both the State, as trustee, and the courts have actively explored and furthered the environmental potential of the public trust doctrine. By way of background, in 1938 the state legislature designated the State Lands Commission as the government agency with jurisdiction over sovereign lands (as well as state school lands).

The state-owned public trust lands in California total approximately 4 million acres, including hundreds of tidal and non-tidal rivers, streams and sloughs; nearly 100 navigable lakes; tidal bays, lagoons, and marshlands; and the three-mile wide strip of tide and submerged lands along the entire 1100 mile coastline. Examples of public trust lands include the Sacramento, Klamath and Eel Rivers, Mono Lake, San Francisco Bay, and the California portions of Lake Tahoe and the Colorado River.

California courts have frequently recognized the environmental values of waterways (e.g. see *Marks v Whitney* above). Decisions have also been made under the public trust doctrine that direct the state to protect these values, or at least take them under important consideration.

We can also find some judicial precedent for addressing the problem of public trust ownership being too limited in scope to adequately protect rivers as ecosystems. There are several court decisions applying the public trust to activities in the watershed of, or in non-navigable tributaries to, downstream navigable reaches. During the late 1880s, Gold Rush hydraulic mining in the Sierra Nevada was prohibited by the courts, based on its devastating sedimentation of downstream sovereign rivers. In another California case at the turn of the century, dams and diversions on upstream waters which impacted downstream navigability were determined to be a public nuisance and could be restrained (reviewed by Stevens 1989).

In one of California's most famous public trust cases in modern times, the above-cited Audubon, the state supreme court also reached upstream into tributaries to apply the doctrine, this time for environmental protection. In Audubon, small streams which drain into Mono Lake had been diverted, threatening the natural ecosystem of the Lake. Although these creeks were not navigable, their flows had a major influence on a public trust waterway downstream, namely Mono Lake. The diverter, the City of Los Angeles, held a state-issued water right permit.

The California Supreme Court ruled that the state, as trustee, must retain continuing jurisdiction over allocation of water resources, and that permission to appropriate water is not a vested property right. Water rights permits are licenses to use water, which may be modified at any time based on changed circumstances or reconsideration of public benefit. The decision also mandates that the protection of public trust resources is one of the preeminent public interests to be weighed in allocating water:

> "The state has an affirmative duty to take the public trust into account in the planning and allocation of water resources and to protect the public trust uses whenever feasible."

This decision is historic in joining the public trust doctrine with California water rights law. Although the court made it clear that the public trust may not always win in head- to-head confrontations with other water uses, trust values should be protected to the maximum extent possible.

A recent decision involving the American River, *Environmental Defense Fund (EDF) v. East Bay Municipal Utility District (EBMUD),* is an example of the new era in California water law following Audubon. In this case, EBMUD desired to divert water from the American River upstream from a river parkway of extraordinary beauty and ecological significance. In fact, the parkway reach is included as a segment in both federal and state Wild and Scenic River systems. Judge Richard Hodge in his 1990 decision (Alameda County No. 425955) ruled that EBMUD may indeed divert for its municipal purposes, but only after substantial instream flow requirements were met downstream. He stated in his decision that the specified instream flow requirements, which are substantially protective of fishery and other natural resources, were mandated by both the California Constitution (Article X, Sec. 2 - requiring water to be put to "the beneficial use to the fullest extent of which they are capable") and the public trust doctrine.

This decision was framed to allow the reasonable and beneficial use of water by EBMUD while protecting public trust resources, rather than deciding the case as all-or-nothing for either use. This case was not appealed by either side, but lives on through the retained jurisdiction of the court. The court appointed a Special Master to ensure that the instream and diversion requirements are met. The Special Master is also charged with continuing further studies on certain technical issues in order to fine-tune diversion and instream flow requirements.

It is of note that Audubon and EDF were both undertaken initially by private environmental organizations, rather than the state. The public can independently force a state to meet its trusteeship responsibilities, a unique and important aspect of the public trust doctrine. The State Lands Commission eventually became a party in both cases, firmly on the side of protection of public trust resources.

There can be no doubt that the public trust doctrine in application has often been controversial and contentious. In part this is due to the dynamic nature of both the doctrine and waterways themselves. Conflicts which cannot be resolved as to ownership, appropriate uses, or impacts to public trust resources, may result in expensive and time-consuming litigation. The public trust doctrine could be applied more effectively and efficiently when more formally enacted in law through state constitutions or legislation (Slade 1990; Stevens 1984).

Today, the California State Lands Commission takes seriously the affirmative duty to protect the state's public trust lands, and is attempting to move away from litigious solutions and move toward more cooperative planning and management on the state's rivers.

For example, to aid in managing sovereign lands more proactively, Commission staff has been preparing reports on the status and trends of public trust values of state waterways. The first such report, on the Sacramento-San Joaquin Delta, was released last year and resulted in and contributed to the passage of the Delta Protection Act of 1992. The next effort will be a similar report on California's rivers, in preparation.

The Commission is also involved with many new programs emphasizing cooperation and consensus with local, state, and federal agencies, and citizens groups. Examples of these cooperative initiatives are the Sacramento River Greenway, and the San Joaquin River Parkway.

For a thirty-one mile reach of the Sacramento River in the vicinity of the City of Sacramento, the State Lands Commission and local governments have signed a Memorandum of Understanding (MOU) to create a river greenway (parkway). The Sacramento River Greenway plan centers on the twin objectives of:

1) preserving and restoring riparian and riverine ecosystem values and

2) providing for public access and river recreational uses. A draft greenway plan has been released for public review.

The San Joaquin River in the vicinity of Fresno has in recent years been the concern of local governments and citizens groups. It still possesses valuable natural habitats and open space, but is experiencing increasing pressures of human activities. The state legislature has sponsored a San Joaquin Parkway planning effort in a thirty-three mile reach of the river, which involves governmental agencies, including the State Lands Commission, and local citizen groups with an interest in river management.

A major role of the Commission in the planning program has been to investigate the extent of the state's sovereign lands and public trust responsibilities throughout most of the parkway reach. This investigation is unusual in that the Commission has gone beyond boundary determinations with single property owners to a more comprehensive study of a large region. Also, it represents a pioneering use of the latest mapping and surveying technology, including satellite global positioning, in sovereign land boundary studies.

In 1992 the Commission staff released maps depicting its determination of the sovereign ownership interests, including high water and low water marks, of the State of California in the San Joaquin River in the proposed parkway reach. Substantial amounts of riparian habitat fall within the public trust lands claimed by the state. It is hoped that this information will assist local and regional governments, public interest groups, and property owners in the planning and management of the riverlands.

Conclusions

1. The public trust doctrine can be an effective environmental doctrine for protecting and restoring rivers, but its potential is largely untapped in the United States.

2. The public can enforce the principles of the doctrine if the trustee fails to meet its obligations.

3. The public trust doctrine is flexible and must be considered in the context of a particular time and place. The behavior of the trustee, and the courts reviewing the activities of the trustee, will vary. The public trust doctrine may not be perceived to be an environmental or ecological stewardship doctrine in a particular situation, but this can change as societal needs change.

4. Much conflict can be avoided if the application of the doctrine is delineated by a state's constitution and statutes, and if the government agency representing the trustee engages in cooperative planning.

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"Climb the mountains and get their good tidings. Nature's peace will flow into you as sunshine flows into trees. The winds will blow their freshness into you and the storms their energy, while cares will drop off like autumn leaves."
John Muir.

River Restoration: Financing Opportunities and Constraints

David Martinez

Introduction

The environmental community in the state of California is being faced with one of the most significant, if not the most significant, challenge since the birth of the "environmental movement." This challenge is not project or species specific, and it is not related to the development of new technologies. The challenge before us is to develop project funding mechanisms which are not dependent on governmental funding.

In the "past," the voters of California were extremely supportive of "green" ballots measures. Park and recreation, open space, and wildlife habitat state bond proposals have been viewed as sure winners in general elections and a secure method of financing conservation and restoration projects. It was a rude awakening in 1990 when all of the "green" bond proposals on the statewide ballot failed.

In 1992, the proposed California Heritage Bond Act failed to make the ballot, a victim of California partisan politics. The last election in which new state funds were approved for conservation projects was in 1988. The 1994 general election will be the next opportunity for voters to approve bond measures for conservation projects. With the state in the midst of the worst recession in its history, there is valid cynicism regarding the passage of a major bond act for environmental purposes.

The birth of the environmental movement was accompanied by the "labor pains" of a public unreceptive to a movement viewed as radical, leftist, or counter-culture based. Now that the environmental community has been incorporated into the mainstream of our society, the difficulties we now face may be viewed as those associated with weaning. Our once secure and ever-present funding source is producing less and being offered at diminishing intervals. In becoming self-sufficient, we must examine our funding constraints and opportunities to best maximize available funds and development of new sources.

Funding Constraints

The following topics are put forward as funding constraints. They are meant to be viewed as issues to be considered when pursuing financing for a conservation project. It should be noted that they could also be construed as funding opportunities. Issues such as community and political support, scope of project, willing partners are constraints that can be worked-through to provide support and funding for a project.

Available Funds/Funding Applicability

As stated in the introduction, California

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has not received new bond funds for conservation purposes since 1988. To add to the significance of this, the 1988 bond act, known as Proposition 70, was very "site-specific". Language in the Act specified how much was to be spent and where it was to be spent. The vast majority of Prop. 70 funds have been expended, or, the available balances are too little to be effective. Proposition 99, the tobacco tax, also provides funding for conservation work.

"Having not to spend funds, is the best financing opportunity available."

The good and bad news relative to this funding source is that people are smoking less. As a result, the available funds in this account are diminishing. Another measure, Proposition 117, is actually a budgetary "shell game." No new funds were created with the passage of Proposition 117. Instead, the act dictated how existing funds sources were to be applied.

With the decrease in California's economy came the resultant decrease in tax related state revenues. The state is experiencing revenue shortfalls which were previously unheard of. As the General Fund base decreased, other discretionary funding sources were tapped to fund baseline operations. One such fund, the Environmental License Plate Fund, has been severely reduced. This fund source is specifically intended for conservation projects. Another issue relevant to the availability of funds is how and what they can be applied to.

Increasingly, funds are specific to geographical location, type of resource, or expressly for a designated species. While this approach has obvious merit, it does place limitations on how the funds can be used. Areas or projects which do not fit the categories established by the various funding mechanisms will have a much harder time finding available dollars.

Scope of Project

There are two scoping processes relative to a project. One process focuses on the ecological parameters of the project. Delimiting factors such as habitat coverage, species habitat needs, buffers zones, and external influences will shape the configuration of the project. These factors are critical to the ecological integrity of the project and cannot be ignored. Often, when these elements are combined, the project scope is fairly substantial. The next process is relative to the fiscal nature of the project. Factors such as land values, restoration costs, and maintenance requirements need to be calculated. When these are compared against available funding, it is not unusual to either be required to reevaluate the project, or pursue additional funding.

With escalating land values, restoration, and maintenance costs, the size of the project is critical. Again, in the "past," funding availability was adequate for single phase project completion. Now, projects are increasingly completed in multiple phases over a period of years. The most ecologically critical components of the project are completed initially, with the remainder being completed at later dates.

Community and Political Support

There are obvious financing constraints, such as those previously mentioned, and there are constraints that are less prominent. These less conspicuous considerations have as much, and in many cases more, impact on the ability to successfully finance a project. Willing partners, community support, and political support are such forces. Each of these factors is linked to each other. A willing partner influences community support and community support translates to political support.

Political support is a necessary ingredient for a successful funding package. From the perspective of the environmentalist, there is often little doubt that the venture being pursued is for the betterment of all within the project's sphere of influence. What is often overlooked is the projects impact to the local economy and local governmental tax base.

Removing land from agricultural use or stopping local development has an influence on the local economy. Transferring property to state, federal, or nonprofit ownership removes that property from the local tax base with a resulting reduction in tax revenues. A weak local economy will feel these impacts more significantly, and usually respond in an adverse manner. This issue is difficult to contend with but must be recognized. Communication, education, and the development of projects which mitigate the economic impacts to communities will be the keys to resolving this complex problem.

Continuing Costs

Almost all projects will have some level of ongoing maintenance requirements. These cost will vary significantly depending on the type of project. An acquisition project that is remotely located with no access will have very minimal requirements, while a water delivery system demands continual maintenance and monitoring. These costs may not always be directly associated with the project. An adjacent landowner's broken fence, which allows cattle onto project property, is not necessarily the responsibility of the project property owner. Yet, the cost of not repairing the fence may will be the loss of the project. Greater pressure will brought to bear on organizations involved with conservation projects to function as responsible landowners, as opposed to absentee landowners. The result is that ongoing project cost will have to be given added consideration.

Funding Opportunities

When funding opportunities are discussed, there is a prevailing atmosphere of demise. Funding sources that have historically been dependable and adequate no longer possess these attributes. There is a bright side to this dimming landscape. We are being forced to explore and develop new and innovative means of financing conservation projects. New partnerships are being formed that were previously thought impossible. Increasingly, projects are being financed by a consortium of partners. With these new partnerships comes an expanded ownership to conservation projects, and ultimately, the conservation mission.

Federal, state, and local governmental funds are decreasing, but, they are not gone. There will continue to be federal and state measures which provide funding. What is interesting about these measures is that they are not always packaged in "green" wrapping, and accordingly, they are harder to find. Two such "non-green" funding sources are the federal Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the State's Caltrans Environmental Enhancement and Mitigation Grant Program. Both of these programs provide funds for wetland acquisition and restoration work. They are both funded from transportation revenues, hence, the "non-green" label.

In California, the federal House Resolution 429, will provide $50.0 million annually for river restoration. By whom and how these funds will be administered is still in question. A voter backed initiative is being prepared for the 1994 general election to provide state bond funds for conservation projects. In addition to these sources, there are numerous others which provide funds for planning, acquisition, and restoration work.

At the local level there are continuing opportunities to create financing mechanisms for conservation projects. These options include the creation of open space districts, special assessment districts, and redevelopment zones, to name a few. Water districts and flood control districts also provide an avenue for the funding of river and wetland conservation and restoration projects. The key to success at the local level is community support. There must be a direct tie to the community and the project benefits. This tie can only be established through a positive relationship with all those involved. Adversarial approaches will often fail at local levels and opportunities will be lost.

Foundations and Nonprofit Organizations

It is surprising to many environmentalist that some of the earliest "environmental" organizations originated with affluent sector of society. This is still the case today. There are a myriad of foundations which, when requested, will fund conservation projects. More often than not, this funding is more discretionary and require less paper work to receive than governmental funding. Nonprofit organizations are another valuable source of funding assistance. In some cases they may be in a position to directly provide funding. In others, they may provide technical or political support to obtain funds. Partnerships with such organizations are extremely valuable as they may have access to information or persons which you do not have, or, they may be able to engage in activities that are off-limits to you. All assistance provided for a project must be considered a type of funding. As such, the guidance and support provided by these organizations have functional monetary value.

Private Sector and Mitigation

The establishment of ties to the private sector will be the one of the most pivotal directions the environmental community will move towards. There are two primary reasons for the importance of this new course. One reason is that private-sector partnerships will bridge two ideologies that have been viewed as incompatible. The common ground established through this process will provide for a host of new opportunities and means of accomplishing goals. The other reason is that the private sector has the continuing financing potential that will be needed to ensure the continuation of conservation efforts.

If reasonable approaches to conservation efforts are developed, it will be in the best economic interest of the private sector to pursue and assist with those ventures. Project delays and redesign due to unmitigated adverse impacts or organized opposition will have notable impacts on the "bottom-line." If these problems can be avoided, fiscal resources will be better utilized and development projects are more profitable. If it can be demonstrated that it is cheaper to incorporate conservation measures into the initial project design, it will only make good fiscal sense to do so.

Another avenue for private sector interaction is through the mitigation process. This approach has deep-rooted resistance in the environmental community. Allowing, or worse yet, facilitating the mitigation of adverse environmental impacts is considered by some as "aid to the enemy." This sector of the environmental community feels that adverse impacts are not mitigable and the mitigation process is just assistance to the development community.

In reality, all of the conservation work we do is mitigation. Our projects may not be directly associated with specific projects. They may not be required by as a condition of a development project or entitlement. The fact is, we would not have to do the work we do if it were not for the adverse impacts to the environment resulting from society's expansion. Again, by working with the private sector in the development and implementation of mitigation projects, we can create or augment funding for conservation projects. The advantage to this route is that the mitigation project will be one that has the support of the environmental community and the potential to effectively mitigate adverse impacts to our natural resource base.

Easements and Development Rights

A common approach to protection or restoration work is to purchase the property outright. It has been felt that this will afford the maximum protection status. As land values increase, and we face the reality of continuing costs, ways to reduce project expenditures must be examined. Money saved has the same value as money spent. An alternative path to full fee acquisition is the purchase of easements or development rights. In many cases is not the ownership of the property that poses the environmental risk, it is the potential development or uses of the lands that are of concern.

A landowner may not even be considering impactive activities, but existing entitlements jeopardize the environmental integrity of the land. The purchase of only those entitlements having negative impacts on the resources will result in significant cost savings. By compensating the landowner for these rights, they realize a return on their investment, the resource will have been protected, and the local tax base is unchanged. Of equal importance is the partnership formed through this agreement. Instead of having sole responsibility for the project, the local landowner now shares this role and has a vested interest in the project.

Revenue Producing Projects

With the development of revenue producing projects comes an obvious shift to self-reliance for the funding of conservation work. The greatest challenge in the development of revenue producing projects may well be the redirection of some basic beliefs within the environmental community. Revenue producing implies a consumptive use of the resources.

It is the consumptive use of our natural resource base that has threatened the environmental integrity of our lands. As such, there is a strong resistance, which may be justified, to engaging in activities associated with the "use" of natural resources. To alleviate this response, longer-range vision is needed. Leaving an orchard in production, by managing the property or leasing it out, will generate funding to complete other projects.

A mining lease with an environmentally beneficial reclamation plan will also generate funds. The property will not experience accelerated deterioration, because it is owned and operated by responsible landowners (you), and at a future date, can be restored with funds generated from the project.

Investments can also be recaptured though this process. As mentioned in the previous discussion, it may well be that existing development entitlements pose the most serious risk to the resources. By purchasing the property and recording conservation easements over the prime natural resources, and doing the needed restoration work, the property is effectively protected. It can then be resold and the monies used for other projects. Depending on how far you take this concept, and how long you can hold the property, a profit can be made on the initial investment.

The key to this approach is the suspension of previously held beliefs that development, farming, ranching, mining, or other consumptive uses of the lands are "bad" and to be avoided at all costs. If these uses can be managed in an environmentally responsible manner, and revenue generated for conservation ventures, this should be an alternative to be seriously considered.

Volunteers

Financing connotes funds, and funds are equated with dollars. Dollars are used to "purchase" properties, merchandise, labor, or expertise. Volunteer labor and expertise, or donated merchandise have exactly the same "value" as the dollars which would have been required to purchase them. Volunteers and donations must be viewed and managed for what they are, valuable financial resources. The value of volunteer labor, if paid, is enormous. Their contribution cannot simply be reduced to dollar amounts. Volunteers are skilled and motivated people who have made a commitment to their projects. They represent the key links to communities and the continuation of the "movement". When describing available project funds, for grant purposes or to generate support, volunteer and donated merchandise should be included in this category. The work associated with volunteers will have increasing value as other fund sources decrease and labor and expertise costs rise.

Conclusion

This new era we are entering may well be the assurance of the long-term viability of conservation endeavors. The necessity of integrating landowners, agri-business, development interests, and other nontraditional partners in conservation projects will increase communication between sectors that have long-standing adversarial relationships. Not only will this improved ability to communicate and understand help solve project specific problems, there will be a greater potential to avoid the creation of problems.

The development of projects which avoid or mitigate negative ecological impacts can only be accomplished through cooperative planning and implementation processes. A prerequisite to this is the establishment of good communication and a relationship reflective of trust and understanding.

Having not to spend funds, is the best financing opportunity available.

River Protection and Rural Communities

Rick Moore

There is a spring named Sheepshead on a tributary of Oak Creek near Flagstaff, Arizona. Several years ago a wildlife biologist with the Coconino National Forest decided that it was a high-priority candidate for a riparian restoration project. One of the first obstacles he ran into was the landowner who held water rights for the stream. The spring had not even produced enough water to fulfill his allocation, and he was worried that increasing the vegetation would further reduce the how much water he would get. However, his fears were eventually overcome, he withdrew his objections, and the project was completed.

After the vegetation grew back and the channel deepened, the amount of water available at his irrigation ditch headgate increased because it no longer flowed underground. Also, he had fought sediment build-up in his concrete irrigation ditches for years. The time-consuming job of removing the sediment ended because the vegetation in the newly established riparian area filtered the water and anchored the silt. So, he received two benefits from a project to which he initially objected.

I bring up this story to illustrate two basic points. In seeking funding for a restoration project, identify who and what will benefit from the project. The beneficiaries will provide the foundation for your funding, because it is through them that you will find both direct and indirect support. Don't be blind to the people who reap indirect benefits, they may be the ones that ultimately make your project possible. In this case the project was not designed to help keep the ditches clean, but because sediment was kept out of them, the landowner was a beneficiary.

If he had been approached as a partner who would benefit, he may have been supportive, rather than an obstacle. Partnerships, often with people you may not originally think of, linked with a thorough understanding of the benefits derived from the project are two vitally important components for getting funding.

The planning and the funding of riparian restoration projects are separate in some ways and intertwined in others. At the conceptual stage of the project the need for funding may drive some aspects of the planning. Part of the plan may benefit fishermen. Part of it may benefit a rancher and his cattle. Some of it may benefit birds, which could bring in support from the Audubon society. In the conceptual stage, it is best to involve as many people who are interested in the watershed as possible. The more people who buy into the project, the broader the base of support, and the more likely that funding will be found.

The upshot of all this is that most projects will be driven by a variety of interests. Some of the interested parties may provide money, some may provide labor, some may provide machinery, and some may provide support in principle. I recommend thinking of funding in terms of a "funding package." Such a

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"funding package" concept also reflects the fact that most streams cross ownership boundaries, so you will probably have a variety of people interested in your project whether you anticipate them or not.

One example of this concept is taking place now in southeastern Arizona at Cook's Lake on the San Pedro River where a mitigation project is going on that is driven by Section 404 of the Clean Water Act. Cook's Lake was a riparian area that needed restoration. The Asarco Corporation needed to balance destruction of one riparian area by restoring another. Eventually a plan was worked out that included the Bureau of Reclamation, Asarco Corporation, the Nature Conservancy, the Bureau of Land Management, the Arizona Game and Fish Department, and the Army Corps of Engineers.

Among other things, the area will be fenced to exclude cattle, drinkers for cattle will be installed away from the stream, all firewood cutting will cease, and a river terrace that was used for growing cotton will be planted in mesquite. After the project is completed, it will be managed by the BLM and the Nature Conservancy.

Another example is happening on the Santa Cruz River, which runs between Nogales and Tucson. There a project is underway which includes The Friends of the Santa Cruz River, Arizona Game and Fish Department, Arizona Department of Environmental Quality, Arizona Parks, local high schools, elementary schools, and a college.

Funding is being provided by all the interested parties. Because a significant portion of the water in the river is effluent, monitoring the water quality is important. It will be done by carefully instructed volunteers and is expected to be accurate enough to stand up in court if the need arises.

Educational programs are also tied into the project which aids funding and helps educate people about riparian issues.

In thinking about benefits, keep three basic categories in mind.

Direct economic benefits

Probably the most obvious direct economic benefit comes from money spent locally by sportsmen and non-consumptive users such as hiker, photographers and campers. The key here is to look at who benefits locally and approach them for assistance. Also, remember there are other forms of assistance besides financial. Merchants may be willing to donate necessary materials, support a restoration project in principle with the local government, or perhaps, provide a backhoe for free, to name a few examples. But remember that benefits can eventually become liabilities. What will the impacts of increased recreation have on nearby communities? At what point will they be adversely affected? The residents of Moab, Utah, for instance discovered that they were woefully unprepared for the thousands of mountain-bikers that recently descended on them.

Indirect economic benefits

Real estate that is located on the edge of a riparian area rather than in it, often benefits economically from the area's aesthetic and natural values. Perhaps a conservation easement between the Nature Conservancy and the developer can mutually benefit the developer and your project. Or, it may be possible that a small town's effluent costs can be lessened by a restored riparian area. It's estimated that the cleansing action of aquatic zones supported by riparian areas is worth anywhere from $400 to $1,500 per acre, per year.

Cost avoidance benefits and beneficiaries

Be sure to consider cost avoidance benefits, such as flood control, while seeking funding. Riparian areas can help reduce flood damage. Think about who would benefit from flood control on your stream and how they may possibly help with funding. The Soil Conservation Service, along with some other agencies, provided $123,000 for a nursery in the Verde Valley, in Arizona, to grow cottonwood "poles" and cuttings, so that cottonwood trees can be planted to hold banks rather than junked cars. The money from the sales will be used to further other projects.

> **"In the conceptual stage, it is best to involve as many people who are interested in the watershed as possible. The more people who buy into the project, the broader the base of support, and the more likely that funding will be found."**

Cost avoidance can range from saving a farmer the cost of rip-rap to saving huge amounts of money from being spent on a massive and intrusive species salvation plan. There are currently 100 threatened and endangered species found in Arizona. Over seventy percent of those listed use riparian areas during one phase of their life cycle. Rather than spending millions of dollars trying to save some of those species, it makes much more sense to save riparian zones themselves.

Also keep in mind is that funding agencies want the best results they can get for the money they spend, so be prepared to show why the stream you wish to work on should be given priority over streams.

If you are working on a riparian area that runs through a town, perhaps you can convince merchants that cleaning up the area and making it into an attractive area will benefit them. Point out that millions of dollars are spent every year to make the inside of shopping malls feel likeriparian areas.

Try and think of all the possibilities, then throw out the bad ones and keep the good ones. Indirect support, such as letters written by local people and organizations are very important in funding proposals.

I recently spoke with Larry Sharp, who is a member of Trout Unlimited in Colorado. He had been very involved in a restoration project on a small stream near Colorado Springs named Trout Creek. At one time Trout Creek was known for its excellent fishing. However, the creek and its attendant riparian area had been heavily impacted by a 100 year flood, improper cattle grazing, and recreation. Studies done by the forest service showed that 75% of the fish in the stream were suckers and only 25% were trout -- stunted trout. Trout Unlimited teamed up with the Colorado Division of Wildlife and the Forest Service to try and get 2 3/4 miles of Trout Creek back to some semblance of what it had once been. The Division of Wildlife and the Forest Service were unable to commit to any hard costs, however, they agreed to provide technical assistance, and consequently designed a restoration plan.

Another important person that needed to be included in the project was the rancher who held the grazing permit where Trout Creek flows. At first he was reluctant to agree to the project because the restoration plan limited access for his cattle to the creek. Upland water troughs were installed and access points were incorporated in the plan. He was given studies that showed his cattle would not sustain any weight loss, and he eventually signed onto the plan.

So, all the main parties agreed to the plan, but there were still a couple of hurdles to jump. The first, of course, was money to implement the plan, which proposed repairing 90 meanders. Cost estimates showed that it would require $23,000 in materials and other expenses. So Trout Unlimited went after the money.

They applied to the Trout and Salmon Foundation, who awarded them a $2,500 grant. They then went to the state office of Trout Unlimited and got another $1,500, for a total of $4,000. They took that $4,000 and went to the Gates Foundation who matched it, which gave them a new total of $8,000. Next they went to the Fish America Foundation who gave them an additional $4,000, which brought the total up to $12,000

While the fund raising was going on, work was also being done on the stream. Consequently, a developer who had built several homes about 30 miles away on the headwaters of Trout Creek, and who was also a fisherman, heard about the project and donated $7,000 more. So they now had $19,000. The final money was provided by the national Trout Unlimited organization through a program in which chapters throughout the United States compete for funding.

The chapter working on Trout Creek is one of 28 in Colorado,and although it was brand new, it was successfully competed and was awarded another $5,000, which brought the grand total to $24,000.

"Point out that millions of dollars are spent every year to make the inside of shopping malls feel like riparian areas."

But it takes more than technical advice and money to restore a stream: it also takes labor. Anywhere from 25 to 50 members of Trout Unlimited would show up on the second weekend of every month. But they decided that they needed more bodies to help -- if they could find them -- especially since many of the chapter members were retired. So, just as they looked everywhere they could think of for money, so to, they looked everywhere for help with the physical work. Two troops of Boy Scouts became involved.

Then the graduating class of a private high school in Colorado Springs donated two weekends to the project. Then Larry contacted ComCorp, the local community project program for people who had been sentenced by the courts to perform community work. The response from them was very enthusiastic, and according to Larry, they were very helpful. The Forest Service gave anybody who worked more than 40 hours a jacket with a logo on it representing the Trout Creek project.

The plan also called for root balls to be cabled to the banks of the stream to help slow erosion, provide a starting point for vegetation, and also to provide cover for the fish. A local builder who had cleared some lots while building homes, donated the needed root balls -- including trucking them to the stream.

And so the project went for three full summers. By the time a couple of years had passed, the populations of suckers and trout had flip-flopped: there were 75% trout and 25% suckers, or "rough fish." Vegetation has returned to the stream, and last year Larry's son caught a 14" trout out of the creek.

As the old saying goes: "Inspiration is 90% perspiration." Creative financing means more than having the best computer software program to seek out money. It means looking at the project from beginning to end to see who will benefit. From that examination a group of interested people can be pulled together.

The group, which will become a community, in the sense that they are a group drawn together because of common interests and goals, will then form the base for the creative process. If everybody stays open to all ideas, the creative process will begin.

In closing, I'd like to point out once again the importance of partnerships. The Trout Creek restoration project came together because of two agencies, one conservation organization, six funders, a rancher, a developer, and a couple of hundred volunteers. It was not one organization getting funding from one source, and I submit to you that this is how a great deal of "creative" funding is done, and will continue to be done in the future.

Water Quality Management Tools for National and Western Nonpoint Source Control

Roger Dean

Background

The control of nonpoint sources of pollution has evolved from the Clean Water Act (CWA) since its initial passage in 1972.. The first step in the process, starting in 1974, was the preparation of Section 208 Water Quality Management Plans with an appropriation of $400 million These 208 Plans focused on assessment of point and nonpoint pollution sources and evaluated management agency roles and responsibilities in the control of those sources. The 1987 CWA amendments added the Section 319 Nonpoint Source (NPS) Control Program. Two documents were required from the states, a NPS Assessment Report and a NPS Program Management Plan. The content of both documents was specified in a December 1987 Program Guidance document.

State Assessment Reports

The State Assessment Reports are required to:

1) identify the navigable waters within the State which, without additional action to control nonpoint sources of pollution, cannot reasonably be expected to attain or maintain applicable water quality standards or goals and requirements;

2) identification of categories and subcategories of nonpoint sources which add significant pollution to each portion of the navigable waters;

3) description of the process for identifying best management practices (BMPs) and measures to control each category and subcategory of nonpoint sources;

4) description of state and local programs for controlling pollution from nonpoint sources for each portion of the navigable waters.

State Management Plans

State Management Plans were to include:

1) best management practices and measures which will be used to reduce pollutant loading resulting from each category, subcategory or particular nonpoint source designated in the State's Assessment Report;

2) programs (including, as appropriate, nonregulatory or regulatory programs) for enforcement, technical assistance, financial assistance, education, training, technology transfer, and demonstration projects to achieve implementation of the best management practices;

3) a schedule of annual milestones for BMP implementation;

4) State attorney general's certification of authority;

Roger Dean is a Nonpoint Source Technical Expert for EPA Region VIII in Denver, Colorado. He has worked for EPA since 1974, with special emphasis on grazing issues, agriculture, silviculture and nonpoint source pollution. He chaired the work group on CZM grazing for the National Coastal Zone Management Nonpoint Source Program.

5) sources of Federal and other assistance funding;

6) a list of Federal programs and projects which the State will review for consistency with the NPS program.

The Watershed Approach

In fiscal year 1990, Congress started appropriating 40 to 50 million dollars per year to implement those two plans. The funds can be used for demonstrating implementation of Best Management Practices on a watershed by watershed approach, for nonregulatory or regulatory programs for enforcement, and for technical assistance, financial assistance, education, training, technology transfer, and demonstration projects. The states are encouraged to use the funds for a balanced NPS program of state staffing, watershed projects, information and education projects, training, technology transfer, enforcement, ground water assessment, and other elements needed for an effective state program.

Each year's funds are distributed to the EPA Regions by formula and then allocated to the respective state NPS agencies on a competitive basis. There are no state entitlements and a 40 % cash or in-kind match is required. Funds for implementation of the programs are also available through the State Revolving Loan Fund established in the Clean Water Act. EPA has developed a tracking system to track projects funded by the 319 program. As soon as the data from existing projects is loaded, key word searches for all projects will be possible.

The 319 program is primarily a voluntary program with enforcement of the state water quality standards and the new storm water permit program as the main regulatory tools to require implementation of BMPs to attain or maintain the beneficial uses of the water body. Consistency of Federal lands and activities with the NPS Management Plans is also required.

Links to Other Agencies

The EPA NPS program is linked to United States Department of Agriculture (USDA) Water Quality programs such as Hydrologic Unit Projects, Water Quality Demonstration Projects, and ACP Special Projects to provide water quality targeting of those programs. The challenge in the West on multiple ownership watersheds has been to develop projects which treat all NPS problems in the watershed concurrently, regardless of boundaries or agency responsibilities. This requires close interagency coordination on technical as well as budget issues.

The Coordinated Resource Management approach promoted by the Society for Range Management and by the National Association of Conservation Districts has been very effective in achieving this coordination along with the input from user and interest groups. An example of the benefits to be gained is the Badger Creek project in Colorado where the United States Forest Service (USFS), Bureau of Land Management (BLM), State Lands, and private parties each have about a 25 % share of the land. The 319 grant of $169,000 has resulted in a total project funding of $650,000 through leveraging of USDA, BLM, FS, State and private funds.

A Technology Based Approach

The next major step in the evolution of the NPS program was taken by Congress in 1990 with the passage of the Coastal Zone Act Reauthorization Amendments (CZARA). It established a technology based approach to NPS control for coastal waters by requiring state programs to ensure protection and restoration of coastal waters. This is to be done by implementing "generally applicable" management measures. Each state is to develop additional, more stringent management measures as necessary to attain or maintain applicable state water quality standards.

This change to a technology based approach is similar to that taken in earlier years on the requirements for sewage treatment plants. There the shift was made from a water quality based approach for individual plant criteria to the approach of requiring all plants to have a minimum of secondary treatment. Assessments were then made to determine which plants would require treatment higher than secondary treatment to achieve water quality standards. The same approach for NPS would require that those practices deemed feasible and cost effective would be implemented for all NPS sources. Water quality analysis would determine where more stringent controls would be required. Equity is achieved in BMP implementation in that all NPS sources have the same initial requirements. Long, complicated water quality analyses and load allocations will not be needed before initiating NPS control programs on streams needing to attain or maintain water quality standards.

CZARA

In a CZARA guidance document entitled "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters" the EPA and the National Oceanic and Atmospheric Administration (NOAA) have specified the first set of "generally applicable" management measures. The management measures were selected by a work group which had representation from agencies within the USDA and the Department of Interior, and other Federal agencies. The work group also included experts from state water quality and coastal zone management agencies. Consultations were held with a variety of trade associations, environmental groups, industry, and other interested parties. Management measures are described in terms of management systems rather than individual practices. Under certain circumstances, states may use alternative management measures if the alternative measures provide an equivalent level of protection and control. Public review of the draft measures was requested through a Federal Register notice in October 1991. Final management measures guidance was released in January 1993

CZARA management measures are technically feasible and economically achievable measures for control of pollutants (such as sediment, nutrients, toxics, pathogenic bacteria/viruses, and pesticides) from existing and new categories and classes of nonpoint sources of pollution. The measures reflect the greatest degree of pollutant reduction achievable through application of best available technology, siting criteria, operating methods, or alternatives. Chapters 2-6 of the guidance identifies the management measures for five specific major categories of nonpoint pollution: agriculture, forestry, urban, marinas and recreational boating, and hydromodification. Each major category has several subcategories. For example, the agriculture chapter is subdivided into: sediment/erosion control; confined animal facility (large/small); nutrient management; pesticide management; livestock grazing; and irrigation. Chapter 7 specifies management measures that apply to a wide variety of sources, including the five categories of sources addressed in the preceding chapters, as well at to protection and restoration of wetlands and riparian areas. One page fact sheets are available for each chapter.

The process for developing the coastal nonpoint programs and the content of such programs is described in a companion guidance document entitled "Coastal Nonpoint Pollution Control Program: Development and Approval Guidanc." Both final guidance documents and the fact sheets will be available in late February from Ann Beier, Assessment and Watershed Protection Division (WH- 553), U.S. EPA, 401 M St. S.W., Washington D.C. 20460.

Applying the CZARA approach for control of nonpoint sources to all areas of the United States was proposed in Senate Bill 1081 as part of the reauthorization of the Clean Water Act during the last session of Congress. This approach to achieving uniformity of the NPS program in all watersheds and all states will probably come up again for consideration in this session of Congress.

For More Information

There are other tools and aids to implementing NPS programs in the Western U.S. that have been or are being developed through EPA initiative and with the support of key personnel in other agencies. A few are listed here:

The Western EPA Nonpoint Source Coordinators

Region VI	(AR,LA,NM,OK,TX)	Brad Lamb	214/655-7140
Region VII	(IA,KS,MO,NE)	Julie Elfving	913/551-7475
Region VIII	(CO,MT,ND,SD,UT,WY)	Carol Russell	303/293-1449
Region IX	(AZ,CA,HI,NV)	Jovita Pajarillo	415/744-2011
Region X	(AK,ID,OR,WA)	Elbert Moore	206/553-4181

"Livestock Grazing on Western Riparian Areas" by Chaney, Elmore and Platts. The document is aimed at the broad and growing audience of people interested in improved management of livestock grazing on Western riparian areas and adjacent uplands. It provides insights into the problems and opportunities encountered and discusses case studies that show that there are"win-win" solutions available on certain streams, in that riparian areas and fisheries can be restored while also getting better weight gain on livestock. Nearly forty thousand copies were purchased jointly and distributed by EPA, SCS, FS, BLM, ES, BIA, NACD, and many user and environmental groups. Roger Dean, EPA, 303/293-1571 is the contact.

A sequel to the preceding document is in the final stages of preparation for release in April 1993. It is entitled "Managing Change/ Livestock Grazing in Western Riparian Areas." It is written for the men and women who own and/or move the livestock. The goal is a heightened awareness and a new perspective of the changes needed in rangeland grazing practices necessary to protect and enhance the quality and quantity of water and to improve riparian/wetland conditions on rangeland watersheds. It discusses various grazing practices and their water quality implications, typical things that can be done, and where to go to get help.

EPA hopes to initiate workshops in conjunction with annual meetings of such groups as the Farm Bureau and State Stockmen's Associations to introduce producers to the document. The EPA NPS Coordinator in each Region will be the contacts when the document is available.

Steve Bauer, formerly of the Idaho Department of Environmental Quality, and Tom Bedell, formerly of Oregon State University Rangeland Resources Department, are preparing a monitoring guidance document for EPA. It is intended to extract, from the extensive national data base, the water quality related protocols/parameters for the monitoring of instream, riparian, and upland areas on Western grazing lands. The document will be used by EPA and Western States to prepare the monitoring plans for the grazing lands portion of 319 watershed projects. The document will list the instream, riparian and upland attributes which could be monitored, the various monitoring protocol methods available for each attribute, and then indicate in general terms, the advantages and disadvantages of each method, including those related to the technical, relative cost, level of difficulty, collection time, and expertise needed. A section on the planning of such monitoring programs will discuss:

1) what do we want to know;

2) why do we want to know it (relationships);

3) when do we want to know it (timing aspects);

4) how will it relate to the project; and

5) where do we monitor it?

Roger Dean, EPA, 303/293-1571, is the contact.

Funding Sources

EPA is searching for three Western watershed projects to test water quality monitoring methods for nonpoint sources typical to the West. Each EPA Regional Office is asked each year to set aside $ 100,000 from its 319 funds allocation to be granted to the respective state NPS agency to fund such a monitoring project. Further information is available from the EPA NPS Coordinator in each Region.

An EPA grant has been competitively awarded to Oregon State University to support state and EPA NPS staff in setting up or evaluating water quality monitoring projects. Further information is available through the EPA NPS Coordinator in each Region.

The EPA Research Lab in Athens, Georgia will soon be advertising a request for proposals for new technology development for control of livestock and/or pollution prevention on grazing lands. Two examples would be new methods to keep livestock out of sensitive areas as alternatives to fencing or new methods for vegetative management as alternatives to pesticide use. Further information is available through the EPANPS Coordinator in each Region or from Sandra Bird, EPA Athens, 706/546-3324.

EPA Region VIII has a grant to the Society for Range Management to compile a range/riparian video loan library. The latest count is 74 known videos available which will be screened by SRM. The SRM loan library should be ready by Fall, 1993. Bud Rumburg, SRM, 303/355-7070, and Roger Dean, EPA, 303/293-1571, are the contacts. Roger Dean, is EPA's focal point for grazing issues. As such he is an EPA representative to the National Association of Conservation District's Public Lands, Pasture and Range Committee, the American Sheep Industry's Cooperative Sheep Grazing Project, and the National Cattlemens Association's Environmental Issues Group. He was also Workgroup Chairman for the grazing section of the CZARA management measure guidance document. He can be contacted at 303/293-1571.

EPA actively supports the development of 319 watershed proposals for use of Section 319 NPS funds to deal with NPS problems on private land inholdings where the Forest Service and BLM are initiating their "Bring Back the Natives" projects to restore or enhance threatened or endangered fisheries. The EPA NPS Coordinators in each Region; Cindy Williams, Forest Service, 202/205-0880; Jack Williams, BLM, 202/653-9202; and Lew Nash,National Fish and Wildlife Foundation, 202/857-0166, are the contacts.

EPA supports and encourages those agencies and organizations interested in environmental issues related to grazing and riparian areas to get involved is their respective State NPS Task Force to provide their input at the state level. They are also encouraged to be involved at the local level in the steering committees for individual watershed projects thereby helping implement the Coordinated Resource Management process.

These are a few of the tools available for water quality issues related to grazing and riparian issues.

Protection and Management of Riparian Areas through Water Quality Programs in Arizona

Kris E. Randall

Values of Riparian Areas

The protection of riparian areas and State Programs developed to protect and improve water quality are intricately connected. Riparian areas perform many water quality functions such as processing chemical and organic pollutants, reducing sediment loads and turbidity of flood waters, and utilizing nutrients. In addition, riparian areas also provide flood attenuation, erosion control, and increase groundwater recharge. In Arizona many riparian areas have been degraded and/or lost. Adequate protection and management of these areas is essential to ensure the perpetuation of these vital ecosystems.

Arizona's Water Quality Programs

One strategy of protection is currently in place at the Arizona Department of Environmental Quality (ADEQ). This protection is through ADEQ's water quality programs. This paper will discuss four programs that are implemented by ADEQ: the Nonpoint Source, Point Source, Monitoring, and Water Quality Standards Programs. These Programs will be described in relation to types of protection they provide to riparian areas and the relation these programs have to Federal Clean Water Act. The development of future riparian protection programs for the state will be also be presented.

The Arizona State Legislature recognized that water pollution was a major problem in Arizona and responded by passing the Environmental Quality Act (EQA) in 1986, Arizona Revised Statutes (ARS) Title 49. ADEQ was established in 1986 through the EQA and was designated as the agency for this state for all purposes of the Clean Water Act (CWA). The EQA mandated that Nonpoint Source Water QualityManagement, Point Source Permit, and Water Quality Standards Programs be adopted by Rule (ARS 49-203). Although ADEQ is a little over 5 years old, this young agency has made tremendous efforts to improve the water quality in Arizona.

Nonpoint Source (NPS) Nonpoint Source pollution (NPS) is pollution that emanates from diffuse sources rather than from specific point sources. NPS sources include agricultural runoff, urban runoff, pollution from road construction, etc. The EQA mandates that Arizona's Nonpoint Source Water Quality Management Program for both surface and groundwater be adopted by rule. Other programs such as Water Quality Standards and Aquifer Protection which deal with specific areas of water quality are coupled into the Nonpoint Source Control Program. The NPS Management Plan is based on categories of nonpoint source pollution. These categories and subcategories are shown in Table 1.

Kris Randall is the Wetland/Riparian Coordinator for the Arizona Department of Environmental Quality in Phoenix. She has a BS degree in Zoology and is completing her MS degree in Riparian System Ecology at Arizona State University. Her past projects have included a revegetation plan for a portion of a regulated river with extreme release fluctuations and an investigation of the fluvial geomorphology of heavy metal distribution in an ephemeral channel. She is Vice President of the Arizona Riparian Council.

Table 1. NPS Categories and Subcategories	
1. Agriculture	Grazing, rangeland management Agricultural land clearing Irrigation crop production/return flows Concentrated animal feeding operations Aquaculture
2. Silviculture	Timber harvesting, reforestation,residue management Forest management
3. Construction	Highway/road/bridge construction and maintenance Commercial, industrial and residential development Military operations
4. Urban Runoff	Surface runoff, Drywells, infiltration basins
5. Resource extraction	Sand and gravel Mining and metallurgical Copper mining, milling and refining Precious metal mining and processing Placer mining, Uranium mining, milling and refining Industrial minerals mining
6. Land disposal	Landfill, Wastewater reuse, Sludge, Recharge On-site wastewater systems (septic tanks)
7. Hydrologic/habitat modification	Channelization/bank stabilization/dredging Dam and reservoir construction Riparian alteration /wetland drainage Flow regulation/hydrologic modification Streambank modification/destabilization Canals/irrigation systems, Stock tanks Watershed yield/vegetation manipulation
8. Other	Waste storage/storage tank leaks Highway maintenance and runoff, Spills In-place contaminants, Utility corridors Motor transportation
9. Unknown	
10.Recreation	

The agriculture program is a regulated program which deals with the application of nitrogen fertilizers and concentrated animal feeding operations or CAFOs. These activities are regulated through a general permit system which requires that Best Management Practices (BMPs) be implemented. Failure to implement BMPs will result in revoking an operator's general permit. The operator must apply for an individual permit which can take over a year. The Regulated Agriculture BMPs, vested in rule, are broad, goal-oriented statements that are applied statewide.

An example of one BMP for Concentrated Animal Feeding Operations is given in Table 2. Each BMP is supported by guidance practices. Unlike the BMPs, the guidance practices are not in rule and can be updated as technology improves. If it was determined that a change to the BMPs was needed, the change would go through the rule-making process which can take anywhere from 2 to 3 years. The guidance practice manual is therefore a "living document" such that it can be changed with little effort.

BMPs in Arizona

Arizona is the first and only state to have BMPs in rule. Many states are using Arizona as a model to develop their BMP programs. The key to Arizona's success has been to make BMPs as goal statements and not technological practices. Best Management Practices are defined in the EQA as:

Table 2. Example of BMP in Rule
Concentrated Animal Feeding Operations
(A.G. Rule No. R90-001)

1. Harvest, stockpile and dispose of animal manure from concentrated animal feeding operations to minimize discharge of nitrogen pollutants by leaching and runoff.

> "those methods, measures or practices to prevent or reduce discharges and includes structural and nonstructural controls and operation and maintenance procedures. Best management practices may be applied before, during and after discharges to reduce or eliminate the introduction of pollutants into receiving waters. Economic, institutional and technical factors shall be considered in developing the best management practices." (ARS 49-201)

Technology is always changing and ways to control and limit nonpoint source pollution are constantly being updated. BMP programs need to have this same flexibility in order to be effective. The NPS Program in Arizona is developing BMPs for the other defined nonpoint source pollution categories. The category activities will be developed around the general permit concept. BMPs for activities that occur in riparian areas will be incorporated into management programs for the defined categories. In this respect, riparian area BMPs will be a component of the grazing program, the silviculture program and so on. Even though Arizona's NPS Management Plan is a model program and on the "cutting edge" for implementing programs to control NPS pollution, it does not follow the watershed approach as directed by the CWA. The EQA in 1986 mandated the NPS Management Plan to be developed on a category by category basis (ARS 49-246). One year later Congress approved of the 1987 amendments to the CWA which added Section 319 for Nonpoint Source Management Programs. Within Section 319, a state's NPS management program is to developed and implemented, to the maximum extent practicable, on a watershed by watershed basis.

Inconsistencies

However, in Arizona inconsistencies between the EQA and the Federal CWA have made it impractical, if not impossible to develop the NPS Water Quality Management Program on a watershed basis. As a result, the program is being developed on a category by category basis. Implementation of each of the regulatory components of the program is required on a statewide basis. Demonstration projects, education and compliance activities will be implemented watershed by watershed. These activities will take place on a priority basis.

Point Source Program

The objective of the CWA is " to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Section 404 of the CWA provides for wetland protection and water quality as part of this objective. A Section 404 permit is required for activities that occur within jurisdictional wetlands and waters of the United States. In Arizona, xeric adapted riparian areas extend beyond these boundaries. These areas do not meet the three criteria necessary to be delineated as wetlands. However, riparian areas preform equivalent water quality functions as wetlands (Sullivan and Stromberg 1991, USEPA 1991).

Riparian Protection

The State of Arizona recognized the need to protect riparian areas and two Executive Orders were signed by Governor Mofford. Executive Order 89-16 Streams and Riparian Resources required:

> "all state agencies to determine whether current and proposed policies, actions, requirements, and funding impact on stream and riparian resources and, when appropriate, to implement changes that will allow for restoration of riparian resources."

In 1991, a second Executive Order 91-6 Protection of Riparian Areas directed ADEQ to

> "consider the protection of riparian areas in its decision making regarding certification, conditioning, or denial of water quality certifications under Section 401 of the Federal Clean Water Act."

Section 401 Permits

Section 401 Water Quality Certification can be a powerful tool for the protection of riparian areas. An applicant applying for a Section 404 permit, issued by the U.S. Army Corps, must obtain State Water Quality Certification. The Water Quality Certification program requires an applicant to define how compliance with fifteen water quality protection policies will be ensured and to have wetland areas identified. The State can certify, certify with conditions, or deny certification of a project that may dredge or fill within waters of the United States. Denial of 401 certification stops the 404 permit process.

Executive Order 91-6 allows ADEQ to broaden its authority in reviewing 401 Water Quality Certifications. The 401 Water Quality Certification may stipulate conditions necessary to protect the watercourse and wetlands within an area of concern, and consider riparian area impacts as well. Cumulative impact and sediment transport analysis are information that ADEQ can request of an applicant. These analyses may be necessary in reviewing a project sited in a sensitive riparian area. Mitigation plans may also be reviewed by ADEQ for the purpose of minimizing nonpoint source pollution.

Surface Water Monitoring Program

ADEQ's statewide surface water quality monitoring network, established in cooperation with the U.S. Geological Survey, collects surface water quality data which is used to determine compliance with water quality standards and is an integral part of ADEQ's assessment program. Data is recorded annually to EPA either through the 205(j) or the 305(b) assessment reports. Approximately 150,000 stream miles occur in Arizona based on digital hydrography at 1:100,000 scale. 108,000 stream miles are estimated to occur on lands not claimed as Tribal Lands. The 1992 305(b) Report assessed 4,461 stream miles. Of the stream miles assessed, 3,325 stream miles or 75% were categorized as being impaired. An impaired stream reach means the water quality standards of a stream reach were exceeded and was therefore categorized as being in partial support or nonsupport of the designated use. The assessment report assists in establishing priorities and evaluating existing programs designed to control water pollution. Hydrologic/Habitat Modifications impacted the protected uses of over 35% of the streams assessed in 1992. Impacts such as channelization, dredging, streambank modification, dam construction, or removal of riparian vegetation contribute to the impairment. Turbidity, suspended solids, and siltation remain the principal causes of stream impairment (ADEQ 1992). ADEQ recognizes high turbidity to be characteristic of watershed and watercourse problems. Watershed conditions are evaluated as a part of the NPS Program.

Water Quality Standards (WQS)

Water quality standards play a fundamental role in the CWA framework to control point and nonpoint sources of pollution. Water quality standards define the water quality goals for the navigable waters in Arizona. The water quality standards also play an important role in the development of an effective nonpoint source management program to protect water quality in Arizona.

Arizona adopted new standards for navigable waters in January 1992. These new standards include a definition of wetlands that essentially restates the federal definition given in 40 CFR Part 122.2. Addition of the wetlands definition ensures that wetlands are protected under the State's navigable water quality standards. This protection includes all of the narrative standards and numeric standards where designated uses for wetlands have been identified.

Arizona has not established wetland-specific designated uses, numeric biological criteria or wetland antidegradation implementation methods. Narrative biocriteria and implementation methods are under development and are anticipated by December 1993. These narrative biocriteria will be presented for promulgation during the 1992-94 triennial review.

National Pollutant Discharge Elimination System (NPDES)

In Arizona, the National Pollutant Discharge Elimination System (NPDES) program is administered by the Environmental Protection Agency. ADEQ certifies NPDES permits but has not assumed primacy for this program. The NPDES program requires permits for facilities to discharge effluent to waters of the U.S. The NPDES permits regulate the quantity and quality of effluent discharge.

NPDES is included in this discussion of water quality programs because of the importance effluent discharges from municipalities have on riparian areas. EPA Region IX issued an Interim Final Guidance for modifying water quality standards and protecting effluent-dependent ecosystems in June 1992. This guidance explains four methods for modifying standards that address the conditions of effluent-dependent water bodies while ensuring that existing uses are fully protected. The regional conditions are being considered in water quality criteria and water quality-based effluent limits. Thus recognizing the importance of these areas in the arid West. ADEQ will continue to work with EPA on this vital issue.

Future Programs

The level of protection is likely to change with the passage of legislation in 1992 for riparian areas in Arizona. ARS 45- 101 requires a Statewide inventory and classification of riparian areas for their function and value. The effects of groundwater pumping and surface water diversions on riparian areas are being evaluated. Various land-use activities are being evaluated for their effects on riparian areas. These three studies will be integrated into a report in which recommendations will be made to the legislature and the governor concerning protection for riparian areas.

Many in Arizona recognize the need to protect riparian areas. These needs range from economic to wildlife preservation, from aesthetic to recreational, from water quality to resource use. Whatever the need, protecting and preserving these vital ecosystems will have far-reaching results for everyone. One of the most effective ways to protect riparian areas is to educate the public on their value.

ADEQ's water quality programs were developed due to water quality problems. These problems are often linked to land-use activities. Through the implementation of these programs, in particular the NPS Program, a protection strategy is provided to riparian areas. Do the Federal laws adequately take regional differences into account for riparian management? What changes inArizona law would be required to utilize the EPA Watershed approach?

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Floodplain Management and the Protection of Riparian Habitat: Status of Efforts and Possible Future Directions

Jon A. Kusler

Introduction

What could be done to better protect riparian habitat in floodplain management efforts?

I'd like to make some suggestions based upon my long-term involvement with floodplain management, wetlands, and riparian zone management. I have spent much of the last twenty five years working with floodplain management at all levels of government and have been the Executive Director of the Association of State Wetland Managers since 1985. I began my professional career as principal investigator of a two volume study, Kusler et al., *Regulation of Flood Hazard Areas to Reduce Flood Losses,* U.S. Government Printing Office, which was published in 1969 and 1971. I updated this in 1979 (See Vol. 3, Regulation of Flood Hazard Areas to Reduce Flood Losses) and participated in a just released assessment of Floodplain Management in the U.S., Federal Emergency Management Agency et al., Status Report on the Nation's Floodplains.

Status of Efforts

Prior to 1965, floodplain management at all levels of government was almost exclusively "structural" in nature and involved the construction of dikes, dams, levees, channels, and other measures to reduce flood threats. Many of these projects were funded by the federal government. These structural projects were designed with little consideration of the impact on riparian communities and broadly impacted riparian areas across the nation.

In 1965, a Federal Task Force on Flood Control recommended a Unified National Program on Floodplain Management involving both structural measures and other nonstructural measures to reduce flood losses. This task force also recommended the protection of natural and beneficial values of floodplain areas.

Based in part upon these recommendations, Congress in 1968 adopted the National Flood Insurance Act. This Act made federally subsidized flood insurance available to communities willing to adopt floodplain regulations consistent with federal standards.

Since 1968 more than 18,300 communities have adopted floodplain regulations and qualified for participation in the National Flood Insurance Program. These regulations have done much to reduce flood damages and have, indirectly, protected some floodplain riparian zones on private lands including natural habitat in floodplains. But the regulations contained no specific standards for protection of natural vegetation or riparian areas. Filling was (and is) allowed in the outer floodplain and channel and floodway modifications are allowed if they will not

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cumulatively increase flood heights by more than one foot within a "reach."

Widespread adoption of floodplain regulations, flood warning systems, evacuation plans, and other nonstructural measures since 1968 has, therefore, somewhat reduced the impact of floodplain management on riparian systems. A number of other measures have also helped. For example, Section 404 of the Water Pollution Control Amendments of 1972 is particularly important for certain areas. Section 404 requires permits for fills or other discharges of materials in "waters of the U.S." "Waters of the U.S." have been defined to include wetlands and some riparian areas below the high water mark. However, much of the riparian habitat in the West is not considered "wetland" or presently subject to Section 404 jurisdiction.

Other statutes providing some protection for riparian areas include the Omnibus Water Bill of 1990 which requires the U.S. Army Corps of Engineers (Corps) to protect wetland acreage and function in new projects. The National Environmental Policy Act of 1968 requires federal agencies to prepare environmental impact statements for projects on public lands. The generic planning and land management statutes of the National Forest Service and Bureau of Land Management have increasingly emphasized planned resource management and these agencies have, increasingly, attempted to protect riparian zones.

At the state level, many states in the West have adopted at least limited riparian protection programs such as Section 401 water quality certification efforts on federal permits. Wyoming and Montana have adopted stream protection initiatives. Two consecutive governors in Arizona adopted riparian zone protection executive orders. However, these state measures are limited in scope.

At the local level, a modest number of cities, towns, and counties in the West have adopted wetlands or other regulations protecting riparian habitat or have undertaken other measures such as acquisition of greenways along rivers and streams. Examples of partially aggressive programs involving not only protection but restoration include Boulder, Colorado; Fort Collins, Colorado; and Scottsdale, Arizona.

In summary, floodplain management regulations and other wetland and riparian habitat regulations and nonregulatory initiatives provide only limited protection for riparian areas in the West. Such areas continue to be threatened by cutting off vegetation, grazing, channelization, water projects, urban development, and other activities.

Future Directions

Despite the limited protection provided riparian habitat by floodplain, wetland, and other regulatory programs at all levels of government, there are signs of hope and new opportunities for riparian protection because of the strong public support for such protection, growing interest in federal, state, and local agencies in protecting such areas, and a rapidly growing science base with regard to stream management, riparian habitat restoration, and watershed management. Recommended future directions include:

1. Citizen groups interested in the protection and restoration of particular rivers need to work with one another and with public land management agencies, water resources management, and regulatory agencies to help shape water, floodplain management, and riparian zone policies "up front.." Across the nation, citizen groups consisting of landowners, environmentalists, developers, and others have played increasingly important roles in helping to develop consensus policies for riparian zones, educate landowners and the public, and gain the necessary funding support to implement such policies.

2. The Clinton/Gore Administration should formulate and adopt a national riparian policy to help protect "waters of the U.S.", reduce flood losses, and meet other goals. The most expensive year for flood/ hurricane losses in history has just occurred. The Clinton/Gore Administration wishes to reduce spending in light of a $4 billion budget deficit and to better protect the environment. Even if only a policy document, a new multi-

objective floodplain management policy with protection of riparian areas as one component would serve both of these objectives. It could help guide public land management agencies in management of public lands, water resource agencies in designing and implementing water projects, and flood loss reduction and disaster assistance agencies in reducing flood and erosion losses.

3. The Clinton/Gore Administration and Congress should support new community, state, and local watershed, riparian zone, and stream restoration initiatives as part of the "jobs" bill and revisions to Clean Water Act. At a minimum, small planning and implementation grants should be provided to communities, modeled after the California Urban Streams Program.

4. The federal agencies responsible for flood loss reduction should incorporate policies pertaining to protection of riparian zones in the revised Unified Floodplain Management Program. The United States is at a pivotal point in floodplain management. The federal agencies responsible for flood loss reduction are about to begin deliberations with regard to future directions in the Unified National Program for floodplain management. The Status Report (described above) identified inadequate protection of natural values as one of the deficiencies in floodplain management. There is an opportunity to redefine policies to better protect riparian zones in the revised program document.

5. The Corps could clarify the definition of "waters of the U.S." pursuant to Section 404 of the Clean Water Act to include additional riparian areas. Riparian areas below the ordinary high water mark are already subject to Section 404 permitting requirements. However, many riparian areas are not subject to Section 404 permitting because they do not meet the definition of wetland and are above the high water mark. There would apparently be no legal obstacle for the Corps to issue new and expanded regulations encompassing more of these areas as "waters of the U.S.," particularly high velocity flow areas subject to frequent flooding.

6. The Corps and various groups and agencies should build riparian habitat protection into various water resource projects (water supply, flood control). A variety of measures could be incorporated into future water projects to better project riparian areas including engineering design to include broad, low velocity and semi-natural floodways with protection of riparian zones, location of dikes on the landward side of riparian zones, and acquisition of multiobjective greenways along rivers and streams. Existing projects could be retrofitted to include restoration of riparian vegetation, "bioengineering" of reservoir drawdown areas, and modification of flood and water release to maintain minimum flows and natural pulses.

7. The Federal Emergency Management Agency should better incorporate riparian protection policies into its community rating system. The Federal Emergency Management Agency has adopted a "community rating" system for communities in the National Flood Insurance Program which exceed minimum federal standards through the adoption of greenways, stormwater regulations, wetland regulations, and other measures to reduce flood losses. Approximately 700 communities have already qualified for reduced flood insurance rates with savings on individual policies approaching 50% in some cities.

8. States and local governments should adopt riparian protection policies and regulations. Local governments could amend existing floodplain regulations to prohibit fills in wetland and riparian areas, require stream setbacks and include tree-cutting provisions.

9. Federal agencies, universities, environmental organizations and others should better document the functions, values, and natural hazards of riparian zones through field observations and scientific studies. This documentation would help develop public support for protection of areas, form the basis for improved evaluation and planning, and provide the basis for better regulating such areas.

10. Federal agencies, state agencies, local governments, universities and environmental organizations should prepare "how to" guidebooks and manuals for floodplain

management engineers, water resource planners, and agency officials concerning the functions, values and natural hazards of riparian zones, protection and restoration needs, and protection and restoration techniques.

11. Federal agencies, state agencies, environmental organizations, universities, and others should carry out training and education for agency staff (federal, state, local), local governments, and landowners concerning the values, protection, and restoration of riparian systems.

12. The Office of Management and Budget and other federal agencies should revise principles and guidelines for water projects including preparation of cost/benefit ratios to better reflect the sustainable values of riparian systems.

Floodplain Management -- Opportunities and Constraints in Reconciling an Environmental Mission with Flood Control

Leslie Lew

Introduction

The Corps of Engineers (Corps) has been a major provider of flood protection for many years. The public's perception of the Corps' flood control methods generally consists of traditional Corps projects such as dams, levees, concrete channels, and rock revetment. While the Corps frequently uses these traditional methods, in the last decade there have been increasing external constraints on constructing these traditional types of flood control projects. Furthermore, in the past five years, the Corps has been developing an environmental mission, which results in the Corps considering restoration of the environment as a mission equal to flood control and navigation. This provides the Corps with a different perspective through which to look at floodplain protection. The Corps has used guidance from the environmental mission to develop and experiment with some new approaches to floodplain management. This paper will discuss the constraints on flood control projects, the environmental mission, and the Corps' new approaches to floodplain management.

Constraints on Flood Control

The Sacramento District (District) includes the northern and central inland parts of California and parts of seven other western states. In the District, the Corps' traditional methods of flood control have been under four major constraints: environmental cost, decreasing lands available for mitigation, public relations, and economic feasibility. These constraints have acted separately and together to frustrate the Corps' attempts to provide flood control.

There are several examples of how environmental costs constrain flood control projects. The environmental revolution of the 1970's caused an increased awareness of the environmental cost of flood control practices such as dam construction, rock revetment, and stream channelization. Dams inundate vegetation, displace wildlife, reduce fish resources, and require excavation at the dam and borrow sites. Traditional levee construction practices also have an environmental cost, especially when levees are constructed partially instream. Rivers meander, leaving levees and riverbanks on the outside of a river bend susceptible to the erosive action of the river current. The traditional solution for this type of erosion has been to armour the easily eroded riverbanks by piling large rocks on the river banks and levees, a practice known as riprapping. Riprap is an unsatisfactory growing substrate for plants and provides little habitat replacement.

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Environmental costs are also incurred from Corps levee maintenance practices that require that riprap be maintained without vegetation. Existing riparian and shaded riverine aquatic habitat are removed by levee construction, but not replaced, thus permanently removing these valuable habitat types upon which resident wildlife depend. The U.S. Fish and Wildlife Service (FWS) and environmental groups have criticized the use of riprap. This practice disrupts many wildlife species, including the endangered yellow-billed cuckoo, threatened bank swallow, threatened Swainson's hawk, endangeredwinter-run chinook salmon, and small mammals and other birds that depend on riparian vegetation.

Mitigation efforts are another constraint on traditional methods of flood protection in the District. The supply of lands that are appropriate for mitigating project impacts is decreasing. In heavily urbanized areas such as Sacramento, the land is often developed, riprapped, expensive, or under a maintenance regime that does not allow planting.

The need for good public relations also constrains the Corps ability to implement traditional methods of flood control. If the public strongly opposes a project, it can be difficult or impossible to construct. The need to take other agencies, organizations, politicians, special interest groups, and the cost-sharing sponsor into account and to address everyone's concerns is critical to project success. An agency has a higher likelihood of gaining project approval if that agency has good public relations.

These three constraints contribute to the fourth constraint, which is economic feasibility. Construction costs can delay a project's progress. Dams, a traditional Corps flood protection method, generally have high construction costs. These costs can be difficult for both the federal government and the local governments to finance.

In reality, the four constraints are interrelated. Environmental damage is generally expensive to mitigate and generates poor public relations. Dam construction usually requires the condemnation of private property and causes adverse environmental impacts, which lead to negative public relations and monetary expense. All these factors constrain the Corps ability to provide flood control using traditional methods. However, the Corps is responding to these constraints in innovative ways.

Environmental Mission

Starting in the mid-1980's, the Corps began to develop an environmental mission. One significant product of this new environmental direction emerged in 1986 when Congress gave the Corps the authority to implement a habitat restoration program. A formal articulation of the environmental mission materialized in 1990 when the Chief of Engineers, General Hatch, promoted the mission, and Congress passed the Water Resources Development Act of 1990. Section 306 of this act directed the Corps to include environmental protection as one of its primary missions in the planning, design, construction, operation, and maintenance of water resource projects.

Since the adoption of the environmental mission, the Corps is gradually transforming the constraints to providing flood protection into an opportunity to investigate some non-traditional methods of floodplain management. These methods emphasize the environmental mission and include setback levees for environmental purposes, new mitigation procedures, biotechnical engineering, and habitat restoration. The next section will describe these four methods and how they have helped to implement the environmental mission.

Opportunities

Setback Levees

Setback levees are constructed some distance away from the river channel, allowing riparian vegetation and other habitat to grow between the levee and the river. When compared with non-setback levees, which are constructed partially instream allowing nothing to grow between the river and the levee, setback levees provide much higher habitat values. The use of setback levees is not new.

In the West, the Corps has been constructing setback levees to control flooding for some time. Setback levees have several structural advantages. In the upstream reaches of a river, for example, setback levees act as a funnel, allowing more surface area for the collection of floodwaters. Also, rivers meander, and a setback levee allows a river enough area to wander without undercutting the levees, which could lead to eventual failure of the levee.

Now the Corps is also looking at constructing new setback levees and setting back existing levees for environmental reasons. The District is currently working on two such projects: the Sacramento River Bank Protection Project and the Upper Sacramento River Study. As part of a major program to protect river banks and existing levees from erosion, the Sacramento River Bank Protection Project will study setting back existing levees, where feasible. The Upper Sacramento River Study will explore relocating levees to allow the river to meander, recreating a more natural river condition. Levee relocation can be considered since the area is rural in character and the purchase of flowage easements is not likely to be prohibitively expensive.

The disadvantage of setback levees is that they require more land and, therefore, more money for the acquisition of real property, flowage easements, and rights-of-way. Also, local agencies are not always interested in dedicating extra land to flood protection. For example, in the 1930's, the Corps proposed constructing a system of setback levees along the Sacramento River. Local interests rejected the idea in favor of non-setback levees because setback levees would have reduced land available for agriculture. In cases where setback levees are infeasible, sometimes other opportunities, such as non-traditional mitigation methods, can be explored.

Mitigation

The constraints and the new environmental mission have also encouraged the development of two non-traditional mitigation methods: berms constructed with dredged materials and off-site mitigation banking.

Riprap can transform a strip of riparian habitat into a lifeless pile of rocks, removing habitat values. In the District, previous construction, dense urbanization, and levee maintenance policies make it difficult to find appropriate sites to mitigate for aquatic and terrestrial habitat destroyed during riprap construction. The first non-traditional method explored involved constructing three experimental dredge berms on the Sacramento River. The berms were constructed by placing dredged material over the top of existing riprapped areas. The dredged material on each berm was held in place by one of three instream retainer features:

(1) a relatively porous barrier constructed with tree cuttings held in place with wooden pilings and wire mesh;

(2) a semi-permeable barrier constructed from large vertical wooden pilings holding stacks of used automobile tires; or

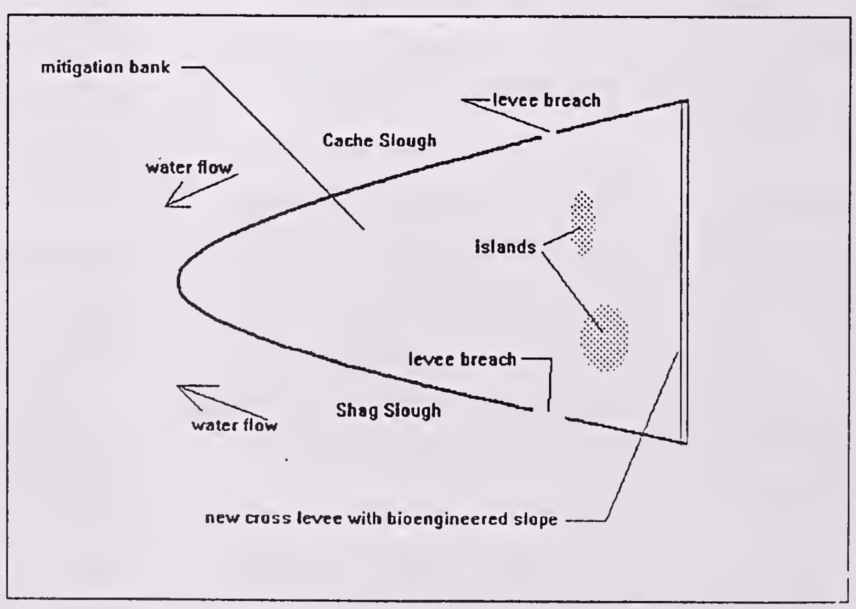

Figure 1. Cache Slough Yolo Bypass Project

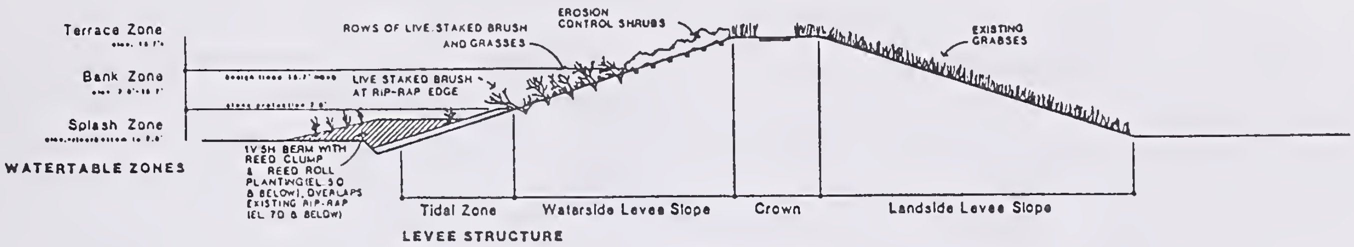

Figure 2

(3) a series of pre-cast concrete panels, forming a non-permeable wall. The fishery feature of this method consisted of short sections of PVC piping constructed into the concrete, and brush packs and tires attached to the panels to increase aquatic diversity and cover.

The various instream retainer features function as fish habitat while the berms provide substrate for vegetation. The berms are currently being monitored by the FWS to determine which instream feature provides the best fish habitat. The first FWS monitoring report, completed in January 1993, reported that it is too soon after project construction to determine which feature is the most successful. The monitoring will continue for two more years. If successful, the dredge berms may become an important method to partially compensate for fish and wildlife impacts when avoidance of impacts from riprapping is infeasible.

Small scale off-site mitigation banking is the second non-traditional mitigation method being considered by the District. Mitigation banking can consolidate mitigation for a single project that includes several construction sites over a large area. For example, if several slopes are to be riprapped, it will be very difficult to provide on-site mitigation because planting on levees is inconsistent with levee maintenance practices. An off-site mitigation bank could provide mitigation lands. Depending on the size of a mitigation bank, it can also provide off-site mitigation lands for other projects that are located nearby.

Banking can be more beneficial than on-site mitigation because it allows the creation of a large habitat area, rather than several small fractured areas. This can be beneficial even if on-site mitigation is available. The District is considering the establishment of a 200-acre mitigation bank for two projects along the Feather and Yuba Rivers. This 200-acre site currently has low habitat value and is located between the Feather River and an existing strip of about 100 acres of riparian vegetation. Consolidating the mitigation for two projects on this site would create a fairly large riparian habitat area adjacent to the river.

Biotechnical Engineering

Another non-traditional method of flood protection that has been used by the District to address flood control constraints is biotechnical engineering. The Corps' experience with biotechnical engineering, using live plant material to effect erosion control, has been primarily through research or special projects. One special project, which is located in the District, is the Cache Slough Yolo Bypass project. Two sloughs, Cache Slough and Shag Slough, joined. Each slough had a levee on the inside edge of the confluence, and these levees continually had subsidence problems. The District devised a solution that involved constructing a cross levee that bridged the two levees, constructing two islands in front of the new cross levee, and then breaching the two existing levees (see Figure 1). The land between the two existing levees and the new cross levee was used for mitigation.

The islands and existing levees protect the new cross levee from the fast flowing waters of the two sloughs. The relatively calm waters next to the cross levee make it an appropriate candidate for biotechnical solutions for erosion control. Erosion control on the waterward side of the cross levee consisted of riprapping the lower portion of the levee and planting the entire levee (see Figure 2). Emergent marsh vegetation and reed rolls were planted on a berm on top of the riprap (see Figure 3). Above this berm, four ranks of live staked brush were installed (see Figure 4). Erosion control shrubs were then planted from the live staked brush to the levee crown. Grasses were planted on the landward side of the slope.

Monitoring of this special project is still underway. The project was constructed in the spring of 1992. The heavy rains that California received in 1993 should provide a good test of the capabilities of the biotechnical engineering aspect of this project.

The District has also submitted a proposal to change its operation and maintenance manual to allow limited planting or natural revegetation in riprap and on the levees. The plantings would consist of grasses and trees that have their lower limbs removed, allowing maximum visibility for inspection. Vegetation would also be allowed in the riprap, but would be maintained so that the plantings are in no danger of being uprooted, which could cause structural damage to the levees.

Ideally, allowing vegetation to grow on levees and using biotechnical engineering methods will decrease the degree of environmental damage and, off-site mitigation requirements for project construction. As a result, the impact of these two constraints on flood protection will be less.

Habitat Restoration

Another opportunity that the Corps is taking to implement the environmental mission is the development of habitat restoration projects. These projects are pursued in two ways. The first way is what the Corps refers to as the Section 1135 program. This is a special continuing program with money allocated specifically for small environmental restoration projects that are cost shared with local governments. Individual projects are not specifically authorized by Congress. The second way is through the General Investigation program. Typically, these projects are congressionally authorized, are larger and have no funding limits. General investigations are also cost-shared and usually take longer to complete than those pursued under Section 1135.

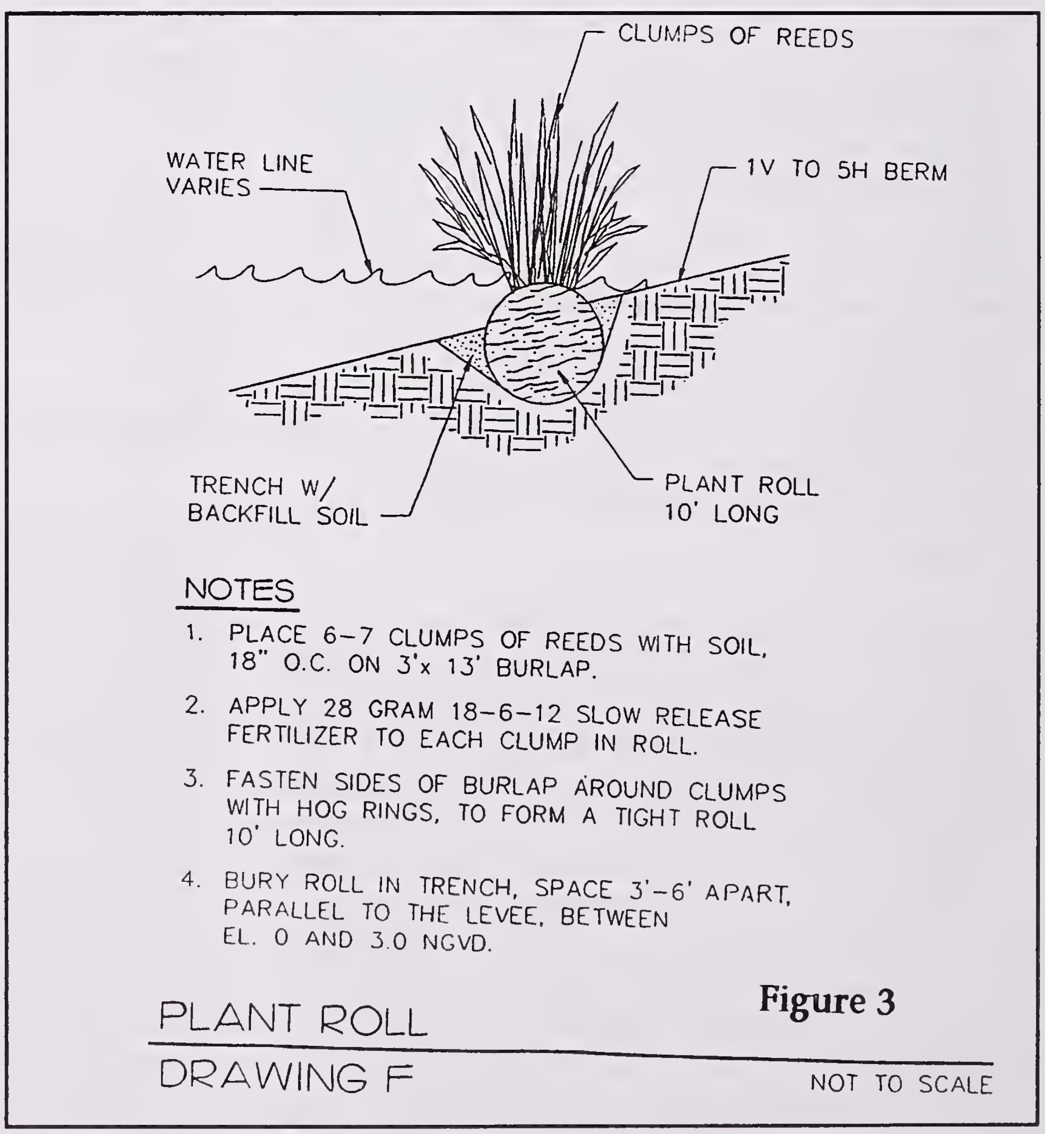

Figure 3

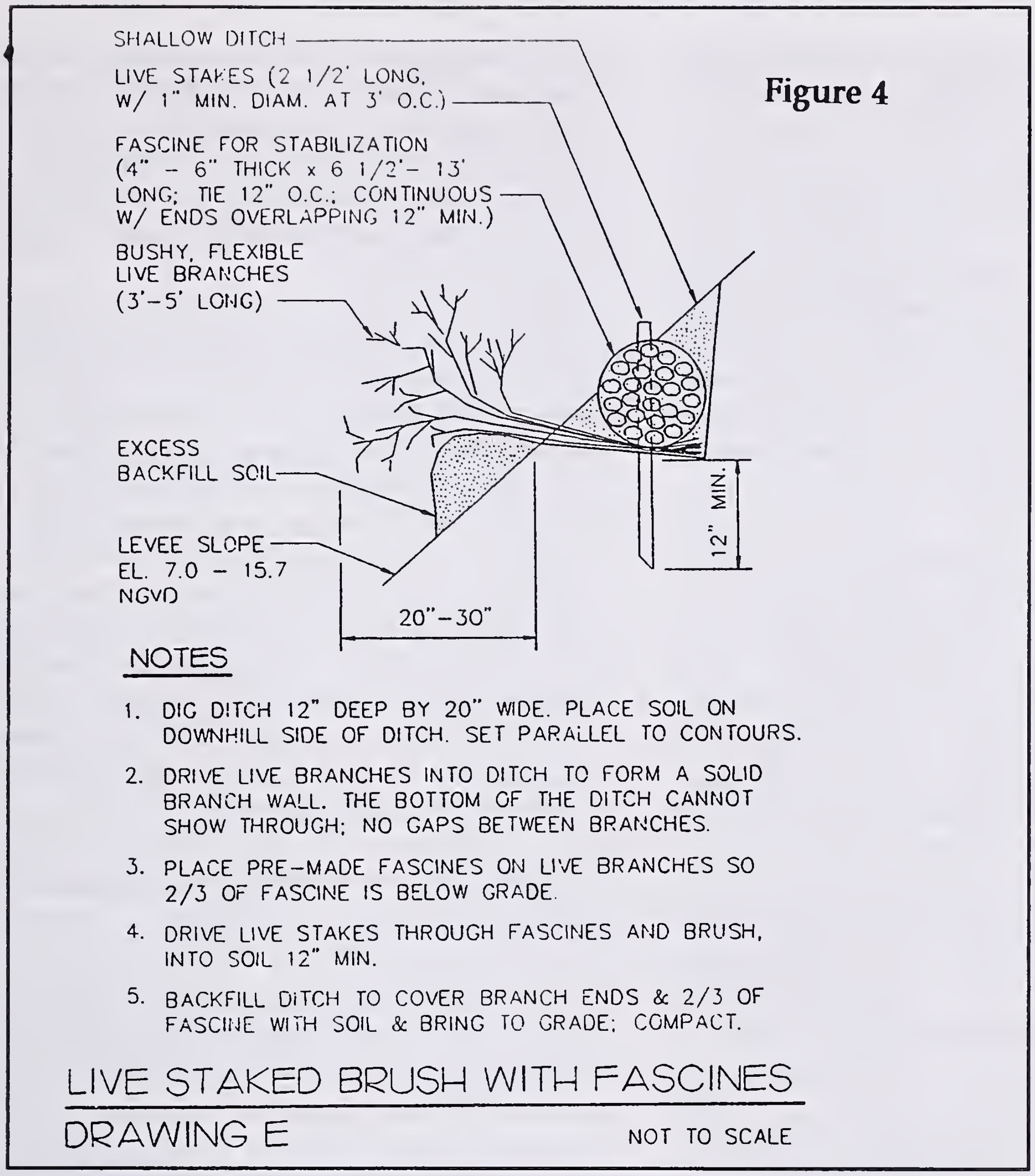

Figure 4

Criteria used to assess the appropriateness of a potential restoration project for admittance into the Section 1135 program include:

(1) a previously constructed Corps civil works project must have contributed to the environmental degradation of the site proposed for restoration;

(2) the proposed modification must be consistent with the purposes of the existing project;

(3) restoration should involve active engineering measures; and

(4) there must be a clear connection between the location of the proposed modification and the original project. If work is proposed on lands not contiguous to existing project lands, then the area must clearly be within the area affected by the original project. Land acquisition should play a minor role or be unnecessary.

Additional details of the Section 1135 program are included in the next section, followed by a description of a Section 1135 habitat restoration case study.

Section 1135 Program

In 1986, Congress passed legislation, Section 1135 of the Water Resources Development Act of 1986, allowing a maximum of $25 million annually for the Corps to restore habitat by modifying previously completed Corps projects. The Corps pays 75 percent of the study and construction costs. Local governments pay 25 percent of study and construction costs and all operation and maintenance costs. Local governments are also required to acquire lands, easements, and rights-of-way and pay relocations costs, for which they receive credit towards their 25 percent contribution to study and construction costs.

Projects proposed for the Section 1135 program follow this process:

1. Local interests contact the Corps directly.

2. A project proposal is developed by the District.

3. Proposals are reviewed by the Corps headquarters in Washington D.C.

4. If the proposal is approved, the District prepares a project modification report\ describing the restoration. If approved, the

project goes to plans and specifications, and a cost-sharing agreement is signed before the project goes to construction.

Section 1135 Program Case Study

The Section 1135 program is so new that the District has not yet begun construction of an 1135 project. The District has two projects in the plans and specifications (construction documents) stage, one project waiting for approval of the modification report, and others still in the proposal stage.

One of the two projects in the plans and specifications stage is the Yolo Basin Wetlands Project. The project will be locally sponsored by the California Department of Fish and Game and consists of 4,000 acres of agricultural land located in a flood bypass. Interspersed with the agricultural lands are some wetlands and riparian vegetation. Total project costs are about $6 million. Lands, easements, and rights-of-way will be provided by the local sponsor. The project modification report has been approved, and currently plans and specifications are being prepared. Construction is scheduled for the spring of 1994.

The project was not initiated through the standard procedure outlined above. The project was initiated when the Yolo Basin Working Group approached their congressman for a mechanism to restore habitat in the Yolo Bypass. The congressman recommended and Congress passed legislation to provide funds for the Corps to restore habitat values in the bypass. From this point, the study progressed in accordance with standard procedures.

A study manager was assigned to the project. The study manager attended numerous Yolo Basin Working Group meetings during which she presented the project as it was legislated by Congress and discussed its section 1135 funding. She also requested input from groups interested in being the local sponsors for the project. Two sponsors came forward, the California Department of Fish and Game and the City of Davis. She worked closely with the sponsors, meeting with them numerous times. The sponsors supplied the study manager with the restoration sites and discussed the features that they wanted to see included on them. The study manager then developed preliminary restoration plans, and through subsequent meetings with the sponsors and the Yolo Basin Working Group, refined the design.

There were some design constraints that needed to be addressed in order to construct habitat restoration in the bypass. The Reclamation Board, the local sponsor of the flood control project of which the Yolo Bypass is a part, has continuing concerns regarding the impact of the restoration project on the flood-carrying capacity of the bypass. The operation and maintenance manual will address these concerns by restricting activities in the bypass. After the restoration design was completed, the Corps prepared a hydraulic model to ensure that floodflows would not be impeded by project construction.

Constraints on the Environmental Mission

The environmental mission is constrained by several factors. Institutional inertia is a major constraint. Even though the Corps has an environmental mission from the Chief of Engineers and Congress, it still takes time to get studies funded and reports completed and sent through the review process. It is likely that once a number of studies have been processed, additional studies will proceed more quickly from concept to proposal to construction. The mission is also constrained by the need to balance the critical need for flood control with the needs of the environment. In the Sacramento area, flood control is a very critical issue and has a very high priority.

Conclusion

Finally, it is our hope at the Corps that we can continue to use the constraints in a productive, pro-active manner to balance our three missions - flood control, navigation, and the environment in newer and more innovative ways to help preserve our precious riparian heritage.

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Political Factors in Riparian Management Issues

Adela Backiel

When most people think of Washington, D.C., they think of politics. And, when most people think of politics, they have preconceived notions that resource law and policy are obstacles to using, developing, preserving, or maintaining resources. Politics is often considered an anathema, a dirty word, an anchor around the neck of a landowner or resource practitioner.

I think nothing is further from the truth. I believe that policies and laws describe our society's values and goals. Societal changes and the evolution of public opinion about how natural resources should be managed are the basis for much of natural resources politics, because politics means making decisions about things that matter to people.

Therefore, rather than obstacles, policies and laws are ways to achieve public expectations for public goods and services and expenditures of public funds. If we look at law that way then it can help us understand public expectations for the land, its natural resources, and us, as natural resource professionals, whether you are a landowner, federal land manager, researcher, or interest group member.

It is an exciting time to be part of the natural resources and environmental profession. Public attitude is changing. Science is changing. Professions are changing. And, politics is changing.

The views expressed in this paper are solely those of the author and do not necessarily reflect the views of the Congressional Research Service or the Library of Congress.

Because of my position with theCongressional Research Service (CRS), I am often asked about the flow of information to Members of Congress, and how to influence that flow of information. What should people think about and know and do when trying to influence people at national levels? Today, I will talk about the changes on Capitol Hill at the beginning of this new Congress, and how these changes may affect riparian management and other natural resource issues. Then, I would like to briefly discuss the role of science in public policy making.

Congressional Factors

It is important to know the structure of Congress, and to whom you need to speak for special influence. Your representatives in both the House and Senate are the best places to start, because you are their constituent. And, State Member preferences are given a lot of credence; very infrequently will something be passed without State delegation participation and/or approval.

But, if your Member of Congress does not sit on a congressional committee of jurisdiction, you would be well advised also to discuss your issue with committee people - Members and staff. And, if your issue has budget and appropriations implications, you

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Congressional Committees
Dealing With Riparian Management Issues

<u>Senate Committee on Energy and Natural Resources</u>

Committee Chair: Bennett Johnston (D-LA).
5 subcommittees, including: Subcommittee on Water and Power, chaired by Bill Bradley (D-NJ) and Subcommittee on Public Lands, National Parks, and Forests with Dale Bumpers (D-AR) remaining Subcommittee Chair

<u>House Committee on Natural Resources</u>
(this Committee was previously the Committee on Interior and Insular Affairs; name was changed in January 1993.)

Committee Chair: George Miller (D-CA)
5 new subcommittees, including: Subcommittee on National Parks, Forests and Public Lands with Bruce Vento (D-MN) remaining as Chair, and Subcommittee on Oversight and Investigations, chaired by George Miller (D-CA)

<u>Senate Committee on Agriculture, Nutrition, and Forestry</u>

Committee Chair: Patrick Leahy (D-VT)
6 subcommittees, including a revamped Subcommittee on Agriculture Research, Conservation, Forestry and General Legislation with Thomas Daschle (D-SD) as new Subcommittee Chair

<u>House Committee on Agriculture</u>

Committee Chair: Kika de la Garza (D-TX)
5 new subcommittees, including: Subcommittee on Specialty Crops and Natural Resources (which includes forestry) chaired by Charlie Rose (D-NC) and Subcommittee on Environment, Credit and Rural Development chaired by Glenn English (D-OK)

<u>Senate Committee on Environment and Public Works</u>

New Committee Chair: Max Baucus (D-MT)
5 new subcommittees, including: Clean Water, Fisheries and Wildlife chaired by Bob Graham (D-FL)

<u>House Committee on Merchant Marine and Fisheries</u>

Committee Chair: Gerry Studds (D-MA)
5 subcommittees, including: Subcommittee on Environment and Natural Resources also chaired by Gerry Studds

may also want to talk with the Appropriations Committee, especially considering that policy is increasingly being made through the appropriations process.

Above is a list of congressional committees, noting some of the changes, with jurisdiction, or partial jurisdiction, over different aspects of riparian management issues.

These Committees all have some sort of jurisdiction over natural resource issues, including riparian management. At this time, one can only generalize about the specific issues these Committees will investigate during the 103rd Congress because none have yet set any specific agendas that they have publicized. However, knowing which laws are up for reauthorization, coupled with a knowledge of what has interested the Committees and the Committee Chairs in the past, the following issues, at least, seem likely to be explored:

- reauthorization of the Endangered Species Act;
- reauthorization of the Clean Water Act, particularly wetlands and non-point source pollution;
- grazing management and grazing fees;
- implementation of ecosystem management;
- special designations of rivers.

There is a similarity among these issues and other natural resource issues which is that with increased population, both domestic and global, everyone is competing for an ever-decreasing piece of the natural resources "pie." This is true not only for water and rivers, but for all natural resources. Decisions regarding these issues are increasingly being viewed as:

"Congress has always been, and continues to be, very single-issue oriented, while natural resource science is trying to become more systems-oriented and inclusive of all resources and uses."

- difficult allocation problems;
- problems with solutions that must include both public and private interests in some type of cooperative way;
- problems with solutions that must incorporate some type of systems approach to management (e.g. ecosystem management).

Congress has always been, and continues to be, very single-issue oriented, while natural resource science is trying to become more systems-oriented and inclusive of all resources and uses. This trend will be difficult for Congress to change, and it will be up to people such as yourself to help restructure this view.

The Role of Science in Public Policy Making

The delicate balance between science and public values defines natural resource politics today. The methodical, rational, and logical culture of science and scientists is not the same as that of the legislators. The legislator's world is structured to resolve conflicts that involve people's values. Information is never complete, and decisions reflect values more than rational, logical selection among hypotheses or alternatives.

This does not mean that to influence legislators effectively, experts should disregard or violate the methods and perspectives of their professional expertise. But, the most effective advisors are those who can place their professional information and knowledge into the context of the legislator's agenda and language. Lay people will judge and evaluate your information, not peers.

A failure to recognize and respond to this process can negate otherwise useful advice and can diminish potential influence by defining a problem in the profession's terms, rather than the legislators'. It is not a problem in "enlightening" the "uneducated;" it is a problem in communication.

Communication is an interactive process in which messages flow two ways, not just one way. And, successful communication is judged by the level of understanding about a choice. The choice is often the status quo versus change. Congress usually gets involved with issues as a last resort -- they respond to complaints when something is not working the way their constituents expect. It must be recognized that legislating is a bargaining process, not just based on science, but also on values.

Summary

I believe we are seeing in America today a renewed belief in democracy. The interest in this last presidential election is a good example of this, with people voting who haven't voted in years, or ever before. Another example is the increasing desire of the public to communicate with their politicians. People are wanting to tell their representatives what they think, and are making their opinions known, not just by letter and phone, but by FAX also. This has been effectively put to use in the Zoe Baird decision to withdraw from nomination for attorney general, and also in the issue on gays in the military.

I believe the public interest will not stop here, but will come to include natural resource issues, which could consequently have a big impact on resource management. This renewed belief in democracy, coupled with an executive branch that is vocally interested in the environment, and with the potential abilities to act and lead because of the same party presiding in both Congress and the Administration, leads to increased attention to environment and natural resource matters in all sectors of society.

If we want this to happen, and I think nothing is better than having people interested in and care about what you do, it means the involvement of every one of us. We are not just resource managers, researchers, or landowners anymore. We are all part of the political process. And the political process does not only reside in Washington, D.C. It starts here.

Play Hard, Play Fair, Nobody Hurt //

Janice Brown

Back in the mid-70s, the New Games Foundation began promoting interactive, outdoor games which emphasized cooperation and healthy competition and de-emphasized winning or losing. Huge New Games Tournaments were held in public parks with participants of all ages engaging in a variety of spirited, creative contests. The basic rules for New Games were, and still are, "Play Hard, Play Fair, Nobody Hurt."

These same rules have real value when applied to the game of politics. Although it may be distasteful, many of us are having to seek state legislative solutions in order to save the rivers and watersheds of our greatest concern. It is always difficult being the underdog, often advocating environmental protection on a playing field known for its hostility toward our viewpoint. So what kind of strategy is best, knowing our competitive disadvantage and having far fewer, experienced players on the field?

1. PLAY HARD

It is discouraging to see some conservationists making only a half-hearted effort at the legislature or in dealing with state agencies. The odds may look so overwhelming that there comes a temptation to back off a legislative approach, water-down a proposal or compromise far too early. Opportunities may be missed to find allies for the cause, and coalitions fail to form that might otherwise balance the playing field.

Strategic planning is necessary to play hard in the game of state politics. Advance work includes fashioning a well-researched, science-based proposal for river protection which involves all the key players in the process and then enjoys at least a modicum of public support. Are all the appropriate sister agencies or interest groups in agreement or at least neutral on your proposal? Have they even been consulted? Do management plans or research reports support or negate your proposal? Who in the agencies or scientific community might be willing to testify at hearings?

Playing hard also means using all tools available to communicate your proposal and basic message. Media will be key in this role, but errors made by press and TV can also be detrimental to your effort. Time spent in preparing materials for media and providing background sessions for all involved will pay off in receiving accurate, timely reporting on your issue. Opponents in this game will also use the media to try to gain advantage, so direct, clear communications with legislators, agencies and the public must also occur.

Stamina is essential with any game, but particularly in state politics. Energy is siphoned off when one loses focus on the central issue or is distracted by other pressing matters. Maintaining a regular presence at the statehouse and being available to legislators or agency personnel communicates an intense interest in the game as well as a willingness to negotiate on the issue when the time is right. Needless to say, this also requires patience as the workings of state government can be tediously slow.

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2. PLAY FAIR

Just watching the nightly newscast can sour anyone on entering politics or engaging in legislative efforts. The political playing field appears to be ethically bankrupt and its players guilty of every sin known to God. Back room deals, party politics and the influence of monied interests are realities that appear contrary to the spirit of democracy and personal integrity.

It is in the long-term interest of river conservationists to avoid using deceptive tactics, gross exaggerations or misleading half-truths to accomplish our goals. While these approaches are commonly seen in the political arena, the integrity of our organizations and our leaders are at stake. By choosing an ethical course of legislative action, those working to preserve watersheds can set an excellent example for others.

In addition to ethical behavior, river activists also need to be familiar with legislative procedures and courtesies. Legal registration as lobbyists, declaration of funders and filing required reports on time is essential in maintaining credibility at the statehouse. Fair play also means understanding the boundaries of play and gracefully acknowledging defeat or victory when the game is over. Often the game ends in some form of compromise, a delicate art in itself, for which river advocates must be prepared. Do all coalition members agree on areas of compromise versus the bottom line? Are the right people sitting at the negotiating table and are they well informed of how any tradeoffs will affect the watershed?

Keeping all team players informed is another important part of fair play. While lobbyists may be on the front line each day, depth of knowledgeable support and competent spokespersons back home will be invaluable. Also, some agencies may not be able to publicly support your cause, but informing staff of your ideas and progress will pay off. No public official likes surprises, so keep elected officials (or their staff) informed as well.

3. NOBODY HURT

Because we are all human beings with basic rights to participate in the political process, those playing the political game must be sensitive and respectful to the needs and limitations of others. This includes our allies as well as our opponents. Although river and watershed protection are serious matters, I can think of no justification for deliberately injuring other people, personally or professionally.

As an example, our opponents have used blackmail against local citizens trying to protect Henry's Fork and its major tributaries from new dams, diversions, hydro projects and damaging stream alteration. Jobs, church positions and even lives have been threatened as the intensity of the debate has increased over the past four years. Although many see this as just another aspect of the political process, I am outraged by those who perpetuate this form of abuse. River advocates will do great injustice to themselves and their causes if they emulate this behavior.

Another caution in this area regards burning ourselves out or exceeding available funds in pursuit of legislative goals. Caring for our own health and that of our organization must be a priority in strategic planning for the campaign. How can volunteers assist staff in the total legislative effort? Which issues have highest priority and which might have to wait another year?

Finally, extending thanks for support, consideration or even a debate well argued should not be overlooked. Personal thanks, phone calls and/or follow up letters are all appropriate for volunteers, legislators, legislative staff, media representatives and any others assisting in your efforts. Courtesy and gratitude are not lost on politicians who may be considering another proposal from you next session. As trite as the saying may seem, it truly matters not if you win or lose, but how you play the game.

The Bureau of Reclamation's Policies

John Keys

The Water Resources Research Center at the University of Arizona is to be commended for having this conference. I have worked in the water resources field all of my career and have dealt with tough issues in several river basins. Never in that time has public interest in "water" been as intense as it is today. I would like to share a few general thoughts about that.

This is a time of "debate" - locally, regionally, nationally. Debate about "prior appropriation doctrine and public trust doctrine." Debate about State rights and Federal supremacy. Debate about the relative importance of "ecology vs. economy." The nation's focus on water will intensify - in communities, in State legislatures, in the Congress, in the courts.

Public attention has built so forcefully that those of us who manage water projects are close to being consumed by the issues. Conferences such as this are essential in increasing our understanding of the issues, laying foundations for cooperative partnerships, and in planning the strategies that will guide us through the next decade.

The Pacific Northwest is confronted with water issues of paramount character. As Bureau of Reclamation Regional Director with management responsibility for a good share of the Federal water projects in the region, I find myself right in the middle of these issues.

For more than half a century the Pacific Northwest was secure in its water management routine which primarily served irrigation, hydropower, flood control, and navigation. Modifications to that routine are needed to respond to the endangered species and water quality issues facing the region.

For example, the recent listing of some Snake River salmon stocks as threatened and endangered has forcefully brought Pacific Northwest resource interests together to seek solutions to preserve the failing fish runs. Habitat, harvest, production, and migration survival are all major issues to be dealt with. Reclamation is most directly involved in efforts to improve conditions for salmon migration. Migration is affected by streamflow conditions, and Reclamation can help plan and implement measures to enhance streamflows. I want to focus my remarks on our efforts to help recover the salmon.

First, a few statistics are in order to place a perspective on the extent of Reclamation's water project responsibilities in the region.

Reclamation developed and manages 48 storage reservoirs in the Pacific Northwest with a total storage capacity of about 25 million acre-feet.

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Reclamation projects provide water to irrigate about 3 million acres in Idaho, Montana, Oregon, and Washington.

Reclamation hydroelectric power plants generate an annual average of 24 billion kilowatt hours of electricity.

Reclamation storage projects are major providers of flood protection on tributary and mainstem streams.

Ten million recreational visits are made each year to Reclamation projects.

Considering the infrastructure that we operate, we have a responsibility to bring public interests to the table, to focus our best management and technical skills on the issues, and to be a fair and honest broker of the resources under our stewardship in efforts to solve problems.

I fully anticipate that the consequence of the formal Endangered Species Act recovery plan for salmon will be to modify the management and operation of some of our projects. I expect that we will

- pursue measures calling for nontraditional uses of stored wate;
- implement programs to increase water use efficiencies; and
- undertake modified flood control and hydropower operations to benefit streamflow conditions for the fish.

In this effort, it is imperative for us to encourage salmon recovery through locally- and regionally-driven programs. We, and others involved in the effort, will be irresponsible if we fail to achieve the necessary "economic and ecological" balances locally, and by default lay the issues before the Congress and the courts for resolution.

I would like to highlight some of the specific salmon work activities we have underway. This work underscores the complexity of the issues that we are dealing with in an effort to make our project operations responsive to the multiple demands being placed on them.

For the past 4 years, we have been party to an unprecedented four-state cooperative effort to develop a comprehensive management plan for the salmon. Initially, this effort was focused in the "Salmon Summit." The Summit was called by Senator Hatfield of Oregon to bring over 30 interest groups to the table to get an early start on recovery. The intent was to reach agreement on measures to benefit the salmon while avoiding catastrophic economic impacts to the region. After a year, that effort shifted to the more formal and public process of the Northwest Power Planning Council. The Council recently produced its "Strategy for Salmon," a comprehensive management plan for the fish. We are now cooperating with the National Marine Fisheries Service as that agency formulates a formal Endangered Species Act Recovery Plan for the salmon.

Today, we are cooperating in over 20 salmon measures emerging from the "Strategy for Salmon" process. Several of these involve our participation on groups responsible for coordinated Columbia River water and power operations, water supply forecasting, water quality issues, flood control strategies, water acquisition, and lower Snake River dam operations.

The most challenging measure calls for 427,000 acre-feet of water to be secured from our Snake River storage facilities in Idaho (which were constructed primarily for irrigation purposes) for lower Snake River flow augmentation and temperature control to benefit salmon migration. There is heated debate on this measure. The migration barriers created by four Federal dams on the lower Snake River in Washington State are considered by Idaho groups and others as the major obstacles to salmon. These entities are calling for the dams to be structurally modified and the reservoirs lowered to near pre-dam river channel levels to aid migration. Others believe that this solution is too costly and propose that releasing large volumes of water from upstream reservoirs in Idaho would help "flush" the fish through the reservoirs on the lower river.

This debate will continue. In the meantime, for the salmon's sake, we need to take action. There are numerous factors bearing on salmon survival, and I believe that we are in a time of "adaptive management" in the recovery effort where some trial and error is appropriate. At least initially, I believe a combination of some level of flow augmentation, reservoir drawdown, and transportation of fish around obstructions is supportable.

Accordingly, we are working with Idaho water users to secure water for salmon migration with the expectation that it will have some benefit to the fish. Importantly, it appears that this water could be conjunctively used to improve water quality in the middle Snake River area of Idaho.

It is important to note that practically all of the storage space in our Idaho reservoirs was sold to irrigation districts at the time the projects were built. Under the terms of "spaceholder" contracts that the districts have with the United States, they have bought the actual storage space in the reservoirs and are entitled to its use in accordance with conditions of the project's water rights and State law. The small amount of uncontracted and uncommitted storage in our Payette River basin reservoirs has been dedicated to endangered species uses. Because of the storage ownership, a willing-buyer/willing-seller approach is being used in efforts to secure water for salmon. With six consecutive years of drought in southern Idaho, such sales are controversial within the irrigation community.

Our storage projects are operated in keeping with conditions of State-issued water permits. Since the use of stored water for salmon falls outside of these conditions, a change in use is required under Idaho law. It has been necessary for us to seek approval from the State to accommodate this water use. Because of the significance of the proposed use, the Idaho Legislature addressed the issue last year. The Legislature and Governor granted approval for a three-year interim period with conditions that water be obtained from Idaho water banks and used only as a part of a comprehensive plan to help salmon - including the drawdown of lower Snake River reservoirs.

To add to our challenge, we must cooperatively plan operations with private power interests who operate storage facilities downstream of our reservoirs and whose facilities control the extent of flow "shaping" during salmon migration.

In addition to the Idaho flow augmentation measure, we are cooperating with a different group of interests to improve flow conditions in the mainstem Columbia River. Our Grand Coulee project in Washington State and our Hungry Horse Project in Montana are contributing to Columbia River salmon flows. In 1992, Grand Coulee was used to store a significant portion of an additional 3 million acre-feet of water dedicated to salmon.

In the area of creative flood control operations, we are cooperating with the Corps of Engineers to shift some flood control responsibility from the Corps' Dworshak Reservoir in the Snake River drainage to our Grand Coulee project on the Columbia River. This shift permits more water to be stored in Dworshak for Snake River flow augmentation.

Recognizing that existing storage capability falls short of meeting flow targets established by fisheries groups, we are leading a cooperative reconnaissance study to determine if construction of additional storage facilities can help.

We are also taking the lead in designing and implementing water conservation demonstration projects in the Pacific Northwest. These projects will provide examples of efficiency measures that can improve tributary and mainstem flow conditions for salmon. The tributary conservation projects are part of cooperative model watershed enhancement programs now being implemented throughout the region.

To assist in accelerating water efficiency programs, we have established a water conservation center in our Boise Regional Office. This staff provides technical assistance to irrigation districts in their conservation programs. We are also working with State water regulation agencies to strengthen local water measurement and management programs.

We have inventoried fish screens at our project diversions on salmon streams to determine if they are providing adequate protection. We will be undertaking upgrade work as needed. We are also providing biological technical assistance to State fish and game agencies to assist in other high priority screen work.

In addition to our discretionary programs, we have a requirement under the Endangered Species Act to "confer" and "consult" with the National Marine Fisheries Service on our actions that may have potential for affecting the listed salmon species. We have a number of consultations underway at this time.

We in Reclamation, along with other Federal agencies, are defending lawsuits challenging our compliance with the provisions of the Endangered Species Act. We have not determined at this time whether there will be impacts from the lawsuits on our project operations.

As a closing observation, the Congress and the President enacted far-reaching legislation this past year in what's called the "Reclamation Omnibus Bill." Two of the provisions of the Act are of particular consequence. The Act "reallocates" water supplies of the Central Valley Project in California with greater emphasis on fish and wildlife and municipal water supply. The other calls for a review of western water policy. With these actions, the Congress has put all western water managers on notice that it is giving "water" high priority.

Concurrently with our own work, I am strongly encouraging local government leaders and water user groups to focus their attention and leadership on the compelling water issues before them. To them, I offer Reclamation's assistance in doing things that respond to the needs of both traditional water users and the other publics. I believe that Reclamation can continue to be of public service in providing technical help, evaluating alternatives, identifying incentives, and building partnerships.

Conferences such as this are invaluable in helping us to achieve these objectives.

River Damming and Riparian Cottonwoods: Management Opportunities and Problems

Stewart B. Rood and John M. Mahoney

Cottonwoods, various species of poplar (*Populus*), are the principal and often exclusive trees in the riparian areas in semi-arid regions western North America. In southern Alberta and elsewhere the riparian forests have special importance for both humans and wildlife as they offer welcome relief from the treeless prairies.

Due to their rapid growth and sometimes ragged appearance, cottonwoods have sometimes been considered as undesirable weeds. However, these trees provide the foundation of the riparian forest ecosystem in semi-arid areas of western North America. Unlike wetter areas to the east (Wilson 1970) and west (Szaro 1990), a loss of cottonwoods in these riparian areas is not compensated through enrichment from other tree species. If the cottonwoods die, the entire forest ecosystem collapses.

Only small remnants of once abundant riparian cottonwood forests survive in most regions of the southwestern United States. Estimates of the extent of riparian vegetation decline range from 70% to 95% for the overall southwest (Johnson and Haight 1984). Even more severe declines have been experienced in the heavily developed areas of California such as the Sacramento Valley, which has lost about 98.5% of the riparian forests that existed in 1850 (Sands and Howe 1977). Losses in more northerly areas of Colorado, Wyoming, Montana and Alberta have lagged behind the decline in California although similar patterns are emerging. The causes of the declines are numerous, with generally similar impacts across different areas but differences in the relative severity from those impacts (Table 1).

In southern Alberta, as in many other sparsely developed areas in western North America, the heaviest pressure on riparian cottonwoods is probably due to livestock grazing. Cattle browse and trample seedlings and saplings preventing replenishment of the forest. Management efforts to control livestock grazing may include rotational grazing and exclusion fencing. This limits cattle use in specific areas for periods long enough for new trees to enter the population and reach a sufficient size that reduces their vulnerability to abuse by cattle.

In Southern Alberta, as with many other regions, a second major cause of cottonwood loss has been agricultural clearing for livestock pastures and for crop production. Such clearing was substantial in Southern Alberta through the first half of the twentieth century but subsequent clearing has generally been minor (Bradley et al. 1991). Thus, although historically important, this impact is not a major problem at present.

Stewart Rood is a Professor of Plant Physiology and Chair of the Department of Biological Sciences of the University of Lethbridge in Lethbridge, Alberta, Canada. Dr. Rood's studies investigate the physiology and ecology of riparian cottonwoods in southern Alberta and adjacent areas of British Columbia, Montana and Idaho. He is particularly interested in water relations of cottonwood forests and the influence of river damming and diversion on riparian cottonwoods.

Table 1.
Negative impacts on riparian cottonwood forests of southern Alberta. Impacts are listed in possible descending order of importance in the Oldman River Basin although quantitative comparisons are incomplete and the ranking remains somewhat speculative (Revised from Rood and Mahoney, 1991).

Factor	Comment
1. Livestock Grazing	Cattle graze and trample seedlings. Overgrazed regions are characterized by a deficiency of seedlings and saplings and forests decline as older trees die out.
2. Agricultural Clearing	Clearing for pasture or crop production. The proximity of rivers enables inexpensive irrigation and flood plain soils are often fertile. Agricultural clearing was more extensive in the early 1900s but relatively little increase in the area cleared for crop production has occurred since 1950.
3. Water Diversion	Following river damming or the construction of diversion weirs, water is diverted offstream for irrigation. Subsequent instream flows downstream from the dams are often minimal, creating drought stress and accelerating mortality.
4. Domestic Settlement	Clearing for homes, towns, cities, roads, bridges and other uses. Pressure is generally proportional to human population density.
5. Onstream Reservoirs	Riparian forests are cleared prior to flooding of river valleys for onstream reservoirs, including the major reservoirs behind the Oldman, St. Mary, and Waterton Dams.
6. Beavers	Beavers are a natural component of the riparian ecosystem. However, an imbalance between beavers and trees may result from the loss of natural predators of beavers and the loss of some trees. The present consumer preference away from natural furs has reduced trapping, an artificial measure that controlled beaver populations through the past century.
7. Gravel Mining	The river valleys are prime areas for sand and gravel extraction. In addition to the areas excavated, roads, buildings and screening plants often involve forest clearing. Although aesthetically offensive, abandoned gravel pits are sometimes areas of cotton wood recruitment, particularly through suckering.
8. Direct Harvesting	During early settlement of southern Alberta, poplars were harvested to provide building materials for forts and homes as well as fuel wood. However, poplar wood is generally undesirable for construction uses, and the availability of coal provided an alternate fuel. Consequently, the impact of direct harvesting has been less severe in Southern Alberta than along many American rivers.
9. Channelization	Alberta rivers have not yet been challenged with extensive programs to straighten rivers and armor banks. Such actions inhibit the dynamic meandering of rivers that is essential for cottonwood replenishment.
10. Herbicide Spraying	Herbicide programs to control the imported noxious weeds, leafy spurge (*Euphorbia esula*) and knapweed (*Centaurea repens or C. maculosa*), were conducted in southern Alberta river valleys, particularly in the 1970's. Many herbicides used would readily kill cottonwood seedlings and saplings and some such as Piclorum or Round-Up could even kill larger trees.

A third probable major cause of the previous and present decline of riparian cottonwoods in Southern Alberta is river damming and water diversion. Declines of cottonwoods downstream from dams have been observed in various semi-arid regions of North America (Table 2). However, the impacts of river damming on downstream cottonwoods are somewhat site specific since it is largely the pattern of downstream flow regulation rather than simply the presence or absence of dams that determines the impact on the riparian ecosystems downstream.

In some areas, onstream reservoirs are operated to trap spring snow melt to allow diversion of water offstream for irrigation use. In southern Alberta, this practice results in abrupt reductions in flow in late spring and early summer followed by minimal flows through the hot, dry period of mid-summer (Rood and Heinze-Milne 1989). Both the abrupt flow reduction (Mahoney and Rood 1991) and the low summer flows probably contribute to drought stress, particularly of seedlings and old trees. Consequently, mortality is accelerated and seedling recruitment fails. These consequences are typical of problems along other dammed rivers, although different patterns of flow regulation can also create other problems for riparian cottonwood forests (Table 3).

Our research has focussed on the naturally occurring interspecific poplar hybrids that are common in the western prairies. These studies have included investigations of the relationships between river flow, drought stress and water relations of cottonwoods, cottonwood replenishment, and cottonwood mortality. Our studies are directed towards the basic understanding of how these trees grow and die as well as the applied aspects relating to water resource management that allows cottonwood survival.

In these studies, we recently participated in two major instream flow needs analyses, one involving Canada's controversial Oldman River Dam (Rood and Mahoney 1991), and the other involving the cluster of the St. Mary, Belly and Waterton Rivers, rivers that serve Canada's largest irrigation system (Reid et al. 1992). Our involvement involved assessments of the relationships between quantity and pattern of river flow and historical, present and proposed impacts on riparian cottonwood forest ecosystems. These studies investigated the causes of historical cottonwood decline, analyzed the probable impacts of proposed river flow management patterns, and assisted in the development of survivable patterns of dam operation.

In participating in these projects, a number of management problems and opportunities were encountered. Some of those were specific to the Southern Alberta situation but others are probably of more widespread relevance. The following introduces aspects of instream flow needs and river management that are probably broadly applicable to other efforts to conserve or recover riparian cottonwoods in semi-arid areas of North America.

River Damming and Riparian Cottonwoods: Management Problems

1. Lack of Scientific Foundation

Virtually every environmental study associated with proposed damming projects in Alberta recognizes that the conclusions are somewhat uncertain because the scientific information is incomplete. This insufficient scientific foundation prevents confident analyses of the relationship between river damming and environmental processes. Substantial gains have been made, particularly in the past decade, when public awareness prompted additional research into riparian cottonwoods. However, some pivotal questions remain. The following are just two of the crucial questions that require resolution prior to confident projections of cottonwood response to river flow regulation.

What is the contribution of sexual recruitment through seedlings versus asexual reproduction through suckering or coppicing and how are these different reproductive mechanisms dependent on river flow? Some studies have assumed that cottonwood forests arise primarily through seedlings and attempt to relate present cottonwood distribution to suitability of historical conditions for seedling establishment. However, our studies have led us to recognize that asexual recruitment is an extensive and even dominant form of reproduction. This appears to be particularly important along foothills type rivers, relatively clear streams with coarse substrates that support balsam poplars (*Populus balsamifera subsp. balsamifera and trichocarpa*) and narrowleaf cottonwoods *(P. angustifolia*).

Table 2.
Reports of negative impacts of river damming on downstream cottonwood forests in western North America (Chronological listing - an original Table in Rood and Mahoney, 1990 is revised and expanded here).

Author (date)	River	Region	Populus	Comments
Johnson et al. (1976)	Missouri	N. Dakota	*P. deltoides*	Reduced tree growth and Fewer seedlings
Brown et al. (1977)	various	Arizona	*P. fremontii, P. angustifolia*	Reduced forest abundance
Ohmart et al. (1977)	Colorado	California	*P. fremontii*	Reduced forest abundance Absence of seedlings
Crouch (1979)	South Platte	Colorado	*P. deltoides*	Reduced forest abundance
Behan (1981)	Missouri	Montana	*P. deltoides*	Reduced forest abundance Absence of seedlings
Brothers (1984)	Owens	California	*P. fremontii*	Reduced forest abundance
Stine et al. (1984)	Rush Ck.	California	*P. balsamifera*	Reduced tree abundance
Strahan (1984)	Sacramento	California	*P. fremontii*	Fewer seedlings
Fenner et al. (1985)	Salt	Arizona	*P. fremontii*	Conditions unsuitable for seedling establishment
Bradley and Smith (1986)	Milk	Alberta/ Montana	*P. deltoides*	Reduced forest abundance Fewer saplings
Akashi (1988)	Bighorn	Wyoming	*P. deltoides*	Reduced forest abundance
Rood and Heinze-Milne (1989)	St. Mary, Waterton, & Belly	Alberta	*P. deltoides*, P. balsamifera, *P. angustifolia*	Reduced forest abundance
Howe and Knopf (1991)	Rio Grande	New Mexico	*P. fremontii*	Absence of seedlings
Smith et al. (1991)	Bishop Ck.	California	*P. fremontii, P. balsamifera*	Smaller leaves, reduced transpiration and water potential
Snyder and Miller (1991)	Arkansas	Colorado	*P. deltoides*	Reduced forest abundance

What are the dynamic relationships between riparian water table depth and river stage? It is the riparian water table depth rather than river stage that determines moisture available for cottonwoods. To link cottonwood response to the river system, the hydraulic connection between the river stage and water table depth must be more fully understood including analyses of riparian water table drainage and recharge.

Table 3.
Factors proposed to contribute to the decline of western riparian cottonwood forests following river damming or water pumping from wells (originally in Rood and Mahoney, 1990, and expanded here).

Proposed cause	Comments	References
I. Hydrological changes:		
A. Reduced water availability	Diversion of water offstream or well pumping creates a water deficit, resulting in drought stress, slow growth, and increased mortality	Brown et al. (1977), Brothers (1984), Stine et al. (1984), Hardy BBT Ltd. (1988), Rood et al. (1989), Williams (1989), Smith et al. (1991), Snyder and Miller (1991), Stromberg and Patten (1991)
B. Reduced flooding	Spring flooding is essential to create moist seedbeds for seedling establishment.	Brown et al. (1977), Ohmart et al. (1977) Johnson et al. (1976)
C. Stabilized Flows	Dynamic flows are essential for seedling establishment.	Strahan (1984), Fenner et al. (1985) Howe and Knopf (1991)
II. Geomorphological changes resulting from hydrological alterations:		
A. Reduced meandering and channelization	With reduced flooding, channel migration is reduced and suitable seedbeds are reduced	Ohmart et al. (1977), Johnson et al. (1976), Bradley and Smith (1986), Howe and Knopf (1991) Snyder and Miller (1991)

2. Historical Overallocation

In much of the semi-arid areas of western North America, substantial quantities of water have already been committed for various consumptive uses. Water allocation has increased over the past century or more, largely without attempting to ensure sufficient instream flows for environmental preservation. This has resulted in problems of current overallocation of water.

The problem of overallocation is amplified by two interacting characteristics of water supply and demand. Firstly, assessments of supply are often based on average annual discharge. However, there are major variations in total river discharge across years. Thus, in one-half (or more) of the years, flows are below average and consequently, if full commitment is based on the average supply, shortages will occur in one-half of the years or even more often. This problem is further exaggerated by a second variable - while supply is reduced during dry years, these are the years in which demand is greatest. Irrigation and other requirements increase in dry years, since these are typically the years of low precipitation and are also generally warmer than usual.

To reduce problems of overallocation, assessments of supply and demand must be based on low flow situations rather than on the annual average. Statistical approaches, involving return intervals and failure probabilities should be employed to more reasonably assess prospects for satisfying the supply and demand balance.

3. Incremental Removal of Water

In the 1990s, the construction and commissioning of a new dam in North America requires substantial planning and assessment, including environmental impact analyses. While such analyses are still prone to problems due to insufficient scientific understanding and ecological unpredictability, at least these major projects receive some assessment and publicity. In contrast, at least in Alberta, irrigation expansion and additional water diversion for other uses seldom receives sufficient study or public scrutiny. While annual increases of water withdrawal may be modest, if such increases occur annually, within a decade or two, the cumulative impacts become major. Unfortunately in Alberta, and probably elsewhere, there is little legislated protection against incremental expansion, since environmental impact analyses are generally required only for major capital projects.

4. Status Quo - Administrators, Legislation

Many of the preceding problems are also amplified by the existing administrative system and legislation. For example, in Alberta, the Water Resources Act explicitly prioritizes the uses of water as follows:

i) human consumption,
ii) food production,
iii) industrial use, and
iv) other uses.

In accordance with this Act, irrigation shall always take precedence over instream flows for environmental preservation, recreational use or aesthetic or cultural benefit.

In addition to the legislative impediments of multiple-use water resource, the individuals that are responsible for water management use typically trained in an era that differed from the present with respect to environmental valuation and preservation. After serving for years or even decades with certain priorities, they are often understandably reluctant to embrace alternate prioritization.

II. River Damming and Riparian Cottonwoods: Management Opportunities

Although there are substantial problems facing attempts to adjust water management programs for the benefit of riparian cottonwoods, there are also substantial opportunities. Some of these relate to the biology of the ecosystem whereas others are associated with social or political aspects of water resource management.

1. Increasing Public Support

In the case of southern Alberta, a decade ago the public would frequently make comments such as: 'why should we bother saving these weeds?' The trees are now recognized by most regional residents as well as the scientific community as providing the foundation for the forest ecosystem. Although some residents find the trees unattractive, most appreciate the birds and terrestrial wildlife that thrive in the cottonwood forests.

Through the late 1980s there was a renewed interest in environmental issues and a broadened appreciation for the value of natural areas and native plants and animals. The conspicuous presence of cottonwood forests makes them particularly prominent as a focus for environmental support and conservationists' efforts. Articles in newspapers and popular media regarding the riparian environment are now relatively common, in addition to the increasingly frequent scientific reports describing the valuable but vulnerable cottonwood
forests.

Government support often accompanies public support and this is certainly the case in southern Alberta. All proposed river management projects in Alberta now require analyses of the status and prospects for riparian vegetation.

2. Few Prior Efforts - Any Adjustment is Likely to be Favorable

`During the planning and the development of the initial operations rules for southern Alberta's St. Mary and Waterton Dams, there was no consideration for the impact on or preservation of riparian vegetation. In the late 1940s and early 1960s, respectively, the negative impact of flow regulation on riparian cottonwoods downstream was unknown and the lack of concern was consequently understandable. With no awareness of the vulnerability of riparian vegetation, no considerations were made in operations plans for these dams.

In contrast, planning for the Oldman River Dam has included consideration for downstream impacts. The operations plans for the Dam attempt to moderate flow changes and maintain modest flows summer long. Although it is unknown whether these efforts will be sufficient for the long-term sustenance of the riparian forests, it is virtually certain that these efforts will prolong the forests' survival. Although there are still numerous questions, the resulting operation plans for the new Oldman Dam are for better than the flow patterns for the St. Mary and Waterton Dams.

3. Cottonwoods are Robust - Vegetative and Sexual Recruitment

The common perception of cottonwoods as 'weeds' reflects their prolific growth and regrowth. These trees are copious seed producers and seedlings are abundant, although seedling survival is less common. In addition to this sexual reproduction through seedlings, some species are also able to reproduce through suckering, the production of new shoots from existing roots, and all riparian species are capable of coppicing, the production of new shoots from existing trunks.

The combination of sexual and asexual reproductive mechanisms provide cottonwood forests with a range of recruitment opportunities. This provides the forests with compensatory recruitment strategies - even if seedling recruitment is limited as a result of river flow modification, asexual replenishment might enable forest continuance - at least in the short term.

However, the asexual reproductive strategies do not introduce genetic diversity and thus, the forests could lose biodiversity. The healthy cottonwood forest involves a balance of sexual and asexual recruitment and efforts should be directed towards the preservation of the natural population cycle.

4. Instream flows provide environmental, recreational, health and aesthetic benefits

It might be difficult to justify instream flow allocation just for the preservation of riparian cottonwoods. The value of these natural woodlands is difficult to quantify, particularly in economic terms. Even if economic benefits could be determined, these might be insufficient to counter arguments for water diversion for other uses.

Fortunately, the benefits of flowing water are broad-ranging. The provision of sufficient instream flows would benefit not only cottonwoods and the associated forest ecosystems, but it would also

i) promote fisheries,
(ii) allow instream recreational use,
(iii) improve water quality, resulting in
(iv) improved human health conditions,
(v) enhance the aesthetic condition.

Other environmental benefits will also result as the larger regional ecosystem interacts with the riparian ecosystem

The cumulative value from these benefits are substantial and may warrant instream flows, even on economic grounds that generally undervalue non-consumptive uses.

Management Opportunities or Problems?

1. Forest Longevity

While the preceding consequences have been represented as favorable opportunities versus unfavorable problems, the categorization is not always clear. Some aspects may be favorable in the short-term but unfavorable in a longer time frame. For example, riparian cottonwood forests downstream from flood-control dams may prosper during the first decades after damming. However, since flooding is required for longer-term forest cycling, a forest decline may follow after a few decades.

The longevity of forests could be beneficial or harmful for cottonwood preservation efforts. Since forest decline may be gradual, decades may be required before changes induced by river flow management become evident. This latent response may provide a false sense of forest well-being.

Conversely, forest longevity may assist in management efforts since river mismanagement may be biologically tolerated in the short-term. Forest decline normally results from sustained environmental stress over a decade or more. Thus, there is an urgency to begin action for cottonwood conservation but fortunately, even if it takes a few years to change the pattern of river flow management, the forests may endure the short term stress.

2. Valuation of Riparian Forest Ecosystems

Much of the historical neglect and abuse of riparian cottonwood forests has been due to the general perception that they have minimal value in economic terms. It is very difficult to assign a monetary value for the benefits provided by the riparian forests, creating a problem for attempts to conserve the cottonwood ecosystems.

However, although such valuation may be difficult, it is likely that as the numerous environmental, recreational, aesthetic and cultural benefits are recognized, the collective social and economic values will be very substantial.

With respect to river damming and riparian cottonwoods, there are undoubtedly other opportunities and problems, including some severe problems that are site-specific. Conversely, as an optimistic concluding statement, the changing situation in southern Alberta provides promise for other areas in southwestern Canada. Some of the problems are being solved and some of the management opportunities are growing. Thus,

although the progressive development of southwestern Canada will continue to create pressures on the remaining riparian cottonwoods, the trees that exist in Southern Alberta today may actually have more favorable prospects than they faced a decade ago.

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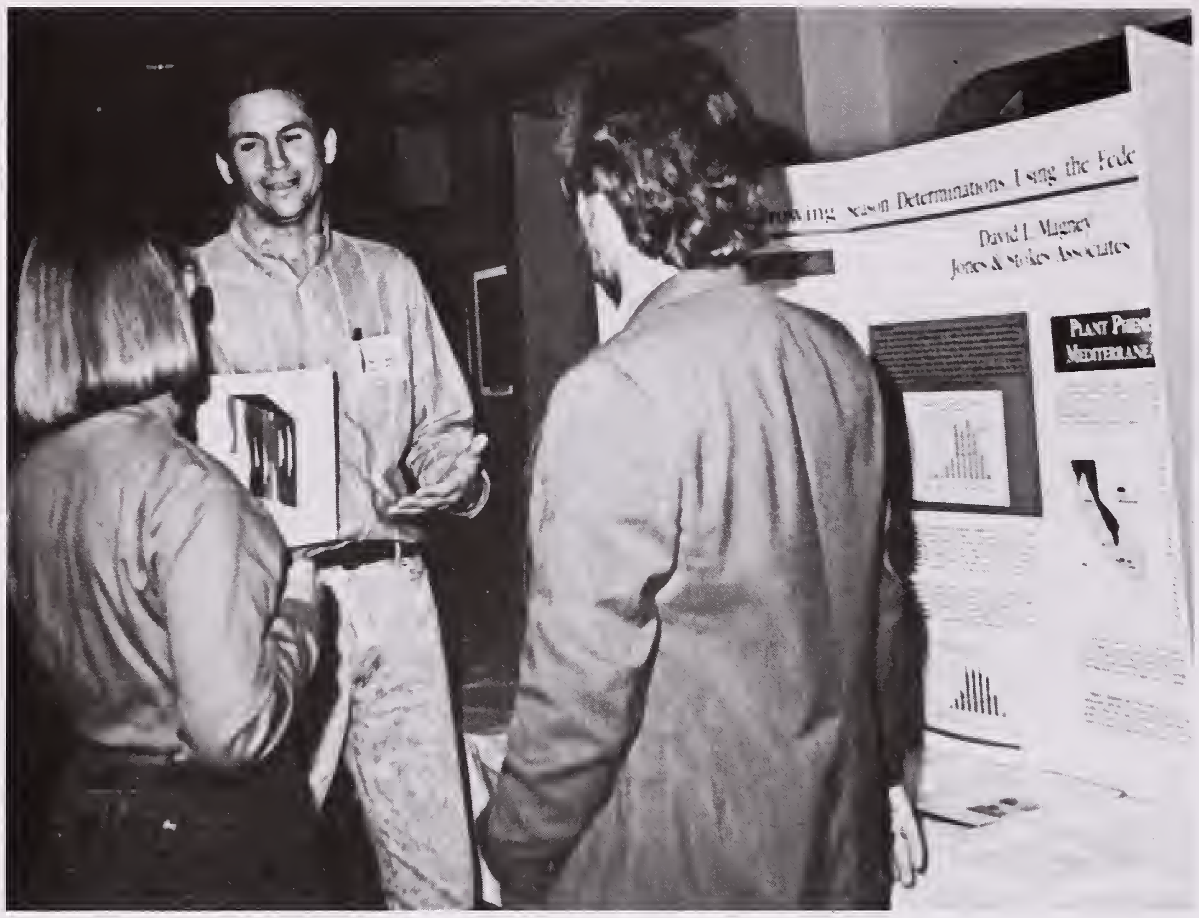
"But here among the hills bare and red,
A violent precipice, a dizzy white curve falls
hundreds of feet through rock to the deep canyon bed;
A beauty sheer and clean and without error
It stands with the created sapphire lake behind it,
It stands, a work of man as noble as the hills,
and it is faith as well as water it spills.

Not built on terror like the empty pyramid,
Not built to conquer but to illuminate a world;
It is the human answer to a human need,
Power in absolute control, freed as a gift,
A pure creative act, God when the world was born!
It proves that we have built for life and built for love
And when we are all dead, this dam will stand and give."

May Sarton on Hoover Dam
in the Lion and the Rose


David L. Magney
Jones & Stokes Associates

CHAPTER FOUR

THE IMPORTANCE OF COMMUNICATION

Beauty before me I walk.
Beauty behind me I walk.
Beauty above me I walk.
Beauty below me I walk.
Beauty all about me I walk.
In Beauty is all made whole.
In beauty is all restored.

Navajo Blessing Way

Solutions for the land and the people

Doc & Connie Hatfield

Much of our personal effort the past ten years has been spent on building bridges between concerned urban environmentalists and long term ranchers who depend on the land for their livelihood. Putting folks with different backgrounds and values together for the purpose of making positive change on the land reality is a slow, painful and rewarding process. The Trout Creek Mountain experience is an example of how the land and the people can win.

History and Background

Evolution of the Trout Creek Mountain Working Group began in June of 1988. The authors of this article and Wayne Elmore were invited by the Oregon BLM Vale District to give a talk to ranchers in the Trout Creek Mountain area of southeastern Oregon. The purpose of the talk was to give examples of how ranchers in the Prineville BLM District are able to work cooperatively with the BLM to make ecological improvement on the land reality.

The Prineville, Oregon area has been well publicized by Wayne Elmore, a BLM riparian specialist, who has shown his talk and slides all over the country and become "Mr. Riparian," a well deserved title. Wayne has worked out of the same area for 18 years. The dramatic results he shows on the Bear Creek watershed were possible because:

1) Prineville district and area managers have been willing to take substantial managerial risks to create ecological improvement.

2) The BLM rancher grazing advisory board has provided financial and positive peer pressure support.

3) A Range Con (Earl McKinney) stayed in place and built trust and credibility with ranchers. With that trust and credibility he was able to negotiate and implement very nontraditional flexible grazing strategies which have resulted in watershed and riparian improvement.

Enough on the history of the Prineville program and back to the sensitive and fragile Trout Creek Mountain area and the June 1988 meeting. Picture the setting of one very angry manager of the Whitehorse Ranch, 5 other unbelievably frustrated ranchers, and several BLM folks including the area manager, range cons, wildlife biologist and hydrologist. Add in a past history of paper and process oriented BLM management. Couple that with a new range con on the ground every few years with never enough time to build trust and a true working relationship with the rancher permitees.

Also picture that for 21 years concern over riparian conditions and the fate of the resident Lahontian cutthroat trout had been voiced by environmental organizations including, the Izaak Walton League, Audubon, the National Wildlife Federation, Oregon Environmental Council, Oregon Natural Resources Council, Trout Unlimited, Oregon

Doc and Connie Hatfield grew up on small rural acreages and have made their living from ranching for the past 20 years. They run 400 cows on 35,000 acres of private and public land near Brothers, Oregon. They spent 14 years in large animal veterinary practice. They have been actively involved for the past 9 years in finding solutions to grazing issues by working with environmentalists from the city.

"One spring some environmentalists came to our ranch for a visit. We always have a lot of birds on the ranch of all kinds, although I don't know all their names. The ducks are special favorites of mine. A woman from the Izaac Walton League asked how many baby ducks had been born on the ranch that spring. When I thought about it, I had to tell her that we hadn't had any babies this spring - or for a long time.

Well, she told me that our ducks were cinnamon teals, so I tried to find out what we needed to do to get baby ducks. After a lot of questioning and talking, we found out that cattle grazing by the water were disturbing the nests and all we needed to do was to keep them away from the riparian area during nesting season.

The next spring - two families of baby ducks.

Following that we made other changes to our grazing practices and have enjoyed seeing baby ducks as well as many other wonderful improvements."
Connie Hatfield

Trout etc ... 21 years of environmental concern and frustrated ranchers with no significant change on the land. No change that is except for a number of study exclosures which showed the potential of the riparian area.

Viewed with a historical perspective it is understandable why no change had occurred in grazing management. Cattle had been summer grazed on the mountain since the late 1800's establishing an accepted tradition. The BLM's primary role during the 1940's, 50s and 60s was to license and administer grazing permits.

It was not until the 1970's that the importance of the environmental affects of grazing were clearly spelled out through environmental lawsuits and legislation. However, during the 80's, political appointees in the Interior Department sympathetic to the sagebrush rebellion frequently issued policies that were in direct opposition to the intent of the environmental legislation. The BLM was caught in the middle attempting to respond to a series of very conflicting signals. Back to the scene being played in the small border town of McDermitt, Nevada that June of 1988. Wayne Elmore gave his 45 minute riparian talk in 2 hours. Angry discussion accompanied each slide, and the day ended with a number of talks including Doc's not given. There was not time to see how positive results had been accomplished cooperatively only 250 miles away. The mood of the room was such that the message would not have gotten through anyway.

The next day was a tour on the mountain which rises from 4000 feet to over 8000 feet in elevation. The riparian areas had few willow and aspen. Those that were present were old. The history was one of 130 years of continual livestock grazing from June to October each year. Even though one of the objectives of the massive Vale range improvement project of the 60s was to provide management alternatives to benefit the mountain, these alternatives had never been used.

At the end of the day, Connie could stand it no longer. As a "Public Citizen" she expressed her right to try and get some changes made that could benefit the land. With substantial help from Bob Skinner, President of the Oregon Cattlemens association, and some friends in the environmental community, the authors were able to put together a meeting one month later at the 14th floor offices of the BLM state director in Portland. Present at that first meeting of what would become the Trout Creek Working Group were 2 representatives of the White Horse Ranch, 2 representatives of the Izaak Walton League, 1 representative of Oregon Trout, 4 representatives of the Oregon Cattlemens association, the Vale District and Area managers, the State Director, Chief of Resources, and the head of the Range Program statewide.

The tension, energy, fear, care and concern in that room for 4 hours was inspiring. At the end of the day it was obvious that changes had to be made, or everyone was going to lose big after a long battle in court. Regardless of the decision made by District Manager, Bill Calkins, someone was going to challenge it with a lawsuit. And while a lawsuit is in process, management reverts to historical precedent which would have meant no change on the ground.

Formation and Action of the Trout Creek Mountain Working Group

Folks from this meeting in Portland with the addition of a member from the Oregon Environmental Council and two ranch couples from the Trout Creek area became the "Trout Creek Mountain Working Group." The group's purpose was to see that change in management occurred immediately that would "make a difference" on the land.

The Trout Creek group, working closely with the Vale BLM and full support of the state director, was able to build enough understanding of the need for watershed improvement that the ranchers involved voluntarily removed their cattle for a three year period of rest.

The Whitehorse and Oregon Canyon watersheds of the Trout Creek Mountain located in the Vale BLM district completed their third year of rest the fall of 1991. The response of 100 miles of critical riparian area was exciting. A lot of credit for the results needs to go to the Whitehorse management who recognized that the past 130 years of continuous grazing was not going to be acceptable in the future.

The Whitehorse ranch made a major financial commitment to the recovery of the watershed by leasing another ranch for three years and drastically changing their grazing program on the lower reaches of the watershed. Four other ranchers also made immediate management changes that involved considerable water hauling and 100 pound reductions in weaning weights to rest their areas of use on the mountain. This change was all accomplished voluntarily even though it caused extreme financial stress to the ranchers involved. The District Manager from Vale issued a grazing decision for the Whitehorse Butte Allotment which became effective in late 1990. The grazing strategy was specifically designed for the benefit of the watershed and the fish which depends on that watershed for its existence. It is important to understand that the mountain received two years of voluntary rest before the grazing decision was issued.

In the late spring of 1992 in the face of the worst drought since the 30's, the cattle were returned to the mountain to graze pastures containing endangered Lahontian cutthroat trout. In September of 1993 after the cattle

"Sometimes people talk in such technical ways that it's hard to understand just what they are trying to say. Many ranchers around here aren't familiar with terms like "biodiversity," "sustainable ecosystems," or even "riparian area." We have had a lot of city environmentalists talk about what they want to accomplish, but it wasn't until a woman from Oregon Trout put it in clear terms that we all understood what they were talking about.

What she said was "What I want to see are baby trees, teenage trees, middleage trees and old trees. And I want to see baby fish, teenage fish, middle age fish and old fish." "Yes, I said, "and I want to see baby ranchers, teenage ranchers, middle age ranchers and old ranchers." Finally it all made sense."
Connie Hatfield

were off the mountain, a two day tour was conducted with the Trout Creek group and the US Fish & Wildlife Biologist. Results on the land after three years of rest and one year of planned grazing are there for everyone to see today. The streambanks now have sufficient young willow, aspen and grass cover that the riparian system would benefit from a modest flood event. And the prospect of the land becoming a much healthier watershed in the future is a lot more than just some dream on paper.

Unfortunately, the season long summer grazing program on the Trout Creek Mountains that was in place 2 years ago is not that unusual in the West today. Most areas have not had as much public interest as the Trout Creeks. But the sad truth is too much ecologically unsound grazing continues to be licensed year after year with no changes.

There are several reasons for our current predicament in the West. Land management through laws and bureaucracy is not very effective. The BLM is a politically directed entity which has basically been paralyzed since 1974 from the conflicting messages it receives on a regular basis from Washington D.C. and various lawsuits. This paralysis can be overcome through a consensus group such as the Trout Creek Working Group. When understanding exists between ranchers, environmentalists, local and state BLM folks, decisions that benefit the land and people can be implemented without years in court.

Factors which Allowed the Trout Creek Group to Exist and Function

1) Trust and respect existed between a number of ranchers and environmentalists in Oregon prior to formation of the Trout Creek Working Group.

2) The problem on the ground was recognized by both the ranch community and the environmental community who together asked the BLM to participate in a unique process to find solutions.

3) Strong support existed at all BLM managerial levels throughout the process.

4) Chad Bacon, State Range Conservationist, was detailed by the State Director to maintain communication between the ranch community, the environmental community and the Vale BLM both at the management and on the ground level. Chad's credibility and ability to communicate with both the ranch and environmental community was and continues to be an important key to success.

Trust, respect, credibility and communication are four simple words to write. They are incredibly difficult items to build and maintain. But for lasting success on the land, they must exist.

The Process at Group Meetings which Makes Consensus and Action Possible

1) Ranch wives are specifically and personally invited to participate. Ranch men frequently are bound by tradition to the way it always has been which makes opportunities for change difficult to see. Woman in general tend to be more right brained and better able to understand the feelings of environmental folks who are viewing the situation from a different perspective.

Everyone's feelings... ranchers, environmentalists and BLM folks.. .have to be acknowledged before true consensus for change can occur.

2) Everyone sits in a circle and speaks in turn. A question starts each meeting such as... "How do you feel about being here and what would you like to help make happen today"? According to conflict resolution consultant, Bob Chadwick, no one is at a meeting until their voice enters the room. By having to think about how you feel (most folks feel anxious and frightened which may be expressed as anger), the right brain is activated. The right brain is where our creativity is located. Answering the question, "what would you like to help make happen today?" affirms that something is going to happen and you are going to be an important part of it.

3) After everyone's voice enters the room, two or three significant problems are discussed. This is in the circle as a whole, or in smaller breakout groups, but always with each person given the opportunity to speak in turn.

4) During the meetings of the working group, BLM representatives participate in turn as people with concerns and cares, not just as BLM employees doing their job.

5) Efforts of the group are goal oriented. The group's future "Big Picture" includes....

a) Baby, junior, intermediate and older aged willows, aspen, trout, wildlife etc. throughout a watershed covered by a thick stand of vigorous perennial grass.

b) Baby, junior, intermediate and older ranchers and their livestock operating in an economically and ecologically sound manner.

There was considerable relief in the room when the ranchers had no problem working to achieve point a), and the environmentalists had no difficulty with point b). Descriptions for how the land need to look throughout the watershed in the future were visualized by including statements such as; how McDermitt creek looks now at the upper access, and how the upper watershed looks now at the head of Oregon Canyon.

6) At the close of each meeting, realistic commitments for accomplishing certain tasks and clearances are made by the ranchers, environmentalists and BLM folks. The ranchers and environmentalists network with their peers to build understanding on what is occurring. The BLM's commitment prioritizes their work toward tasks that will make a difference on the ground. The BLM is presently buried under paper work requirements without the staff or funding to accomplish those demands. It requires some sort of outside consensus pressure plus State Director support to accomplish meaningful change on the ground.

The Trout Creek Working Group is a story of building trust and understanding between people who view the same area from a vastly different perspective. A small but significant example of what can be done when that trust and understanding is developed occurred in February of 1991. Eastern Oregon had been in a 5 year drought. Wild horse numbers are at a problem level. Places they can water are limited.

Richard Ytturiondebatia, a rancher on the Nevada border recognized a very real potential problem. Before the Trout Creek Working Group experience, Richard would have viewed all environmentalists as enemies. However, considerable trust and respect had been developed. Richard felt comfortable in making a call over his static ridden ranch radio phone to Monty Montgomery 500 miles away in Portland, OR to talk about the problem. Monty is the Chairman of Oregon's Public Land Restoration Task Force, a division of the Izaak Walton League. Monty and Richard, visiting jointly with BLM area manager Dave Atkins, caused a solution to be developed which is acceptable to all concerns. It is a real breakthrough when a rancher feels comfortable about talking to an environmentalist about a problem on the land. When together they can talk with three way mutual respect to a BLM manager, results will occur.

Respect now exists both ways. The Trout Creek Mountain meetings have been facilitated by ranchers, environmentalists and the BLM. Mary Hanson from the Oregon Environmental Council served as facilitator for the January 91 Trout Creek Meeting in McDermitt, Nevada. Later she told us she felt more comfortable about getting straight answers about what was going on from ranchers in the Trout Creek Group than she did any other source available. That reality interested her since they were potential adversaries.

It takes people to improve land. We already have more laws and technical information than we need. Time is not on our side in the struggle to solve problems on the public land. But the time is right for more people to people alliances where land owners, environmentalists and federal agency folks work cooperatively to produce action on the ground. Plain folks can make a difference, and we need to do it now.

CHAPTER FIVE

THE URBAN-RURAL INTERFACE

General Considerations
Albuquerque, New Mexico
Boulder, Colorado

LOVE THE EARTH

With eyes that are piercing as the setting sun,
and with words a rich as a forest in spring,
I'll tell of the time when earth and man were as one
with the simple beauty of natural things.

Lift your eyes to the sky, see the hawk as she soars;
turn a rock, look beneath - touch the forest floor.
Hear the song of the wind - come and dance with the breeze
We are one, neither greater nor lesser than these!

"Love the earth" is my plea....

We see the fertile land eroded away,
and the trees cut down so that cities may grow.
Too late we learn the price for progress we pay -
A price the land and the waters and wildlife know.

The salmon, the wolf, and the falcon too ...
Though they're scarce, they are brother and sister to you.
If man was given dominion o'er lands and seas,
As good stewards we must take care of these!

Love the earth, and believe ...

As long as water flows from mountains streams,
and the sun shines down in a clear, blue sky,
We all must dedicate ourselves to the dream
And save what neither progress nor money can buy.

The earth is the only home that we know;
As we tend our garden, so too, will we grow.
The seeds must be planted in minds unaware ...
for the health of the land depends on our care ...

Love the earth, do your share ...

Love the earth!

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Positives and Negatives of Recreation in Riparian Areas

Patricia L. Winter

The Wildland Recreation and Urban Culture Project of the Pacific Southwest Research Station has been in existence since 1987. With a focus of study on wildland areas, we have had excellent opportunities to study urban-rural interface issues. We have conducted many of our studies in riparian day-use areas because we have found such areas to be reliable contact points for recreationists.

Riparian Areas Attract People

Water is a drawing force for recreation. Riparian areas are cool and relaxing. One can either recreate in the water, or at the water's edge. Riparian areas are often shady, and if there is not enough natural shade we have discovered that our visitors will bring their own.

Riparian areas near large urban centers offer residents an opportunity for a brief escape from the hustle and bustle of the city and can attract users from further distances as well. Such areas invite a diversity of activities including, but not limited to, picnicking, swimming and wading, hiking, panning for gold, fishing, enjoying music, and cycling. However, "relaxing" is the activity that the majority of our users report engaging in on weekends.

The Importance of Relaxation

A day-use study from two years ago revealed that relaxation was not only engaged in as the primary activity, it also was selected as an activity that heavily contributed to one's sense of self (Chavez 1992). Riparian areas invite a diversity of users in different group sizes, different ethnicities, and varying degrees of physical mobility.

Ethnic Diversity

Site studies in southern California have revealed an increasing ethnic diversity over the past several years. For example, at the San Gabriel Canyon on the Angeles National Forest, visitors of Hispanic origin represent the majority (Simcox, Pfister, and Hodgson 1989). Ongoing studies are revealing large differences in the diversity of ethnic and racial groups represented between sites. The potential for adjacent communities to benefit from tourist dollars continues to exist, although many of our recreationists are repeat visitors (Chavez 1991) who live throughout southern California (Simcox, Pfister, and Hodgson 1989).

A Negative Side to Recreation in Riparian Areas

However, there is a negative side to recreation in riparian areas as well. As the popularity of an area increases so can the problems in that area. Problems are most likely to be experienced in riparian areas closest to large urban centers. More people are likely to visit, and those individuals, according to Ewert and Knopf (1989), may lack an appropriate land

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ethic because of their limited experience with the land. One set of problems occurs when riparian areas suffer from over-visitation. At times parking can be inadequate, leading visitors to leave their cars wherever an open area can be found. Toilet facilities may be inadequate, increasing the chances that people will relieve themselves in the stream or along the water's edge. Not only does this reduce esthetic value, but creates a health risk as well. Litter becomes more likely when trash cans are far and few between or are obviously overflowing.

With increasing numbers the recreation experience of individual visitors may be adversely affected. Recreationists may begin to experience a sense of crowding if the number of individuals in an area is greater than what they expected to encounter. Work by Debbie Chavez (1991) showed that crowding was perceived to be moderate to extreme by more than a third of the visitors at one site. That same study showed that a little over half of the visitors expected a larger crowd than was present. Current research by Heywood and Chavez is revealing that people hold a set of behavioral conventions for an area that may include the expectation of being crowded to the point of having people that they do not know walk through the site they are using. We believe that over time, recreationists who find the increasing popularity of an area and the accompanying changes to be undesirable, will be displaced to other areas. Findings by Hartley (1986) suggest that displacement occurs, although our work has yet to confirm these findings. A future series of day-use studies will shed more light on displacement.

Conflict becomes more likely as an area's popularity increases, and it is more intense near large urban centers. As the demand for recreation in urban-proximate areas continues to increase, the opportunities will probably remain at the same level, or be reduced, thereby leading to competition over a scarce resource. Even now, conflicts are occurring between users whose recreational choices are incompatible. Conflicts occur when a recreationist wishes to engage in an activity that has taken place in an area for years, but with increasing numbers may be viewed as unsafe.

A policy of multiple use requires that such potential conflicts be carefully considered and measures taken in advance to help avoid problems wherever possible. In some instances areas can be specifically designated for special use, such as for shooting. With such actions, however, comes the question of which uses will be allowed. Who, if anyone, can be excluded?

Meetings between resource managers and various user groups may also be helpful in reducing conflicts. We have found several instances of successful conflict resolution when representatives from multiple interest groups have met with resource managers (Chavez, Winter, and Baas 1993). There is the additional benefit of groups being more likely to accept a final decision when they have been able to participate in the decision making process.

Depreciative behaviors are likely to occur in areas with high use. Whether intentional, or unintentional, the impact upon a resource can be dramatic as evidenced by signs being knocked over, trash bins with graffiti, trees with carving on almost every inch of exposed bark, and litter. A multitude of underlying factors are related to these depreciative behaviors including differing land ethics and a desire to rebel when one feels unfairly dealt with. Our project is continuing to examine the dynamics behind depreciative behaviors and the best intervention strategies.

Some Recommendations

What has become very clear in examining all of these negatives is that communication with visitors is increasingly important and increasingly complex. While most of our visitors find out about recreation areas through word of mouth, once they arrive at the site several messages may need to be conveyed.

Activities permitted, hours of use, and habitat information would be a few examples. The use of signs in a resource area continues to be an effective medium for communication when used properly. Some considerations in signing that our research has uncovered include these:

(1) Signs should have messages that are short and simple. Few recreationists are motivated to read a sign that has complex and lengthy messages, and the messages might not be understood or remembered even if they are read;

(2) Signs should be positive whenever possible. People are more likely to respond and comply with positive messages than they are with negative ones. The one exception here would be if a visitor would be cited for a legal violation, in which case the disallowed behavior has to be clearly stated;

(3) Signs have to be carefully examined for the possibility of multiple interpretations; and

(4) Signs have to be multi-lingual in areas with diverse users (Simcox, Pfister and Hodgson 1989). If the majority of visitors to an area speak and read Spanish as their primary language, for example, then signs in the majority language should be provided.

Finally, communication is most effective when face-to-face, particularly if the communicator speaks the same language and is similar to the communication target (Cialdini 1988). Eco-teams of bilingual urban young adults are being used on the Angeles National Forest in cooperation with the California Environmental Project. Their purpose is to communicate messages about land ethics and other basic visitor information. While this program is very new, it appears to be quite promising.

Summary

In summary, riparian areas invite a diversity of activities and users. As riparian areas continue to increase in popularity as recreation sites, new management challenges are created. Concerns related to over-visitation, crowding, conflict, depreciative behaviors, and communication will only increase. We intend to continue to work on understanding and meeting those challenges.

"There is a direct link between recreation and family unity; between recreation and social cohesion; between recreation and the prevention of crime and juvenile delinquency, reduced health care costs, and local economic growth and diversity." The President's Commission on Americans Outdoors

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Rio Grande Valley State Park /(

Rex Funk

The Rio Grande River

It is said that the Rio Grande is second only to the Ganges in the intensity of use and over-appropriation of use of its waters. It is true that the River has been consistently acknowledged as the life blood of Central New Mexico as well as parts of Colorado, Texas and Mexico. Over the last century, increasing efforts to control, apportion, and tame the river have resulted in sweeping changes to its natural character, many at the expense of biodiversity and sensitive wildlife species.

In the last 25 years, however, a drive has begun to save and restore the River's natural diversity and a growing constituency of citizens have rallied around this effort. One of the most successful demonstrations of the counter movement toward rebuilding the natural communities of the Middle Rio Grande is Rio Grande Valley State Park.

When early naturalists visited New Mexico in the 1800s, they found vast flocks of waterfowl, extensive marshes, and a live river in the Rio Grande Valley near Albuquerque. These ecosystems co-existed with an historic irrigation system begun by Native Americans and improved by Spanish settlers.

The Conservancy District

Following some disastrous floods in the 1920s, the State legislature chartered the Middle Rio Grande Conservancy District to focus on flood control, irrigation, and drainage. The Conservancy District went to work draining wetlands, lowering the water table, confining the River to straight line channels, and making the Valley safe for agriculture and residential development. After a large flood in 1941, the federal government became involved through the Bureau of Reclamation and Army Corps of Engineers and the Middle Rio Grande Flood Control Project was born. They were cheered on by the Interstate Stream Commission, which was responsible for delivering water to Texas and Mexico under the Rio Grande Compact of 1934. Levees were raised, and a network of "Kellner Jetties" was erected to protect levees and form a low flow channel. Federal agencies took over many of the flood control and drainage functions of the Conservancy District.

Within the span of 35 years, over 7,000 acres of wetlands were lost on the Middle Rio Grande. But the engineers were not satisfied. They were convinced that the riparian vegetation ("phreatophytes") along the river was consuming large quantities of water which was "lost" to beneficial use such as agriculture. In the mid 1960s, they proposed the Middle Rio Grande Water Salvage Project, which advocated removing and root plowing riparian vegetation and maintaining the area with herbicides.

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The public and a fledgling environmental movement in New Mexico reacted strongly to this proposal, and the State Legislature commissioned a Rio Grande Valley State Park Feasibility Study. Published in 1969, this study proposed that the Rio Grande and its riparian vegetation were of great value to people for recreation and to wildlife for survival. It further proposed that the floodplain of the River be declared a state park, and that facilities to attract recreation and tourism be built adjacent to the River.

A group of proponents of saving the River and bosque (Spanish for "forest") was formed and carried the message to the public and elected officials. The City of Albuquerque adopted goals and a Comprehensive Plan which included preserving the Rio Grande as part of its Open Space system.

Creation of the State Park

These plans were finally implemented in 1983 when the City lobbied the State Legislature to create Rio Grande Valley State Park on 25 miles of the River owned or controlled by the Middle Rio Grande Conservancy District in the Albuquerque Metropolitan Area. The park was created to preserve and improve the natural character of the River and bosque, while allowing low impact recreation. The City of Albuquerque's Open Space program was designated as the operating party. Work begun immediately to clean up trash and close the area to motor vehicles. The result was an immediate reduction in fires, wood cutting, vandalism, illegal activity and destruction of the bosque. At the same time, recreational activities such as walking, jogging, horseback riding, and nature study increased.

A planning effort began to balance calls for more recreational use with advocates of preservation. A management plan was followed by vegetation, bird, mammal, and archaeological studies. A fire plan was also prepared. These data were incorporated into a Geographical Information System and Biophysical Land Unit (BLU) classification system. The GIS allowed specific impact analysis of the human impacts in each of the eight BLUs. Thus it was possible to know how many miles of trails and other features were found in each BLU.

The Bosque Action Plan

This planning tool, combined with extensive public involvement, was used to formulate policy and project proposals for the Bosque Action Plan scheduled for approval in 1993. At the same time, work continued to improve access controls, remove trash, control transient camping, and restore habitat along the River. The cottonwood bosque is an even-aged stand dating back to the flood of 1941. Control of the River by upstream dams had precluded overbank flooding required for germination of cottonwood seeds. The forest was also being invaded by exotics like Siberian elm and tamarisk. The Open Space Division began pole planting cottonwood and black willow poles in 1989. To date, over 3,000 poles have been planted, and grants have been received to continue the effort. Success ratios of over 90% for the first year area attributed to using local pole stock and pre-monitoring the water table for one year.

The next phase in the park will include implementing the recommendations of the Bosque action plan including closing many trails, building some others, and constructing rustic picnic areas near bridges for public use. Handicapped accessible fishing piers and boat/canoe launch areas are also planned. There are many challenges facing the Park. The Middle Rio Grande Conservancy District is looking to expand its revenue base and would like to see an income stream from the park or the City for use of the area. They have indicated that they will refuse to approve the Bosque Action Plan until this issue is resolved.

Some Major Issues

A bill was introduced in the 1993 N.M. Legislature to repeal the Rio Grande Valley State Park Act. If successful, management will cease, and the area will revert to pre-park conditions. Fire and exotic species continue to make inroads on the natural communities. This combined with the lack of cottonwood reproduction threatens to change the character of the riparian forest. Management solutions will be expensive to implement.

A "31 Flavors" of recreation mentality provide constant pressure and management challenges. Mountain bicycles, hovercraft, canoe liveries, horse concessions, rubber duck race benefits, and hot air ballooning have all been proposed or exist in the park. One politician suggested that the river be dredged so that "riverboats" could be used as a tourist attraction.

In addition to the challenges, however, many opportunities exist. Senator Dominici's Bosque Initiative Steering Committee recognizes the success of Rio Grande Valley State Park, and considers it a model for protecting the natural processes of the River in other areas. This effort could address such issues as instream flow and watershed management which are beyond the boundaries and jurisdiction of Rio Grande Valley State Park. It could also result in more Federal support and resources for restoring, rather than controlling the River.

The Corps of Engineers is charged with establishing 75 acres of wetlands in conjunction with a levee upgrade project in the Park. The borrow pit lake/marsh concept is favored, and has the promise of adding greatly to the diversification of ecosystems and wildlife. These areas could provide habitat to threatened or endangered species such as the willow Flycatcher, meadow jumping Mouse, and cotton rat as well as numerous waterfowl and marsh wildlife. The River and Bosque comprise a 6,000 acre oasis running through the heart of a growing city. Now, as in years to come, Rio Grande Valley State Park is a refuge for both people and wildlife.

The Boulder Open Space Program

Delani Wheeler

Background

Boulder, Colorado, is a small city of approximately 90,000 people in the eastern foothills of the Rocky Mountains. It is crossed by two creeks and ten streams. In 1986, the City opened the Boulder Creek Trail which now meanders through the riparian zone from Boulder Canyon over six miles to the eastern city limits. The paved trail carries over 4000 users on a typical sunny day and is crowded with bicyclists, runners, roller bladers, strollers and dog walkers of all ages and abilities. It is one of Boulder's most popular recreational assets and carries a substantial number of commuting bicyclists as well. Improvements have been made to fish habitat but most of the wildlife diversity along Boulder's largest creek has been lost.

In 1990, the City adopted a Tributary Greenways plan which was intended to address all functions of the riparian corridors including wildlife values, water quality, flood carrying capacity and, where appropriate, trails. Because of the popularity of the Boulder Creek Trail, most of the emphasis of the Tributary Greenways program has been focused on trails development, with other aspects such as instream habitat improvement coming as an adjunct to this. Now citizens are becoming concerned about the cumulative impacts of the construction and use on the remaining wildlife in the valley. It is anticipated that these concerns will be addressed in a variety of ways through the public forum later this year.

Presentation

La tierra es su madre, la aqua es la sangre - the earth is your mother, the water is her blood.

We in the arid west are acutely aware of the importance of water to life. Our narrow riparian corridors have, for millennia, provided for storm water flow, wetlands and aquifer recharge, habitat diversity and an abundance of wildlife: from the fish that live in the water to the birds and mammals which feed and breed in the adjacent habitat.

Within the past 100 years the impacts of human use on these areas has escalated. We have diverted water out of our streams for agriculture, mining, industry and urbanization. We have channelized long reaches in an elusive pursuit of engineered floodway protection, we have dredged productive sandbars and riverbanks to remove gravel and precious metals, we have built our cities across the floodplains. Our challenge in this decade is to begin to properly manage and restore what is left of the riparian habitat in this region.

Boulder represents a microcosm of Colorado's eastern slope. Our planning area is bisected by creeks and streams, with Open Space and Mountain Parks systems around the periphery of the valley, and streams intersecting it. While the riparian habitat

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represents only a small percentage of our land areas, it carries a majority of our species diversity.

In spite of past incursions into these areas by development, many habitat-dependent wildlife species have survived along these narrowing corridors. In the rural areas, species such as bobolinks and herons still breed. Even in the city, streams flowing through back yards and back lots support a diverse abundance of wildlife.

"La tierra es su madre, la aqua es la sangre - the earth is your mother, the water is her blood."

Until recently these areas have been impractical for urban development because of the risk of frequent flooding and the expense of filling. However, in recent years the desire for outdoor recreation and attractive bicycle commuting has focused human intrusion further into these corridors. These recreational activities include walking, biking, jogging and aquatic sports - all very socially desirable activities. The problem we see as land managers is that intensified human use of riparian areas consumes almost all of the remaining wildlife values of the stream corridor. Only a few of the most adaptive species will remain and even their breeding habitat is affected. Instream improvements can create habitat for game fish, but access for fishing further degrades the stream banks. Seasonal aquatic sports provide excitement and challenge to individuals and seasonal celebrations attract large crowds. The Boulder Creek trail was opened eight years ago. With over 4000 human trips per day, as well as numerous dogs, even human aesthetic and natural requirements are used up and our children can no longer experience a natural setting.

The Boulder Creek trail is well known nationally and even internationally, but this blessing is also a curse. Its popularity has created a desire by many people for even more trails along its tributaries. Creating trails along the tributaries to Boulder Creek will further diminish the space for wildlife in the valley.

Although Boulder Creek used to be the major support for riparian wildlife diversity in the valley, loss of this habitat has elevated the importance of the remaining habitat along its tributaries by several fold.

Many in our community now wish to step back and assess the potential of our remaining undeveloped riparian corridors before more trails are built. They want to look at alternatives for trail location and evaluate the long term system wide impacts of trails use in the riparian areas.

As we approach the next century we must recognize and protect the importance of other species to our own survival. This is not just for the survival of an individual plant or animal, but also for the protection of the whole fabric of our region, so that we and our children can know and protect the natural systems that have sustained the earth for over a billion years.

Closing Thought

Communities should look very closely at all aspects of the functions and needs of their riparian corridors and discuss the long- term cumulative impacts of various use and preservation options before embarking on a major program to change the structure of these corridors. Once this analysis is complete, the community can make informed decisions about how to manage these precious community assets.

CHAPTER SIX

SCIENCE AND DECISION MAKING

The Role of the Scientist

"Say you are in the country; in some high land of lakes. Take almost any path you please, and ten to one it carries you down in a dale, and leaves you there by a pool in the stream. There is magic in it. Let the most absent-minded of men be plunged in his deepest reveries - stand that man on his legs, set his feet a-going, and he will infallibly lead you to water, if water there be in all that region. Should you ever be athirst in the great American desert, try this experiment, if you caravan happen to be supplied with a metaphysical professor. Yes, as everyone knows, mediation and water are wedded forever."

Herman Melville in Moby Dick

Integrating Science and Decision Making

Duncan Patten

Introduction

The use of science in national decision making goes back more than a century. In March 1863, the National Academy of Sciences was chartered in an Act of Incorporation passed by Congress and signed by Abraham Lincoln. The Academy was to be called upon to serve as an official adviser, upon request, to the federal government on any question of science or technology. The world has become more complex and scientific information has increased exponentially since 1863, but does this guarantee that we will increase our use of scientific information as we try to come to grips with important issues, many environmental in nature?

The decision making system in this country and the rest of the world has become politicized. Decisions are not necessarily made because they are scientifically correct, but rather because they are politically correct.

The public reads the paper and assumes that most decisions made by congress and federal or state agencies related to science are based on scientific information. For example, the Food and Drug Administration requires hundreds of thousands of dollars of tests before a drug can be sold to the public. Engineering standards must be met before bridges or dams are constructed. But are these tests or standards applied in the environmental arena when decisions are made?

We've seen a gradual evolution in the use of scientific information, either directly through application of data to decision making, or through use of information in regulatory actions. If we look back to World War II and the period shortly following, we often find a total disregard for environmental consequences of our actions. Regardless of whether this was for lack of information or disregard for data that would have warned us of environmental damage, activities went ahead. For example, tank training during the war left long-term scars in the desert, scars that could have been predicted if existing scientific information had been used. Did we want to know the impacts of our actions or did we use national security and the economy as justification for our actions, excuses still used today? Until the 1960s, it appears that we hid behind a false screen of ignorance to allow environmentally degrading development to take place.

It is unlikely that there was a total void of scientific information to guide decisions that had potential environmental impacts before the National Environmental Policy Act (NEPA) was passed in 1969. We knew much of our ecological heritage was at risk. For example, a group of ecologists in the 1920s established an ecosystem protection committee within the Ecological Society of America because they realized through their research that the rapid expansion of urbanization and

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the infrastructure of America was threatening remaining pristine areas. This group eventually became The Nature Conservancy in 1951.

Use of science in decision making, although acknowledged, was not commonplace. For example, from the 1950s to 1990s a series of "blue ribbon" committees has attempted to convince the National Park Service to improve its research program and use sound scientific information in management decisions. Only recently, following another report from the National Academy of Sciences (Risser et al. 1992), have these recommendations been taken seriously. It is this lack of use of scientific data or the scientific method in decision making that stimulated creation of NEPA, a regulatory statute that requires consideration of best available information in evaluating actions that might have environmental impacts.

Originally, NEPA emphasized use of scientific information in evaluating impacts. Developers were required to select alternatives to their proposed projects and determine levels of ecological impact for each alternative, both short-term and long-term. Socio-economic impacts were also to be considered. Often information was not available for these evaluations and "new" data were developed through research or literature searches. Seldom, however, were projects turned down. NEPA was not structured for easy denial of an action. Also, in most cases, alternatives to the proposed action were demonstrated to have greater detrimental impacts. This became especially true in the 1980s as socio-economic consequences were considered more significant than ecological consequences. Dollars became the currency for weighing decisions. Development of non-use value economics was in its infancy and the numbers developed by this discipline were unacceptable to resource management agencies.

An example of how science might have been used in decision making in the Southwest can be found in the decision on building Orme Dam at the confluence of the Salt and Verde rivers in Arizona in the 1970s. Orme Dam, originally part of the larger Central Arizona Project and therefore first considered under the CAP NEPA process, was to be primarily a flood control dam. The impoundment behind the dam would be a shallow lake with a widely fluctuating surface level. It would inundate one of the last stands of desert riparian forests in Arizona and flood much of the Fort McDowell Indian Reservation as well as one of the prime river recreation areas for Phoenix residents.

On the other hand, it was claimed the dam would create an important recreational lake that would bring money to the Indians. This ignored the large fluctuations in level and exposure of a half mile of silt laden shore line when the lake was down. Primarily, the dam was to prevent millions of dollars of damage to the downstream developments in the floodplain. There was scientific evidence, ecological and geological, to suggest that the dam should not be constructed. The prevention of socio-economic losses in the Phoenix valley strongly favored building the dam. The decision to not construct the dam was not primarily based, however, on either of the above, but on consideration of social responsibility and emotionalism. The Fort McDowell and Salt River Indian tribes did not want the dam.

About this same time, either through misunderstanding of the role of riparian vegetation or disregard for scientific information, Salt River Project decided to increase flows in the Verde River in Arizona through removal of cottonwoods and other riparian trees along the river margin. The reduction of evapotranspiration resulting from tree removal was to increase stream flow. The ultimate outcome of this decision based on little scientific evaluation was siltation of the river bed, reduction in spawning surfaces and aquatic food sources, and little or no increase in stream flow.

Case Studies

There are many recent examples of integrating science into decision making, thus we must be optimistic that this is a trend. But many of these examples still are based on regulations and requirements rather than on a desire to do the right or best thing. I will describe three cases where the use of scientific information was paramount in the decision to take action. These examples relate to riparian and aquatic ecosystems, one including small streams and a lake in the Mono Lake Basin of the eastern Sierra Nevada, another the river corridor in the Grand Canyon, and the third a riparian mesquite bosque in southern Arizona.

Mono Basin Ecosystem

In the 1984 California Wilderness Act the U.S.D.A. Forest Service received the area around Mono Lake as a National Scenic Area. With the designation of the scenic area, Congress also requested the National Academy of Sciences/National Research Council (NAS/NRC) to study the effects of a declining lake level on the lake ecosystem, a decline caused by water export from the basin's streams to Los Angeles. The Forest Service took advantage of this assignment to develop a management plan for the Scenic Area, to be based in part on the NAS/NRC study. Coincidental with the NAS study, the California Fish and Game Department initiated a study of the effects of withdrawals of water from the Mono Basin on the Mono Lake ecosystem and the water economics of Los Angeles. As a result, the Forest Service had two documents (Patten, et al. 1987, Botkin, et al. 1988) to use in establishing lake levels and concomitant stream flows as part of its management plan.

The NAS/NRC study (Patten et al 1987) reviewed all of the literature, interviewed scientists who had studied in the basin, developed its own hydrological models and did limited groundwater studies. The Fish and Game study group (Botkin et al 1988) supported the completion of a series of studies in the Mono Basin and then developed an integrated interpretation of the studies. The Patten and Botkin committees came to essentially the same conclusions about the ecological consequences of the declining lake level, what lake level should be maintained and how that level should be maintained through return of discharges in the basin's streams, many of which had been dewatered for extended periods of time.

To summarize some of these findings, the committees found that a continued decline in the lake from its 1986 elevation of 6380 ft to below 6372 ft would cause one of the islands which is a primary nesting ground for California Gulls to become a peninsula allowing coyotes from the mainland to raid gull nests and reduce the gull population. Also, as the lake level dropped, actually a decline in lake volume, the salinity level of the lake would reach a threshold at about lake elevation 6360 ft when it would become lethal to brine shrimp and brine flies. These invertebrates are the primary food source for the myriad birds, including Grebes and Phalaropes that use the lake as a molting and fattening stop prior to long range winter migrations to the southern hemisphere. Reduction in lake level also would cause continued damage to the exposed tufa towers, columns of calcium carbonate formed by springs beneath the original lake surface.

The streams that once supported brown trout were often dry following diversion of water to Los Angeles which began in 1941. But when water was released into the streams following the wet winter of 1983, the trout population "reappeared" and legal challenges by California Trout Unlimited required Los Angeles Department of Water and Power to continue discharging water into the streams, especially Rush Creek. This continuous flow not only maintained the trout but began to revitalize the riparian vegetation (Stromberg and Patten 1989).

The emphasis of the two Mono Basin study committees was on the declining lake, but the consequences of their studies, especially the NAS/NRC study, was to indicate levels of discharge through the feeder streams to Mono Lake that would maintain various lake levels. Through interpretation of the NAS/NRC data and direct recommendation of the Botkin et al (1988) report, the Forest Service selected about 6380-6382 ft as the maintenance elevation of Mono Lake, recognizing a natural fluctuation around this level. The Mono Basin Scenic Area management plan (Inyo National Forest 1989) also recognized that recovery of the riparian vegetation would be a consequence of instream flows and removal of grazing, a point brought out by other studies.

The Forest Service used the strength of the scientific reports to establish its management plan. There have been continued court challenges to this plan, but the management guidelines have been upheld. There is also an ongoing Environmental Impact Report study (California's equivalent to the federal EIS) to determine how much water Los Angeles can export from the Mono Basin without significantly affecting the basin's rivers, Mono Lake, and the upper Owen River valley which has been used as the "upper end" of the Los Angeles aqueduct. In this case, the California Water Board will use this information to determine the amount of diversion of the water resource and the level of maintenance of riparian ecosystems.

Grand Canyon and Glen Canyon Dam

In 1963 the gates of Glen Canyon Dam were closed and the river corridor through Grand Canyon would never be the same. For the next 20 years, the widely fluctuating, cool clear water flowing through Glen, Marble and Grand canyons altered the riparian system from a scoured, sediment laden river margin with drought tolerant riparian species along the high water mark to a dense stand of tamarix and willow near the river. Some positive benefits of this change included an increase in diversity of bird species and the establishment of a blue ribbon trout fishery below the dam. Unfortunately, concomitant with these changes was the loss of five of the seven native fish species, loss of raised sediment deposits (beaches), and gradual erosion of archaeological sites (National Research Council 1991).

While the Bureau of Reclamation was studying the impacts of Glen Canyon Dam operations on the downstream ecosystem which were initiated in 1982 (U.S.D.I. 1988), the Secretary of the Interior announced in 1989 that the Bureau would lead a multiagency team to write an Environmental Impact Statement on alternative dam operations. The EIS was required because establishing new dam operations that protected the downstream environment while considering hydroelectric power demands was a major "federal action."

The first few years of the Glen Canyon Environmental Studies (U.S.D.I. 1988) showed that dam operations were having major impacts on the downstream ecosystem. Continued Glen Canyon studies reinforced this conclusion. Writing the EIS apparently was taking too much time to satisfy some of the federal agencies, Native American tribes, and environmental groups. The consequence of this impatience was establishment of "interim flows" to occur between the time controlled research flows ended in July 1991 and the EIS decision was made in late 1994. How were these interim flows determined?

The water and power community thought that interim flows should be changed little from "normal operations." Lobbying of the Commissioner of the Bureau of Reclamation and the Secretary of the Interior by water/power interests appeared to sway the thinking. There was also intensive lobbying by environmental and other interest groups to establish an interim baseflow for the river, that is, no daily fluctuations during interim flows.

During this "lobbying period," a group of scientists familiar with the physical and ecological processes within the canyon met. They were to consider the existing knowledge base and, along with their long-term expert experiences in the canyon, recommend interim operations of the dam that would both minimize downstream ecological degradation during the EIS preparation period while still permitting some fluctuations for hydropower response.

The scientific group considered sediment budgets and storage, native and non-native fishes, riparian habitat, archaeological and historical sites, and recreation. Primary consideration was on the downstream ecosystem thus power economics was not a major component of the discussion. The existing data indicated that as maximum dam discharge rose above 22,000 cfs, sediment losses from the system increased exponentially. Rapid daily fluctuations with a wide range between maximum and minimum discharges appeared to cause increasing losses of sediment from bars and beaches, while stranding trout, desiccating spawning beds and flushing young humpback chub from the warm waters of the Little Colorado River into the cold water mainstem. This evidence, along with impacts on recreation and archaeological sites lead to a conservative recommendation of holding maximum and minimum discharges to 20,000 cfs and 5,000 cfs, while ramping rates (i.e., hourly changes in discharge) were reduced to about 1,500 cfs/hr depending on up or down ramping.

As part of an interim flow development process established by the Bureau of Reclamation after the scientific group first met, these recommendations were discussed by all of the EIS cooperating agencies. They were adopted by most as the baseline for interim flows. Water and power interests did not agree and continued a strong lobby for their recommendation of little change. Faced with lobbying pressures and a scientific recommendation, the Commissioner of the Bureau recommended interim operations of Glen Canyon Dam closely aligned with the scientific recommendation.

It is interesting to note that additional research since the interim flow decision suggests a possible need for changes in the scientific recommendation.

Tanque Verde Creek

Tanque Verde Creek is an ephemeral Sonoran Desert stream that flows through Tucson, Arizona. Extensive mesquite bosques (woodlands) cover the floodplain terrace, mesquite being dependent on shallow groundwater recharged by periodic stream flows. In the 1980s the City of Tucson increased groundwater withdrawal from wells along the Tanque Verde stream channel. There was evidence that groundwater withdrawal was affecting the mesquite population but this had not been proven. A study of the response of mesquite populations near the wells measured plant water potential, leaflet size, leaflet number, canopy height and live and dead vegetation volume (Stromberg et al. 1992). This study statistically related the effects of groundwater depression at the wells on these parameters. The complex ecophysiological data and statistical analyses, however, were not readily understood by Tucson City Council members or the Tucson Water Department.

As the Stromberg et al (1992) study was being completed, the scientific team wrote a short document on the "Effects of Groundwater Pumping on the Tanque Verde Creek Mesquite Bosque," presenting their results in terms that made the negative effects of groundwater pumping understandable to decision makers. One of the scientists also demonstrated these negative impacts to the Tucson City Council in a clear, non-scientific presentation. Based on the short interpretive document and the presentation, the Council decided to reduce the amount of groundwater withdrawal along Tanque Verde Creek.

Conclusions

Evidence in these cases leads to the conclusion that it is not the quantity of available scientific information that leads to integration of science into decision making, but how useful decision makers perceive the information. In the Mono Lake and Glen Canyon cases, extensive amounts of scientific information were "filtered" by highly qualified scientific groups and presented in an understandable format. In the Tanque Verde case, limited but very technical information was "reduced" to a level understood by the non-scientific community. It is development of general documents or presentations by credible scientists that make technical information acceptable. If the "filtering" process is accomplished by a multidisciplinary group of scientists, challenges to use of the information in decision making are limited. In addition to information reduction and interpretation, integration of science and decision making takes time, willingness of decision makers to listen, and recognition that science continues to refine its information, necessitating some form of adaptive management. Without these components, emotionalism, lobbying, and non-factual public perceptions will be the "data base" used by those who decide the fate of our natural resources and heritage, including our western riparian ecosystems.

CHAPTER SEVEN
THE POSTER SESSION

Restoration Projects
Technical and Scientific Studies
Management Programs

ESTA TIERRA

Esta tierra es mi madre
Esta tierra es mi padre,
Esta tierra es mi mundo,
enel dia y la noch es lo mismo
en invierno y verano para mi...

This land is home - this land is all I know,
This land is all I'll ever need.

Si - es seco --- Si - no hay nada para cultivar,
pero, mira! aqui esta mi casa,
Y mira, aqui esta mi marido ye mis ninos,
Creciendo, estan bien, y estan sano y seguro.

My family lives here, and life is good.

Donde esta el mundo tuyo?
donde vive tu corazon?
Que sopn las cosas que tuquiered ...
Son simples y fuertes como las montanas?
Son claras como las estrellas en el cielo?

Where is your heart - where are the things you love?
Are they as strong as these dry hills?

Aqui is donde vivo,
Es donde voy a morir,
En este lugar travajo,
Comprendo sus humores y estaciones,
Conozco el viento y aves de la tierra.

I love these hills - I watch their seasons come and go -
and all that lives upon the land.

Si - es seco ... Si - no hay nada para cultivar,
Pero vivir para mis hijos,
Cuando yo muera y no este aqui.
La tierra corazon y alma descanso de me.

This land will hold my heart for it is home.

©Rita Cantu

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A Comprehensive Approach to Restoring Habitat Conditions Needed to Protect Threatened Salmon Species in a Severely Degraded River - The Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan

Anderson, J.W., Beschta, R.L., Boehne, P.L., Bryson, D., Gill, R., Howes, S., McIntosh, B.A., Purser, M.D., Rhodes, J.J., and Zakel, J.

The Grande Ronde River occupies the northeastern corner of Oregon (Figure 1) and is a tributary to the Snake River in the Columbia River basin and provides habitat for spring chinook salmon and steelhead. Most of the 3,950 square mile watershed of Upper Grande Ronde River is part of the Wallowa-Whitman National Forest (Figure 1) with some interspersed private land.

The Upper Grande Ronde River Plan (UGRRP) was developed in response to several environmental and social issues. Spring chinook populations have declined precipitously over the past three decades (Figure 2). A 1989 flood following a fire killed many of the adult and juvenile steelhead and salmon using the river at the time, further reducing the low salmon population. Severely degraded habitat conditions in the Upper Grande Ronde have contributed to the decline in salmon populations by reducing the survival and production of salmon in natal habitat. Water temperatures violate Oregon's water temperature standard. Under the Wallowa-Whitman Forest Plan, extensive timber harvest and road construction was proposed for the basin over the next ten years. These activities, if implemented, promise to exacerbate the poor condition of salmon habitat and have been a source of conflict between fishery co-managers and the land managers of the Wallowa-Whitman National Forest.

Four Columbia Basin Indian Tribes have federally secured treaty rights to take those harvestable salmon from the Upper Grande Ronde River that pass the Tribes' usual and accustomed fishing places. These four tribes are the Umatilla, the Nez Perce, the Warm Springs, and the Yakima. The rebuilding of Columbia River salmon stocks is mandated by federal legislation, as well as obligations under treaties with the Tribes and an international treaty with Canada. Subsequent to the development of the UGRRP, the National Marine Fisheries Service included spring chinook salmon in the Grande Ronde River as a component of the Snake River salmon species listed as "threatened" species under the Endangered Species Act. Although spring chinook salmon are a primary concern, the UGRRP is also aimed at protecting and restoring summer steelhead habitat.

The Upper Grande Ronde River has undergone severe sedimentation caused by the cumulative effects of high levels of erosion generated from road construction, mining, logging, grazing, and wildfire.

While all of these activities have increased sediment delivery to the streams, roads typically cause the greatest increases in sediment delivery. Road density within the basin is extremely high, 4 mi/mi^2 overall and 7 mi/mi^2 outside of roadless areas. Most of the roads in the basin have been built to low standards and have high erosion rates. The loss of riparian vegetation caused by grazing,

The authors of this paper work for the Columbia River Inter-Tribal Fish Commission in Portland, Oregon. The poster was presented at the conference by Jon Rhodes.

logging, and road construction has also decreased bank stability, increased channel erosion, and decreased sediment interception by vegetation. Riparian vegetation is the most effective means of intercepting eroded sediment before it is introduced into streams (Megahan 1984; Heede et al. 1988). Over the past 50 years, the amount of fine sediment in the channel substrate has increased (McIntosh 1991). The high sediment loads generated by land-disturbing activities are a probable cause of the increases, because increased sediment delivery typically increases the amount of fine sediment in channel substrate (Diplas 1991). Fine sediment in channel substrate reduces fish production and salmon survival by reducing rearing habitat or reducing the survival-to-emergence of incubating salmon (Alexander and Hansen, 1986; Chapman and McLeod 1987). Fine sediment is now at levels which severely impair salmon survival and production. Improvement in fine sediment levels in fish habitat is contingent on reducing sediment loads (Platts et al. 1989; Bohn and Megahan 1991).

Much of the logging, grazing, mining and road construction has been in riparian zones. This has reduced riparian vegetation throughout the watershed. It is estimated that stream shading averages about 72% under natural conditions; in contrast, the Upper Grande Ronde is estimated to have an average stream shading of about 28%. This significant loss of stream shading has contributed to high summer water tempertures that now commonly exceed 68 ° F. Water temperatures in excess of 68° F impair salmon growth and may be indirectly lethal to salmon (Theurer et al. 1985); they also exceed Oregon's state water temperature standard.

The loss of riparian vegetation has also reduced inputs of large woody debris (LWD) that are vital for pool formation and fish production. Fish production decreases with the loss of LWD and large pools. (Fausch and Northcote 1991). Recent research indicates that the Grande Ronde River and tributaries have lost about 70% of the large pool volume over the past 50 years (McIntosh 1992). The loss of pools is attributable to both the loss of LWD (Fausch and Northcote 1991) and high levels of sediment delivery (Lyons and Beschta 1983; Alexander and Hansen 1986) caused by land disturbance at the watershed scale. Elevated sediment delivery also tends to increase the width to depth ratio of stream cross-sections (Lyons and Beschta 1983). Channel morphology in lower reaches of the

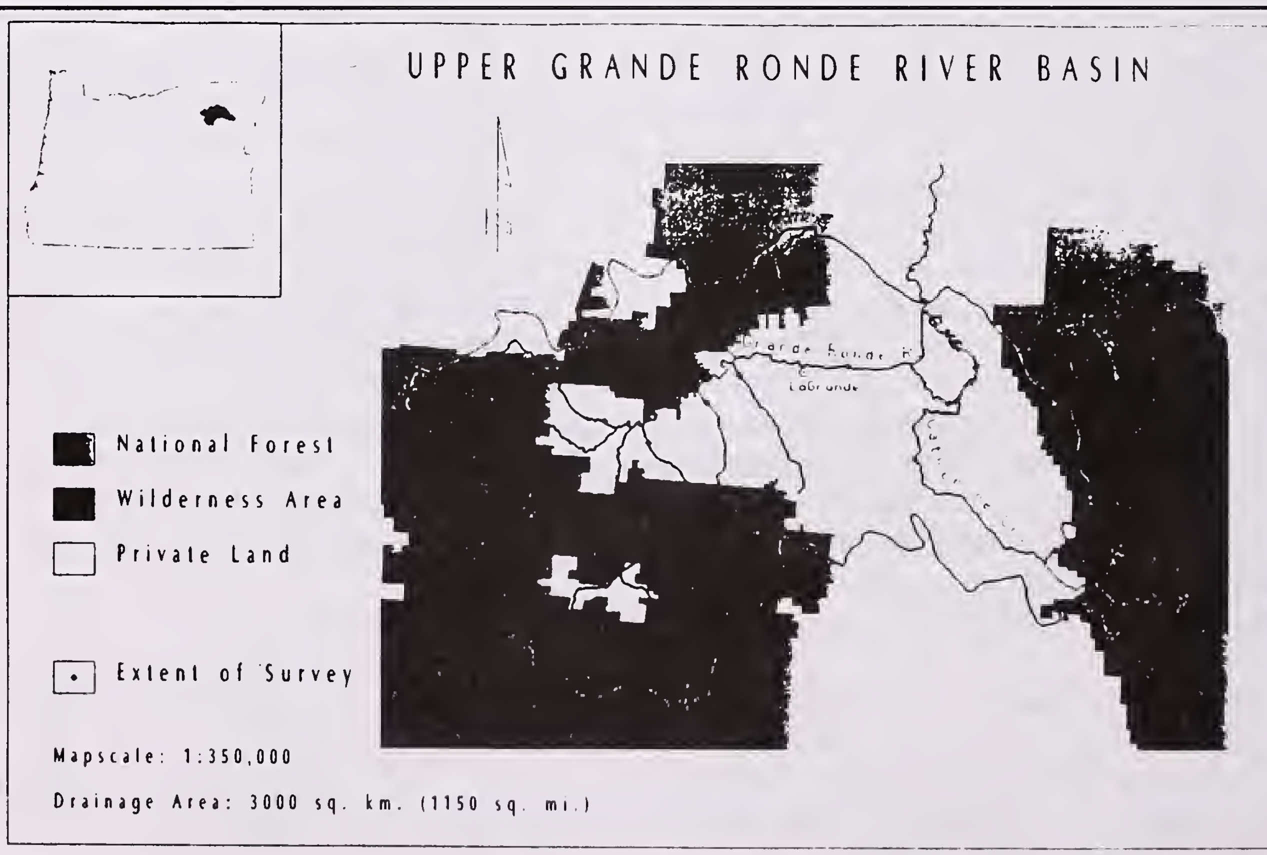

Figure 1. Location of the Upper Grande Ronde River Basin.

Upper Grande Ronde exhibits a high width to depth ratio which is exacerbating problems with seasonal temperature extremes.

The spring chinook salmon and steelhead stocks in the basin undergo extremely high mortality during downstream passage through the Columbia River hydroelectric system; this mortality is probably the main factor responsible for the decline of chinook salmon populations in the Snake River basin. However, the best available scientific information indicates that the changes in the character of the habitat caused by land-use activities have significantly reduced salmon and steelhead survival in the natal habitat.

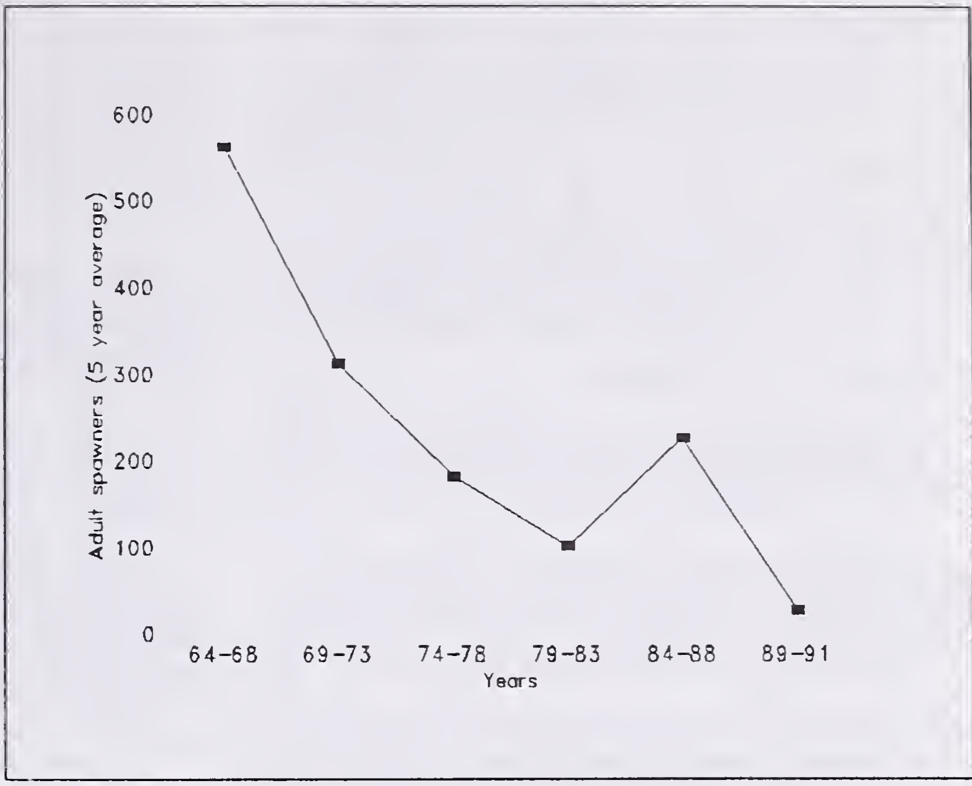

Figure 2. Trends in counts of adult spring chinook salmon returning to spawn in the Upper Grande Ronde.

While downstream passage mortality must be reduced if the full benefits of habitat restoration are to be realized, the existing conditions of water quality and riparian areas in the Grande Ronde River increases the severity of the threat of extirpation of spring chinook from the Upper Grande Ronde. Habitat damage takes years to reverse. Even under proper management, the recovery of riparian areas, fish habitat, and water quality may require 25-200 years (Gregory and Ashkenas 1990). However, it will never begin to recover if protection and restoration measures are not implemented. It is essential that freshwater survival rates of these fish be returned to the highest possible level as rapidly as possible, in order to alleviate the biologically perilous status of the basin's salmon.

The UGRRP was developed through a consensus process among multi-disciplinary personnel from agencies and organizations with fish habitat expertise and management responsibilities, including the Confederated Tribes of the Umatilla Indian Reservation, the Nez Perce Tribe, Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Oregon State University, the USFS Pacific Northwest Research Station, and the Wallowa-Whitman National Forest.

The UGRRP was developed in steps. First, the specific condition of biological habitat features required for salmon and steelhead survival were identified using the best available scientific information and data. Second, quantitative performance standards were established for these habitat features. Third, the existing status of the essential habitat features were assessed. Fourth, the cause of existing conditions was determined using the best data and scientific information available. Fifth, some protection measures were set as performance standards for land-use activities to ensure that progress was made toward attainment of habitat standards by arresting and reversing the causes of habitat degradation. Sixth, management guidelines were established as a means to ultimately achieve the habitat standards. An overarching goal was to create a habitat restoration plan that stresses accountability and has measurable "yardsticks" for measuring the effectiveness of restoration.

The primary goals of the UGRRP are to reduce sediment loads and summer water temperatures, and re-establish natural loading of LWD to the streams. Riparian protection and rehabilitation strategies provide a means to achieve these goals. However, the UGRRP also contains watershed level measures aimed at reducing the existing high sediment loads caused by past activities throughout the watershed.

The following were set as quantitative habitat standards in the UGRRP:

1) Maintain surface fines and fines by depth in channel substrate at less than 20% in salmon spawning habitat.

2) Achieve a decreasing trend in maximum summer water temperatures. Maximum daily water temperatures should be less than 61 degrees F in small subwatersheds. In streams greater than sixth order, maximum summer water temperatures should be less than 65 degrees F.

3) The watershed average for LWD should be least 20 pieces of LWD per 1000 feet of stream. LWD pieces should be greater than 1 foot in diameter and have minimum length of 35 feet; 80% of the pieces should be longer than 35 feet and exceed 1.75 feet in diameter.

4) In meadow ecosystem riparian zones, at least 80% of banks should be covered with shrubs, of which, at least 50% should be more than 8 feet tall

5) Achieve an increasing trend in pool volume and depth.

6) Width-to-depth ratios in channel cross sections should be less than 10.

7) No removal of forest vegetation within buffer zones. Minimum width of buffer zones set at 75 feet times Strahler stream order from edge of floodplain on both sides of stream. On streams greater than fourth order, 300 feet from the edges of floodplain is the minimum buffer width.

8) Roadless areas remain roadless until there is a documented improving trend in downstream habitat. The small fragments of roadless areas in the watershed serve as the anchor points for restoring riparian vegetation, water quality, and fish habitat.

The following management guidelines were developed to progress towards meeting the performance standards:

1) Mandatory pre-project monitoring of parameters set as performance standards.

2) No implementation or continuation of activities that could forestall an improving trend in habitat parameters in watersheds where performance standards are not met.

3) Suspension of riparian grazing in watersheds that do not meet performance standards. Rapid revision of grazing allotments plans with focus on the recovery of riparian vegetation.

4) Net reduction in sediment delivery as part of all projects in watersheds where fine sediment standards are not met. Until an improving trend in downstream substrate conditions is documented through monitoring for three consecutive years, any land-disturbing activity that produces sediment will be preceded by rehabilitation activities which actively reduce existing sediment loading by about three times the sediment delivery expected from the land-disturbing activity.

5) Active program of obliteration or rehabilitation of roads; roads in riparian zones have the highest priority. Upgrade erosion control on all roads which cannot be obliterated for management purposes. The construction of roads paralleling streams is prohibited. Avoid riparian road crossings.

6) Annual monitoring of performance standard parameters in representative reaches for analysis of trends and effectiveness. The data will also be used to adapt the UGRRP and its implementation over time.

7) Long-term validation monitoring of fish populations and fish habitat interactions.

The UGRRP also identifies research information needed to refine the UGRRP provisions over time. Several studies are currently underway, including surveys of habitat conditions by the Wallowa- Whitman National Forest and the Oregon Department of Fish and Wildlife, water temperature monitoring and model validation by Oregon State University, sediment transport monitoring model validation by Oregon State University, and monitoring of inter-annual sediment deposition in spawning habitat by the Confederated Tribes of the Umatilla Indian Reservation and the Columbia River Inter-Tribal Fish Commission. The information garnered from these monitoring and research efforts should be useful not only to the restoration of the Upper Grande Ronde, but also to the many equally degraded watersheds in the Columbia basin.

The UGRRP is presently being used as general foundation for the development of the Wallowa-Whitman's Conservation Strategy for Snake River Salmon under the Endangered Species Act. This Conservation Strategy is still in the public involvement process. Although the UGRRP has not been formally adopted, it provides a comprehensive approach to habitat restoration that is biologically sound, measurable and adaptive. Salmon habitat throughout much of the Columbia River has undergone similar degradation by similar causes as in the Grande Ronde. The UGRRP is broadly applicable to these watersheds.

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A Demonstration of Biogeomorphic Techniques to Restore a Segment of the East Fork of the Sevier River, Garfield County, Utah

Chad Gourley and Nancy Lillquist

Introduction

The East Fork of the Sevier River, located in Garfield County in southwestern Utah, flows north from forested headwaters on the Dixie National Forest near Bryce National Park to its confluence with the Sevier River at Junction, Utah. Through most of John's Valley (above the project area), the river is dry most of the year due to the operation of Tropic Reservoir. Water stored in Tropic Reservoir is flushed to Otter Creek Reservoir two to three times each year. Spring inflow in lower John's Valley and at Black Canyon (project area) provides perennial flow downstream through agricultural lands near Antimony.

Human activities that have contributed to degradation of the East Fork of the Sevier River include timber harvest in the upper watershed, flow manipulation, livestock grazing throughout the watershed and along the river, road encroachment, and channelization. Problems include bank erosion, downcutting, braiding, increased width, loss of depth, sedimentation, and loss of riparian vegetation. Flood events in 1984 exacerbated channel degradation.

The purpose of the project was to demonstrate the use of biogeomorphic techniques to restore a privately owned 2 km segment of the East Fork of the Sevier River. If successful, these techniques could be employed by landowners and resource managers on streams throughout the region.

Project Design and Implementation

Our hypothesis is that human impact has greatly diminished riparian vegetation and has altered the channel morphology. Restoration plans emphasized natural vegetative recovery by excluding livestock, and by reconstructing segments of the channel where excessive braiding and downcutting have occurred. We used hydraulic geometry to create a meandering channel which would closely simulate conditions of dynamic equilibrium. Riparian vegetation was considered essential for erosion reduction and riverine ecology. We believe the newly constructed channel configuration and dimensions are consistent with what would naturally occur, in time, given improved land management. The project was implemented in two phases.

Phase I

A 0.16 km section of braided stream was selected for Phase I of the restoration. The design considered aerial photographs (dating back to the 1940's) to determine historic channel patterns, dimensions and migrations. Channel geometry predicted by empirical relationships (Leopold 1957, 1960, 1964, Rosgen 1985, Williams 1986) were compared to measurements from the field and air photos.

A single, meandering channel was fit

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over the existing multiple channels. We determined factors of hydraulic geometry, including slope, sinuosity, width, depth, meander length and amplitude, and radius of curvature. The new channel (figure 1), was constructed by the landowner in Summer, 1990, using a small bulldozer and backhoe, and local volcanic rock, one to two feet in diameter.

Healthy riparian vegetation was considered critical to stabilize stream banks. The project area was fenced to exclude cattle in summer 1989. Disturbed areas were broadcast seeded in autumn, 1990. During spring 1991, volunteers planted containers of red osier dogwood (*Cornus stonifera)*, western river birch (*Betula occidentalis fontinal*), woods rose (*Rosa woodi*), narrowleaf cottonwood (*Populus angustifolia*), and oakbrush sumac (*Rhus trilobata).*

Phase II

Phase II of the restoration involved restoring a willow-sedge wet meadow by raising the stream base level, and changing channel morphology from an entrenched system lacking sinuosity to a broadly meandering type. A new channel was constructed on an abandoned river terrace. Using an approach similar to Phase I, designers compared field observations and measurements with empirically predicted hydraulic geometry (Fgure 2). The channel was constructed by Garfield County in spring, 1992. Volunteers broadcast seeded disturbed areas in March, and planted bareroot narrowleaf cottonwood (*Populus angustifolia*) in May. Vegetative restoration included cuttings from sand bar willow (*Salix exigua*), and other willow species, plus sedge mats (1 foot square) that were taken from adjacent sites and transplanted to the capillary rise zone of the new channel. The new channel was irrigated throughout summer and autumn, 1992. The river will be diverted into the new channel in June, 1993, allowing two growing seasons for vegetation establishment before being tested by high flows.

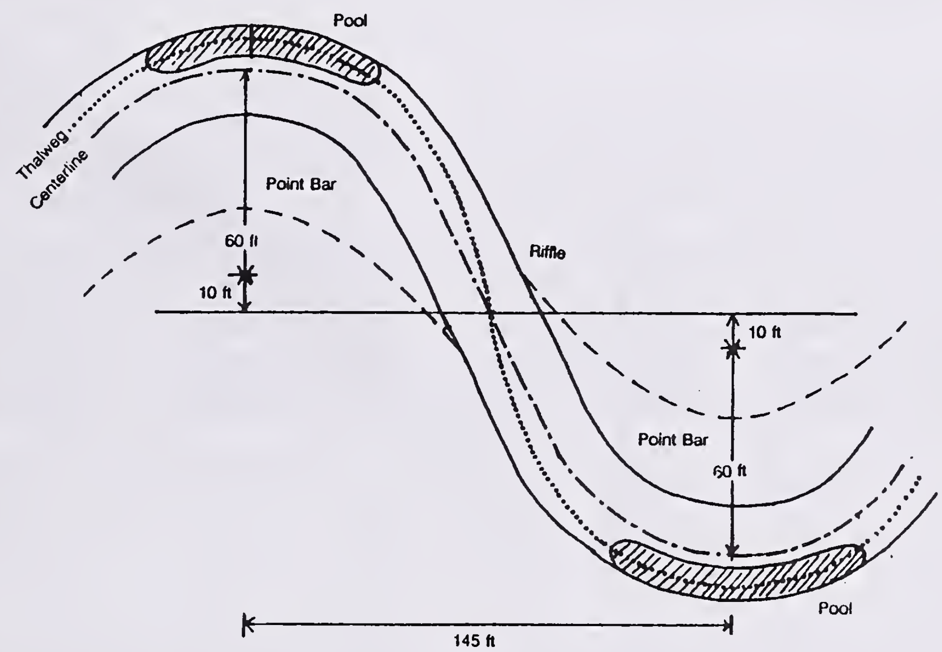

Figure 1 Channel design. East Fork of the Sevier River

Biological and Physical Response

Macroinvertebrate recovery, fish populations, and channel cross-sections were monitored before and after the Phase I construction. Photo points also demonstrate improvement to riparian vegetation, bank stability, and channel conditions.

Macroinvertebrates

Since aquatic organisms respond to their total environment, macroinvertebrates are

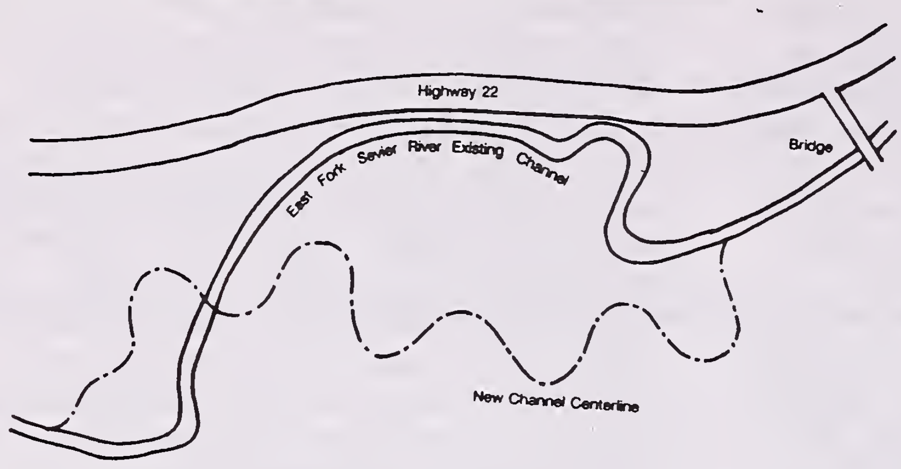

Figure 2. Phase II design plan view. East Fork of the Sevier River.

used to detect environmental changes and to indicate general stream health (Mangum 1991). Macroinvertebrates were collected in 1989 (before construction), 1990 (two months after construction), and 1991 (one year after construction), from three sites, below, within, and above, the construction site using a surber sampler and taking three samples at each site. Samples were analyzed at the U.S. Forest Service Aquatic Ecosystem Analysis Laboratory in Provo, Utah.

As shown in Table 1, the diversity index, standing crop, and number of taxa were severely depressed in 1990, immediately after channel construction. The diversity index and number of taxa had recovered to their pre-construction conditions one year after treatment at the construction site, even as these parameters declined at the control sites above and below the construction site. Clean water taxa were missing from all samples, indicating sediment load may limit fish spawning survival. The low number of shredders observed indicates the riparian condition is fair to poor. Standing crop declined significantly at all stations in both 1990 and 1991, as compared to 1989, but declined most dramatically at the construction site immediately after

Table 1

Macroinvertebrate Analysis, East Fork of the Sevier River.

Date	Location	Diversity Index (DAT) (mean)	Standing Crop g/m² (mean)	Number of Taxa	Biotic Condition Index (BCI)
12/05/89	Below site	6.8	19.9	23	76
	Construction site	7.5	20.4	20	71
	Above site	7.8	21.3	29	74
10/17/90	Below site	7.2	7.3	17	76
	Construction site	1.9	2.0	12	73
	Above site	7.7	10.3	20	68
11/11/91	Below site	7.2	11.1	15	63
	Construction site	7.5	13.7	20	71
	Above site	3.8	9.7	16	68

Scale	DAT	Stand Crop	BCI
Excellent	18-26	4.0-12.0	above 90
Good	11-17	1.6-4.0	80-90
Fair	6-10	0.6-1.5	72-79
Poor	0-5	0.0-0.5	below 72

construction. Standing crop was considered excellent for all sites in all years, (except the construction site was good in 1990), indicating an abundant food source for fish is present. The reconstruction of the stream from a braided to a meandering condition appears to have affected the macroinvertebrate community for less than one year. However, other factors appear to be to causing declines in diversity, standing crop and numbers of taxa at the stations above and below the construction site.

the number of catchable fish (>152 mm) nearly doubled (from 27 to 62 fish). Trout biomass in the reconstructed channel doubled for all sizes (from 43.42 to 94.66 kg/ha) and nearly tripled for catchables (from 33.59 to 92.52 kg/ha). Total trout biomass also increased in the control section (from 110.55 to 130.59 kg/ha) even though their numbers declined (from 180 to 94 total fish, and from 91 to 80 for catchable size fish). Much of the increase in biomass in both sites was due to changes in numbers of large rainbow and cutthroat trout which were almost absent in the 1989 sampling. There was also a substantial

Table 2.

	Population estimates				Biomass Estimates			
	Construction Site		Control Site		Construction Site		Control Site	
	12/5/89	12/4/91	12/5/89	12/4/91	12/5/89	12/4/91	12/5/89	12/4/91
Brown trout >152 mm	27(0.2)	48(1.0)	82(6.0)	72(12.0)	33.59	64.69	87.14	96.31
Brown trout <152 mm	2(0)	8(0)	33(5.9)	8(2.9)	0.46	2.14	7.52	2.12
Cutthroat trout >152 mm	0	13(0)	1(0)	4**	0	23.61	2.42	18.29*
Cutthroat trout <152 mm	89(3.7)	0	28**	0	9.37	0	3.22*	0
Rainbow trout >152 mm	0	1(0)	8(0.6)	4(1.5)	0	4.22	5.17	12.60
Rainbow trout <152 mm	0	0	27**	6(0.8)	0	0	4.78*	1.27
Brook trout >152 mm	0	0	0	0	0	0	0	0
Brook trout <152 mm	0	0	1(0)	0	0	0	0.30	0
Total >152 mm	27(0.2)	62(1.8)	91(6.6)	80**	33.59	92.52	94.73	127.2
Total <152 mm	91(3.7)	8(0)	89**	14(3.7)	9.83	2.14	15.82	3.39
Total All Sizes	118	70	180**	94**	43.42	94.66	110.55	130.59

*Two catch removal estimate not possible. Estimate represents minimum population (total number collected).
**Station sizes at sampling were: Construction site 1989: 528 ft, 0.123 ha
Construction site 1991: 605 ft, 0.120 ha
Control site 1989: 528 ft, 0.113 ha
Control site 1991: 528 ft, 0.113 ha

Fishery

Fish populations in the construction area and in a control section were sampled using a backpack electroshocker in December, 1989 (pre-construction) and 1991 (post-construction) (Table 2).

Total trout population decreased after channel reconstruction (from 118 to 70), but

increase in the numbers and biomass of the larger group of brown trout in the reconstructed section. Cutthroat fry and brown trout fingerling have been stocked each summer, except in 1991, when no cutthroat were stocked. Lack of stocking cutthroat is evident in the sample at both the control and reconstructed sites. The population in the reconstructed channel is still lower than in the control section, but is expected to improve as riparian vegetation becomes established and improves the amount of cover available to fish.

Vegetation

Recovery of riparian vegetation is critical to the stability of the reconstructed stream channel in high flow periods. In addition, riparian vegetation provides cover for fish, and habitat for other wildlife. It also keeps water temperatures lower by shading the channel.

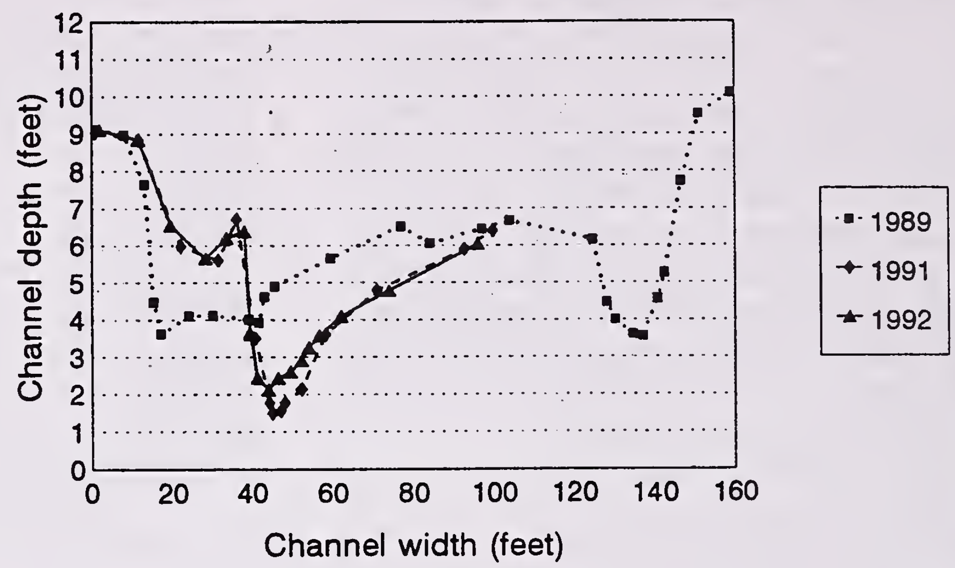

Figure 3. Phase I channel cross-section. East Fork of the Sevier River.

The Phase I construction area was mostly devegetated in 1990. Soils are comprised of sands, gravels and cobbles. Vegetative recolonization has been slow due to lack of fine grained topsoil. Seeding and planting efforts have been successful in places, but the density of vegetation is low. The greatest recovery, throughout the entire project area, is along the channel's edge where silt is deposited, accommodating growth of willow sprouts and aquatic grasses and forbs. Growth of willow from sprouts to sapling and mature plants has been observed. Vegetative recovery has been more rapid outside the construction area. Success of planting, seeding and natural vegetative recovery in Phase II appears promising in the short time since channel reconstruction due to existing fine grained soils and irrigation efforts.

Channel Cross-Sections

Four permanent channel cross-sections were surveyed each fall using a level, tape, and stadia rod to monitor changes in the channel morphology. Figure 3 shows the channel profile before construction (1989) compared to the current meander apex, which is deeper and narrower. Some deposition (1/2 foot) has occurred in the pool since construction.

Conclusions

Management of livestock adjacent to the stream channel has had a positive effect on the East Fork of the Sevier River demonstration area. Willow and aquatic grasses are encroaching into the channel, making it narrower and deeper. Stream banks which were once eroding and vertical are now mostly sloped and have naturally revegetated. Biogeomorphic techniques were successfully employed to restore a single meandering channel in Phase I of the project. Macroinvertebrate populations were only temporarily affected by construction. Fish populations have responded favorably to the changes in channel morphology. Vegetative recovery appears to be slow in areas disturbed by construction in Phase I. It is too early to draw conclusions regarding the success of Phase II. We will continue to monitor biological and physical responses. We anticipate faster vegetative recovery due to finer soils and irrigation capabilities.

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Lessons Learned from Large-Scale Riparian Restoration Projects.

Ellyn Miller Davis and Amy Rucker

Lesson 1: Clearly Define Restoration Goals

Jones & Stokes Associates' restoration ecologists design restoration plans to provide a visually appealing landscape; provide public recreation opportunities; and develop abundant, self-sustaining, and high-quality wildlife habitat.

Large-scale projects often have multiple, conflicting goals, but the project goals must be well defined and prioritized before a restoration plan is designed.

Example Goals:

- Develop high-quality nesting habitat for least Bell's vireo.
- Provide visually appealing landscape for adjacent housing development.
- Ensure long-term protection of habitat.
- Design self-sustaining, low-maintenance habitat.
- Provide public access and interpretive areas.
- Protect sensitive species from disturbance.
- Limit the spread or invasion of exotic pest plants into habitat.
- Manage floodwater from watershed to accommodate 100-year storm event.
- Discourage mosquito breeding conditions.

Priority of Goals:

The restoration goals need to be prioritized to avoid potential future conflicts. For example, if flood control has priority over wildlife habitat in designated areas, vegetation can be removed from these areas to accommodate flood capacity

Lesson 2: Identify Physical Requirements of Target Riparian Habitat

Hydrologic conditions, soil types, exposure, and other physical conditions of the site should be analyzed before designing the restoration plan. Data collected from a detailed site analysis should be the basis for directing an appropriate restoration design.

Example: Creating a Freshwater Tidal Riparian Wetland

Riparian and wetland habitat was created by grading the site so that the hydrology, elevations, and soil conditions were optimum for native vegetation.

The restoration project was designed so that natural establishment and regeneration would occur, allowing the site to develop wildlife habitat values without intensive management.

Ellyn Miller Davis and **Amy Rucker** are restoration ecologists with Jones and Stokes Associates of Sacramento, California and have prepared restoration plans for wetland and riparian habitats and sensitive plant populations.

The design maximized wildlife habitat values by establishing diverse vegetation types on a gradient of elevations ranging from open water to high-terrace riparian.

Lesson 3: Address Multipurpose Needs

Restoration projects often must achieve multiple purposes. Incorporating various management techniques into the restoration plan can dictate project design. The following examples are management scenarios that frequently are incorporated into our restoration designs.

Mosquito Management - Use Water Level Management for Mosquito Control. Sudden changes in water levels disturb the water-plant interface where mosquito larvae live during their aquatic stage. To control unacceptable levels of mosquito larvae, the water level can be raised or lowered at least 6 inches within a 2-day period. Short-duration water level adjustments may be needed two or three times per year to control mosquito populations.

Erosion Control - Establish Riparian Vegetation in Riprap. Wind and wave erosion can seriously threaten the integrity of natural and human-made structures, including levees. Riparian vegetation can be planted in association with riprap bank protection to create a more visually appealing solution that also provides riparian habitat values.

Flood Control - Integrate Detention and Retention Facilities into Restoration Design. Because of the growing concerns regarding flood control and the water quality of stormwater runoff, incorporating solutions to these concerns into restoration plans is important.

Recreation - Integrate Public Access and Use in Habitat Areas. Designated recreation corridors and interpretive centers focus human activity in distinct areas rather than throughout the site. Interpretive signs or dense plantings of vegetation further reduce potential conflicts between human use and wildlife habitat.

Lesson 4: Evaluate Potential Obstacles and Use Effective Establishment Techniques

After plants' physical needs are met (e.g., hydrology and soil requirements), the most frequent obstacles to successful establishment of riparian vegetation are competition with weedy plants and damage to the revegetation material from herbivory.

Weed Competition

Cover Crops. Seeding the area around the revegetation material with a low-growing cover crop, such as clover, can effectively limit the invasion of weedy species into the area. Cover crops, however, can harbor larger populations of undesirable rodents.

Weed Mats. Installing a water-permeable, light-restricting mat around the revegetation material inhibits colonization by weedy species. We have found, however, that weed mats can encourage damaging fungal growth and provide a refuge for undesirable rodents.

Mowing Regime. Regular mowing of undesirable annual species before flowering encourages the establishment of more desirable perennial species. Mowing the vegetation opens the understory and exposes rodent populations to potential predation.

Herbivory

Browse Screens. Installing protective screens around the revegetation material protects young saplings from deer.

Raptor Perches. Installing raptor perches effectively controls rodent populations, including rabbits, mice, voles, and gophers, and reduces herbivory on revegetation material.

Lesson 5: Plan Ahead for Appropriate Timing of Implementation

Planning ahead is critical when developing an implementation plan for a large-scale restoration effort.

Activities Schedule. Maintaining a monthly schedule of activities helps to keep project activities on track.

Seed Collection. Plan ahead to obtain local seed material during the appropriate time of year.

Cutting Collection. Proper timing to collect and store cuttings is essential to obtaining the best material for planting.

Installation. The timing of installation can determine the success or failure of restoration efforts. Cuttings will not survive if they are stored too long or planted too late.

The Mt. Shasta Meadows Restoration Project

Kristen Meyer

The Mt. Shasta Meadow Restoration Project was initiated to halt human induced degradation and reclaim the ecological and cultural integrity of fragile sub-alpine meadow systems on Mt. Shasta. Mt. Shasta, a major cascade volcano, is easily accessible from the interstate highway and attracts a wide variety of users. Panther and Squaw meadows lie only a short walk from the end of the highway leading up the mountain. The meadows range in elevation from 7440' to 8200' making them particularly vulnerable to human foot traffic. A network of user-created trails, established over several decades, criss-crosses the meadows. The trails serve as drainage channels during periods of runoff and threaten to change the hydrology of the meadows.

Glacial basin springs feed these relatively lush islands of biodiversity. The xeric environment surrounding the meadows is comprised predominantly of porous volcanic soils. Each meadow is a virtual oasis attracting a wide variety of users, including many who visit the mountain for spiritual pursuits. The Wintu, a local Native American Indian tribe, continue to perform ceremonies at the spring in Upper Panther meadow. Many organized and unaffiliated religious groups and individuals who consider the mountain sacred come to the meadows to worship, meditate, and pray. The meadows also serve as a major focal point for socializing. In addition vegetation loss and soil erosion caused by foot traffic, other physical and social impacts associated with meadow users include: dams, altars, shrines, offerings, chanting, drumming, graffiti, vandalism, and nudity.

The Mt. Shasta Meadow Restoration Project began in 1991 as a cooperative effort between the Mt. Shasta Ranger District of the Shasta-Trinity National Forests and the Department of Forestry and Resource Management at the university of California at Berkeley. The Forest Service funded two UC Berkeley graduate students to conduct research while living in a campground near Lower Panther meadow. A full-time volunteer camped at the edge of the parking area adjacent to Upper Panther meadow to interface with meadow visitors. Data collection during 1991 included vegetation identification and community mapping, soil sampling, visitor use observations and surveys, and classification and mapping of user-created trails. A Draft Meadow Restoration Plan was completed in April 1992.

During the summer of 1992, the Forest Service hired two restoration coordinators and four full-time volunteers to live next to the meadows. To initiate the establishment of a single trail system, directional signs were located at trail junctions in Panther Meadows. Wooden stakes with "no walking" symbols were strategically placed to identify trail closures. The volunteers provided interpretive services and interacted with meadow visitors.

Private funding, secured from the McConnell Foundation of Redding, California, is assisting with meadow restoration efforts. Funding is being used to purchase and construct a greenhouse for native plant propagation. Seed collection began in 1992 and propagation of cuttings will begin in 1993. Portable interpretive displays illustrating the meadow restoration process are being

Kristin Meyer works as a dispersed recreation and wilderness manager on the Mt. Shasta Ranger District of the Shasta-Trinity National Forests. She is currently completing a Master's Degree in Recreation and Parks Management at California State University in Chico, California.

developed for use in the field with additional funds provided by the McConnell Foundation.

This project serves as a case study. The managerial implications of restoring a severely impacted sub-alpine meadow system while understanding and educating a varied and diverse user public demands creative solutions. This project exemplifies the need to address socio-cultural and ecological concerns simultaneously. In this case, it is apparent that no restoration effort can succeed without understanding and cooperation from the user culture. Despite noble intentions and state-of-the-art techniques, restoration success will partially depend on the adoption of mutually acceptable values and behaviors by the agency and the users. This demands a concerted effort on the part of the agency to initiate and maintain effective communication with the user culture. Two-way dialogue is the best route to shared understanding between the agency and user cultures. Simcox (1990) terms this process "convergence communication" and outlines characteristics which make agency personnel particularly suited for intercultural communication. "The most effective means of creating this convergence between cultures is through on-site interpersonal contact and a bridging of cultural networks through a member of the agency culture who is perceived to be similar and empathetic toward the cultural user group" (Simcox 1990 p. 6).

Prior to 1991, camping in Panther meadows was commonplace. Forest Service signs were routinely vandalized and unintentional destruction of meadow vegetation occurred due to the absence of a well-defined trail system. During one season, the full-time presence of a "similar" and "empathetic" volunteer practically eliminated all camping in Panther meadows. The graduate students and the volunteer wore attractive "Meadow Restoration Project" tee-shirts instead of agency uniforms to identify themselves and the project. Interpretive signing was designed specifically to appeal to meadow visitors. The use of generic government signing was reduced as much as possible. The volunteer provided a relatively non-threatening bridge from the agency to the user network and culture.

The greatest shortcoming resulting from the use of volunteers in 1991 and 1992 was the evident potential for volunteers to become distanced or estranged from the agency culture. This may result from over-identification with the user culture or alienation from the philosophy or members of the agency. It is difficult to predict how different individuals will react to the constant stresses and demands of such intense human contact. More volunteers were used in 1992 to insure full-time presence at the site and adequate time off for volunteers.

Efforts to effectively communicate with meadow users are ongoing. Future goals and objectives will be outlined in a public involvement plan for 1993.

Nichols Meadow Restoration Project, Mariposa Ranger District, Sierra National Forest.

Marilyn Myers,

Abstract

Nichols Meadow is located on the west slope of the Sierra Nevada, Sierra National Forest. The meadow is scarred by a deep gully approximately 350 feet long, 60 - 90 feet wide and 20 feet deep. Resource degradation has occurred from the massive amount of sediment transported downstream, loss of meadow habitat, loss of the fishery which once existed in the creek, lowering of groundwater table in the meadow, and the aesthetic loss of a healthy mountain meadow.

Although the gully in Nichols Meadow had been documented for many years, the size of the project, the complexity of the problem, and the lack of access by road thwarted ideas to treat the area. However, the head and portions of the sidewalls were actively eroding and it was essential to stabilize these areas to prevent further resource losses. In 1990, planning for the project began in earnest, work was begun in 1991 and the project work was completed in 1992.

The purpose of the project was to stabilize the head and sidewalls of the gully, re-establish ground cover over all the bare soil, and re-establish the riparian vegetation along the channel. No attempt was made to raise the groundwater table.

The poor access forced us to explore the use of materials which would be relatively easy to move to the project site on wheelbarrows. We decided to use a product called Geoweb for the structural elements of the project. Geoweb is a cellular soil confinement material made of heavy gage plastic. Geoweb was stacked to form 3 retaining walls and a single layer was used to form the bed of the new channel. The cells were filled with native soil and rock. Elgin drains were installed behind the retaining walls to intercept groundwater that collected behind the structures and to route the water out to the main channel.

Once the structural work was completed the area was seeded with native grasses and covered with excelsior. Alders willows, and elderberries were planted to hasten the recovery of the riparian vegetation. A 5-strand barb wire fence was constructed in the spring before grazing began to exclude cattle from the project area. Cross sections and photo points were established to evaluate the project over time.

All work was done with hand tools and all materials were hauled in on a trail over 1/4 mile from the work site. A majority of the labor was contributed by a group of European volunteers from the Council on International Educational Exchange. The California Native Plant Society also contributed labor in planting the riparian vegetation.

Marilyn Myers is a North Zone Fisheries Biologist with the Minarets Ranger District of the Sierra National Forest in North Fork, California.

Rehabilitation of Sites Along the Colorado River through Grand Canyon National Park

Linda M. Jalbert and Meg Heim

Abstract

Each year, over 22,000 individuals travel through the Grand Canyon on the Colorado River. Visitors travel on commercial or non-commercial river trips which are offered on a variety of watercraft, and vary in length and duration. Major drainages and side canyons along the 225 mile corridor in Grand Canyon National Park provide recreational activities off-river including hiking, camping and swimming. These destination or "attraction" sites are regular stops for nearly every trip that passes through the canyon. They are also popular areas for backpackers.

The impacts of recreational use are most evident at major rapids, popular camps and attraction sites. Multiple trailing, proliferation of campsites, and disturbance of cultural features are results of repeated use.

The Colorado River Management Plan (CRMP) mandates an integrated monitoring program that includes assessment of impacts resulting from recreational use. As a result of the monitoring, sites are placed into impact categories, and should these impacts exceed the Limits of Acceptable Change prescribed by the CRMP, remediation actions are planned.

The Colorado River Rehabilitation Program at Grand Canyon National Park is directed by the Division of Resources Management. The projects are accomplished in cooperation with the River Unit, the Trail Crew and volunteers. Trips are conducted during the low use season, primarily in late fall; so that winter precipitation may benefit revegetation efforts.

Rehabilitation work is conducted primarily in the desert area above the new high water zone, but includes stabilization of mooring and camp areas in the riparian zone. Project work includes multiple trail eradication, trail delineation and relocation, routine trail maintenance, campsite stabilization, revegetation, and archeological site stabilization.

The revegetation work emphasizes the use of native seed collected in the canyon. Temporary closure of revegetated areas have also been necessary to assure project success. Trail relocation and delineation has directed traffic reducing impacts to archeological sites and fragile vegetation adjacent to the trails. Emplacement of rock and log checks at campsites has stabilized access trails and slowed erosion initiated by recreational use. The rehabilitation work, coupled with public education efforts, has resulted in reduction of impacts to cultural and natural features at high use attraction sites along the Colorado River corridor.

Linda Jalbert and MegHeim are Resource Management Specialists for the Grand Canyon National Park in Grand Canyon, AZ. Ms. Jalbert's responsibilities include monitoring programs for the Colorado River and Backcountry areas of the Park. This involves monitoring sites adjacent to the River and developing actions plans for mitigation. Ms. Heim in involved in coordinating the revegetation aspects of various parkwide projects ranging from construction site revegetation on the South Rim and landfill restoration on the North Rim, emphasizing the use of native plants.

Riparian Restoration Projects in Arizona, Soil Conservation Service

David Seery

This display is made up of photographs with labels showing successful riparian restoration projects by Soil Conservation Service (SCS) in Arizona. Some were in conjunction with Emergency Watershed Projects after floods in 1978-84. Others were done to replace riparian vegetation. All projects returned the functions and values that were lost back to the original ecosystems. The dormant pole technique works well when done properly.

GILA RIVER

After the floods of 1979 along the Gila River near Safford, Arizona, dikes were built to protect river banks and farms. Trees were installed by SCS to further protect these dikes using the dormant pole technique. Using SCS specifications local farmers were contracted to install their own plantings of cottonwood and willow along the river in conjunction with structural measures. Wildlife use of these areas began immediately with javelina using the rows as corridors for travel, while bird use began when trees reached ten foot height after one or two growing seasons. Beavers have been a problem in some areas.

VERDE RIVER

Floods in the fall of 1984 eroded banks at Dead Horse State Park threatening a developed picnic area and large ramada for group activities. The SCS protected the vertical bank by removing debris from the river channel, so the water would go back to its original channel and planted cottonwood and willows at the waters edge. The dormant pole technique was used to great success. These trees are now beginning to be used by neotropical migratory birds.

FERGUSON VALLEY

SCS restored a dike to protect a ranch house after a flood in 1984, in Ferguson Valley near Prescott, Arizona. Trees were planted at the inside toe of the dike to help control erosion on the dike. Eight hundred dormant cottonwood and willows were cut from native stock in the local area. Growth of the original five foot cuttings now exceeds 25 feet. Mule deer and javelina use the area for feeding and resting.

SANTA CRUZ RIVER

The Santa Cruz river removed established banks and threatened houses and a school during a flood in October 1983 near Tubac, Arizona. Large steel structures called "jacks" were installed to protect the banks. Trees were planted among the jacks to further stabilize the bank and catch debris. Five foot poles are now twenty to thirty feet tall. The jacks are completely hidden from view. Neotropical migratory birds are abundant in this area during summer.

David Seery is the State Biologist for the Soil Conservation Service in Phoenix, AZ. Mr. Seery has designed and installed various riparian projects on watersheds to create, protect, or enhance habitat over 20 years in New Mexico, Arizona and Nevada. He was educated at New Mexico StateUniversity in range and wildlife management.

MOENKOPI WASH

In 1985 a farmer near Tuba City, Arizona contacted SCS personnel for assistance in arresting bank erosion adjacent to his farm. He was loosing farm fields to the Moenkopi Wash, which was dry on the surface most of the time but had a water table standing at 3-6 feet from the surface. Four hundred dormant coyote willow poles were installed in the offending oxbow. using local tree stock. The wash has since changed course and been forced away from the oxbow. The trees have filled in the oxbow. Bird use is heavy in this small oasis.

Six Rivers National Forest Watershed Management and Road Restoration.

Chuck Glasgow

Why Restore Roads?

Watershed managers, hydrologists, and engineers are recognizing that potential road-related problems of mass wasting and sedimentation are eliminated by identifying and preventing problems before they begin. Roads can alter natural drainage networks and related physical processes such as sediment transport and storage, and slope stability.

Where forest roads are located on steep terrain, mass soil movements such as landslides and debris torrents are the most common example of erosion and sediment delivery to streams. The sediment input into streams from such sources can be a long term impact to aquatic ecosystems.

Extensive acres of young plantations exist on most National Forest lands; plantations that after the initial planting and thinning will not require re-entry for numerous year, perhaps anywhere between 20 to 80 years. As the road system becomes more extensive, maintenance priority tends to go toward big system roads at the expense of smaller system and temporary roads leading to landings and plantations. To protect the investment in plantations and prevent sediment from reaching streams, it is crucial that these lesser priority roads be examined carefully in terms of their long term need.

Without adequate maintenance, culverts are likely to loose their capacity to transport water, further increasing the chance for surface diversion. In steep terrain, this may increase the likelihood of gullies, debris torrents and landslides thereby jeopardizing plantations and the viability of the streams below.

In recognizing the importance of road stability in relation to watershed and stream integrity, Six Rivers National Forest Watershed Program had begun the process of inventorying spur and abandoned roads to determine potential road-related sediment sources. The intent is to identify all roads with potential failure problems, rank them in order of priority based on the beneficial uses at risk, and establish a time line for their restoration.

The primary objective of road restoration is to minimize future erosion and mass wasting through removing culverts and outsloping unstable portions of the road. Excavating fill from stream crossings and removing culverts is one of the most cost- effective treatments available for reducing sediment input into streams. Removing a drainage structure that is no longer maintained (and/or is failing) through a relatively small excavation of road fill can prevent major fluvial erosion and/or landslides from developing, with potentially catastrophic consequences to beneficial uses. Excavation of fill from stream crossings returns streams to more naturally functioning hydrologic systems.

Chuck Glasgow is a co-op hydrologist at the Six Rivers National Forest in theLower Trinity Ranger District in Willow Creek, CA. He has a BS degree in Fisheries from Humboldt State University.

For portions of road that are slumping, outsloping or recontouring to restore natural drainage patterns that blend with the surrounding topography is the preferred technique. An outsloped surface dissipates overland flow naturally and prevents runoff from diverting or concentrating in ditches, waterbars or culverts. Outsloping also requires no maintenance as do other erosion control structures such as waterbars. Another benefit of outsloping is that it disperses excessive concentrations of gravel and rock, restores depth of soil above bedrock, and retrieves much of the original sidecasted topsoil. These combined effects accelerate the re-establishment of native vegetation.

In conclusion, as the Forest Service continues to manage the landbase for timber, it is vital that the investment in roads, plantations and impacts to beneficial uses be examined carefully. It is imperative that as road maintenance dollars become scarce, and as management intensity in an area decreases, that we not forget smaller system roads and spurs.

Watershed managers must identify roads with the highest potential and work together with other disciplines to reach a future management consensus regarding potentially unstable roads. Managers must not only understand the link between roads and the health of watersheds and streams, but also commit the dollars required to prevent road failures from happening, in order to maintain a sustainable land management system. Unless this is accomplished, we may stand to lose not only the road, but possibly the plantations and health of stream ecosystems.

General Cost Analysis For Road Obliteration:

The cost-per-mile of road removed is highly variable depending on the terrain, road width, and drainage density and size. The majority of heavy equipment cost is in stream crossing excavations. Outsloping the intervening stretches of road is usually a minor portion of the overall project cost. The most cost-effective method for resorting roads is to use a large excavator and bulldozer in tandem. Some examples of typical road removal cost-per-mile are listed below. The cost estimates were generated by the Redwood National Park.

<u>Small road</u>, gentle terrain, few stream crossings - $10,000 to $20,000.

<u>Medium sized road</u>, frequent small to medium size stream crossings $20,000 to $40,000.

<u>Major, mid-slope haul road</u>, frequent large stream crossings $40,000 to $70,000.

<u>Major road</u>, low on slope, frequent large stream crossings $100,000 to $250,000.

Accurate cost estimates are difficult to make until the actual work is surveyed and laid out. However, over the years average costs have been determined for outsloping, ripping, and removing stream crossings:

<u>Outsloping</u> averages $10,000 per mile or $1 per cubic yard for a road with an average width of 30 ft and a fill bank (outboard edge) of 8 ft.

<u>Ripping</u> to a minimum depth of 2 ft averages $800 per mile or $.15 per linear foot for a 30 ft wide gravel road.

<u>Stream crossings</u> vary with size, amount or organic debris, stream flow, fill saturation, etc. In general, simple, straight forward crossings can average between $1 to $2 per cubic foot.

For more information on road obliteration costs and design, contact Terry Spreiter, Supervisory Geologist at the Watershed Restoration Program, Redwood National Park, P.O. Box 7 Orick, CA 95555.

Road Obliteration Design Tools:

The Redwood National Park Watershed Restoration Program has developed an excellent software package to facilitate both road restoration design as well as the determination of excavations and/or outsloping road fills. The program takes simple survey data (survey equipment = two stadia rods, clinometer, and tape measure) and through menu driven prompts calculates excavation volumes, places the information into technical specifications for contracts, and creates files to be used by Design Cad if technical drawings are desired.

The software package is very user friendly and an inexperienced user can readily follow the instructions. The software does require a specific format for the survey information and as such, users should contact the Redwood National Park (Terry Spriter or Greg Bundros (707) 488-2911) or the Lower Trinity Ranger District (Carolyn Cook (916) 627-2118) before using the software.

The survey technique is simple and can be learned in a few hours in the field. In summary, the road restoration software package is easy to use, save time, and should be examined by anyone interested in road restoration projects. The software is in the public domain.

Benefits of Photo Monitoring and Stereo Photographs

We use stereo (3-D) slides to document all our projects. This has several advantages:

- The image reveals the depth in the scene; often the 3rd dimension contains crucial visual information.

- This provides a backup slide; an important safeguard for project documentation, but not normally available with slides (no negatives).

- The images are more fun to look at and help to show results to people who cannot visit the site. People enjoy looking at 3-D photos.

- Through establishing photo points, changes over time can be monitored.

The technique is simple. Take a shot and note a reference point in the picture. Move the camera about 4 inches sideways (more for distant objects, less for closeups) and take another picture with the exact same framing. Pop the resulting slides into the viewer (in the same left/right orientation that you took them) and....voila - 3-D!

Viewers and other 3-D supplies can be obtained from: Reel 3-D Enterprises, P.O. Box 2368, Culver City, Ca., 90231, (213) 837-2368.

Strategies to Define and Implement Large-Scale Watershed Restoration Project Policy on the Navajo Nation

Nic Korte, Peter Kearl and Dave Koehler

Introduction

Range scientists generally agree that the condition of riparian areas on the Navajo Reservation has deteriorated seriously over the last century. Historic accounts of overgrazing in the latter half of the 19th century suggest that much damage occurred at that time (Sheridan 1981). Since then, continued grazing has additionally degraded, or at least prevented the natural restoration of riparian areas (USGAO 1982).

Fortunately, techniques for restoring small riparian zones, at least on an empirical basis, are well known and not technically difficult. Additionally, although overgrazing is often the reason for degraded riparian zones, it probably is not necessary to remove all livestock to effect restoration. For example, the Executive Committee of the American Fisheries Society has drafted a position stating "when properly implemented and supervised, grazing could become an important management tool benefiting fish and wildlife riparian habitats" (Armour et al. 1991). The technical literature contains several successful case histories of riparian restoration. One study, conducted by the U.S. Forest Service Rocky Mountain Experimental Station in western Colorado (Heede 1977), demonstrated the dramatic effects a series of check dams could have on a formerly overgrazed watershed. In addition to halting erosive losses of soil, vegetative cover was restored, the water table was raised, and an ephemeral stream became perennial once more. Other successful projects have been conducted in the Bear Creek watershed in Oregon (Young 1991) and watersheds located in several other western locations (USGAO 1988).

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Check-dams constructed on streams within the Navajo Reservation during the New Deal were later washed away by floods (Parman 1976). The work by Heede (1977), however, demonstrated that with improvements in design and construction, rock check-dams can be built to withstand expected floods. Moreover, work performed by Rosgen (1992) showed that restoring streams to near-natural geometries can result in stable systems without significant long-term maintenance. Conflicts over the management of riparian zones in arid landscapes are already severe and are becoming increasingly complex (Zube and Simcox 1987). Consequently, additional research in watershed restoration is needed in order to determine whether the Navajo Nation should enter into the large-scale, multi-million dollar, long-term commitment that would be needed to fully restore degraded riparian areas.

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It is important to note that the effects and benefits of riparian restoration are accepted, but only from empirical and biological points of view (Zube and Simcox 1987). The hydrologic aspects, especially as translated into economic effects, have not been quantified. As noted by a speaker at a recent National Policy Conference on American Rivers, "emphasis in the 1990's will be on restoration rather than protection. . . .the need to restore watersheds, for example, will make science and technology more and more vital" (Marston 1991).

Current Status

The typical effects of poor land-management practices on riparian zones are evident throughout the Navajo Nation. After many years (50 to 100 or more) of overgrazing by livestock, the original riparian vegetation is gone. Seedlings were eaten and killed until only the most grazing-resistant plants remained: the sparse and shallow-rooted vegetation that remains is insufficient to prevent severe erosion.

Often vegetation which survives severe overgrazing does so only because it cannot be eaten by livestock. Plant-type changes caused by overgrazing eliminates alders and willows at higher altitudes, leaving only associated grasses. At middle elevations, sycamores and cottonwoods are often entirely missing, and are replaced by bermuda grass, desert willow, seep willow, and sometimes tamarisk (Kennedy 1977).

Similar effects of eliminating riparian vegetation were reported by Glinski (1977), who studied cottonwood reproduction in a southern Arizona stream. Cottonwood reproduction was nearly absent in areas grazed extensively by cattle, and was confined to the narrow erosion channel. Two significant, negative consequences of such channeling are evident: the containment of floodwaters within the confines of the relatively narrow channel, and the scouring of vegetation that occurs within the erosion channel. When overgrazing occurs, rain falling within the watershed spends relatively less time in the drainage because the channel quickly transports the water along the valley floor. Thus, water cannot disperse laterally from the creekbed onto the adjacent floodplain. The rapid transport of water through eroded channels, also negatively affects the water table recharge rate. Once streambed cutting begins, it is perpetuated and accelerated by floodwaters that concentrate in the erosion channel. These floodwaters transport and remove vegetation and debris that otherwise would have remained in place and promoted dispersal of less forceful floods. Erosive channeling that results causes an elevated terrace adjacent to the channel, which becomes increasingly dry due to reduced overbank flooding outside the channel. The depth of the water table increases as erosion progresses.

Various studies have shown that riparian zones can be restored and that rapidly eroding watersheds can be stabilized. For example, check dams installed nearly 30 years ago in the Alkali Creek watershed in western Colorado (Heede 1977) remain intact. These dams have trapped suspended sediment, raised the base level of the stream, and permitted the establishment of a thick cover of vegetation. The project was described as expensive, but no cost/benefit analyses were performed. More recent projects in larger streams have also demonstrated that dramatic improvement of aquatic and riparian habitats is possible (Rosgen 1992). The prospect of determining the value of large-scale restoration of degraded riparian areas now may have significant implications for the Navajo Nation because of the consequence of such actions on water balance, water quality, livestock production, and reservoir operation.

Finally, for a restoration project to have lasting beneficial effects, it is desirable that the tribe be active participants in the project. Examples of training and experience that can be gained include: training of students in monitoring and surveying techniques, training of workers in the necessary construction and revegetation methods, and the eventual assumption of all decision-making tools (e.g., models) by tribal scientists. The hoped-for result, therefore, is;

(1) a decision-making tool that can be used to determine where and how much restoration to perform, and

(2) a trained work force with the experience and knowledge to conduct such projects when appropriate.

Research Needs

Water balance and the timing of water release within the watershed are important considerations in stream restoration efforts. Currently, water quality and water balance are controlled by circumstances of channeling, downcutting, and the resultant lowering of the water table. If a large-scale watershed restoration project was conducted, what changes would occur in the water balance of the individual, small watersheds? With a fully restored and functioning watershed, the spring floods would provide less water because more of it would be held back in the now higher water tables associated with restored streams. Undoubtedly, some of this water would be lost by evapotranspiration due to greater quantities of the increased riparian vegetation, and some would merely be released more slowly and delivered later in the season. Under which circumstance --restored versus non-restored -- would water loss and water quality be greater? How would the change in watershed processes affect grazing and the need for irrigation? What is the appropriate balance between the benefits derived from watershed restoration and livestock production? These are the types of questions that need to be answered in order to determine if a large-scale project should be initiated to restore watersheds.

Another scientific question to be answered is whether water quality (e.g., salinity) can be improved. The literature suggests that salinity decreases as the sediment load is decreased (Gellis et al. 1991). As reported by Schlosser and Karr (1981), efforts to improve water quality during base flow should emphasize maintenance of riparian vegetation and stable flow conditions. If there are improvements in water quality, what is the value of the economic benefit? Considering that millions of dollars are spent on salinity

control throughout the western United States, any alteration due to large-scale restoration projects could have a significant economic benefits and thus, lead to increased federal support for more large-scale restoration efforts.

Concurrent with studies of water issues, thorough evaluations of the effects of watershed restoration on wildlife and aesthetics are needed. Increasingly, economists and landscape scientists are developing quantitative procedures for establishing a dollar value on such features. For example, the recent literature has presented approaches to evaluating the economic benefits of instream flow levels (Douglas and Johnson 1991; Brown et. al. 1990; Ward 1987), wetlands (Farber and Costanza 1987), range improvement projects (Pope and Wagstaff 1987), and environmental features in general (Bergstrom 1990; Rahmatian 1987, Turner et al. 1988).

Although it may appear that the benefits of watershed restoration are obvious, recent work has demonstrated that the results of economic analyses are affected by several complex factors. For example, a study concerning the value of instream flow in the Colorado River Basin expected to focus on effects on water deliveries and consumptive uses. The authors found instead that impacts of flow increases on water use were dwarfed by the impacts of changes in reservoir operating rules (Brown et al. 1990). Similarly, a study evaluating the economic effects of erosion control in the east and midwest suggested that the locations with the greatest erosion losses did not suffer the most economic damage (Ribaudo and Young 1989)

A watershed approach to ecological monitoring has been proposed for use in national parks (Herrmann and Stottlemyer 1991). Applying a similar approach to a recovering watershed would provide the information to determine the quantitative effects on water balance and water quality. Tracer studies could also be performed as a means of obtaining concentration-versus-time curves (Castro and Hornberger 1991) which could be used to quantify changes that occur during the restoration process. It is assumed that the curves will show that solutes have a longer residence time in reaches of the stream as the restoration process continues. Eventually a steady-state situation should be attained which can be used to evaluate water balance and the time needed to determine whether the restoration process is complete.

After all data are obtained and an economic value for watershed restoration is established, landscape modeling techniques could be used to extrapolate the results to the reservation as a whole. This process is difficult because insufficient replication of broad-scale experiments limits one's ability to test the process (Turner et al. 1989). Nevertheless, with continued pressure on natural resources, it is necessary that socially acceptable rates of range deterioration be assessed in terms of trade-off in welfare between present and future generations -- a process that currently is being promoted in parts of Africa (Livingstone 1991). A project of this type could be used to determine whether large-scale watershed restoration should be a goal of the Navajo Nation.

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Tamarisk Control Methods and Water Table Relations at Sacatone Spring.

Curt E. Deuser

Abstract

Most of the 40 springs within the Lake Mead National Recreation Area have been impacted to various degrees by the exotic tamarisk (*Tamarix. ramosissima*) tree. Tamarisk has replaced many of the native riparian species, reducing biodiversity and wildlife habitat. This alien tree is also responsible for consuming large amounts of water through evapotranspiration. Eradication and restoration efforts at these remote springs have been high in priority since they are crucial for supporting diverse plant and animal populations in this extremely arid region. Sacatone Springs has been chosen as a site at which to conduct a multi faceted demonstration restoration project. Tamarisk removal using a combination of methods including mechanical, herbicides, and prescribed fire is underway. Hourly water level data are collected over the course of the project to document effects of Tamarisk eradication and revegetation efforts of the riparian zone water table. Water levels are recorded upstream, downstream, and within a Tamarisk thicket using an Omnidata easy logger system. Revegetation will occur using mesquite (*Prosopis glandulosa*) and other natives.

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Transplanting Mature Riparian Trees Using a Tree Spade or Crane

Bobbie A. Stephenson and Lori Woods

Introduction

Preservation is always the first choice in mitigating impacts to habitat, but preservation is not always possible. Most often, some sacrifice of resources occurs during construction of projects. This poster/ paper does not imply that transplanting trees is appropriate mitigation, but shows only that transplanting large trees is possible to preserve specimen-size plants which otherwise would be lost. When the decision is made to transplant mature riparian trees, it can be done successfully and quickly using a tree spade or crane. These two methods, which were used to transplant trees at two sites in San Diego County, California, are described in this poster/paper.

At one site in northern San Diego County, 200 mature willow trees (*Salix lasiolepis*) were transplanted using both pieces of equipment. These trees were moved from a drainage which was to be impacted by a proposed development project and replanted at a nearby mitigation site.

At a site on the San Diego River in Santee, California, a crane was used to move eight mature western sycamore trees (*Platanus racemosa*). These trees were removed from the proposed impact zone for construction of a freeway through a regional park and replanted within the park but just outside the impact area. (Poster photos of transplanting willows were by the author; the western sycamore photos were courtesy of the California Department of Transportation, District 11.)

Tree Spade

A tree spade is mounted on the back of a large truck and consists of four large blades that are positioned in a circle. The blades slide individually into the soil, severing roots extending beyond the circle, to cut out an inverted cone around the rootball of the tree. Each tree with its rootball is called a "grab." Tree spades come in various sizes; the one used at the site depicted in the poster cut a grab approximately six feet in diameter and four feet deep, with the tree in the center. The spade lifts the tree and rootball from the soil and moves into a horizontal position on the bed of the truck. The tree can then be transported directly to the replanting area.

One grab at a time can be moved in the spade, or several grabs can be transported in an"egg crate" type transport vehicle.

To replant, the grab is positioned directly over a hole previously cut by the tree spade at the replanting area. Large roots projecting from the joints between the blades may need to be trimmed so the root/soil mass will fit perfectly into the hole. The spade then lowers

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the grab into the hole and the blades are individually raised.

Following placement of the tree into the hole at the revegetation site, soil is tamped to fill any remaining spaces and a low berm is formed to create a well around the tree for watering.

Access is a major factor in determining which trees are suitable for transplanting. The tree spade must be able to back up to the tree and position the blades in a circle around the trunk. The spade depicted in the poster cut a circle approximately six feet in diameter around the tree. Trees chosen for transplanting must have fairly straight trunks so they can be balanced in the spade. Large horizontal branches may need to be trimmed to help balance the weight and so that they do not inhibit positioning or movement of the blades.

Generally, a large tree spade can move trees up to 30 feet tall, with a six-inch trunk diameter at breast height (dbh) or smaller. Smaller spades can be used for smaller trees.

This poster shows native willows being moved with a tree spade, but any trees, shrubs, or even smaller plants can be transplanted using a spade. Other native species which have been transplanted with a spade include large summer holly (*Comarostaphylis diversifolia ssp. diversifolia*) shrubs, mule fat (*Baccharis glutinosa*) shrubs, coast live oak (*Quercus agrifolia*) trees, and San Diego ambrosia (*Ambrosia pumila*), a small perennial herb.

Benefits

The benefits to the tree by transplanting using a tree spade rather than digging and moving it bare-root are many. The major portion of the rootball remains intact with only minimal disturbance to roots within the grab. Other organisms are moved with each tree in the grab. Soil floral, faunal, and mycorrhizal components move with the tree to the mitigation site, increasing the speed at which they colonize the site. Smaller shrubs, annuals, and seeds are also transported as part of the grab, and even multiple trees can be moved if they fit within the circle of blades.

Large mature trees installed at a revegetation or mitigation site provide immediate structural diversity which can be especially important when a mitigation site must meet certain vegetative structure goals within a short time.

Moving trees with a tree spade can be extremely cost efficient if trees do not have to be transported very far. Tree spade use is less costly than boxing trees or buying mature trees grown in nurseries, and most native riparian trees are not available as mature specimens.

Crane

Willows

The willow trees were moved using a small crane. A backhoe was used to cut a trench and loosen the soil around each willow tree. A collar attached to the crane was placed around the trunk of each tree, one at a time. Most of the trees were less than four inches dbh. Each tree was then pulled slowly (and as gently as possible) from the soil and roots were cut as necessary as they were exposed to allow the crane to lift the tree free. Almost no soil remained around the roots. Several trees were laid horizontally on the bed of a truck and transported to the mitigation site, where the crane lifted them one by one and placed them in previously excavated holes. Workers filled in the soil around each tree before the crane released its hold. Trees could be guyed, if necessary, but those described in this poster did not require guying.

Sycamores

The mature western sycamore shown on the poster was at the mouth of a canyon which was bridged during construction of a freeway. Since a 12-ton crane was at the site for bridge construction, it was used for moving the eight trees. The trees were moved from within the freeway footprint to just outside the impact area. They were not transported with the crane; the crane lifted them from the ground, swung around, and placed them in previously excavated holes.

A collar attached to the crane was positioned around the trunk of the tree for balancing while the roots were cut and for lifting the tree. Using a backhoe, a trench was cut around each western sycamore at a distance of approximately six feet from the trunk. A chain, such as a chain used for brushing, was positioned in the bottom of the trench around the rootball. The backhoe was used to pull the chain under the rootball to cut the lower roots.

The crane lifted the tree, swung slowly around, and lowered the tree into a previously excavated hole. The rest of the hole was then backfilled using the native soil. Eight trees were transplanted; one did not survive because the collar slipped while the tree was being moved and cut through the cambium, girdling the tree.

Benefits

Transplanting with a crane may not maintain the soil integrity around the rootball as a tree spade does; however, large transplanted trees can provide the structural diversity needed at a site. Often, if the rootball is thick, as were those of the western sycamores, soil organisms can be transplanted with the tree.

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Evaluation of Saltcedar Control - Pecos River, New Mexico//

K. W. Duncan, S. D. Schemnitz, M. Suzuki, Z. Homesley, and M. Cardenas

Saltcedar (*Tamarix* spp.) is an introduced phreatophyte growing primarily in riparian areas of western North America. Saltcedar is highly salt tolerant and has been shown to not only thrive on ground water containing 8000 ppm dissolved solids (Gatewood et al.1950), but also exudes salt from its leaves. Gatewood reported 41,000 ppm dissolved solids in the guttation sap of saltcedar. This ability to disperse highly concentrated salt excretions provides saltcedar a competitive advantage over native plants.

Saltcedar has been labeled as an "extreme" phreatophyte because of its ability to tap and exploit deep water tables. This ability enables saltcedar to survive almost indefinitely in the absence of surface saturation or shallow soil moisture which is required by other plants. Saltcedar has been shown in numerous studies to have very high evapotranspiration rates. Robinson (1965) reported that saltcedar in Arizona used between 4 and 5 acre feet of water per acre per year, while Davenport et al. (1982) showed transpiration rates of 4 to 13 acre feet of water per year.

The phenomenal spread of saltcedar along the Pecos River in New Mexico and the continued reports of high water use by saltcedar prompted the Bureau of Reclamation and the New Mexico State Engineer Office (1967) to estimate that the continued spread of saltcedar could dry up the Pecos River by 2000 or 2010. Hughes (1970) reported removal of 40,000 acres of saltcedar from Las Vegas to Carlsbad could probably yield between 60,000 and 70,000 acre feet of additional water each year. More recently, Weeks et al. (1987) working in the Acme to Artesia reach of the Pecos River reported that annual water use by saltcedar probably is about 0.3 meter greater than that by replacement vegetation. Therefore, Weeks predicted a net gain of one acre foot of water for each acre of saltcedar treated.

The monotypic stands characteristics of saltcedar also affect wildlife populations. Saltcedar provides little browse or seed food source for native North American wildlife species. In comparing the number of birds in cottonwood, willow and mesquite, to saltcedar stands, saltcedar consistently had fewer birds (Cohan et al. 1978, Anderson and Ohmart 1977). Engel-Wilson and Ohmart (1978) observed more birds in cottonwood, willow and mesquite communities than in saltcedar even though the native plants covered less than 98 acres of a 49,000 acre study area. The authors further stated that "cottonwood-willow communities not only contain a higher density of birds than saltcedar but also support a higher species diversity and richness."

Cohan et al. (1978) concluded that saltcedar has a low value for a majority of bird species. However, the wildlife value of saltcedar infested areas can be improved. Cohan et al. (1978) stated that "through a combination of adding more plant species favorable to wildlife and manipulating the vegetative structure, it may prove relatively easy and economically feasible to manipulate saltcedar to enhance the vegetative community for wildlife." The encroachment of saltcedar and subsequent replacement of a diverse native

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vegetation with dense saltcedar is a drastic habitat change which results in a limited wildlife population. The U. S. Fish and Wildlife Service (1987) stated that "...with the possible exceptions of doves and bees, saltcedar communities are clearly less valuable to wildlife than are native riparian plant communities."

Wildlife populations can be drastically influenced both positively and negatively by the impacts of herbicide applications on vegetation. Herbicides are a widely used and accepted management tool to manipulate and improve wildlife habitat by a wide number of state wildlife departments and federal natural resource agencies (Scifres 1980).

Imazapyr has been found to be extremely nontoxic to wildlife (BLM 1991). Risk use of imazapyr is at a low level ("no risk") according to EPA standards for terrestrial animals when typical application rates are used (US Department of Agriculture 1988). An acute lethal oral dosage for bobwhite quail, mallard ducks and rats is > 5000 mg/kg. Of 22 commonly used herbicides tested, imazapyr had the lowest toxicity (low number = high toxicity) of 500 (mg/kg/day). The next closest nontoxic herbicide had a dosage of 31. Some other widely used herbicides and their toxicity dosage were 2,4-D (1.0), picloram (7.0), simazine (5.0) and tebuthiuron (12.5). Acute toxicity of pesticides are ranked in four categories from severe (parathion LD50=3 mg/kg) to very slight. Imazapyr ranked in the very slight category (LD50 to rats > 5000 mg/kg). Imazapyr was also found to be non-mutagenic and noncancer causing in five assays.

Imazapyr does not leach or move laterally in soils, therefore it does not contaminate groundwater. "Even using the worst case assumptions, the use of ...imazapyr... is not expected to pose unacceptable risks to terrestrial wildlife" (BLM 1991). Imazapyr has been used in such environmentally sensitive areas as the Attwater Prairie Chicken National Wildlife Refuge, EvergladesNational Park and the Bosque del Apache Wildlife Refuge.

Studies conducted by New Mexico State University scientists have shown imazapyr (Arsenal) to provide 90-99% control of saltcedar (Duncan and McDaniel 1992). In one study, saltcedar growing in two 13 acre dry lake beds near Artesia, New Mexico, were aerially sprayed with a fixed-wing aircraft in August, 1989. Imazapyr was applied at 1.0 lb ai/acre. In June, 1992, water returned to the surface of one of the two lakes for the first time since 1970. Data from the project indicate the water table on the area rose from a depth of greater than 20 feet below the soil surface to the surface within 34 months after application (Duncan 1993). Saltcedar canopy reduction and mortality was estimated on September 28, 1992 to be 99% and 95.1% respectively. Cost of the application was $85/acre.

Duncan and McDaniel (1992) also reported that tank mix applications of imazapyr + glyphosate (Rodeo) provided 90-99 control of saltcedar. The advantage of imazapyr + glyphosate applications is cost. Whereas, the cost of aerial application of imazapyr at the recommended rate is approximately $85/acre, the equivalent application of imazapyr + glyphosate may cost as little as $60/acre. These costs for herbicide application are in contrast to that of mechanical saltcedar removal of $600-700/acre as reported by the U. S. Fish and Wildlife Service at the Bosque del Apache (Personal communication 1992). The U. S. Fish and Wildlife Service is attempting to restore the native riparian habitat by a combination mechanical/herbicide/fire operation. The restoration effort involves root plowing, racking and stacking, burning of the piles and individual plant treatment of resprouts with imazapyr.

Every stream and river system in New Mexico is infested or has the potential to be infested with saltcedar. The opportunity to protect existing native riparian habitat and restore riparian habitat is tremendous. However in the past, saltcedar manipulation has been cost prohibitive for large scale studies. Now, with the development of imazapyr and imazapyr + glyphosate tank mixes as management tools, the economics for a large scale study are much more favorable. In this light, the Pecos River Native Riparian Restoration Project (PRNRRP) has been proposed.

The area included in the project extends from the Pecos River bridge on U. S. Highway 82, south approximately six miles on the west side of the river to the southern edge of the former Brainard Lake. The project involves approximately 5,000 acres of saltcedar infested private, deeded land in the McMillian Delta.

The project is sponsored by the Pecos River Native Riparian Restoration Organization (PRNRRO) which is a nonprofit corporation (501C-3). PRNRRO is composed of various community and business leaders in southeast New Mexico. The objectives of the PRNRRP are to:

1) Demonstrate native wetlands and wildlife habitat improvement through saltcedar management.

2) Demonstrate effective, economical and environ-mentally sound saltcedar control.

3) Monitor possible hydrologic effects from saltcedar control and management.

These objectives will be accomplished through a series of goals. These goals are to:

1) Field test and implement integrated control procedures for maximum saltcedar suppression at minimum cost.

2) Re-establish native trees, shrubs and grasses for wildlife habitat improvement by increasing plant species diversity and establishment of motts and clumps.

3) Monitor ground water levels and surface flow through drainage channels.

The vegetation in the project area will be intensively surveyed to determine the plant composition, density and distribution. This information is to be compared to studies conducted from 1920-1940 by the Bureau of Reclamation prior to saltcedar invasion. The Bureau of Reclamation studies will be used to determine the native plant composition, density and distribution once the saltcedar has been removed.

Current wildlife population data will be collected from treated and control (untreated) areas. Birds will be sampled along transects and mammals sampled on live-trapping grids. Reptile abundance will be determined with drift fences and pitfall traps. This baseline data on the abundance and diversity of birds, mammals and reptiles will be used to measure the response of native wildlife populations to the saltcedar removal and the reestablishment of the native plant community.

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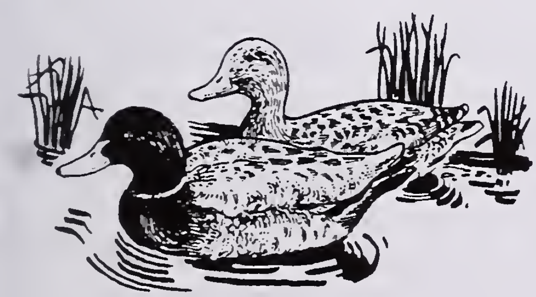
Improvement of a Sierra Nevada Riparian Zone During the Recent Drought Period

Carlos F. Lopez, Patricia Gradek and Larry Saslaw

Abstract

A demonstration project on sections of Long Valley Creek, a tributary of the South Fork of the Kern River, showed increases in the percent canopy cover and improvement of the riparian plan community. Change from a "hot" summer to fall/winter grazing system and the installation of check dams resulted in a positive channel response during the recent prolonged California drought.



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Bird Use of Riparian Habitats in North-Central Arizona During Fall Migration - Results and Recommendations

Deborah M. Finch and Robert M. Marshall

Introduction

The population status of North American landbirds that migrate to the neotropics (neotropical migrants) has attracted widespread attention from biologists during the last 13 years. Documented declines in populations of eastern neotropical migrants (Briggs and Criswell 1978, Lynch and Whitcomb 1978, Robbins 1979, Butcher et al. 1981, Ambuel and Temple 1982), as well as habitat fragmentation on breeding grounds and habitat loss on wintering grounds all have led researchers and resource managers to increase efforts to understand and effectively manage for the long-term conservation of neotropical migratory bird populations (Finch 1991). Despite this attention, little is known on the population ecology of neotropical migrants inhabiting the western United States. Western populations may be particularly vulnerable to disturbance because:

(1) most western neotropical migrants breed in riparian or montane forested habitats;

(2) the distribution of these habitats is limited, and;

(3) total population sizes may be much smaller than for eastern species due to habitat restrictions, leaving western populations more vulnerable to land-use practices that degrade habitat (Finch 1991).

The availability of suitable habitat for migrating birds also may influence survival and population stability of neotropical migrants (Finch 1991). Successful migration depends on a bird's ability to replenish energy reserves rapidly, locate suitable stopover sites and travel routes, avoid predation, and cross unfamiliar habitats or travel barriers (e.g., deserts, oceans. (Moore and Simons 1992). These time and energy constraints leave populations particularly vulnerable to fragmentation and losses of in-transit habitats (Finch 1991).

Although migratory habitats represent a crucial link in the annual cycle of neotropical migrants, little research has been done on the habitat or population ecology of migrants. This preliminary study was designed to address, in part, the need for data on bird use of western riparian habitats during fall migration. We focused on riparian habitats because they are known to have high breeding bird densities and species richness (Carothers et al. 1974, Bottorff 1977, Carothers and Johnson 1975) and, occurring as woodland corridors within the dry, sparsely-vegetated Southwest, are intuitively acknowledged by ornithologists as important refugia for migrants also. While their distribution is extremely limited (< 0.5% of Arizona's landscape is comprised of riparian woodlands.) (Strong and Bock 1980), riparian habitats are also important areas for development, recreation, and grazing, and thus the potential for habitat degradation and the weakening of conservation strategies developed for neotropical

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Table 1. Summary of Site Data for Fall Migration Study (1992).

	Study Sites				
	Dry Beaver Creek	Clear Creek East	Clear Creek West	Walnut Creek	Total
Total Site Visits	4	5	5	4	18
Date of First Site Visit	15 Sep	15 Oct	1 Oct	29 Sep	
Date of Last Site Visit	21 Oct	5 Nov	30 Oct	28 Oct	
Number of Nets	10	11	10	10	41
Total Net-Hours	236	367	321	205	1129
Birds Captured	50	72	96	55	273
Species Captured	22	12	20	12	39
Mean Birds/Net-Hour	0.2	0.2	0.3	0.3	

One net-hour = one 12 m mistnet run for one hour.

migrants on breeding grounds remain high.

Our study was preliminary in nature because, in addition to collecting quantitative data on the extent, timing, and species composition of migrants in riparian habitats, we wanted to evaluate the applicability of constant-effort mist-netting (Ralph et al. 1992) as a method for investigating fall migration in riparian habitats. In addition to providing data on the timing, abundance, and extent of fall migration, mist-netting enables researchers to more accurately identify individuals in basic or juvenal plumages, obtain demographic data (e.g., sex and age ratios), and basic biological data important for migrants (e.g., lipid reserves, body condition).

Study Sites

Four study sites located south of Flagstaff, AZ on the Coconino and Prescott National Forests were selected in drainages containing a deciduous riparian overstory (mainly cottonwood, *Populus fremontii;* willow, *Salix sp.;* sycamore, *Platanus wrightii;* walnut, *Juglans major;* alder, *Alnus sp.*) and sufficient vegetation volume in sub-canopy layers to support migratory bird use. The sites were located in the following drainages: Clear Creek West and Clear Creek East are located on West Clear Creek (Coconino, NF; Yavapai Co.). Clear Creek East is situated at the western edge of the Clear Creek Wilderness Area (Bull Pen Ranch) at an elevation of 1109 m. Clear Creek West is situated at the west end of the Clear Creek Campground where West Clear Creek flows underneath Arizona Rt. 260 (elev. 998 m). The Dry Beaver Creek site (Coconino NF, Yavapai Co.) is located on the west side of AZ Rt. 179 approximately 1 km southwest of where the creek flows under Rt. 179, and lies at an elevation of 1109 m. The Walnut Creek site (Prescott NF, Yavapai Co.) is located at the confluence of the Apache and Walnut creeks at an elevation of 1578 m.

Methods

Sampling Method

Ten to eleven standard 12 x 2.6 m (4 tier, 36 mm mesh) nylon mist-nets were used to capture birds at each site. Net lanes were established to maximize the capture rate by placing them within natural travel corridors (e.g., gaps in vegetation, edge of vegetated river bank) and within feeding areas (e.g., grape vines). Each net lane was marked in the field using colored, plastic flagging, and the orientation of each net lane was plotted on study area maps. The total area sampled and the configuration of net-lanes varied at each study site depending upon the size and shape of the riparian corridor. Sampling area, or the area encompassed by net-lanes, ranged from ca three to seven ha.

To minimize variability of the data the number and position of net lanes was standardized at each study site. The hours of net operation also were standardized among study sites. Nets were operated for six hours during each site visit beginning one-half hour prior to local sunrise. Netting effort was calculated using the following standard: one 12 m mist-net operated for one hour = one net-hour (Ralph et al. 1992). Nets were opened and closed in the same order during each site visit, and were checked for captures every 45 - 60 min, more often (every 30 min) in inclement weather. Nets were not operated during periods of rain, high wind (steady wind >16 kmh, or gusts >24 kmh), or extreme heat.

Processing Captured Birds

For each bird captured the following data were recorded: name of persons processing the individual; date of capture; time of capture; location (study site); species name; USFWS band number; natural wing chord (length); body mass; presence and extent of molt; presence and amount of subcutaneous fat, following Ralph et al. (1992); age and sex of individual, when possible, and; the criteria used to age and sex individuals. The USFWS Office of Migratory Bird Management's *Bird Banding Manual* and Pyle et al. (1987) were used as the primary sources for identifying, ageing, and sexing individuals. Migrant designations follow those in use by the Partner's in Flight initiative (Gauthreaux 1992).

Results and Discussion

Species Data

We mist-netted for a total of 18 days between 15 September and 5 November 1992 for six hours daily beginning 1/2 hr before local sunrise. We operated for 1129 net-hours and captured 273 birds comprising 39 species. Table 1 presents summary statistics for each site. Fourteen species captured (36% of total species) for a total of 46 individuals (17% of total individuals) were neotropical migrants (see Table 2). Chipping sparrow, western tanager, and summer tanager accounted for 63% of all neotropical migrants captured (see Table 3 for scientific names). Numbers of neotropical migrants dropped off rapidly during late September indicating that most individuals from this group pass through north-central Arizona by September's end. The last neotropical migrant netted was a Dusky Flycatcher captured on 23 October. Dry Beaver Creek had both the highest species richness (11 species) and abundance (25 birds) of neotropical migrants (Table 2). No neotropical migrants were captured at the Walnut Creek site.

Coincident with the decrease in neotropical migrants was an increase in the number of short-distance migrants that winter primarily in the U.S. Eleven short-distance migrant species (28%) for a total of 152 individuals (55%) were captured mostly from early October on. Dark-eyed junco, ruby-crowned kinglet, hermit thrush, white-crowned sparrow, and rufous-sided towhee accounted for 92% of all short-distance migrants captured. Hermit Thrush were recaptured throughout October indicating winter site fidelity or a protracted stopover period. Six Hermit Thrush that we had previously banded were recaptured, two at Clear Creek East and four at Clear Creek West. The number of days between recapture ranged from seven to 22. Hermit Thrush were netted as late as 4 November. Walnut Creek had both the highest species richness (8 species) and abundance (47 birds) of short-distance migrants (Table 2).

Table 2. Number of birds captured by study site and migratory category during fall 1992. Short-distance migrants winter in both the continental U.S. and south of the U.S. border, neotropical migrants winter in tropical Central and South America and the Caribbean Basin.

	Study Sites				
	Dry Beaver Creek	Clear Creek East	Clear Creek West	Walnut Creek	Total
Resident Species					
Gila Woodpecker	0	1	1	0	2
Ladder-backed Woodpecker	0	0	1	0	1
Black Phoebe	0	0	1	0	1
Scrub Jay	1	0	0	0	1
Bridled Titmouse	6	9	8	2	25
Plain Titmouse	1	0	0	2	3
Verdin	0	1	0	0	1
Canyon Wren	0	0	1	0	1
Bewick's Wren	4	3	7	3	17
Winter Wren	0	0	0	1	1
Hutton's Vireo	0	0	2	0	2
Northern Cardinal	1	2	3	0	6
Abert's Towhee	2	0	11	0	13
House Finch	0	0	1	0	1
Short-Distance Migrants					
Sharp-shinned Hawk	1	0	0	0	1
Belted Kingfisher	0	0	1	0	1
Red-naped Sapsucker	0	0	0	1	1
Ruby-crowned Kinglet	3	16	10	6	35
Hermit Thrush	4	8	10	4	26
Rufous-sided Towhee	0	0	0	10	10
Fox Sparrow	0	0	0	1	1
Song Sparrow	0	1	2	4	7
White-throated Sparrow	0	0	1	0	1
White-crowned Sparrow	1	0	0	16	17
Dark-eyed Junco	1	28	18	5	52
Neotropical Migrants					
Hammond's Flycatcher	2	1	0	0	3
Dusky Flycatcher	0	0	1	0	1
Gray Flycatcher	1	1	0	0	2
Orange-crownded Warbler	1	0	0	0	1
Ovenbird	1	0	0	0	1
Wilson's Warbler	1	0	0	0	1
Summer Tanager	5	0	0	0	5
Western Tanager	6	0	0	0	6
Black-headed Grosbeak	1	0	0	0	1
Blue Grosbeak	0	0	1	0	1
Indigo Bunting	1	0	0	0	1
Green-tailed Towhee	1	0	0	0	1
Chipping Sprarrow	5	0	13	0	18
Lincoln's Sparrow	0	1	3	0	4
Total	50	72	96	55	273

The remaining 14 species (76 individuals; 28%) were year-round residents. Bridled titmouse,Bewick's wren, and Abert's towhee accounted for 72% of the resident species captured. Clear Creek West had both the highest species richness (10 species) and abundance (36 birds) of residents.

Capture Rate and Seasonal Timing

Overall capture rate was low (mean = 0.25 birds/net-hour; Table 1), but similar across sites. Capture rates varied considerably throughout the sampling period probably corresponding closely to migration pulses. At Dry Beaver Creek, neotropical migrants peaked on 16 September with a capture rate of 0.39 birds/net-hour. Resident species were captured at a rate of 0.12 birds/net-hour on that date, and no short-distance migrants were captured. Short-distance migrants peaked at Walnut Creek on 14 October (0.3 birds/net-hour) and Clear Creek on 22 October (0.23 birds/net-hour). The capture rate for residents across all sites ranged from 0.04 to 0.12 birds/net-hour. While neotropical migrants exhibited the highest single-day capture rate, overall, short-distance migrants were captured at more than double the rate of residents, and more than triple the rate of neotropical migrants. These data suggest that our sampling period missed the bulk of migration for neotropical birds moving through north-central Arizona. Given that migration periods for neotropical migrants will vary annually as a result of the length and timing of the breeding season and weather patterns during the fall, we recommend fall migration studies be started in early August and run through at least the end of September.

Estimates of the capture rate necessary to provide adequate data over the course of migration are unavailable. Ralph et al. (1992) suggest that a capture rate of two birds/net/day provide a reasonable dataset over the course of the breeding season. Our mean daily capture rate was 1.6 birds/net. However, early during our sampling period when neotropical migrants were still moving through, our daily capture rate was close to three birds/net suggesting that sampling earlier in the season would provide sufficient data on neotropical migrants.

Recommendations

The two most important factors governing capture rate are seasonal timing and net placement within the study site. Migration often occurs in pulses brought about by weather patterns. Given the unpredictability of seasonal migration pulses, we recommend that two or more study sites be established in close proximity to each other and sampled simultaneously so that temporal changes in abundance and species composition may be corroborated. In addition, time and duration of net operation should be standardized among study sites to facilitate comparisons.

Finally, since mist-nets only sample birds that use the first three m above ground in any given location, it is extremely important that nets be placed in areas that funnel birds, such as habitat edges (e.g., where a woodland bisects a field), feeding areas (e.g., grapevines), edges of water, and natural travel corridors or openings in dense vegetation. While 12 m mist-nets are considered standard for banding operations, the narrow, linear nature of many riparian areas often limit their use and placement. Therefore, to better sample riparian habitats containing small vegetation patches attractive to birds, we recommend using a combination of six and 12 m mist-nets at study sites. Calculations of netting effort for six m nets is as follows: one six m net run for one hour = 1/2 net hour (Ralph et al. 1992).

Acknowledgments

We wish to thank the staffs of the Coconino and Prescott National Forests for their continued support of our riparian study and the following participants for assistance in the field: Sharon Bellovin, Laura Bonk, Allan and Laura Duncan, Jacquita Bailey, Patti Hodgetts, and Brenda Zimpel.

Table 3. Common and scientific names for species captured during fall 1992. Species arranged taxonomically within migratory categories.

Migratory Category	
Resident Species	
Gila Woodpecker	*Melanerpes uropygialis*
Ladder-backed Woodpecker	*Picoides scalaris*
Black Phoebe	*Sayornis nigicans*
Scrub Jay	*Aphelocoma coerulescens*
Bridled Titmouse	*Parus wollweberi*
Plain Titmouse	*Parus inornatus*
Verdin	*Auriparus flaviceps*
Canyon Wren	*Catherpes mexicanus*
Bewick's Wren	*Thryomanes bewickii*
Winter Wren	*Troglodytes troglodytes*
Hutton's Vireo	*Vireo huttoni*
Northern Cardinal	*Cardinalis cardinalis*
Abert's Towhee	*Pipilo aberti*
House Finch	*Carpodacus mexicanus*
Short-Distance Migrants	
Sharp-shinned Hawk	*Accipiter striatus*
Belted Kingfisher	*Ceryle alcyon*
Red-naped Sapsucker	*Sphyrapicus varius*
Ruby-crowned Kinglet	*Regulus calendula*
Hermith Thrush	*Catharus guttatus*
Rufous-sided Towhee	*Pipilo erythropthalmus*
Fox Sparrow	*Passerella iliaca*
Song Sparrow	*Melospiza melodia*
White-throated Sparrow	*Zonotrichia leucophrys*
White-crowned Sparrow	*Zonotrichia atricapilla*
Dark-eyed Junco	*Junco hyemalis*
Neotropical Migrants	
Hammond's Flycatcher	*Empidonax hammondii*
Dusky Flycatcher	*Empidonax oberholseri*
Gray Flycatcher	*Empidonax wrightii*
Orange-crownded Warbler	*Vermivora celata*
Ovenbird	*Seiurus aurocapillus*
Wilson's Warbler	*Wilsonia pusilla*
Summer Tanager	*Piranga rubra*
Western Tanager	*Piranga ludoviciana*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Blue Grosbeak	*Guiraca caerulea*
Indigo Bunting	*Passerina cyanea*
Green-tailed Towhee	*Pipilo chlorurus*
Chipping Sprarrow	*Spizella passerina*
Lincoln's Sparrow	*Melospiza linconii*

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Groundwater Elevations and Temperature Adjacent to a Beaver Pond in Central Oregon.

Michael M. Lowry

This study was designed and implemented to observe the spatial and temporal dynamics of groundwater levels and temperatures adjacent to a beaver pond in semi-arid central Oregon. The study site was located on the eastern boundary of Painted Hills National Monument along Bridge Creek, a tributary to the John Day River. Groundwater levels and groundwater temperature were monitored in 64 wells from July 3, 1991 to June 11, 1992.

Groundwater elevations varied seasonally and were generally positively correlated with increased streamflow. In addition, beaver dam-building activity appeared to increase aquifer recharge near the beaver pond in comparison to downstream areas. The groundwater elevation of a well located near the pond, rose 0.35 m between August and November 1991, while the Beaver pond stage increased by 0.22 m. Groundwater elevations at another well located downstream of the dam increased by only 0.17 m during this period with a corresponding increase in stream stage of 0.05 m. Groundwater levels throughout the study site averaged a 0.31 m gain from August to November 1991. All wells at the study site responded to changes in streamflow, and thus appear to be hydraulically connected to the stream.

Based on hydraulic gradients, the movement of water from the stream to subsurface recharge of riparian areas appeared to be greater near the pond than the streamside locations. A zone about 50 m from the pond of relatively high hydraulic gradient (0.05 m/m) persisted over time, and groundwater flow directions in this area were both normal and parallel to the stream.

The groundwater storage potential adjacent to the pond was calculated to be 446 m^3. Given a specific yield of 20%, approximately 90 m^3 of water could be drained from the aquifer if the dam were breached. However, the results of this study support the conclusion commonly expressed in the literature, but seldom quantified, that elevated water tables do occur adjacent to beaver ponds.

Groundwater temperatures for each successive month closely followed stream temperatures in wells next to the stream, indicating that stream temperatures readily influence groundwater temperatures adjacent to the stream. Wells located farther from the pond responded less quickly to changes in stream temperature. For example, the groundwater temperature in August, 1991 for a well 44m from the pond was 13.5° while the stream was 28 °C.

Wells located a few meters from the beaver pond were nearly in phase with stream temperature. A downstream well adjacent to the stream had a lag time of about three months. Wells located relatively far out on the floodplain (i.e. 50m) but opposite to the beaver pond had about a two month response lag behind stream temperature. These results further indicate that stream temperature can influence groundwater temperature, and that groundwater recharge is highest near the pond.

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Influence of Dry Storage on Seed Viability and Germination of Eight Intermountain Rushes

Emerenciana G. Hurd and Nancy L. Shaw

Abstract

The influence of dry storage on seed viability and germination of 8 common intermountain rush species (*Juncus articulatus, J. balticus, J. bufonius, J. effusus, J. ensifolius, J. howellii, J. tenuis,* and *J. torreyi*) was examined. One collection of each species was harvested in southwestern Idaho or southeastern Oregon in 1990, air-dried, cleaned, and stored in sealed glass containers in the laboratory. Seed weight and fill were determined for each collection. Viability of each collection was measured at 6-month intervals from December 1990 to December 1992 using tetrazolium chloride staining techniques. In addition, stratified (30 days at 3-5°C) and nonstratified seeds of each collection were also placed in incubation for determination of total germination annually, beginning in December 1990. Seeds were germinated for 60 days at 25/15°C (8 hrs/16 hrs) with exposure to light at 25°C. Viability and germination tests were conducted on 4 replications of 50 seeds from each collection. Total germination was calculated as the percent of viable seeds producing normal seedlings after 60 days.

Rush seeds are tiny and ellipsoid to fusiform; some are apiculate or tailed. Seeds of all collections were easily cleaned by careful screening to purities exceeding 90%. Most empty or poorly developed seeds were removed during conditioning. Fill ranged from 84% for *J. articulatus* to 99% for *J. bufonius, J. howellii, J. tenuis,* and *J. torreyi*. Seed weight ranged from 32 million/kg for *J. balticus* to 152 million/kg for *J. ensifolius.*

Viability of all collections remained constant after more than 2 years in sealed, dry storage at room temperature. Averaged over time, viability ranged from 87% for *J. torreyi* to 93% for *J. tenuis* ($P<0.05$).

Germination response to duration of dry storage and stratification varied among the eight collections. Seeds of *J. articulatus* were essentially nondormant under all test conditions. Response of the remaining species was more complex with no consistent pattern emerging.

Results to date indicate that seeds of these rush species can be maintained in dry storage for at least 2 years. Successful propagation of rushes from seed will require further study of germination requirements for individual species and populations.

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Vegetation Effects on Retention of Stream Channel Sediments

Warren P. Clary, Steven Abt and Christopher Thornton

Abstract

Disruption of riparian-stream ecosystems has occurred throughout the mountainous landscape of western United States. These ecosystems have experienced multiple impacts from many sources, such as mining, logging, road building, recreation, water diversion, and livestock grazing. On the smaller headwater streams the greatest cumulative damage has often been a result of extensive livestock grazing. Improper grazing management can eliminate riparian vegetation, cause widening or incisement of stream channels, change streambank morphology, and in some cases lower the floodplain water tables.

Sediment deposition in the degraded stream system is an essential part of the natural streambank rebuilding process. Sediment deposition in mountain streams must often be induced because sediment loads can be below the sediment carrying capacity. Vegetation within the streambank-stream channel structure is known to enhance sediment deposition and to improve retention of these deposits. Vegetation height and biomass within the channel system depends, in part, upon the management of grazing livestock. Therefore, riparian grazing management guidelines should consider the dynamics of streambank depletion and rebuilding.

This study was designed to

1) quantify the ability of a typical herbaceous species, Kentucky bluegrass, to entrap sediments and

2) develop insight on deposition retention during the reduced sediment loading of the hydrograph tail-off.

A meandering stream was physically simulated in the Hydraulics Laboratory at Colorado State University. A 19 meter long streambed was constructed at a slope of 0.4% and was capable of conveying a flow of up to 0.2 cubic meters per second. The channel has a "dished-out" or laid-back bank. Insert sections were formed in the channel bottom and provided for the placement of vegetation mats into the channel bottom and sides. A test series was conducted in which flows of approximately 0.09, 0.14, and 0.2 cubic meters per second were conveyed through the stream channel with a sediment injection rate of 18.8 grams per second for a six hour duration. Flushing flows were applied for 2 to 6 hours following the injection period. Sediment deposition patterns were recorded for both vegetated and non-vegetated conditions. The rate of sediment deposition was documented by taking core samples from the vegetation inserts during and after sediment injection.

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Faults with Growing Season Determinations Using the Federal Wetlands Delineation Manual

David L. Magney

Introduction

According to the COE 1987 wetlands delineation manual (Environmental Laboratory 1987), a site must possess a predominance of hydrophytes (water-loving plants), hydric soils (soils with periods of anaerobic conditions), and wetland hydrology (soggy soils for a significant portion of the growing season) before it is considered a jurisdictional wetland as defined in Section 404 of the Clean Water Act. The COE manual was developed to determine the boundaries of jurisdictional wetlands to implement provisions of the Clean Water Act. The COE wanted to have one manual that could be applied nationwide. Areas with a Mediterranean or summer-drought climatic regimes do not consistently develop all three wetland characteristics as readily as wetter climates.

Wetlands are simply lands transitional between permanently flooded aquatic habitats and never or nearly never flooded terrestrial habitats. The degree of wetness can vary tremendously, depending on any number of variables. The current practice of excluding the wet winter season from consideration as part of the growing season based solely on a growing season determination that applies an artificial and inaccurate basis is invalid.

Soil Temperature Determinations

Wetland areas in the arid southwest that have surface water or saturated soils for extended periods during the "growing season", as currently defined in the manual, are rare, partly because of restrictions and generalizations put on what constitutes the growing season. The COE manual defines growing season as "the portion of the year when soil temperatures at 50 centimeters (cm) (19.7 inches) below the soil surface are higher than biologic zero." The manual goes on to say, "For ease of determination this period can be approximated by the number of frost-free days." The COE's reasoning does not follow basic logic; the frost period does not necessarily mean that the soil is at or below biologic zero. Many areas can have frost days with soils above biologic zero at 50 cm below the surface. In fact, nearly all of California and much of Arizona have soils that never reach biologic zero but do have frost.

For example, western Riverside County has a Mediterranean climate with precipitation occurring almost exclusively between October and May (Figure 1). Staff at the local Soil Conservation Service (SCS) office stated that the frost-free period for agricultural crops in southwestern Riverside County is between April 15 and October 30 (199 days); the soil survey for the western Riverside area states the growing season is February through October. The average daily minimum temperature for Riverside for January (the coldest month for Riverside) is 2.9°C (37.3°F), but the average daily maximum is 18.5°C (65.3°F)

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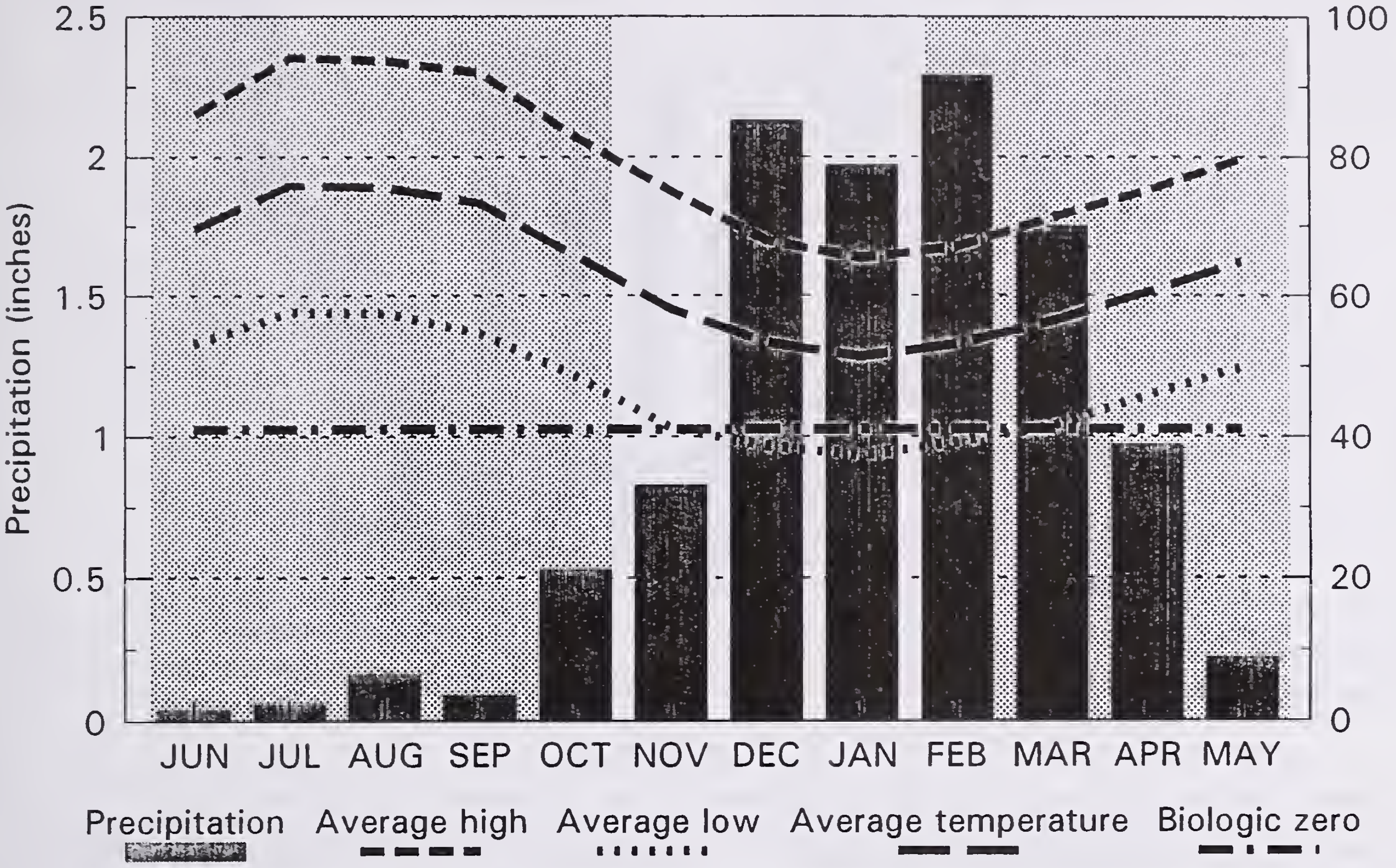
Figure 1
Average Monthly Precipitation and Temperature Riverside, California



Note: Shaded months indicate Soil Conservation Service growing season.

(Knecht 1971); it is highly unlikely that, on the average, the soil temperature would drop below biologic zero. In fact, the mean air temperature in Riverside in January is 12.8°C (55°F), well above biologic zero (Figure 1).

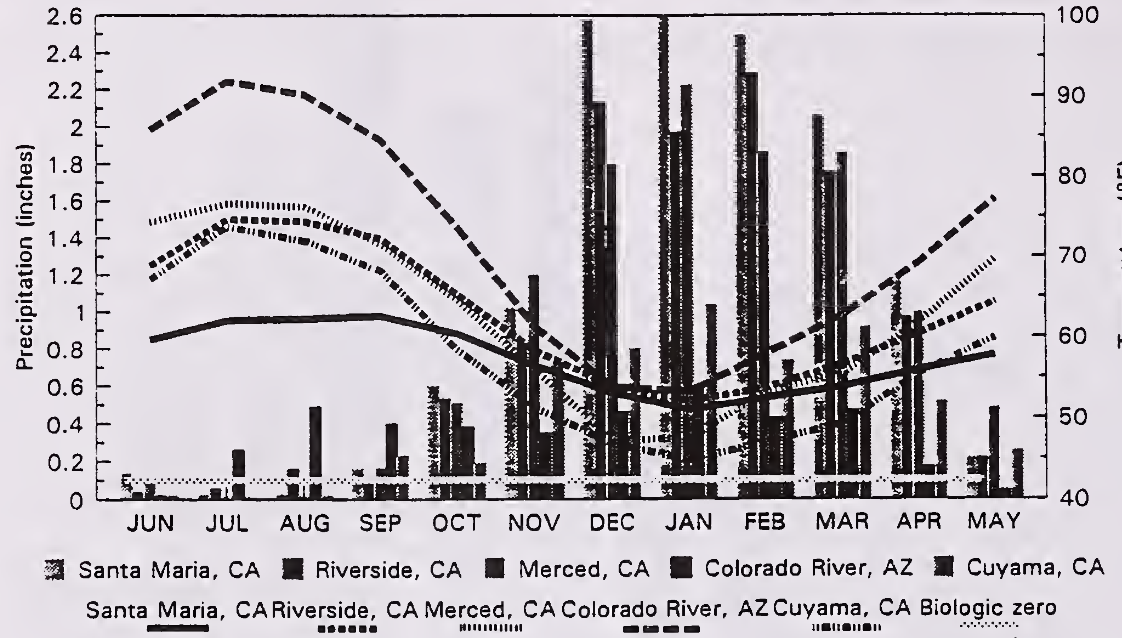
Soils temperatures at 50 cm and deeper are generally considered to be 1°C (1.8°F) warmer than the mean annual air temperature (Soil Survey Staff 1975, Fanning and Fanning 1989). Soil temperature fluctuations are further moderated in saturated soils because water has a high latent heat capacity. Singer and Munns (1987) demonstrated it takes 333% more energy to change a volume of water than the same volume of air. Similarly, it takes 230%more energy to change a volume of wet sand (40% water) than dry sand. Furthermore, there is a time lag between soil temperature change and air temperature. Thus, soils that are dense or wet tend to have the least temperature variations.

Using the frost-free period would not accurately characterize the soil temperatures and potential for biological activity during the frost-prone months. The frost-free period, as suggested by the SCS, is primarily concerned with agricultural crops, not natural vegetation. Figure 2 compares the average monthly air temperature and precipitation in lowland stations in California with biologic zero which demonstrates the problem with using the frost-free (agricultural crop) growing season to determine the growing season for native wetland plants.

Plant Phenology in a Mediterranean Climate

In intermittent or seasonal water courses of areas with a Mediterranean climate, water is only present during the winter and early spring and sometimes in the late fall as illustrated by Figure 3, showing average monthly precipitation in lowland stations of California and Arizona. Soil moisture is often lacking

Figure 2
Average Monthly Precipitation and Temperature
Lowland Areas of California and Arizona



during the hot summer months. In all lowland areas of California (generally below 1,000 meters), the soils are above biologic zero 365 days per year (Figure 3), but water is lacking during the seasonal drought.

Native and naturalized plants can be found growing in the Riverside area during any month of the year if sufficient moisture is available. Some plants are winter-deciduous and are not actively growing between late fall and late winter, such as species of *Salix, Populus,* and *Alnus* associated with riparian vegetation. Many annual and perennial species adapted to a Mediterranean climate begin active growth as soon as sufficient precipitation has fallen to allow seed germination or shoot growth. Winter-time observations suggest that the designation by the local SCS office of the growing season set for agricultural crops is not valid for determining the growing season for natural vegetation and natural vegetation is what is being examined during a wetland delineation. For example, annual and perennial grasses and herbs germinate and begin growing in the Central Valley and coastal and southern California as soon as sufficient precipitation has fallen.

In most of the country, the onset of frost correlates to the cessation of plant growth. This is not true in most low elevation areas of the Pacific southwest. Herbaceous vegetation actively grows in areas such as the lower Sacramento Valley and the entire San Joaquin Valley and California coast in December and January. Therefore, excluding the winter from consideration as part of the growing season will prevent many acres of wetlands from being delineated as such.

Figure 4 illustrates the actual growing season of several native plant species. Some plant communities have species with different growing seasons. For example, Blue Oak Woodland consists of Blue Oak (*Quercus douglasii*) and grassland species (Figure 5). Blue Oak actively grows from April to October, while the grass and herb understory grows between October (generally the month with significant precipitation after the summer drought) and May.

Expanding the growing season to include the winter months in areas such as Riverside would require a wetland to have wetland hydrology, soil saturation or inundation for a longer period of time than the

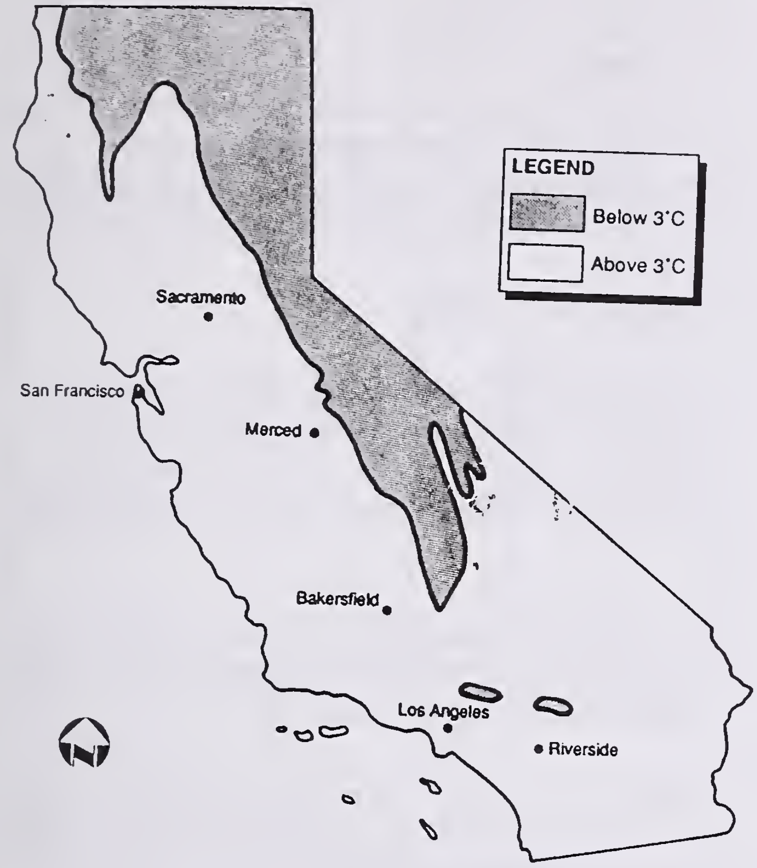


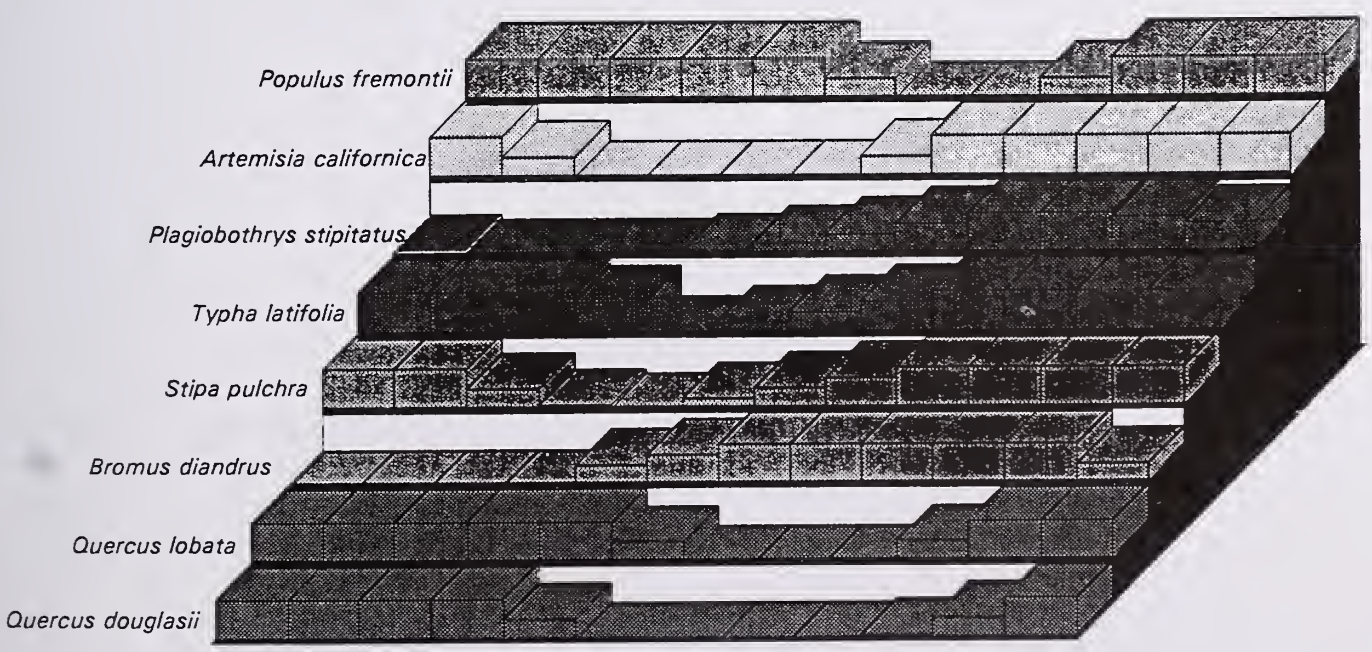
Figure 3 Average Temperature of the Coldest Month in California

typical 273-day growing season. To complicate the issue, the USDA has determined different growing seasons for different crops. The USDA recently recognized that the summer drought in southern California shortens the growing season for some crops such as nectarines (*Federal Register* 57[22] February 3, 1992). Therefore, if we include the winter, where appropriate, and exclude the summer drought periods as part of the growing season, the environmental parameters that in fact determine what vegetation types grow at a given site will be more appropriately determined, and COE jurisdiction will be delineated more accurately. The expected results will be that more wetland and riparian wetland areas will be delineated as jurisdictional wetlands in the arid southwest. It is important to note that most of these sites are already considered jurisdictional waters of the U.S.; therefore, total COE jurisdiction is not expected to expand.

Conclusions and Recommendations

The result of applying the manual as written is that many areas that have wetland hydrology during the winter that

Figure 4 Growth Periods for Selected California Plants



drain or evaporate by late winter or early spring (i.e., February to March according to my example) would not be considered a jurisdictional wetland. Therefore, setting the growing season to exclude the winter for purposes of wetland delineations would not accurately portray the growing season for the soils and many wetland plants in this region. February through October for the purposes of wetland delineations would not accurately portray the growing season for the soils and many plants (including hydrophytes) in this region. Furthermore, the actual season for natural vegetation is determined by the presence of sufficient water, with temperature not being the limiting factor in most of California and parts of the arid southwest. A more accurate growing season can be applied for sites with summer drought by considering that the complete absence of water during the drought period causes some plants to go dormant in the summer.

The manual should be modified to allow for more flexibility in determining the growing season as determined by climate, not the frost-free period designed for agricultural crops. Modifying the manual to take into consideration the problems outlined above would allow more accurate wetland delineations to be performed in the arid southwest.

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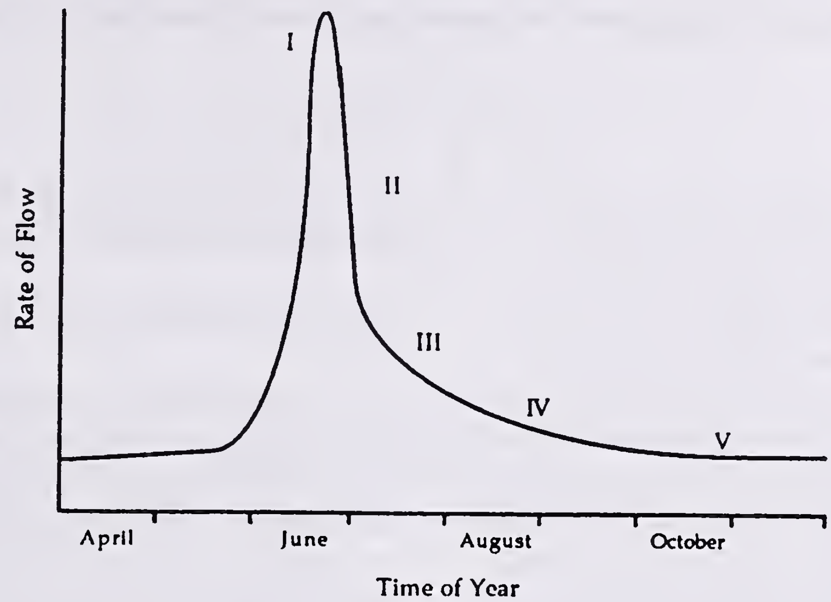

Figure 1. A generalized hydrograph for a river in the foothills of Alberta. The hydrological factors important for cottonwood seedling establishment are:
1. Peak flows to prepare germination sites,
2. Receding flows at time of seed release to expose new germination sites,
3. Gradually declining water table to limit seedling drought stress and prompte root growth,
4. Adequate summer flows to meet high water demands, and
5. Adequate autumn flow to improve plant water balance and over-winter survival

A Model for Assessing the Effects of Altered River Flows on the Recruitment of Riparian Cottonwoods

John M. Mahoney and Stewart B. Rood

Introduction

Riparian cottonwoods (poplars) have declined along many rivers in western North America (Johnson and Haight 1984; Rood and Mahoney 1990; Sands and Howe 1977). The effects of livestock grazing or clearing for agricultural use or domestic settlement have reduced cottonwood abundance directly. Other factors, such as alteration of the hydrological regime, have had an indirect effect on cottonwood abundance (Stromberg et al. 1991). The indirect factors can prevent cottonwood forest replenishment by affecting conditions that are essential for the recruitment of cottonwood seedlings (reviewed in: Rood and Mahoney 1990).

River valley cottonwoods are phreatophytic and obtain moisture from the riparian water table. This saturated zone extends more or less horizontally from the river and fluctuates with the river stage. Cottonwoods are adapted to natural variations in water table level caused by seasonal fluctuations in river flow.

Figure 1 presents a general hydrograph for a western foothills river showing five hydrological elements that are essential for cottonwood seedling establishment and initial survival. Elimination of any of these elements will result in the failure of seedling establishment. Minor changes to only one element may not have a deleterious effect on cottonwood seedlings, but if two or more elements are altered, the cumulative effect may become substantial.

This research was enabled by a research grant from Alberta Public Works Supply and services to S.B. Rood and J.M. Mahoney and supported by a NSERC Strategic Grant to S.B. Rood.

The 'Recruitment Box'

The following model considers the basic hydrological elements that are necessary for the establishment of riparian cottonwood seedlings. Attention is given to seedling recruitment because it is likely to be a particularly vulnerable component of the cottonwood forest cycle. The model does not consider the effects of precipitation, temperature, or other factors that can affect the the success of developing seedlings; nor does the model address the conditions necessary for the maintenance of established cottonwoods.

The hydrological conditions essential for cottonwood seedling success can be defined by river stage and time of year (Figure 2). The river stage identifies a zone along the river bank where cottonwood seedlings can survive. Seedlings that establish above an upper elevation limit will not be able to maintain adequate root growth to tap the deep

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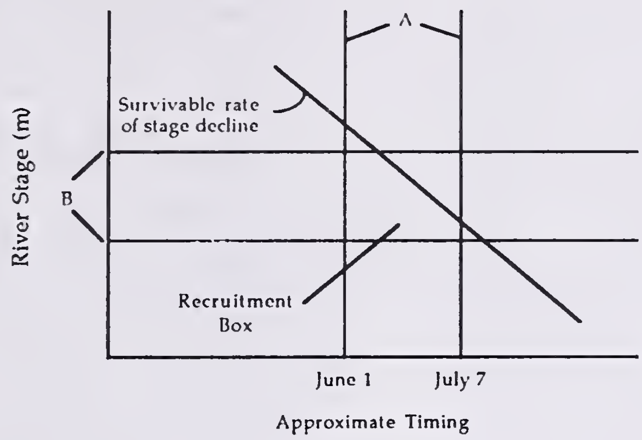

Figure 2. Model framework including the maximum survivable rate of water table decline for cottonwood seedlings in southern Alberta. The annual opportunity for successful seedling recruitment is limited to the 'Recruitment Box'. "A" indicates the period of seed release and viability. "B" indicates the approximate bank elevation for successful seedling establishment.

water table at the end of the growing season. These seedlings will suffer from drought stress and die. A lower bank elevation limit can also be identified for seedling survival. Seedlings that establish below this elevation are likely to be scoured away by ice or flooding, or may be covered with fresh sediment the following year. These upper and lower elevation limits result in the formation of characteristic bands of cottonwoods along river banks of the foothills and western prairies (Bradley and Smith 1986).

A critical period for cottonwood seedling establishment occurs annually. This seedling establishment period starts with the onset of seed release and continues through the period of seed release, typically a four to six week period. The seedling establishment period ends about one week after seed release is complete, when the small cottonwood seeds lose their viability. Inadequate moisture conditions during this period will result in the failure of seedling establishment for that year.

The limits set by upper and lower bank elevations and the availability of viable seeds define an annual opportunity for cottonwood seedling establishment. This opportunity is represented as the 'Recruitment Box' in Figures 2 through 4.

Water Table Decline

A third hydrological component that determines initial seedling survival is the rate of water table decline. The water table must drop gradually enough to allow cottonwood seedlings to maintain root contact with the receding water supply. Greenhouse experiments confirm field studies that indicate that drought stress and drought-induced mortality of seedlings accompanies abrupt rates of water table decline (Mahoney and Rood 1991). A water table decline of 4 cm per day has been found to be the maximum survivable by some cottonwood seedlings (Mahoney and Rood 1991). However, the survivable rate of water table decline varies with cottonwood species and is influenced by the texture of the riparian substrate (Mahoney and Rood 1992).

Figure 3 illustrates hydrological conditions that are potentially ideal for cottonwood seedling establishment. A peak flow precedes seed release to prepare new seed beds. Initial stage decline is fairly rapid, exposing large areas that are moist and barren. The stage decline in the latter part of the critical period is slow enough that roots of the new seedlings are able to maintain contact with the receding water table.

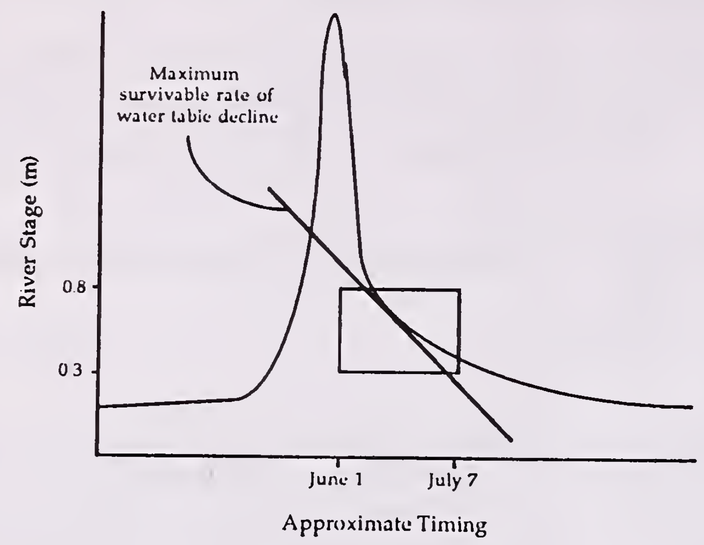

Figure 3. The relationship between a generalized hydrograph for southern Alberta and the 'Recruitment Box' including the survivable rate of water table decline for cottonwood seedlings.

Application of the Model

Seedling Recruitment

This model may explain why cottonwood establishment is not successful every year under natural conditions. Although the elements that define the Recruitment Box are relatively constant, hydrological patterns vary from year to year. If peak flows occur early in the season, flows may taper to low levels before seed release so that seedlings only germinate at low bank elevations. These seedlings are likely to be covered with sediment or scoured away the following spring. In years where peak flows are late, seeds germinating prior to peak flows will be washed away by higher flows that same year. Seedlings that establish following the peak flow will be at bank elevations too high for root growth to the late summer water table. These seedlings will suffer drought stress and die during the first summer. Field studies in southern Alberta indicate that although numerous cottonwood seeds germinate annually, very few survive the initial summer (Virginillo et al. 1991). The poor survival of

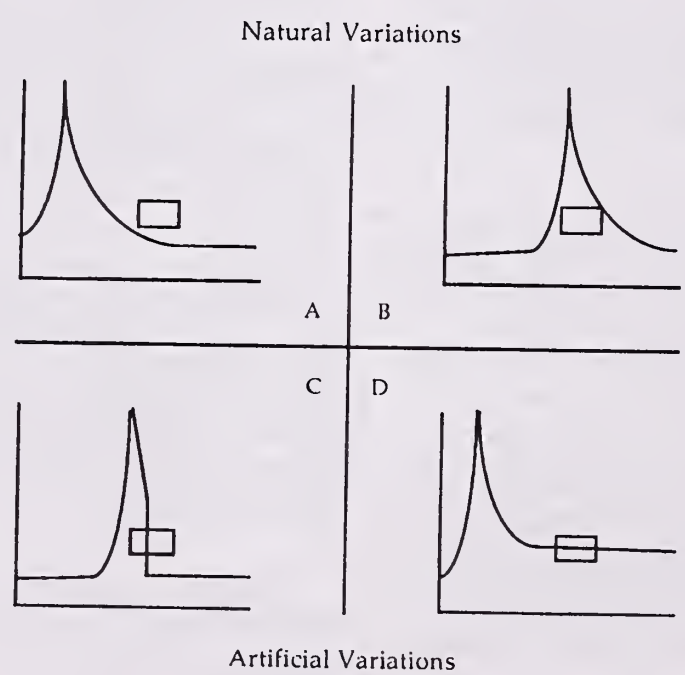

Figure 4. Variations in river flows and their relation to the 'Recruitment Box'.
A. Peak flow receding to minimum levels before the onset of seed release,
B. Peak flow receding to minimum levels after seed germinability has ended,
C. Abrupt reduction of river flows during the period of seed germinability,
D. Constant flow regulation during the period of seed germinability.

seedlings suggests that natural flow patterns are seldom suitable for cottonwood seedling survival in southern Alberta and that new trees may only establish at five or ten year intervals.

Artificial Flow Regimes

The effects of managed river flow patterns on cottonwood seedling establishment may also be predicted with this model. Figure 4c (not included in this paper) illustrates a situation where a dam is closed shortly after peak flow causing an abrupt decline in downstream flows (Rood and Heinze-Milne 1988). In this case the rate of water table decline is too great for the roots to maintain contact with the water supply. Seedlings that germinate under these conditions will suffer drought stress and die.

Constant flow conditions may not affect seedling survival during the first year and may be favorable to existing trees. However, the new seedlings would develop a shallow root system making the them vulnerable to subsequent scouring or flooding. A gradually declining water table is preferable as it encourages deep root development in new seedlings (Mahoney and Rood, 1991). Stabilized flows also permit encroachment of grasses and other vegetation to the river's edge, further limiting the formation of new barren zones essential for cottonwood seedling establishment.

The values applied to each parameter defining the Recruitment Box will vary with the reach of the river being investigated and the regional cottonwood phenology. For rivers in the foothills of southern Alberta, seed release normally occurs from late May to early July. The bank elevation for seedling establishment is about 0.3 m to 0.8 m above natural minimum summer flows with some variation likely between rivers. Experimentation in the greenhouse has shown that natural poplar hybrids can survive a maximal rate of water table decline of about 4 cm day-1 in a gravel/sand substrate typical of southern Alberta floodplains.

Conclusion

The preceding model provides a framework for assessing the effects of existing or proposed flow regimes on seedling recruitment of riparian cottonwoods. Recorded or projected flow patterns for a particular river reach can be evaluated for the critical period of seed release to determine whether river stages and rate of decline fall within the range necessary for seedling establishment. In managed river systems, identification of the hydrological elements that fail to meet these ranges may allow river managers to adjust flow patterns to improve the prospects for the replenishment of riparian cottonwood forests.

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Associations between Riparian Ecosystem Parameters in Happy Valley, Arizona

Roy L. Jemison

Introduction

Riparian areas are defined by the Southwestern Region of the Forest Service, U.S. Department of Agriculture, as "geographically delineable areas with distinctive resource values and characteristics that are comprised of both the aquatic and riparian ecosystems" (USDA Forest Service 1986). Riparian areas occupy approximately 113,150 ha in Arizona (Babcock 1968). These areas are represented in every life zone, from mountain alpine communities to subtropical Sonoran Desert scrub plains and valleys of the lower Gila and Colorado Rivers (Brown 1982). These areas are unique in contrast to the communities that surround them because they are supplied with water, from permanent or semi-permanent sources, in excess of the amount received by the surrounding communities (Johnson et al. 1985). Vegetation, when present, can be distinct riparian species, or a mixture of these and species from the surrounding communities (Szaro 1989).

To preserve riparian areas, clear management objectives are needed. These areas are managed for different and sometimes competing uses including farming, grazing, recreation, wildlife, forest products, roads, mining, and water quality (Thomas et al. 1979; Johnson et al. 1985).

Studies which clarify how physical and biological processes influence riparian vegetation are needed to guide the development of management practices. Past studies have demonstrated how improper management can cause permanent loss of riparian areas (Carothers 1977; Lacey et al. 1975). Studies should cover multiple disciplines, including hydrology, soils, geomorphology, ecology, topography, wildlife and surveys of past and present land use (Asplund and Gooch 1988, Bryan 1928, Johnson et al. 1985; Reichenbacher 1984).

The **Objective** of this study was to determine the associations, in time and space, between the hydrologic inputs, vegetation and soils in a low mountain (1,000 - 2,000 m above sea level) riparian ecosystem. Specific parameters observed included precipitation, streamflow, water table level, vegetation, soils, location with respect to the stream channel and date of observation. The understanding was the results of this study would increase the basic knowledge available to managers for developing guidelines for use of similar areas in southeastern Arizona.

Methods and Materials

Study Site

This study was conducted along Paige Creek in Happy Valley, on the eastern side of the Rincon Mountains, 48 km east of Tucson, Arizona. The elevation of the study area is approximately 1,250 m above sea level. Paige

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Creek drains a watershed of approximately 26 km^2. Annual precipitation in Happy Valley is between 305 and 406 mm (Clemmons 1973). Temperatures have not been recorded in Happy Valley.

Paige Creek is a slight to moderately entrenched channel as it passes through the study area. The active channel varies from 0.1 to 1.5 m deep, 3 to 10 m wide, with a channel slope from 1 to 2 percent. Channel bed materials vary from fine sands to coarse gravels, with some small boulders.

Happy Valley is on the Coronado National Forest, managed by the USDA Forest Service, except for two privately owned sections. Uses of the valley have included cattle grazing, irrigated farming, and residential. Cattle grazing was the only activity on the site during this study.

Study Design

Two areas bordering Paige Creek were selected as representative sites from the standpoint of vegetation, soils, topography and land use. Two transects, 92 m in length, were surveyed and marked across each site. The transects were perpendicular to the stream channel and began from the center of the channel. The four transects served as permanent reference lines for soil moisture measurements and vegetation surveys (Jemison 1989).

Soil Moisture Study

Soil moisture was measured monthly at 30, 46, 61, 76, 91, and 122 cm below the soil surface, at approximately 23-m intervals along each transect. At each sampling location, two readings were taken, one to each side (5 m) of the transect line. Measurements were taken in 5-cm diameter access tubes using a neutron soil moisture probe.

Soil and Root Survey

Soil pits, 2 m deep, were dug at 23 m intervals along the transects. Soil horizons were described and samples collected for a particle size analysis. Particle size classes, for the portions under 2 mm, and textural classifications were determined by standard laboratory procedures (Buol et al. 1980; Foth et al. 1976). The percent organic matter in the surface horizon was estimated visually. Plant roots were estimated visually while sampling the soil pits.

Hydrologic Inputs

Precipitation, streamflow, and water table levels were continuously measured with recording gauges during the study. Rainfall was measured by 3 recording rain gages spaced across the study area. Streamflow was measured along a straight channel reach with a float operated water level recorder. Water table elevation was measured at 15 and 58 m away from the stream channel in wells with float operated water level recorders. The water table wells are approximately 2.4 m deep.

Vegetation Survey

The vegetation along each transect was sampled using a split block design beginning from the center of the stream channel (Jemison 1989). Sampling in each block (465 m^2) took place in three phases. First, ground cover percentages, including grasses, forbs, litter, rock cover, and bare ground were measured in equally spaced plots (0.1 m^2). Cover class was determined by the Daubenmire Cover Scale (Mueller-Dombois and Ellenberg 1974). Next, shrub cover percent was estimated using the line intercept method along 3 equally spaced lines in the blocks. Finally, total tree basal area (m^2), in each block, was measured. Plant species were identified and classified according to Kearney and Peebles (1951).

Data Analysis

Soil moisture was analyzed using a repeated measures analysis of variance. Depth was treated as a repeated measurement, date and transect treated as analysis of variance factors, and distance treated as covariate. Variation among depths was assessed using orthogonal contrasts, comparing each of the upper depths with the lowest (122 cm). Correlations between soil moisture and precipitation and between streamflow and water table elevations were analyzed by standard regression methods.

The relationship between vegetative cover and distance from the stream channel was analyzed with a two-factor analysis of variance on distance and transect using orthogonal polynomials to isolate linear and nonlinear components of the distance relationship.

Results and Discussion

Soils

The soils along Paige Creek are divided into two groups. The soils bordering the stream channel are recently formed, coarse, mixed sands, ranging in depth from 25 cm to greater than 200 cm deep. The width of these soils varies from 0 to 30 m, from the stream channel. The soils beyond the recently formed sands, moving away from the stream channel, are finer textured, sandy-loams that are compacted in the subsurface layers. Where these soils are close to the channel, they are on top of coarse sands with gravel. These soils are greater than 200 cm deep and have noticeably higher organic matter contents: 3 to 4 percent (estimated visually).

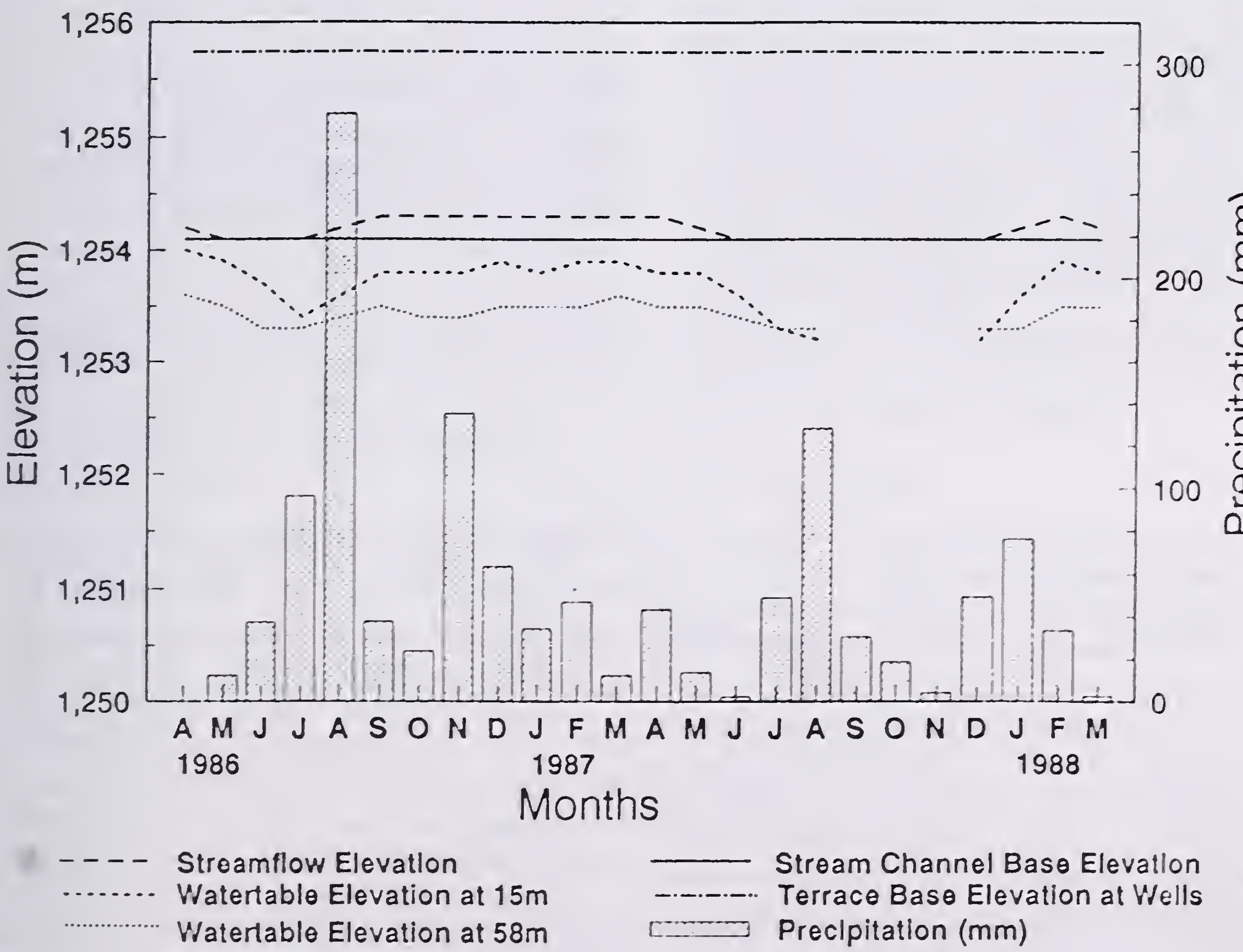

Figure 1. Monthly precipitation, streamflow and water table elevations for Paige Creek in Happy Valley, Arizona, April 1986-1988.

Roots

Roots of grasses and forbs were observed throughout the upper 46 to 61 cm of surface soil, in the recently formed sandy soils, near the channel. Roots of *Platanus wrightii* (sycamore) and *Populus fremontii* (cottonwood) up to 5 cm in diameter, were also observed throughout the sample pits (200 cm deep).

In the sandy loam soils, further away from the channel, roots of grasses and forbs were observed in only the upper 46 cm of soil. Several large roots of *Prosopis juliflora* (mesquite) and *Quercus emoryi* (emory oak) were observed 91 cm below the soil surface.

Hydrologic Inputs

Precipitation, streamflow, and water table fluctuations are the primary sources of soil water recharge in the study area. The average annual precipitation during the study, from 1986 to 1988, was 335 mm (Figure 1). This was low, compared to the 6-years prior to the study, when precipitation varied between 330 and 686 mm annually, measured at a nearby ranch (Unpublished data, USDA Forest Service, Coronado National Forest, Tucson Arizona 1987). Most of the precipitation occurred during the months of July through August and November through February.

Paige Creek flowed 6 to 8 months annually, during this study (Figure 1). The average streamflow level was 15 cm (a discharge of 0.06 m^3/s), for the months when flow occurred. Streamflow and on-site precipitation were not correlated, indicating most of the water flowing in the channel was coming from higher up the mountain. Correlation between the mean monthly streamflow and water table elevations, in observation wells, 15 m and 58 m away from the stream channel, was significant. The water elevations in the three recording wells always had declining profile moving away from the stream channel, indicating the water from the stream was replenishing the water table.

Soil Moisture Condition

Mean annual soil moisture increased significantly from 9 percent, in the recent sandy soils near the stream channel, to 14 percent in the finer loam soils further away from the channel, at an average depth of 45 cm below the soil surface. Although varying with distance from the channel and site, soil moisture generally increased with depth down to 122 cm, the maximum depth measured. Average soil moisture across the entire study are was highest in March 1987 (16%) and lowest in December 1987 (7%).

Distance From Channel Center Center (m)	% Grass Cover	% Forb Cover	% Shrub Cover	Tree Basal Area (m^2/ha)
0 - 15	7	9	11	15
15 - 30	11	15	11	28
30 - 45	16	23	16	47
45 - 60	38	25	22	25
60 - 75	50	24	20	4
75 - 90	37	16	13	9

Table 1. Vegetative Survey Summary for Happy Valley, Arizona, September 1988

Precipitation and soil moisture, from 0 to 30 cm below the soil surface, were significantly correlated. Below 30 cm there was correlation at some sample points and below 61 cm there was no correlation between precipitation and soil moisture. This analysis indicates that precipitation primarily replenishes soil moisture in the upper soil layers, the zone occupied by grasses and forbs.

Vegetation

The vegetation on the study area was classified into two distinct overstory plant communities. A sycamore - cottonwood woodland borders the stream channel on the recent sandy soils. Tree crown cover in this community is dense and continuous. The understory forb, grass and shrub cover included, *Bouteloua aristidoides* (needle grama), *Mulhlenbergia rigens* (deer grass), *Wyethia arizonica* (mules ears), *Heterotheca psammophila* (camphor weed), *Conyza canadensis* (horseweed), *Arctostaphylos pungens* and *Baccharis glutinosa*. The second overstory community consists of mesquite, *Fraxinus velutina* (ash), and emory oak. The trees in this community are in general smaller and fewer in number than trees in the sycamore - cottonwood community. The understory cover included *Bouteloua rothrockii* (Rothrock grama) *Aristida divaricata* (H&B poverty three-awn), *Acacia greggii* and *Juniperus deppeana*. This community coincides with the fine sandy loam soils, further away from the channel. Overstory and ground vegetation cover percentages are summarized in Table 1.

Grass and forb cover increased linearly from the recent sandy soils, near the channel, to the finer loam soils, further away from the channel (Table 1). Grasses were also taller and denser, farther away from the channel. The increased cover percentages of these plants could be attributed to the increased soil moisture,decreased overstory shading and less site disturbance. The primary disturbances close to the stream channel are cattle. While flooding can cause site disturbance, the stream never exceeded the banks during this study.

Tree basal area per hectare increased fourfold with increased distance from the channel, to a maximum of 47 m^2/ha, between 30 to 45 m away from the channel (Table 1). Sycamores and cottonwoods represent 71 % and 16% of the total tree basal area, respectively. The greater tree basal area per hectare, further away from the presently active channel is due, in part, to the fact that the stream has shifted in its course over time and has also been down cutting in the channel. The locations of the older overstory species are good indicators of where the stream has flowed in the past and what the conditions of the site may have been.

Another factor contributing to the higher basal area away from the channel is the emory oaks. The emory oaks are first present in the area of transition between the sycamore - cottonwood and mesquite - ash woodlands. From the transition area to approximately 90 m away from the stream channel scattered individuals of this tree are present. While few in number, these trees are the largest trees in the mesquite - ash woodland, the largest surveyed was 1.4 m^2, observed approximately 60 m from the channel. Emory oak is considered an indicator species of a water table at a depth below that of riparian species such as cottonwood and sycamore (Meinzer 1927). The absence of this species farther than 91 m from the stream channel suggests the distance at which the water table is unavailable to phreatophytes in this area.

Conclusions

Several significant correlations were apparent from the data collected along Paige Creek. Streamflow and water table levels at 15 and 58 m away from the stream channel were significantly correlated. The water levels in the three wells always had a declining profile, moving away from the stream channel, indicating the stream is replenishing the water table in the study area. In addition, stream flow and precipitation were not correlated, meaning the water in the stream was coming higher up the mountain.

Precipitation and soil moisture content, from 0 to 30 cm below the soil surface were significantly correlated. Greater than 61 cm below the soil surface these two parameters were not correlated. Soil moisture increased with distance away from the stream channel, from 9 percent in recent, coarse, mixed sand to 14 percent in a finer, sandy loam, measured at an average depth of 45 cm below the soil surface.

The roots of grasses and forbs were observed primarily in the soil surface layers (0 - 61 cm) replenished by precipitation. Numerous large and small roots of sycamore and cottonwoods were observed from 0 - 200 cm below the soil surface in observation in the recent, coarse, sandy soils near the stream channel. Fewer and smaller roots of mesquite and emory oak where observed below 91 cm in sandy loamy soils further away from the stream channel.

Grass and forb cover percentages increased significantly with distance away from the channel. This corresponded with changes is soils, from recent, coarse, mixed sand to finer textured sandy loam; increased soil moisture; decreased overstory cover and less disturbance.

Tree basal area increased to a maximum of 47 m^2/ha, between 30 - 45 m from the stream channel, then decreased. The increase was due in part to the fact that the stream has shifted over time.

Implications

The primacy objective of this study was to determine the associations between several select parameters along Paige Creek in Happy Valley, Arizona. An understanding these associations is needed to properly maintain this ecosystems which is in constant flux, due to natural and human intervention. The two years of data collected as part of this study and the understanding developed will permit the managers to know the flow levels and timing are required to maintain this area. This information can aid in answering questions such as, what could happen to this riparian area if the irrigated fields less than a mile upstream from this area were put into operation again, or what if that same area became developed for residential use? The knowledge developed from this study will also assist managers to develop guidelines for the management of similar areas.

The study of this area is not complete. Further studies needed in this area include: determination of the requirements to regenerate and grow new riparian vegetation and determination of the extent of similar riparian areas and how the information learned in this study applies.

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Groundwater and Surface Flow Models Used to Simulate Impacts and Benefits to Riparian Vegetation Caused by Flood Control and Water Supply Management Projects

Steve Chainey, Gus Yates and Bill O'Leary

Abstract

Several case studies of seasonal creeks and permanent streams are presented that demonstrate the effective use of hydrologic modeling to simulate flood flows, low flow, and groundwater profiles for riparian impact analysis and to guide the recovery and management of channel vegetation. Examples described will include the following:

Lee Vining, Rush, Parker, and Walker Creeks are tributaries of Mono Lake, California. Flow in all four creeks was diverted and the channels dewatered between 1947 and 1982 for municipal water supply. A matrix of piezometers placed along the channel floodplain was used to detect variation in water table depth and groundwater slope under several controlled release streamflow regimes to create a model of the relation of riparian zone groundwater to surface flow conditions. The completed study will be used to determine the relative benefits of six different rewatering flow regimes as part of the Mono Lake environmental impact report.

San Simeon Creek, a central California coastal stream, supports a channel riparian forest that could potentially be affected by groundwater extraction for the nearby community of Cambria. A one-dimensional finite difference, groundwater flow model was "embedded" in a conjunctive use operations and storage model to show the interrelation of surface flow in the creek, surface diversions, seasonal depth to water table, and evapotranspiration water use by riparian vegetation.

Steve Chainey is a Plant Ecologist; **Gus Yates** is a Hydrologist; and **Bill O'Leary** is a Civil Engineer with Jones and Stokes Associates, Sacramento, California.

Responses of Riparian Vegetation and Groundwater to Activities Along the Tijuana Corridor

Nancy E. Kramer and Alan D. Steinman

Abstract

The potential effects of groundwater extraction and river diversion on riparian vegetation in southern San Diego County, California were monitored from September 1991 to October 1992. Water potential data were collected on five riparian species (*Salix lasiolepsis, S, gooddingii, S. laevigata, S. exigua,*and *Baccharis glutinosa*) at five selected sites: two sites that received irrigation beginning in August 1992, two sites that were not irrigated, and a reference site located on a permanent stream approximately five miles northeast of the study area.

Groundwater level declined at approximately the same rate (i.e. ca. 97 mm/month) at the two sites where groundwater wells were monitored. Water potential showed a general increase during the two months following irrigation; however, there were no consistent statistical trends. Declines in water potential occurred in all monitored species at the non-irrigated sites during the same time period. At the Reference Site, mid-day water potential did not change significantly for *Salix* spp. during September or *B. glutinosa* during September or October. However, *Salix* spp. exhibited significant increases in water potential during October, likely due to phenological changes.

Alan D. Steinman is a Senior Scientist and Nancy Kramer an Ecologist with Science Applications International Corporation in San Diego, California. Dr. Steinman specializes in freshwater ecology. He has an MS in botany from the University of Rhode Island and a PhD in botany from Oregon State University. Ms. Kramer's BS degree in is biology from Kansas State University and her MS is in biology from San Diego State University.

Arizona Riparian Inventory and Mapping Project

Ruth Valencia

Abstract

The Arizona Game and Fish Department has initiated a statewide mapping and inventory of riparian areas in response to recent legislation and to better understand the functions and values of riparian ecosystems in the arid Southwest. The Department will be developing a geographic approach to identification, classification, and quantification of the state's riparian resources. The project will process Landsat satellite imagery, low-elevation aerial videography, and a broad array of field data into a geographic information system (GIS). The resulting system will allow us to generate a statewide vegetation map of riparian communities and associate a number of characteristics at any given location. This interactive approach will allow us to begin to make determinations as to whether a particular riparian function is occurring in an area. The project will be developed in phases. The first phase will give priority to mapping areas of perennial water. Later phases will include intermittent and ephemeral streams. The first phase of this project will be completed by December 1993.

Ruth Valencia is the Ecosystems Program Manager, Nongame Branch Arizona Game and Fish Department, Phoenix and was previously in charge of the Arizona Natural Areas Program. She has an MS degree in Environmental Management from the State University of New York at Buffalo and a BS in Natural Resources Management from Allegheny College, in Pennsylvania.

Riparian-Wetland Initiative for the 1990s

Ron Clark

An updated plan for managing riparian areas and wetlands on federally managed public lands was recently released by the Department of the Interior's Bureau of Land Management (BLM). Initially released in September 1991, the plan is titled *Riparian-Wetland Initiative for the 1990's* and sets a series of goals and strategies to meet healthy conditions on the 23.7 million acres of riparian-wetlands managed by BLM. The initiative also summarizes the state of our efforts for managing these vital ribbons of green that are so valuable for fish, wildlife, livestock, water quality, recreation, and biodiversity.

The plan document sets forth four national goals:

1. Restore and maintain riparian areas and wetlands so that 75 percent are in proper functioning condition by 1997. The overall objective is to achieve an advanced ecological status, except where resource management objectives, including proper functioning condition, would require an earlier successional stage;

2. Protect riparian and wetland areas and the associated uplands through proper land management, and avoid or mitigate negative impacts. Acquire and expand key areas to provide for their maximum public benefit, protection, enhancement, and efficient management;

3. Ensure an aggressive riparian-wetland information/outreach program, including providing training and research; and

4. Improve partnerships and cooperative restoration and management processes in implementing the riparian-wetland initiative.

Broad-based implementation strategies to achieve these goals have been established in the following categories:

Inventory/Classification - Collect, compile and evaluate baseline information to determine current ecological status, potential, and condition;

Land Use and Activity Preparation/Revision - Develop revise plans that involve riparian wetland areas prescribing actions to meet management objectives.

Project Development/Maintenance - Complete projects such as fences, water developments, tree planting, prescribed fire, and habitat improvement structures to create, improve, and/or maintain riparian wetland conditions. Maintain projects to continue their beneficial use.

Monitoring - Monitor to determine if management actions are meeting specific objectives for Riparian-Wetland areas.

Protection/Mitigation - Avoid or mitigate the impact of surface disturbance activities on riparian-wetland areas.

Acquisition/Expansion - Acquire and expand wetland-riparian areas primarily through land exchanges. Specific objectives and priorities for actions are taken at the local field level through their individual strategic plans.

Ron Clark is a Watershed Specialist with the Bureau of Land Management at the Colorado State Office in Lakewood, Colorado. He performs national level and state level assignments in a variety of areas for the initiative on riparian area management and other watershed management activities.

Oregon's Watershed Enhancement Program

Lorraine Stahr

Abstract

The Governor's Watershed Enhancement Board provides grants funds and technical assistance to Oregonians proposing projects which demonstrate the benefits of improvement or enhancement of watersheds or riparian areas. The Board includes five members of the public serving on Oregon's natural resource boards and commissions and five federal and state agency representatives.

The purpose of the program is to improve water quality and quantity in streams by promoting changes in land management practices beneficial for sustaining natural watershed functioning.

Since the inception of the program in 1987, over 200 projects have been funded. Some are purely educational, such as development of curriculum and teacher's workshops; others are on-the-ground projects consisting of resource management and public awareness components.

Funding for the program is provided through the Oregon State Lottery.

The poster display uses photographs and diagrams to illustrate various elements of the program. Samples of project evaluation reports including before and after pictures are available for review.

Lorraine Stahr is the Program Manager of the Governor's Watershed Enhancement Board in Salem, Oregon. Prior to her work with Watershed Enhancement Board, Ms. Stahr was staff to the Water Resources Commission at the Oregon Water Resources Department. She has a BS degree in Natural Science with emphasis on geology, botany and communications, from Oregon College of Education, now Western Oregon State College.

Contribution of Legal Buffer Zones to Nonpoint Source Pollution Abatement Following Timber Harvesting in Northeast Washington

Richard A. Corner and J.H. Bassman

Abstract

Nonpoint-source pollutants, such as mineral sediments, nutrients, and pesticides, account for more than 50% of the pollution in United States waters. Sedimentation of streams resulting from forest management practices is among the greatest non-point source pollution concerns due to the potential for adverse effects on critical fish habitat, reservoir capacity, quality of domestic water supplies, and aesthetic and recreational values. Stream-side forests have been shown to filter excess sediments and nutrients from surface runoff and shallow groundwater and so play a critical role in protection of water quality. Thus, most states have adopted regulatory programs which require a certain amount of stream side forest be left to serve as a 'buffer zone' between the timber harvest area and the stream which drains it.

In this study, the contribution of legal buffer zones for nonpoint-source pollution abatement following harvesting of timber was evaluated on three sites in northeast Washington subjected to clearcutting and mechanical scarification site preparation. On two of the three sites a 50 foot buffer zone was left in accordance with Washington State Forest Practices Rules and Regulations. No buffer zone was required or left on the third site. Parameters of water quality (solids, turbidity, and nutrients) and soil movement into stream channels (sedimentation) were measured on each site for one year after harvest. There were no significant changes in average stream water quality associated with timber harvest. However, failure to detect sediments and nutrients in the stream appeared to be a function of the sampling regimen rather than the lack of off-site export of these materials. Significant increases in sedimentation rates were detected on two sites; one with and one without a buffer zone. Increased rates of sedimentation on the unit with a buffer zone occurred primarily from a 525 foot gully formed in a primary skid trail that ran down a 50% slope. Although soil erosion was observed on the third unit, sedimentation did not occur. It was concluded that although riparian buffer zones can be instrumental in protecting against nonpoint-source pollution, their effectiveness is directly related to physical properties and the nature of management on the upland area. Hence, a legal buffer zone width should be calculated as a function of physical parameters (e. g. slope, soil permeability, soil erodibility) and intensity of management practices rather than as a designated fixed distance.

Richard Corner and J.H. Bassman are with the Tree Physiology Lab in the Department of Natural Resource Sciences at Washington State University in Pullman, Washington.

A Conservation and Management Strategy for Riparian Forests in Southern Alberta

Cheryl Bradley

Abstract

In spring 1990, World Wildlife Fund Canada and the Fish and Wildlife Division of Alberta Forestry, Lands and Wildlife jointly initiated the development of a conservation and management strategy for riparian forests in southern Alberta. Strategy development was guided by a multi-stakeholder advisory group and was accomplished in four key steps.

First, information was gathered on the current distribution and density of riparian forests, historical trends, factors affecting regeneration and survival and the conservation biology of riparian forests.

Second, interviews were conducted with a broad range of stakeholders to determine management issues and options. Third, a draft document was prepared and a multi-stakeholder workshop convened to review and recommend a conservation and management strategy. Finally, a strategy document was developed based on the results of the previous three steps. The strategy document contains a statement of vision and mission, guiding principles, and recommended goals, objectives and actions. The strategy has been endorsed by the Prairie Conservation Coordinating Committee, a 50-member committee of organizations responsible for implementing projects in prairie conservation.

Cheryl Bradley, conducts background research on environmental issues, scopes issues through interviews and media monitoring, and facilitates workshops and information sessions for various W.E.S.T. projects. Her MSc topic was river regime and cottonwood forests on the Milk River in Alberta and Montana.

Idaho Riparian Cooperative - Is Idaho Ready? History of Starting a Riparian Cooperative

Leland L. Mink and George H. Belt

Abstract

Nearly three years ago, concerns were expressed by federal and state agencies and the users of public lands about how riparian lands were being managed in Idaho. These concerns centered around the lack of a focused statewide riparian management approach. It was believed that it would be more acceptable if a common effort were used by agencies to address riparian management needs, as well as the concerns of the users of public lands.

The Idaho Water Resources Research Institute, University of Idaho, was asked to spearhead an effort to bring together representative from state and federal agencies and user groups to outline the possibilities of a riparian cooperative or association. Organizational and scoping meetings were held along with a workshop to determine the riparian and wetland needs for Idaho.

These meetings led to the establishment of the Idaho Riparian Cooperative. The overall mission of the Idaho Riparian Cooperative is to provide information to improve the management of riparian-wetland systems in Idaho.

The goals of the cooperative are as follows:

- develop information and techniques needed for riparian and wetland management
- provide education, training and related outreach activities
- foster communications, coordination and technical information exchange.

Progress on establishing the cooperative has been slow but steady as each agency's concerns are addressed and a true cooperative atmosphere is fostered.

Leland Mink is Director of the, Idaho Water Resources Research Institute at the University of Idaho in Moscow, Idaho. George H. Belt is a Professor in the Department of Forest Resources at the University of Idaho.

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Water Banking in Idaho

Leland L. Mink

Water banking in Idaho has been occurring for over 60 years. Water transfers from storage were first conducted during the 1930's drought period. Early transfers were very risky for several reasons. First, the ability to determine water supplies was in its infancy causing inaccurate water forecasts. Also, early statutory language relating to water storage rights allowing for change in use did not exist, and the state constitution provided no protection to a water right which may be transferred from one user to another.

The State Water Board officially originated the water bank policy in 1976. This policy stated:

> *"A water supply bank should be established for the purpose of acquiring water rights or water entitlements from willing sellers for reallocation by sale or lease to other new or existing uses."*

In 1979 it was adopted into law. The law approved water banking activities to occur by allowing changes in point of diversion of storage water in the use of water without the threat of jeopardizing the water right. Before these changes could be approved the following criteria had to be met:

- Will the quantity of water available under other existing water rights be reduced?

- Is there sufficient water supply for the intended purpose?

- Will there be any expanded use of water beyond that authorized under the water right?

- Will there be any conflict with the local public interest?

State code provided that the State Water Board appoint a local committee to administer the Water Bank within the basin that it is established. The local committee would then develop the rules and regulations for the administration of the water bank which then must be approved by the State Water Board.

The Upper Snake River was the first to be formally adopted in 1979, even though this water district had been leasing stored water and operating a type of water banking since 1930. The Upper Snake Water Bank includes the area of the Snake River drainage in eastern Idaho which begins in Wyoming and continues to the Milner diversion near Twin Falls in south central Idaho (see Figure 1). This area covers approximately 4.1 million acres and supplies water to about 1.2 million acres of agriculture land. The system also contains about 4.1 million acre feet of storage space in federal and private reservoirs.

Three other water banks have been established in Idaho. The Boise River Water Bank was established in 1988 and supplies 300,000 acres of irrigated agriculture land with one million acre feet of storage in three federal

Leland L. Mink is the Director of the Idaho Water Resources Research Institute at the University of Idaho in Boise. He is a Professor of Hydrogeology and Co-director of the Center for Hazardous Waste Remediation Research at the University of Idaho. He has served as a research geohydrologist for the E.P.A. in Las Vegas, Nevada and spent 4 years with the U.S. Department of Energy in Washington D.C. and Boise Idaho. He has an MS degree in hydrology and a Ph D in geology from the University of Idaho.

Figure 1 Idaho Local Water Bank Areas

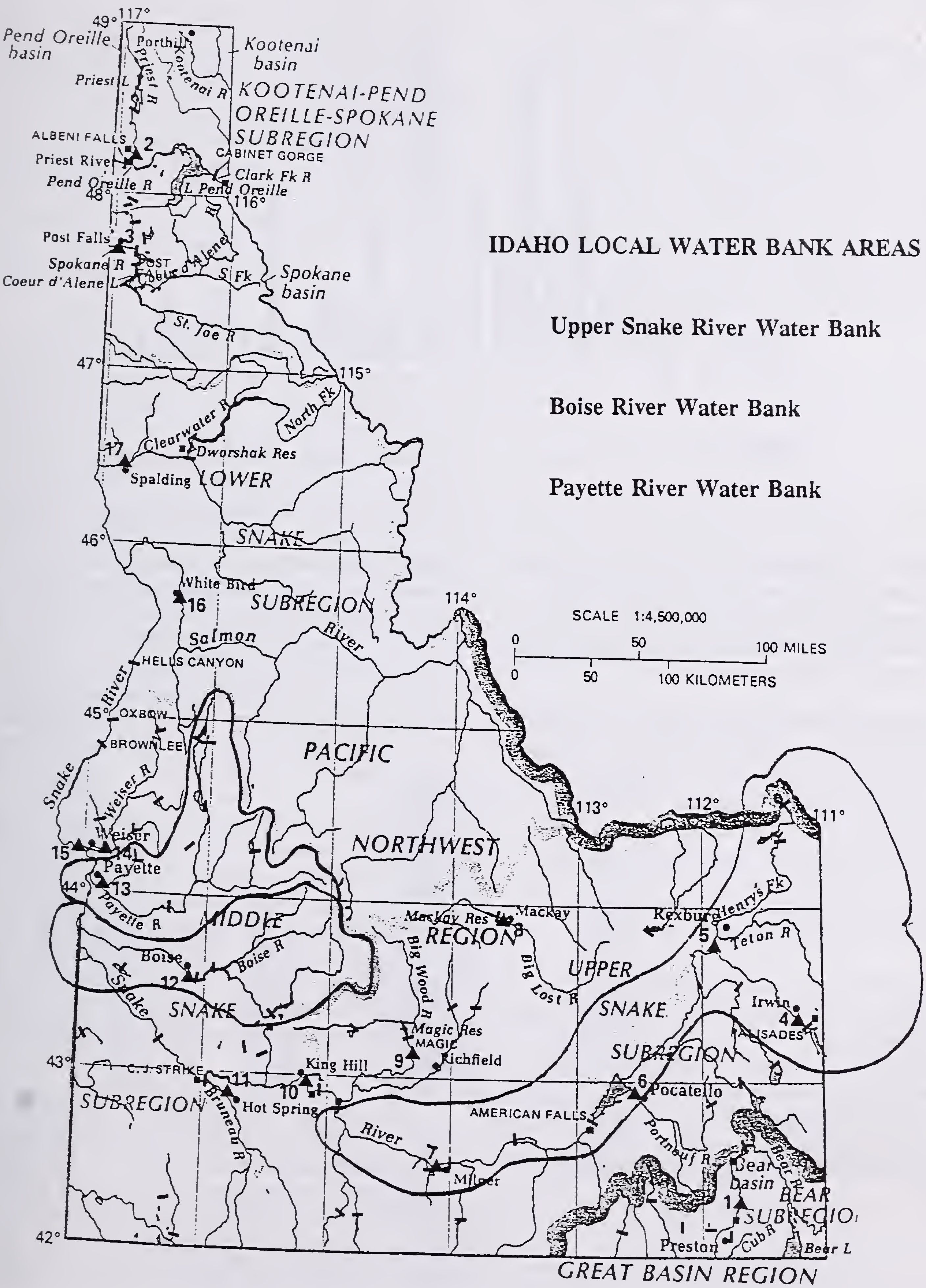
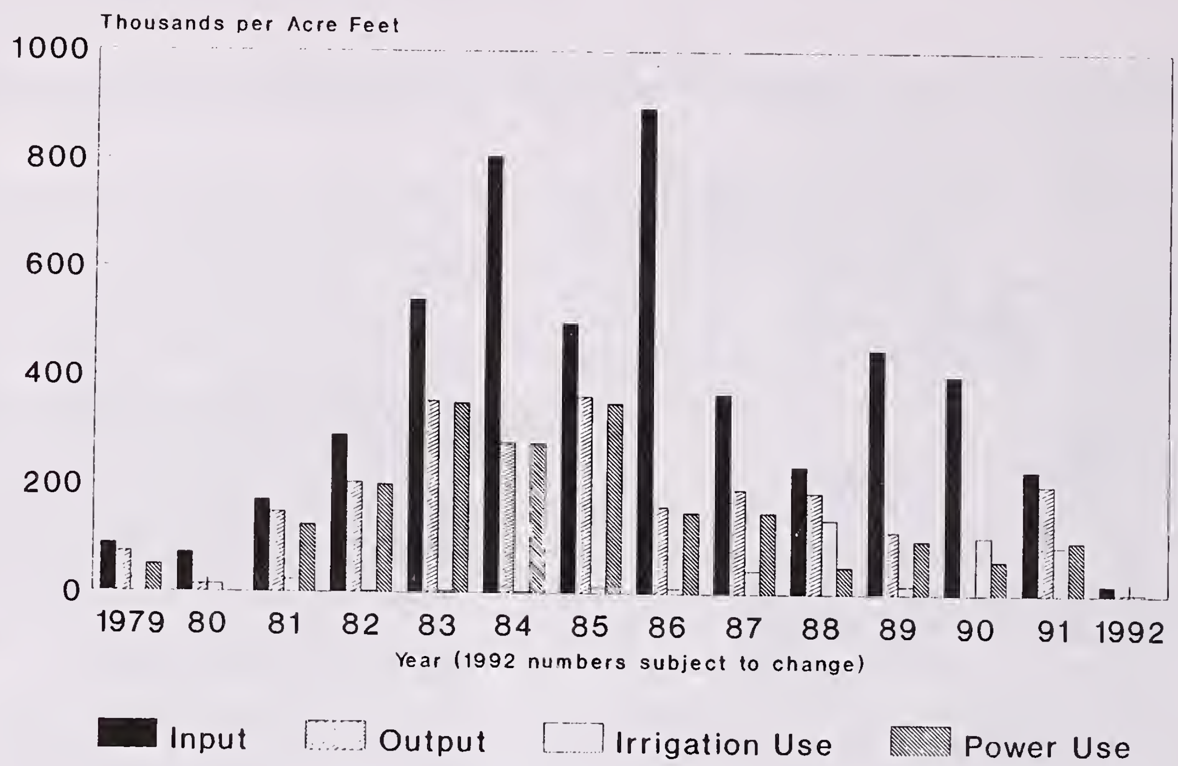


Figure 2 Upper Snake River Water Bank Activity 1979-1992



reservoirs. The Payette River Water Bank was established in 1990 and covers the Payette River basin in southwest Idaho. This water bank is served by storage from Payette Lake and Cascade Reservoir.

Along with these water banks the state of Idaho operates a statewide program which allows any water in the state to be placed directly with the State Water Board. This water bank has only seen limited use, primarily from water rights not used because of idle farmland. Recent interest in using this water bank for providing instream flows for fish, wildlife and recreation has been seen.

Water banks in Idaho have favored the use of water for irrigation purposes. This use most often results in return flow which is available for local reuse. Also, power use downstream of the lowest diversion makes the storage space subject to the last to refill rule for the following season, which is designed to protect the water right priority system.

Figures 2-4 show recent activity for the Upper Snake River, Payette River and Boise River water banks, respectively. The Upper Snake River Water bank has been fairly active during the 1980's because of drought conditions in Idaho. Because of the severe drought conditions (1987-1992) in Idaho there was little available surplus water storage in the upper basin reservoirs.

The Payette River and Boise River water banks also reflect this lack of available water during the years of severe drought. Historically, the water from water banks has been used for either irrigation or hydropower. In 1991, approximately 100,000 acre feet of water was released from the Payette River Water Bank for instream uses during a salmon smolt fish flush/reservoir drawdown test on the Lower Snake River.

The pricing of water in the water bank shows a rather stable structure from the start in the 1930's through the 1960's for the Upper Snake River Water Bank. Early water was routed at a rate of $.17 per acre-foot. By 1934, the price had risen to $.25 per acre-foot. At this time 40,000 acre feet of water was leased to water users in southeastern Idaho. A formal upper valley storage pool was formed in 1937 to establish a leasing policy and an annual lease fee for available storage water. Because the storage fee at this time was $.12 per acre foot, the remaining lease fee for storage water released under the water bank concept was divided between the space holder and the Bureau of Reclamation. Prior to 1942, the lease fee varied based on demand, but in 1942 a new arrangement was established placing the lease fee at $.30 per acre-foot with the revenues being divided evenly with between the Bureau of Reclamation and the leasing company. The $.30 fee remained stable until 1961 when it was raised to $.50 per acre foot.

In 1978, the price started escalating as a result of changes in the regulation of diversions and increased recognition of water rights issues in the Upper Snake. Also, the implementation of computer technology in the management of water at this time allowed the distribution of stored water with minimal impact on natural river flows. As a result, in 1978 rental pricing was set at $.75 per acre foot with $.50 going to the space holders and $.25 going to the water district for administrative costs. This cost has steadily increased over the last decade to meet demands and increasing costs in supplying water for irrigation needs or other beneficial uses (Figure 5).

The water banking process has undergone several charges through the last 60 years of its history in Idaho, and will probably go through other modifications in order to make the water banks more responsive to the needs of each basin. The modification of laws and regulations governing water banks as well as the procedures developed by the respective water districts should encourage the holders of water rights to use the water banks and make water available for use in Idaho for more productive purposes.

Figure 3 Payette River Water Bank Activity 1990-1992

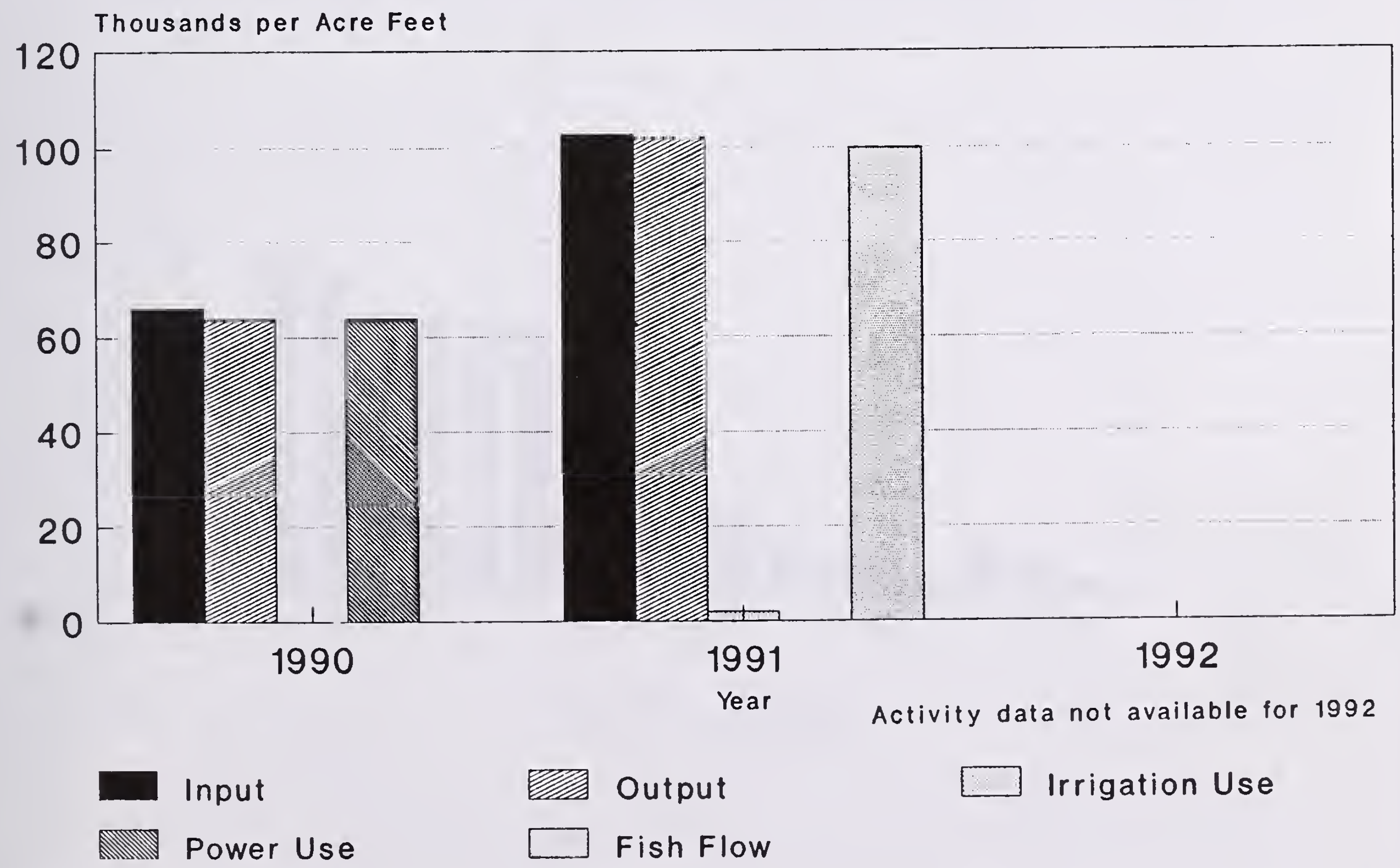


Figure 4 Boise River Water Bank Activity 1988-1992

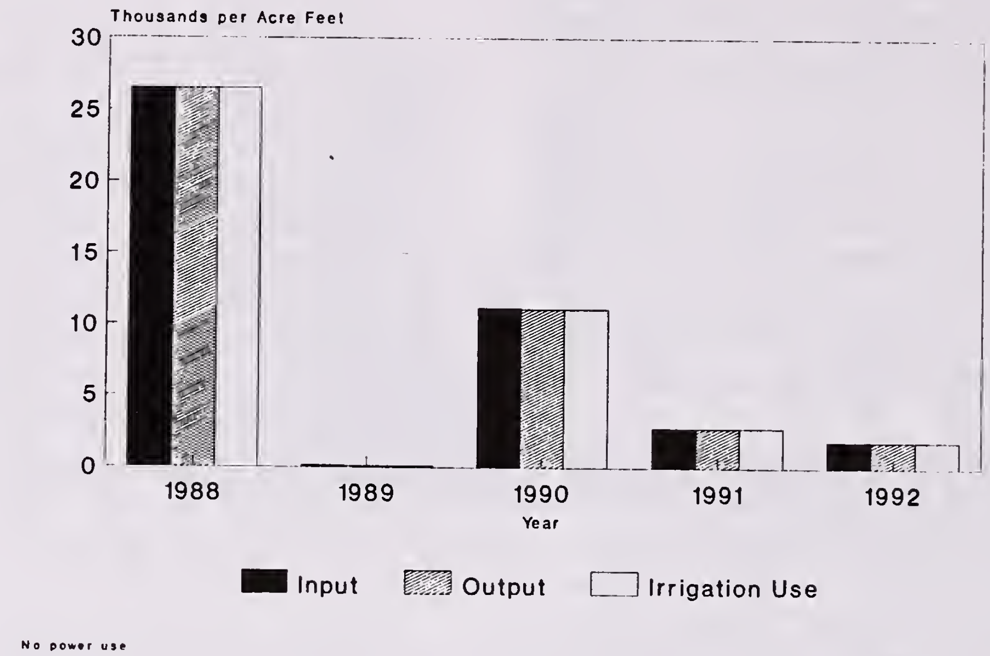
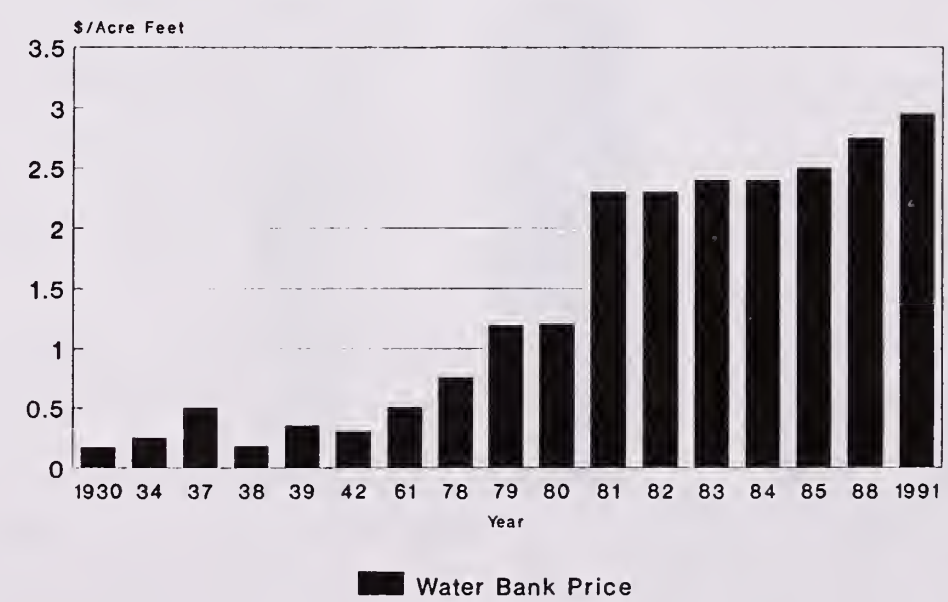


Figure 5 Upper Snake River Irrigation Water Costs 1930-1991



CHAPTER EIGHT

INVOLVING THE PUBLIC

Rio Grande River, New Mexico
Washington State Parks

DE COLORES

De Colores se vistan los campos en la Primavera.
De Colores con los pajaritos que vienan de afuera
De Colores es el arco iris que venos lucir -
y por eso los grandes amores
con muchos colores me gustan ami.

Cante el Gallo --- con el CARA CARA CARA ---

La gallina, la galline con el kim kiri kiri kiri kiri

Los poneulos, los ponuellos con el pio pio pio pio pe

Y por eso los grandes amores con muchos colores me gustan ami!

Moving From Diverse Viewpoints to Results

William deBuys

I'm not sure who came up with the auspicious and impressive title for this talk, but I certainly hope those noble words prove eventually to be true for the Middle Rio Grande.

The effort I have been associated with on the Middle Rio Grande has certainly required paying attention to diverse view points, and I am hopeful that the process that we have used and followed will prove interesting and even helpful to you as I review it.

The business about results, however, is more problematic. We earnestly hope that our present actions will produce tangible changes in management of the river and real improvement in the health of the river system, but those changes are, at best, still some time off.

When I speak of we I mean the Rio Grande Bosque Conservation Committee which New Mexico's senior senator, Pete Domenici, called into being in September of '91. Senator Domenici did this without prompting from any particular interest group. He had become aware of the serious problems threatening the future of the Rio Grande Bosque—particularly the failure of native cottonwoods and willows to reproduce— and he decided to do something about it. (For those of you who come from outside this region, bosque is a Southwestern term referring to riparian gallery forest typically dominated by cottonwood and willow. It is often used as shorthand to refer generally to a river's riparian corridor.) Senator Domenici initiated his effort knowing the condition of the Bosque was not good. He also knew, as you do, that the Rio Grande is New Mexico's preeminent natural treasure. You have probably seen the widely reported figure that some 95% of the Southwest's native riparian ecosystems have been lost. A major portion of the remaining 5% is here in the middle reaches of the Rio Grande.

But, our Bosque, though it is the best of the last, is beset with problems. A lack of regeneration of major species, in particular cottonwood and willow, the invasion of such exotics as salt cedar, Russian olive and others, past extinction of several native fish species and current endangerment of another, the Rio Grande silvery minnow, near loss of another species, the southwestern willow flycatcher—all of these symptoms invite the inevitable diagnosis of a system in crisis.

In addition the middle Rio Grande bosque is subject to all kinds of illicit and conflicting uses— dumping, arson, vandalism, the discharge of firearms without regard for who may be picnicking or strolling a few hundred yards away. Plus, we've got people building houses, with no protection from levees, in the two-year floodplain, which besides being an invitation to disaster from fairly ordinary flows also deprives us of options for biological management. We've also got water quality problems to the point that farmers who irrigate from the river immediately downstream of Albuquerque can't grow chili anymore and sometimes lose whole crops of

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alfalfa and hay. I could spend the afternoon just going through the catalog of troubles of the Middle Rio Grande.

Recognizing these problems, Senator Domenici appointed a committee of nine citizens from diverse backgrounds and asked us to look into these matters and make recommendations to him. In assembling the committee, he appointed a gentleman who also serves as a director of the Middle Rio Grande Conservancy District - which is the principal entity that puts the river to use through the stretch the Senator asked the committee to consider.

Another appointment to the committee was the president of the state chapter of the League of Women Voters. Another was the chair of the Albuquerque Recreational Trails Council. Domenici also appointed a farmer and rancher from Valencia County who served on the board of the State Farm Bureau. He appointed or invited the Governor to appoint a representative to the committee and that individual also has a background in ranching. Another important appointment was the provost of the University of New Mexico, an ecologist of national standing, who now, sadly for New Mexico, has left us to accept the Presidency of the University of Miami, Ohio. Another committee appointment was a business leader and former County Commissioner in Socorro County whose business was and is connected to Bosque-related tourism. Domenici also appointed to the Committee a governor of one of the six pueblos that lie along the stretch of river that we are dealing with. Finally, there was me, a conservationist and writer, as chair.

You can tell, I hope, from the kinds of people who were on this committee that we began with diverse viewpoints, and you will not be surprised to know it took us a while to learn how to work with each other and to agree on a more or less common view of the river and its problems.

We spent our first several months familiarizing ourselves with the bosque and the issues associated with it. Then we had to make a decision: the universe of problems was so big we had to divide it into units we could actually deal with. So we did the simplest thing we could think of and that was to separate the biological issues from the social and cultural ones. Then, because Governor Frank Tenorio of San Felipe Pueblo was unable to serve on the committee for the time being due to health concerns and because we didn't want to work on social and cultural issues without Governor Tenorio's being present, we elected to address biological issues first.

We decided to host a colloquium of water experts and managers. We wanted them all in the same room, speaking not for the record but discussing candidly the obstacles to doing a better job managing the river and the bosque.

We invited the Army Corps of Engineers, the Bureau of Reclamation, the State Engineer, the Middle Rio Grande Conservancy District, and the City of Albuquerque. They all came, and they all had much to say. What we learned was that the Middle Rio Grande has received more than 70 years of biological management but nearly all that management has been inadvertent and virtually all of it has had a negative effect on native ecosystems.

We learned that much was known about the ecological dynamics of the Middle Rio Grande but that little of this knowledge had been systematically integrated and virtually none of it had had a significant impact on management. The participants in our colloquium generally agreed that existing water delivery obligations and distribution practices could be modified or restructured to have a better effect on the biology of the river, but they also made clear that no plan existed for how to go about doing this. The committee concluded that there existed broad consensus that things could be done better but there was no immediate prospect that the agencies would agree on what that might entail. In the end, we felt the river managers had said to us, "Give us a plan that tells us what you want us to do and then at least we can react to it - no promises - but we'll see what we can do."

We took that invitation rather seriously. The colloquium was held in February, 1992, and by the end of the following March we had submitted to Senator Domenici a proposal for an interagency task force to be formed to develop a biological management plan for the Middle Rio Grande.

In April of last year the regional heads of the Bureau of Reclamation, the Army Corp of Engineers and the U.S. Fish and Wildlife Service signed a Memorandum of Agreement under which they agreed to cooperate on development of such a plan, subject to Congressional funding. Senator Domenici secured the support of his colleagues in Congress and secured the necessary funding. He used his considerable influence, not just to get the funding, but to ensure that the agencies remained committed to the project, including persuading senior officials in the Pentagon to permit the Army Corps of Engineers to participate. Finally, in the autumn of 1992, with an appropriation in hand, the heads of the agencies picked a first-rate team. Shortly after the first of the year, the task force (most of whose members are in this room) went to work on the project, not at their regular offices, but in facilities provided by the University of New Mexico, with Professor Cliff Crawford of the university's Biology Department as their Chair.

"In drafting the questionnaire I had included the item "Just knowing it is there" at the very last on a kind of whim. I never imagined it would surface as the most universally acknowledged and widely shared value people associate with the Bosque."

You people gathered here from all around the West no doubt know better than I whether the interagency effort to prepare a biological management plan for the Middle Rio Grande is a significant new precedent in the management of western rivers or if it is simply the reinvention of someone else's wheel. I would be grateful to have your perspectives on this. In any event, while the seeds for this kind of process in New Mexico had been present for some time, it took the senator's interest and support to cause them to grow into something meaningful.

Because the river is not managed by one agency but by several with overlapping, conflicting and often ambiguous jurisdictions, we had to leave open the question of who would be responsible for implementing the biological management plan.

We also had to leave open the question of what force this plan would have on the affairs of the river and of who would be the ombudsman to push for its incorporation into the affairs of the river. I will come back to these questions in a little while.

Having dealt with the issue of biological management to the best of its ability, the committee next moved to the still broader universe of social and cultural issues. By that time health concerns had unfortunately obliged Governor Tenorio to resign from the committee. Senator Domenici appointed a replacement for Governor Tenorio from the Pueblo of Cochiti, but he too served only a short time before he resigned, in this case owing to a lack of support for him among the pueblo community as well as to personal reasons. We worked with the Pueblo community for several months trying to find a successor and realized ultimately that perhaps we were asking the wrong question. To a large degree it appeared that we were wrong in thinking that one person could represent all six pueblos. That's a difficult and very tall order. In the end we took another route and initiated a process of consulting individually with each of the six Governors of those six pueblos and their staffs. It was time consuming but it was the right way, we felt, to assure that the Pueblo points of view were heard in our process.

The central feature of our effort to deal with social and cultural issues was a public involvement program. We had known from the outset that we needed to have public meetings in communities along the river. We needed to have an open house, let people come in, let them tell us what the social and cultural issues were. It wouldn't do to rely on solely so-called experts and managers. We wanted instead to conduct a truly democratic exercise.

So, we did a number of things. We found that preparation was essential to a good process, and we developed fact sheets, we sent out a newsletter, we prepared a questionnaire to use at our public meeting. The most important thing we did was raise a little bit of money and hire professional facilitators to help us design the public involvement process we would use and to run the actual meetings when we had them.

I'm sure everybody in this room has been to public meetings that turned out to be perfectly dreadful: you sit there all evening and you hear folks grandstanding, haranguing, repeating themselves with gripe after gripe, hour after hour. Believe me, it doesn't have to be that way. A well run, well facilitated meeting can be a wonderful event in terms of surfacing important concerns and issues and in terms of getting the people involved in talking matters out with one another. With the help of the professionals we hired, that's how our first round of meetings went. I should add that the people who attended these meetings were on their good behavior because the Senator came to all three. We met on successive August nights in Socorro, Los Lunas and Alameda, which is part of greater Albuquerque. Senator Domenici didn't stay for the entirety of the meetings but he attended at least the first hour of each and certainly gave a great deal of legitimacy to the overall effort by lending presence.

We made a commitment also to the people at those meetings that we would send them summaries of each meeting so that they could see how we had written down what they had said. They could consult those summaries and be sure that their concerns had been duly noted and were part of the record. We also promised that once we developed our draft recommendations we would come back to them and have a second series of meetings so that they could tell us whether they felt we had come up with the right answers.

What we found out from these meetings was integral to our process. And what we found out was that the value of the Bosque and the river is clearly and markedly greater that the sum of its individual uses and benefits. People everywhere value the river for its own sake. One of the major sections of our questionnaire asked people, "Which of the following activities do you consider important to your personal enjoyment of the Bosque?" We listed hiking, hunting, picnicking, fishing, and a dozen other activities. Interestingly, the "activity" that received the highest ranking and most unanimous approval was "Just knowing it is there."

In drafting the questionnaire I had included the item "Just knowing it is there" at the very last on a kind of whim. I never imagined it would surface as the most universally acknowledged and widely shared value people associate with the Bosque.

Second after that was, "Enjoyment of solitude." Third, "Nature study." Fourth, "Photography." Fifth "Hiking." While we received the greatest number of responses from the Albuquerque area, down in Socorro and Los Lunas the priorities came out more or less the same.

People told us they badly wanted stricter enforcement of existing laws. They said they were willing to play by the rules but they want the rules enforced.

They told us they didn't want greater government complexities. They wanted local governments and existing agencies to work together to protect and manage the Bosque and the river. And people told us they don't think the river and the corridor should be managed just for flood control, drainage, and irrigation. While those activities remain as vitally important as ever, people also want a healthy, diverse ecosystem, clean water and recreational opportunities. They want to see a balance of compatible goals and activities.

After the meetings were over, and after we had consulted with the governors of the six pueblos along the middle Rio Grande, the committee conducted a retreat. We borrowed a facility at Sevilleta National Wildlife Refuge and spent a weekend there hammering out our draft recommendations. Then we sent them to the Senator and he reviewed them. And here I want to say a word about Senator Domenici's participation in all of this.

The process would not have worked without his genuine commitment. The only influence or authority the committee had was borrowed from him. The agencies paid attention to us because of him; people came to our public meetings and took us seriously because of him.

And he never let us down. When we sent him material, he personally read and critiqued it. When we needed his presence, he found time for us in his busy schedule. From the outset, with his encouragement, our effort was nonpartisan and open-ended. Senator Domenici never steered us toward any particular conclusion or product. He simply asked us to follow the questions where they led.

This is not to say he didn't give us advice from time to time on how not to shoot ourselves in the foot, but advice is a far different matter from not being permitted to develop our own agenda.

So the committee sent its recommendations to Senator Domenici, and he made some minor editorial changes and approved them. These draft recommendations will be released, actually, this coming Monday at 3:00 p.m. at the Rio Grande Nature Center. I wish I could talk about them now and review them with you. After Monday I will be able to.

Immediately following the release of the draft recommendations, we are going to go back to the communities and have a new round of public meetings. We expect they will start on the 19th of February, and we will again do a series of three meetings in different locations. Based on what we hear, we will revise and make final our recommendations.

All of our major recommendations have to do with same problem, which is that management of the river and the Bosque is inadequate, and where it exists, it is focused on goals that are too narrow. Looking at the situation from a historical perspective, there is no reason for surprise. Our rivers, especially western rivers, are controlled by large and entrenched institutions. The most important of these—irrigation districts and the Bureau of Reclamation were invented, literally, in the early part of this century. And the other important player, the Army Corps of Engineers may be older as an organization but its involvement in western river dates from essentially the same period.

At the time these institutions were designed, society wanted principally three things from its rivers: flood control, drainage, and irrigation. Ultimately it added hydropower and occasionally other outputs to its list of desiderata for river systems elsewhere in the West, but here in New Mexico the key three remained flood control, drainage and irrigation. In the early part of this century, when our river management institutions were being designed, society took for granted the things it already had: recreational opportunity; intact ecosystems; opportunities for solitude—the list is long, and most of the terms in it sound pretty contemporary. That's because back then such things as these were so common and basic that people had not yet given them names.

We know today that society should not have taken these things for granted, and now, having seen them diminish under the pressure of population growth, as well as resource management that was oriented to other outputs, society wants them back.

The challenge before all of us is to find a way to reinvigorate our existing institutions or to reinvent them with a broad enough mission to pursue all the benefits we want our rivers and riparian corridors to provide. Let me be clear that I do not mean we should diminish the importance of the old three goals of flood control, drainage, and irrigation, for we need them as much as ever. But we also need to add to them and complement them with the fundamental goal of keeping our rivers healthy—or where necessary restoring their health— and of mediating the interaction of people with them.

Put simply, we need to create the institutional infrastructure for implementing—and continuously revising— the biological management plan I mentioned earlier. That institutional infrastructure needs to possess a number of characteristics not currently present in the management structure of the Middle Rio Grande. Among them is responsiveness to public input and concerns.

The underlying theme behind the work of Senator Domenici's Rio Grande Bosque Conservation Committee has been that society wants more from its rivers and bosques than it is currently getting. It wants live rivers and not dead ditches. It wants riparian systems that are sustainable and diverse. It craves any place where folks can go off and be alone if you can figure you can be alone in a place full of birds and other critters. It craves places for birding, for horseback riding, for family picnics, for just letting the kids play in the mud. It craves water you can kayak in, canoe in, swim in or just float. It craves places that are like the places Grandpa and Grandma used to talk about and it doesn't much matter your ethnicity, whether you are Hispano or Indian or Black or Anglo or Asian. If you had a grandpa or a grandma—heck if you just have a bellybutton—then you are part of this group.

So, what we are coming around to, if you will pardon the term, is a kind of watershed change. At least I hope so. The essence of this change is that we are finally realizing we should value our rivers and riparian corridors intrinsically for what they are, not just instrumentally for what they can do for us.

I would like to leave you with a final thought. I see in the registration packet that all of you have passes to visit the Bosque del Apache National Wildlife Refuge on February 6th. I hope you will go. The Bosque del Apache is one of the most exciting and beautiful places in New Mexico. It is the brightest jewel of the Rio Grande Bosque. In winter it teems with tens of thousands of snow geese, Canada geese, sandhill cranes, ducks of all kinds. Its got turkey and deer in abundance. Roadrunners skitter all over the place. It is a great place. But, if you go down there, take note whether seeing the river is part of your visit. The Rio Grande runs right smack through the middle of the Bosque Del Apache Wildlife Refuge, and its water is what gives the place life. But normally it is out of bounds to visitors.

Think about that. Here is a shrine to the natural diversity of the Rio Grande system. The whole Bosque, all those wonderful agricultural lands that feed the waterfowl, all those marshes where the birds roost at night, everything that gives the place its identity is made possible by the river. But if you go to the refuge, you can't see the river because the folks who designed the tour loop didn't think it was important. So when you go down there— tell your hosts that you want to see the river. And if they ask why, just say, "It's intrinsically important." And go see it. You will be glad you did. Thank you.

2.5

Public Participation in the Planning and Management of Rivers: Washington State Scenic River System //

Steve Starlund

Introduction

In past years, involving the public in review of river management plans and prescriptions meant formal review hearings after a legal announcement of a draft resource plan. Planners had most often made the decisions about the resource management and simply wanted a public concurrence on the final document.

As environmental awareness grew in the United States in the early 1970's, the general public began to scrutinize public forest management plans, instream flow regimes and public use considerations of public land and water resources in detail. By the 1980's, citizens were flooding public agencies with comments on drafted plans. The U.S. Forest Service received over 35,000 responses on its 1988 Draft Forest Plan for Gifford Pinchot National Forest in Washington State. Interest groups and concerned, neighboring landowners were responding with critical scientific reviews and suggesting alternative management schemes. There was clear indication that the public wanted to be heard and counted in the decisions about the rivers and the lands around them.

Citizens began demanding early review of resource management alternatives before final draft documents were prepared. They had become distrustful of resource planning which was carried on "behind closed doors" until the agencies were ready to share the decisions. They wanted to be involved early, at the inception of a plan which would affect public lands and public resources. They were neighbors and interested share holders in the common resources.

Public officials were challenged to invite and involve the public early in the planning process. They responded with open public hearings and multi- interests task forces that were designed to allow all to participate.

The Washington State Legislature mandated mass participation for the planning of the Nisqually River Basin, which includes over 100 river miles from Mt. Rainier to Puget Sound. A task force was designed to offer all interests a voice; dairy farmers, forest land owners, recreationists, environmentalists, Indian Tribes and other land owners within the watershed were invited. Sixty five participants eagerly attended the planning sessions and dozens others observed. After of two years and hundreds of large group meetings, sub-group meetings and formal public hearings, this public participation process produced a river management plan. The outcome was effective in getting broad community support for the land use and water quality

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decisions, but required enormous amounts of staff time and organizational costs. The implementation plan for the Nisqually continues to have broad public participation with over 60 citizens in advisory and task force roles.

This emerging desire for participatory planning has spawned large scale public meetings and forums without regard for the extensive time and cost of such processes. In the rush for everyone's opinion, government officials had emphasized mass public participation at a risk of de- emphasizing resource planning expertise and cost efficiency.

As we move into the 1990's, there is evolving participatory planning processes which do offer this balance. Efficient planning structures must offer the array of river community interests a place at the planning table, provide for ecologically sound decisions and derive river plans which are efficient in time and money.

Skykomish Scenic River Planning Model

Sensitive to these new demands, the Washington State Parks Scenic Rivers Program looked to incorporate a mix of public participation and technical planning when a management plan was begun for the Skykomish River in 1988.

> "The Scenic Rivers Program was mandated by the Washington State Legislature to prepare a river management plan which protects and enhances the natural qualities of this free-flowing river while protecting the property of private land owners and balancing the multiple public uses of the river." (Revised Code of Washington, Section 79.72)

The program was budgeted one staff member and one year to develop a management plan. There was little time or budget for a complex or lengthy public participation plan yet the river planning issues were similar to any mainstem river system in the state.

Since 1988, The Scenic Rivers Program has been working to develop a river planning and management structure which coordinates activities on the lands and resources among federal, state and local governments. It also includes encouraging voluntary protection actions by private citizens living along the River. This is a common sense approach to planning and management.

Because the river traverses lands of multiple ownerships, responsibility is taken and shared by those with the most direct control over a river. It also acknowledges two simple yet essential ideas about river management. First, no public action can replace wise use of a river by those living along it. Secondly, effective planning and management cannot succeed without local consensus and support.

The Skykomish Scenic River would be the first model for this new style of public involvement in river conservation along a river of diverse character and management issues. The Skykomish River System flows from the Cascade Mountains at a beginning elevation of 2500 feet and reaches the saltwater of Puget Sound over 90 miles to the west. Cascading through rich evergreen forested slopes, the river's basin is managed for intensive forest harvest activities. As the waters meander into flatland, beef and dairy cattle farms utilize the rich flood plains. From the boulder zone to the floodway, the river provides for salmon fishing, white water rafting, kayaking and stream-side hiking. River tributaries and the mainstem pass through federal ownership, state ownership, county and city jurisdictions and hundreds of private land ownerships. The towns along the river range in size from several hundred in population to several thousand and are growing rapidly as the urban centers expand less than 40 miles downstream. River management issues cover a wide spectrum of public use conflicts, water quality, environmental education, wildlife and fisheries health and habitat and debate over hydropower dams and flood control.

The Skykomish Scenic River planning process began in the spring of 1988. The Scenic River Program had one full time staff member and one year to complete a management plan. The planning process has two

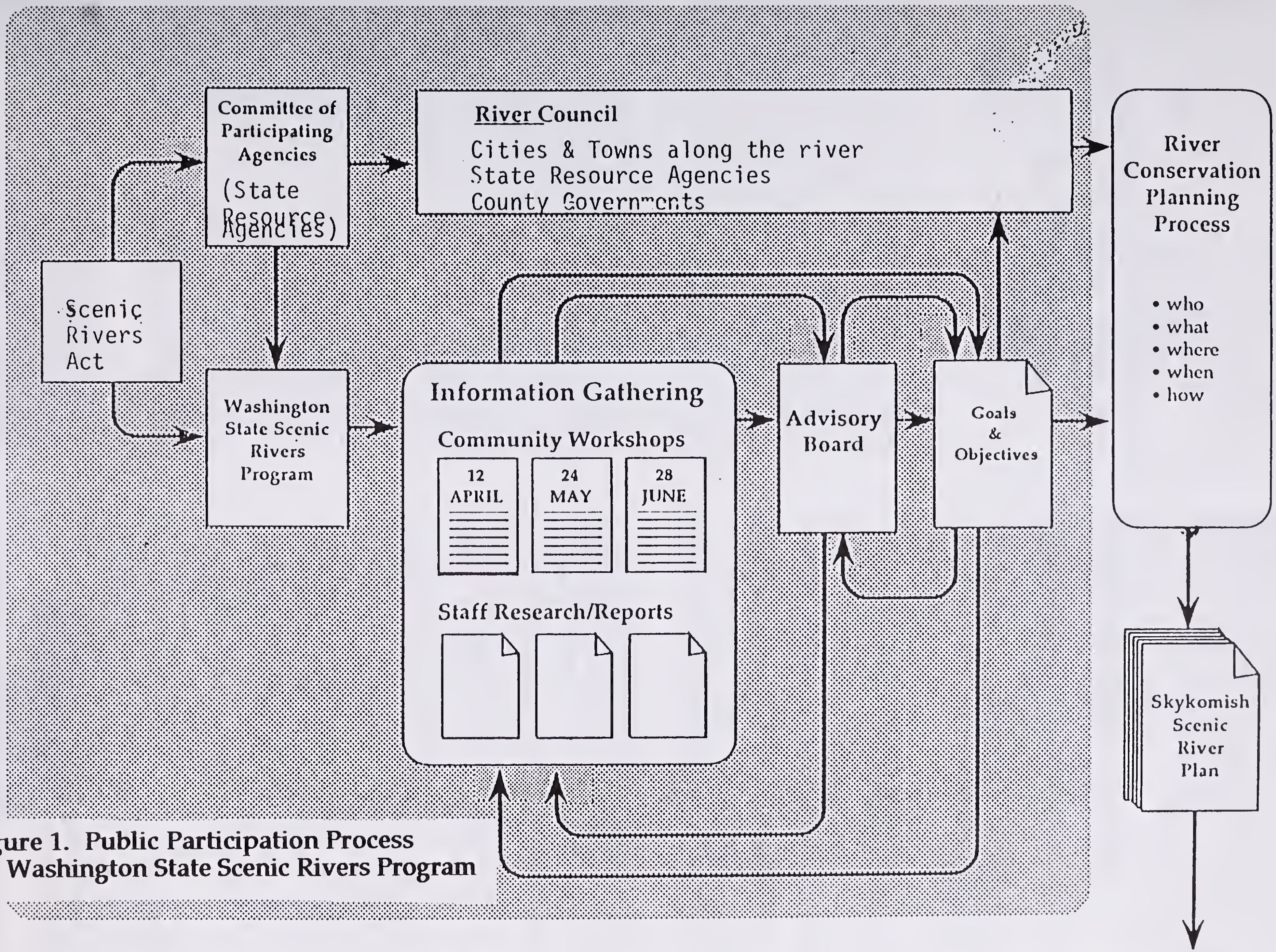

Figure 1. Public Participation Process for Washington State Scenic Rivers Program

important components. An organizational element which sets up a River Council (comprised of affected resource agencies and local town and county governments along the River). Through this council public lands will be cooperatively managed, private lands will be voluntarily managed and problems will be collectively solved.

The other element is public involvement. River issues are to be identified and prioritized by both technical resource experts and citizens. A local advisory council is created to work with the River Council. In catalyzing local action, the Scenic River Program used a few key ideas:

1) citizens living along the River and those using it have valuable expertise necessary for developing realistic expectations of what conservation of the Skykomish means;

2) by understanding and embracing their role in the planning process, citizens will make legitimate, working decisions about what can be accomplished.

The result of this planning process is a strategy for river conservation and protection that is uniquely suited to its special qualities and the demands of the local communities.

The Program initiated its public involvement by providing many avenues for public participation including "river workshops" or "listening posts" which were held to extract the multitude of river issues and concerns of local citizens. Staff then produced an assessment of the river's natural resources; river structure, soils, flows, land use history, fish and wildlife and existing resource management. Guest speakers from the U.S. Forest Service, State Department of Natural Resources and Department of Wildlife presented information on issues and described their roles in the River's management. River conservation workshops and presentation programs began developing a broad based River constituency which included all interests.

Within six months time, the community members and resource experts had agreed upon specific issues, goals and possible actions to enhance the river and protect private

property rights. The resulting conservation plan for the river includes goals, objectives and action steps and a matrix of all the responsible agencies and authorities who will work to implement this plan. The plan created a permanent local advisory board to oversee the stewardship of the river and to hold accountable the River Council who adopted river conservation policies.

Because the planning process was time efficient, staff time and energy could be quickly put to implementing the action plans. During the next two years, the program had accomplished public access plans, purchased property for habitat protection and established a working liaison between the local community and the many levels of government.

It was evident throughout the planning process of the Skykomish Scenic River Management Plan that may hurdles in public participation had been overcome. Much of the reluctance of planners to empower local citizens with resource management decisions had dissolved. Much of the fear and mistrust of the citizens about government not listening to their concerns was tested and proved to the contrary.

After many months of interaction, planners and the general public had new understanding of each others values and knowledge regarding their common concern, the River. The swift implementation of the plan and public support was evidence of a strong working relationship that had been built.

The reason for a well designed public participation process became clear as local new media turned in favor of the Scenic Rivers Program and touted it as the local community's plan for the River. Three full page articles appeared over the year praising the river and the work of the planning team and the citizen's advisory board Throughout the progress of the river plan, the value of public participation was assessed and specific planning processes were designed to maintain trust and cooperation in the future.

Reasons for Public Participation

It has become evident that long term stewardship of the river is dependent upon satisfying the needs of the river's social community and recognizing their values relating to the river. Local citizens must recognize "what's in it for me", or they have little stake in the outcome of the plan. Without local adoption of river conservation goals, a plan can be delayed by local governmental officials who will respond to their constituency. Law suits may ensue and any hope for voluntary actions for river conservation may be entirely thwarted. Whereas, planning which clearly addresses community concerns can amplify local pride and create sense of local responsibility for the river area. If there is a sense of being able to affect the future of their environment, the local community feels more secure and willing to "make deals" for the benefit of the common good and the good of the river. When threatened by the possibility of "outside forces" managing a rural river, (anticipated federal river management), one river community in Washington State took their fears to the State Legislature. They asked for and received money and staff to do their own river planning. This is a case where the river landowners decided not to involve the planners and governmental officials. (Kettle River in north central Washington)

There are more reasons for participatory planning than just the potential clash of communities and authorities. Recognizing that rivers represent valuable resources for farmers, sportsmen, and river-land home owners, is sufficient rationale to involve local business and community leaders from the beginning.

The mainstems, tributaries, flood plains and estuaries also traverse many ownerships and multiple land uses. The waters flow through many backyards. Inevitably, stewardship must be shared by all the river neighbors and all the various levels of water resource authorities. Shared responsibilities must rely on shared knowledge and shared commitment to solve problems collectively. Public interaction is not only reasonable, but essential.

Resistance to Public Participation

In conservation with river planners and managers from federal, state and local governmental agencies, several issues regarding public participation consistently arise. Planners typically have uncertainty in the following areas:

- Selecting appropriate levels and structure for public participation in planning;
- Working with social value differences within the river community;
- Compensating for varying levels of public knowledge and understanding river resources;
- Determining how planners can demonstrate responsiveness to public desires. (Agrimis, 1989)

The beginning of the Skykomish Scenic River Plan was predictable and all of these reservations were expressed by local and state authorities. But at each category of "planning doubt" there arose opportunities for test participatory solutions; everything from town hall meetings, and on-site river workshops, to river rafting tours were designed to bridge the gap.

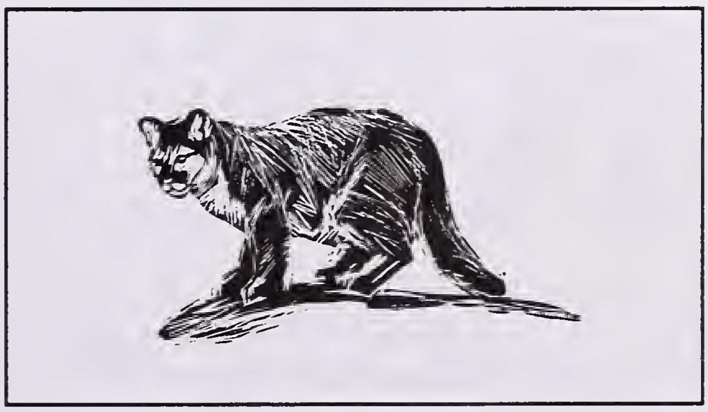

Figure 2 Accountability matrix for Implementing Goals and Objectives

Governing Organizations & Responsibilities

Goals & Objectives	U.S.	Committee of Participating Agencies							Counties		Towns				Skykomish Scenic River Committees	
	USFS	State Parks	DNR	Ecology	Fisheries	Wildlife	WaDOT	I.A.C.	Snohomish	King	Sultan	Gold Bar	Index	Skykomish	Advisory Board	River Council
Identify Existing Regulations																
1. Produce conservation directory	■	■	■	■	■	■			■	■	■	■	■	■		
2. Obtain agreements	■	■	■	■	■	■			■	■	■	■	■	■		
3. Develop interagency liasison	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Identify river access needs																
1. Develop safety programs	■	■				■			■	■						
2. Collect information	■	■	■			■	■	■	■	■	■	■	■	■		
3. Contact user groups															■	
4. Develop/implement access plan	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
5. Create river group		■													■	
Maintain water quality																
1. Identify existing regulations & needs	■	■	■	■	■	■			■	■	■	■	■	■		
2. Provide sanitation facilities																
3. Encourage BMP zoning											■	■	■	■		
Maintain wildlife populations																
1. Identify existing riparian plans	■	■	■	■		■			■	■	■	■	■	■		
2. Encourage private protection									■	■	■	■	■	■		
3. Request biotech. methods by WaDOT		■	■	■	■		■		■	■						
Promote Public Education																
1. Develop events		■			■	■		■	■	■	■	■	■	■		
2. Involve local schools, libraries			■								■	■	■	■		
3. Develop education materials		■	■	■	■	■										
4. Organize river workshops																
Restrict hydropower	■	■	■	■	■	■										
Sign & identify Skykomish as Scenic River																
1. Develop information kiosk	■	■	■		■	■	■	■			■	■	■	■		
2. Communicate goals & objectives															■	■
3. Develop promo materials															■	■
Establish advisory board																■
Expand scenic river designation	■	■														■

ABBREVIATIONS:

USFS= United States Forest Service

WaDOT= State Department of Transportation

IAC= Interagency Committee for Outdoor Recreation (State)

BMP= Best Management Practices for Agriculture

DNR= State Department of Natural Resources

Appropriate Public Participation in Planning

The term participatory planning refers to planning efforts where community values and interests are incorporated extensively from the beginning of planning, (Hester, 1984: Oberdorfer,1988). Efforts at participatory planning in river conservation are not always well received. They have shared some disappointments resulting from the inadequacies of formal public hearing style participation.

Complaints from citizens about participatory planning belong to two major categories:

"No one ever asks us anything"

"They pretended to ask, but did not even want to hear" (Kaplan, 1978)

Planners' complaints also demonstrate disappointment with participatory planning:

"They watched the presentation with glazed eyes and no one said anything"

"It's always the same people who raise problems and you don't know what the silent majority is thinking"

"Hardly anyone showed up at the public hearing"

"What's gained by asking people to make decisions about things they know nothing about? (Kaplan, 1978).

Complaints often stem from participants not understanding their role in the planning process. They should be informed of the entire structure and decision making process right from the start.

One planning and management structure incorporated in the Skykomish Scenic River plan was the creation of an association of accountable government entities who manage the river resources and public use of the waterway. The structure is a cooperative local and state River Council. It consists of representatives from each of the cities along the river, counties and all state and federal agencies which have land holdings or interests in the river area.

One of the purposes of the Council is to review and decide on the planning priorities derived from the local workshops. The authority of the Council is that of a cooperating body which connects all levels of government and ownership. On the Skykomish Scenic River, the Council meets quarterly to review the implementation of the conservation plans. River tours are part of the regular meetings to further acquaint the officials with river specifics and develop a more personal relationship with the surroundings.

Community workshops, called "listening posts" were the main public forum. These were meetings in every "nook and cranny" of the river community, designed to go where the people reside rather than ask people to travel to large town centers. Public listening posts function as an opportunity to orient and introduce the local community to the planning program and to listen. Listen to their concerns about public trespass, local water quality, access for fishing, forest harvest practices and a myriad of other individual issues. Emotions are often displayed at these meetings in the beginning, but the group is separated into small groups to record their interests. Small groups tends to reduce loud outbursts and give the quiet members of the audience a comfortable arena to share their ideas. Listening posts are tightly managed with several meeting facilitators. The meeting purpose, agenda and time schedule is proposed by the planner and agreement is sought by the gathering group. Consensus decision making begins early.

Comments are summarized at the end of the "listening posts" to gain a perspective of the variety of concerns amongst the whole group and further acknowledge their ideas. Listening post workshops offer a sense of plan creation to participants. This level and structure of open participation tends to attract more people than the formal public hearings.

Further involving and empowering of the local community in the planning process happens with the creation of a local Advisory

Board. The listening posts meetings on the Skykomish Scenic River attracted a wide spectrum of river interests and from this group, the Advisory Board was chosen. This selection process was different than the normal appointment of all the established community leaders. A new cadre of river interested citizens emerged.

The advisory board will generally be built of team players who have the time and commitment to see the plan through. Participants are requested to volunteer for the Advisory Board positions and they are chosen based on criteria set by the River Council. The advisory board formation has eventually given the Skykomish valley a new set of community leaders.

Written reports from the listening posts and a newsletter from the Advisory Board meeting serve as tangible demonstrations of the planning work. New media coverage increases as the local names are mentioned in these informal planning proceedings. The river conservation plan becomes "our plan". The polarization between the managing agency and the citizens begins to diminish. At least for this planning effort.

Key principles of designing appropriate levels of public involvement include:

- Design processes to manage public emotions;

- Listening to public concerns through small local meetings and recognizing public issues in writing;

- Empower the local citizens and interest groups through the creation of volunteer local advisory boards.

Working with Social Value Differences within the River Community

The importance of a humanistic, personal approach in planning has been pointed out by successful public planners. Many have recognized the importance of being open to seeing the world in terms of local residents, and being able to communicate ideas across cultural boundaries. (Carroll et al. 1988). This has not been widely recognized by the resource planning community. A large proportion of planning problems arise when it is perceived that the strongest social force rules.

There are differences of cultures within the community and differences between the planning authority and the advisory board. It is easy to ignore the individual who does not understand planning processes and wants to go straight to "real actions". The loudest voice sometimes commands the social pressure in a group. The advisory board, for example must take the time to consider the values of every member, no matter how askew it may seem at first. Some members may feel that the planning progress is bogged down by waiting for all to share and waiting for consensus. But experience on the Skykomish has shown that the individuals begin to concede some unrealistic demands and offer the group new alternatives, if their values are legitimized. Polarization occurs when not enough time is allowed for the "... painstaking, time consuming process of face-to-face interaction and trust building" (Carroll 14 et al. 1988).

In the Skykomish Scenic River planning model, consensus and trust building are the key to continued participation of minority factions. Progress, at first was slow and consensus began with simple decisions, such as the acceptance of the purpose and role of the Advisory Board, the goals and objectives of the river conservation plan and adoption of the individual meeting agendas. Advisory Board members reported initial frustration with the consensus process but later admitted that it improved their attention to others' concerns and that, as a result, they learned more about the river community. Voting can be viewed as a war against.conflicting ideas, where the largest force wins. Consensus is achievable and has not proved to weaken the substance of decisions. Consensus does take special meeting management. Each meeting used a neutral facilitator; someone who had no interest in the outcome of the plan, but who would balance discussion and enforce the meeting agenda. This further empowered the group to make decisions as a whole and not rely on voting or a the arbitration of a meeting chair person.

Other techniques worked to recognize everyone's unique situation along the river. The Advisory Board frequently took tours of river areas where problems were indicated. For example, the Board made several trips to walk out onto local farmlands to witness the effects of flooding. This first hand knowledge developed a sense of mutual concern and broadened the awareness of Board members and planners alike.

The Advisory Board became an essential trust building forum. Their work generated the community's plan. It was no longer an "out of town" plan created by an "out of town" entity. A strong local pride developed around the planning decisions and citizens later testified on behalf of the plan before the State Legislature.

Key principles involved in dealing with social value differences include:

- Maintain regional control but localize planning issues and concerns, and allow a continual public forum with a local advisory board;

- Make decisions by consensus.

- Use a neutral meeting manager to facilitate the workings of the meeting and ensure a balanced participation by advisory board members.

- Provide opportunities for the understanding of opposing values and work toward solutions which demonstrate balance.

Compensating for Varying Levels of Public Knowledge and Understanding of the River Resources

Planners have often considered participatory methods cumbersome and prone to produce results of questionable integrity from a planning perspective (Agrimis, 1989) Much of their concern is with not trusting the level of understanding of the river, its dynamics and interrelated resources to the local citizen. The public cannot be expected to make recommendations about river gravel management as it relates to spawning habitat, or know the alternative methods for bank stabilization, or be familiar with the needs of wintering deer and elk populations for example. For these reasons, the study of river environment is carried out by experts such as hydrologists, geomorphologists, and fisheries and wildlife biologists. But it is the job of the planner to convey and interpret these technical data to the public. The public or advisory group will, thereby, receive a technical education about the river once again bridging the gap of diverse knowledge and culture surrounding the fluvial environment.

On the Skykomish River, geologists and hydrologists were invited to speak to the Advisory Board and the local community about. the dynamics of flooding and characteristics of the bank full stage of a river. After these presentations, discussions included new perspectives about the balancing forces of the river, natural meanders and the ill effects of the effects of continued channelization. From these early educational presentations, the Advisory Board requested informational sessions at each of their monthly meeting. Educational sessions broadened to include explanations about the shoreline management regulations, the government budgeting process and financial grants.

The Advisory Board also began to put more emphasis on viewing and enjoying the river. The planning regimen was supplemented with trips to the river, to float the river and walk along its banks. This continued appreciation of the river's beauty and power coupled with new scientific understanding enriched the entire process. One Advisory Board member expressed that the planning over the past year had greatly added to his education about the river valley and he had lived there for 30 years.

Key principles regarding the varying levels of public awareness and understanding of the river include:

- Recognizing the professional resource expert and scientific knowledge of the riverscape.

• Incorporating education programs into the public participation process.

• Increasing a sense of stewardship with additional knowledge of scientific and social/cultural values.

Determining How Planners Can Demonstrate Responsiveness to Public Desires

Goetz (1979) suggested the need for public agencies to treat the public as partners. The quality of public participation is essential according to Arnstein (1969), and this is determined by the amount of power shared. Arnstein claimed that participatory planning must involve some sharing of power if it is to be more than a hollow ritual. A flexible approach is suggested when dealing the many unknowns of the public, but this is contrary to the strict planning processes. Planners must be willing and show good faith in altering their process, if the community requests change.

An example is shown in the beginnings of a river plan in another rural sector of Washington State. The Kettle River management plan, started in 1990, called for river mapping and a resource assessment prior to the public involvement process. Paranoia about governmental motives behind the plan prompted early public workshops which superseded the technical river study. County commissioners were pleased with the quick response of the planning team. Soon after the public process began, the citizens realized the need for the maps and resource studies and requested those be done.

Goetz (1979) found the direct personal ties between planners and community people to be a necessity for establishing local credibility.

Community members are typically not as patient as planners in waiting to see results of the policy and river management decisions. Action is often expected within a year's time. To expedite the process on the Skykomish, the Advisory Board set up an "accountability matrix" (Figure 2). This chart outlines the objectives of the plan and identifies the appropriate authority responsible for implementing that portion of the plan. The plan could then be acted upon by many levels of government at once. Several local and state agencies were able to place action items into their budget plans for the next two years.

The plan also gave certain river conservation responsibilities to the Advisory Board. Within the first year, the Board initiated community wide, river clean-ups. They coordinated the design of a river recreation site plan, working with several parks agencies, volunteer landscape architects and landscape architect students, and local citizens. This design was later approved by agency engineers and was appropriated grant monies for the park's renovation. The river plan continued to gain credibility through quick action. A result of these action within a short time was an expanded public involvement in the river events and further action plans.

An aid to increase responsiveness for river conservation is the development of a published listing of river conservation agencies, and river interest associations, called a "river conservation and recreation directory". The first was developed for the Skykomish River 1989 and served to direct citizens with complaints, concerns or requests for information about the river to the agency or organization with the best answer or authority. This telephone and address directory and includes explanations about the management regulations on the river and details physical descriptions of the river valley.

Success of the Skykomish public planning process has been recognized statewide. The Skykomish Scenic River Advisory Board received the Governor's award for excellence in environmental protection in 1989, within a year of the adoption of goals and objectives for the Skykomish Scenic River System.

Key principles which demonstrate responsiveness of the plan and planners are:

• Maintain flexibility in the planning process to respond to public needs and desires;

- Identify what agency or organization has the authority and capacity to implement the plan;

- Develop small action plans which can be accomplished within the first year of the plan's adoption and include public participation in these actions.

- Develop a network of interested citizens and agencies which can respond to river problems. Networks and partnerships take time, but soon there will be many eyes watching over the river.

Conclusion

Public participation in river planning too often has the appearance of government planners wanting acceptance and approval of their product rather than acknowledging the value of involving the river community. The integration of social and cultural values inherent to a river community has proven to be not only important in planning, but is a long term means of local river conservation action. Now there are more and more examples of successful plans which fully integrate community issues and concerns. The farmers, towns people, fishermen and boaters are the closest to the river. They will be the day-to-day stewards of the river. The art of finding ecologically sound decisions which can be accepted by all neighbors of the river is still evolving.

What planners receive out of an efficient public planning process is a much stronger understanding of the whole river environment. Experience has demonstrated that participatory planning is personally rewarding, as the river area citizens will also integrate the planner into their community.

Local citizens, in seeking more control over their surroundings and life style, are challenged to educate themselves and their neighbors about the intricacies of a river ecosystem.

The river, under close scrutiny and debate, is most likely to benefit from the attention to detail and more widespread recognition of its dynamic nature. Once the initial river conservation plan is achieved, the actions by all those concerned focus more on protecting the River. The saying "all river planning is politics and all politics are local politics" appears to be true.

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CHAPTER NINE

RIVER MANAGEMENT STORIES - ISSUES OF SCALE

"Up north of the San Francisco Peaks, around Cedar Mesa, there used to be a big lake--but it's not there anymore. One December day a few years ago, a flock of ducks landed on it, and moments later the temperature dropped suddenly, causin' that lake to freeze solid. Didn't hurt those ducks none. They up and took off, flappin' their wings and carried that lake right along with 'em. Far as we know, that lake's down in Mexico somewhere and now there's just another dry hole in northern Arizona.

Out near Willcox is a huge dry lake bed. Old-timers claim that at one time its sparkling blue waters matched those of Lake Tahoe. That is, until a group of German tourists held a picnic there a few years ago. They brought along several kegs of beer and a barrel full of pretzels. They sipped suds and devoured pretzels all afternoon, but when they got ready to leave, there was still half a barrel of pretzels. So they emptied the rest into the lake. Well, the fish started eating those pretzels, got so thirsty they drank up all the water. And there hasn't been enough rain since to refill it."

It Always Rains After a Dry Spell
Marshall Trimble

Accommodating Issues of Scale

Hilton L. Silvey

I am a hydrologist by trade, formerly as Regional Hydrologist with the Forest Service in the Rocky Mountain Region. I, and most of the Forest Hydrologists I am acquainted with have had a great deal of professional experience related to the problem, or perhaps better stated as the challenge of dealing on a day-to-day basis with an almost infinite range in the scale or magnitude of impacts that are encountered with the variety of watershed concerns and riparian management issues that exist on National Forest System lands.

One successful approach to accommodating the issue of scale which I have learned over the years, is to continually emphasize the concept of process identification, and to insist on and maintain the overall perspective of managing the perhaps numerous localized impacts on a system-wide or watershed area basis. In other words, the condition or integrity of the land area located adjacent to, or upstream of a particular riparian area of concern becomes as equally important to riparian health and welfare as does the condition of the riparian area itself.

The scale or magnitude of a developmental impact or a land use activity issue may be something described as small: where perhaps a local rancher is losing valuable riparian pasture land to a basic process of stream-bank erosion, initiated by exuberant herds of watershed roaming elk; and range up to a situation or issue described as one of a grand scale: where, for instance, a major electric power utility, suffering from the effects of fluvial processes or sediment deposition, is undertaking to reduce overall sediment yields from the upstream watershed areas by implementing an extensive program of land and channel stabilization across an entire watershed.

Here, it is important to note that while both of the described riparian impact situations may have a vastly different ranking in terms issue scale, or impact magnitude; they are, on an individual basis of equal ranking in terms of importance or concern to the individual resource users in question. Both issues are of course worthy of accommodation, and require both local process identification, and systemic watershed considerations to resolve. Some of the aspects of how such accommodations may be brought about at various scales are presented by the panelists for this morning's session.

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El Papel del Centro Ecológico de Sonora en la Proteccíon y Conservacíon de Humedales en Sonora

Alejandro Varela-Romero

Introducción

El Estado de Sonora está localizado en el Noroeste de México y comparte la frontera internacional con los Estados de Arizona y Nuevo México. Los humedales que conocemos hoy en Sonora, fueron parte tiempo atrás de grandes complejos hidrólogicos en una gran extension del Noroeste de México y Suroeste de los Estados Unidos, lo que explica las afinidades entre la flora y fauna entre ambas regiones. En general, Sonora posee una variada gama de humedales permanentes o efímeros entre los que se cuentan los naturales como rìos grandes, arroyos desérticos y de alta elevacion, deltas de ríos, ciénagas, esteros, lagunas costeras; y artificiales como presas, represos y canales. Estos habitats mantienen una gran diversidad de especies de flora y fauna silvestre, algunas endémicas a México y otras a los Estados Unidos, pero la mayoría se encuentran compartidas en ambos lados de la frontera. No selo en humedales se presenta esta afinidad entre flora y fauna, las cuencas hidrológicas y las montañas proporcionan una variado habitat que funcionan como corredores biogeográficos para importantes especies de mamíferos como el jaguar, ocelote, oso negro, un gran numero de aves migratorias, anfibios y peces.

Los Projectos del Centro Ecológico

El Centro Ecológico de Sonora desde 1986 ha venido realizando actividades de investigación sobre la ictiofauna dulceacuícola y sus habitats en Sonora bajo el proyecto Estudio Ecológico de la Ictiofauna Dulceacuícola del Estado de Sonora. Este proyecto ha proporcionado las herramientas indispensables al definir la situación actual de los peces nativos a Sonora y proporcionar los factores que causan las principales alteraciones en habitats naturales del Estado. Con el fin de dirigir los esfuerzos de estudio y conservación de esta importante fauna y sus habitas se diseño el proyecto Estudio y conservación de Peces Nativos en el Noroeste de México. Actualmente se plantea realizar acciones espécificas de manejo de poblaciones de peces nativos enlistados como en Peligro de Extinción, Amenazados y algunos Endémicos en habitats naturales del Norte de Sonora.

El proyecto Conservación del Delta del Río Colorado y la Parte Norte del Alto Golfo de California surge a principios de los 90 como una necesidad real de fundamentar e instrumentar estudios sobre la problemática ambiental de la región del Delta del Río Colorado y la Parte Norte del Alto Golfo de California, con el fin de proporcionar las herramientas necesarias para el manejo y conservación de esta región. Adicionalmente el CES apoya directamente al equipo de trabajo del proyecto Evaluación de la Ciénaga de Santa Clara, importante humedal ubicado dentro del delta, conformado por diversas instituciones como el Centro de Ecologia de la Universidad Nacional Autónoma de México, el Environmental Research Laboratory de la University of Arizona y el Drylands Institute, en el afán de caracterizar este importante humedal sujeto a modificaciones futuras.

A pesar de que el CES, desde su creación en 1985, ha desarrollado actividades de investigación dirigidas al conocimiento de los recursos naturales con fines de protección conservación, no habia diseñado un programa que dirigiera sus esfuerzos hacia la promulgación de aéreas naturales protegidas, retomando los antecedentes realizados por los Gobiernos Federal y Estatal hasta el momento.

The Role of the Centro Ecologico de Sonora in the Protection and Conservation of Wetlands in Sonora

Alejandro Varela-Romero

Introduction

The State of Sonora is located in northwestern Mexico and shares the international boundary with the states of Arizona and New Mexico. The wetlands that we know today in Sonora, was once a great hydrological complex in an extended area of Northwestern Mexico and Southwestern United States. This explains why the flora and fauna have affinities for both regions. In general, Sonora has a wide variety of permanent and ephemeral wetlands. A list include natural wetlands like big rivers, desert and high elevations streams, river deltas, cienegas, marsh areas, estuaries, coastal lagoons; and artificial wetlands like dams, reservoirs and channels. This habitats have great biodiversity. Some of these species are endemic to Mexico and others are to United States, but most of them are living in shared areas in both sides of the boundary.

Not only in the wetlands exist affinities, but also in the mountains and the hydrological watersheds which give a wide habitat that works like a biogeographical corridor for important species of mammals like jaguar, ocelot, black bear, a lot of migratory birds, reptiles, amphibians and fishes.

Projects of the Centro Ecologico

The Centro Ecologico de Sonora (CES) has been studying the biodiversity of Sonora from 1985. In 1986 it initiated research activities on freshwater fishes and their habitats in Sonora with the project "Ecological Study of Freshwater Ichthyofauna of the State of Sonora". This project gives us the necessary information for defining the status of native fishes of Sonora, and gives us the principal factors which impact the natural riparian areas of the State. With the aim of directing the study and conservation efforts on these important fauna and their habitats, we designed the project "Study and Conservation of Native Fishes in Northwestern Mexico". We have planned to make specific management actions on native fishes populations listed as Endangered, Threatened and some endemic to Sonora.

The project "Conservation of the Colorado River Delta and the Upper Gulf of California" emerged in early 1990 as a real necessity in order to give support and to develop studies about environmental problems in this area, with the objective of providing the necessary information for the management and conservation of this important region. Additionally the CES gives direct support to the Environmental Research Laboratory of the University of Arizona, The Drylands Institute, The Centro de Ecologia of the National University of Mexico, and the Arizona Game and Fish Department as a team for the "Santa Clara Slough Evaluation Project." This Slough is an important wetland which belongs to the Colorado River Delta. The aim of the project is to describe this wetland

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Esfuerzos Oficiales Dirigidos a la Conservación

En Sonora desde los años 30 se tiene precedente de esfuerzos oficiales dirigidos a la conservación de sus recursos naturales con el establecimiento de cinco aéreas naturales, Arroyo Los Nogales; Zona Protectora de la Ciudad de Hermosillo; Región del Bavispe; Sierra Los Ajos, La Púrica y Buenos Aires; Cajón del Diablo; Isla Tiburón y Sierra del Pinacate. La administración de estas áreas está a cargo del Gobierno Federal, la Secretaría de Desarrollo Social (SEDESOL) para Isla Tiburón y Cajón del Diablo y la Secretaría de Agricultura y Recursos Hidráulicos (SARH) para el resto, a excepción del Arroyo Los Nogales y Zona Protectora Ciudad de Hermosillo que han prácticamente desaparecido por el desarrollo urbano de estas ciudades. La administración y manejo de estas áreas ha sido muy irregular y no se conocen planes o programas de manejo que aplique a cada una de las áreas las acciones adecuadas para su protección, conservación y aprovechamiento racional de acuerdo a los fines del decreto,derivándose problemas de desapariciones por cambios de uso de suelo y propiciando los aprovechamientos ilegales, saqueos, cacería furtiva, actividades de afluencia de turistas e investigadores incontroladas.

En el marco de esta realidad de deterioro de los recursos naturales a causa del incremento poblacional, desarrollo económico ininterrumpido y ausencia de políticas eficaces, el Gobierno de Sonora, atendiendo el reclamo de los sonorenses, ha puesto en marcha el "Sistema de Areas Naturales Protegidas del Estado de Sonora (SANPES)". El SANPES comprende el estudio de las áreas con relevancia en su biodiversidad, interés económico, escénico y social, e intenta someter las más relevantes a un sistema de manejo, con el fin de protegerlas y conservarlas. El SANPES constituye una plataforma más de apoyo al cumplimiento delas políticas y estrategias de los programas del Gobierno del Estado en materia de conservación ecológica en el marco del proyecto de la Secretaría de Infraestructura Urbana y Ecología (SIUE).

Los objetivos de SANPES son de carácter bioecológicos, socioculturales y económicos. Los bioecológicos son:

- Preservar muestras representativas de las principales provincia biológicas del Estado.

- Proteger áreas de alta diversidad biológica y genética.

- Conservar especies raras, amenazadas o en peligro de extinción.

- Garantizar el funcionamiento de sistemas biológicos como son los corredores biogeográficos, rutas migratorias, zonas de anidación, entre otras.

- Proteger formaciones geológicas importantes.

Los socioculturales y económicos están relacionados con la satisfacción de las necesidades del hombre y son:

- Proteger sitios de belleza escénica con fines de recreación y esparcimiento.

- Administrar cuencas hidrológicas.

- Establecer zonas para la investigación científica y educación ambiental.

- Desarrollar planes de aéreas íntegramente manejadas comoejemplos de uso sostenible.

El SANPES recibe apoyo y reconocimiento del Gobierno del Estado de Sonora, la SEDESOL, la SARH, The Nature Conservancy, la US Agency International Development, Mac Arthur Foundation, North American Wetland Conservation Council, Sequoias Foundation, U S Fish and Wildlife Service, Arizona Game and Fish Department y International Conservation.

Como fase inicial del SANPES se llevó a cabo un Taller sobre la Identificación y Con servación de Habitats Críticos y Diversidad liable to be altered greatly in the future. Other projects are the study and evaluation of the Bald Eagle population in the Rio Yaqui and studies of rare plants in northern Sonora in collaboration with the Nature Conservancy and the U S Fish and Wildlife Service.

Official Conservation Efforts

In Sonora there have been official conservation efforts since the 1930's toward natural resources conservation with the establishment of five natural protected areas: the Arroyo Los Nogales, Protected Area of Hermosillo City, Bavispe Region; Sierras Los Ajos, Buenos Aires and la Purica; The Pinacate area, Cañon del Diablo; and Tiburon Island. The administration of these areas is by the Federal Government, the last two by the Secretary of Social Development (SEDESOL) and the rest by the Secretary of Agriculture and Hydraulic Resources (SARH).

The protected area of Hermosillo City and the Arroyo Los Nogales were absorbed for the human development of this cities. The administration and management of the rest of the areas has been irregular and there are no management programs that develop the conservation activities, protection and rational exploitation on the bases of the decree for these areas. These factors provide an opportunity for illegal uses, plundering, illegal hunting and excessive tourist and research influence.

Thinking in this reality of natural resources damage by population growth, permanent economic development and the lack of efficient policies, the Sonoran Government, considering the attitudes of Sonoran people, has initiated the "Natural Protected Areas System of Sonora, SANPES". This program includes the study of areas with relevant biodiversity, economic, social and scenic interest and a study of the most relevant management system. The SANPES is another forum for the performance of policies and strategies of the ecological programs of the State Government.

The SANPES biological and ecological objectives are:

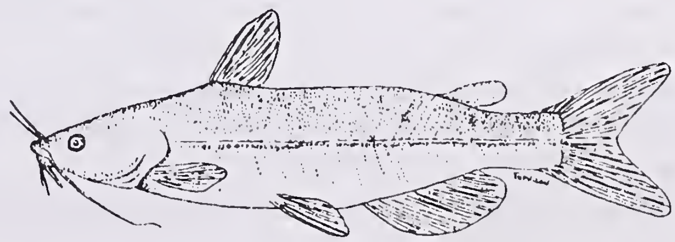
- Preserve representative samples of the principal biological regions of Sonora.
- Protect areas with high biological and genetic diversity.
- Protect and conserve rare, threatened and endangered species.
- Guarantee that the biological systems function as biogeographical corridors, breeding zones, etc.

The sociocultural and economic objectives are:

- Protect areas with landscapes for recreational purposes.
- Administer hydrological basins.
- Establish areas for research and environmental education.

SANPES has the support and recognition of the Government of Sonora, SEDESOL, SARH, The Nature Conservancy, The US Agency of International Development, Mac Arthur Foundation, North American Wetland Conservation Council, Sequoias Foundation, US Fish and Wildlife Service, Arizona Game and Fish Department and International Conservation.

As an initial activity for SANPES, we developed a "Workshop on Identification and Conservation of Critical habitats and Biological Diversity in Sonora, Mexico" with the goal of developing, with the consultation of International Conservation.



Yaqui catfish

Biológica de Sonora, México" con el objetivo de proveer, previa consulta de especialistas en el área procedentes del Noroeste de México y Suroeste de los Estados Unidos, una lista de los habitats críticos que requieren de protección y conservación en Sonora. En este Taller se identificaron 70 sitios que requieren de estudios y propuestas de protección y conservación desde el corto al largo plazo. En Febrero de 1992 se realizó una revisión y sistematización de la información de los 70 sitios detectados y fue posible agrupar 25 áreas de interés. Posteriormente en Marzo de 1992 se realizó un segundo taller con el propósito de revisar y analizar los aspectos écnicos para la identificación y selección de ieslas áreas susceptibles de proponerse al Sistema Nacional y/o Estatal de áreas protegidas, considerado la Planificación de Áreas Naturales Protegidas, Técnicas de Evaluación Ecológica Rápida, Identificación, Evaluación y Selección de Áreas Naturales y Criterios para la Selección y Priorización de Áreas Naturales Susceptibles de proponerse al Sistema. Como resultado de este análisis y en respuesta a proposiciones de Dependencias del Gobierno Federal Mexicano y Agencias Conservacionistas Internacionales, se determinó trabajar con 14 áreas designando un responsable técnico para cada una de estas.

En estas áreas se incluyen siete importantes humedales sonorenses, el Delta del Río Colorado y Alto Golfo de California, Río San Pedro, Arroyo Cuchujaqui, Arroyo Cajón Bonito, Arroyo El Reparo, Bahía de Lobos y la zona costera de las Islas Tiburón y San Esteban y del Cajón del Diablo. Para estas áreas y el resto que conforman la materia de trabajo del SANPES se ha definido su área de estudio en base a caracteristicas biofísicas, políticas, sociales, económicas y culturales. Se elaboraron mapas base escala 1:50,000 para cada área de estudio y se elaboraron mapas sobre vegetación, uso de suelo, hidrológico, edafológico, geológico, tenencia de la tierra, elementos especiales, distribución de centros de población, infraestructura fisica y amenazas principales sobre los recursos naturales de cada área.

Además se han elaborado en base a recopilación bibliográfica, de campo y en consulta con investigadores nacionales y extranjeros, dependencias del Gobierno Federal y Estatal, Agencias Conservacionistas internacionales y usuarios de las áreas, listados de flora y fauna silvestre, directorios de instituciones y además se han recopilado y sistematizado la información más relevante de los sectores sociales y económicos para cada área (Educación, Salud, Ganadería, Actividades extractivas, Población y empleo, entre otras). Con esta información para cada área de estudio se ha elaborado una propuesta de delimitación y zonificación de la unidad de conservación que se integrará a la propuesta general de SANPES para integrar el sistema y solicitar para el mes de Marzo de este año, el decreto correspondiente de las áreas estudiadas bajo el programa.

Las Perspectivas a Futuro

Las perspectivas a futuro del SANPES son prometedoras. Las Áreas Naturales Protegidas (ANP) adecuadas a las necesidades de desarrollo, son la mejor estrategia para mantener los procesos productivos a largo plazo y la función de los ecosistemas permitiendo la permanencia de la biodiversidad, mejorando la utilización del agua y controlando la erosión de suelos. El SANPES representa un marco jurídico donde se pueden desarrollar actividades de estudio, conservación y recreación. Representa además una forma de ordenamiento territorial que aplica medidas de protección y conservación a las estrategias extractivas desarrolladas comúnmente.

El carácter de Sistema, le permite integrar una red de áreas naturales con un nivel de protección legal que pueda desarrollar programas de manejo a largo plazo integrando áreas de grandes dimensiones y es además una herramienta de conservación donde es posible revalorar los criterios y estrategias de conservación para Sonora dependiendo de las necesidades apremiantes en su momento.

researchers of Northwestern Mexico and Southwestern United States, a list of critical habitats that require studies and proposals for protection and conservation in Sonora and proposals of protection and conservation in short term. In February of 1992 a review and categorization of the 70 sites information was made, and it was possible to detect 25 areas of interest. Afterwards, in March of 1992, a second workshop was held with the purpose of selecting the important areas to include in the System. As a result of this workshop, and in response to agencies of the Mexican Federal Government and International Conservation Agencies, the SANPES initiated its work in 14 areas with one researcher as a leader of one of each one.

In these areas are included seven important Sonoran wetlands: The Colorado River Delta and the Upper Gulf of California, San Pedro River, Arroyos Cuchujaqui, and El Reparo, Bahia Lobos, and the coastal zone of Cajon Bonito and Tiburon and San Esteban Islands. For this areas and the rest of them, we defined the study areas in terms of its biophysics, policies, social economical and cultural issues. We made 1:50,000 base maps with the vegetation, land use, hydrology, geology, land owners, special elements, distribution of human populations, facilities and potential threats for natural resources for each one of these areas.

In addition to field and bibliographical compilations, international and local specialists worked together to elaborate of a list of species and a directory of institutions involved in the area. The information includes social and economics issues like education, health, economic activities, populations , employment, ranching, and others. With this information and the delimitation of boundaries of each conservation unit, a proposal for a decree from the Federal Government will be made in March of this year.

Prospects for the Future

The future prospects of SANPES are promising. The Natural Protected Areas involved in human development are the best strategies in the management of long term productive activities and the function of ecosystems and permanence of biodiversity, especially considering water use and erosion control.

Es ampliamente conocido que las crecientes presiones del desarrollo están rápidamente alterando y destruyendo los ambientes naturales, ocasionando la extinción demuchas especies y contribuyendo a la larga a graves problemas como los cambios climáticos globales. Muchas actividades de conservación se pueden emprender, pero su efectividad dependerá de la disponibilidad de información biológica y ecológica sobre las áreas y la disponibilidad politica de ambas naciones por apoyar estas actividades.

La creación de los Centros de Datos para la Conservación (CDC) apoyan directamente esta carencia de información, sobre todo en México. Un CDC en un inventario computarizado, continuamente actualizado, de las características más importantes del país o región donde se encuentra. Esta información es particularmente valiosa para identificar las áreas naturales de alta prioridad que requieren protección, manejar el desarrollo sostenible de áreas naturales y de otros recursos estbiológicos, e identificar conflictos ambientales potenciales en el proceso planificado.

En Sonora, como una importante herramienta de apoyo a SANPES y a los proyectos de monitoreo de poblaciones de flora y fauna nativa a Sonora que desarrolla el CES, se encuentra el Centro de Datos para la Conservación de la Naturaleza en Sonora. Creado en 1991 ha integrado a un ecólogo, botánico y zoólogo y un coordinador en un equipo de trabajo adquiriendo información relacionada con aspectos de Conservación Planificada, Desarrollo Planificado, Manejo de Parques y Áreas Protegidas e Investigación y Educación. Toda la información desarrollada en SANPES y los proyectos de monitoreo se incluyen en la base de datos del Centro de Datos para la Conservación de la Naturaleza en Sonora.

Este ejemplo de cooperación internacional es resultado de una necesidad de proteger y conservar áreas y recursos naturales en una importante región a través de las fronteras.

SANPES represents the first state system which uses the support of the Federal Government for the development of study, conservation and recreation programs as a whole system in Sonora. It is too, a legal kind of land uses application with special interest in the regulation of the common use of natural resources. SANPES is a system which includes a net of natural areas with legal protection and can develop long term management programs.

As an valuable instrument to SANPES and monitoring projects of native species populations activities, the CES and The Nature Conservancy implemented the Data Center for the Conservation of Nature in Sonora. This Conservation Data Center began in 1991 with the grouping of specialists in biology, ecology and conservation in a group working with the acquisition of information related with Sonoran natural resources, conservation and planned development, management of parks and protected areas, research and environmental activities. All this information of SANPES and the CES research activities, and all published material related to Sonoran natural resources are included in this Data Center.

This example of international cooperation is a result of the necessity of protecting and preserving natural resources and areas in a region across the international boundary.

Yuma Clapper Rail

The Little Colorado River

Mike Tremble

The River and its Life forms

The Little Colorado River begins in the White Mountains of Arizona on the slopes of Mount Baldy and flows northwest where it meets the Colorado River in Grand Canyon National Park. The watershed is comprised of approximately 26,964 square miles in northeast Arizona and northwest New Mexico (Arizona Department of Water Resources 1989). Over 69% of the watershed is managed by the Federal government while 21% of the watershed is privately owned. The Navajo Nation occupies the greatest portion of the public lands. The waters of the Little Colorado River and its watershed have many values; these include endangered fish, recreation, industry, irrigation, and sites sacred to Native-Americans.

The principal plant species of the riparian zone are *Tamarix chinensis* (salt cedar), *Salix exigua* (coyote willow), *Baccharis glutinosa* (seepwillow), *Tessaria sericea* (arroweed), *Typha latifolia* (cattail), *Phragmites australis* (giant reed), and *Alhagi camelorium* (the introduced species, camelthorn). *Prosopis* (mesquite) occurs on the high terrace of the Little Colorado River gorge. A few old stands of cottonwood also occur.

Neotropical migratory birds, waterfowl, bighorn sheep and waterfowl are found in the Little Colorado River gorge.That gorge is also the only regional spawning habitat for the endangered fish, *Gila cyph*a (the humpback chub). Another endangered fish, the Little Colorado River spinedace occurs in tributaries including Chevelon Creek.

Management Considerations

Any attempt at effective management of the Little Colorado River for the purposes of any entity must address a full range of proximate and ultimate controls over a full range of spatial and temporal scales. Ultimate controls are those factors that operate over large areas (<1 square km.), are stable over centuries and are responsible for a range of conditions in the watershed network (Naiman 1992). Proximate controls are geomorphic and biotic processes that operate at small scales (<10 square m.) and change the stream over time periods of less than a decade. These processes include discharge, temperatures, erosion, channel migration, sediment transport, reproduction, disease, and competition (Naiman et. al. 1992). Stream processes function over 16 orders of magnitude (Minshall 1988).

Therefore managers need to address particular problems or goals by examining processes that operate over many spatial and temporal scales. This paper will describe the dynamic processes that operate at different scales in the Little Colorado River watershed;

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it will also address how organizational and cultural scales must be examined in the development of any management strategy.

The Watershed

On a large spatial scale, it is important to consider the watershed of the river. The watershed is the Coconino aquifer. This aquifer receives recharge from the Defiance uplift on the Navajo Nation and the Mogollon Rim/ Flagstaff area. This water migrates to the lowest topographic exposure at Blue Springs where it discharges from a series of springs from the Redwall Limestone into the gorge of the Little Colorado River (Arizona Department of Environmental Quality 1991).

The Coconino aquifer contains 413 million acre-feet of water; it can be tapped in most areas (Arizona Department of Environmental Quality 1991). Major withdrawals from this aquifer total about 100,000 acre feet and these withdrawals are for power, forest industries, irrigation, municipalities and coal. The aquifer supports many reaches of perennial flow in the southern portion of the watershed. This perennial flow could be impacted by extensive pumping of the Coconino aquifer (Arizona Department of Water Resources 1992).

The Little Colorado River surface water flow is ephemeral except for the Blue Springs, which occur between 3.7 and 20.9 mi above the confluence of the Little Colorado River and the Colorado River (Loughlin 1983). The Little Colorado River gorge receives less than 8 in. of annual precipitation while the San Francisco peaks receive more than 35 in. (Loughlin, 1983). The river has two principal runoff periods; these are the summer and spring. Most of the summer run-off that reaches the Navajo Nation originates from the Puerco River. Extensive grazing has removed vegetative cover and compacted the soil. Any effort to develop a downstream reservoir to divert the sporadic summer flows would have to address the high sediment loads from the Puerco River (Arizona Department of Water Resources 1992). In fact, the sediment loads of the Little Colorado River are among the highest in the world due to cyclic climate change and localized influences of grazing. Spring run-off is the most dependable continuous streamflow in the watershed. At this time, evaporation is low, phreatophytes are at a low activity period, and snowmelt is available (Arizona Department of Water Resources).

There is a significant correlation between regional precipitation and discharge from the Little Colorado River. A reconstruction of the annual discharge through time demonstrates that discharge has varied considerably due to climate change. Departures from the median and mean discharge (165,800 and 189,890 acre-feet) include over 800,000 acre feet in 1973 and less than 20,000 acre-feet in 1974. In general 1892-1904 was a low discharge interval and 1905-1941 was a high discharge interval. Subtle changes in climate are probably responsible for the variations in discharge and the consequent periods of erosion and aggradation. Erosional phases were associated with a 1 degree Centigrade rise in annual temperature, a 50 mm. decline in precipitation, and a period of large floods. Aggradation of the floodplain was associated with rising precipitation and discharge and declining temperature (Hereford 1983). Spring discharge from two rivers in New Mexico were 6-7.4 times higher in El Niño years (Dahm and Molles 1992). It is predicted that predicted large global climate changes will affect arid regions more than others.

Historic Changes

An examination of the historical record of observers of the Little Colorado River demonstrates these changes in the watershed. In 1598, the Spanish explorer, Quesada crossed the river and named it Rio Almeda, the river of groves, because of the great groves of cottonwoods. Sitgreaves was blocked by extensive swamps near what is now Winslow in 1851. In 1858, Beale noted, "what good stock country, I have never seen anything like it and I predict for this part of New Mexico, a large population" (Colton 1937). Beale proved to be prophetic; however the large population consisted of sheep rather than people. In the 1880s Navajos were forced to feed young cottonwoods to their sheep during a drought.

In the 1890s Navajos named the river, Big Timbers, because large floods uprooted old cottonwoods and sent them riding down the river (Colton 1937). A co-worker relates that, during floods, his Navajo father would travel to the river in order to lasso floating cottonwoods and bring them to shore for firewood.

Tamarisk

Tamarisk or salt cedar was not present in the channel until after 1937, although it was cultivated as an ornamental 1 km. from the river in 1909. In 1939, 1200 cuttings were planted by Holbrook citizens along banks in order to halt river spreading and blowing sand. Until 1941 large annual floods prevented salt cedar invasion and controlled flood plain development. After 1941 flood frequency declined, vegetation stabilized the banks and trapped sediment. By 1954 the channel width had decreased by 54% (Hereford 1982).

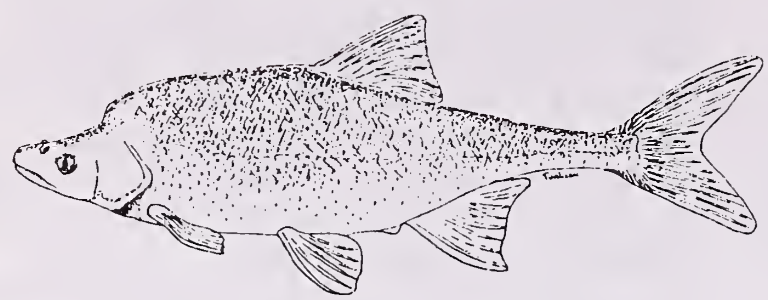
Consideration has been given by managers to control the phreatophytes because they deplete water. If all cultural activities, including reservoirs, irrigation and industrial diversions were halted south of the Navajo Nation, the streamflow at Winslow could increase by 60,000 acre-feet (Arizona Department of Water Resources 1989). However the already extensive phreatophyte population would increase due to the larger amounts of available water. In fact tamarisk could cover over 60% of the 5,700 acres of pasture and cropland within the floodplain (Arizona Department of Water Resources 1989). Tamarisk resists the effect of prolonged inundation during flooding, and therefore it survives better than the natives (Stevens and Waring 1985). When the species establishes itself on a floodplain or channel, there is an increase in overbank flooding and sediment deposition. Vegetated channel bars could stabilize and therefore change the fluvial geomorphology of the river and this in turn could affect the development of backwater habitats for fish.

The Navajo Nation in 1992 set aside a wetlands in the flood plain of the Little Colorado River near Winslow as the Hugo Meadows Wildlife Refuge. The Navajo Natural Heritage Program is currently weighing options for the management of the wetlands. Can the wetlands be restored to a historical condition that facilitates biodiversity? Should tamarisk be exterminated? What native species can outcompete and replace the introduced species? Can that native species survive under the current hydrological conditions? Will the wetlands be jeopardized by development that lowers the water table and at what distance will the development affect the water table? What will the cyclic climate change effects be on the erosion and aggradation of this part of the floodplain? These are questions that must be addressed at several scales.

The Humpback Chub

An important stream segment of the Little Colorado River is that .perennial portion, the Little Colorado River gorge. Here the humpback chub spawns and enters Grand Canyon National Park in the Colorado River. This segment has been proposed as critical habitat by the USFWS. It has also been proposed as a candidate for wild and scenic river designation by some groups. The gorge is also of cultural significance to the Navajo and Hopi tribes. Traditional salt gathering areas are located in the gorge.

The Little Colorado River also provides a significant amount of the sediment to the Colorado River; this sediment is important to maintaining beaches. In this deep canyon, a series of springs, Blue Springs, discharge 211 cubic feet of water per second (Loughlin 1983). The Blue Springs fault strongly influences the water chemistry and



Humpback chub

temperature of water from the individual springs. Springs west of the fault have lower water temperatures and higher dissolved solids than springs east of the fault. Carbonate mineralization upon diatoms and debris have created travertine dams. Below these dams pools have developed. One travertine dam may form a barrier to the upstream migration of the humpback chub. The riffles, pools,rapids, and dams are subunits of the stream segment. At each of the spatial scales there are processes operating that are undoubtedly important to the life history of the humpback chub. The fish depends upon the aquatic productivity of the stream which in turn depends upon detritus brought into the gorge by seasonal floods. Decadal scale variability in precipitation can influence these factors (Grimm and Fisher 1992).

"A fundamental question to be asked is whether a management plan for the Little Colorado River should be developed from studies that examine only one species in the system."

Arizona State University and the Navajo Natural Heritage Program have tagged and recaptured over 4,000 fish in order to delineate the life history and ecology of the humpback chub. The USFWS is mapping the streambed habitat. These studies are among the conservation measures for the Biological Opinion on the humpback chub. The information collected is also being utilized for the Environmental Impact Statement on the Operation of Glen Canyon Dam. The operation of the dam may affect the confluence where the humpback chub apparently stages for spawning migration. Humpback chub are found in the Grand Canyon; however reproduction has probably ceased there due to the cold temperatures of the water created by the dam; non-native fish also prey upon the humpback chub in the Grand Canyon. Therefore, whereas the Little Colorado River is historically an important habitat for the humpback chub, it is probably now also an important refugia for this endangered fish. Current management efforts for the Little Colorado River are being driven by the Endangered Species Act.

Questions that need to be addressed in managing the humpback chub include those on several scales. On the longitudinal scale, how does climate change and water diversion affect thermal loading, and transport of sediment, nutrients and toxic material. For example, a uranium tailings pile broke and released radionucleides into the Rio Puerco. Has the material dispersed into the Little Colorado River gorge? Has it bound to sediment and if so where was that sediment transported and under what discharge? If a reservoir impounded seasonal flow upstream, could this affect the behavioral spawning cues of the humpback chub? Would the impoundment prevent nutrient transport? Would sediment fill the pools because floods no longer flushed the silt out of the gorge? How much sediment is needed to maintain beaches in the Grand Canyon? On the transverse scale, riparian vegetation contributes shading to the stream as well as invertebrate biomass. On the vertical scale the connection between groundwater and surface water needs to be addressed. A fundamental question to be asked is whether a management plan for the Little Colorado River should be developed from studies that examine only one species in the system?

Issues of scale have received increasing attention in the scientific community. It has been suggested that scaling issues be a primary focus of research efforts (Wiens 1989). However, issues of organizational and cultural perspectives of scale also need to be addressed in any effective riparian management planning.

Information Flow Pathologies

Management of water basins has traditionally been viewed as best done by large scale organizations (Lee 1992). Large organizations however may not best understand the ecosystem due to "information flow pathologies" (Lee 1992). McGovern (1988) identified six of these pathologies.

1. False Analogy. Managers bring their understanding of one ecosystem to bear on another. In the EIS on the operation of Glen Canyon Dam the Bureau of Reclamation brings its perspective as a dam building agency to the role as directing agency of the associated Glen Canyon Dam Environmental Studies (GCES). Some studies under GCES have been negatively evaluated by the National Academy of Science.

2. Insufficient Detail. The manager may have an overgeneralized model of the ecosystem. For instance, current Little Colorado River management planning addresses only the habitat of the endangered fish, the humpback chub. A larger scale is necessary to even manage this small segment of river.

3. Short Observational Series. Managers have a short term memory and cannot separate short term and long term processes (Lee, 1992).Studies under the conservation measures for the humpback chub must be completed within the time frame of funding. Plans may therefore may miss important life history characteristics of the fish which lives in a different ecological scale.

4. Managerial Detachment. Managers are detached spatially and culturally from the local users. For instance agencies have condemned waste products flushed into the river from the Navajo Nation. The waste is assumed to originate from the Navajos and the condemnation is made without the managers knowing that there are currently no approved landfills available.

5. Reactions Out of Phase. The manager does too little too late in order to ameliorate an impact. For instance, Glen Canyon dam was built; only now they will develop a management plan to preserve the native fish. Another example is the adjudication of the Little Colorado River water rights. This adjudication has been underway for several years. All parties want the water. They will decide what to do with the water when they get it.

6. Someone Else's Problem. Managers may only take an action when their short term interests are benefited. Bureau of Reclamation employees may change their policy under a new four year administration; the current Secretary of Interior, Bruce Babbitt once proposed abolishing the Bureau of Reclamation.

7. Ideological Beliefs. (Lee 1992). Managers overlook ecological information because it does not conform with their ideology whether it be capitalism (electric power) or environmentalism (no active management is needed).

I would like to identify another information flow pathology, cultural clashes, to the list of information flow pathologies. Initially tribes were not included as cooperators in the EIS on the operation of Glen Canyon Dam. This was despite the clear responsibilities of the Navajo, Hualapai, and Havasupai tribes in particular, as these tribes have lands along the Colorado River as well as important sacred sites. After political pressure, however tribes were reluctantly accepted into the planning process. However, in this process it has been apparent that cultural differences make communication of information and goals difficult. This problem will be identified from the perspective of Navajo culture.

A Navajo World View

In the Navajo world view, mind and language cause events. One needs to control one's thinking in order not to cause bad events. In order to plan things, pure thoughts can be used (Remington 1982). Consequently there may be a reluctance to see the need to write a management plan. Navajos intuit the whole in order to understand things, whereas Anglos understand by deducing the parts (Remington 1982). Navajo society operates on consensus and everyone having a voice; Anglo society is based on majority rule and control by an elite. Navajos view time as circular while Anglos view time as linear.

"Navajo society operates on consensus and everyone having a voice; Anglo society is based on majority rule and control by an elite."

Navajo institutions are informal. The Navajo tribe did not exist as a political unit until the 1920's when the federal government imposed one because oil was discovered on the reservation (Griffin-Pierce 1992). Therefore, traditionally, responsibility was to one's relatives or local groups rather than to the tribe; disputes were solved by individuals meeting to resolve differences (Griffin-Pierce 1992). The Navajo Nation is currently studying decentralization in effort to return to a more appropriate and workable scale of organization.

Graf (1986) describes how cultural differences and inadequate scales of study led to a misguided federal policy regarding fluvial erosion on the Navajo Nation. In the 1920s the Hoover Dam project was developed in order to protect irrigation works in southern California and to regulate the flow of the Little Colorado River. These strong political forces led to the first study of sediment in the Colorado River. These studies found that most sediment was derived from the Navajo Nation. Federal planners concluded that sediment eroded from the Colorado Plateau threatened to fill the reservoir behind the dam. Overgrazing by Navajos was blamed for the silt problem. A government report concluded that "the Navajo Nation is practically 'Public Enemy No.1' in causing the Colorado Silt problem" (Graf 1986). The federal government decided the problem could be solved by instituting a large livestock reduction plan on the Navajo reservation.

However, it is now widely believed that hydroclimatic change was responsible for 95% of the fluvial erosion; stocking levels in fact were responsible for only 1-5% of the variation in sediment and water yields (Graf 1983). Navajos to this day cite the livestock reduction as one principal reason that the Federal government is to be distrusted. Currently the Navajo Division of Resources is attempting to change the Grazing Code. The legacy of this misguided federal policy is a major obstacle. This demonstrates the fact that policies have temporal scales of their own.

Recommendations

An examination of issues of scale with regard to management of the Little Colorado River leads to more unresolved questions than answers. However some tentative recommendations can be made. There is no correct scale for describing a system (Levin 1992). The principal problem is not choosing the correct scale, but rather to acknowledge that change is happening on many scales at the same time; the investigator needs to study the interaction among processes on different scales (Levin 1992).

Managers need to beware of the numerous information flow pathologies and be cogniscent that cultures and agencies have perceptual biases. Wiens (1989) demonstrates that studies conducted over a long time at fine spatial scales have a low predictive capacity; short term studies conducted at broad scales have high apparent predictability. This mixing of different spatial and temporal scales can lead to pseudopredictions. Pseudopredictions are a common resource management problem (Wiens, 1989). Methods of spatial statistics may be useful. These methods include fractals, nested quadrant analysis, spectral analysis, and correlograms (Levin 1992). Lee (1992) postulates that local communities may be more effective and efficient organizations to develop ecological sustainable watershed management. However, there may be no correct scale of human organization; but rather, what is essential are people who care enough about the river to be attentive enough to make a concerted effort to understand the mechanisms that operate across the scales of the physical, biological, and cultural processes.

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The Modoc-Washoe Experimental Stewardship Process 1/

Rick Delmas and Sherman Swanson

The hunter, hiker, tourist, rancher, miner, fisherman, logger, biker, each know what they want from the public lands. Unfortunately, most of these people do not have the same concept, vision nor goal for our public lands. This results in conflict, controversy, and decisions that satisfy no one. Legislatively and judicially dictating land-use decisions does not meet the needs of the public lands nor our nation. Thoughtful resource management planning, based on site specific knowledge, is needed if we expect to perpetuate, restore, and maintain our federal rangelands.

The Experimental Stewardship Program (ESP), established in 1978, is a collaborative forum in which ideas, perceptions, and dreams are translated into a holistic integrated strategy to manage for change. ESP is a process. It is the means to involve many people in making a plan, putting that plan in action, measuring and evaluating the results of those actions and revising or affirming the original plan.

The Modoc Washoe Experimental Stewardship Program was one of three experimental stewardship areas established in 1978 under section 12 of the Public Rangeland Improvement Act. It comprises 2.2 million acres of public and private range land located along the border of California and Nevada. The goal of this program was to experiment with ways to provide incentives and/or rewards to holders of grazing permits for improving public rangelands.

To implement sound management, it was first necessary to resolve natural resource conflicts before these conflicts resulted in long and costly legal battles that satisfied none of the interested publics. A steering committee representing all interested groups and the principal state and federal agencies was formed to guide the ESP process. The steering committee makes recommendations on land use to the Bureau of Land Management and Forest Service.

The steering committee operates by two cardinal rules:

1) It attempts to incorporate all interested publics into the planning and decision making process and

2) It attempts to make decisions by CONSENSUS (full agreement).

While advisory committees are nothing new, the role of consensus is unique. The Modoc Washoe ESP has been effective in large part because the agency officials work shoulder to shoulder with concerned citizens to help resolve land use issues. When recommendations come through this process of consensus building, all parties, including the agency officials, become committed to the results.

A second responsibility of the ESP is to resolve site specific concerns on individual allotments. Technical Review Teams (TRT'S) speed up this process. These teams usually consist of 6 to 10 people and are made up of field level professionals from the affected land management agency(s), public lands permit users, state wildlife agencies, the Soil Conservation Service, and other groups that have a particular concern about the planning area or resource issue.

Each TRT starts with an on-the-ground tour through the planning area (usually an allotment). TRT members discuss all issues and site specific information about resources and site potential furnished by the lead agency.

Each TRT member is given a chance to say what they are concerned about and to describe their vision for the planning area. Everyone on the team, because of their different experiences, brings a unique set of view points to the team and is able to identify opportunities, conflicts, and resources that the rest of the team members might otherwise overlook.

Following the tour, the TRT develops and completes an integrated set of recommendations through consensus agreement. Management strategies and goals are tied to objectives. The report is presented to the steering committee for consensus approval before it is considered a completed recommendation that goes to the land management agency and others for implementation.

Stating good objectives is a key to producing sound allotment management plans. Good objectives:

- Are clearly stated;
- Have a time frame;
- Present the rationale that led to the objective,
- Describes the action to be taken;
- States how progress toward the objective will be measured; and
- States what will equal success. In addition, all objectives for an allotment are checked against each other to avoid conflicts between objectives.

Through the critical analysis of past allotment management plans we have discovered certain common problems of previously written allotment management plans. These problems were:

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- Some resource issues became stranded and were not carried through the entire allotment management plan;

- Some objectives were not based on an identified resource issue and/or if based on a resource issue were not carried through the entire allotment management plan; and

- Some objectives became worded so that they were no longer related to the resource issue upon which they were based.

While riparian sites occupy only 3% of the Modoc Washoe Program Area they've become the corner stone for proper land management. Riparian goals for the Modoc Washoe Experimental Stewardship Area are:

- To improve herbaceous cover;

- To maintain or increase populations and age distribution of willow and aspen;

- To improve stream bank stability; and

- To raise riparian meadow water tables.

Lassen Creek, on the Modoc National Forest, is a good example of what is being accomplished with on-the-ground management in the Modoc Washoe Experimental Stewardship Program. The Lassen creek allotment and watershed encompasses approximately 44,000 acres of both public and private lands. This allotment had received heavy grazing from before the turn of the century through the 1940's. Added to this heavy grazing use were a series of large wildfires that burned much of the watershed, followed by less than prudent heavy logging.

Today the Lassen Creek watershed is a popular recreation area and is utilized for timber production and livestock grazing. The stream provides refugial habitat for five endangered fish. Dealing with a small watershed such as Lassen Creek usually means vegetation management, however, the TRT considers wildlife, recreational use, timber production, archaeological values, and any other resource issues before arriving at a final management plan.

On Lassen Creek, four major concerns were expressed:

- Excessive livestock grazing on riparian areas;
- High stream water temperatures reducing fish survival;
- Shrub overabundance on uplands had decreased forage production for wildlife and livestock; and
- Declining livestock production. An allotment management plan addressing these concerns was developed.

A five pasture rotational grazing pattern which prescribes spring/early-summer use of riparian areas, regrowth during the remainder of the season, and rest the following year was set up to increase preferred riparian vegetation. Targeted vegetation included sedges and grasses for stream bank stability and willows and aspen for shade.

This new grazing system had no impact on livestock gains and moderately increased livestock management costs. However, it has allowed vegetation recovery so that strategically placed log weir dams, juniper tree placement on stream banks, and rock wing deflectors worked effectively and reduced stream bank erosion. Permanent stream transects were established in 1986 and measured again in 1992. They have shown a 15% increase in number of pools, doubling of Goose Lake Redband Trout populations, and the overall improvement of trout habitat even through a six-year drought.

In addition, a prescribed burning brush control plan was developed to improve grazing and wildlife habitat. It has resulted in increased plant vigor, increased forage production, improved species composition, and decreased bare soil. The lower two miles of Lassen Creek, between the National Forest boundary and Goose Lake (a large alkali lake), runs through private lands. A water quality grant, written with the cooperation of the private land owners, was received this past year.

Improvements along the lower reaches of Lassen Creek will be implemented this year. While to date the Lassen Creek Allotment has been the most intensively managed allotment in the Modoc Washoe Experimental Stewardship Area, other allotments have improved through the establishment of allotment grazing plans. These plans usually incorporate fencing and natural barriers to create pastures within an allotment, use a deferred grazing system, and/or prescribe grazing every other year.

Small high-mountain meadows may be totally fenced from grazing to improve livestock distribution. The Yankee Jim Allotment, a large allotment formerly continuously grazed, is a prime example. Natural barriers and fencing created three pastures allowing a deferred grazing pattern and alternating turnout units. Together with herding of livestock away from Pine Creek Basin, a popular backpacking area, the management has improved the camping, hiking, and wilderness experience, as well as stream bank stability, riparian vegetation, and fish habitat throughout the watershed.

The cornerstone for the success of the Modoc Washoe Experimental Stewardship Area has been it willingness to incorporate all interested publics into the resource management process. Consensus is a necessary part of this process. Jean Schadler, an original member and strong leader in the experimental stewardship program once said "The land to my point of view is not suffering from a lack of good management. It is suffering from a lack of a common goal". It is critical that land use goals and resource issues be

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translated into realistic, measurable objectives from which management action, monitoring and evaluation parameters can be derived.

The Modoc Washoe Experimental Stewardship Program has for the past 12 years provided the local leadership, vision, detail, positive inspiration, commitment and trust needed to make sound land management decisions which are making a difference on the public lands in our area.

Reference

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A Stream Restoration Project Along the North Raven River //

Rocky D. Konynenbelt

Introduction

The North Raven River, formerly known as Stauffer Creek, has long been regarded as one of Alberta's finest trout streams. This stream has supported a very popular fishery since the introduction of brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*) earlier in this century.

In a 1986 angler survey, Rhude (1990) found that anglers locally, provincially, and from many parts of North America and even Europe, visited the North Raven. Angler utilization of the small stream was found to be high during the four summer months surveyed. Based on a 1990 survey of sport-fishing in Alberta, Bodden (in prep.) estimated that active anglers spent over $127 million on items such as food, lodging, transportation and supplies in Alberta during 1990. In addition to the intrinsic natural value of the North Raven, is the obvious economic importance of the self-sustaining trout fishery it produces. The significance of ensuring its long-term protection and preservation is evident.

The integrity of a stream is largely dependent on adjacent land use practices and land management. Homesteading began in the Stauffer district circa 1905, which led to significant changes in the local landscape. Although gradual deterioration of fish habitat and water quality are often indiscernible over time, by 1964 it was quite apparent that the effects of agricultural and rural development were having their toll on the North Raven River (Cunningham 1964). The impacts of livestock grazing, land clearing and road construction had caused increased siltation throughout the watershed. Beaver dams had effectively trapped silt over important spawning areas, and were blocking spawning migrations. Stream morphology, in general, had changed enough to significantly reduce fish habitat and water quality. Shirvell (1972) further documented the poor condition of the North Raven and recommended a habitat improvement strategy for the stream.

The "Stauffer Creek Habitat Improvement Program" was developed by the Alberta Fish and Wildlife Division in 1973, outlining a plan to initiate habitat protection and improvement, while monitoring changes in the streams physical characteristics and fish populations (Anon. 1973). While existing legislation provides for the protection of fish habitat, the Government of Alberta chose to take a non-aggressive approach with landowners, due to the common and widely accepted practices of farming along watercourses (Makowecki 1980). In extreme cases of riparian abuse, the legislation has, and will continue to be enforced.

The purpose of this paper is to summarize the habitat protection and improvement techniques implemented on the North Raven River since 1973, in order to associate those activities with the habitat and fish population responses shown by Rhude and Kraft (1987). This paper does not contain an abundance of

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technical data, but rather, only sufficient information to indicate the magnitude of results achieved.

Study Area

Located in west-central Alberta approximately 80 km southwest of Red Deer, the North Raven River is a first and second order stream (Helm 1985) which drains an area of 145 km^2. The stream originates at an elevation of 1,002 m above mean sea level, from two springs having a combined discharge of approximately 0.35 cubic meters per second (m^3/sec). Numerous other springs enter the stream within its first 1.5 km, contributing to a total mean discharge of approximately 1.25 m^3/sec at its mouth. This volume of flow remains very stable year-round. The North Raven has a mean gradient of 1.7 m/km (0.17%), and flows into the Raven River at 52°05' latitude and 114°30' longitude. Average stream width is about 9 metres. Approximately one-fourth of the stream, from it source downstream, remains ice-free throughout winter.

Native vegetation in the North Raven River watershed is a parkland type, characterized by open grasslands interspersed with poplar (*Populus spp.*), spruce (*Picea spp.*) and pine (*Pinus spp.*). Black spruce (*Picea mariana*), tamarack (*Larix laricina*), willow (*Salix spp.*) and bog birch (*Betula glandulosa*) are found in the low, wet areas.

The North Raven is situated in a silty clay loam soil type formed on lacustrine material (Peters and Bowser 1957). Agriculturally, this soil type is most suited to the production of forage crops, and is rated poor to fair in terms of arable land. The foremost land use in the area is agricultural; primarily livestock grazing; secondarily hay and feed grain production. Land ownership is mixed; predominately private titled land interspersed with occasional parcels of public land.

The climate in the area is characterized by moderately warm summers and relatively cold winters. Thirty km northwest, at Rocky Mountain House, the average daytime temperatures are +15°C in July, and -13°C in January (Atmospheric Environment Service - Rocky Mountain House, pers. comm.). Average annual precipitation in the area is approximately 55 cm.

Methods

In order to implement a habitat improvement program on the North Raven River, several requirements were essential; resource evaluation, land retention and a source of funds. Once those factors were met, then stream corridor fencing, streambank and instream modifications, and beaver management could proceed.

Resource Evaluation

To rate the effectiveness of any habitat improvement program, pre-treatment data on stream morphology and fish populations must be obtained. This information would provide a baseline for future comparison following program implementation.

While conducting a fisheries survey of the North Raven River in 1964, Cunningham (1964) noted that stream siltation was increasing and fish habitat was deteriorating compared to surveys he had done on the same sections of stream in 1961 and 1962. He recommended removal of beavers and beaver dams to flush silt, reduce weeds and improve spawning conditions. He also suggested that the government strive to gain control of the land surrounding the spring source of the North Raven, to provide long-term protection for this unique resource.

Shirvell (1972) conducted measurements of the steam's physical characteristics, water quality, invertebrate and fish populations. He found a major siltation problem as a result of streambank instability and breakdown caused by livestock grazing and trampling. Land clearing too close to the stream, followed by runoff had also caused siltation. Beaver dams were compounding the problem by retaining silt within the system rather than allowing downstream transport. He suggested that sediment was the major limiting factor to the trout population and he investigated means of reducing habitat deterioration through streambank protection. His main recommendations were to:

- immediately initiate a habitat improvement program, primarily by stream corridor fencing to allow natural revegetation;

- use private landowner agreements or land acquisition to secure land and angler access;

- control beavers and dams to reduce silt accumulation;

- monitor fish and invertebrate populations and habitat changes in the future.

Kraft and Shirvell (1975) conducted additional fish population work and confirmed the habitat problem. They suggested that meagre habitat and competition for that habitat were limiting factors to the trout population; not angler harvest, as was thought. Their recommendations were very similar to those of Shirvell (1972),

Antoniuk (1976) conducted measurements and mapping of water types, bottom types and aquatic vegetation, in two short study sections, for future comparison. He suggested that increased siltation had led to a substrate more suitable for aquatic vegetation, which, once growing, reduced water velocity and caused a damming effect by late summer each year. Excessive stream width was a problem, which contributed to a more shallow, slow, warm stream condition. Artificial channel narrowing was recommended to increase velocity and flush silt, thereby reducing the substrate for aquatic plants.

All of the above authors outlined factors affecting the water quality, habitat and fish populations in the North Raven River. Most of these factors were directly or indirectly attributable to stream degradation from livestock activity. Kauffman and Krueger (1984), citing many authors, summarized a number of undesirable livestock effects on riparian resources, including fish, wildlife, soil and vegetation. Bohn (1989) reported on the effects of streambank frost in relation to vegetative cover (insulation), and postulated that soil ice weakens the internal structure of streambanks, leading to increased bank breakdown when the vegetative cover is removed. The effect of livestock grazing on aquatic resources is well documented in other areas of western North America, as is the quick recovery of riparian areas when fenced to exclude livestock grazing (Platts 1991).

Stream corridor fencing to eliminate livestock from the riparian corridor was highly recommended as a first step in the restoration of the popular North Raven River.

After a decade of program implementation, Rhude and Kraft (1987) examined fish populations and habitat conditions in both fenced and unfenced sections of the stream, in order to provide comparison to pre-treatment data gathered by Shirvell (1972), Kraft and Shirvell (1975) and Antoniuk (1976). Rhude (1990) conducted an angler survey in both fenced and unfenced sections of the North Raven River during 1986.

Land Retention

In order to implement a habitat improvement program on the North Raven river, some form of land control was required. This control would ensure long term security for stream protection, physical improvements made, and angler access. At the outset of the program, only two of the 36 land parcels along the North Raven were public land; the balance were privately held. Land acquisition, land exchange, or private land agreements (easements) have been negotiated on many of the remaining parcels, through a series of group and individual meetings with landowners along the stream since 1973.

Program Funds

A special fund was introduced by the Government of Alberta in 1973 following a suggestion by the Alberta Fish and Game Association. One dollar from the sale of each angling licence and each hunting licence was committed to the "Buck for Wildlife" fund. Private donations to the fund were also accepted from individuals or firms interested in financially supporting habitat programs. This fund was designed to maintain, improve or develop important fish and wildlife habitat throughout the province. By 1992, contributions to the fund had been increased to $5.00 from each angling licence and $11.50 from each hunting licence, with additional revenue from draw applications fees, pheasant permits and donations. Currently the fund generates approximately $2.25 million annually.

The majority of funds for fencing and other physical improvements along the North Raven River have been obtained through the Buck for Wildlife Program, which is administered by the Alberta Fish and Wildlife Division. The Alberta fish and Game Association provided financial assistance early in the program during initial survey work (Shirvell 1972). A grant from the Recreation, Parks and Wildlife Foundation to Trout Unlimited partially financed a habitat assessment project on the North Raven in 1986 (Bradley and Crouser 1986). Funds for land acquisition were derived from Govern of Alberta general revenue sources designated for that type of activity.

Stream Corridor Fencing

Many land managers consider fencing the best alternative for protecting stream habitats and offering the best chance for rehabilitation in the shortest period of time (Platts and Wagstaff 1984). Studies generally show that when fenced to exclude livestock grazing, riparian habitats improve quickly, stream morphology improves slowly, and fish populations may or may not improve (Platts and Wagstaff 1984).

Commencing with the installation of the first fences along the North Raven River in 1975, a major stream corridor fencing effort was initiated. The purpose of this technique was to prevent further riparian damage by livestock, and to allow natural habitat recovery and streambank re-stabilization. Platts (1991) stressed the importance of the recovery of streamside vegetation as a primary goal of riparian fencing. The benefits of stream corridor fencing are many (Table 1), which make this habitat improvement technique a very positive first step in stream protection and rehabilitation along high profile stream fisheries (Konynenbelt 1987).

Where an entire quarter-section of land was purchased by the Government of Alberta, a sizeable riparian corridor was fenced out and the balance of land was leased for agricultural purposes.

Where only a portion of a quarter-section was acquired, the original landowner generally retained the balance of the quarter under private title. In both cases provisions were made for livestock watering and crossing.

Stream corridor fences on private land were installed only after careful negotiation with, and consent of the landowner, culminating in a formal agreement between the landowner and the Government of Alberta. Agreements did not contain a provision for financial compensation. Each participating landowner agreed to exclude his/her livestock from the fenced corridor and to allow reasonable foot access to anglers. The landowner retained the right to evict anyone abusing the access granted. Fenceline location and livestock watering and crossing requirements were established as agreed by both parties.

Two types of agreements were used, at the landowner's choice:

- a perpetual agreement allowing "everlasting" existence of the fenced corridor and angler access;

- a 15 year agreement pro-rated to the cost of improvements, allowing the landowner a buy-out option at any time during the term, upon appropriate payment. A caveat was then placed on the landowners title, to reflect the established agreement and program investment on private land.

By agreement, the Government of Alberta is committed to fence maintenance each year, with funds provided through the Buck For Wildlife program. This maintenance is conducted each spring prior to the onset of pasturing season.

Table 1. Benefits of stream corridor fencing to the natural resources, the landowner, and the public.

Natural Resources	• reduced siltation leading to increased fish spawning opportunities and increased benthic production (fish food). • increased fish habitat such as undercut banks and overhanging vegetation. • increase in fish and other riparian-dependent wildlife populations, as the result of higher quality and more diverse habitats. • improved water quality.
Landowner	• stream corridor fence acts as a cross-fence, allowing more effective grazing strategies. • gravelled onstream watering sites or offstream dugouts provided for livestock. • gravelled livestock/machinery stream crossings provided. • improved water quality leading to better relations with downstream landowners. • fenced corridor affords better control of anglers. • improvements paid by the Buck For Wildlife program.
Public	• more pleasant outdoor experience. • more and better fishing opportunity. • ensured foot access throughout fenced corridor, without livestock confrontations. • stiles provided for passage through fences at roads and across livestock/machinery crossings. • long term stream protection for future generations.

Streambank and Instream Modification

Between 1976 and 1979, a number of techniques were used to modify the stream channel and flow characteristics in a two km stretch of stream identified as a major problem area. This stretch of stream was situated on land which had been acquired by the Government of Alberta. The purpose of this work was to narrow the channel in certain areas, stabilize banks and to increase water velocity. In theory, a scouring action would then expose more gravels and thereby improve spawning success and benthic production.

Gabion baskets filled with rip-rap rock were used at a total of 14 sites, largely to reduce channel width. Wide meander bends were significantly narrowed with a row of gabions, then backfilled with pit-run gravel and reclaimed with topsoil and vegetation. Gabion baskets were also used as deflectors (groynes) to force water flow to one side of the stream, producing a narrowing effect. Log deflectors were used in a similar fashion on another stretch of the project area.

Rip-rap revetments were used to stabilize streambanks in areas of active erosion. Grass seed and willow seedlings were planted throughout areas disturbed during modification activities. Trout Unlimited Canada have also planted poplar, spruce, willow and other shrubs along the North Raven in a number of areas. These trees provide further bank stability and fish cover.

An experimental silt dredging project was undertaken in a 1.5 km stretch of the North Raven River in 1987. The objective was to remove unconsolidated sediment from the streambed in a heavily silted area. In theory, a narrower, deeper section of stream would result with a positive effect on fish habitat in that area. Extracted sediment was placed in depressional areas near the stream, then reclaimed.

Beaver Management

Beaver activity was recognized as a limiting factor to the trout fishery by Cunningham (1964). Undoubtedly, landowners were already practicing some form of beaver control along the stream to reduce flooding of agricultural lands. This action may have inadvertently assisted the fishery. Active management of beavers and dams by the Alberta Fish and Wildlife Division began in 1973 following recommendations by Shirvell (1972). Beaver dams were acting as settling basins for silt, and were impeding spawning migrations of trout. In recent years, Trout Unlimited Canada has voluntarily taken a lead role in beaver management along the North Raven.

Beavers and dams are generally left in place in the lower one-half of the stream, where gravel substrate is rare. In the upper sections of stream, both beavers and dams are removed in order to reduce sedimentation, to allow unrestricted fish movement, and to increase spawning opportunities.

Results

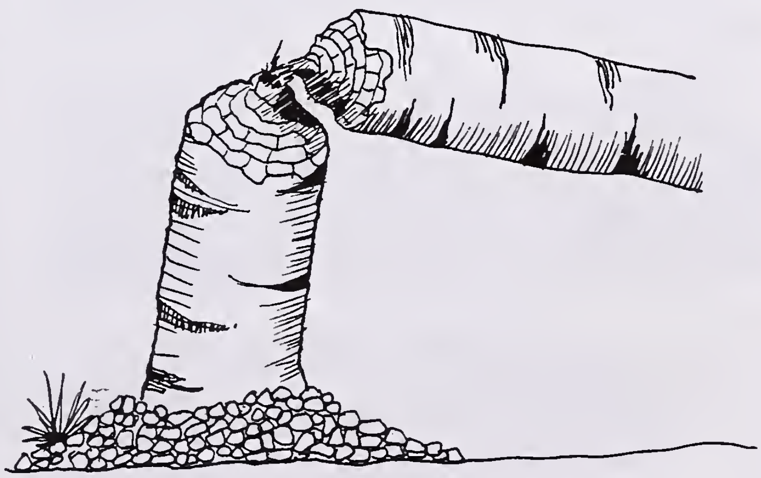
Land acquisition or exchange has had a very important role in the preservation of the North Raven River and its associated resources. Aside from stream habitat protection, valuable riparian wildlife habitat has been secured through land purchasing.

Approximately 425 ha of land have been acquired along the stream to date, at a total cost of $552,300. Fence agreements on private land have functioned reasonably well, however are subject to a certain amount of interpretation regarding the changing expectations/operations of the landowner, or a change in landowners. Fenced stream corridors on private land tend to be much narrower and more askew than those on public land, due to the landowners desire to keep "lost" acreage to a minimum. Corridors on private land are therefore prone to higher maintenance requirements while returning a lower habitat benefit.

Landowner concerns with the program are:

- loss of agriculturally usable land.
- adequate livestock watering.
- adequate fence maintenance.
- increased fire hazard as vegetation matures.
- public littering, vandalism, harassment and parking.
- adequate beaver management.

The program was developed, and has been adjusted over time, to address many of these concerns in the best interest of landowner relations.



On private land, fencing has excluded an average of 4 ha/km of stream length fenced. At a carrying capacity of 2.5 Animal Unit Months (AUM)/ha, this represents a grazing loss of 10 AUM/km of stream fenced, or about 2 AU for one five month full-duration grazing season. Assuming a beef gain of one kg/day, at a market value of $2.20/kg, a landowner with one km of stream fenced out could lose $660 in beef production annually. Participating landowners have accepted this loss, and have realized alternate management benefits in terms of easier rotational grazing schemes, in some cases leading to greater beef production than prior to fencing. Before fencing was installed, some landowners had lost livestock which had become mired in the soft stream substrate. Total exclosure fencing and hardened watering/crossing sites have clearly helped in reducing that type of loss.

Currently the Alberta Fish and Wildlife Division has stream corridor fencing on 17 parcels of public land and eight parcels of private land along the North Raven River. Approximately 25 km of stream have been protected to date, through the installation of 39 km of fence. Fenced corridor widths vary from narrow (15 m total width on some private parcels) to wide (300 m total width on some public land). Capital fence construction costs along the stream have averaged $3,400/km of fence, including the cost of alternate watering development, or $5,300/km of stream protected. Total fence construction costs to date are $132,600 on the North Raven River. Fence maintenance costs have averaged $200/km/year, or a current total of about $7,800 annually. Eleven parcels of private land, representing 30% of the total stream length, remain unfenced to date. Attempts to involve these lands in the program are ongoing.

With differing dates of fence installation, different areas of the stream are naturally at differing stages of recovery. Overall habitat changes observed since 1975, particularly on those parcels fenced early in the program, are:

- streambanks have stabilized and revegetated.
- overhanging vegetation and undercut banks have returned.
- channel has narrowed resulting in increased water depth and velocity, and reduced silt accumulations.
- surface area has decreased as the stream becomes narrower and deeper.
- a vigorous streamside willow community has returned.

Streamside vegetation throughout protected areas has made a remarkable recovery, again providing stream shading, increased trout cover and a source of trout food in the form of terrestrial insects.

Although the effectiveness of the streambank and instream modifications have not been well documented, they appear to be somewhat successful in providing a narrower, deeper channel in the treated areas. In the areas not treated, stream substrates and patches of rooted aquatic vegetation have not changed significantly between 1975 and 1985, likely due to stable flows and lack of any significant scouring or natural downcutting. The area experimentally dredged has shown some benefit as a result of the artificial downcutting; specifically, increased depth and gravel exposure. Revetments and manual revegetation along the streambanks have successfully stabilized areas that were once actively eroding.

The total cost of streambank and instream modifications on the North Raven River is $96,000 to date. It is important to note that these works affected only about 8% of the total stream length fenced. Therefore, most of the improvements in riparian health and stream productivity are attributable to fencing alone. The cost/benefit of streambank and instream modifications is difficult to determine, but do not appear as favorable as fencing.

According to Rhude and Kraft (1987), total stream surface area had decreased by 33% to 53% between 1976 and 1985, in the two study sections established by Antoniuk (1976), (Table 2). These sections included some degree of streambank and instream work, which therefore account for some of the surface area decrease. Increases in total surface area between the spring and fall of the

Table 2 A comparison of total stream surface areas (m^2) in two study sections of the North Raven River, Alberta, before and after approximately ten years of habitat protection and improvement.

Study Section	Spring May 1976	June 1985	% change	Aug. 1975	Fall Aug. 1985	% change
A	4008	2099	-48	5211	2475	-53
B	3818	2565	-33	4906	2560	-48

same year, reflect the flow restricting influence of abundant aquatic vegetation by late summer. As a result of this restriction, mean width and depth increase as summer progresses, regardless of the effects of precipitation (Rhude and Kraft 1987).

Beaver management along the North Raven has been very successful to date. Uninterrupted stream flow has clearly reduced silt accumulations in previously impounded areas, resulting in improved channel conditions in those sections of stream. Trout have more unrestricted access to areas of suitable spawning substrate. Although there is potential for controversy surrounding beaver management, it is clearly beneficial to spring streams such as the North Raven. Beaver management is well accepted by the adjacent landholders, and helps to maintain positive relations.

The effects of habitat protection/ improvement are particularly evident from the response of the fishery, as shown by Rhude and Kraft (1987). Trout abundance and biomass increased dramatically in fenced sections of stream, and decreased similarly in areas not fenced, between 1973 and 1985 (Table 3). To eliminate a surface area bias in biomass calculations, the 1973 stream width measurements were used for both 1973 and 1985 data, when the stream was actually narrower in 1985. This adjustment tends to underestimate the actual biomass increase.

During the period of the fisheries study, Alberta saw a 60% increase in the number of anglers, and a 140% increase in the number of angler days afield (Longmore, Brickley and Stenton 1982, and Anon. 1988). Clearly, trout populations and trout biomass increased through a time of increased angling pressure.

Rhude (1990) reported that 2,224 angler days were expended in catching 4,144 trout along the North Raven River during the period of May through August, 1986. Anglers averaged 3.3 hours angling/day, resulting in a catch rate of 0.6 trout/angler/hour. Although 17% of the survey effort was directed at an unfenced section of stream, only 0.2% of the total catch was reported from that area. The 12.4 km of stream surveyed (including 2.1 km of stream unfenced) produced a total angler utilization of 180 angler days/km during the four summer months surveyed.

According to a 1990 survey of sportfishing in Alberta (Bodden, in prep.), average angler expenditures/day were $34.10 for food, lodging, transportation and supplies, including both residents and non-residents. At 180 angler days/km during the four summer months, the North Raven River would generate $6,138/km in economic value each summer. At that rate, capital fence construction costs ($5,300/km of stream protected) are returned within one angling season, without considering the year-round angler utilization observed on the stream.

In summary, the estimated value of the North Raven fishery is high. Minimum life expectancy of the fences is 15 years, yielding a very positive cost/benefit ratio.

Table 3. A comparison of trout populations (#/km) and biomass (kg/ha), in section I (not fenced), section II (fenced for seven years), and section III (fenced for 10 years), in the North Raven River, Alberta, between 1973 and 1985.

Section/ years fenced	Number of trout/km 1973	1985	% change	Biomass kg/ha 1973	1985	% change
I/0	1180	624	-47	50.4	11.5	-77
II/7	996	1505	+51	32.7	75.3	+130
III/10	222	717	+323	16.2	71.5	+341

A public access site was developed on the North Raven River in 1982 by the Government of Alberta, to address some of the landowner concerns with respect to parking and littering. A small parking lot, toilet and garbage facilities were installed on a parcel of public land at a total cost of $15,000.

A summary of total project costs to date is given in Table 4.

Discussion

Agricultural activity, primarily livestock grazing, was significantly affecting the habitat and fishery of the North Raven River earlier this century. The removal of streamside vegetation had contributed to less cohesive banks, which were then easily trampled by livestock. As a result, the stream suffered the effects of increased erosion and became wider and shallower. The loss of shading and cover led to a poor stream habitat condition.

Stream corridor fencing was established along much of the river, which brought about a remarkable recovery in riparian health and in the fishery during a relatively short period of time. Other habitat improvement techniques were employed, which also contributed to better stream conditions in specific areas of need.

Trout populations and biomass increased in protected/enhanced areas, even during a time of increased angling pressure. There were no changes in angling regulations during the period of the fisheries study (1975-1985).

Riparian corridor fencing may not be feasible in all areas, but is clearly beneficial on intensively grazed high profile fisheries in small streams. The Alberta Fish and Wildlife Division has stream corridor fencing on other Alberta streams having a discharge of up to about 5 m^3/second. Larger Alberta streams would not realize the same level of benefit, due to the effects of natural flood events and natural bank erosion.

The cost/benefit of fencing the North Raven is considered to be very favorable. The fencing of streams containing valuable fisheries may be easily justified, but comparative values of many western streams are not as clear, and conflicting uses must be examined in terms of cost and net benefits (Platts and Wagstaff 1984).

Approximately 30% of the North Raven River, including the land surrounding the spring source, remains unfenced to date. The landowners throughout these areas will not participate in the program, and do not wish to sell even a portion of their property.

Table 4 A summary of capital costs for the North Raven River habitat restoration project, 1974-1992.

Activity	Cost to Date
Land Purchase	$552,300
Fence Construction	$132,600
Instream Works	$ 96,000
Public Access Site	$ 15,000
Total	$795,900

Landowners reasons vary, and no consistent reason for non- participation exists. Unrestricted agricultural practices continue through much of this land, leading to further deterioration of the stream and fishery in those sections and downstream (Bradley and Crouser 1986). This element remains the most limiting factor to the stream and its fishery. Continued fencing occurs as opportunities arise, which are usually a result of change in private ownership or land purchase by the Government of Alberta.

Fence maintenance, beaver management, and ongoing liaison with participating landowners are very important aspects of the program, which have a positive influence in community relations.

The long range goal for the stream, is to maintain a high quality, naturally reproducing trout fishery for public benefit. This goal is largely being realized through the North Raven River habitat restoration program, which has been very successful to date, as evidenced by the favorable response in trout populations. The North Raven continues to be one of Alberta's top brown trout streams.

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CHAPTER TEN

DEALING WITH CONFLICT

Managing Areas in Mixed Ownership

Deschutes River, Oregon
Feather River, California
San Juan River,
Colorado, Arizona, New Mexico
Ruby River, Montana
Virgin River,
Utah, Arizona, Nevada
Oldman River, Alberta

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Managing Areas in Mixed Ownership//

William C. Krueger

The eleven Western states include about equal amounts of privately owned and publicly owned land. In these states natural resource based industries, ranching, timber, and recreation are important components of local economies. Many of these businesses are conducted totally on privately owned land. It is common, however, for natural resource based industries to utilize a mixture of both public and private lands.

Frequently, western watersheds are likewise made up of mixed private and public ownership. Natural resource managers and consultants are often faced with land use programs that require skillful blending of public and private land use strategies. I will use public land dependent ranches as the example of how mixed ownerships can be used to meet objectives of the multiple interest group that are involved in these activities.

Issues

In planning for use of mixed ownerships, there are two primary issues that need to be understood. These are property rights and the desired land uses. On private land, property rights fundamentally protect individual freedom while preventing damage to others. On public lands, property rights, as currently practiced, attempt to optimize collective needs while allowing individual access for a variety of uses.

The desired land use or the purpose of the land is also different for public and private lands. Private land usually must return income to the owner and simultaneously to the public through taxation. The specific form of land use is the preference of the ownfr. On public lands generation of income is a secondary objective. Public lands are managed to accommodate the desires of society for a variety of uses, both commercial and amenity.

All lands will have a variety of topical or site specific issues such as biological diversity, sustainability, water quality, etc. that must be accommodated by land use practices. The people, through the law, recognize differences in appropriate uses of public and private land. These ideas, regulations, and principles change over time as society changes. Individuals view appropriate uses differently depending on their particular viewpoints. There is a gradient of views from maximum exploitation to total preservation. Each of us can imagine our place on this scale. The acceptable uses of public or private land depend on equity, environmental quality, ethics and various rights. The differences in perception of these concepts results in conflict and disagreement.

This results in groups and individuals using pressure to force their views to prevail. The outcome is frequently a stalemate in land use that results in no action on the land, while opponents endlessly debate the issues in offices.

Progress

It is possible to effectively manage mixed ownerships and, in fact, excellent management is frequently accomplished. As a wider spectrum of interests continues to be involved

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in land use decisions, the need to enhance and formalize interactions among land use interests grows. Effective management depends on: Developing a common vision for the land, designing management strategies to achieve the vision, and communication to continue to understand common goals. This has been accomplished in a variety of areas. I will explain this process with an example in Oregon that focuses on ranching and environmental issues. The principles are widely applicable.

The Oregon Watershed Improvement Coalition

The Oregon Watershed Improvement Coalition (OWIC) has been able to bring a wide variety of commercial and environmental interests to a common vision of watershed values, uses and potential. Details of formation, operation, and accomplishments have been previously reported (Krueger 1992). The OWIC was formed in 1985 as a Riparian Task Force of the Pacific Northwest Section of the Society for Range Management. At that time, controversy about rangeland uses was developing. Ranchers and environmental groups had no understanding of each other. Mistrust was the norm among groups. Land management decisions focused on dictates of law and policy rather than ecological potential. And, the situation seemed to be deteriorating. The Riparian Task Force brought together ranchers and representatives of environmental groups to see if communication was possible and if there was common ground among these groups.

Subsequent to this, the Oregon Watershed Improvement Coalition was formed. When we began to work together it was obvious that we were all approaching the issues with a philosophy of scarcity (Leritz 1987). This approach assumes that there is not enough to meet the needs of everyone. Consequently, everyone was competing for their share of scarce resources. Recognizing this, OWIC accepted an assumption of abundance. We assumed that if resources were managed to meet their potential, there was sufficient output to meet eveyone's needs.

It is important to understand the basis that underpins a negotiation. Scarcity requires allocation of insufficient resources and leads to fears. These fears are losing profit from a business, sustainability of a resource by overuse, the recreational values or other amenities. Assuming abundance leads the negotiation towards mutual understanding and cooperation. Since each participant knows their needs will be met, the group mutually works towards meeting the collective need. With this philosophical basis, OWIC focuses its efforts on developing the resource so all needs are realized.

The OWIC has adopted a simple goal: To ensure the long term sustainability of Oregon's watersheds and to improve communication among the diverse interests that affect watershed management.

Current membership of OWIC includes representatives from: Oregon Cattlemen's Association, Pacific Northwest Section Society for Range Management, Oregon Trout, Oregon Environmental Council, Izaak Walton League-Public Land Restoration Task Force, Oregon Forest Industries Council, Oregon Small Woodlands Association, The Nature Conservancy, Oregon Chapter Sierra Club, and Oregon Rivers Council.

During the formation of OWIC we recognized the fears and needs of the various participants. As a result, we made three key decisions that helped with future progress. First, we maintain a field orientation. This has greatly assisted communication. By seeing resource conditions and responses together, it is much easier to agree on what is happening and why resources respond as they do. Second, we have focused all our attention on what works to achieve objectives rather than on problems and errors. This maintains discussions and the vision in a constructive framework. Third, we agreed to operate from consensus. We all agree or we take no action. This eliminates the risk of OWIC supporting an action that would be unacceptable to a member group. It also helps come to decisions as each participant wants the OWIC process to work.

The OWIC has functioned for six years and have met, usually for two days, 32 times over that period. This represents a significant commitment of the members to work towards the goal of the coalition.

"We need to focus on resources not bureaucracies and policies. When this is done, we will have a common vision of the primary interests and trust among participants. Only then we are ready to develop action plans to change the land."

Principles of OWIC

OWIC has been successful by focusing attention on progress rather than debating the current status of rangeland watersheds in Oregon. There are eight significant agreements that have made this group successful.

1. OWIC shares the desire to achieve the ecological potential of the watershed. Products are considered of secondary importance and we all believe that when watersheds are at their potential the output will be sufficient to meet everyone's needs.

2. OWIC has agreed to seek a common understanding. We know we share the same goals, in part. We know everyone can teach us something if we are open to it. We know it is important to allow others to think and feel the way they do.

3. OWIC remains a private organization. By representing private groups, OWIC is not bound to any agency policy or position. This enhances acceptability among private citizens. However, both state and federal agencies are supportive and cooperative. The work of OWIC is greatly enhanced by support of public agencies.

4. OWIC accepts where we are in resource condition without blaming anyone for current conditions. What is important is where we are going in the future, not where we are today.

5. OWIC assumes abundance which allows us to work for mutually beneficial programs.

6. OWIC operates totally from consensus. Everyone agrees or nothing is done, including discussion of issues. We work on solvable problems and by agreeing to consensus we keep the organization in a positive attitude.

7. OWIC keeps its education and activities field oriented. By working together in the field we understand the issues, potentials and ideas better than by working around a conference table and dealing with abstractions.

8. OWIC has used role playing to assist our internal education. For example, by asking a rancher to perform as if the rancher represented one of the environmental groups (and vice versa) the role players force themselves to fully evaluate what they believe are the viewpoints of others. This leads to constructive discussion and real learning.

OWIC Lesson

Through the years of cooperative work, OWIC has concluded that the land can be changed based on sound ecological knowledge, management feasibility and hard work.

Change will be slow but there is no quick way to achieve what are long term ecological objectives. Likewise, people have to change. To work together we must develop trust and mutual respect. We have to teach each other values, needs and technology. We need to focus on resources not bureaucracies and policies. When this is done, we will have a common vision of the primary interests and trust among participants. Only then we are ready to develop action plans to change the land.

Coordinated Resource Management

When a common vision for the land condition has been achieved, the hard work of developing and implementing action plans begins (Anderson 1990 and Anderson 1991). Coordinated Resource Management (CRM) was developed in Oregon beginning in 1949. It has proven to be an effective process to incorporate varied interests into operational plans. Originally, CRM was used to integrate ranching needs with wildlife, watershed, and other agency programs. It is now being used to include a wider variety of interests. CRM is useful as it is widely tested and has developed a format that successfully integrates multiple use objectives. CRM is most often used specifically to solve resource problems. However, the process has been used successfully to prevent problems from developing.

The details of developing and implementing Coordinated Resource Management plans has been described in detail by Anderson and Baum (1988). The approach depends on defining the management unit at a practical scale. If the unit is too large, it must be subdivided. The planning team should be kept small to allow efficiency. The land use goals should already be established. A check list of issues has been developed that helps prevent oversight of common resource needs. The process encourages discussion, debate, and suggestions for solutions. It is important in CRM to be sure the issues the team is attempting to resolve are really management related and not land use issues.

The process of Coordinated Resource Management Planning includes several actions or phases:

1. Identify all the appropriate participants. This usually includes the primary resource users, state and federal agency resource managers, and technical specialists such as Soil Conservation Service or Extension Service.

2. Select a leader to guide the organization of the group, assemble data, schedule meetings, and keep the process going.

3. Select a moderator to facilitate the meetings. The moderator should have a solid resource management base and the ability to work with people especially in a group setting.

4. Before the initial meeting relevant ecological inventories, etc. need to be collected and made available. This material should be as complete as possible and can be supplemented as the process continues.

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A View of the Lower Deschutes River Planning Process

Ron McDermid

Overview of The Planning Process

This presentation has been prepared in the hope that it can provide insight to those who may have a hand in charting the course of management planning efforts yet to be developed. This information is not intended to be used as a blueprint for other planning efforts as each situation presents its own challenges. In its 5 year duration, the Lower Deschutes River Management planning process produced many learning opportunities including occasional doses of frustration, satisfaction, and ultimately, a much needed river management plan.

Oregon's Deschutes River has long been one of the most beloved rivers in the west. Widely known as a world class steelhead and trout stream, it has also become a popular whitewater recreation area, easily accessible to Oregon's population. Since the mid 1800's farming and livestock operations have been located in the proximity of the river with some of the current residents being descendants of early settlers. A much longer tradition of perpetual involvement is that of the Native American population. Todays members of the Confederated Tribes of the Warm Springs Reservation carry on the tradition of their early ancestors as the river flows through reservation lands.

The Lower Deschutes River Management Plan was not the first attempt at addressing management issues in the area. Several single agency planning efforts have been attempted in the past and have been largely unsuccessful. The complexity of issues and the administrative requirements proved to be too great for one agency to bear.

In 1980 then governor Victor Atiyeh appointed a task force to take testimony from the public and to develop recommendations for further action. Some recommendations were acted upon while others were not.

In 1983 a Coordinated Resource Management Plan (CRMP) was developed for the lower 24 miles of the Deschutes after a large block of land went into public ownership. Participants included local, state and federal managing agencies, private landowners, representatives of local government, as well as other user and conservation groups. Led by a neutral facilitator, the group listed objectives, major problems, and decisions or needs to remedy the problems. The group generally made decisions by consensus.

The CRMP has functioned for nearly 10 years and has provided a forum for the various parties to communicate and pursue common goals. Since final decision making powers stayed with each agency or landowner, issues were not always resolved to the favor of the majority of participants. Another limitation involved the fact that many items influencing management of the lower 24 miles originated outside the planning area and were therefore out of the control of the CRMP process.

Ron Mc Dermid is Chairman of the Deschutes River Planning Group in Wasco, Oregon. Mr. McDermid is involved in the family grain and livestock operation located in Sherman County, Oregon, near the Deschutes River. He has been involved in planning efforts for protection of the Deschutes River.

In 1987 two groups introduced bills into the Oregon Legislature regarding the Deschutes. One was by a coalition of recreational user groups while the other came from the Warm Springs Tribes. Generally speaking, the user groups wanted to assure that recreational access to the river would not be greatly restricted while the Tribes preferred more substantive regulation of use. Though major philosophical differences existed between the two entities one piece of legislation was ultimately supported by all parties and became law. The new law created the Deschutes River Management Committee (DRMC), a committee of citizens which was to participate, along with representatives of certain state and federal agencies, in the development of a recreation management plan for the lower Deschutes River. This effort began in early 1988.

"A plan serves no purpose unless it is successfully implemented."

By the fall of 1988 development of the plan was well underway though there was disagreement between some of the participants over plan methodology. At approximately the same time, the federal Oregon Omnibus Wild and Scenic Rivers Act was passed into law creating a federal planning mandate along the same portion of the Deschutes as the state statute effected.

After spending several months retooling the planning process a joint State/Federal planning effort was launched featuring the 20 member Deschutes River Policy Group. The Policy Group was made up of the 9 member DRMC and representatives of the 11 tribal and public entities with direct involvement in the management of the Deschutes. Representatives of each entity involved in the plan were parties to a Memorandum of Understanding (MOU) adopted to pin down specifics of the planning process. The MOU set forth a process that would assure compliance with the National Environmental Policy Act and with all applicable state criteria. The MOU stated that all decisions made in formulating the plan would be by 100% consensus of the group. A four member conflict resolution body called the Executive Review Board (ERB) was created to make decisions on issues where the full 20 person board was unable to reach consensus.

Once the structure of the planning process was determined, the joint effort got underway in 1989. Figure 1 illustrates steps undertaken in developing the plan and the corresponding time frame.

The process spelled out above was complicated, time consuming, and expensive. However, it was designed to accomplish things that a less thorough effort would not have been able to. It assured compliance with all state and federal mandates and through the high level of public involvement found throughout the process, allows members of the public to feel a sense of ownership in the final product.

The Process At Work

Perhaps the most certain thing you can say about a planning process is that the human element is the key to any success that may be gained. The Deschutes process was fortunate to have many people of integrity who gave unselfishly to the cause. Those who displayed questionable conduct could potentially have caused great harm to the process through the subsequent erosion of public trust, as well as through alienation of fellow participants. The members of the Deschutes Management Committee had somewhat of a fine line to walk as they each represented specific interests but were guided by statute to fairly consider all points of view. Without question, these people brought a knowledge base with them which was invaluable.

In addition to fairness and objectivity as important factors, enthusiasm was also essential. Whether a participant was involved as a volunteer or by assignment, those who displayed a positive, constructive demeanor added more to the process than those who did not.

As the Deschutes process unfolded, it was clear that differences of opinion would occur. As there had been disagreement as to which

Figure 1
Steps in Developing the Plan

Phase 1 - Identification of Issues & Alternatives

Step	**Date**
Initial Scoping	Dec 1988
Goal and objectives for plan developed	May 1989
Issues identified and described in detail	July 1989
Range of management alternatives developed	October 1989
Public meetings held on the issues and preliminary alternatives as part of the required National Environmental Policy Act scoping process	Jan/Feb 1990

Phase 2 - Preparation of Draft Management Plan and Environmental Impact Statement

Step	**Date**
Draft Environmental Impact Statement (DEIS) prepared that addresses each alternative	Summer/Fall 1990
Preferred alternative for each segment selected	Fall/Winter 1990
Draft plan and EIS are completed and distributed for public review and comment	Spring 1991
Additional data collected	Summer 1991
Public hearings held on the draft plan	Summer 1991
Public comment analyzed/plan revisions begun	Fall 1991
Executive Review Board (ERB) convened	Winter 1992
Supplement to draft prepared	Summer 1992
Draft plan revised into Final Plan/EIS	Winter 1993

Phase 3 - Plan Implementation and Monitoring

Step	**Date**
Plan implemented, including state agency rulemaking, as appropriate	Spring 1993
Plan monitored, periodically reviewed and updated	Ongoing

type of legislation provided the best vehicle for developing a plan, there would also be disagreement over how to interpret the legislation. For example, the group spent considerable time discussing what constituted a "last resort" since the statute stipulated that certain actions could be entered into only as a "last resort".

Perhaps the lesson here is that the statute should be as clear as possible in its language. However, another example shows how language which is very specific can be constraining. The statute required that diverse interests be represented in the process, yet it also required that decisions of the group be made by consensus. Some people viewed those requirements as being somewhat in conflict with one another. This put a great deal of pressure on the plan participants to display good faith through the interactive process.

As previously mentioned a conflict resolution body existed to resolve matters when the larger group was unable to. The ERB consisted of one representative each from State of Oregon, local government, BLM, and Tribal concerns. The ERB was created to make decisions when stalemate occurred within the 20 member group. However, it turned out that the smaller 4 member group also had a great deal of difficulty reaching consensus as well. Suffice to say future planning endeavors would be advised to develop as clear and concise a decision making process as possible.

The Deschutes River process attempted to anticipate situations where conflict would occur and to mitigate where possible. Early in the process, the policy group utilized the skills of a facilitator to help in keeping meetings running smoothly. Also early on, the policy group, with the help of the facilitator, developed a set of ground rules that the participants agreed to abide by throughout the process. Objective leadership proved important in keeping the overall effort on track.

When the process reached the delicate stage of final decision making a number of mediation techniques were used. Among these were small group sessions featuring carefully selected participants which were designed to establish positive momentum. Just the knowledge that key issues had to be addressed in the plan provided powerful incentive for everyone to negotiate. As the facilitator aptly stated, "You only lose if you walk away." The intent of these types of strategies was to get people away from "positional bargaining" in favor of seeking areas of mutual interest. These strategies could not work miracles but they did help establish a positive setting for decision making.

As stated earlier, much of the impetus behind the creation of the plan involved recreation. However, other important issues were considered by the Policy Group. Subject matter related to the environment was addressed under the category of 'Protection/ Enhancement of Natural and Cultural Resources'. Descriptions of issues and associated problems were prepared and solutions were proposed consistent with the overall plan objectives.

Addressed under the subcategory of 'Fish Habitat/Water Quantity and Quality' was the role of livestock grazing in the planning area. Some observers anticipated that this issue would become hotly debated and the fact that it did not is probably due to a combination of factors. First, a lack of intense public interest seemed to confirm the notion that monumental change was not being called for. Additionally, throughout the development of the plan there was a degree of familiarity among those closely involved with the grazing issue which allowed for positive avenues of communication to take place. Ultimately, a set of guidelines was developed by those having the best understanding of the issue and later adopted by the full policy group.

The Lessons Of The Process

It is difficult to boil down a five year process into a concise set of recommendations to other planners. In the case of the Deschutes the effect of the plan will not be known for some time. Nonetheless, certain factors encountered in this process appeared so clearly critical to success that it would seem remiss to not present them once more for consideration.

Here are some keys to a successful process:

Embark on a well-defined mission

Planners must be provided with a workable task. All participants must understand what the process can and cannot accomplish. They must work within the process.

All participants must bring honesty and credibility into the Process and Maintain it Throughout

This does not need to be explained further.

Continuity of Personnel must be maintained

Turnover within the planning body impairs the establishment of trust and teamwork.

In a public process, the public matters

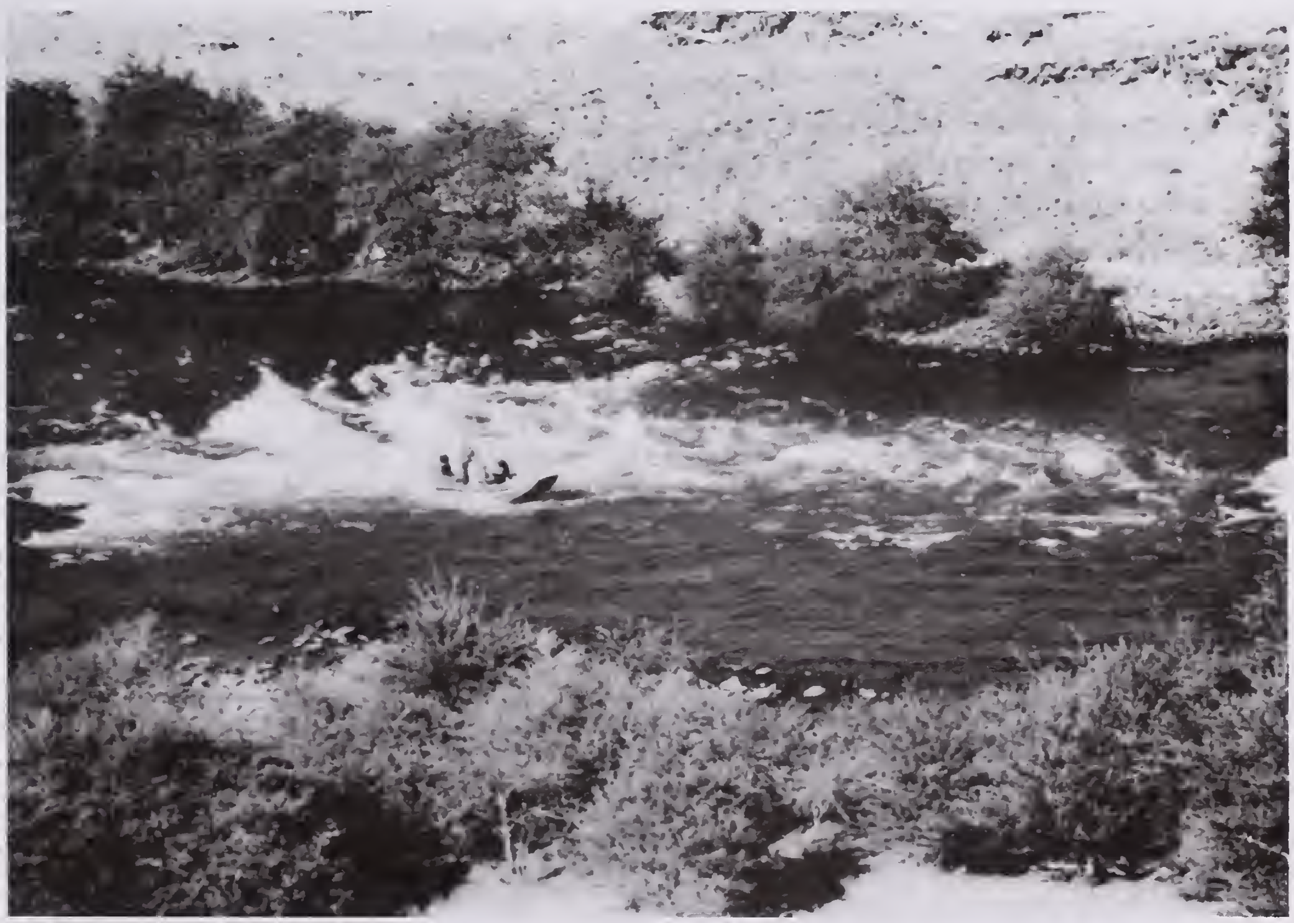
People are most likely to accept a decision if they feel they have truly been listened to.

Do not rush important decisions

Time pressure can be good to a point, but a process must work deliberately.

A plan serves no purpose unless it is successfully implemented

The work of those involved in the Deschutes plan or any other planning process must ultimately be tested not on paper, but on the land.



A Grass Roots Perspective
Feather River Coordinated Resources Management

Leah Wills
with input from the CRM Executive Committee and Management Committee

Introduction

Coordinated Resource Management (CRM) is enjoying increasing attention from natural resource owners, managers and regulators in California. Since the CRM's authorization by the federal and state governments in the early 1980s, approximately 200 groups have formed statewide to cooperatively solve a variety of resource problems such as water quality degradation, fuel hazards, decreases in fish and wildlife habitat, declines in species biodiversity, etc. California's recent Memorandum of Understanding on Biodiversity (MOU) proposes CRM as one strategy for implementing ecosystem management on the scale necessary to prevent future threatened and endangered species listings in the state. This paper will comment on the CRM and its potential for implementing ecosystem management from one grassroots CRM perspective. The opinions of this paper's authors reflect five years of CRM implementation experience in one Sierra Nevada county rather than objective and comprehensive research on the subject of CRMs in California.

History of Resource Problems in the East Branch North Fork Feather River (EBNFFR) Watershed

Landscape Description

The EBNFFR encompasses 763,600 acres of the most northern and eastern watershed of the Sierra Nevada Bioregion and is located completely in Plumas county. The EBNFFR watershed straddles the Sierra crest and drains westerly to the Sacramento River in the Central Valley in California. The downstream boundary of the EBNFFR watershed, the confluence of Spanish and Indian Creeks with the North Fork of the Feather River, is located approximately 180 miles northwest of Reno, Nevada (Great Basin Province), 160 miles northeast of Oroville, CA (Central Valley Region) and 90 miles south of Lassen Volcanic National Park (Cascade Province).

Approximately twenty seven percent of the eastside watersheds are highly erodible, primarily due to decomposing granitic parent material, moderate to steep slopes, intense precipitation events coupled with and arid climate. Twenty six percent (26%) of the wetter west side sub-watersheds are highly erodible or unstable, primarily due to numerous steep and oversteepened slopes of metavolcanic and metasedimentary parent material.

Lake sediments and glacial deposits are common in alluvial valleys. Soils are moderately erodible on north facing slopes and highly erodible on south facing slopes. Rain or snow flood events are common. Elevations vary from 3200 feet at the mouth of Spanish Creek to over 8000 feet at Mt.Ingalls. The average elevation is approximately 5100 feet.

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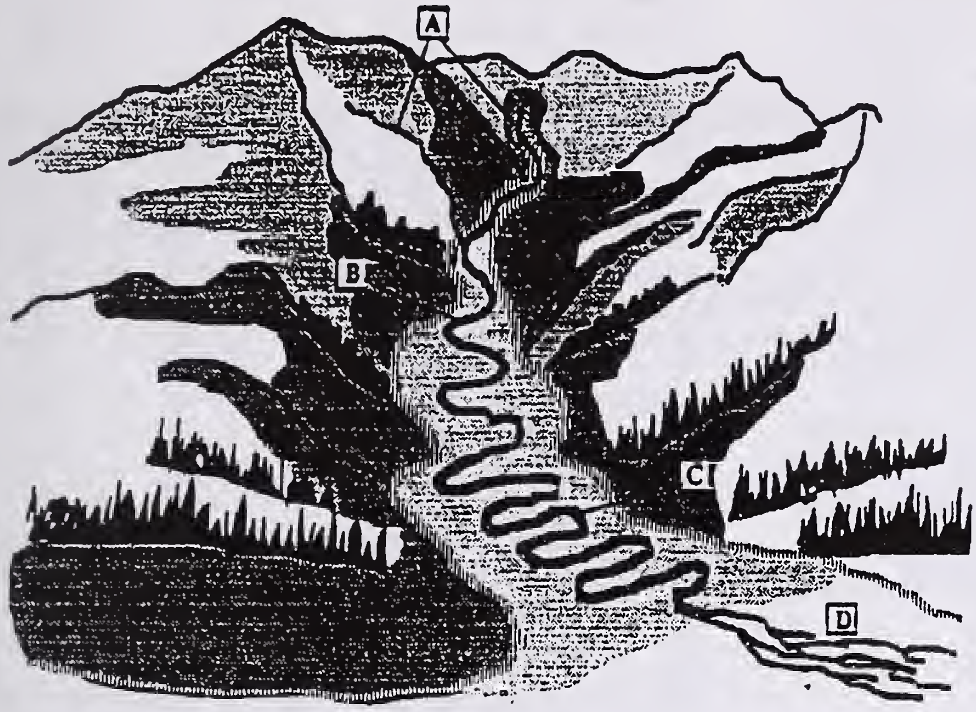

Figure 1. Stream Type Diagram
(Source: Wildland hydrology Consltants)

Problem Description: A Historical and Current Perspective

Existing conditions in the east and west side of the EBNFFR sub-watersheds are a result of four major land uses. These uses are both historical and current. They are

- mining, primarily in the Spanish Creek sub-watershed,
- wildfire,
- livestock grazing, and
- timber harvesting and associated roads, skid trails and landings.

At least 60 percent of the watershed has been adversely impacted, resulting in decreased soil productivity, degraded water quality, greatly diminished riparian plant and animal communities, lowered water tables, frequent damaging flood flows, etc (Clifton, 1992). 758,000 of the 763,600 acres have been inventoried for water quality problems through CRM efforts. 770 stream miles are severely degraded and 152,000 acres of wetlands, meadows, and rangelands are in a degraded condition. (Benoit, 1987)

In the EBNFFR watershed riparian areas are limited to very narrow strips of land and vegetation along most streams, but larger, alluvial meadows can be found throughout the watershed. These meadows act as floodplains, wildlife habitat and livestock pastures. Large meadows are associated with "C" and "F' type channels in the Rosgen Stream Classification System, while the narrow meadows are usually associated with the steeper "A" and "B" type channels (Figure 1.). They each react differently to runoff events and land use impacts, but similar degradation patterns are occurring as gullies form major incisions, cause meadow dewatering, and changes to riparian plant and animal communities. An estimated 6 to 12 inches, or more, of top soil has been lost from many meadow and upland areas. Numerous large gullies have formed in almost every meadow with some 100 to 300 feet wide and 8 to 20 feet deep, running the full length of the valleys. Headwater meadows are plagued by many discontinuous gully systems (Benoit 1987, Clifton 1992)

Landscape Ownership and Users

The Plumas National Forest (USFS) manages 84 percent of the watershed. Industrial and non-industrial private timberlands comprise 11 percent of the watershed and 4 percent of the lands are in agricultural holdings while 0.8 percent of the watershed is in urbanized and other public ownerships.

Watershed users include the 300,000 electrical customers served by three Pacific Gas & Electric Company's (PG&E) East Branch Feather River hydroelectric powerhouses. PG&E is experiencing operational problems related to sedimentation of its hydroelectric reservoirs from erosion in the East Branch

North Fork Feather River watershed and is reducing sediment problems via upstream stabilization. The EBNFFR watershed users also include the 19.7 million municipal and industrial users of State Water Project (SWP) water. The East Branch of the North Fork of the Feather River produces 25.4 percent of the SWP water which provides 48 percent of the developed municipal and industrial surface water supplies in California. Users include the estimated 2,300,000 recreational visitor days per year to the streams, lakes, meadows, forests, and rangelands of the Plumas National Forest (PNF) and clients include the users of the 85 million board feet (MMBF) to 200 MMBF of timber harvested annually from the watershed since the early 1900's.

Local Economic Aspects

Plumas County had nearly twice California's unemployment rate throughout the 1980's and had the third highest rate of female headed households in poverty as of the 1980 census. Current unemployment rates exceed 18 percent. Yet, Plumas enjoyed the highest rate of growth in per capita income throughout the 80's in this region of California and ended the decade with the second highest per capita income of all northeastern counties. These seeming contradictions are the surface manifestations of a sea of change in the local economy. Plumas county's economic growth during the last decade has been almost entirely due to non-wage incomes. Residents of this county receive less than 55 percent of total incomes from wages and other employment related income while the state and nation receive more than two-thirds of their incomes from employment. This relative dependence on non-wage income is partially a reflection of age. 30 percent of the population is over 55 years while California (long known as a retirement Mecca) has only 18 percent of the population above 55.

The county's per capita annual net wage increased by $2,000 between 1985-1990 while the state's and nation's increased by over $3,000 during the same period. Plumas started 1985 with per capita annual wage earnings ($6954) which were only 62 percent and 73 percent of the state and federal levels. Plumas continues to fall behind in this most important sector of the economy, primarily the result of decreases in the role of timber harvest and production in the county. In 1972, lumber provided 26 percent of Plumas jobs. By 1990 only 13 percent of jobs were lumber related. No high paying jobs have come about to replace this sector and consequently relative per capita wage incomes have lagged.

Rationale for an Integrated Approach

The East Branch North Fork Feather River (EBNFFR) CRM has evolved in the context of two decades of intense community polarization over forest management and intense community identification with "Feather River Country" landscapes and lifestyles. Over time, polarizing forces and "sense of place" binding forces have created a desire for a shared resource management vision. During a decade of public forums on Plumas County's economic future, "Feather River Country" residents developed and refined the shared idea that the key to a harmonious and productive future was a sustainable economy and sustainable environment.

Plumas Corporation, the county's local non-profit economic development corporation, was charged with part of the responsibility for attracting, retaining and aiding the expansion of economically and environmentally sustainable business enterprises and opportunities. Concurrently, Plumas County Supervisor John Schramel began a dialogue with Feather River watershed resource managers about water quality and water supply problems and issues in the watershed. Out of these two initiatives a need and role for Coordinated Resource Management (CRM) emerged. The local CRM group would work on the shared economic and environmental problem of cumulative watershed effects (CWE). The CRM would not duplicate or interfere with the activities, agendas or roles of polarized interest groups or agency mandates relating to current resource management practices. In practice, this has meant developing consensus driven demonstrations of innovative watershed restoration techniques on multiple use lands on a voluntary basis using

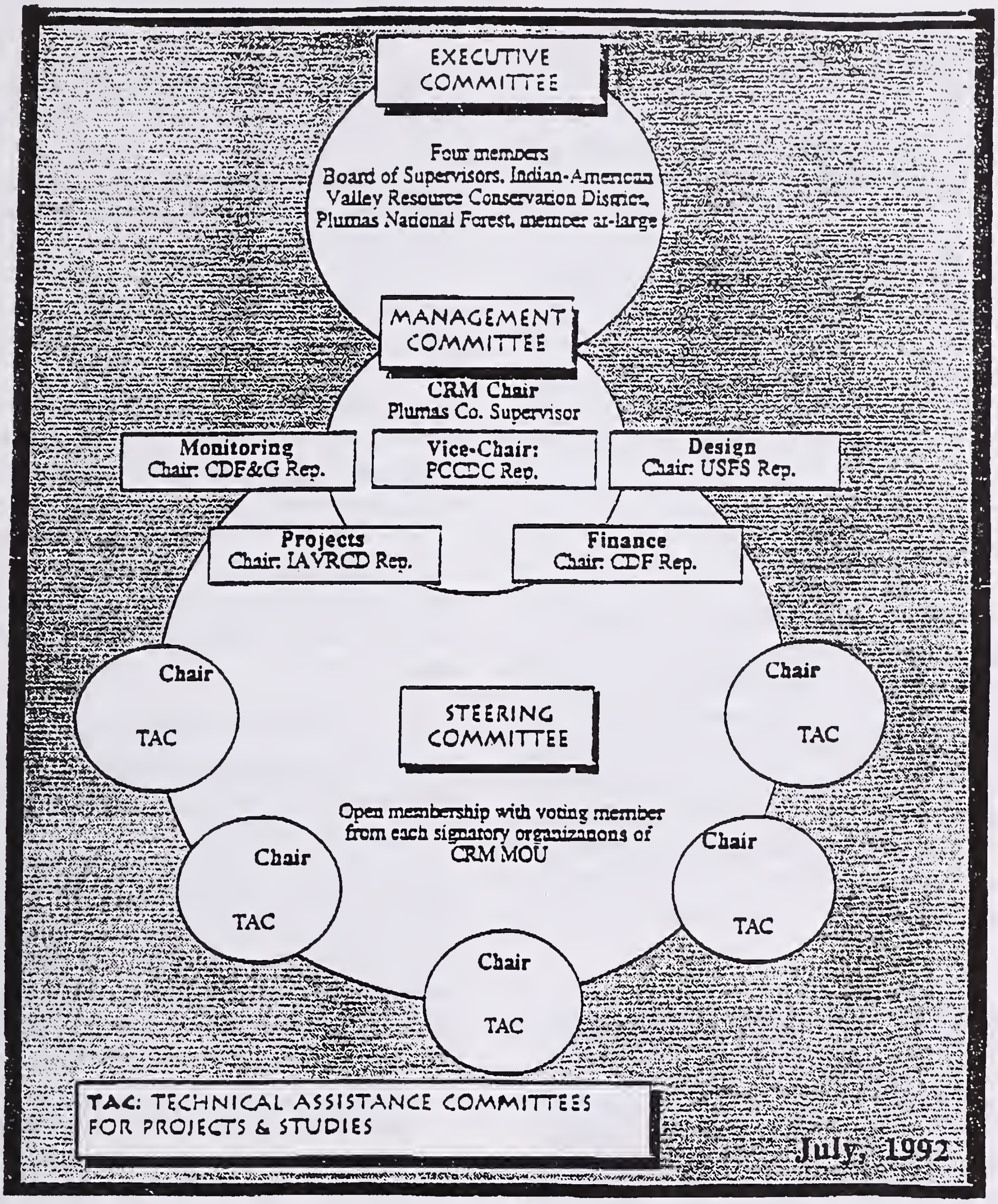

Figure 2. Coordinated Resource Management Structure

a variety of public and private grants. A philosophical contribution by the CRM group to sustainable ecosystem management has been redefining cumulative watershed effects (CWE) as the political, environmental and economic manifestations of shared problems rather than a scientific process for documenting blame.

For the CRM group CWE are operationally defined as: water quality, fuel hazard, desertification and biodiversity problems that:

1) can not be solved by rest or management changes alone within a reasonable investment period;

2) are caused by multiple and cumulative events over decades involving many people mostly whom are now gone;

3) are not solved without comprehensive long term strategies (instead of piecemeal or quick fix approaches);

4) are causing rapidly increasing costs and conflicts among resource users;

5) involve solutions which can be monitored for ecosystem recovery using ecological function and succession criteria; and

6) involve solutions where monitoring will directly influence long term sustainable management strategies for restored resources.

CRM Structure, Process and Accomplishments

The EBNFFR CRM structure (Figure 2.) and process were developed to maximize local initiative and local control over resource management issues and to coordinate requests for federal and state technical and financial assistance. In retrospect, the EBNFFR CRM structure and process was developed in response to the following fears at the local level about state and federal resource management politics.

Fears

1. The forest management controversy could, depending on the whims of politics, result in either total exploitation to exhaustion of the resource base or no use of the resource base. Either outcome would be catastrophic for the local economy.

2. Federal and state level forest management mandates would mean more rhetoric and more regulation from the federal and state level without tangible support for restructuring the timber dependent economies.

Structure

Representatives from the 17 EBNFFR CRM signatory organizations serve on the steering committee, project technical assistance committees and as staff to the CRM management committee and the CRM executive committee. (see Attachment #1)

Process

CRM participants adhere to the following focus and process:

1. The CRM works on cumulative watershed effects (CWEs) on multiple use lands (public and private);

2. All decisions are reached by consensus within the CRM;

3. Enlightened self interest and a long investment horizon are necessary attributes for achieving solutions that are sustainable economically and environmentally;

4. Education, innovation, and demonstration projects are used to encourage cooperation and participation (rather than regulatory approaches);

5. All affected interests (necessary to implement a long term, comprehensive solution) are involved nearthe beginning of the process;

6. The public and private landowners take the lead on the projects on their lands. Landowners develop goals, worst case scenarios, and land use history information. All participants, including technical experts, investorsand regulators, make a three part promise:

1) to attempt to achieve shared goals,

2) to prevent landowner and participant fears from being realized; and

3) to use monitoring to document and ensure the success or failure of restoration (structural, vegetative and management) treatments in achieving goals and preventing worst case scenarios relating to sustainable ecosystem management.

Accomplishments

Since 1988, the CRM group has implemented 33 riparian and wetland restoration projects and studies on timber and rangeland projects totaling $2,500,000, including one urban stream and one abandoned mine tailings Superfund site. The first Junior College Watershed Management Technician program in the state, developed by Feather River College, is operating profitably. For two years Greenville and Quincy High School students have been monitoring " first in the county" and "first in the state" geomorphic stream restoration projects.

On restoration projects old enough to generate monitoring results, waterfowl populations have increased from 20 percent to 700 percent, trout populations have increased from 50 percent to 500 percent and streambank erosion has decreased 90 percent to 50 percent. Part and Full time employment has been provided to 71 persons.

Monitoring

Monitoring is conceived by the CRM as the pivotal key to coordinated resource management or sustainable ecosystem management. Ideally, long term monitoring of restoration projects and best management practices (BMPs) will differentiate the grey area between cumulative watershed effects (CWEs) and the effects of current management. Long term monitoring provides continuity and accountability as resource managers, owners, regulators and the users of resources come and go. Long term monitoring could link consumers and producers of resource products in a way that promotes a sustainable balance between resource demands and supplies. To date, the main benefit for monitoring to the EBNFFR CRM has been allowing the consensus agreements to be revisited by all parties if the project goals are not being achieved as predicted or if worst case scenarios begin developing. The management flexibility and accountability afforded by monitoring has been more attractive to all participants than relying solely on top down legislation, litigation, and regulations to achieve a sustainable future in Plumas County.

Futuring - CRM Potential for Sustainable Ecosystem Management

Sustainable ecosystem management and cumulative watershed effects restoration are long term propositions. The attractiveness of the CRM process depends on a perception of the alternatives. Some local residents see the CRM as attracting public and regulator attention to controversies that would otherwise "blow over". Other residents who have directly experienced the rise and fall of such resource management fads as massive water and power dam building, predator eradication, intensive clearcutting, subsidized monoculture, etc. disagree. Some residents experiencing first hand the collapse of a resource dependent economy which had structured around a seemingly permanent management style are hedging their bets with CRM and ecosystem management. The EBNFFR CRM is not viewed by anyone involved as a panacea for resolving resource conflicts. But, CRM driven restoration could provide an opportunity for 1) providing information on ecosystem recovery useful for evaluating best management practices (BMPs) and mitigation strategies via CWE restoration with long-term monitoring and 2) involving the crucial partner for sustainable ecosystem management: the consumer via consumer investment in CWE restoration.

Grants to this CRM for restoration and monitoring demonstrations by many public and private investors have indicated its potential for a sustainable future. But ecosystem management will require significant demand and supply side economic restructuring to be sustainable. Currently the public's and media's emphasis has been on the cumulative overuse of resource supplies perpetrated in and by the resource dependent communities. Until the consumer takes some responsibility for one hundred years of cumulative resource problems, the political "quick fix" solution will continue to be reduced multiple use in areas valued by consumers as playgrounds and intensified uses of less visible watersheds to provide products for runaway consumer demand. A more sustainable strategy, we believe, would be watershed reinvestment by consumers for:

1) long-term ecosystem monitoring;

2) rest of riparian and wetland areas using leases and easements;

3) CWE restoration; and

4) "green" certification of new and traditional products derived from sustainable ecosystem management.

Ecosystem restoration and ecosystem management projects will remain "demonstrations of a dream" until reinvestment enabling economic restructuring supplements sporadic grant financing. In this watershed, reinvestment partners could include downstream power and water users as well as a reallocation of 5 percent or more of Plumas National Forest's gross timber receipts from the U.S. Treasury to the CRM effort now underway. An allocation of 5 percent of timber receipts was authorized in the 1991 Farm Bill for rural economic diversification in the area of origin but no funds have been appropriated to date. A decade of reinvestment by end users, in partnership with current local initiatives, could advance current efforts from "Demos" to sustainable ecosystem management through economic restructuring.

"When the best leader's work is done, the people say 'we did it ourselves.'"
Lao Tzu

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The San Juan River //

Steven Chischilly

Introduction:

The headwaters of the San Juan River begin on the western slope of the Rocky Mountains in southwestern Colorado. The headwaters, located at over 14,000 feet in elevation, are the beginning of what downstream is to become the second largest tributary to the Colorado River (San Juan River Basin Recovery Implementation Program, 1992). The San Juan River is located within the San Juan River Basin (Fig. 1) which drains approximately 38,000 square miles of southwestern Colorado, northwestern New Mexico, southeastern Utah, and northeastern Arizona. Many tributaries add to the San Juan with the largest being the Animas river. The San Juan River flows approximately 360 miles from headwaters in Colorado to the Glen Canyon National Recreation Area in Utah. There are approximately 7 diversions along the river concentrated between Navajo reservoir and Shiprock, NM. These diversions are used for irrigation, municipal purposes, and for the generation of power. Weirs constructed for diversion purposes are believed to prevent the upstream movement of native fish species. Historically, the Colorado squawfish and the razorback sucker were found much further upriver prior to the construction of the weirs and Navajo dam (NIIP Consultation, 1992, SJRBRIP, 1992).

Navajo Reservoir:

Navajo Reservoir built in 1962 by the Bureau of Reclamation stores approximately 1,036,000 acre feet of water (SJRBRIP, 1992; Gallup-Navajo Ind., 1984). A portion of this water, along with water attained via other tributaries, is allotted to many different parties. Water being an extremely valuable resource in this part of the country there are many interests with an opinion as to the best utilization of this resource. However, much of the water is claimed or otherwise has been promised to various peoples along the river. With the placing of the Colorado squawfish and the razorback sucker on the federal endangered species list a portion of the water, as yet undetermined, must be utilized to insure their survival via preservation of their habitat.

Endangered Species:

The Colorado squawfish was considered endangered in 1967 and with the passing of the Endangered Species Act in 1972 both the Colorado squawfish and later the razorback sucker (1981) were placed on the list. The inclusion of the Colorado squawfish and the razorback sucker to the endangered species list and the proposal by the United States Fish and Wildlife Service (USFWS) to designate segments of the San Juan River as critical habitat for the Colorado squawfish, razorback sucker, bonytail chub (*Gila elegans*), and the humpback chub (*Gila cypha*) raises further questions as to how much water can be diverted or otherwise used without negatively affecting these species (Federal Register, 1993). Historically, the bonytail chub was found in the San Juan River; however, they have been extirpated

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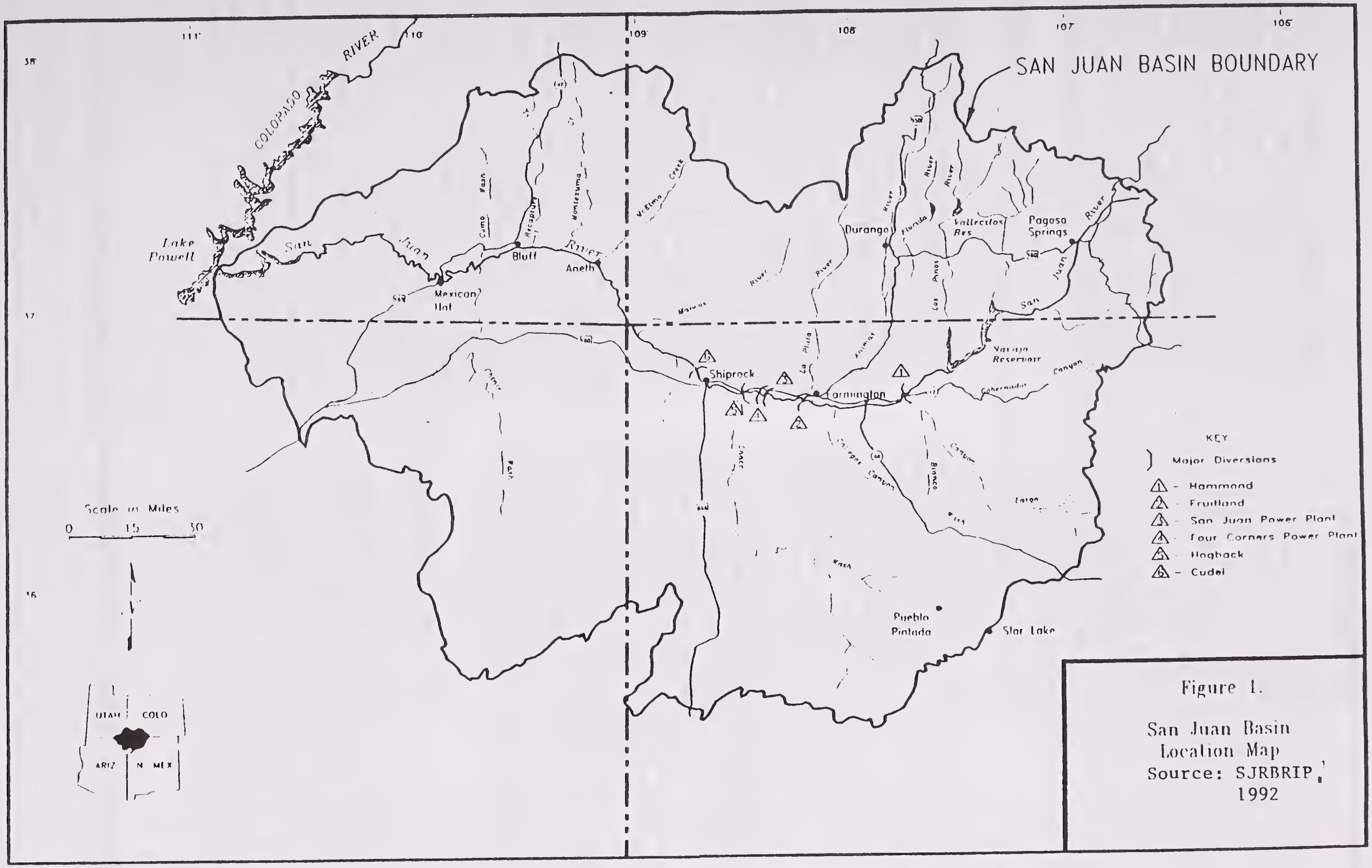

Figure 1.

San Juan Basin
Location Map
Source: SJRBRIP,[1]
1992

and are currently found in Lake Mohave in southwestern Arizona (Jordan 1891; Sigler 1963; Sublette 1977). This population of bonytail chub found within Lake Mohave is old and may not be reproducing. This may be the reason for the very low observed recruitment. The humpback chub is also believed to have inhabited the San Juan. However, there is no substantial evidence other than partial skeletal remains of what archaeologists believe to be either a bonytail chub or humpback chub in an archaeological site along the San Juan River. (NIIP Consultation 1992; SJRBRIP 1992).

Figure 2.
Non-native and native fish species of the San Juan River Basin:

Non-Native Fish Species:	Native Fish Species:
Cutthroat Trout	Roundtail Chub
Rainbow Trout	Bonytail Chub
Brown Trout	Colorado Squawfish
Kokanee Salmon	Speckled Dace
Northern Pike	Flannelmouth Sucker
Red Shiner	Bluehead Sucker
Sand Shiner	Razorback Sucker
Fathead Minnow	Mottled Sculpin
White Sucker	Colorado River Cutthroat Trout
Black Bullhead	
Channel Catfish	
Plains Killifish	
Mosquitofish	
Striped Bass	
Green Sunfish	
Bluegill	
Smallmouth Bass	
Largemouth Bass	
White Crappie	
Black Crappie	
Threadfin Shad	

Source: SJRBRIP, 1992

The once periodically flooding San Juan River was dammed and its flow controlled with the building of Navajo Reservoir in 1962. The environmental consequences entailed in post dam construction include the decrease of mean river temperature below the dam to the Animas river confluence, the mean decrease in volume (cfs), the halting of great flood stages (80,000 cfs), and riverbed geomorphology alteration (Fisheries Survey of the San Juan River 1987). With the decrease in mean flood stages there was also a correlated decrease in native fish species. Native fish species had adapted, over thousands of years, to the high sediment load, and the fluctuating flow of the San Juan. Major habitat alterations and the introduction of non-native fish species drastically affected the abundance and distribution of native species (Behnke 1980). (Figure 2)

River Alterations

Radical riverine alterations, such as the construction of dams, caused dramatic changes in the river with regards to associated species. Detrimental influences upon native species through the introduction, either accidentally or intentionally, of approximately 23 non-native fish species. These fish species largely adapted to warmer water temperature increased in population. Competition, predation, and river alteration is believed to have caused native fish populations to decline (SJRBRIP 1992).

Controlling the river to best suit human needs caused other problems as well. Exotic invader plant species like tamarisk or salt cedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*) became established. Without the frequent flooding of the San Juan River the banks were no longer scoured and thus cottonwood were soon replaced with Russian olive and tamarisk. The encroachment of these species along the banks of the river channelized the river further. Generally cottonwood require flooding events to become established. Tamarisk is a phreatophyte; and Russian olive is tolerant of saline soils. Both grow very rapidly. These species have replaced cottonwoods in many areas along the San Juan River.

Contamination

Riparian areas along the San Juan River which were regularly inundated with water during flood periods are no longer inundated. Declines in flood periods have caused concentration of contaminants in irrigation settling ponds which ultimately flow back, either through subsurface or surface flows, into the San Juan River. Evaporation from these irrigation ponds as well as decreased scouring of these riparian areas via flooding induce contaminant concentration and thus poor habitat for fish and waterfowl. The naturally, highly seleniferous San Juan Basin exacerbates the situation. Selenium found within these irrigation settling ponds concentrate to levels that may be dangerous to wildlife. Selenium, at high levels, has been found to affect reproduction and cause birth defects. It should be noted that the concentrations within the irrigation run-off ponds are high and pose a potential threat to wildlife. However, when the water from these ponds enters into the San Juan River these contaminants are diluted and the levels of these elements within the river are relatively low (Blanchard, P. Pers. comm.).

Oil and gas exploration and development within the San Juan River basin, including drilling in riparian areas, also affect the river. Carcinogenic polycyclic aromatic hydrocarbons (PAH's) bioaccumulate within the fatty tissues of fishes and other aquatic fauna. The PAHs are a major contributor to the pollution found in the San Juan. Oil exploration and development occurs most of the length of the river from below Navajo Reservoir, NM to Mexican Hat, Utah. External lesions linked to PAH's have been found on channel catfish and the flannelmouth sucker in irrigation drainage study sites. Of the channel catfish sampled 37% had lesions and of the flannelmouth suckers sampled 50% had lesions. Also, 77% of flannelmouth suckers sampled from the San Juan River were diagnosed to have eosinophilic foci (NIIP Consultation, 1992). The health of the river and associated ecosystem can be gauged from the health of resident fish species. Development and exploration for gas and oil must and should be done in a way as to minimize detrimental effects on the river and associated inhabitants.

Research

A seven year biological study initiated in 1991, as mandated by the USFWS concerning the Animas La-Plata Project (A.L.P.), will investigate the diversion of water from the Animas river into the Ridges Basin Reservoir and the subsequent effects on the endangered fish species found down river. This additional diversion from the Animas River is proposed to be offset by an increased flow release from Navajo Reservoir. The diversion and storage of water within the Ridges Basin reservoir will identify water resources for southwestern Colorado farmers, the Southern Ute Tribe, Ute Mountain Ute Tribe, and other municipal and industrial purposes (SJRBRIP, 1992).

Conclusion

The San Juan River is a beautiful river providing water for diverse needs to the people, communities, and wildlife existing along it's banks. The water is utilized by humans for irrigation, municipal purposes, power generation, and recreation; however, it should not be forgotten that there are inhabitants within the river who make the river their home and they have been there longer than human settlements. Parties interested in obtaining water from the San Juan River must work with the river to provide habitat for the flora and fauna which make up the riparian ecosystem. River straightening, damming, further allocations of water, and attempting further control of the river may result in further destruction of this ecosystem and perhaps the extinction of the endangered fish species.

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Developing a Successful Riparian-Wetland Grazing Management Plan for the Upper Ruby River Cattle and Horse Allotment in Southwestern Montana //

Paul Hansen

Introduction

The Upper Ruby Cattle and Horse Grazing Allotment lies in the Upper Ruby River drainage, a watershed of approximately 88,000 acres in southwestern Montana. The Allotment encompasses 43,261 acres within the Beaverhead National Forest. It is located approximately 35 air miles southeast of Sheridan, Montana. The Ruby River flows northward and is bounded by the Snowcrest Range to the west and the Gravelly Range to the east. To the south lies the Centennial Valley. The entire area has been grazed by livestock since the late 1800's. The landscape of the Upper Ruby River is characterized as having open grasslands and wet meadows, sagebrush and grass slopes, willow and aspen complexes, open conifer/grass stands, and dense coniferous forests. Topography is varied and includes the Ruby River bottoms, large open valley bottoms, high benches, open basins, and rough rocky mountainous terrain. Elevations range from 6,000 ft on the lower Ruby River to over 10,000 ft on the Gravelly crest.

Since the 1970 Allotment Management Plan (AMP) was implemented, a large number of interest groups have expressed concern. More recently; this concern has been elevated to the national level by the various parties. In 1990 the Beaverhead National Forest started to prepare an Environmental Impact Statement (EIS) for the allotment. The draft EIS became a focal point for the various groups.

The major concern with the Upper Ruby Cattle and Horse Grazing Allotment has been the health of the riparian zone. The historic use of the riparian zone along the Upper Ruby River and its major tributaries has left much of it in a degraded state. The issue is complicated in that both allotted and nonallotted livestock trail along the main road which lies for most of its length immediately adjacent to the Upper Ruby River.

Cattle and sheep are trailed annually to and from the Upper Ruby, adjacent USDA Forest Service allotments, and private, State, and USDI Bureau of Land Management lands in the Centennial Valley. In the spring, approximately 2,919 cow/calf pairs of the Upper Ruby Allotment are trailed from home ranches to the Allotment. Also in the spring, an additional 2,450 nonallotted cow/calf pairs are trailed southward through the allotment to USDI Bureau of Land Management, State, and private lands in the Centennial Valley. In the fall, approximately 3,275 head of nonallotted cattle and 3,245 head of nonallotted sheep trail back through the Allotment. In addition, 2,919 head of cattle from the Upper Ruby Allotment trail back through the Allotment.

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The fall trailing has historically taken place immediately before the opening of big game hunting. The fall is typically characterized as a time of increased precipitation when heavy rainfall or snowfall may occur at any time. The main road and livestock trail lie immediately adjacent to the Ruby River, the same location where many of the big game hunting camps are established. This has created a classic case of big game hunting vs. livestock managing.

In 1990 the Beaverhead National Forest began preparing an Environmental Impact Statement (EIS) for the Allotment. The draft EIS became a focal point for the various groups. All sides reached an impasse and wanted an independent third-party review of the Allotment and requested the Section 8 process. Within Montana, the Section 8 process represents a Memorandum of Understanding (MOU) between the Governor of the State of Montana and the Regional Forester of the USDA Forest Service regarding rangeland management issues such as allotment management plans (AMP). (The MOU was signed on May 31,1990.) The USDA Forest Service has just recently started to develop a memorandum of understanding on a state-by-state basis in the West.

The Section 8 process can be invoked by either the USDA Forest Service or the grazing permittee(s). The process typically occurs after both sides have met an impasse and all other attempts, such as a Coordinated Resource Management Planning (CRMP) process, has failed. If technical concerns develop during the development or revision of an AMP, either the USDA Forest Service or the grazing permittee(s) can request that the Governor's representative become involved in the consultation. The USDA Forest Service, the permittee(s), and the Governor's representative then become the Core Consultation Group or Core Group. The Core Group then selects a Target Group to provide technical services. The issues, concerns, and resource values of the allotment determine the composition of the Target Group. The Target Group reviews existing data in a timely manner and identifies any additional data that will be needed to develop or revise the AMP plan. The Target Group can also identify responsibilities for additional data collection. In order to resolve the issues in conflict, the Target Group will make recommendations that are based on a consensus. The comments on the recommendations of the Target Group are given to the Core Group. Any consensus reached by the Target Group must comply with applicable federal laws, policies, administrative orders, guidelines, etc. The recommendations of the Target Group are included in the environmental analysis and the National Environmental Policy Act (NEPA) documentation. The appropriate USFS line officer selects an alternative (NEPA decision) and approves the final AMP. If the permittee(s) disagrees with the line officer's decision, the permittee(s) retains the opportunity to appeal the decisions as provided in the appeal regulations.

In 1991, a Target Group was chosen that included Edward Ruppel, state geologist from Butte; Pat Currie, a range consultant from Miles City; Don Collins, a biologist from Montana State University; and myself, Paul Hansen, a riparian-wetland ecologist from The University of Montana. The Target Group prepared a draft set of recommendations. After a review of these recommendations by the Core Group, additional riparian-wetland technical information was requested. The Core Group felt this was necessary to support recommendations concerning riparian-wetland management and monitoring. The following discussion represents my recommendations on developing a riparian-wetland grazing management plan for the Upper Ruby Cattle and Horse Grazing Allotment. The same discussion is also applicable to riparian-wetland areas throughout the West.

Background

Although the land area is small, riparian-wetland areas occupy a unique position in the landscape and life of the West with their importance far exceeding their total area. Riparian-wetland areas are important islands of diversity within extensive upland ecosystems. Abundant water, forage, and habitat attract a proportionately greater amount of use and conflict than their small area would indicate. They are of prime importance to water quality, water quantity, stream stability, and fisheries habitat. They are vital to the livestock grazing industry and many are also well suited for development as high quality agricultural farmland. In addition, many riparian-wetland sites are excellent timber producing sites. Most sites provide critical habitat needs for many species and they support a greater concentration of wildlife species and activities than any other type of location on the landscape (Pfister and Batchelor 1984). Finally, riparian-wetland areas can be considered the "thread" that ties together all the other ecosystems. The importance of these areas as wildlife corridors can not be emphasized enough.

Riparian-wetland areas are defined as the green zones associated with lakes, reservoirs, estuaries, potholes, springs, bogs, fens, wet meadows, and ephemeral, intermittent, or perennial streams. The riparian-wetland zone occurs between the upland or terrestrial zone and the aquatic or deep water zone.

In contrast to their importance, riparian-wetland communities are among the least studied and least understood areas in terms of structure, function, and management. The riparian-wetland zone has often been overlooked, ignored, or considered a minor inclusion of the larger terrestrial or aquatic systems. Impacts from improper grazing, timber harvesting, road construction, and agricultural practices may drastically affect these communities. However, in general, riparian-wetland areas are among the most resilient ecosystems. Depending on the health of the site (condition) and potential of the site, riparian-wetland areas usually respond more quickly to changes in management than do drier upland sites.

Identifying the Problem

The management of livestock grazing in riparian-wetland areas is one of the most difficult and complex issues facing the western rangeland manager today. Kinch (1989) and Clary and Webster (1989) found that in reviewing the literature and in discussions with range managers, it is apparent that no single grazing management system has as yet conclusively proven to result in consistent improvement of degraded riparian-wetland areas throughout western range. Many varying combinations of sites, resource health (condition), and impacts as well as the interaction of many different human perspectives are involved. Therefore, the grazing management strategy designed for an area should be tailored to the conditions, problems, site potential, objectives, and livestock management considerations on a site specific basis that will best meet the resource needs.

Moore and others (1979) summarized it best by stating "From the standpoint of achieving livestock management objectives and minimizing soil, vegetation and water quality impacts, grazing management plans will vary. There is no set formula that will identify the type of grazing system or management plan that will be best for any livestock operation or allotment. Water quality impact will be closely related to soil erosion and sedimentation, associated with vegetation cover and concentration of livestock grazing. The grazing system must be designed on the basis of soil and vegetation capabilities, water quality considerations and livestock and wildlife requirements."

> ***"Livestock grazing is a compatible use in riparian-wetland areas when the functions of the riparian system (sediment filtering, streambank building, water storage, aquifer recharge, energy dissipation during storm events, etc.,), potential of the site, and the needs of the riparian vegetation guide the development of the grazing management strategy."***

Livestock grazing is a compatible use in riparian-wetland areas when the functions of the riparian system (sediment filtering, streambank building, water storage, aquifer recharge, energy dissipation during storm events, etc.,), potential of the site, and the needs of the riparian vegetation guide the development of the grazing management strategy.

Developing Management Objectives

Grazing management based only on objectives related to nonriparian-wetland areas (uplands) does not usually result in maintenance or improvement of riparian-wetland areas present in the same pasture or allotment. Therefore, where maintenance or improvement of riparian-wetland areas is desired, land use plan, activity plan objectives, and management prescriptions must be determined specifically for the riparian-wetland features while considering the needs of the entire watershed.

The establishment of specific objectives, description of the desired plant community, and selection of key species should be an interdisciplinary effort carried out in close cooperation with the range user. Objectives need to have realistic and attainable goals. They should be dictated by the present condition and trend of the riparian-wetland habitat in relation to management goals, the resource potential for change, and the importance of other resource values. Major considerations in establishing management objectives in riparian-wetland areas should include the following (Kinch 1989):

Vegetation

1. The potential of the site (e.g., the riparian-wetland plant association).

2. The desired plant community.

- If the potential of the site is woody vegetation, then the health and reproduction of woody vegetation should receive equal consideration as the herbaceous vegetation (depending on the riparian-wetland objectives). If one of the objectives for a riparian-wetland area is streambank stability, then woody vegetation vigor should be of utmost importance due to the vastly different streambank stability protection afforded by the woody vegetation when compared to the herbaceous vegetation.

- The development and/or maintenance of different age classes (e.g., seedlings, saplings, poles, and mature for trees; seedlings, saplings, and mature age classes for shrubs) of the key woody plant species on the site in order to maintain a viable plant community. (Once again, only if the potential of the site is for woody vegetation.)

- The type of vegetation cover necessary to minimize trampling damage and reduce the erosive effects of run-off events.

- The vegetation structure necessary for wildlife cover diversity.

3. The stabilization of streambanks and elimination of bank hoof shearing.

4. The value of the site for forage production.

5. The amount of vegetation stubble required to trap and hold sediment deposits during run-off events to rebuild streambanks and restore/recharge aquifers. It is important to realize that on streams with high gradients and low silt loads, it is more difficult to improve them than those with low gradients and high silt loads (e.g., mud management).

Water Quality/Quantity Issues

1. Raising the elevation of the present water table.

2. The improvement or maintenance of water quality and quantity or change in the timing of the flow.

Streambank Stability

1. The establishment of proper stream channels, streambanks, and floodplain conditions and functions.

2. The maintenance of long term adjustment processes which may affect channel/riparian-wetland zone conditions. These processes include sediment deposition, streambank development, floodplain development, and stream dynamics (meandering).

Wildlife

1. The improvement or maintenance of the fishery habitat.

2. The importance of the riparian-wetland community to riparian-wetland dependent wildlife and to wildlife species that occur primarily on upland sites but are periodically attracted to riparian-wetland areas.

Other

1. The aesthetic values of a healthy riparian-wetland zone.

2. The period of time which is acceptable or necessary for riparian-wetland rehabilitation/restoration.

3. The reduction of upland erosion and stream sediment load and the maintenance of soil productivity.

The proper management of livestock grazing in riparian-wetland areas requires a recognition that:

- grazing management practices which improve or maintain upland sites may not be good management practice for riparian-wetland areas, and

- season-long grazing is not a viable option to improve deteriorated riparian-wetland areas or to maintain a healthy riparian-wetland zone. Grazing management must provide for an adequate cover and height of vegetation on the streambanks and overflow zones to permit the natural stream functions (e.g., sediment filtering, streambank building, flood energy dissipation, aquifer recharge, and water storage) to operate successfully.

Developing the Monitoring Plan

Key Areas

As objectives are considered and developed for riparian-wetland areas, key areas for monitoring must be located in representative portions of the riparian-wetland areas as well as in the uplands. These key areas will serve as the location where appropriate monitoring will be conducted and where decisions will be made as to whether management objectives are being met or not. Key areas must possess (or have the potential to produce) all the specific elements in the objective(s) because these will provide data for evaluation of management efforts. In many cases, it is appropriate to select the key areas first and then develop objectives specific to each.

Key Species

Key species will vary with the potential of each individual site. Key species should be selected which are necessary to the operation of the natural stream functions. The type of vegetation present will affect channel roughness and the dissipation of stream energy. Willows and other large woody vegetation (trees) filter large water-borne organic material, and their root systems provide streambank stabilization. Sedges, rushes, grasses, and forbs capture and filter out the finer materials while their root masses help stabilize streambanks and colonize filtered sediments. On sites where the potential exists for both woody and herbaceous vegetation, the cumulative effect of plant diversity greatly enhances stream function. Finally, it is essential that the physiological and ecological requirements of the key wood species, along with key herbaceous species, be understood so that a proper management program can be designed. This includes determining the effects of grazing/browsing on the particular growth characteristics of the species involved.

Utilization Guidelines

Utilization targets guidelines are a tool that can be used to help insure that long-term objectives are met. Utilization can be monitored annually, or more often, whereas progress in reaching long-term resource objectives such as streambank stabilization, rebuilding of the streamside aquifer, and the re-establishment of beaver, fish, or moose habitat can only be determined over a longer period of time. The accomplishment of these long term objectives relates directly or indirectly to the need to leave a certain amount of vegetation available for other uses (soil stabilization, trapping sediment, wildlife cover, or forage, etc.,). Utilization monitoring provides a means of insuring that the necessary amount of vegetation is left to protect the site and provide for reaching other vegetation-dependent objectives.

The establishment of utilization targets for riparian-wetland key plant species and the management of grazing to insure these targets are met are critical factors involved in proper riparian-wetland area management. It is important to remember that without proper livestock distribution, utilization targets in riparian-wetland zones will usually be reached much sooner than those in adjacent uplands. The establishment of utilization targets requires that the manager know the growth habitats and characteristics of the important plant species for which they are managing and how the plant species respond to grazing and browsing.

The manager must know the characteristics, preferences, and requirements of the grazing/browsing animals. Therefore, utilization targets should be developed for riparian-wetland areas that:

- Will maintain both herbaceous species and woody species (where present) in a healthy and vigorous state and promote their ability to reproduce and maintain different age classes in the desired riparian-wetland plant community.

- . Will leave sufficient plant residue necessary to protect streambanks during run-off events and provide for adequate sediment filtering, and dissipation of flood water energy.

- Are consistent with other resource values and objectives (e.g., aesthetics, water quality, water quantity, wildlife populations, etc.,).

- Will limit streambank shearing and trampling to acceptable levels.

In many instances, proper utilization guidelines can only be derived over time through trial and error by monitoring, analyzing, and evaluating the results. Initial results may be different that expected. The manager should not hesitate to make changes in key species or utilization guidelines where required to meet objectives.

When establishing utilization targets to ensure riparian-wetland area improvements, guidelines should be considered that will provide a margin of safety for those years when production is less than average (Riparian Habitat Committee 1982). This could take the form of reduction in the utilization targets for both riparian-wetland and upland areas to provide additional carryover forage and vegetation necessary for streambank protection and sediment filtering. The importance of providing for adequate vegetation vigor and regeneration at the end of the growing season can not be emphasized enough.

Finally, due to the variation in riparian-wetland sites and management, one standard utilization target is not appropriate. However, utilization should be considered, together with regrowth potential, to ensure the presence of vegetation stubble necessary to the operation of natural stream functions or accomplishment of other land use objectives.

Compliance And Supervision

Range management in riparian-wetland areas will require a greater level of management because livestock are attracted to riparian-wetland areas during certain seasons. Resource managers must work closely with users to insure that alternate water sources are functional, that fences are maintained, that salt and supplements are located as required in the management plan, that essential riding and herding is done, that livestock are in the proper pasture at the proper time, and that the necessary vegetation stubble is left. It only takes a few weeks of unauthorized use or overgrazing to set back years of progress in improvements of riparian-wetland systems. Myers (1981) states "that compliance with grazing systems is critical. When livestock are moved from a management pasture, it is commonplace for a few animals to be overlooked. In one stream, annual use by a few head of unauthorized livestock throughout most of the hot season period has nullified positive riparian-wetland habitat responses in an otherwise excellent grazing systems." Therefore, compliance is one of the key issues in proper riparian-wetland management.

Steps Necessary for a Successful Management Plan

The following steps are necessary in order to have a successful riparian-wetland grazing management plan (Kinch 1989, Skovlin 1984): 1. The grazing management designed for an area must be tailored to a particular site or stream reach. The management plan should include the following: a) determine the site potential(s), b) determine the existing vegetation type(s) (community type[s]), and c) determine the desired plant community or desired future condition. Determine the current health (e.g., condition) of the site or stream reach. Identify the factors contributing to undesirable habitat conditions (if applicable). Grazing must be managed to leave sufficient vegetation stubble on the banks and overflow zones to permit the natural functions of the stream to operate successfully. Define realistic and attainable management objectives for the site or stream reach. Those involved in the management of the area including the livestock user and the involved public (if applicable) should understand and agree on the problems and objectives to be addressed, as well as understand the changes which can occur, and how they can benefit from proper management and improvements in the riparian-wetland conditions. All parties involved need to share the commitment to achieve the management objectives. Rangeland rest should be employed wherever and whenever possible. Implement the management plan. Design a monitoring plan that will evaluate the effectiveness of the management plan. Monitor the site or the stream reach over time. Grazing management must be flexible enough to accommodate changes based on experience. Mistakes need to be documented and not repeated elsewhere. Once the management is in progress, the most important element is frequent use of supervision. This is necessary to foresee and avoid adverse impacts (e.g., trampling damage to streambanks and excessive utilization). Determine the outcome of the management plan. If it is successful, then proceed with the existing management plan. If the plan was either a partial or complete failure, then modify the management objectives.

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"When man obliterates wilderness, he repudiates the evolutionary force that put him on this planet. In a deeply terrifying sense man is on his own."
David Brower

The Virgin River: an Institutional Nightmare of Opportunity

Ken Rait

The Virgin River rises in the high mountains of southern Utah, flows down through the deep redrock canyons of the Colorado Plateau, and further on down through the eastern Mojave Desert before emptying into Lake Mead at Overton Bay. The moisture derived from these high plateaus is delivered to the lowlands of the Virgin River basin through surface stream flow and groundwater flow from the Navajo sandstone formation, which emerges in the form of seeps and springs. This river system is unique in that it flows on a virtually uninterrupted path through every life zone, from the sub-alpine to the Mojave Desert.

One of the few remaining largely wild tributaries of the mighty Colorado River, the Virgin River is now at a crossroads. Water planners, looking through the rearview mirror of western states' water policy, intend to transform the wild Virgin, turning it to an indentured servant of outmoded values by damming most wild stretches. Environmentalists, however, are intent on seeing the Virgin remain the sustenance of the region's ecologically fragile riparian areas. The challenges of water allocation in the Virgin River basin embody virtually all of the different types of conflicts inherent in western water conflicts. Any course the Virgin takes is bound to be muddied with controversy.

Population and Water Use Trends

Population trends in each state within the Virgin River basin are marked by exponential growth. Increases in populations are accompanied by corresponding increases in water demand. As a result, numerous surface water and groundwater development projects have been proposed to satiate the growing thirst.

In the Utah portion of the Virgin River basin, the Washington County Water Conservancy District is projecting local populations to grow from current levels of about 50,000 to as much as 700,000 by 2030. According to the Utah Department of Water Resources, water depletions by municipal and industrial sectors would quadruple while depletions from irrigation would only decrease minimally.

To support these projected water use increases, the Utah Department of Water Resources together with the Soil Conservation Service, and the Washington County Water Conservancy District (WCWCD), have identified as many as 96 potential reservoir sites in the Virgin River basin. Although that number was recently pared down to 16, a half-dozen of these proposals affect waters upstream from Zion National Park, including tributaries which Zion is claiming federally reserved water rights in Utah's Virgin River adjudication. In addition, there have been extensive groundwater filings throughout the Utah portion of the basin.

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Population growth in Littlefield, Arizona, is projected to increase. As well, the number of golf courses along that 25 miles strip of the Virgin River which flows through Arizona, is expected to quadruple. The 370% increase in water use for golf courses would raise cumulative depletions to more than 17,000 acre feet by the year 2040.

In Clark County, Nevada, population is projected to double to 1.8 million by the year 2030. To support this increase the Las Vegas Valley Water District has turned its eyes to the Virgin River basin. The District is currently working with the Bureau of Reclamation to develop plans for a 70,000 acre-foot per year water project funded through the Colorado River Salinity Control Act. This project would divert water out of the Virgin River below Riverside into an off-stream reservoir in Halfway Wash.

By relying almost exclusively on structural solutions to solve the projected water shortages, local water planners have neglected two very important water sources: conservation and reallocation. Water users in St. George, Utah, consume 401 gallons per capita per day. Although the Department of Water Resources views conservation as an important element of its planning strategy, a close look at the numbers reveals that future demand projections are based on a nondeclining demand of the current per capita usage. Similarly, the Arizona Department of Water Resources has outlined water conservation as one of the assumptions upon which future demands will be calculated, but projects increases in the per capita usage from its current level of 250 to 300 gallons per capita per day by the year 2040. To water users in the Virgin basin, discussions of water conservation have been purely rhetorical and this potential source has been effectively ignored.

Reallocation of existing supplies is another source which could yield tremendous supplies of water at a far lower cost than expensive and ecologically catastrophic dam construction. In Washington County, 80% of the water is used to grow 2% of the county's personal income. This 80% is used mostly to grow alfalfa and pasture, which require roughly six acre-feet per acre in this arid climate. On-farm irrigation is highly inefficient with ranges from 25% to 55%. This represents a gross misallocation of scarce supplies. As the region becomes increasingly urbanized, water once used to grow these thirsty, low valued crops should be transferred to relatively less water-intensive, but much higher value municipal uses. In conjunction with Arizona-style water conservation programs, water reallocation yields tremendous potential to negate any need for a dammed Virgin.

Natural Values of the Virgin Basin

The vulnerable diversity of the Virgin Basin is reflected in the number of threatened and endangered species in the basin. As many as 76 special status species grace the Virgin basin. As the interface between the Colorado Plateau and the Mojave Desert bioregions, the Virgin River Ecoshed contains important, fragile and diverse biological systems, as well as important wetland and riparian communities along its corridor.

Two indigenous fish species, the Virgin River chub and the woundfin minnow, have been listed as endangered due to stream channel alterations and de-watering, mining and competition with exotic species. A third, the Virgin River spinedace, has been petitioned for listing as endangered; the U.S. Fish and Wildlife Service has recently found that such a listing may be warranted. Although population trends for all three species show alarming declines, no recovery plans have been finalized and no critical habitat has been established by the U.S. Fish and Wildlife Service.

In its Nationwide Rivers Inventory completed in 1982, the National Park Service identified a 76 mile stretch (upstream from Lake Mead National Recreation Area) where the river flows through Nevada and Arizona, as well as 40 miles of the Virgin in and around Zion National Park as potential wild, scenic or recreational stretches under the purview of the 1968 Wild and Scenic Rivers Act. In its Resource Management planning processes, three Bureau of Land Management Resource Areas having jurisdiction over different stretches of the Virgin River, and are responsible for carrying out the required eligibility and suitability studies to determine which stretches should receive varying levels of protection. Zion National Park and Lake Mead National Recreation Area are responsible for those segments within those reservations.

The existence of federal reservations such as parks, Indian reservations and wilderness areas raises the issue of reserved water rights in the Virgin River basin. Zion National Park has filed reserved water right claims for the East and North Forks of the Virgin River in the ongoing state-level adjudication to protect recreational values, wildlife habitat, and the erosional processes which have shaped Zion's majesty. Lake Mead National Recreation Area is currently studying the potential for reserved water right filings in Nevada to ensure that Virgin River flows, which provide a critical source of nutrients to Lake Mead and its sport fish populations, are protected. The Shivwits Indian Reservation has filed for more water within the Santa Clara sub-basin than is annually delivered.

Still unresolved remains the question as to whether the Clinton Administration will overturn the Tarr Opinion, issued during the Reagan Administration, which denied federally reserved water for wilderness areas. If reversed, the Administration would seek reserved water rights for the Beaver Dam Mountains Wilderness through which the Virgin River passes in both Utah and Arizona. Additionally, several BLM wilderness study areas upstream from Zion National Park are crossed by the Virgin. Separate but related, and of great concern to water purveyors in Utah, the BLM in Arizona has applied to the Arizona Department of Water Resources for an instream flow right of nearly the entire flow of the river to fulfill the purposes for the designation of the Virgin River Gorge Area of Critical Environmental Concern.

The Institutional Nightmare

Despite the importance of the Virgin River to each of the states, no interstate compact guides the allocation of the waters between Utah, Arizona, and Nevada. In fact, very little interstate cooperation exists on the river, with the exception of a moratorium on the issuance of water right permits in the Beaver Dam Wash sub-basin pending further hydrologic studies. Preliminary results of the Virgin River adjudication in Utah indicate that the river is already over-allocated, even before it crosses into Arizona and then further down, into Nevada. Each state views the river as entirely theirs, and each proceeds with its plans to develop the river as if there were no other interests.

Despite its widespread presence in the basin, the sister agencies of the Department of Interior have resembled more a dysfunctional family than the coordinated team which is its potential. For example, the three BLM resource areas in the basin have, through their resource management planning process, each approached the issue of wild and scenic river designation inconsistently. The Dixie Resource Area in Utah has done eligibility studies, the Strip District in Arizona has gone forward with suitability studies and the Stateline Resource Area in Nevada has done nothing-almost as if the Virgin is three entirely different rivers.

While the Fish and Wildlife Service has identified 48 threatened, endangered and candidate species in the Utah section of the Virgin River basin, other regions of the same agency have identified 76 such species in that stretch of the basin in Arizona and 36 in the Nevada portion. Although species numbers can be expected to vary in different areas of the basin, these wide disparities suggest lack of coordination between the three Fish and Wildlife Service regions.

While Interior's Bureau of Reclamation is analyzing a salinity reduction project in Nevada, BLM's Dixie Resource Area has issued a right of way for the Quail Creek Dam, which was built on gypsiferrous geological formations, thus making the project a net contributor of salt to the river basin. BLM is considering another proposal by the WCWCD for a dam and reservoir which would be built atop an abandoned oil field as well as atop gypsiferrous formation, potentially making that site a contributor of additional salinity and hydrocarbon contamination to the basin. The Las Vegas - Bureau of Reclamation desalinization plant being considered by the Bureau of Reclamation would dewater suitable habitat for two endangered fish species which its sister agency, USFWS, is responsible for protecting.

Dams being proposed upstream from Zion National Park on Utah school trust lands are facing no opposition from BLM, though that agency could play a pivotal role in acquiring the trust lands to protect park values for its sister agency. These are just a few of the many examples which typify the lack of coordination and integration in Interior's role on the Virgin. While these examples define the Virgin as a river of contradiction, Interior must elevate its role to be a leader in the transformation of the Virgin into a river of opportunity.

The River of Opportunity and Interior's Role

When Col. John Wesley Powell reported back to Congress after his pioneering expeditions through the western domain, he urged that the states be divided by watershed rather than by arbitrary delineations. Powell's argument that the West's aridity would only engender burdensome complexities in multi-jurisdictional river basin management fell on deaf ears, and western state boundaries were carved by straight lines. The Virgin basin is a living embodiment of Powell's fears.

Despite the relegation of water adjudicative authority to the states, there are some Western river basins where the Department of Interior retains a great deal of authority via its wide ranging management responsibilities. Perhaps nowhere are the many roles of the Department of Interior so intertwined in the management of a river basin as they are in the Virgin River. Within the basin, Interior manages two units of the national park system, three BLM resource areas, a designated wilderness area, several wilderness study areas, Bureau of Reclamation offices and three U.S. Fish and Wildlife Service regions responsible for protecting the basin's threatened, endangered, and candidate species.

The Department of Interior must embark upon a new era of integrated watershed management amongst its various agencies to fuse the watershed management philosophies of Col Powell with the ecosystem management priorities articulated by Secretary of Interior Bruce Babbitt. The Virgin River is a river of opportunity for the Department and should serve as the flagship in an Interior's EcoShed Initiative. The numerous Department of Interior agencies must join together to identify their role and define their cooperative strategy in the protection of the Virgin's outstanding natural values.

Protection of the Virgin basin necessitates a redefinition by Interior of its role as an ecosystem manager on a watershed basis. The values of the Virgin are at stake, not only because of the specific development proposals slated for the basin, but also by the fragmented nature of the ongoing decision-making processes by the disparate agencies of Interior. For local interests in the Virgin basin, an Interior Basin Authority could develop the data that will be essential in the formulation of an interstate compact which will inevitably be developed between the three states in the basin. For the broader public interest in the Virgin, the initiative will provide the information essential for Interior to claim the public's stake in the Virgin River as the compact moves forward.

Conclusion

The consumptive use interests in the Virgin basin appear fixated on the rear-view mirror approach: don't plan it, dam it. While the rear-view mirror reveals a host of dams and reservoirs, the front window reveals a reallocation and conservation framework which could protect a broad range of interests. The Department of Interior, which wields broad management authority in the basin, is integral to the management of the basin as the important ecological unit it still represents. Integrated and coordinated watershed management by Interior agencies could make the Virgin basin a pilot project in an EcoShed Initiative. In conjunction with its sensitive and vulnerable natural values, the complexities of the Virgin basin demand creative solutions.

> *"No one can stand in these solitudes unmoved, and not feel that there is more in man than the mere breath of his body."*
>
> *Charles Darwin*

Keeping the Oldman River Rolling Along - - The Courts as a Tool for Riparian Habitat Protection

Cliff Wallis

The Oldman River Dam Project

The headwaters of the Oldman River lie in the rugged Rocky Mountains in the extreme southwestern corner of the Province of Alberta, Canada. The Oldman River flows eastward across the Foothills and onto the arid Great Plains where it joins with the Castle and Crowsnest Rivers. In 1966 the Oldman River Dam was conceived by the Government of Canada's Prairie Farm Rehabilitation Administration but it wasn't until 1975 that the first major studies on the dam were initiated by Government of Alberta. From 1978 to 1979 the province's Environment Council of Alberta (ECA) held hearings on water management in the Oldman River Basin and after hearing some 260 briefs and technical submissions ruled that

> "a dam on the Oldman River is not required now or in the foreseeable future ... the Three Rivers site would be the worst possible location from environmental and social perspectives."

Despite this recommendation, Alberta announced in 1980 its intent to build a dam at the Three Rivers site. Southern Alberta supports an extensive irrigated agriculture industry. Repeated droughts and low late summer river flows have led to water shortages for irrigation farmers which prompted them to ask the Government of Alberta for the dam. Over the years, both the federal and provincial governments refused to do an environmental review despite numerous requests from local residents and environmental groups.

The ECA and many individuals and groups proposed a number of water storage, conservation and pricing alternatives that would provide the water southern Alberta needs at far less cost and with no environmental damage. These proposals, a 12,000 name petition against the dam, large public rallies and thousands of letters to elected officials failed to sway the governments. Friends of the Oldman River's (FOR's) only recourse at that point was to pursue court action to force governments to comply with applicable legislation.

Court Actions by Friends of the Oldman River

In September of 1987, the federal and provincial governments issued licences to construct the Oldman River Dam. Friends of the Oldman River (FOR) was formed and launched a legal action alleging that Alberta did not follow proper procedures in issuing the construction licence. Court of Queen's Bench Chief Justice Moore quashed Alberta's licence to construct but work continued while Alberta appealed. In February of 1988 Alberta reissued a new licence which was ruled valid by the courts. It allowed for the evaporation of 6340 acre-feet from the surface of the reservoir. The dam was not licensed for irrigation as Alberta would have had to produce plans and costs that they did not have.

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In July of 1988, the Oldman River was diverted into diversion tunnels and 1.5 km of riverbed and productive fish habitat was destroyed. Martha Kostuch, FOR's Vice-President, laid an information under the Federal Fisheries Act charging Alberta and its contractors with unauthorized and harmful disruption of fish habitat.

After years of claims and counterclaims, repeated attempts by both levels of government to prevent FOR from privately prosecuting this case, and appearances before over 20 judges at three court levels, process was issued by the courts against the provincial government and its contractors in July of 1992 and January of 1993. A date for a preliminary trial has been set for March 1993.

These charges related to damage caused by construction of the Oldman Dam, diversion tunnels and related works to over 38 km of fish habitat along the Oldman, Castle and Crowsnest Rivers. At least one of the judges was highly critical of the actions of the Attorneys General of Alberta and Canada in trying to prevent FOR from proceeding with its prosecution. Other court actions were also launched but construction of the dam continued.

> *"Why should ordinary citizens find it necessary to go to court to force their own government to respect the law? Why has government grown so lax that it fails to automatically obey the law? Furthermore, if citizens are forced into policing duties because of government neglect, what happens in instances where there are no citizens willing to take on that responsibility?"*

The most successful of these court actions ended up in the Supreme Court of Canada which determined in January of 1992 that the Government of Canada must conduct environmental reviews of provincial projects, including the Oldman Dam, where there is a federal regulatory role or funding. This was a major victory for FOR and other environmentalists and native organizations across Canada -- it has led to environmental reviews on numerous projects. As a result of this court action, an Environmental Assessment Review Panel (EARP) was appointed by the Government of Canada.

Federal Environmental Review Panel Conclusions

From June to December of 1991 the federal EARP Panel conducted hearings on safety and on the social, economic and environmental impacts of the Oldman River Dam. In May of 1992 the Panel released its landmark report stating that:

> "the environmental, social and economic costs of the project are not balanced by corresponding benefits and finds that, as presently configured, the project is unacceptable."

The Panel's first recommendation was to decommission the Oldman River Dam. The first recommendation was rejected by the Government of Canada but the other twenty-two recommendations were accepted although not one has yet been implemented. As a result, FOR filed a Notice of Motion in Federal Court in January of 1993 asking that the federal government be prohibited from licensing the dam until the Environmental Assessment Panel's recommendations have been implemented and to force the federal government to comply with its legislation by:

1. implementing the Panel's recommendations;

2. ensuring the spillway gates and diversion tunnel valves are kept open until the dam is licensed; and

3. ordering decommissioning of the dam if the Panel's recommendations are not implemented in the time frame set by the Court.

Although construction is complete, the Oldman River Dam Reservoir has never completely filled. 90% of the predicted environmental impact from continued operation of the dam has not yet occurred. FOR's legal actions may yet prevent damage to miles of nationally significant riparian habitat downstream of the dam and save some prime river valley that has not yet been flooded in the reservoir area. FOR is also sending a strong message that governments cannot ignore and break laws protecting the environment.

A January 1993 editorial on FOR's legal actions in the *Lethbridge Herald* newspaper stated:

> "Why should ordinary citizens find it necessary to go to court to force their own government to respect the law? Why has government grown so lax that it fails to automatically obey the law? Furthermore, if citizens are forced into policing duties because of government neglect, what happens in instances where there are no citizens willing to take on that responsibility?"

Our actions will continue to have implications not only for the Oldman River Dam project but for dozens of other developments in Canada.

Potential Environmental Impacts

The fishery directly affected by the Oldman River Dam Reservoir includes about 1.3 million square metres of critical trout habitat. Other impacts would be felt on rare and threatened fish such as the Shorthead Sculpin and migratory Bull Trout. The EARP Panel concluded that there is no commitment for long term monitoring, evaluation and management of fish mitigation works and that it is unlikely that "the goal of no net loss of recreational fishing opportunity . . . can be achieved by any combination of physical, chemical and biological manipulations." Furthermore, "any fish in the reservoir will likely become contaminated with mercury."

Extremely productive riparian cottonwood forests and associated wetlands and shrubbery extend for dozens of miles downstream of the dam along the Oldman River. These have been classified as provincially and nationally significant ecosystems that support a diversity of wildlife, the most important of which are deer and numerous songbirds. Over 3/4 of the birds of the grassland region use the riparian habitats at some point in their life cycle. Dozens of species of birds from other regions also use these habitats in their migrations across the continent.

There is controversy over the effect of the dam's continued operation on downstream riparian communities; however, studies on other streams in southwestern Alberta have showed dramatic declines of cottonwoods following dam construction on two other rivers, the St. Mary and the Waterton. In addition, there is no long-term commitment from the dam's operator, the Government of Alberta, to ecologically sensitive operation and monitoring of the Oldman River Dam.

The EARP Panel concluded that "given the losses on other regulated rivers the effectiveness of this mitigation measure (i.e. an appropriate operating regime) is not assured and that the effects of the project on vegetation would, in general, be negative, but that the magnitude of these effects cannot be quantified with existing information."

The Peigan Indian Band considers the Oldman River or Napi's river to be their sacred or spiritual river and they claim ownership of its bed and its water through a treaty with the Queen (i.e. the Government of Canada). In addition to the loss of valuable spiritual and archeological sites in the reservoir area, the reserve lies immediately downstream of the dam and the reserve's natural habitats will be impacted by changes in the water flow.

The EARP Panel concluded that "the irreversible loss of an area which contains so much historic and prehistoric information would be a significant cost of the project and that the Peigan were not treated fairly in the decision-making, planning or implementation phases of this project." - Alternatives and Economic Efficiency of the Oldman River Dam With respect to the economic efficiency of the project, the EARP Panel concluded that "the social, economic and environmental costs of the project outweigh the social, economic and environmental benefits, even with construction costs as sunk costs and that the need for increased irrigation acreage was not convincingly demonstrated."

The Panel also found that the federal government needs to support demand management, encourage greater efficiency in water use and that specific reserves of water should be set aside for non- consumptive uses such as environmental protection. This would lead to greater use of water conservation technology including better scheduling, more efficient water delivery systems and more appropriate crop mixes. They stated that "as long as water is provided to users without charge, and environmental protection is undervalued, as it was in the planning for this project, more environmentally damaging projects will be proposed."

Other Actions by Friends of the Oldman River and the Peigan

In June of 1989 FOR staged the highly successful "This Old Man" benefit concert on the banks of the Oldman River with Ian Tyson, Gordon Lightfoot, Murray McLauchlan, Sylvia Tyson, Great Western Orchestra, David Suzuki, elders of the Peigan Nation, and Andy Russell. Estimates of attendance ranged up to 18,000 people. In July of 1990 "A Cowboy Song for the Oldman" indoor benefit concert was held in Calgary, headlining Michael Martin Murphey and Ian Tyson. These concerts were instrumental in raising awareness of water issues and in raising the funds necessary to pursue the court actions.

In August of 1990 the Lonefighters Society of the Peigan Nation starts what they term as a "healing of the Oldman River" downstream of the Oldman River Dam.

They used a bulldozer and a backhoe to divert some of the Oldman River's flow into a former channel of the river and away from the irrigation water outlet. Alberta went to court and claimed title to the Peigan land and ownership of the river and obtained an injunction halting the Lonefighters' action. Late in 1990, Alberta moved in equipment and heavily armed police to the Lonefighters' diversion and repaired dikes along the Oldman channel. The Lonefighters' direct action created a large rift in the local native and non- native communities but were important in drawing attention to their concerns in Europe, the United States and other parts of Canada.

The Lonefighters launched several legal and political actions, nationally and internationally, which continue to this day. They are now drawing attention to issue of water export from Canada to the United States. In July of 1992, FOR and others called for the cancellation of the "Festival of Life" planned by governments to celebrate the Oldman River Dam grand opening. With mounting local, provincial and national opposition and the withdrawal of the headlining Prairie Oyster band, the whole festival was canceled.

The provincial government has come to realize that their intransigence and lack of regard for the environment has strengthened and intensified the river protection lobby. FOR has participated in many public forums on the dam and other water issues. We have spoken at numerous schools, universities, and colleges, and to industry groups, professional associations, political parties and other environmental groups.

The impact of FOR's legal and political actions is being felt across Canada and we have been recognized internationally for our work. Improvements were made to the controversial Bill C-13 legislation on environmental assessment, in part, as a result of the Supreme Court of Canada decision in FOR's favor. This legislation was delayed in Parliament pending the outcome of the court action. Plans for a dam in an environmentally significant area on the Milk River Ridge in southern Alberta have been shelved as a side- effect of our successful court actions on the Oldman River Dam.

FOR was one of only twelve North American grassroots organizations featured in the 1993 Environmental Almanac published by the World Resources Institute (WRI). WRI is a Washington, D.C.-based, world renowned research and policy institute working to ensure sustainable use of the world's natural resources and the preservation of our global environment. We are now being contacted by groups across Canada and outside of Canada to advise on strategies to achieve river protection.

Even in Alberta, we can see some light at the end of the long dark tunnel. Our persistence and successful court actions have been partially responsible for the initiation of an overhaul of the badly outdated Water Resources Act. Both the revisions to the Act and a new Water Policy are being developed with the direct involvement of many interest groups. The Alberta Irrigation Projects Association and the Alberta Environmental Network which represents over 200 environmental organizations have taken the first steps towards a consultation process to see if there are areas where the two sides can move forwards with respect to environmental protection and sustainable economic benefit.

Numerous government, industry, agricultural and environmental organizations participated in the development of a conservation and management strategy for riparian forests in southern Alberta. While little concrete action has been taken to actually protect these systems on the ground, the building blocks are being put into place that will ensure that this eventually happens.

Conclusion

Court actions and confrontation should not be the preferred way to conduct environmental decision-making -- there are more constructive and less time-consuming methods that will achieve the goals of riparian habitat protection. However, there are times when riparian habitat managers and protectionists are left with no alternative. In the Oldman River Dam case, the federal and provincial governments ignored or broke their own laws and procedures. Without the benefit of an environmental review, they pushed ahead with the construction of a very controversial project that is likely to have serious social and environmental impacts and marginal or negative economic benefits.

All attempts at political and scientific persuasion failed as the governments ignored their own staff and hearing boards as well as the public. Even the direct action of the Peigan's Lonefighters failed to achieve any measure of protection for the Oldman River. The only non-violent option was to pursue the matter in the courts although many anti-dam advocates did not believe FOR would get very far. FOR's patience and persistence is paying off but the successes have largely been in other areas and, up until now, the numerous successful court actions have not had a positive outcome for the Oldman River.

The court decisions have had a very positive influence on events and groups across Canada. Projects for dams have been shelved and environmental assessments are now being conducted on other projects before construction has begun. Water policy and water legislation is now being reviewed and updated with the participation of public interest groups. Consumptive and non-consumptive users are coming together to jointly develop strategies to protect riparian habitats.

It is unlikely that there will be a quick resolution of the Oldman River Dam problem. Rome wasn't built in a day -- likewise, precedents in environmental law take years to develop. The stakes are high -- FOR's court actions continue to be some of the most important environmental law cases in Canada -- they will ultimately determine who has jurisdiction over the environment and how private prosecutions can proceed.

Some people don't believe the dam will ever be decommissioned; however, FOR draws strength from:

1. commitments by federal opposition political parties -- they have agreed to decommission the dam while environmental studies are conducted. An election must be held in 1993 and, given its low popularity in the polls, the governing political party is not expected to survive.

2. the federal Fisheries Act -- it will probably take another three years and two trips to the Supreme Court of Canada to wind up FOR's Fisheries Act prosecution. Should the prosecution be successful, remedies under the legislation include removal of the offending structure and stiff penalties. Courts are just another tool, albeit a relatively ineffective one, in the riparian habitat manager's toolkit. Court actions consume vast amounts of human and financial resources and decisions may take years to be handed down and implemented. In the meantime, environmental destruction is often allowed to continue. However, when scientific and political strategies fail, the courts may be the only means to ensure that regulatory authorities perform their legislated duties for environmental protection.

CHAPTER ELEVEN

MANAGEMENT OF AREAS WITH SPECIAL DESIGNATIONS

"Speaking of fish, Arizona has a rare native species called a "Desert Canteen" fish. This unusual fish has a hump on its back similar to a camel, and, like the camel, uses it to store water. It has the uncanny ability to know when a water hole is drying up so it drinks its fill and then sets out across the desert in search of another water hole. They can smell water for a distance of forty miles and have been known to travel that far in search of a new home. These fish must eventually find water before their canteens run dry.

Canteen Fish shouldn't be confused with the Desert Native Trout, a unique species that can't swim at all and doesn't need water to survive. Avid fisherman, Bob Hirsch, a longtime friend and one who would never fib about something so serious, claims that he caught one that was so big, he took a picture and the negative weighed four pounds.

Desert Natives are normally found in dry riverbeds like the Agua Fria and the Hassayampa. Desert Catfish are also found in those dry riverbeds. Oliver Snagnasty claimed to have caught a big one one time that had fleas. It seemed reasonably intelligent, for a fish, so he took it home and trained it to catch mice. At Verde Hot Springs, there is a place in the rocks where water comes gushing out at over a hundred degrees. Dooley Ledbetter claimed he knew the exact spot where the hot water flowed into the Verde. It was his secret fishin' hole. He said the specific gravity of the scalding water caused it to stay on top and float on a stratum three or four feet thick in that area. Dooley dropped his line down to the cold water beneath. He'd snare a trout, then lift it up slowly through the hot water cooking the fish as it passed through. He swore the fish were ready to eat by the time they were reeled in. "

It Always Rains After a Dry Spell!
Marshall Trimble

Management of Rivers with Special Designations

Phillip Wallin

I'm here to talk about rivers that have been designated, by Congress or otherwise, for "special management." Generally, these are rivers and riparian lands to which some political entity has given some special degree of protection. There are three messages that I want to get across today. First, and most important, we are at a crisis point in river protection in this country. Riparian ecosystems are collapsing all across the country. We're facing wholesale extinction of riverine life-forms: according to a 1990 study, 28% of amphibian species, 34% of freshwater fishes, 65% of crayfish species and 73% of mussel species are in danger of extinction. In Arizona, out of 30 species of native fish, 25 are listed as threatened or endangered. It's not good enough to lavish our care on a few "crown jewel" rivers. We have to find a way to bring every stream in the country under some form of "special management." Second, after 25 years in which the National Wild and Scenic Rivers Act has set the standard for river protection, I believe it is high time for new federal legislation that will give us more tools for protecting, not just river segments but riverine ecosystems. Third, I'm going to argue that a public agency, to effectively manage a river for conservation, over the long haul, needs a strong citizen watchdog as an advocate for protection of the resource. I want to assert that the public agency which manages the river should take the initiative to create and support such a watchdog.

Because River Network is a national organization, we work with people protecting rivers all across the country. In New York State, the biggest problem facing rivers is probably hydropower development. In Oregon and Washington, there's no doubt that the biggest problem is logging. In Ohio, it's channelization. In Montana it's depletion of the stream by irrigators. In the Midwest, it's polluted run-off from agriculture. In the Southwest, it's probably grazing within riparian areas. What it all adds up to is that rivers and their watersheds have continued to deteriorate. Look at any given stream and you will find a whole complex of problems that have their origin in human activities. Nevertheless, when a river gets protected in our country it normally is because of local citizens responding to a single perceived problem. When we move to protect a river, we generally are reacting to a particular imminent threat. We use that threat as the theme for organizing a constituency for the river. If we succeed in obtaining legislation to protect the river, generally that legislation is designed to cope with a particular threat, not to provide a framework for long-term ecosystem management.

Let me use an example that one of our speakers will address: the Skagit River in Washington, formerly a world-class salmon and steelhead stream. In the mid-70's, a band of citizens formed the Skagit River League to prevent the construction of a nuclear power plant on the river. They organized around this issue and persuaded Congress to designate the Skagit a National Wild and Scenic River in 1978. Once the legislation passed, they all went home. My point here is that the Wild and Scenic Rivers Act was an appropriate solution for the nuclear-power plant, but not for all the other problems afflicting the

Phillip Wallin is the Director of River Network in Portland Oregon. He founded River Network in 1988 to support grass-roots river conservationists. This group provides a clearinghouse, a River Leadership Program, the River Wealth Program, and The Riverlands Conservancy. In 1985 he founded the Rio Chama Preservation Trust and was instrumental in designating that a Wild and Scenic River.

river. The Skagit is largely a private-land river. Under the Wild and Scenic Rivers Act, the U.S. Forest Service has had virtually no authority to regulate land development, road-building, clear-cut logging on private and State lands, or other activities that have severely degraded the Skagit watershed. The valleys of the key tributaries like Finney Creek and Jackman Creek have been denuded. The great runs of salmon and steelhead are gone. The Forest Service, to whom Congress gave the mandate to conserve the river and its fishery, has been powerless to prevent its deterioration.

This year we celebrate the 25th anniversary of the National Wild and Scenic Rivers Act, which was created by, among others, Senator Clinton Anderson of New Mexico. It was intended to "immunize" the nation's most outstanding rivers from federal water projects. While the Act is still the most powerful tool for beating dams, it is simply not capable of conserving private land rivers from the many ills that beset them. The limitations of the Wild and Scenic Rivers Act have led to a variety of other special designations for rivers. The Gauley River National Recreation Area. The San Pedro Riparian National Conservation Area. The Kings River Special Management Area. The Columbia Gorge National Scenic Area. The Blackstone River Valley National Heritage Corridor. These are models that have been created or adapted to fit particular settings, particular problems, particular politics.

It will always be necessary to have special solutions to special problems. But we also need a basic model for river and watershed conservation that will apply to most situations. We need a statutory framework within which ordinary citizens living along a thousand different rivers in this country can work with County Commissioners, ranchers, the EPA, and anyone else to protect the integrity of their stream and watershed. On this 25th anniversary of the Wild and Scenic Rivers Act, it is time to create a second generation of laws for river conservation. We need a new Act of Congress to create a new model. In fact we need two Acts - one for public land rivers and one for private land rivers. These Acts would redefine the scale, the issues, the tools and the process for river conservation. The scale would encompass the whole watershed, not just a narrow corridor. The issues would include all the human activities that impinge on water quality and biodiversity. The tools would include everything in the tool-box: federal land planning, denial or conditioning of federal permits, water quality standards, biological surveys, technical assistance to state and local governments, funding for compatible economic development, land acquisition, water rights dedication, funding for restoration projects, state and local planning and zoning, and so on. The process would include all the players: Congress, which must provide the mandate and funding; federal agencies, when they are involved; state and local governments which have the power to zone private lands; citizen stewardship organizations; and private landowners and river-users.

This is a tough order to fill, but what better time could there be for it than 1993, with a new President, Vice President, and a far-sighted new Secretary of the Interior? The leadership in this search for new models has been provided by the Pacific Rivers Council, formerly called the Oregon Rivers Council. They have worked closely with American Rivers, River Network and others to devise two new proposals which they plan to place before Congress. The first is aimed at federal land rivers. Among other things, this Act would mandate federal agencies to set aside our remaining undisturbed watersheds as "Riverine Biodiversity Management Areas."

The second proposal, aimed at private land rivers, calls for a National Watershed Registry for private land rivers. This Registry is analogous to the National Registry of Historic Places. It would provide a framework for citizens in any watershed to work with local, state and federal agencies to restore the health of their stream and watershed. Once a watershed were listed in the Registry and a restoration plan approved, the watershed would qualify for federal grants and assistance in planning, restoration, and local economic development. Such a program would greatly stimulate local citizen efforts to conserve a river and its watershed. The last major point I want to make is that public agencies managing a river can greatly benefit from the presence of a citizen watchdog group. A river designation comes with a mandate, whether from Congress, the state legislature, or some other political body. That mandate can get watered down and muddied very quickly when managers get down to the job of managing. Economic interest groups, governments, and river users of every description chip away at the plan and program until there may be little left of the original legislative intent. People can get so bog- ged down in issues and compromises that they forget about the things that make the river special: the fish, the forests, the water quality. What the manager and the public need to hear, over and over again, is a voice that speaks loud and clear on behalf of the river.

More than that, there needs to be a citizen group that will educate the county commissioners, the local newspaper and the general public, about the value to the community of a healthy stream and watershed. If funding is needed for land purchases, the citizen group can go lobby Congress or the state legislature, something the management agency cannot do. The Grand Canyon Trust, of course, is a well-known example of a citizen watchdog. However, there are more than a thousand grass-roots river guardians across the country who are watching out for their river. The biggest problem is to keep these river guardians active and vigilant after the legislation is passed. This is when the activists tend to turn their attention away from the river to other concerns, like work and family and fishing. But this is precisely the time when the river manager needs their help in building a strong management program.

The river manager needs to take the initiative to seek out the activists and urge them to stay organized and active. 'This may seem like an odd suggestion, that a public agency encourage formation of an advocacy group. But the time will come when the river manager will need someone to face up to the "wise use movement," someone to keep the special interests honest, someone to lobby for funding for good management, someone to run a public education program. These are things that are very difficult to do from within government.

A good example exists here in New Mexico. The Amigos Bravos is a citizen organization which the Bureau of Land Management helped form as a "watchdog" over the Rio Grande Wild and Scenic River. The organization has developed a good deal of independence, as the BLM State Director can attest. They have gone into the trenches to protect the Wild and Scenic River from mining pollution, over-grazing and scenic degradation. They have been a bridge between the Wild and Scenic River program and the sometimes hostile citizenry of Taos County. When the Amigos concluded that additional protection was needed for wildlife habitat along the Rio Grande, they supported legislation to create a National Conservation Area. They have made life more complex and interesting for the BLM on the Rio Grande, but that is true in any good marriage.

With the beginning of a new Administration, it seems like a good time to look forward. What I see ahead is a whole new way of conserving rivers -- not just the "crown jewel" rivers and not just the National Forest rivers, but all rivers, no matter how ordinary. I think we will see a new kind of special designation for rivers that will address the health of the whole watershed, including the economic health of its human community. This new designation will bring all the players into the game, federal, state, local and private. It will give local government and business and agriculture some real incentives for buying into watershed protection. And it will give a central role to citizen organizations who are willing to roll up their sleeves and work on watershed restoration. I think we will do this, within the next eight years, because we have to. We really have no choice unless we are willing to write off the ecological health of our rivers, and hence of America. It will do us no good to focus on a few Grand Canyons and preserve them as museum-pieces. Our heritage of rivers, still magnificent despite all that we have done to it, will survive as a whole or it will not survive at all.

The Idaho Protected Rivers Program
William G. Graham

Introduction

Idaho's Water Resources include 93,000 miles of lakes and streams, and contain scenic and recreational waters of national and international renown. The Lochsa, Selway, Middle Fork and Main Salmon, North and South Forks of the Payette, and the Hells Canyon and Milner reaches of the Snake provide some of the finest whitewater boating opportunities in the world. Idaho also contains nine of America's 100 best trout streams, as selected for the 30th anniversary issue of *Trout* Magazine. The Henry's Fork of the Snake, due to its optimum balance of nutrients and temperature, is one of the nation's most productive trout streams with growth rates exceeding 17 inches in a four-year period.

A number of Idaho's streams are geographically prominent. The Salmon River, 480 miles in length, is the longest free-flowing river in the United States, and is the longest stream wholly within the boundaries of a single state. Along Idaho's western border, the Snake River flows through the deepest gorge in the North American Continent - Hells Canyon. In its upper reaches the Snake, locally known as the South Fork Snake River, is the largest mile-high river in the United States. Just below Palisades Reservoir in eastern Idaho, the South Fork also flows through one of the largest remaining cottonwood riparian forests in the west. The Bear River, in Southeast Idaho, is the largest tributary to Utah's Great Salt Lake, and is one of the and is one of the largest land-locked streams in the world.

Recognizing the value of Idaho's water resources, the state legislature passed the Comprehensive State Water Planning Act in 1988. The Act directed the Idaho Water Resources Board to progressively formulate, adopt and implement a comprehensive state water plan for conservation, development, management and optimum use of all unappropriated water resources and waterways of the state in the public interest. The legislation provided for the plan to be developed in stages based upon waterways, river basins, drainage areas, river reaches, groundwater aquifers or other geographic considerations.

Two actions by federal authorities provided the necessary incentive for passage of the Comprehensive State Water Planning Act. The first was a court ruling in favor of a position taken by the Federal Energy Regulatory Commission (FERC) that, in essence, the Commission could establish water rights through their hydropower licensing authorities. The second was an action by the Northwest Power Planning Council to protect over 12,000 miles of Idaho streams from hydropower development for fish and wildlife values.

The Plan

Each water management plan must contain a description of the water resources and related economic, cultural and natural resources, a description of existing and planned uses of these resources, and the goals,

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objectives and recommendations for improving, developing and conserving the water resources. The water and related resources that must be described include:

- Navigation
- Power development
- Energy conservation
- Fish and wildlife
- Recreational opportunities
- Irrigation
- Flood control
- Water supply
- Timber
- Mining
- Livestock watering
- Scenic values
- Natural or cultural features
- Domestic, commercial, municipal and industrial uses
- Other aspects of environmental quality and economic development

This list is similar to the resource elements that the FERC considers in its hydropower licensing process. The legislature structured the comprehensive plan requirements in an effort to ensure FERC consideration of Idaho's planning actions.

Each management plan, or component, may also include waterways designated by the Water Resource Board as state protected rivers. These waterways must have outstanding fish and wildlife, recreation, geologic or aesthetic values, and may be protected as either a Natural or a Recreational River. A state Natural River, by definition, is free of substantial man-made structures and the riparian area is largely undeveloped. A state Recreational River may contain some man-made development within the river channel, or within the riparian area. The riparian area is defined by statute as that area within 100 feet of the mean high water mark of a waterway.

"The one process ongoing in the 1980s that will take many years to correct is the loss of genetic and species diversity and the destruction of natural habitats. This is the folly our descendants are least likely to forgive us." Dr. Edward O. Wilson, Harvard University

State protection may prohibit the following activities from occurring within the stream channel:

- Construction or expansion of dams or impoundments.
- Construction of hydropower projects.
- Construction of water diversion works.
- Dredge or placer mining.
- Alterations of the stream bed.
- Mineral or sand and gravel extraction.

Under a Natural River designation, all six of these activities are prohibited. Under a Recreational River designation, the Water Resource Board may determine which activities are prohibited, and the conditions under which those activities not prohibited may go forward.

The Act also provides for interim protection for a period of time up to 2 years. This measure affords temporary protection to the values of a waterway that may justify permanent protection while a comprehensive state water plan is prepared.

The Process

The planning process begins with an extensive literature search and collection of data pertinent to the water and related resources. Data gaps are identified and, subject to available funding, additional studies are conducted. This is especially important where gaps occur in the resources used to evaluate waterways for state protection.

Public and agency input is important throughout the planning process. Concurrent with the data collection effort, a local advisory group is formed, and a series of public scoping meetings are conducted to determine the issues and concerns relevant to the planning area.

Upon completion of data collection, resource maps are prepared using a geographic information system. These maps inventory current resource conditions and uses, and help identify future uses and potential development opportunities.

After preparation of the resource maps, a screening procedure is utilized to identify river segments potentially eligible for designation as state protected rivers. Eligible segments must possess one or more outstanding fish and wildlife, recreational, aesthetic, or geologic values. The fish and wildlife assessment is based on both physical habitat and biological species criteria. The recreational evaluation focuses on the diversity and uniqueness of the recreational experiences. Scenic quality is appraised using the resource evaluation methods of the U.S. Bureau of Land Management and the Forest Service. The evaluation of geologic features considers the uniqueness or significance of the features and the degree of protection.

The suitability analysis is initiated by developing river protection alternatives, which may include minimum streamflows, for the planning area. These alternatives, ranging from no protection to protecting all outstanding segments, are evaluated using the geographic information system to assess conflicts and compatibilities with current and future resource uses. After further advisory group discussion, an alternative is selected and a draft plan is prepared.

Upon approval by the Water Resource Board, the draft plan is subject to a public review process that includes information meetings, formal hearings and a 60-day comment period. The plan is then adjusted to reflect public comment and is adopted by the Water Resource Board. The Board's adopted plan is subject to review and amendment by the state legislature at the first regular session following board action. Protected river designations do not become a final part of the Comprehensive State Water Plan until approved by law.

Actions taken by the Water Resource Board through the planning process include designating state protected rivers, and filing applications for permit to maintain minimum streamflows. Plan recommendations generally support use of good best management practices in forestry, mining and agriculture, and encourage conservation, good watershed management and effective land use planning.

Coordination

Coordinated water resource planning was a major outcome of the first Idaho Rivers Symposium organized by Wendy Wilson, Executive Director of Idaho Rivers United, in 1990. Governor Cecil Andrus, in a keynote address, encouraged federal and state resource management agencies to closely coordinate river planning activities. This lead to formation of the Idaho Rivers Working Group and a subsequent in-depth comparison of state and federal water resource planning and river protection processes. The comparison indicated that the state and federal processes were similar enough to combine water resource planning activities, and possibly river protection options. A fully coordinated planning effort could result in a spectrum of protection options that would range from dual federal and state protection to either federal or state protection to no protection.

Combined protection offers substantial benefits over separate state or federal protection. Federal protection under the Wild and Scenic Rivers Act requires that a waterway be free flowing, whereas under state designation, lakes and possibly some wetlands are eligible for protection. Under federal wild and scenic river designation, the Federal Energy Regulatory Commission is prohibited from authorizing any new power facility within the protected area. The Commission is required only to consider state comprehensive plans, but, to date, has not taken any action contrary to state management direction as set forth in acknowledged plans. A corridor 1/4-mile on either side of the stream channel is explicitly protected from new adverse development under federal designation. Under the state program, direct statutory protection is limited to activities that occur within the stream channel, and implied protection of the riparian area is limited to 100 feet on either side of the channel. However, the less rigorous corridor protection under state designation has received strong local support where a waterway is bordered by predominately private land.

Current Status

Currently in Idaho, 960 miles are protected under the state program, in addition to 550 miles protected under the federal Wild and Scenic Rivers Act. Comprehensive state water plans have been completed for four river basins and one river reach, and three other plans are currently in some stage of the planning process. Plans have been adopted by the Water Resource Board for the Priest River Basin, the South Fork Boise River Basin, the Henry's Fork Basin, the Upper Boise River Basin and the Payette River and its North and South Forks. A draft plan for a 90-mile segment of the Snake River between Milner Dam and the community of King Hill was recently completed, and is in the public participation phase with final Board approval expected in March of this year.

The first fully coordinated planning effort is underway in the South Fork Snake River basin of eastern Idaho. This effort involves the Idaho Falls District of the Bureau of Land Management and the Targhee National Forest in addition to the Idaho Water Resource Board. Data gathered and analyzed through the joint process will be used to conduct simultaneous state suitability and federal environmental impact analyses. Recommended actions, based to a large extent on public input, could include a mix of state and federal protection mechanisms.

The Nature Conservancy's Sweetwater River Project

Richard G. Studenmund

Background

The Sweetwater River Project was initiated by the Wyoming Field Office of The Nature Conservancy in 1991 with the acquisition of approximately 5,000 acres of private land along the Sweetwater River between South Pass and Sweetwater Station in Fremont County, Wyoming. The Conservancy became interested in this area when the property was put on the market and after hearing of the importance of the property for moose, elk, deer and pronghorn antelope habitat. As the first step, Conservancy Natural Heritage Program scientists were asked to inventory the area. In addition to discovering *Antennaria arcuata*, a globally rare plant species, and several other species rare in Wyoming, it was the consensus of the Heritage staff that this was one of the best remaining examples of a middle elevation riparian system. The river has no dams and very little withdrawal of water for irrigation purposes, leaving its hydrologic regime essentially intact. Its hydrology is driven by melting snow, with little moisture during the warm season. Over the 18 years of data gathered by the U.S. Geological Survey, streamflow varies from a late summer low of 1.5 cfs to a spring high of 5,750 cfs.

The Sweetwater is a corridor for the migration of moose and elk from their summer habitat in the Wind River Mountains and provides important winter range. It is a uniquely green ribbon of life in a huge expanse of high sagebrush desert, home to huge herds of antelope, other mammals such as river otter and mink, and many species of waterfowl and raptors. In addition to its natural attributes, the Oregon and Mormon Trails, as well as the Pony Express, follow the Sweetwater en route to the nearby continental divide.

This is not to say that the Sweetwater is an untouched paradise. Like almost all riparian areas in Wyoming, this area was heavily overgrazed earlier in this century and has seen dramatic changes from the elimination of such species as bison, bighorn sheep and grizzly bears. The landscape has been altered over the years, due to grazing practices, introduction of weeds, local extirpation of species, erosion, etc. Much of the land along the Sweetwater was unfenced and adjacent to large Bureau of Land Management common allotments, the largest of which has 500,000 acres and 17 livestock operators.

This area has had season-long grazing for many years resulting in severe degradation of the riparian area through compaction of soils, destruction of streamside vegetation, erosion of streambanks and sedimentation of the river. This has led to reduced fish populations and less winter forage for the moose herd which depends on the stands of willows along the river. We suspect that there has been a strong shift from willow dominated communities to meadows dominated by such "increaser" species as Kentucky bluegrass, adapted to repeated grazing.

Richard Studenmund is Director of Stewardship at the Nature Conservancy's Wyoming Field Office in Lander. He is responsible for management of all the Conservancy's lands in Wyoming. He has worked in natural areas management for over 15 years, previously as Stewardship Director for a Mid-Atlantic states land trust and as Forest Supervisor of a Puerto Rican State Forest. His academic background is in economics, botany and forestry.

Perhaps the most dramatic changes have been caused by the near elimination of a much less charismatic character. Beaver once clogged this small river and its tributaries, according to journals of early explorers. Place names like Beaver Creek and Beaver Rim echo their previous abundance. We are only now beginning to realize how beaver may interact with the river's hydrologic regime to create the vegetational mosaic, and how the extirpation of beaver has major consequences for the riparian plant communities and their associated fish and wildlife species.

In order to protect the rare species and communities found on the property, as well as to begin the restoration of those communities, the Conservancy decided to put together a plan to acquire the property. As is often The Nature Conservancy's way, a number of creative ideas were combined to protect these important lands along the river. Some of the acquisition techniques used were:

Option – In order to gain time to develop strategies and raise money, an option was purchased to buy the property at a given price within six months.

Conservation buyer – Because the price of the ranch was high, a private buyer with a strong conservation interest was found to purchase the most expensive section of the ranch, including the ranch headquarters.

Conservation easement – The buyer donated a conservation easement back to the Conservancy which will assure that the ranch's resources will be managed properly and the land will never be subdivided for development. This assures that the land will stay in private ownership with its traditional uses protected.

Building partnerships – Neighboring ranchers who wanted to acquire isolated parcels and BLM and state grazing leases were enlisted and a team of buyers created.

Designation – Seven miles of adjacent BLM land along the river has been proposed for wilderness designation. The Nature Conservancy was not responsible for this, but has worked with the BLM to coordinate management goals.

Working in this manner, about 25 miles of the Sweetwater River have been protected to date. Parallel with the real estate activities to protect this stretch of river has been the development of a management (or stewardship) strategy to assure the long-term well being of the biological values of the land. This strategy likewise has several elements, linked together through a management plan now being written. This plan will unite the following areas into one cohesive document:

Biological management

We have developed a five stage system culminating in the management plan. These stages are:

- **Identification** What's out there? An inventory of the biological resources of the land is performed. Important species or natural communities (together called elements) are identified.

- **Element Research** What do we know about it? Through field observation, literature searches and personal contacts, information is compiled on the species or community in question.

- **Ecological Model** How does an element interact with other elements and its environment? A simple conceptual model with boxes and arrows can be extremely helpful both in understanding and manipulating the system.

- **Monitoring Plans** How will we know the results of our management? Plans for all important species and communities are formulated to provide feedback on our management practices. At the Sweetwater, surveyed transects across the riparian areas have been laid out with plant communities mapped in relation to environmental gradients like depth to water table, soil texture and salinity. A system of monitoring wells is being established to monitor the water table and the possible changes that occur as beaver recolonize the area.

• **Management Plan** How will we manage our lands? The biological information gathered through the steps above is integrated with programmatic uses of the property, maintenance needs and legal requirements into a document that provides continuity to our efforts over the years. At the Sweetwater, these other activities include the following.

Restoration and Demonstration

Instead of eliminating grazing, The Nature Conservancy plans to use this project as a demonstration of new techniques in managing grazing in riparian areas. Instead of season-long grazing, we plan to introduce a new system of grazing with large numbers of animals for short periods of time, followed by longer rest periods, imitating the grazing pattern of buffalo herds. Fences have been constructed to create a series of movable grazing cells along the river using two lines of permanent fencing roughly paralleling the river and temporary, electric cross fences that will be moved, leapfrog style, downriver as the forage is utilized in the previous cell. The advantages of this system include: the ability to easily remove the cross-river fencing in the off season facilitating the movement of moose, elk, deer and pronghorn; the lower initial cost of fencing across the river and the lower maintenance cost of not having fences exposed to ice flows and spring flooding.

Beaver will be encouraged in the project area and closely monitored. If the beaver population does not grow through natural expansion, we may consider transplanting beaver from nearby drainages and/or feeding them for a couple years to jump-start the system. Monitoring systems will be set up to show how the vegetation, streambanks and trout population respond to the change in management, hopefully resulting in an example that will inspire other riparian landowners to try new techniques.

Building partnerships

Trout Unlimited has donated $2,000 to help fund this effort and chapter members worked over 100 person-days to build over five miles of fence. The Conservancy received a $10,000 grant (E.P.A. section 319 funds) through the Wyoming Riparian Association to purchase fencing materials to get the project going. The Bureau of Land Management has been extremely helpful in setting up the project. The Soil Conservation Service is doing a complete range survey. The Wyoming Game & Fish Department has performed fish population sampling and done a study on the moose herd. The University of Wyoming and the WY Department of Agriculture have also provided technical advice and support. Several local ranchers have agreed to participate in the project. They will help manage electric fences and move their livestock when target grazing levels are reached.

Visitor use and education

Public fishing, hiking and limited camping are allowed, providing benefits to the local community and building support for conservation. School groups have started to use the property for studying natural science and will be helping with restoration efforts. In addition to providing a demonstration of new grazing ideas to local ranchers, the project will be used to demonstrate to conservationists how livestock can be used as a tool for the successful management of riparian areas.

Conclusion

The Nature Conservancy has realized that the protection of biological diversity will be achieved most effectively through the conservation of whole ecosystems. Given the scale of most ecosystems, we will not be able to protect biological diversity solely through acquiring lands. Partnerships with both the private and public sectors will be critical as we move from protecting individual species to whole ecosystems. Identifying sustainable economic activities and demonstrating their compatibility will be key to accomplishing the conservation of nature's diversity. We hope that the Sweetwater River Project becomes the type of model that helps move us from the current polarized atmosphere of "jobs versus owls" to a long-term perspective that provides for secure jobs <u>and</u> owls (or beaver!)

Little Bear River Hydrologic Unit Area

Michael D. Allred

In 1989, in response to landowners' concerns, the Blacksmith Fork Soil Conservation District (SCD), and the Bear River Resource Conservation and Development Council (RC&D), approved and submitted to U.S.D.A.'s Soil Conservation Service, an application for Hydrologic Unit Area (HUA) planning and implementation funds for the Little Bear River (LBR) Watershed. Approval of that request was granted in 1990.

Project Location, Land Use and Agronomics

The Little Bear River Watershed is located in Cache County, Northern Utah. The watershed encompasses 196,432 acres and includes irrigated cropland, irrigated pasture, meadow pasture, non-irrigated cropland and pasture, and rangeland. Two reservoirs are located within the project area (Porcupine and Hyrum), with a third just down stream from the project area. Land use is approximately 70% range/forest/wildlife, 19% irrigated cropland, 7% dry cropland, and 4% other.

Land ownership is 85% private, 11% national forest, and 4% state lands.

Land within the watershed is primarily used for livestock feed production and as grazing land for livestock and wildlife. There are 36,807 acres of irrigated cropland, and 14,682 acres of nonirrigated cropland within the watershed. Crops produced include corn, small grains, alfalfa and pasture/hayland. The remaining 144,943 acres consist of rangeland, forestland, waterbodies, and towns.

Non-Point Source Pollution Problems

The Little Bear River watershed was identified by the Utah NPS Task Force as a high priority watershed in Utah, needing treatment to resolve nonpoint source pollution impacts. The most obvious pollutant is sediment produced from streambank erosion of the Little Bear River channel between Porcupine and Hyrum Reservoirs, and between Hyrum and Cutler Reservoirs.

A second problem area includes several tributary drainages to the Little Bear River approximately four miles upstream from the Hyrum Reservoir. These small drainages are heavily impacted by intense summer convection storms and rapid snowmelt runoff. During these events high peak flows cause severe erosion of the main and tributary channels. Sediment and nutrient loading to the river system also results from road damage and cropland erosion.

A third problem is created when excessive amounts of nutrients and coliform enter the system after being flushed from concentrated animal feeding operations (CAFO), pasture

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and cropland located adjacent to the river. A major portion of the river corridor is used for livestock grazing and crop production.

A fourth problem develops from high phosphorous input into the Hyrum and Cutler Reservoirs causing accelerated eutrophication.

A fifth problem occurs along the western and southern shorelines of Hyrum Reservoir when wave action beats against the toe of highly erosive bluffs. This action causes major sloughing that results in sediment deposition to the reservoir.

Demographics

Approximately 12,000 people live within the hydrologic unit area. About 8,200 individuals live in the incorporated communities of Hyrum, Paradise, Wellsville, and Mendon. The remainder live in unincorporated areas.

Purpose

The objectives of the Little Bear River Project are as follows:

• Reduce erosion of streambanks by 80 percent and rangeland erosion by 70 percent on acreage identified as critical.

• Reduce nutrient and sediment water pollution impacts coming from cropland, pastureland, farmsteads, CAFO's and rangeland to both surface and ground waters to meet Utah's water quality standards.

• Improve the quality of water within the Little Bear River system to augment fish and wildlife habitat, enhance the aesthetics, recreational, agricultural and municipal water quality.

• Inform and educate all individuals associated with the project area of the need to manage the resource within the watershed in such a a way as to maintain and improve water quality and water related resources.

• Isolate water quality problem sources, monitor progress in reducing water quality impacts, determine effectiveness of treatment alternatives, and evaluate economic benefits for implementing water quality improvement activities.

Present conditions do not indicate a groundwater pollution problem within the LBR drainage. The practices planned will help insure that the present quality will be maintained.

Planning Overview

The Little Bear River Hydrologic Unit Area is large. It includes 34 subwatersheds, over 50,000 acres of cropland and well over a hundred miles of stream channel. The planning and inventory activities were directed to address scoping and technical concerns first.

The watershed plan uses a Geographic Information System (GIS) database. Many of the overlays produced by the GIS have been valuable in developing accuracy in inventory, analysis, planning evaluation, acreage, lengths, and sizes in general.

Public Participation & Scoping

The majority of planning activities initially were focused on scoping concerns of landoperators, landowners, environmental awareness groups, government agencies with a vested interest, technical considerations, and civic leaders such as city mayors and Soil and Water Conservation Districts.

Organization

Under guidance of the SCD Board of Supervisors and the RC&D Council with cooperation of various federal, state, and local agencies the Little Bear River Steering Committee (LBRSC) was formed. The responsibility of the Little Bear River Steering Committee includes program leadership and direction. This committee includes community leaders, landoperators, environmental group leaders, and Little Bear River Water Users Association representatives.

In 1989 the Little Bear River Steering Committee established a Technical Advisory Committee for the purposes of inventorying, evaluating, and developing conservation treatment alternatives to address water quality problems. The Technical Advisory Committee is also responsible for providing technical expertise for implementing the approved treatment plans.

The Technical Advisory Committee, in an effort to address nonpoint source water quality concerns, provides leadership for Coordinated Resource Management Planning (CRMP) efforts of five work groups. The five work groups are: Hydrology/Sediment/Range, Cropland, Wildlife and Recreation, Monitoring and Evaluation, and Information and Education.

Work group team leaders are members of the Technical Advisory Committee and direct the planning and implementation efforts of each group.

Land Treatment and Best Management Practices

In general, bank stabilization measures are being implemented along the banks of the Little Bear River where needed. Efforts to armor the west shoreline of Hyrum Reservoir are planned. Filter strips are being established in areas where they will be most beneficial. Rangeland is benefiting from; grazing management, seeding, fencing, livestock water development and deferred grazing. Pasture treatment includes proper grazing use, fencing, livestock watering facilities, irrigation water management, seeding, and improved irrigation systems. Riparian zones and streams are benefiting from drop structures, rock pools, vegetative enhancement, and streambank protection. Cropland improvements include, irrigation water management, irrigation system improvements, improved tillage practices and crop rotation. Feedlots located along the channel or tributary channels are being managed to reduce pollutants by excluding livestock from the channel and providing alternate sources of water. Also waste control practices such as installing manure storage bunkers and other animal waste control facilities are being implemented. All land treatment practices that reduce NPS pollution in the LBR HUA have beneficial effects on the aquatic life, fisheries, waterfowl, etc.

Information & Education

Within the Little Bear River Watershed approximately 88 percent of the land is privately owned and approximately one-third is in cropland. Many farmers view their role toward the natural resources they manage from the standpoint of stewardship of the land. Stewardship, however, requires knowledge about environmental problems, such as ground- and surface-water contamination, riparian management, and the adoption of practices that preserve long-term soil productivity and water quality. The effective treatment of NPS ground-water and surface-water pollution in the Little Bear River Hydrologic Unit requires the timely delivery of educational materials and conservation technology.

The LBR hydrologic unit's Information and Education (I&E) work group objective is to attack the problem of NPS water pollution at the local level and use education as a force for increasing understanding and changing current behavior.

Technology Transfer

Technology transfer in the area of water quality and riparian management can be a complex issue. It involves identifying the problems, compiling information and sometimes developing technology capable of making improvements. Next, one must be able to assess the target audience where this technology must be applied. Often the target audience is unaware of the problem or the technology available to remedy the problem. The target audience requires valid reasons why the technology should be adopted and assistance in adapting the technology. Finally, the impacts of this technology on both the targeted audience and the situation it is designed to address must be assessed.

Many groups, organizations and government agencies are seriously concerned about water quality and riparian management but their approaches differ. By addressing the issues within the Little Bear River Watershed in a coordinated resource management planning (CRMP) style, the existing problems have been more accurately identified, the occurrence of conflicting messages to the target audiences are being minimized, inaccuracies are being reduced, the scope has been broadened, information is being better coordinated and misinformation is being curtailed dramatically. In this way the hydrologic unit area is able to communicate a consistent message to effect needed and acceptable changes.

Within the LBR watershed several methods have been used to improve the communication of technology from researchers to landowners, operators and the general public. Continuing efforts to improve this communication link is an important element of the Information & Education work group's efforts. One means, being used to assist in effectively transferring technology is a Geographic Information System (GIS). In addition to being an effective and accurate means of transferring technology, the GIS provides a rapid means of putting together various planning scenarios, provides accurate measurements of areas and distances and produces impressive visual aids that can be effective tools in helping to gain public and landowner support and participation.

Interactions With Cooperators

Much of the success of the Little Bear River Hydrologic Unit is dependent not only on direct financial support from cooperators but also on their active participation in research and technology transfer. Establishing strong working relationships between researchers, work group members and resource managers is essential for rapid exchange of information. Many individuals within the watershed have developed innovative strategies to deal with problems in resource management. The Information and Education work group is building on this expertise by involving cooperators as speakers on field trips, at workshops, and as contributors to the LBR newsletter. We also seek advice from cooperators on the objectives, topics and design for research. Cooperators are also instrumental in providing operational-scale support such as yearly stream channel maintenance.

Active involvement of key individuals and cooperating organizations, helps work group members focus on significant problem areas and increases the application of research results. The development of open communication between these work group members and cooperators enhances the two-way flow of new information vital to the hydrologic units objectives.

Increasing Public Awareness and Cooperation

Many Cache Valley residents take an active interest in the management of our natural resources, among them the water resource ranks very high, perhaps number one. Unfortunately, public understanding of this resource and of the problems surrounding its management is often incomplete, resulting in misperceptions of the issues and complexity involved. Consequently, the Information and Education work group will continue to seek an increased public understanding of the Little Bear River Hydrologic Unit's objectives and the steps necessary to achieve those objectives.

Establishing strong linkages between agencies is critical if we are to be successful in addressing water quality and riparian management issues. These linkages take time, a lot of hard work, and a commitment to success. It not easy, but the goal is worth the effort. Just as no one social system is responsible for a problem, no one system alone can solve it. Fragmented communities don't need fragmented services. In a new age, as Appley and Winder put it, "competition as a valued behavior can no longer ensure survival in the turbulent environment." The old Cowboy management approach must go the way of the frontier. Instead, the more we work together, the more we have the possibility of better understanding complex problems and acting on them in an atmosphere of trust, cooperation, and mutual respect.

Malheur National Wildlife Refuge

Forrest W. Cameron

Introduction

The National Wildlife Refuge System (NWRS) of the U.S. Fish and Wildlife Service (Service) consists of over 480 units and 90 million acres, and as of 1992 has at least one refuge in each of the 50 states. Malheur National Wildlife Refuge is a 185,000 acre member of that National Wildlife Refuge System, and as such is one of the largest freshwater marsh and riparian habitats managed by the Service outside Alaska.

The mission of the NWRS is to provide, preserve, restore, and manage a national network of lands and waters sufficient in size, diversity, and location to meet society's needs for areas where the widest possible spectrum of benefits associated with wildlife and wildlands is enhanced and made available (USFWS 1982: Refuge Manual 2RM 1.3). Management of National Wildlife Refuges is guided by legal mandates including the Refuge Recreation Act of 1962, the National Wildlife Refuge System Administration Act of 1966, and the Endangered Species Act of 1973. Policy guidance for management actions on Refuges is contained in the Service's Refuge Manual (1982).

The Setting

Malheur Refuge lies at the 4100 foot elevation in the hydrologically closed Harney Basin of southeastern Oregon, in a nine inch precipitation zone. Supplemental water comes in the form of spring flows and snowmelt runoff from three drainages: Silver Creek, the Silvies River and the Donner and Blitzen River and five of its tributaries.

Silver Creek flows intermittently dependent upon the amount of snowpack in the Blue Mountains to the north. Silver Creek and several perennial springs in the Double O portion of the Refuge flow southeasterly and terminate in Harney Lake.

The Silvies River has its headwaters on the high elevation south slopes of the Aldrich Mountains and Strawberry Mountains roughly 70 miles north of Refuge land. Along its course its course through 1290 square miles of drainage the Silvies is diverted into a diffuse system of canals and ditches designed for flood irrigation of meadow land to support haying and livestock grazing in the Silvies River floodplain. The floodwater eventually enters Malheur Lake at 13 main points.

The Donner and Blitzen River (Blitzen River) and its tributaries originate on the north and west slopes of the Steens Mountains immediately southeast of the Refuge. The Steens rise to over 10,000 feet and their snowpack provides the Refuge's most reliable and highest volume water source. Fully 80% of their 500 square mile watershed flows westward into the 65,000 acre Blitzen Valley and then northward into Malheur Lake. It is along the 40 mile length of the Blitzen Valley and along its tributaries, Mud, Bridge, Krumbo, Kiger, McCoy, and Cucumonga Creeks, where the majority of Malheur Refuge's riparian habitat occurs.

Forrest Cameron is the Refuge Manager of the Malheur National Wildlife Refuge in eastern Oregon. He has worked for the U.S. Fish and Wildlife Service since 1969 in wildlife refuges in Montana, Nevada and North Dakota. He was Assistant Refuge Supervisor for the six western states. He has managed the Malheur Refuge since 1989.

Land Use Patterns of the Past

Prehistorically the ancestors of todays Paiute tribes inhabited the productive wetland areas of Malheur, Mud and Harney Lakes and the Blitzen Valley, hunting and gathering from their abundant food supplies. Explorers and trappers entered the region in the 1840's, but not much was learned about the area until the early 1860s, when the U.S. Army conducted surveys for military wagon roads. In 1863 and 1864, cattle herds were being moved out of the Willamette Valley of western Oregon to provide food for the mining activity in eastern Oregon and southern Idaho. By 1868 the troops at Fort Harney, 10 miles north of Malheur Lake, had removed the barrier of hostile Indian tribes and the Harney Basin was primed for settlement.

Peter French, one of the more notorious of the early settlers, began carving out his empire centered at the south end of the Blitzen Valley in 1872, with 1200 head of cattle from northern California. Before his murder on December 26, 1897, his holdings had grown to 132,000 acres and spread around the south shore of Malheur Lake and included nearly all of the 65,000 acre Blitzen Valley. With over 50,000 head of cattle using the area, the Harney Basin had certainly become cattle country.

The nature of the Blitzen Valley and the associated riparian areas were forever changed with the advent of cattle, development of a water delivery system and flood irrigation to raise and harvest native meadow hay to feed cattle and horses. While a limited amount of willow habitat was desirable to early ranchers for the shelter it provided during calving, any excess of willows robbed from the productivity of grass meadows and made harvest of meadow hay difficult. The meandering and ever shifting channels of the rivers and creeks were a nuisance and so were channelized for a 20 mile section between 1914 and 1920.

Malheur National Wildlife Refuge was established in August of 1908, by Presidential Proclamation that reserved the area around Malheur and Harney Lakes as " a refuge and breeding ground for native birds." It was not until 1935 that the refuge boundary was expanded to include land in the Blitzen Valley, and in 1941 the last major acquisition was the addition of the Double O unit west of Harney Lake.

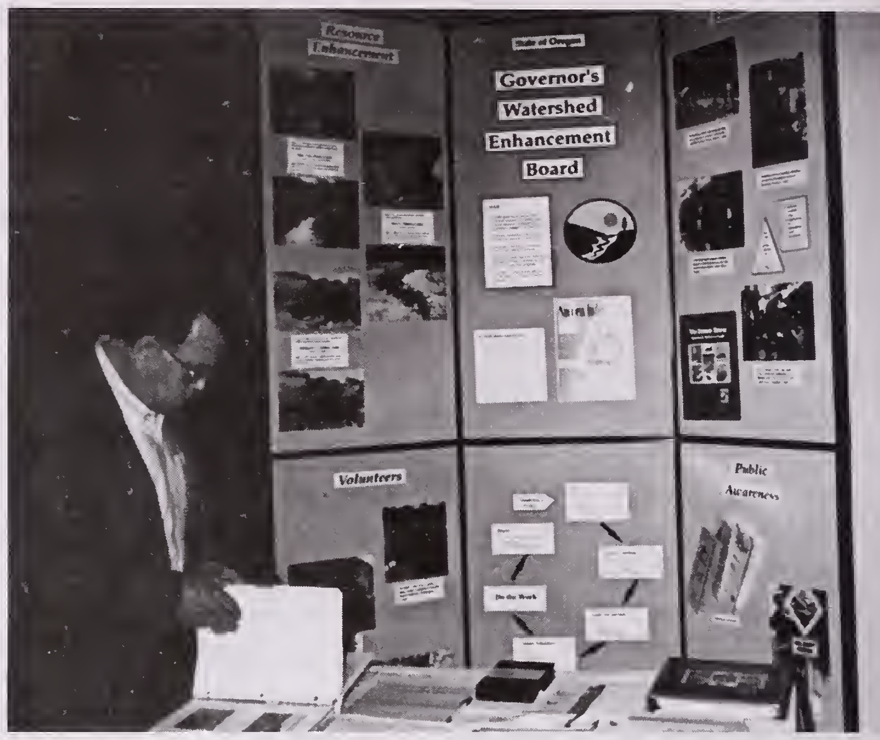
For years the land of the Blitzen and Double O had been used as an integral part of the local economy to support the livestock industry. Unfortunately, not much changed when the land became Refuge. At that time the perceived value of the Blitzen Valley was as a guaranteed water source for the "more productive" wildlife habitat of Malheur Lake. The irrigation systems of the Blitzen Valley and Double O were changed to be more responsive to wildlife needs for ponds and lakes, but still virtually every acre of meadow and upland was grazed by cattle or hayed for cattle.

It was not until the introduction of carp into Malheur Lake and loss of its productivity as a nesting and feeding ground for birds that the Service took seriously its management responsibility of the alternative wildlife habitat that existed in the Blitzen Valley and Double O. We had sprayed, hayed and bulldozed willows as our ranching predecessors had done. We allowed grazing to denude stream and canal banks and erode their soils. We allowed removal of upland grasses of watersheds that resulted in more siltation into and erosion of our streams. Fishery values for the native redband trout were sacrificed in the interest of an irrigation system to raise forage. Water temperatures and turbidity increased, encouraging upstream expansion of carp into wetland habitat.

Some Land Use Solutions

Armed with stronger environmental legislation, emphasis on management for species diversity, new leadership, and a new Refuge Manual for policy guidance, staff at Malheur Refuge entered a painful process of change in the mid 1970's. Gone were the days when every acre of Refuge habitat was either hayed or grazed. The grazing rate was cut from a high of 127,000 AUM's in 1973 to 34,000 AUM's by 1983. The haying and grazing that survived was to be done for a management purpose to benefit wildlife.

I would like to cite three case examples of the diverse methods used to restore, protect and enhance the riparian habitats associated with Malheur Refuge.



The Upper Blitzen River

As water enters the south end of the Refuge it is almost immediately diverted into ponds and meadow habitat. With the entire area being grazed or hayed the willow habitat along the Blitzen River had long since been sacrificed to cows. Bank erosion was tremendous during spring runoff. The natural channel shifted frequently making maintenance of water control structures a time consuming job. Buildings at the P Ranch substation, including the historic Long Barn built by Peter French in 1876, were under constant threat of flooding by rapid spring runoff. Habitat for native fishes was without shade and underwent extreme temperature fluctuation.

In 1988, Refuge staff entered into two planning efforts that would contribute to restoration of the upper Blitzen River riparian zone. One was the Blitzen Valley Management Plan, a complex habitat document that took over two years to complete with extensive public involvement, workshops and comment periods for individuals, groups and agencies. One of its recommendations identified the areas of riparian habitat that were to be protected and the species that were expected to benefit from it. Protection means nonuse status with possible use of prescribed burns to increase structure and density.

The second planning effort began with a small group of experienced professionals on a field trip to the site in April 1988. The Forest Service, BLM, SCS, Trout Unlimited and Oregon Department of Fish and Wildlife were present. A Riparian Area Protection Plan was completed by SCS in June 1988, as a result of the field trip and an Environmental Assessment was completed shortly thereafter.

The restoration outlined in the Riparian Area Protection Plan was divided into four phases and includes 48 new jetties, repairing 7 old jetties, 1250 feet of juniper riprap, 300 feet of willow planting, and 30 fish rocks. The first phase was completed as a weekend project by volunteers and Refuge fire crews in 1989. The fourth and final phase will be completed in August 1993.

Krumbo Creek

As followup to a water rights settlement, I was on a horseback trip in April 1990 to the upper reaches of Krumbo Creek, a tributary to the Blitzen River. The canyon floor showed evidence of longterm erosion from cattle grazing in trespass from adjacent BLM allotments. Cutbanks in excess of 15 feet deep were present in one of the three forks of Krumbo Creek.

A field trip on horseback with three BLM staff and two Refuge staff members was arranged for later in 1990. Topics discussed on site included a land exchange just being completed between BLM and an adjacent landowner, fencing in the area, water sources available to BLM permittees, the cooperative attitude of a new permittee in the area, and plans already drafted by a BLM biologist for riparian restoration. Those plans had not been prioritized for funding or action.

We worked through BLM to immediately enforce gate closures and fence repair by permittees in the adjacent allotments. Once the land trade was done the adjacent landowner built two miles of common boundary fence to keep his cattle out of the area. Another quarter mile of drift fence was completed by the new BLM permittee in 1991. That and more frequent patrols of the area by Refuge staff took care of the protection phase for Krumbo Creek.

The streambank restoration phase had been planned for 1991, but was to involve helicopters ferrying juniper trees to the site. When helicopters on fire standby were not made available, neither agency could afford helicopter time for the resource work as planned in 1991. Work was delayed until 1992, and still no helicopter time was available, so Refuge fire crews took over. Three crews with three members each took supplies and 4-wheelers into the area and camped out for a week, dragging junipers to the site and placing them along the first phase of streambank. Healing rate will be assessed and our crews will be there again in 1993 for the next phase.

No Environmental Assessment was done for this one; just a lot of coordination, some enforcement and implementation of some plans that had been on the shelf for far too long.

Silver Creek

Silver Creek enters the northwest corner of Malheur's Double O unit and flows through the Refuge for over 10 miles before terminating in Harney Lake. Along that path Silver Creek flows through one half-mile section of privately owned land that is leased for grazing. That 115 acre parcel plus the adjacent 2000 acre private pasture rely totally on the private section of Silver Creek channel for a livestock waterhole. The most commonly used portion of that waterhole is at the entrance road to our Refuge substation. The streambank was annually denuded and many visitors thought the area was part of the Refuge which resulted in us receiving several adverse comments on improper management of Refuge land.

In 1991, the Service began the Partners for Wildlife program to improve and protect fish and wildlife habitat on private lands while leaving the land in private ownership. The amount of federal land ownership in southeastern Oregon is a sensitive issue, and retention of private ownership helps us avoid the conflicts associated with fee title acquisition.

One of the first Partners for Wildlife projects funded was this half mile riparian restoration endeavor. It included a dike for water control, 0.6 miles of fence, a cattleguard to exclude grazing from the 115 acre parcel and construction of an alternative water source for the adjacent 2000 acre leased pasture. Costs of about $10,000 were to be divided 50:50 with the landowner and a 25 year agreement for protection and nonuse of the site was signed by our Regional Director and the landowner.

Work began in the fall of 1991, and the streambanks have been protected. Installation of the cattleguard in the county road will be completed in 1993, since a county permit was required and they wanted no installation until the 3 year lease had expired on the 2000 acre pasture. We gave notice to the lessee that after the final year of his lease, there would be no water available to him by trespass, and another water source would be necessary if he wanted to continue grazing. Some willow habitat could possibly regrow naturally, but if it has not shown progress by 1993, then plans will be made to replant much of the streambank in 1994. Volunteers, Youth Conservation Corps enrollees or 6th grade environmental education classes will probably provide the labor and willow cuttings will come from other parts of the Refuge at no cost.

The result in just a few years will be half mile of healthy riparian corridor, a large pasture with cattle watering in it where they should be, no cattle trespass on private or Refuge land and water, and no cattle standing in a county road at the entry to a National Wildlife Refuge.

Conclusion

Malheur National Wildlife Refuge has had a land use pattern dominated by grazing for 140 years, often to the detriment of resource values in the riparian zone. Modern management plans include grazing as well as haying, but only in a way designed to benefit wildlife objectives. The transition has been a difficult one that resulted in a reduction of nearly 100,000 AUM's; in a shift from virtually every nonflooded acre being grazed or hayed to the present situation where only 15% of the available habitat is utilized by livestock. We moved from a time where willow habitat was persecuted as counterproductive for good hay meadows and in the way of an efficient irrigation system to a time when species diversity and the riparian habitat to support them is one of the most commendable traits of a properly managed national wildlife refuge.

Every restoration project that we face is unique and has evolved under special circumstances. The three examples given were cases chosen to show not just the diversity in riparian habitat restored, but to show the variety in people and agencies that we must work with to get results. The cooperation of all affected parties is needed to get the best results. But regardless of the complexity of ownership, complexity of the problem, amount of permits or planning required, or cost of the project, we have gotten results not by wondering if something can be done, or by lamenting the lack of budget for such work, or by recounting the methods that have failed in the past. We have clearly identified the problem areas and then flexibly applied our energy to find the opportunity to fix them.

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The San Pedro Riparian National Conservation Area

Greg M. Yuncevich

The San Pedro Riparian National Conservation Area is in the southeastern part of Cochise County, Arizona, in the Safford District's Tucson Resource Area. The upper San Pedro River is the focal point of the area. Arising in northern Mexico, it flows northward to its confluence with the Gila River near Winkelman, Arizona. The river is perennial throughout most of the conservation area and supports a riparian ecosystem in good condition with abundant species diversity.

The rich human history of the area spans 11,200 years and proves that riparian resources have been of value since the first Americans. The Clovis hunters had a mobile subsistence pattern based on following herds of now extinct mammals such as mammoth, horse, camel, bison and tapir. The National Conservation Area contains more known Clovis sites than any other area in the new world and the Lehner site is listed as a National Historic Landmark. The transition to the Cochise Culture occurred about 8,000 years ago and lasted 6,000 years. The most important single event during the Cochise Culture's long occupation was the acquisition of an agricultural technology. They began to grow corn in about 300 B.C. The Mogollon, Hohokam and Salado cultures (AD 1 to 1450) developed agriculture as a major subsistence activity, acquired pottery-making technology, developed semipermanent house types, began using the bow and arrow, and changed to a more sedentary lifestyle. The most important events involving the Sobaipuri (1450-1769) were their battles with the Apache and their contacts with the Jesuit missionary Eusebio Kino (1692). Father Kino brought them cattle and a variety of European crops. The National Conservation Area contains more Sobaipuri sites from this period than any other area.

Spanish exploration, religious and military activities and ranching occurred from 1539-1820. Both Fray Marcos de Niza in 1539 and Francisco Vazquez de Coronado in 1540 followed the San Pedro River in their explorations. The legacy of the Apache (1600-1886) was their raids on the Sobaipuri and foreign intruders. This raiding was the major cause of abandonment of the area by the Sobaipuri, the prevention of permanent and expanded Spanish settlement, and the long delay in American settlement. The Spanish began constructing the Presidio of Santa Cruz de Terrenate (fortified settlement) in 1775. Abandonment of the post, due to the continuous Apache attacks, occurred in 1780. This marked the end of Spain's attempt to maintain its northern frontier beyond Tucson. The Presidio of Santa Cruz de Terrenate is on the National Register. It is the only presidio in the country under federal management, still in a natural setting, and with ruins of a commander's quarters of that period.

After Mexico's independence from Spain, two large land grants were issued in 1827. The San Juan de las Boquillas y Nogales land grant was later conveyed to William

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Randolph Hearst in 1901. The San Rafael del Valle land grant was conveyed to William Cornell Greene in 1905. Establishing the land grants was important because it allowed the large ranching operations of the Spanish settlers to continue into the Mexican and American periods. The land grant pattern continues today as the primary boundary of the National Conservation Area.

At the same time that the Spanish were beginning construction on the presidio at Terrenate, the Continental Congress declared the independence of the 13 colonies from Great Britain. In 1780, the Congress of the Confederation called upon all the states to relinquish their claims to the western country and pledged itself to administering the lands for the common benefit of the nation. For the next 200 years the public domain represented challenge and opportunity for development and revenue generation. The era was marked by a policy of disposal.

From those beginnings, the Bureau of Land Management (BLM) today administers what remains of the nation's once vast land holdings. Of the 1.8 billion acres of public land acquired by the United States, two-thirds went to individuals, corporations, and the states. Of that remaining, much was set aside for national forests, wildlife refuges, national parks and monuments, and other public purposes, leaving BLM to manage 270 million acres. The Bureau of Land Management was created in 1946 by the merger of the General Land Office and the Grazing Service by Harry Truman's Reorganization Plan. The creation of the Bureau marked a change in historical policy from holding public lands for transfer to private ownership to one of proprietary handling by the United States.

The 1960's brought rapid growth and fundamental changes to the BLM. With attention from President Kennedy and direction from Secretary Udall, a multiple use philosophy emerged that viewed natural resources as finite, interrelated, and vulnerable components of larger systems. The Bureau became involved with a growing national conservation movement. Urban Americans began to take notice of the public lands, conservation organizations gained new members and began to petition Congress for new parks, wilderness areas, and outdoor recreation facilities. BLM designated its first recreation area, the Red Rocks Recreation Lands in southern Nevada in 1967. Red Rocks became a National Conservation Area in 1990. The King Range in northern California became the first National Conservation Area in 1970.

The Federal Land Policy and Management Act of 1976 (FLPMA) formally recognized the management principles that the Bureau had been developing for thirty years. Congress established policy to retain the public lands under federal ownership, to inventory and identify their resources, and to provide for the multiple use and sustained yield management of public lands and resources through land use planning. The Bureau had moved from a disposal agency to a retention and management agency.

A front page article in the *Tucson Citizen* on January 13, 1978 explored the first thoughts about bringing the San Pedro into Federal Management. Bill Quimby, the Outdoor Editor, stated, "An 80 to 100-mile stretch of the San Pedro River from a point south of Tombstone almost to Winkelman has been targeted as a 'unique wildlife area' by the U.S. Fish and Wildlife Service and is being considered for purchase under President Carter's National Land Heritage Program."

Under the direction of the Arizona State Director, Dean Bibles, the Bureau began an aggressive program to resolve a longstanding problem of federal land debt to the State of Arizona in 1984. The Bureau was also responsible for reimbursing the State for lands taken by the Bureau of Reclamation for the Central Arizona Project and for lands to be exchanged for the Navajo-Hopi Relocation Act of 1980. By 1988, more than 1.7 million acres had been exchanged, transferred, or undergone changes of administration. The properties that were to become the San Pedro Riparian National Conservation Area were part of this dramatic land tenure adjustment.

Most of the San Pedro river acquired by the BLM was comprised of two Spanish land grants dating from 1827. Tenneco West

Conservation Area was established to conserve, protect, and enhance the riparian area and the aquatic, wildlife, archeological, paleontological, scientific, cultural, educational, and recreational resources of the public lands surrounding the San Pedro River.

The legislation specified that only uses that would further the primary purposes for which the conservation area was established should be allowed. The use of motor vehicles would only be allowed on designated roads. Subject to valid existing rights, all Federal lands within the conservation area were withdrawn from all forms of entry, appropriation, or disposal under the public land laws; from location,

bought the lands in 1971, and by the early 1980's was ready to subdivide and dispose of them. There were strong feelings among environmental groups and others who wanted to protect the area from housing developments. The BLM saw an opportunity to acquire and preserve this prime resource for the American public. White Tanks Associates, a Phoenix private land developer, purchased the lands from Tenneco. Then, in exchange for the 43,000-acre San Pedro River properties, White Tanks Associates received 40,947 acres of undeveloped public land west of Phoenix. Some additional exchange lands were added to the area and the total land within the National Conservation Area is now nearly 57,000 acres.

Ten years after the passage of FLPMA, the Bureau published "Fish and Wildlife 2000." The strategic plan emphasized the preservation and enhancement of ecosystems to ensure an abundance and diversity of wildlife, fisheries, and plant resources on the public lands. On November 18, 1988, Congress passed the Arizona-Idaho Conservation Act that created the San Pedro Riparian National Conservation Area. The language in the Act reflects the ecosystem management philosophy that had been developing. The San Pedro Riparian National

entry, and patent under the mining laws; and from disposition under all laws pertaining to mineral and geothermal leasing. Congress reserved water rights sufficient to fulfill the purposes of the legislation. The Act required the development of a comprehensive plan for the long-range management and protection of the conservation area and authorized research to assist in the development of appropriate management strategies. A 7-member San Pedro Riparian National Conservation Area Advisory Committee was established. Land acquisitions within the boundaries of the conservation area were authorized and the methods of acquisition specified. And finally, the Act required periodic reports to Congress and authorized appropriations necessary to carry out the provisions of the Act.

The San Pedro River Riparian Management Plan and Environmental Impact Statement was finalized in August of 1989 and the first report to Congress is being prepared this year. The major decisions for managing the San Pedro Riparian National Conservation Area are:

Recreation

Vehicle use is limited to "Designated Roads". Four moderate-sized developed recreation sites and seven small sites are permitted. Discharge of firearms for the purposes of regulated hunting is permitted during the period of September 1 to March 31 except for the public lands between Charleston and Highway 92.

Lands

The acquisition of additional lands for the NCA, by mutual agreement via exchanges or purchases, is authorized.

Water Resources

Water resources are to be used only to the extent necessary to achieve management objectives and to protect water rights.

Wildlife Habitat

Specific wildlife habitat improvement needs will be identified in a Habitat Management Plan (HMP) prepared in cooperation with Arizona Game and Fish Department. An evaluation will be made on the impacts of visitor use on wildlife and the riparian ecosystem. Trapping is prohibited.

Vegetation

Major vegetation improvement will be through natural processes. Abandoned farm fields may be used for experimental plantings or reseedings of native species. A fire management plan will be developed to guide the use of prescribed fire and wildfire suppression.

Soils/Watershed

Portions of existing berms and dikes will be removed to allow natural drainages to reestablish. Any erosion control structures or watershed improvements will require a site specific watershed project plan.

Cultural

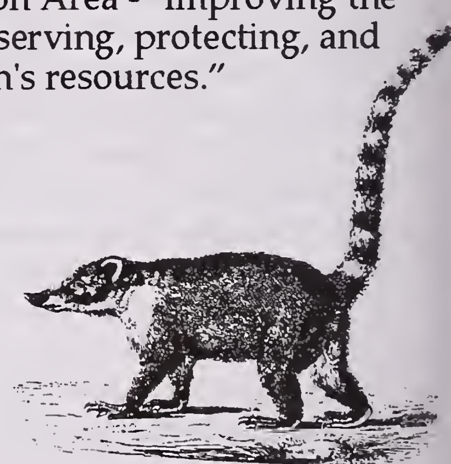
A Cultural Resource Management Plan will allocate cultural properties to either scientific use, management use, public use, socio-cultural use or conservation for future use.

Paleontological

Excavation and collection for paleontological research and interpretation is encouraged.

When the San Pedro lands were considered by Congress for designation as a National Conservation Area, certain restrictions in uses were identified. The intent of the legislation is that management will focus on the riparian ecosystems. Activities excluded by legislation include minerals development and off-road use by vehicles. An administrative decision excludes livestock grazing from the acquired lands for a 15 year period and provides an opportunity to monitor and evaluate natural changes in a riparian ecosystem.

The resource values that have drawn humanity to the river for 11,000 years are becoming widely recognized. In May of 1990, the Nature Conservancy designated the San Pedro River basin as one of the "Last Great Places" in the Western Hemisphere. The Bureau of Land Management is planning to construct an interpretive and educational center at the river in 1994 to serve a projected 100,000 visitors per year. All management actions are intended to fulfill the mission statement adopted by the San Pedro Riparian National Conservation Area - "Improving the quality of life by conserving, protecting, and enhancing the Nation's resources."



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Skagit Wild and Scenic River: Management Status and Issues

Robert Wissmar, Cindy Halbert, Jim Chu and Jim Doyle

Introduction

This paper reviews the management directions and major issues regarding the management of the Skagit Wild and Scenic River (WSR) corridor, Washington. We begin by describing the major characteristics of the "Wild & Scenic Rivers Act" (PL 90-542 and PL 95-625) and of the Skagit River Basin. We then examine the goals of the US Department of Agriculture Forest Service (FS) which has management authority for the Skagit WSR. The following sections review Forest Service management directions and the current status of management actions for protecting and maintaining the "outstanding and remarkable values" for which portions of the Skagit River were added into the National Wild & Scenic River system. We conclude by discussing the major problems which may influence the successful management of the Skagit WSR.

Wild & Scenic Rivers Act of 1968

The Wild & Scenic Rivers Act (PL 90-542) establishes that certain selected river areas which possess outstanding and remarkable values, shall be preserved in a free flowing condition. Furthermore, these rivers and their related adjacent land areas shall be protected for the benefit and enjoyment of present and future generations. A river area to be eligible must possess one or more "outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values." A designated river area is administered as one of the following:

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(1) Wild rivers areas - Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

(2) Scenic river areas - Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

(3) Recreational river areas - Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past."

Skagit Wild and Scenic River (WSR)

Portions of the Skagit River in Washington state were designated the Skagit Wild and Scenic River (WSR) in 1978 (PL 95-625)

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Table 1.
Common names of fish residing in the Skagit River basin

Anadromous species	Resident species
Chinook Salmon	Rainbow Trout
Coho Salmon	Eastern Brook Trout
Pink Salmon	Arctic Grayling
Chum Salmon	Bull Trout
Sockeye salmon	Sculpins (4 species)
Steelhead	Largescale Sucker
Sea-Run Cutthroat	Dace
Sea-Run Dolly Varden	Cutthroat Trout
	Golden Trout
	White Fish
	Kokanee Salmon

(Final Environmental Impact Statement, Mt. Baker-Snoqualmie N.F., 1990).

(Figures 1 and 2). Public Law 95-625 is an amendment to the Wild & Scenic Rivers Act (PL 90-542). The amendment includes a provision that allows the use of rip-rap to protect agricultural land along the recreational segment. This provision is unique to the Skagit WSR and is in conflict with the Wild & Scenic Rivers Act (PL 90-542) because rip-rap can impede the free-flowing nature of the river.

The Skagit WSR system was designated because it possesses outstandingly remarkable:

- wildlife represented by the largest wintering bald eagle population in the US outside Alaska;

- fish represented by five species of salmon and three species of anadromous trout populations; and

- outstanding scenic qualities.

The Skagit WSR system includes a recreational segment on the mainstem of the Skagit River and scenic segments on portions of the Sauk, Suiattle and Cascade Rivers (Figure 2). The recreational segment on the Skagit River is designated from Sedro Woolley 58.5 miles upstream to Bacon Creek. The scenic segments include: 21.8 miles on the Cascade River; 50.8 miles along the Sauk River, and 27.4 miles on the Suiattle River. The area within the WSR corridor, 38,939 acres, is approximately one quarter of a mile wide on either side of the river.

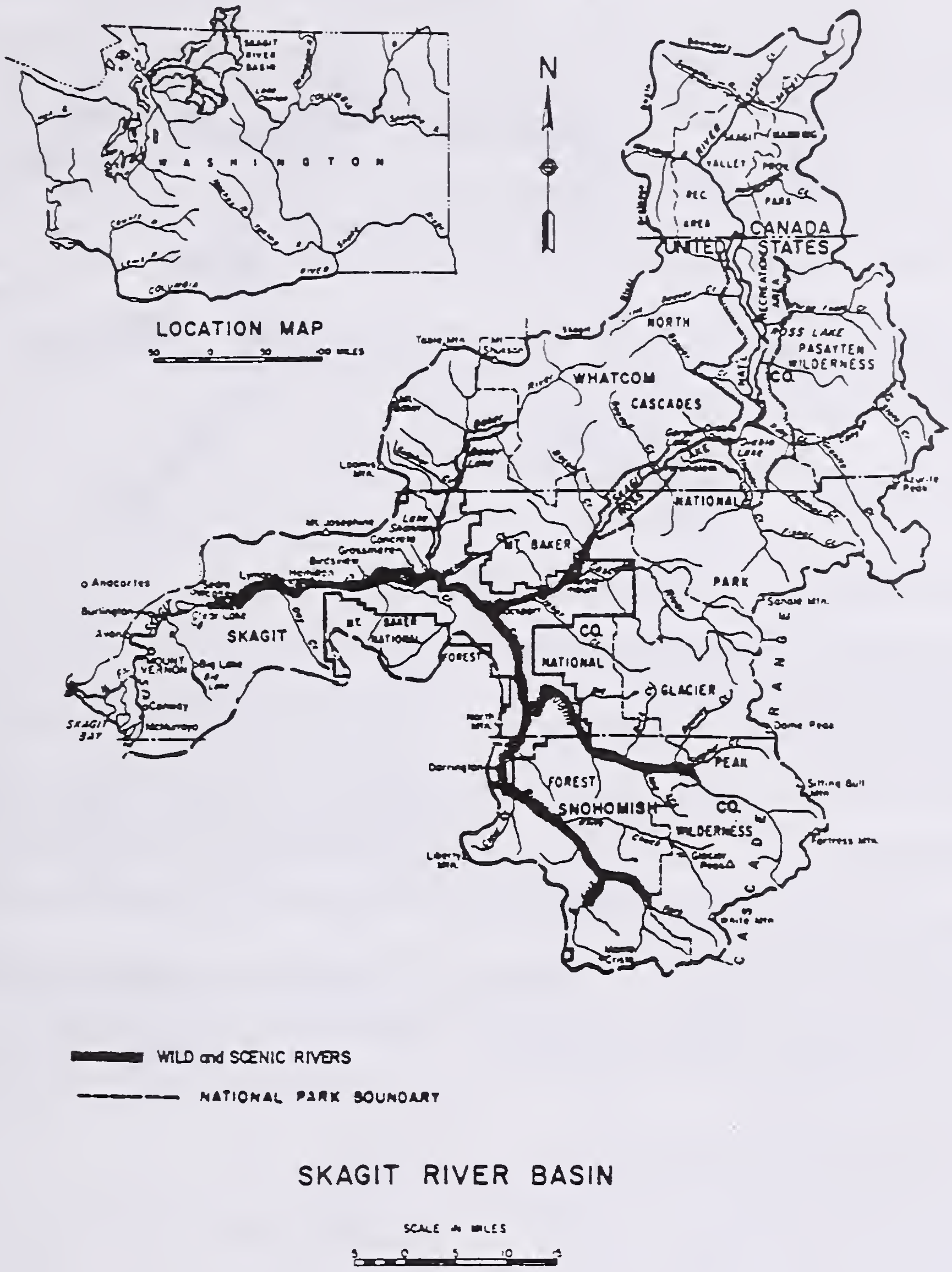
Characteristics of the Skagit River Basin

The Skagit River basin is located in the North Cascade Mountains and empties into Puget Sound (Figure 1). The river basin is the largest (3,100 miles)) in Puget Sound (Williams 1975) and second only to the Columbia River in Washington state. The basin's elevations range from sea level near Puget Sound to over 8000 feet at the crest of the Cascade Mountains. The climate of the basin is a West Coast marine climate controlled by Pacific Ocean currents. Characteristically the mountains are steep and covered with forests except above timberline where alpine peaks, snow fields and glaciers persist. Although lower portions of the Skagit River valley have extensive floodplains (90,000 acres), floodplains are essentially absent above the confluence of the Cascade River. The water quality of the basin is excellent.

The Skagit River basin provides a variety of recreational uses including camping, fishing, rafting, mountain climbing, skiing, hunting, hiking, tourism and wildlife viewing. The Skagit is the winter habitat for the largest population of bald eagles in the lower 48 states. During the fall and winter bald eagles can easily be viewed feeding on salmon carcasses in undeveloped reaches. A large eagle sanctuary has been established by The Nature Conservancy on the Skagit recreation segment upstream from the Sauk River confluence (Final Environmental Impact Statement, Mt. Baker-Snoqualmie N.F., 1990).

The Skagit River is the only large river system in the state that contains all five native salmon species and three species of anadromous trout. They include chinook, coho, pink, sockeye, chum and steelhead and cutthroat trout (Table 1). Within the Skagit

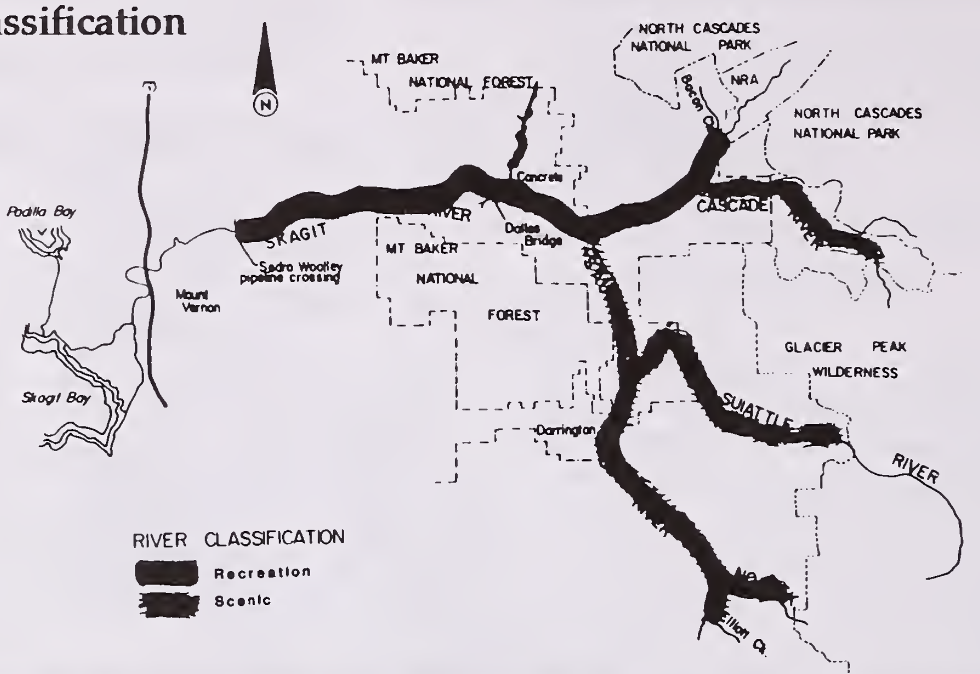
Figure 1 Map of the Skagit River Basin



miles of optimum anadromous fish spawning and rearing habitats capable of producing and sustaining wild populations of anadromous fish. This type of habitat is in short supply in the State of Washington. Fish production in the Skagit River's tributaries is significant to the sport, subsistence and commercial fisheries in the Puget Sound region. Production of anadromous and resident fish within these river basins include fish that spawn naturally, as well as hatchery fry that are out-planted to suitable areas to imprint and rear.

Maintenance, protection and improvement of these fish stocks and habitats is a very significant issue with the public, State and federal resource managers and the numerous Point-No-Point Treaty Tribes. Chinook, coho, pink, chum, and sockeye along with steelhead and resident trout are extensively managed because they are significant sport/commercial or subsistence species, and because their viability is sensitive to environmental change. The Forest Service is responsible for the management of *fish habitats* on their lands. The management of salmon *populations* is the responsibility of the Washington State

Figure 2. River Classification

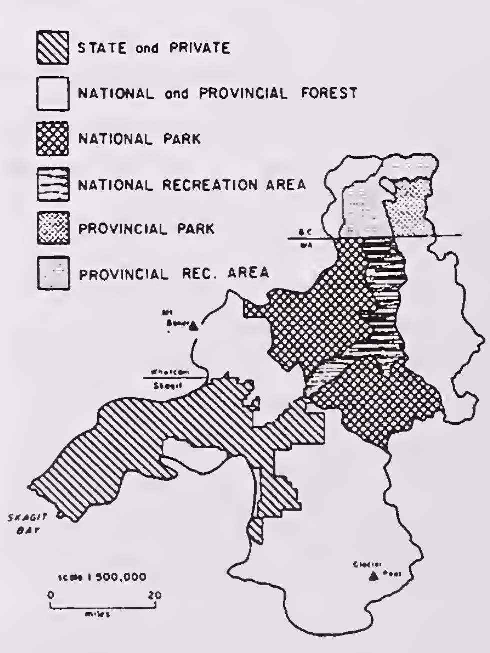


Department of Fisheries (WDF) and resident fish and anadromous trout populations is assigned to the Washington State Department of Wildlife (WDW).

Management Authority

The Skagit WSR system is managed by the US Department of Agriculture Forest Service according to the Final River Management Analysis and Plan: Skagit River (River Management Analysis and Plan 1983). The development of the River Management Analysis and Plan (1983) was required by PL 90-542. The regulation of surface use of waters within the Skagit WSR system is by the Forest Service (Mt. Baker-Snoqualmie National Forest). Forest Service management of National Forest lands within the corridor is according to laws and regulations pertaining to National Forest lands. The Mt. Baker-Snoqualmie National Forest administers 44% of the land in the Skagit WSR corridor which includes the three *scenic* river segments (Figure 2). Laws of other agencies govern the other 56% of the land in the corridor (50% private and 6% State of Washington), Figure 3. Although the Forest Service originally recommended (Skagit Final Environmental Statement (1977) that the State of Washington fully administer the Skagit recreational segment, there is currently no State administration of the Skagit WSR *recreation* segment. Administrative and priority changes by the State resulted in the State not

Figure 3 Land Ownership and Management in the Skagit River Watershed



Land Ownership and Management in the Skagit River Watershed

Table 2. Management goals for protecting wildlife and fish, and for maintaining the quality and integrity of the Skagit WSR corridor
(River Management Analysis and Plan 1983)

"Provide for maximum involvement of local, county, state, and other federal agencies in management and administration of the Skagit Wild and Scenic River System."
"Minimize conflicts between public use and private landowners within the Wild & Scenic River corridor."
"Provide for the conservation and continuation of the patterns of agriculture, forests, and structures to retain the environments of primitive, rural and pastoral landscapes."
"Protect and enhance the various landscapes visible from the river, as well as from its banks."
"Provide for public access to and along banks of the Skagit, Cascade, Sauk & Suiattle rivers consistent with other resource capabilities, and the 1982 inter-agency guidelines."
"Allow timber management for commodity purposes consistent with the 1968 Wild and Scenic Rivers Act and 1982 inter-agency guidelines."
"Protect the cultural resources within the Skagit Wild & Scenic River system corridor."
"Protect and maintain wildlife habitat."
"Protect and maintain fish habitat."
"Maintain and enhance the identified important eagle habitat within the WSR within the Skagit Wild & Scenic River corridor."
"Provide coordination with the National Park Service river management of the Skagit River above Bacon Creek."
"Provide coordination with The Nature Conservancy management of the Bald Eagle Natural Area."
"Improve the opportunities for a wide variety of water-related recreation opportunities consistent with the river character and the 1968 WSR Act."
"Maintain or improve present water quality."
"Maintain and enhance free-flowing characteristics of the rivers."

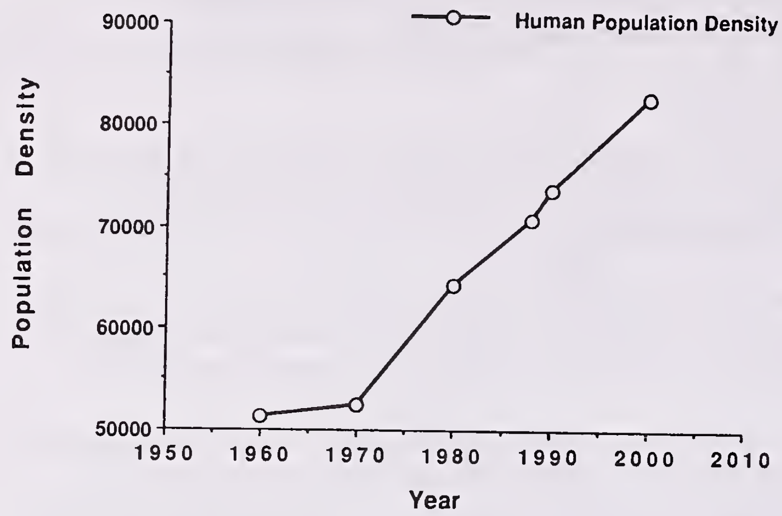
being involved in the management of the Skagit WSR system (River Management Analysis and Plan 1983).

The Wild & Scenic Rivers Act 1968 (PL 90-542) calls for establishing an average of not more than 320 acres per mile on both sides of the river. Under the Act funds may be appropriated for acquiring lands only within the designated boundaries. Most non-private lands can only be acquired by the consent of the appropriate governing body. State lands may be acquired only by donation. Private owners must be paid the fair market value of the property on the date of acquisition. Condemnation authority can be used by the federal government to access and conservation easements. Public Law (PL 95-625) states that "not more than $11,734,000 for the acquisition of lands or interest in lands and not more than $322,000 for development."

Management goals

Fifteen management goals for protecting wildlife and fish and for maintaining the quality and integrity of the corridor are presented under the River Management Analysis and Plan (1983) of the Mt. Baker-Snoqualmie National Forest (Table 2). The goals were formulated according to Public Law 90-542. The management goals were not prioritized by the Mt. Baker-Snoqualmie National Forest. The River Management Analysis and Plan (1983) set numerous "management directions" or objectives to meet the aforementioned goals. However, the management directions were not linked to specific goals. The following section provides a brief review of select management directions relative to the status of current actions for protecting the outstanding and remarkable values of the Skagit WSR corridor.

Figure 4



Population density of Skagit County, 1960 to 2000

Status of Management Directions

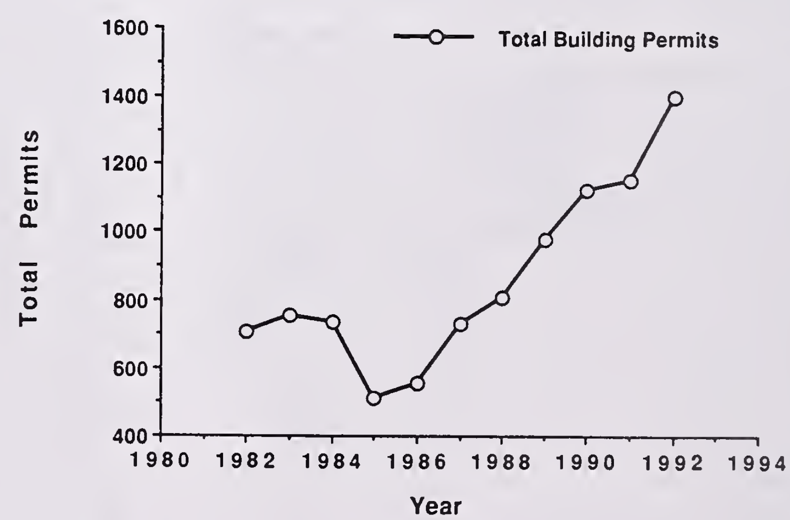
A summary of select management and actions directions is presented in Table 3. The management directions are listed along with management actions taken since the designation of the Skagit WSR. The management directions in Table 3 are summarized by the following sub-sections of the River Management Analysis and Plan (1983): Administration, Native American Treaty Rights, Land ownership, Floodplains, Recreation, Wildlife, Fisheries,Vegetation Management, andVisual Resource.

The summary in Table 3 gives the status of current actions that should help protect and maintain overwintering bald eagle populations, salmon populations and habitats and the scenic qualities of the Skagit WSR corridor. This summary represents an inventory of management actions taken to date. Discussion of the effectiveness of these activities is not possible because of the recent implementation of most management actions and the lack of long-term monitoring data. However, additional information pertaining to the current conditions of wildlife, fish and scenic values of the Skagit WSR corridor is provided by our discussion of problems influencing the management of the Skagit WSR.

Problems Influencing the Management of the Skagit WSR

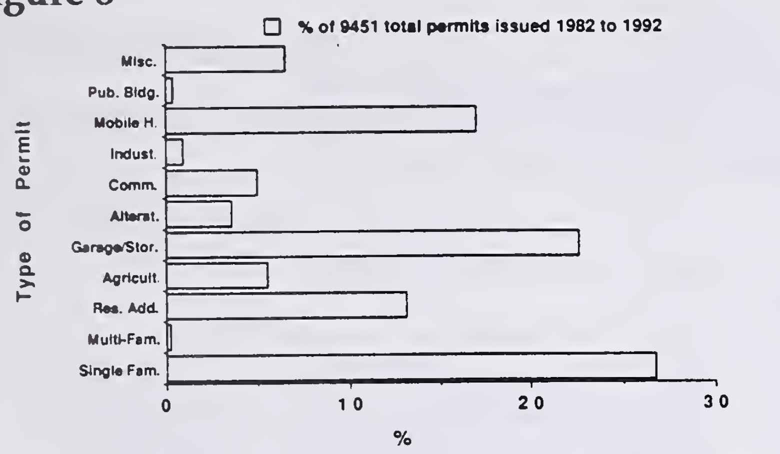
Some of the major problems facing the management of the Skagit WSR involve increases in population growth, land development, timber harvest and recreational uses as well as related changes in wildlife, fish and scenic values of the Skagit WSR corridor. The altered values include declines in scenic and habitat qualities because of timber harvest practices inside and outside the corridor, the disturbance of wintering bald eagles by recreational activities and declines in fish stocks because of habitat degradation and overfishing. Other equally important problems influencing the management of the Skagit WSR, but not described in this document, include hydropower development and the alteration of river flow regimes, modification of shorelines by rip-raping within both recreation and scenic segments by highway construction.

Figure 5



Building permits issued, Skagit County 1982 to 1992.

Figure 6



Building Permits Issued in Skagit County, 1982 to 1992.

Many of these problems reflect the increased urbanization of Puget Sound. The Puget Sound region in one of the fastest growing areas in the U.S. In 1988 over 2.6 million people or 50% of Washington State's population resided in the Puget Sound region.

a. Increases in Population Growth and Land Development

Most of the Skagit River drainage basin and all of the WSR corridor fall within Skagit County. Although Skagit County is the least populated county in the Puget Sound region, this county experienced a 37% increase in population between 1970 and 1990. Twenty-two percent of the increase occurred between 1970 and 1980 and 15% between 1980 and 1990. The County's population is presently projected to increase another 12% between 1990 and 2000. (Figure 4.) (Final Environmental Impact Statement, Mt. Baker-Snoqualmie N.F. 1990).

Along with the increased population growth during the past decade, greater land development is reflected by the increasing number of building permits being issued. Building permits issued in Skagit County increased 98% between 1982 and 1992 (Figure 5). A total of 9,451 total permits were issued between 1982-1992. The majority of the permits issued were for single family (27%), garages and storage (23%), mobile homes (17%) and residential additions (13%). (Figure 6)

The general spatial patterns of land-use within the Skagit River basin are shown in Figure 7. Although most of the urbanization is in the downstream portion of the Skagit River valley, the pattern of increased home building and fragmentation of farms appears to be spreading upstream into rural and

Figure 7

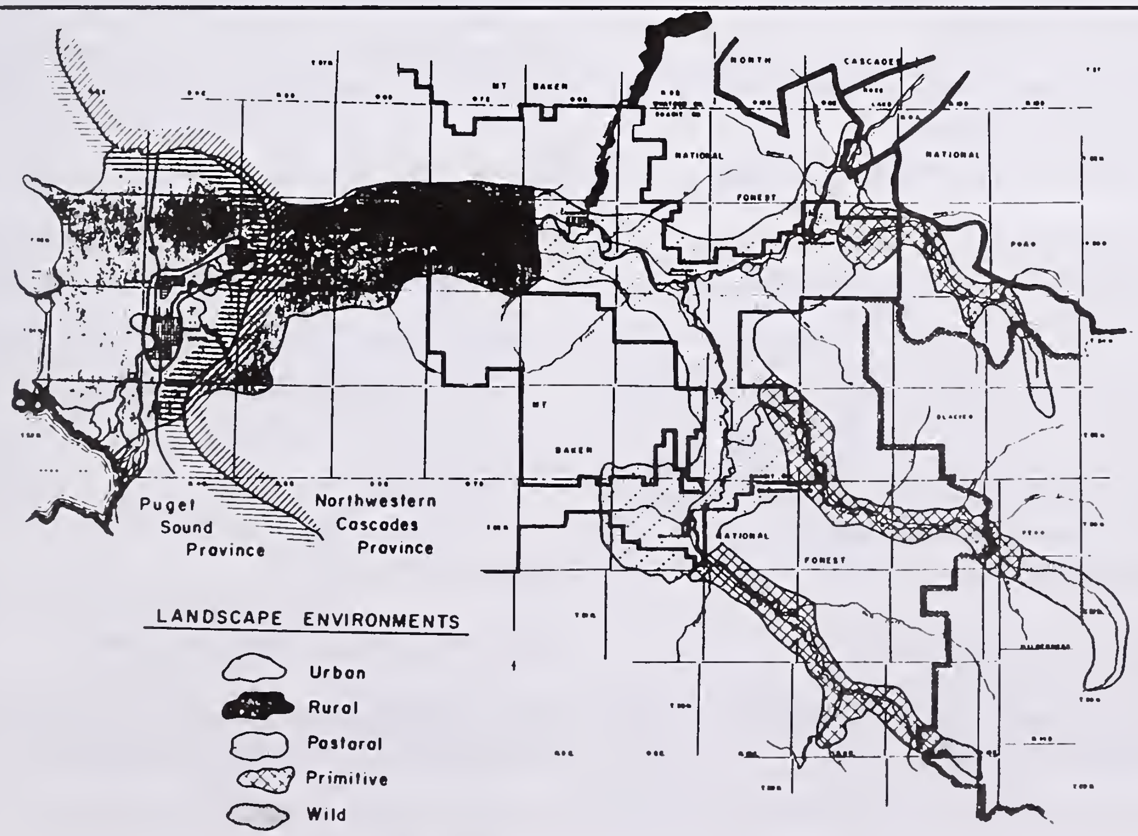


Table 3.
Summary of Forest Service (FS) management directions and status of actions taken since the Skagit Wild and Scenic River (WSR) designation in 1978.
These select management directions are considered important in protecting wildlife and fisheries values. The management directions are summarized by sub-sections of the River Management Analysis and Plan (1983).

Management Directions by Sub-section	Status
Administration	
(1) Review WSR Plan 1985 and 1990	*WSR incorporated into FS Forest Plan in 1990
(2) Develop agreements with other government agencies to protect river	*EPA water quality monitoring plan (1993) *FS reviews timber sales for Washington to State Dept. of Natural Resources (DNR)
(3) FS with other agencies, prepare zoning ordinance and monitor on the-ground uses	*WSR field monitoring with Skagit County, DNR State fisheries (WDF) and US Army Corps and Eng. (CE)
Native American Treaty Rights	
(4) Update "Plan" to accommodate the Boldt ruling on salmon harvest	*FS and tribal nations area co-managers for fish habitat
(5) Coordinate with Skagit System Cooperative (SCC Tribes)	*FS has SCC support for watershed restoration projects and potential land acquisitions *FS initiated SCC cost share-cooperative projects
Land ownership	
(6) Obtain conservation easements to protect land threatened with development or non-conforming use	*FS has developed a draft acquisition plan to protect or enhance WSR
Floodplains	
(7) Encourage the coordination of all floodplain and wetland management programs	*FS working with Skagit County, WDF, FEMA, and CE on floodplain management plans
(8) Obtain Corps of Engineers "MOU" to review all 404 Section 10 permits	*FS and CE reviewing draft agreement (enforcement, monitoring and compliance)
(9) Prepare or review Environmental Assessments on all bankside modification projects	*Skagit County currently coordinating bank side projects with FS and WDF
(10) Implement regulations as needed	*FS reviewing effectiveness of permits
Recreation	
(11) Initiate interim procedures and determine demand and use capability of the rivers	*FS developing a community task force that will address the amount and type of recreation
(12) Monitor existing recreation use	*FS River Ranger monitors recreation use
(13) Monitor and protect spawning from recreation use on the upper Sauk R.	*No permits issued (e.g., rafting)
(14)Determine recreational use of the four rivers, resource capabilities and proper levels of use and management	*Same as 11
(15) Manage river use activities	*Same as 11, 12 &13
Wildlife	
(16) Initiate a wildlife species inventory	*FS has habitat monitoring project
(17)Monitor trends in Threatened and Endangered species	*FS has habitat T&ES monitoring project and has identified habitat conservation areas

Table 3 (Continued)

Management Direction by Sub-section	Status
Wildlife (cont)	
(18) Identify disturbance factors between use activities and eagles	*FS funded a 5 year study that has assessed effects of recreation on bald eagles *Same as 11
(19) Regulate human use if conflicts develop with eagle use	*Same as 11
(20) Protect eagle habitat rated excellent	*Same as 11, 12, 13,16 & 18
(21) Establish eagle night roost protection zones within the National Forest	*Same as 11, 12, 13,16 & 18
(22) Complete eagle habitat rating for scenic rivers	*Same as 11, 12, 13,16 & 18
(23) Complete formal consultation with U.S. Fish and Wildlife Service	*Informal consultations in progress
(24) Conduct salmon carcasses inventory on the scenic rivers and eagle distribution on Cascade River	*Same as 12 & 16
Fisheries	
(25) Rate fish habitat	*Same as 12 & 16
(26) Coordinate fish habitat needs with the State	*Informal coordination in progress
27) Participate in Standing Committee Flow Agreement	*Skagit River Hydroelectric Project FERC # 553 accepted by the FS (1991), see References.
(28) Establish a water monitoring system utilizing existing water monitoring programs when possible	*Same as 2
(29) Work with State to retain the integrity of gravel bars	*Informal coordination in progress
Vegetation Management	
(30) Timber harvests in WSR conducted to avoid adverse impacts on Wildlife, Fisheries & Visual Visual Resource	*FS can review DNR timber harvest permits
(31) Coordinate with counties on shoreline classification	*FS procedures developed in Forest Plan 1990

pastoral lands of the recreation segment. The major sources of employment supporting increases in population growth and land development and changes in land-use patterns in Skagit County has been agriculture and the forest products industry. However, tourism, trade and the service industry are growing in importance (Washington State OFM 1989).

b. Timber Harvest Problems

Settlement and timber harvesting began in the Skagit River basin in the late 1880s. Timber harvest levels were low until the turn of the century. Records show that logging on state lands increased in the 1920s and 1940s as the virgin forests were harvested and then declined through the 50s and 60s. During the 70s logging increased again as forests were reentered for second cuttings. Annual harvest data for Forest Service lands are compared to decade totals for state lands in Figure 8 (Flooding in West Cascade Mountain River Basins, Mt. Baker-Snoqualmie N.F. 1992).

From 1950 to the mid 1980s most of the timber harvest shifted to Forest Service lands progressing from lower elevations to higher slopes. As timber harvest activities and roads moved onto steeper slopes they entered

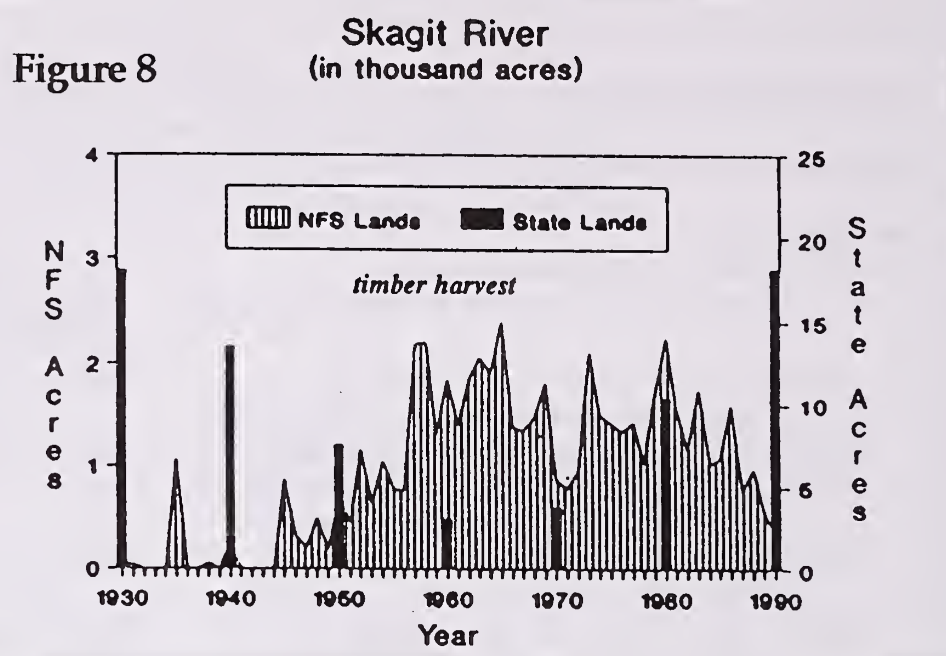


Figure 8

rain-on snow elevations. Rain-on-snow elevations are where rapid snow melt can occur because of warm Pacific rains. The rapid snow melt leads to high surface water runoff and flooding. Timber harvest practices and road building at rain-on-snow zones can greatly alter snow melt and water runoff patterns and increase erosion. The increased occurrences of sources, delivery and impacts of sediment and debris have damaged tributary streams, riparian habitats and different segments of the WSR corridor. Forest management practices can lead to land failures and debris flows in streams that pass through tributaries to the WSR corridor. Examples of recent debris flow events in 1990 include those of Lime and Straight Creeks that reached the Suiattle scenic segment and of Jackman Creek that reached the Skagit recreational segment. Timber harvest activities on State, Federal and private lands, when combined with population and developmental trends and forest conversions to other land-uses within the Skagit River's floodplains, have all greatly affected the way watersheds respond to storm events. These conditions confounded flood management throughout the river basin (Kunzler 1991).

c. Conflicts Between Wintering Bald Eagles and Recreational Use

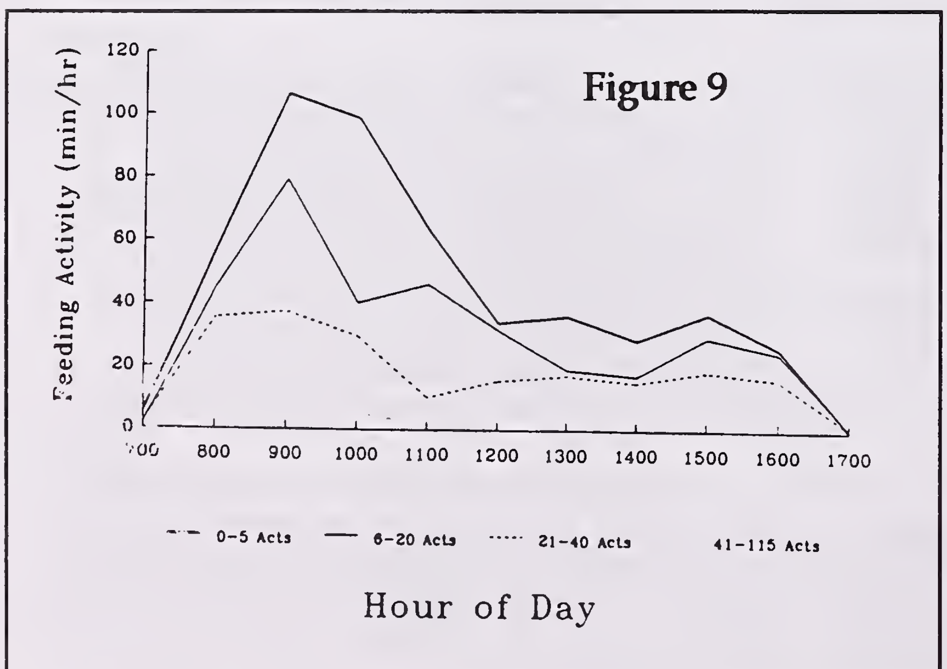


Figure 9

A variety of recreational uses occur within the Skagit WSR. A major concern is the growth of recreational use as exemplified by conflicts between wintering bald eagles and recreational use. Shoreline observers and float trips to view wintering bald eagles and float trips for fishing are growing in popularity. Other recreational pressures within the corridor include one-third of the of the total white-water river rafting in the Mt. Baker-Snoqualmie N.F. The Skagit drainage basin is also becoming increasingly recognized has having a diverse salmonid fisheries of national significance.

As part of the Forest Service management of the WSR they supported a 5 year study of the effects of recreational activity on wintering bald eagles (*Haliaeetus leucocephalus*) on 155 km of the Skagit River WSR (Stalmaster et al 1991). The study focused on the Skagit River Bald Eagles Natural Area (SRBENA1) which is jointly managed by WDW and the Nature Conservancy. The SRBENA1 preserves eagle feeding habitat were chum salmon (*Oncorhynchus keta*) is the primary food. The study showed that winter use by birds and recreationists were highest from December through February. A maximum of 501 eagles/day and 115 people/day were observed with the highest eagle densities occurring in the SRBENA1 and Illabot areas. Eagles were found to be especially sensitive to motorboats

Table 4.
Management jurisdictions within and adjacent the Skagit WSR.

Federal	State
Dept. Of Interior Agencies	Washington Dept. of Fisheries
U.S. Fish & Wildlife Service	Washington Dept. of Wildlife
National Park Service	Washington Dept. of Ecology
U.S. Geological Survey	Depart. of Natural Resources
Bonneville Power Administration	Dept. of State Parks
Bureau of Reclamation	Dept. of Transportation
Bureau of Indian Affairs	Dept. of Social Health Services
Bureau of Land Management	
Department of Agriculture	**County**
U.S. Forest Service	Skagit County
Soil Conservation Service	Snohomish County
Dept. of Transportation	
Federal Highway Administration	**Native American Tribes**
	Skagit System Cooperative
Environmental Protection Agency	
U.S. Army Corps of Engineers	
Federal Emergency Management Agency	
Dept of Commerce	
National Marine Fisheries Service	

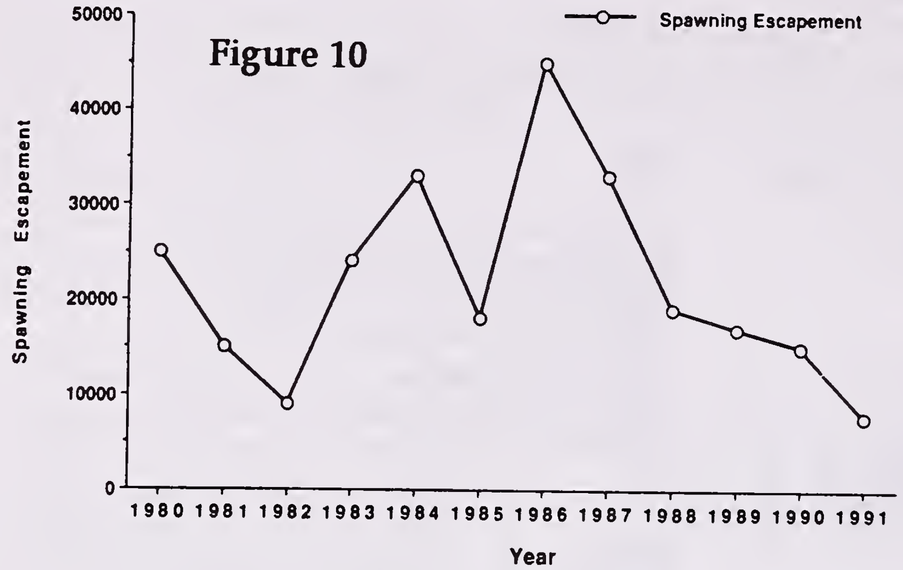
and foot traffic with increasing disturbance activities causing declines in eagle densities and feeding behavior, Stalmaster et al 1991 (Figure 9). Numbers of sub-adults feeding on gravel bars declined faster than adults and sub-adults were slower to resume feeding. Recovery behavior or the resumption of feeding activity after disturbance events was high for activities early in the sequence of daily disturbance events. As the frequency of events increased the feeding activity progressively decreased. For example, after 20 disturbance events the remaining eagles were reluctant to eat, while after 40 events the feeding was nil. The study recommended public education programs and temporal management of recreationists to reduce disruptions of eagles by visitors.

d. Declines in Salmon Stocks

The current status of the five salmon stocks in the Skagit River basin has been defined in a recent report by the the Pacific Fisheries Management Council, the Pacific Northwest's regulatory body for commercial fisheries. The report indicates fish being lost because of overharvesting and the degradation of riverine habitats (Pacific Fisheries Management Council 1992). The degradation of habitats relates to the previously discussed problems (e.g., land development and timber harvest practices) as well as altered flows on the Baker and upper Skagit Rivers by large scale hydropower operations. Salmon are used as indicator species of ecosystem and habitat health by government agencies, the Tribes and environmental organizations. Declines in numbers of salmon suggests that both the fish stocks and the Skagit River ecosystem are at risk. Further declines in the salmon stocks could become a major problem to fisherman if any of the species are listed as threatened or even worse as endangered.

Of the salmon stocks of the Skagit River basin, coho and spring chinook salmon appear to be declining the most (Pacific Fisheries Management Council 1992). The escapement goals for the number of returning coho (30,000 fish) and spring chinook (3,000 fish) to spawn has not been met since 1988 (Pacific

Figure 10



Coho salmon spawning escapement, Skagit River 1981 to 1991.

Fisheries Management Council 1992). The coho salmon escapement has decreased from 45,000 fish in 1986 have decreased to very low levels after 1987, with only 7,800 fish in 1991 (Figure 10). The poor status of the stocks is forcing regulators to curtail oceanic commercial and river harvests and causing much controversy and demand for solutions to the problem.

The American Fisheries Society (AFS) recently provided a list of 214 depleted native naturally-spawning Pacific Salmon stocks from the Pacific Northwest and California (Nehlsen et al,1991). Nehlsen et al. (1991) reported for the Baker River, an impounded major tributary of the Skagit River, that the sockeye stock is a threatened population. A threatened population is defined as one with a declining production rate, a ratio of approximately one adult returning to spawn per parent spawner, and little likelihood of an increasing adult production rate under existing conditions. Although the salmon stocks *other* than sockeye do not appear threatened at the present time, the designation of sockeye does signal that the Skagit River and the WSR is experiencing altered watershed and stream conditions. At present, no federally-listed threatened or endangered salmonid species are known to use waters in the Skagit River basin. However, suspected bull trout habitat exists in these waters and bull trout are presently considered by the U.S. Forest Service as a *sensitive* species (Final Environmental Impact Statement, Mt. Baker-Snoqualmie N.F., 1990). It should be noted that the presence of FERC licensed and future hydropower developments have and will continue to influence fish habitats and populations inside and outside the WSR corridor.

e. Land Ownership and Jurisdictional Problems

Most of the Forest Service's management directives come from the Wild & Scenic Rivers Act (PL 90-542) and the River Management Analysis and Plan (1983). When federal lands are included in the corridor, administration is usually by the Department of Interior or the Department of Agriculture depending on ownership. As directed by PL 90-542, because the Forest Service is the principal federal holder of land within the Skagit WSR, it is responsible for managing all federal lands in the corridor. Federal lands only cover 44% of the corridor. This situation presents a large problem for any effective management of the entire corridor. The Forest Service as the administrator of Skagit River WSR corridor has no jurisdiction over the remaining State and private lands that cover the recreation segment of the corridor. Although subject to some State regulation, the State has not managed the recreation segment to protect the values of the WSR designation.

Land ownerships, their fragmented spatial patterns and diverse management practices within the corridor all complicate the effective management of the Skagit WSR by the Forest Service (Figure 3). The spatial patterns of the non-federal land holdings cover the entire recreational segment and effectively separate the Forest Service's Sauk and Suiattle River scenic segments from the Cascade River scenic segment. These patterns of State and private holdings exists throughout the floodplains and mainstem watersheds of the Skagit River creating a large hole within surrounding Forest Service lands (Figure 2). The

Table 5. Summary of issues and problems that influence the success of the Skagit WSR system	
Management Sub-sections	**Issues & Problems**
All Sub-sections	*Increased population growth *Increased land development *Poor State growth management plans *No river basin management plan *Wild & Scenic Rivers Act 1968 (PL 90-542) may not have adequate provisions for dealing with complex river basin social, economic & environmental conditions
Administration **Land ownership** **Vegetation Management** **Visual Resource** **Floodplains**	*Forest Service (FS) management by default *FS owns less than half the WSR corridor (44%) *Land ownership fragmented in WSR corridor &(Forest Service 44%, Private 50%, State 6%) *FS has no jurisdiction over timber harvest on other lands *FS has no jurisdiction over land conversions *Agencies have incompatible management jurisdictions and records *Most agencies keep poor records
Eagles & Recreation	*Human disturbance of bald eagles *No consensus of different agencies on implementing Stalmaster et al (1991) recommendations for minimizing the effects of recreation on bald eagles.
Salmon **Native American Treaty Rights & Recreation**	*Overfishing *Habitat destruction

* The sub-sections are from the River Management Analysis and Plan (1983).

problem of the lack of the Forest Service jurisdiction over some of these non-federal lands was to be partially addressed by the acquisition of various lands holdings. The lands were to be acquired by the Forest Service using funds to be appropriated (PL 95-625) after the 1978 designation. After more than a decade of delay, Congress provided funds in 1991 to acquire land for access. The Forest Service has currently used an the 1991 appropriation of $1.8 million dollars to acquire 613 acres within the corridor and 220 acres outside of the corridor.

As previously mentioned, various jurisdictional responsibilities of different agencies (Table 4) within Skagit County complicates the effective management of the Skagit WSR by the Forest Service. The Forest Service has the responsibility of reviewing "administrative and management policies, regulations, contracts, and plans affecting lands under their respective jurisdictions which include, border upon, or are adjacent to the rivers" as designated by (PL 90-542). Particular attention is required for "scheduled timber harvesting, road construction, and similar activities which might be contrary to the purposes of the Act". None of these Forest Service responsibilities extend to non-federal lands. However, a recent arrangement with the State of Washington's Department of Natural Resources (DNR) allows the Mt. Baker-Snoqualmie N.F. to assist in reviews of timber sales on non-federal lands. Nevertheless, numerous obstacles prevent effective monitoring of various permits and more effective cooperation between different agencies within the Skagit River basin.

Some major obstacles include the incompatibility of information data bases that relate to different record keeping procedures and jurisdictional responsibilities of federal, State and local agencies. These problem are evident in the lack of long-term records for permits, monitoring of land conversion rates. In the case of DNR, managers commonly keep short-term records for land conversions that have been summarized by large management regions. In most cases, these DNR management regions do not correspond with the jurisdictions of the County and other agencies.

The array of agencies and different jurisdictional responsibilities contributes further to the incompatibility of information data bases. The complexities of managing the corridor are enormous when there are 26 agencies or entities having different management responsibilities within the designated WSR corridor (Table 4). Such conditions have tended to delay and limit the implementation and management of the Skagit WSR corridor and the original intent of designations put forth by the Wild & Scenic Rivers Act (PL 90-542) of 1968.

Conclusions

Although the Forest Service has the authority to administer federal lands within the Skagit WSR, it has no official "management authority" or enforcement capabilities over state and private land occurring within the corridor. This management situation has also been exacerbated by little past federal administrative and Forest Service priorities for management of river ecosystems and recreational demands.

For example, although the Skagit River was designated as WSR in 1978, funds to administer the corridor were given a lower priority in the Mt. Baker-Snoqualmie National Forest's budget until 1986 (Potter, personal communication). Furthermore, the majority of these funds, about 90%, that are expended on the management of the WSR corridor come from the "Recreation" division of the Forest Service. Minimal Forest funds have come from the "Watershed" and "Fish and Wildlife" divisions. Funds used by these latter two divisions for WSR purposes include "Forest-wide" activities concerning flood damage assessments, enhancement and monitoring of of salmon habitats. More importantly, additional funds that were identified in (PL 95-625) to be appropriated by Congress for acquiring land easements within the corridor have also been slow in coming. Congress did not appropriate these funds until 1991. The result has been an delay of nearly a decade in active implementation and management of the Skagit WSR corridor.

We conclude that the above problems influencing the management of the Skagit WSR, time delays in funding and incompatible management and jurisdictional authorities have all combined to compromise the Forest Service's desired management directions for protecting and enhancing the "outstanding and remarkable values" for which portions of the Skagit River were added into the National Wild & Scenic River system. The issues and problems that influence the success of the Skagit WSR system are summarized by management sub-sections in Table 5. The problems of incompatible management goals and authorities are especially evident in the the lack of Forest Service management and jurisdictional responsibilities over the non-federal lands occurring within the corridor. This incompatibility stems from fragmented land ownership patterns and the numerous agencies managing within and outside the corridor. The complexities of managing the corridor are enormous when there are 26 agencies or entities having management authority or responsibilities within the designated WSR corridor. These complexities could expand given increases in population growth, land development, habitat destruction and diverse land ownership. Nevertheless, a recent favorable development has been the Forest Service's efforts in implementing watershed restoration initiatives on Forest lands. Such restoration efforts are also desired for State and private lands.

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CHAPTER TWELVE

SOME SUCCESS STORIES

Bluewater Creek, New Mexico
Duck Creek, Idaho
Verde River, Arizona

The Paradigm Shift

"What I believe we have seen at this conference is a shift in the essential requisites for successful land management. River and riparian management is simply the example before us. Science and the humanities have both taught us to value sustainable ecosystems. Ecology has taught us to integrate and consider second and third order consequences. Art touches a deeper chord in a human spirit. Our society is complex and so are people. It is entirely possible for a person to love the land and make a living from it too. Collectively we must.

It is also possible for one's love of, and life on, the land to cause pain to mother Earth. Sometimes that pain is visible and it hurts us to inflict the pain. Sometimes the pain is not recognized or not recognizable. To stop inflicting pain, people must have options and usually must have help to see those options or the need for them.

Not too many years ago many of us began to recognize the pain. Many of us changed our lives. We perceived from the exponential curves that time was short. To stop the pain we therefore became willing to inflict a lesser pain on our neighbors, sometimes for their own good. But the neighbors became defensive. Even if they loved the earth, they may have loved their family or their future more. To express love for the earth, people must feel safe. Many of us have found help with the communication skills needed to become part of a diverse community of neighbors. We have been richly rewarded by joint pursuit of a shared vision. We have stories to share. These experiences have enriched our lives and given us hope. With hope, we became capable of love. We see that we are all one people and one sustainable family. "

Sherm Swanson

2065

The Bluewater Creek Story--Rebuilding a Land Ethic

John Caffrey and Jim Rivers

History

The Bluewater Story began in the last century. Early establishment of adjacent settlements and the transcontinental railroad brought abusive land practices, including clearcutting of the vast stands of ponderosa pine and mixed conifer, heavy overgrazing by sheep and cattle, and a multitude of poorly-located and high-density roads. Identified in the Cibola National Forest Land and Resource Management Plan as an issue, Bluewater began as a watershed improvement emphasis area. The project scope changed as more people became involved, and the complexity of resource conflicts became apparent. It was a highly visible area, and the public was interested--and concerned--with its poor condition. The project blossomed into all resource areas, and represented new thinking in integrated land management; spawned from the Forest planning effort work begun in 1980. Work continues to this day, although most of the work has been accomplished and the results are now being enjoyed.

The Cibola National Forest took on a monumental task--Bluewater Creek is a major watershed (51,000 acres) in the Zuni Mountains of northwestern New Mexico. It is the major source of water to Bluewater Lake, a very popular fishing lake in the state, and important to the local economy for tourism and agriculture. Timbering and grazing abuses began as early as 1840, and later railroad logging and sheep grazing left this privately-held watershed in a denuded condition with eroding stream channels, active cut banks, a lack of riparian vegetation and extremely high silt loading flowing into Bluewater Lake.

Wetlands and riparian areas were common throughout the Zuni Mountains, and encumbered early commercial transportation. Railroad grades and roads proliferated in the wide meadowlands of the upper watershed. As the existing roads eroded in the fragile soils, new ones were made. The trout fishery that had once existed in the creek was decimated by sediment-loading, high water temperatures, peak water flows, lack of woody riparian cover and low aquatic diversity. It was a classic tale of man-caused exploitation, similar to conditions reflecting worst-case scenarios of land abuse that led toward establishment of the forest reserves.

In the mid-1940s, concerned local citizens petitioned the state of New Mexico and the Forest Service to acquire the lands. This acquisition was finally completed in 1947. Unfortunately, grazing reservations in the areas persisted until 1973, postponing needed recovery efforts. The problems inherited with the land acquisitions were staggering. Cattle grazing was still a problem in the Bluewater drainage with upward of 15,000 head of cattle

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and sheep trailed through the canyon to distant summer ranges. Poorly-located roads, loss of ground cover, and widespread headcutting lowered water tables in many area. Rabbitbrush was rapidly invading bottomlands that had formerly been wet meadows. Off-road vehicle use was compounding ongoing meadow erosion and causing sheet erosion on adjacent hillsides. Heavy recreation users seeking the cool environment of the creek were keeping stream banks eroded and raw, as well as contributing to water quality problems.

Tackling the Rehabilitation

Although identified in the Forest planning process in 1981, work did not begin in earnest until 1986, with some riparian plantings, stream structure maintenance and water quality monitoring continuing. The early watershed plan addressed the basic indicators--Forest Service and Soil Conservation Service baseline monitoring (sediment loading, aquatic invertebrate surveys) recommended attacking the source of the stream degradation problem.

The Forest Plan guided the program to address overall health of the entire Bluewater Creek watershed. We were talking about vegetative management on a grand scale. Included in the planning was a careful survey of the hydrologic function of the creek and its tributaries, soil capability, cultural and historic resources to protect, road and ORV management, and methods to accommodate present and future recreation use.

The timing was right. The Forest Plan has increased emphasis on watershed conditions, wildlife habitat enhancement, and recreation opportunities and decreased emphasis-on timber and grazing. Bluewater was an ideal site for reflecting the changing emphasis. The excellent historic photographic collection documented what had occurred in the past. Downstream water users, concerned with the impact of the recovery efforts on their future water supply, could be shown the results of the past degradation, and the fact that little in the way of commodity or amenity values were presently being produced. All the players were in place. It was up to the Forest Service to prove what could be done to portray our land stewardship prowess.

Rehabilitation efforts were orchestrated, first to control and intensify grazing management. Unneeded roads were obliterated. Next came pine plantations and riparian plantings along the creek. Then rehabilitation work started with watershed structures, rewetting of meadows, and construction of fish structures. At the same time, the SCS approached upstream private landowners to do similarly.

Interest in the project gathered momentum both on the Forest and regionally. Accessibility of the area gave visibility (at first this was both good and bad) and impetus to it being an area to showcase. Regional expertise and interest in hydrology and fisheries supplemented Forest Service expertise in range management, timber, soils, wildlife and hydrology. The Regional support helped set funding priorities. Recreation interest was at first geared toward limiting the destructive ORV use, but as conditions improved, recreational opportunities focusing on day use became feasible. The University of New Mexico became interested in research dealing with nutrient cycling and beaver/riparian relationships.

Appropriated dollars used for reforestation, watershed structures, and recreation improvements have been used very effectively to promote multi-resource management of the area, and show that most uses can be accommodated, although at a lesser scale.

Successful implementation of a combination of 'tried and true' methods and innovative ideas were a practical demonstration of what could be extended to adjacent private, other federal, and Indian reservation lands. New management approaches in conservative grazing in riparian areas, fish structure construction, road and ORV and recreation management, and reforestation techniques were tried.

In the short space of six years (1986 through 1992) the following has been accomplished.

- Three miles of riparian areas closed to off-road travel.
- 700 acres of reforestation in the Blue water watershed accomplished to improve fishery, hold soil, provide wildlife cover and provide cover for fish. In addition, over 60,000 cottonwood and willow trees were planted.
- Intensified grazing management including establishment of a riparian pasture in the Bluewater Allotment.
- 17 miles of road obliteration in fragile bottomlands and 42 miles within the watershed.
- Watershed structures--revetment fencing, wet meadow improvements, gully erosion control and gabion structures.
- 28 stream structures to improve fish habitat.
- 2.5 miles of ORV fencing.
- Construction on Bluewater dispersed recreation area.
- Four miles of recreation trail construction.

Partnerships and Cooperation

Volunteer groups were contacted by Cibola National Forest and regional office personnel, and numerous volunteer groups responded to help restore the Creek. These groups accomplished most of the labor-intensive stream improvement and riparian plantings. Wildlife groups in Albuquerque, including the New Mexico Wildlife Federation, Trout Unlimited and Wild Turkey Federation were the first to respond. As the work spread, Albuquerque Boy Scout groups asked to get involved. Some of the groups wanted to adopt sections of the creek.

In April of 1987, the Cibola National Forest sponsored an Involvement Day, and employees constructed stream structures, off-road management barriers, regulatory signing and riparian plantings of cottonwood and willow. Almost all employees forest-wide participated and offices were closed for the day. In 1989, the Izaak Walton League approached the Forest to sponsor a work weekend to highlight the benefits of healthy riparian areas and enhancement. All federal, state and local agencies having interest in the watershed (USFS, Bluewater State Park, BLM, SCS, NM Land Department, New Mexico Environmental Dept.), organized to plan and direct an assortment of enhancement efforts that eventually included 700-800 volunteers in a mass effort. This included 4-H, Boy Scouts, Girl Scouts, Cubs, Campfire, Trees Unlimited and school children from Grants, Bluewater Village, Milan and even Albuquerque. All were invited to participate on federal, state and private lands. The three-day program included activities to cultivate a renewed land ethic. By the time the work was done, five federal agencies, four state agencies, four grazing permittees, various downstream water users and different volunteer groups were involved, including one from Portland, Oregon.

The variety and success of the completed work has resulted in continued demands for show-me trips by land management agencies, Indian tribes and professional organizations to observe what can be done when interest is sparked by a a good project, and you get commitment across a broad spectrum. Visitors are frequent to Bluewater Creek, and include representatives of the B.I.A. Southern Pueblo Agency, Zuni Pueblo, Navajo Tribe, BLM, SCS, Society for Range Management and the Wildlife Society.

Regional Significance

The Bluewater Creek project has involved a lot of in-service and out-service people and has developed a lot of interest region-wide. Project planning has emphasized varying treatments that will have application in several locations over the Arizona-New Mexico landscape. A lot of people in the Southwestern Regional and the Cibola National Forest have made a time investment, as volunteers and as specialists, in Bluewater Creek. Implications of the photographic history show examples of degradation that can be compared with similar conditions elsewhere on federal, state and Indian lands and the proven track record shows what can be accomplished. In 1988, the Project received the Forest Service Southwest Region Land Stewardship Award, and was a Finalist for the Chief's Centennial Award in 1991.

What's Special about Bluewater?

What so special about Bluewater Creek? The remarkable resource recovery in a short time and the people involvement. Our success can be seen by anyone who looks--sedges and other wetland grasses are returning; the raw banks are starting to heal and sediment has been decreased substantially. Pine plantations are sticking their crowns above perennial grasses. Local residents are patting us on the back for quality resource management. And they are volunteering to help us keep it clean because they are proud of it too.

Bluewater Creek is an illustration of excellent land stewardship, especially in light of that fact that no National Forest activities or resources were eliminated. The public trust has been and continues to be enhanced. The attention of adjacent landowners, along with other state and federal agencies, promises to buy dividends in similar situations in other places. Particularly important is that we have changed some attitudes with its success. This will be an educational tool for some time to come, as well as an outdoor laboratory for environmental education.

Jøl5

Duck Creek Riparian Habitat Restoration Project, Henry's Lake, Idaho

Richard Prange

Background

Henrys Lake is located in eastern Idaho near Yellowstone Park and is nationally renowned for its trophy trout fishery. The lake's fertile waters and submerged springs nurture a rich aquatic environment highly conducive to growing large cutthroat, brook, and the famous Henrys Lake hybrid trout. The fishery has been threatened, however, by habitat degradation, irrigation water withdrawal, improper land use practices and water quality problems. In 1982, the nonprofit Henrys Lake Foundation was formed to organize sportsmen support, dollars, and labor for the protection and enhancement of the fishery. Since its formation, the Foundation has worked in partnership with state and Federal agencies and private landowners to implement fish habitat and water quality improvement projects. The Duck Creek riparian habitat restoration project represents a good example of the Foundation's approach.

Project Description

Duck Creek is a small tributary entering Henrys Lake that historically supported about 20 percent of the cutthroat trout spawning run. Like many other streams in the area, repeated season-long livestock grazing had trampled streambanks and drastically reduced riparian vegetation. The stream was too wide and shallow and spawning gravels were embedded with eroded silts. As a result, Duck Creek's capability to produce, rear, and recruit young wild trout back to the Henrys Lake fishery was severely diminished. The Henrys Lake Foundation desperately wanted to fence degraded riparian areas around the lake, but private ranchers were reluctant to cooperate and become involved.

In 1985, the Foundation finally reached agreement with a rancher to allow a small pilot demonstration fencing project to be constructed along 1/4 mile of Duck Creek. Rancher incentives were incorporated to bring the project to fruition and included the following features:

- A formal agreement and statement of understanding outlining project conditions was signed between the rancher and the Foundation. The fencing project was designed to be compatible with the rancher's livestock operation while fully protecting streambanks from grazing.

- Solar powered electric fencing was selected. This represented a new fencing technology not previously used in the area and allowed the rancher to evaluate the system at no risk to him.

- The project would be in place for 5 years, after which time it would be evaluated for continuance. This was deemed sufficient time, both for judging riparian recovery and application of the new fencing technology.

- The rancher reserved the right to remove the fence during the 5 year agreement period. All project costs were paid by the

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Henrys Lake Foundation. The Foundation provided volunteer labor and hired the rancher and his heavy equipment to assist in construction. An annual stipend was paid to the rancher to maintain the fence.

Project Results

The Duck Creek fence was constructed in September 1985. Within the first year, riparian vegetation recovery was dramatic, and during the second season, willow cuttings were planted to accelerate healing of degraded streambanks. Creek banks were soon anchored by rooted vegetation, the stream channel narrowed, sediments were flushed from spawning gravels, and young trout thrived in the fenced section. Solar electric fencing proved to be a useful application for the rancher, saving both cost and maintenance time over conventional barb wire fencing. People began to visit the project site. The rancher took pride in his participation, he began to enjoy working with Foundation representatives, and trust and friendship developed. The project showed that livestock and fishery advocates could work together to mutual benefit; and, the Foundation now had a successful riparian restoration project to point to.

As a direct result of the initial Duck Creek fencing work, the Foundation and Idaho Department of Fish and Game negotiated to fence the remaining 1.5 miles of stream on the rancher's land. The second project included cross fencing, subdividing pastures into smaller units so that an intensive grazing system could be instituted. Except for cattle water gaps, the entire reach of Duck Creek on the ranch was corridor fenced. Based on fishery and water quality benefits that would eventually accrue, the Foundation and Department were willing to pay all costs associated with the second project.

In effect, the first Duck Creek fencing project "broke the ice" with other livestock operators. Ranch owners viewed the results and came to understand the economic and ecological sense in improving stream habitat on their holdings. Within 2 years, fencing projects were started on other tributaries. The Foundation and agencies were willing to continue to fund these projects, but consciousness grew and a few landowners voluntarily fenced and removed cattle from riparian areas on their own.

Since the Foundation's first venture on Duck Creek, an estimated 10 miles of streams and 4 miles of Henrys Lake shoreline has been fenced on a mix of 15 private and public properties. Additionally, 9 fish screen structures have been constructed at irrigation diversion locations on several spawning tributaries. Nearly $100,000 has been invested in these worthy projects, with costs shared among the Henrys Lake Foundation, Federal and state agencies, and private landowners.

Ingredients for Success

The first Duck Creek riparian restoration project showed that ranchers and fishery interests could overcome traditional barriers and work together for common gain. Its success proved contagious and directly led to instituting similar projects with other property owners. Why was the Duck Creek riparian habitat restoration project successful?

- The project embodied the notion that improving the lake fishery and riparian conditions was also in the interest of landowners. In time the local economy would benefit from improved fishing, property values would rise accordingly, and less soil/land erosion would occur on streamside properties.

- There was a willingness to invest outside private and agency capital for fishery/riparian improvement projects on ranch lands.

- A modest project was initially undertaken. Nonetheless, this small project demonstrated the riparian recovery that could be expected on a much larger scale. In time, the success of the first fencing project engendered other riparian restoration projects.

- A win/win approach was emphasized and rancher incentives brought the project to fruition.

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Verde River Corridor Project

Tanna Thornburg

From 1989 to 1991, the rivers staff at Arizona State Parks conducted a multi-objective river corridor planning project for the middle segment of the Verde River. The completion of the Verde River Corridor Project was only the beginning of local citizen involvement in the management of the Verde River and its resources.

The Verde River is one of Arizona's major perennial rivers (approximately 190 miles long) and drains a basin that encompasses over 6,000 square miles. The Verde cuts across the center of the state and is free flowing for most of its length (125 miles) except for the two large dams at its lower end before it flows into the Salt River. Famous for its perennial waters, lush riparian habitat, abundant wildlife, diverse recreation opportunities and incredible scenery, the Verde River is one of Arizona's most treasured assets. There are 46 known sensitive plant and animal species found along the river; several are on the Federal and State Threatened and Endangered Species lists.

Only limited archaeological surveys have been conducted, but the Verde corridor promises to contain a wealth of cultural sites. There are six State Parks and 2 National Monuments located in the watershed. The upper canyon reaches of the river are accessible by a scenic train ride that is internationally renowned. The lower Verde also boasts the state's only designated Wild & Scenic River segment - 39.5 miles - which is a popular whitewater rafting stretch.

Located near the City of Cottonwood, the six-mile Verde River Greenway managed by Arizona State Parks is one of only five remaining extensive stands of cottonwood-willow gallery riparian forests left in the state. This forest type is considered to be globally endangered and the rarest forest type in North America according to The Nature Conservancy.

American Rivers has named the Verde River as one of the 15 highly threatened rivers in the United States. The primary threat is groundwater depletion; secondary threats include previous mining operations, sand and gravel extraction, agricultural diversions, overgrazing, urban development and associated contamination, and overuse by uncontrolled recreation.

Research conducted by the U. S. Fish & Wildlife Service has determined that the riparian resources associated with the Verde River between Tapco and Camp Verde are unique and irreplaceable on an ecoregional basis and that no loss of existing habitat value is acceptable.

The corridor project focused the middle segment of the river from just above the town of Clarkdale (Tapco) down past the town of Camp Verde to a point called Beasley Flat. This area is known as the Verde Valley and is

Tanna Thornburg is Chief of Resource Stewardship for Arizona State Parks in Phoenix, Arizona. Ms. Thornburg's position involves oversight of six major programs, including rivers assessment, streams and wetlands, trails, natural and recreation resources, natural areas, and riparian mitigation. She received her BS degree from the University of Arizona in watershed management. She is on the board of the Arizona Riparian Council.

populated by about 30,000 people. This 60 mile river stretch is a rural mix of private, city, county and tribal ownership with limited state and federal management. No one entity controls or manages this segment of the river which has led to inconsistent and uncoordinated management. The upper and lower reaches of the Verde are predominantly within Forest Service management. This middle segment of the river is bridged by an interstate highway and numerous other local and state roads and has three rapidly growing communities, an Indian reservation, two State Parks, and a National Monument situated along its banks. Numerous other communities and features are found nearby along the banks of the Verde's many tributaries.

The Verde Valley is still a pastoral community with farming and ranching in evidence with many ditch companies diverting river water onto agricultural fields. The most attractive and expensive homesites are those adjacent to or overlooking the river and its lush tree-lined banks and there is plenty of land for sale as historical agricultural land is converted into subdivisions. An early century mining operation has left its mark on the river via tailings, slag heaps and contaminated seeps. There are several sand and gravel extraction operations along the river that are currently negotiating with the federal government to continue mining in the river.

While the local residents and communities have water rights to the Verde, the major senior water right holder is the Salt River Project which maintains the two dams and reservoirs downstream for use by the metropolitan Phoenix area. The upper headwaters area and adjacent underground basins to the Verde are being studied by upstream water users to determine if pumping would affect downstream flows. Everyone seems to be coveting the Verde River's water and its resources.

As you can see, the Verde River is an extremely valuable resource to the State of Arizona and to the Southwest as a whole. It deserves recognition and appropriate management that will maintain and enhance all its values. Many river management planning processes are begun because the river is involved in an extreme controversy regarding use or has been designated as a National or State Wild & Scenic River and preparation of a plan is the next logical or mandated step. However, in the case of the Verde River Corridor Project neither of these scenarios applied and it had no official mandate or authority to support its creation.

In the mid to late 1980s, several citizen groups attempted to work together on a Verde River management plan, but were unsuccessful for various reasons. The sheer enormity of the task and differing opinions and unyielding positions were usually the stumbling blocks. But there were still committed individuals in the Verde Valley who refused to give up. All these factors set the stage for the Verde River Corridor Project.

In 1989, Arizona State Parks was just getting into the river management business as part of the implementation plan of its Statewide Comprehensive Outdoor Recreation Plan (SCORP). The agency had just begun its first statewide rivers assessment and wanted to initiate multi-objective river corridor planning as a means of better managing our dwindling river resources.

The rivers we evaluated for multi-objective corridor planning had diverse natural, cultural and recreational values and opportunities, had competing interests and were owned and managed by a multitude of entities. We chose the Verde River for our first corridor planning attempt because it had nearly all the elements, both positive and negative, of any river in Arizona. It would prove to be an excellent model for future river planning efforts.

Since Arizona State Parks has no authority over the river or its users and we had no reputation for doing this kind of long-term community planning, we knew we would have to be requested to serve as facilitators by the local groups in order to be successful in gaining the broad-based citizen participation and depth of involvement the project required. We were viewed by the locals with suspicion because we represented State government and we were from the greedy, powerful metropolis of Phoenix. Also, as a parks agency, we were viewed primarily as pro-preservationists.

"The best way to cope with change is to help create it."

We enlisted the partnership of the Arizona Department of Commerce to introduce us to the local town and county councils and other key players in each of the affected communities. Then we held several open public meetings to see whether there was sufficient interest in such a long-term project and what issues and concerns would have to be addressed. The point that was made crystal clear from the onset was that local citizens would control the process and the outcome.

We got a big surprise at our very first meeting and it continues to this day. The consistent, large attendance at our meetings was phenomenal, especially for a small rural area. Attendance averaged 100+ people for each of the initial meetings, tapering to 50-75 at all the others. We met nearly once a month for over one and a half years and none of the meetings were of the controversial nature that normally generates such high attendance. Simply put, the people were excited over the idea of planning before there was a crisis and they liked the novel concept that they were in charge of the process.

The staff at Arizona State Parks agreed to serve as facilitators only, with the direction and decisions coming directly from the local citizens. Other agencies willingly agreed to serve as technical advisors. The 26 steering committee members were chosen by the communities and anyone could participate on the five subcommittees. All interest groups were represented on the committees - town mayors and other elected officials and their staff, chambers of commerce, local businesses, major industries, farmers, ranchers, water users, realtors, homeowner associations, private landowners, and environmental and recreation organizations.

Initially, many groups came to the meetings just to make sure their interests were protected or to voice their opposition to a particular stand. There was certainly no shortage of discussion topics. It took about three months before all the committee members were appointed by the town councils. In the meantime, we continued public meetings to identify all the issues and concerns everyone had regarding the use, management and protection of the river.

It quickly became obvious there were considerable differences in the positions and opinions held by those participating in this process. In the beginning, there were demands that certain uses of the river come to an immediate and complete stop and, from the other side, there were angry declarations of "over my dead body," etc.

The next step then, after identifying the issues, was to come to consensus on the overall vision and mission of the project and that task required considerable discussion. The first meeting where we tried to discuss the overall vision ended in resounding failure. Arguments, accusations and confusion dominated the meeting and we couldn't seem to make any progress. We all left dejected and disappointed. We had been running the meetings in a completely open format with no one person or group in charge, especially since the steering committee wasn't in place yet. But most people were used to the method where those who shout the loudest get their way. The two styles were in conflict.

At our next meeting, we explained what we perceived as the problem and asked the group for a solution. The more people talked, the more people listened to each other. The environmentalist realized how much he relied on sand and gravel for his home and the roads he drove on. The mining executive shared his experiences of fishing along the river with his daughter and how he thrilled at seeing beaver, deer and eagles. We became a unified family that night and came to the consensus that we all loved the river and wanted it managed in a way that maintained a healthy, functioning ecosystem while still providing for some level of use. We agreed to remind ourselves of that common vision - that bond - whenever things got too heated or when we couldn't agree on a solution. It was a major milestone for the project.

> ***"Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has."***

The big question that kept recurring throughout the process was "What will the end result of all this effort be? The plan has no legislated authority and there is no budget for implementation." Our standard response was "We don't know. The result will be what YOU make it!" There was plenty of doubting and grumbling, but the meetings were always well attended and communication of some sort was constant, during and between meetings. It seemed everyone in the Verde Valley had heard of the Corridor Project and optimistic comments were more frequent than pessimistic ones. The rest of the project ran like most other public participation efforts with the key difference being that project control and direction was definitely local and citizen-based.

The subcommittees and State Parks staff worked together to gather information, conduct needed research, and hold open forums on key topics. There was active and productive participation by other state and federal agencies to ensure that recommendations and suggested actions were feasible.

The subcommittees developed over 140 recommendations that were publicly discussed and then approved by the steering committee. A plan of action was developed along with guiding principles. Toward the end, the steering committee identified the top ten priority actions to be tackled first. This action plan is the "blueprint" for what the people want for the Verde River. The plan and its executive summary have enjoyed widespread distribution and many of the recommendations have been achieved or are in various stages of completion.

One of the priority actions recommended by the Corridor Project was the establishment of some form of "coordinating group" that would oversee implementation of the action plan and development of a coordinated river corridor management strategy. As an clear indication of the success of the project and of letting the citizens take responsibility for their local resources, that coordinating group was established just a few weeks ago.

The Verde Watershed Association came into being at the January 16, 1993 conference held in Prescott, Arizona. It was the result of local individuals and groups (not state or federal agencies) taking the corridor planning process to its next logical step. The Association has adopted bylaws and an interim board of directors which includes all major interests and its first meeting was February 20, 1993 in Sedona, Arizona. The overriding premise of the group is to remain a consensus-based organization. While governmental agencies will continue to play a key role in the Association, they will be serving as advisors. "Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has." (Margaret Mead)

Arizona State Parks is beginning its second multi-objective river corridor planning process this month. The Santa Cruz River in southern Arizona has been chosen for the second project. The river begins in Santa Cruz County, Arizona, flows south into Mexico for approximately thirty miles and then flows north back into the United States just east of Nogales continuing northward past Tucson until it connects with the Gila River south of Phoenix. The upper Santa Cruz River supports a magnificent stand of cottonwood-willow gallery riparian forest and the associated wildlife. The river is perennial in its upper reaches and is considered to be an effluent-dominated stream for much of its length. The downstream reaches are ephemeral and show evidence of considerable erosion. Most of the river's length is in private ownership.

With the passage of the North American Free Trade Agreement and its considerable implications, this project with its international flavor promises to be very hot. Like the residents of the Verde Valley, the residents of the Santa Cruz Valley love their river and do not want to see things change. However, that valley and its river are posed on the edge of monumental change. What will be the end result? Stay tuned. *"The best way to cope with change is to help create it."*
(L. W. Lynet)

CHAPTER THIRTEEN

LOOKING TO THE FUTURE

One By One

I am just a farmer - I plow the fertile ground,
and I plant my grain and till my fields as the seasons spin around.
But I'll be gentle on the land as I watch my harvest grow,
For the web of life feeds more than I could hope to reap or sow.

I am just a logger as my granddad was before,
and these northwoods have been home to us for a hundred years or more.
But the big trees have all fallen and so few are on the land,
that the mills won't long stay open - leave the ancient ones to stand.

CHORUS: Day by day, one by one
We will make this world a better place -
Our planet and our home.

Side by side, hand in hand
We will all join in together
to bring health back to our land.

I'm the mother of a family - just struggling to survive
to put my kids through school and feed them well, I work from nine to five.
Though there's little I can buy for them, the gift that I'll pass on
is the knowledge that the earth abides for my children's children's sons.

I am just a rancher and I graze my cattle far,
in the valleys and the hillsides, where the lush, green grasses are.
But I will not overload my range, though the cost of beef is low,
for the grasses are worth more than meats that fill the grocery store.

CHORUS

I am just a miner and my back is bent from toil,
for I've stooped and dug these veins for ore for twenty years or more.
But I'll work beside the ones who try to cover where they can,
all the traces of the diggings that we've made upon the land.

I am just a schoolchild - I ride the bus each day,
and our teacher says that trees are scarce, but she throws her notes away.
So I've asked her to recycle and we've formed a group in school,
so that kids like me can save the trees, and pass on the Golden Rule.

CHORUS

I work for the government in my office every day,
and I've seen some things that hurt my heart, but I turned my head away.
Now I understand the strength our systems give us all,
And I'll do my part and make a start, be it grand, or be it small.

I am just a scientist - I try to read the signs
of the creatures living with us as they struggle to survive.
and sometimes my spirit cries out when it sees disaster near,
the I whisper, "Just be still my heart - if you listen, you will hear."

CHORUS

I am just a poet who with symbols and with words
tries to keep alive the child within and share it with the world.
I can feel the strength our spirits have - I see it in your eyes,
for the poet lives in all of us - and we dare not let it die.

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A River Ran Through It

Ann Bartuska

In closing, I want to share with you what I have heard from this group today, yesterday and the day before. For those who have been here for the two and a half days, what I would like to do is get back to you some of the thoughts that I have been recording and what has resonated with me for the last two and a half days because I think we have really shared a lot.

I think there have been some really marvelous discussions - in the bar, in the hallway, in here and everywhere else - and one of the things the steering committee would particularly like to do - we have been taking notes. We have people who have been sitting here writing down a lot of things as well as the steering committee members but we now you have some thoughts that maybe have not been captured. If as you are flying home or driving home or just have the time to sit down and write your thoughts and send them in to us, we would like to include those in the *Proceedings* and just as sort of a way to carry some of these ideas forward.

What I'd like to do is just give you a brief revisit of where we've been. O.K., first, we talked a lot about the vision - what's the vision that we want to move forward in. How do we all view things?

"The earth is our mother and the water is her blood. What if there was no water?"

And Arnold Rice brought that poignantly towards us in the very first interlude that we had.

"Everything comes together and a river runs through it."

I think that resonated with a lot of us and some of us even spent $7.95 and watched a *River Runs Through It* this week.

Dave Rosgen brought this forward in a very technical presentation, but he said

"listen to the river."

And said later in the week

"think like the river."

We must have a vision and I think we know what we're working towards.

And we also had such comments as

"These are special places."
"These are productive places."
"These are unique places."
"These are vanishing places." and
"These are our places."

Ann Bartuska is the Director of Ecosystem Management , U.S.D.A. Forest Service in Washington, DC. Dr. Bartuska's previous Forest Service positions include Wetland Specialist, Assistant Director of the Southeastern Forest Experiment Station, and Program Manager for several acid rain/air pollution programs. She currently manages the Forest Service's program to develop ecosystem management approaches on the National Forests.

Now of course we did have some technical information and I won't repeat that. There were some key phrases that I want to run through and "Just the facts ma'm."

"Maintaining a healthy system will ensure resiliency. In the long run that's better and cheaper."

Julia Fonseca, I thought, brought this forward in a very practical sense.

"It's cheaper to purchase the land than try to put levees on it."

And I thought "that is really how we have to take some of these concepts forward."

"Riparian areas have historically fallen through the cracks. They are not land. They are not water."

That was from Jo Clark.

" We're doing things piecemeal."

From Dave Rosgen.

"Federal manager" - I like this one - *"aren't here to manage lands. They are here to implement laws."*

Boy that one really hit me between the eyes. And I think it's probably the reality and a lot of us have realized that. Of course there's the other side and that's not the way we do these things.

I thought this one was great and it sort of carries on a lot of information. The *"information flow pathology."* Now I tie that to federal land managers. I don't know why exactly, but there is some truism to that.

"Riparian areas are collapsing all across the country."

And finally,

"We know what to do, we just need to get on with it."

And that brings me to my last collection which is on communications and partnerships. The *communication iceberg*. Now wasn't that a good image to take home with us and one thing that struck me was that line that Doc drew across that iceberg. I think that dropped a little bit lower during the meeting, and maybe we're getting more of those values into that upper part of our discussion.

I want to ask how you feel about being here today. Well I feel really good. I have gained so much more from this conference than I ever expected, even with spending two and half days moderating.

"Sit down at the table and let the community develop."

I think we've just done some of that. We have undergone a paradigm shift. And I think that hit us very well this morning as to where we have come and not only in the last two and a half days but also over the course of our own experiences.

And this is one of my personal favorites and I know a lot of other people felt this way.

"The reason we have women come to these meetings is so we can get something done when we all go home."

Thank you Connie Hatfield for that special insight.

Finally I tried to capture some of the partnerships that were referenced. And these are just a few. These are all direct quotes folks.

"The Conservancy was our partner."
"We worked with the ranchers."
"The coalition....."
"We Hualapai want to sit at the table."

And finally

"Then we invited the BLM. "

And then the last bunch of speakers

"and listened and listened and listened."

I thought that was also very powerful. So we do have the shared vision and what I think we all need to go home with and think about is the shared responsibility. How we all can work together - citizens, scientists and all of us who are stewards, whether we are federal managers or a private land owner - that's our responsibility. So lets take it from there. We have a great field trip for the afternoon and another session with our closing interlude. And I hope we'll be carrying on these discussions much longer into the future.

Thank you all very much for coming.

"And they shall turn the rivers far away. And the water will certainly be dried up from the sea, and the river itself will become parched and actually run dry. And the rivers must stink; the Nile canals of Egypt must become low and parched. The reed and the rush themselves must molder. The bare places of the Nile River, at the mouth of the Nile River, and every seedland of the Nile River will dry up. It will certainly be driven away, and it will be no more. And the fishers will have to mourn, and all those casting fishhooks into the Nile River must express sorrow, and even those spreading fishing nets upon the surface of the water will actually fade away."
" Isaiah 19:5

APPENDICES

Conference Cosponsors

Conference Steering Committee

Conference Participants

"... The grass is rich and matted, you cannot see the soil. It holds the rain and the mist, and they seep into the ground, feeding the streams in every kloof. It is well-tended, and not too many cattle feed upon it; not to many fires burn it, laying bare the soil. Stand unshod upon it, for the ground is holy, being even as it came fro the creator. Keep it, guard it, care for it, for it keeps men, guards men, cares for men. Destroy it and man is destroyed.

Where you stand the grass is rich and matted, you cannot see the soil. But the rich green hills break down. They fall to the valley below, and falling, change their nature. For they grow red and bare; they cannot hold the rain and the mist, and the streams are dry in the kloofs. Too many cattle feed upon the grass , and too many fires have burned it. Stand shod upon it, for it is coarse and sharp, and the stones cut under the feet. It is not kept, or guarded, or cared for, it no longer keeps men, guards men, cares for men. The titihoya does not cry here any more.

The great red hills stand desolate, and the earth has torn away like flesh. The lightning flashes over them, the dead streams come to life, full of the red blood of the earth. Down in the valleys women scratch the soil that is left, and the maize hardly reaches the height of a man. They are valleys of old men and old women, of mothers and children. The men are away, the young men and the girls are away. The soil cannot keep them any more."
Alan Paton, Cry the Beloved Country

APPENDIX A
CONFERENCE SPONSORS

Major Financial Sponsors

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Boone and Crockett Club
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Desert Fishes Society
Grand Canyon Trust
Idaho Water Resources Research Institute
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U.S. Army Corps of Engineers
U.S. National Park Service
Western States Riparian Council
Wildland Resources Center, University of California
Wildlife Society
Wyoming Water Research Center

APPENDIX B
CONFERENCE STEERING COMMITTEE

Leonard De Bano - U.S.D.A. Forest Service
Ann Bartuska - U.S.D.A. Forest Service
Stan Bradshaw - Trout Unlimited
Mary Butterwick - Environmental Protection Agency
Jo Clark - Western Governors Association
Hanna Cortner - University of Arizona
Wayne Elmore - Bureau of Land Management
Steve Gloss- University of Wyoming
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Bill Krueger - Oregon State University - Cooperative Extension
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Roy Mink - University of Idaho
Gail Peters - American Rivers
John Rinne - U.S.D.A. Forest Service
Hal Salwasser - Boone and Crockett Club, U of Montana
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Barbara Tellman - University of Arizona
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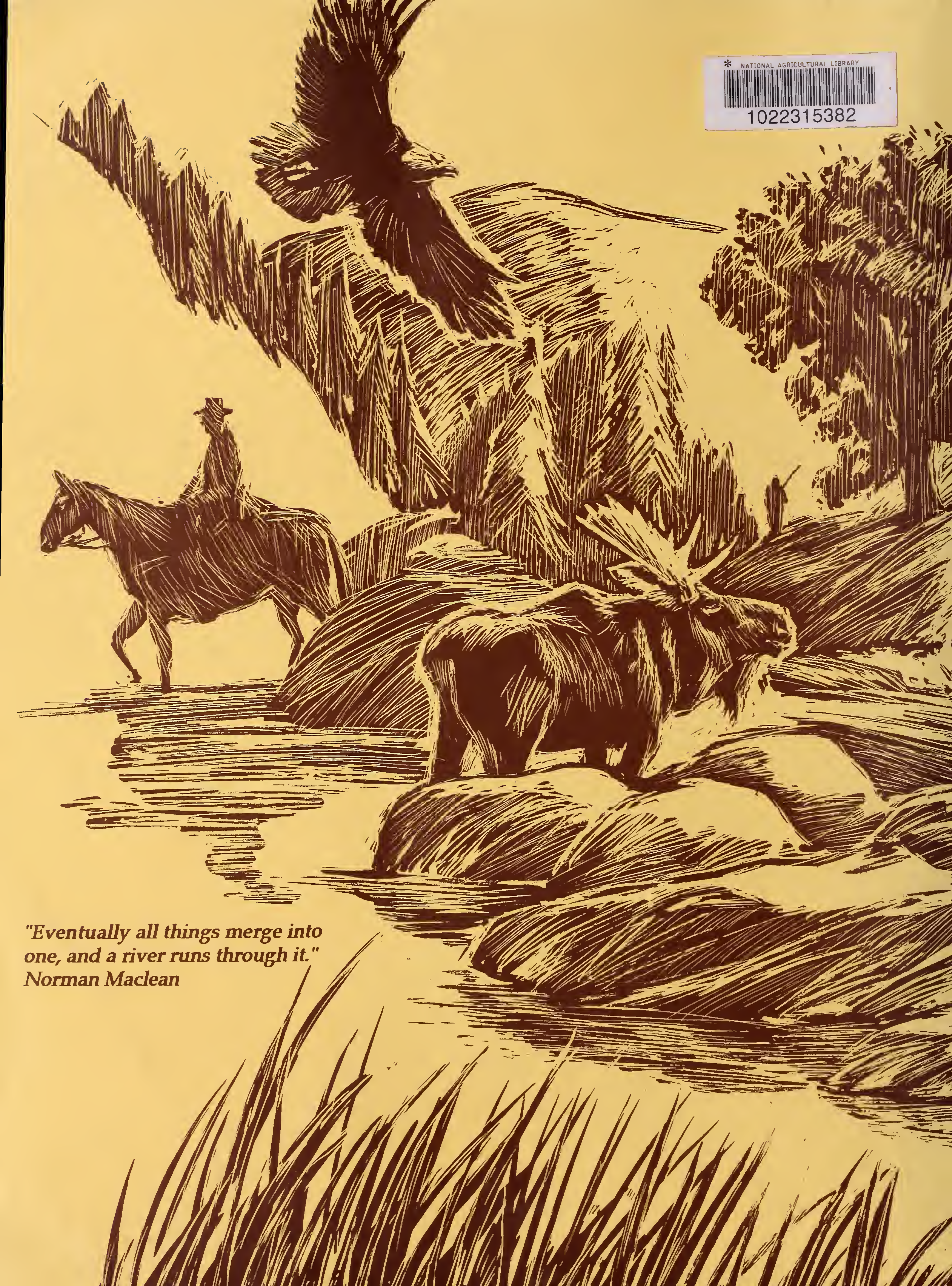

"Eventually all things merge into one, and a river runs through it."
Norman Maclean