

INTERNATIONAL

# Journal of Wilderness

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- Research and Stewardship Awards



DECEMBER 2000

VOLUME 6, NUMBER 3



I N T E R N A T I O N A L

# Journal of Wilderness

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Front cover photo of the headwaters of the Blackfoot River, Montana, USA © 2000 by the Aldo Leopold Institute. Photo inset of young river rafter © 2000 by David Cole.

# International Journal of Wilderness

The *International Journal of Wilderness* links wilderness professionals, scientists, educators, environmentalists, and interested citizens worldwide with a forum for reporting and discussing wilderness ideas and events; inspirational ideas; planning, management, and allocation strategies; education; and research and policy aspects of wilderness stewardship.

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## EDITORIAL PERSPECTIVES

# Wild Rivers and Wilderness

BY DAVID N. COLE

Rivers are magic. Their draw is irresistible. Their value cannot be overestimated. This issue of *IJW*, guest edited by Alan Watson and myself, is the first of two emphasizing rivers. Our hope is that both issues will help increase interest and attention to wild rivers as an important component of the wilderness resource.

People flock to rivers for recreation. Many wild rivers in the United States, particularly those with opportunities for prolonged trips and the thrill of whitewater, are so popular that access to them must be limited. Commercial outfitting on rivers is a huge and growing enterprise. Private groups often must obtain permits through lotteries (with chances of drawing a permit less than 5%), or go on a waiting list of up to 10 years.

Animals are attracted to rivers for water and shade. Riparian vegetation along rivers provides habitat for diverse species, many of which are not found elsewhere. Rivers are corridors for the transportation of people and their goods. Recently, rivers have become corridors for the transportation of undesirable invasive species, such as tamarisk and spotted knapweed.

Since rivers—particularly wild rivers—are rare and highly valued, their management is complex and controversial. Managers of terrestrial wilderness have much to learn from the experience of river managers, who were among the first to deal with explosive increases in recreation use.

Two lessons are particularly important: First, limiting use has side effects, many unintended and undesirable. Questions surround the issue of private versus commercial permit allocations. Any established limit will tend to favor certain types of users. Tight restrictions on one river will increase use on other rivers. River managers have long dealt with these issues. Among their most important innovations has been the management of rivers on a regional scale, such that opportunities are provided for as many different types of users as possible. Rivers like the Selway in Idaho are managed for extremely wild, once-in-a-lifetime experiences, while others in the region offer less challenging experiences and more people.

The second important lesson is the importance of instilling ethics and Leave No Trace education for river users. The success of such programs on wild rivers has been phenomenal. Campsites used virtually every night exhibit little evidence of human use other than footprints in the sand. While certain riverine environments (beaches, for example) are highly resistant and resilient, much of the credit in limiting impact is from the progress river managers have made in persuading floaters to minimize their impact on this rare and valuable resource.

Several articles in this issue of *IJW* illustrate the opportunities and challenges of river management, hopefully providing lessons and insight for wilderness managers everywhere. **IJW**

# A Value in Fear

## Some Rivers Remembered

BY LUNA B. LEOPOLD

I stared at the snow-covered peaks of the Brooks Range that seemed to hover over this glaciated valley in Alaska. It would be some hours before the airplane returned with the rest of my research equipment. I laid my rifle across my knees and focused on the local scene. I was completely alone.

A wide gravel bar in the John River stretched away downstream. The rocks were rounded as usual, but what impressed me was the uniformity of size; they were all about the dimensions of a lime. Why were the gravels so uniform, well sorted, and small? This is a big river, and the Brooks Range snowmelt provides plenty of water. But the explanation is more complicated. Across the river was a vertical bank some four meters high against which the water impinged at high flow. The top of the far bank was flat, obviously a terrace, the remnant of a former floodplain. The exposed material underlying that surface was made up of gravel similar to that under my feet. These rocks must have been worked over, rounded and sorted not just by one, but by two or perhaps more glaciations during the Pleistocene.

As I looked across the gravel to the bordering thicket, I wondered how long it would take a grizzly bear to cross that narrow open space. I realized then, but did not want to acknowledge it, that I was afraid.

I remember traveling with my father, Aldo Leopold, in northern Arizona on the way from Heber to Globe. The sky was threatening and the sound of thunder indicated a storm was close by. It had not yet begun to rain, but we looked around for shelter. My father asked, "Are you afraid of lightning?" No, I replied. "Well," he said, "then you have never been on the Mogollon Rim." A few minutes later rain poured out of the sky, and a lightning bolt streaked down the trunk of a ponderosa pine not 30 meters away.

I was too young then to give much thought to the power of rivers, the magnitude of glaciers, or the time required to reduce a large rock to the size of a small fruit. And I was too young to understand how small we human beings are. I am not so young anymore.

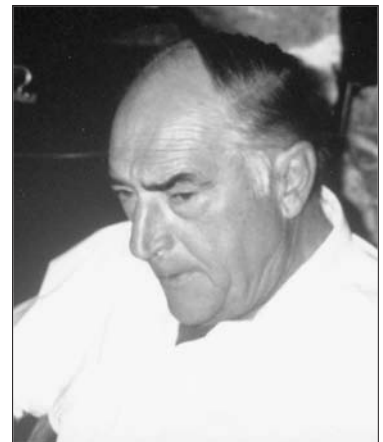
Along this river in Alaska I had plenty of time to think—perhaps more time than I wanted. I thought about fear. Fear in the wilderness is different than fear experienced on a dark street where a moving shadow might be a depraved or irrational *Homo sapien* after my wallet. But a grizzly bear cares nothing for my wallet. Protecting its offspring is everything.

### Fear Then and Now

As I waited for the plane, my mind wandered again, this time to the ancient people

whose tools and rock flakes I have been studying near my home in Wyoming. Their crude hand axes were used to skin animals, cut flesh, and break bones. I visualized a man standing on the hillside near where my house now stands, looking out over the valley as he methodically picks out just the right kind of yellowish quartzite that will break into sharp flakes. He is alone, as I am now. He must be thinking about antelope, or the flesh obtained during the last communal hunt, and whether he must be content this day with the humdrum roots of wapato baked in the rock-lined depression he constructed near the river.

I imagine this man has little to fear except hunger. So what makes me fearful? I again turn my attention to the far stream bank. It is several meters high, meaning that at some time in the past, very recent in geologic time, this big river flowed over a gravel plain some meters higher than now. The gravel exposed in the far bank was deposited as successive point bars. The rounded rocks under my feet have no doubt been in the outwash plains of at least one and possibly more glaciers.



Article author Luna Leopold. Photo courtesy of the Aldo Leopold Wilderness Research Institute.

This river is wild, and it is the culmination of natural processes that shape alluvial rivers. These interrelated physical processes that influence width, depth, velocity, slope, roughness, and bed material have been well described, but they have not been integrated into an ecological vision of how alluvial rivers work. McBain and Trush (1997) attempted this integration based on their long experience observing and measuring rivers in the field. To integrate these processes into an ecological vision of how alluvial river ecosystems work, they described a set of 10 attributes characterizing healthy alluvial rivers. For example, a healthy river, able to reshape its bed and banks, moves the surface layer of gravel for a few days each year, but once every few years, the riverbed is completely set in motion. Point bars are rearranged and stands of cottonwoods or willows are severely damaged or washed away. By such occasional events, channels form and the riparian borders are reset. A controlled river deprived of these resetting events becomes fixed in form and place by a border of vegetation too firmly established and too large to be moved. The river traps itself by the living border it planted, nurtured, and watered.

Lost alluvial function has extreme ecological consequences. On the Trinity River in northern California dams isolate salmon from most of their upriver spawning grounds, and previously mobile gravel bars, now bordered and anchored by dense alder stands, cannot provide slow-water habitat required for rearing salmon young. Periodic cleansing of sand from spawning gravels is prevented by lack of flows capable of mobilizing the channel bed. The set of alluvial attributes provides a convenient thermostat for gauging river ecosystem health.

A passing raven broke my river reverie, and I realized that my initial spasm

of fear had been ameliorated and transformed into inquiry. Fear had apparently opened my mind to things unrelated to this river, this day, this trip.

### **Studying How Rivers Work**

My plan for a river attribute measurement program was clearer now that I saw the size, form and character of this river and its landscape. No data of any kind were available for this region, so the slate was clean. It was real wilderness. The first job to describe and understand this wild river was to make a sketch map, then survey a cross section, measure the velocity distribution, compute the discharge, run lines of level to establish the slope, and make a pebble count to record the size distribution of gravel. This same procedure will be carried out near the mouth of every tributary, and at successive points along the master stream. These data provide the basis for understanding the hydraulic geometry of channels of different size and changes in the downstream direction. From these measurements, many quantities can be estimated. But how accurate are these estimates? To answer that I decided then to choose one of the few wild rivers in the United States where extensive long-term data had been collected. Before inspecting those data, a single river trip would be organized to take the same measurements on that river and its tributaries as we would later on this river in Alaska. Estimates would be made of various quantities and compared with analyses of the extensive record.

I contemplated the relationship between this planning and my initial

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## **Lost alluvial function has extreme ecological consequences.**

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fear. It seems that a modicum of fear in the gut sets off a train of mental processes that might be not only healing but perhaps innovative.

The airplane arrived in the rain, and there was a flurry of activity. We set up camp, sorted equipment, and prepared for work. By mid-afternoon we were organized. We stretched a tape across the river with the help of Smuss, who ran the boat. The drizzle had stopped, so I brought out the plane table, surveyed the cross section, and began the longitudinal profile.

In the morning we counted rocks. The gravel was so well sorted that there was a scarcity of both large and small pebbles. We packed the boat and proceeded downstream to the first tributary, where the process was repeated. And so it went day after day in cold cloudy weather punctuated by rain. We had one night of a damn cold freeze. It was a typical fall season in the Brooks Range.

The uniformity of gravel size was such that at one place the river bed was so level laterally that the water depth was uniformly shallow, too shallow for our heavily loaded boat to pass. We got out to lighten the load and pull the craft. When at last it finally scraped by, the bow came over me and I emerged from the river wet and cursing; the next several days were miserable.

When we finally reached the Koyukuk River, the only large enough gravel bar for the plane to land on consisted of large rounded rocks the size of watermelons. It was the roughest landing strip I have ever seen an airplane negotiate. When the airplane was loaded and Chappie gunned the engine, fear



**The Middle and Main Forks of the Salmon River stretch for nearly 180 miles through the Frank Church River of No Return Wilderness in Idaho. Photo courtesy of the Aldo Leopold Wilderness Research Institute.**

again hit me as I realized that the laboring plane might not make it. It did.

I often think back on those uncomfortable days, the big moose in the muskeg, and the morning I stepped out of the tent to find footprints of both a wolf and a bear in the mud of camp. I was young, but old enough to appreciate a wilderness with clear water, unbroken soil, spruce edged muskeg, and animals present, though unseen. Aldo Leopold once wrote, "Is my share in Alaska worthless to me because I shall never go there?" I was luckier than he.

## More Wilderness Rivers

The plan of investigation formulated that cloudy day on the gravel bar materialized. I chose the Middle Fork of the Salmon in Idaho, on which very good stream-flow data were available. A trip on the Middle Fork in 1965 was well before the crush of commercial rafting in the final decades of the 20th century. The measurements made were identical to those we took in previously unmeasured Alaska.

Data on the Middle Fork came from six gauging stations, records of which

totaled 140 station years, each station being equipped with continuous recording equipment that operated 24 hours a day. Our trip down the Middle Fork consisted of taking measurements at seven locations along 100 miles of river, measurements at each location consuming one-half to three-quarters of a day. Comparisons were made for a variety of parameters.

Some hydrologic information depends on a continuous record, such as storm hydrographs, but many crucial parameters can be obtained quickly and inexpensively by direct measurements made in a few weeks. The values of bank-full discharge are more consistent and extend over a larger range of flows for the river-trip data than in the published record. The hydraulic geometry, values of width, depth, and velocity as a function of discharge, are comparable in the two sets of data. With regard to mean annual discharge, the river-trip data failed to discern that in the Salmon River, average flow per square mile decreases with increased drainage area. For this reason the estimates of mean discharge from river-trip data are very good for large drainage areas, but too low for small areas. In summary, estimates of significant flow parameters useful for geomorphic description are more complete than long records at instrument stations (Leopold and Skibitzke 1967).

The last scientific expedition in the Grand Canyon of the Colorado before the gates of Glen Canyon dam were closed, was my trip in the middle 1960s. The water was brown and warm, not the frigid benthic green deprived of the sediment a river needs to function as a river. The great sandbars seemed limitless and welcoming, driftwood was everywhere, tamarisk nonexistent. It was a different world from the overused and less-appreciated world of commercial rafting. Over the course of our trips, we plotted and

measured water depth in about 6,000 places. We floated the Green from Vernal to the mouth, the San Juan, the Colorado, Moab to Lake Mead.

## Fear Remembered

The main stem of the Colorado was running fairly high, 50,000 c.f.s., higher than all the releases from Glen Canyon can now muster—and there were enough tough spots to curl your toes. Each big rapid required scouting and careful choices. The most memorable one was Lava Falls. Our little crew gazed with trepidation at the giant hole, the spray rising 25 feet above the churning surface. At long last, Smuss spoke. "I want a volunteer," he said slowly. "If we make it we can pick up the people from the second boat. If we don't, it's only two of us." I was the leader.

The experience of fear in a wild landscape, even of short duration, leads to a reorientation of mind. It can clear out the clutter of the modern scene and allow one to see life and land in a new context. These moments will be long remembered. My time in Alaska, on the Colorado River and its tributaries, on the Middle Fork of the Salmon, and on the Mogollon Rim with my father, was a coming of age. **IJW**

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## REFERENCES

- Leopold, Luna B., and Herbert E. Skibitzke. 1967. Observations on unmeasured rivers. *Geografiska Annaler* vol. 49, Ser. A 2-4: 247–255.
- McBain, Scott, and William Trush. 1997. Trinity River maintenance flow study. Hoopa, Calif.: Hoopa Valley Tribe Fisheries Department, 318 pp., 104 Appen., 25 plates.

# The Value of Wilderness to the U.S. National Wildlife Refuge System

BY JAMIE RAPPAPORT CLARK

I'm often asked how the designation of wilderness contributes to the National Wildlife Refuge System (NWRS). After all, aren't wildlife refuges already protected?

They are, of course, but that hasn't always kept our refuges safe from development. Take the 1994 proposal by the Alaska Department of Transportation to construct a road through a seven-mile section of the Izembek National Wildlife Refuge. When biologists argued that the road would adversely affect Pacific brant, Steller's eiders, emperor geese, brown bears, and salmon, proponents of the project disputed all the biological data and countered that the natural resource impacts could be mitigated. Unfortunately, the wildlife issues were not enough to stop the development.

"In the end, there was the impact on one resource that could never be disputed," recalls then-refuge manager Greg Siekaniec. "That was the irreparable loss of wilderness character." Even when congressional action sought to override The Wilderness Act (TWA), the thought of violating a wilderness sparked such a political outcry that the road proposal was finally derailed.

Izembek is just one example of the value the wilderness concept has for the NWRS. Another lies off Florida's eastern shore. Pelican Island, the world's first National Wildlife Refuge, is a sanctuary for nesting birds, including pelicans, herons, egrets, and the endangered wood stork. Its five acres were designated as wilderness in 1970. Because of the vulnerability of the nesting birds, all public entry is now prohibited. People still enjoy watching the birds, but they do it from a respectful distance. "Wilderness heightens public sensitivity to the values of the island and the threats," says refuge manager Paul Tritaik. "It enhances people's acceptance of necessary restrictions."



Article author Jamie Rappaport Clark at Cape Peirce, Alaska, part of the Togiak National Wildlife Refuge. Photo courtesy of USFWS.

But the wilderness designation's greatest contribution to Pelican Island is unseen: It is the use or development that was never even considered because, as Tritaik says, "wilderness has given the island the character of being a special place." This is the power of wilderness, an aura of inviolability that captures the imagination and galvanizes support for places like Izembek and Pelican Island.

## Evolution of Wilderness in the Refuge System

The U.S. Fish and Wildlife Service (USFWS) is the only public agency dedicated to the conservation of the flora and fauna of the United States. The NWRS—with a land



Located on Florida's eastern shore, Pelican Island is the world's first National Wildlife Refuge, established by President Theodore Roosevelt in 1903. The entire island is designated wilderness. Photo courtesy of USFWS.

base of 93 million acres in 530 plus units—is the largest network of lands specifically set aside for the conservation of fish, wildlife, and plants.

In its earlier years, the USFWS did not realize the potential of wilderness character to protect refuge resources. In 1968 3,700 acres of the Great Swamp Refuge in New Jersey became

In the NWRs's early years, the term “refuge resources” was applied primarily to “preferred” species, and we tended to manage land for their benefit within a hands-on, production-oriented paradigm. We plowed and planted, drained and dammed. We controlled water, fire, predators, and natural succession. The results: The dramatic re-

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## This is the power of wilderness, an aura of inviolability that captures the imagination and galvanizes support for places like Izembek and Pelican Island.

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the Department of Interior's first designated wilderness. The then four-year old TWA stated that wilderness is “an enduring resource,” but the law's eloquent, almost poetic definition of that resource left our managers uncertain about how this new mandate should be interpreted within the context of refuge management. One point, though, was entirely certain: Wilderness was unlike any other resource we had ever managed.

covery of numerous depressed populations of preferred species.

But the training and techniques that led to these tangible results did not easily transfer to the TWAs resonating mandate to “preserve wilderness character.” Phrases like “primeval character and influence” were not part of our lexicon. The charge to manage a “community of life” as “untrammelled” seemed at variance with the precepts of game management.

Even today, traditional attitudes and some apparent conflicts between wilderness and our other mandates continue to challenge our agency. I've heard, for instance, field staff voice concerns about wilderness restrictions (such as prohibiting the use of mechanical equipment in an area) that would make it more difficult for them to improve habitat conditions for target species.

Valid concerns like this one are emerging, but I am nonetheless truly heartened by our progress. More and more, refuge managers are no longer questioning the value of a wilderness designation. Rather, they are asking: How can we employ this powerful concept to help meet our ever-expanding wildlife stewardship responsibilities? How can wilderness designation be used to further the conservation purposes of our refuges?

There are now 75 designated wilderness areas comprising more than 20 million acres within 63 refuges; that accounts for 20% of the National Wilderness Preservation System (NWPS), spanning the country from the subtropics to the subarctic, from desert to rainforest, from small islands to large pristine landscapes.

Diverse as our wilderness areas are, they share one important attribute: nature's primacy. All aspects of nature—our much-loved birds and mammals, certainly, but the little-appreciated life-forms just as well, together with the physical environments they need and all the ecological and evolutionary processes that shape them—comprise the wilderness condition. Wilderness is the headwater from which flows a diverse set of landscape values, symbolic and experiential as well as ecological. The convergence of these diverse values into one rich concept is the sum and substance of wilderness character, a powerful concept that connects a diversity of people to these remnant landscapes.

People attach values, feelings, and needs to these lands, all rooted in respect for heritage and hope for the future. These cultural and psychological associations meld with ecological science to form what Aldo Leopold (1949) called the “ecological conscience.”

## Protecting Ecological Integrity

The USFWS has long been among this nation’s leaders in pursuing an ecosystem approach to conservation, answering Leopold’s call to treat the landscape as a community, a whole much greater than the sum of its parts. As an area, in the words of TWA, “where the Earth and its community of life is untrammelled by man,” wilderness expands our thinking about wildlife to include all indigenous life-forms, at all levels of organization, from genetic to species to ecosystem.

This community-of-life perspective is most easily grasped in wilderness because of its distinguishing feature; *untrammelled* is a word deliberately chosen by the chief author of TWA to represent the keystone concept of wilderness. Howard Zahniser, a former USFWS employee, chose the word to emphasize the importance of preserving ecological integrity, including the natural ecological and evolutionary processes that shape our biosphere.

The perpetuation and connection of untrammelled communities of life are twin goals of the ecosystem approach to managing refuge wilderness. Translating such an expansive perspective into policy was a rather unprecedented step. But the thinking behind it was really a rediscovery.

The preeminent field biologist Olaus Murie, who left a career with the USFWS to head The Wilderness Society in 1945, emphasized ecological integrity in leading the campaign to establish the Arctic National Wildlife

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Social research affirms what Murie knew intuitively: The wilderness experience is “something more, something that has a mental, a spiritual impact on us.”

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Refuge. Describing “this basic effort to save a part of nature, as evolution has produced it,” Murie said:

*“Certainly a wilderness area, a little portion of our planet left alone, undeveloped, will furnish us with a number of very important uses . . . . We have only begun to understand the basic energies which through the ages have made this planet habitable. If we are wise, we will cherish what we have left of such places in our land” (1961).*

## A Setting for Recreation

Murie also extolled the deep and multiple values of wilderness recreation, a term woefully inadequate to convey

what a hiker, hunter, angler, or camper experiences. Social research affirms what Murie knew intuitively: The wilderness experience is “something more, something that has a mental, a spiritual impact on us” (Murie 1959). His wife, Margaret, summarized the recreational value of wilderness for all generations: “[they] will need and crave and benefit from the experience of and travel in far places, untouched places, under their own power. For those who are willing to exert themselves for this experience, there is a great gift to be won . . . a gift to be had nowadays in very few remaining parts of our plundered planet—the gift of personal satisfaction, the personal well-being purchased by striving . . . .” (Margaret Murie 1959).



Caribou thrive in the wilderness of the Arctic National Wildlife Refuge, the largest and northernmost national refuge in the United States. Photo courtesy of USFWS.



When a road through the Izembek National Wildlife Refuge was proposed, only the wilderness character of the area had the power to derail the planned development. Photo courtesy of USFWS.

But one need not journey to the wilds of Alaska, or undertake an arduous trek to receive the gift. A mere 50-minute drive from New York City, the Great Swamp National Wildlife Refuge's meandering trails attract people of all ages and walks of life. Here they can reconnect with nature, the world human beings did not make and do not control.

## A Connection to Cultural Heritage

"Wilderness is the indigenous part of our Americanism," wrote Leopold (1924). The framers of the TWA believed that contact with wild landscapes was a defining element of our national character. Wilderness serves as a repository where one can revisit the conditions that once surrounded and formed us as Americans. For a nation rapidly and inexorably being transformed by myriad environmental, technological, and social changes, wilderness holds open a path to our heritage.

It is a connection open not only to visitors. Like those who may never see

the Liberty Bell, Independence Hall, or the original Constitution of the United States, but who take pleasure in knowing they are preserved, countless Americans find it a matter of national pride that some vestiges of the wilderness chapter of our history and prehistory remain untrammelled.

## A Bequest for the Future

I believe that history will remember today's generation for what we leave of the land, rather than what we build on it. Wilderness may be the most encouraging example of our generation's willingness to pass on an undiminished natural legacy. It demonstrates that we are capable of restraint. It contributes to the establishment of a sustainable economy. As environmental historian Roderick Nash (1976) points out, one of the greatest contributions of wilderness is to develop and reinforce environmental responsibility, "to build a legacy of limitation."

We preserve wilderness for wildlife, and ecological, experiential, and symbolic values. But I agree with Howard

Zahniser (1956) that "the most profound of all wilderness values in our modern world is an educational value." In that insightful piece of TWA's legislative history "The Need for Wilderness Areas," Zahniser wrote that the great lesson of wilderness arises from the understandings that come to us when we realize that

*"we deeply need the humility to know ourselves as the dependent members of a great community of life . . . . Without the gadgets, the inventions, the contrivances whereby men have seemed to establish among themselves an independence of nature, without these distractions, to know the wilderness is to know a profound humility, to recognize one's littleness, to sense dependence and interdependence, indebtedness, and responsibility."*

Today, more than ever, we need the restraint and the larger sense of stewardship that emerge from these understandings. We need the humility evoked by landscapes set free of our tendency to dominate and bend nature to our purposes. We need the vision they inspire—to think outside the context of our uses, and beyond the boundary of our life and lifetime. Herein lies the potential contribution of wilderness character. And herein lies the test of our character as wilderness stewards.

These are some of the more prominent reasons why I have placed a high priority on wilderness within the NWRS. Wilderness stewardship is important and we must be a leader in this area.

To this end, a new USFWS policy on wilderness has been developed. It requires refuge managers to consider how their actions impact the wilderness condition of the lands under their charge. It directs refuge managers to respect both the natural conditions of the land

and the wilderness that distinguishes it from other conservation lands. The policy prompts refuge managers to question their course of action for a wilderness area: What long-term effects will the management action have on the landscape's wilderness character? Would alternative actions, or even no action at all, better serve the ecosystem? Further, I have asked all refuge managers to evaluate their lands for possible wilderness recommendations by the close of the year 2000. In the coming year, I expect to see wilderness recommendations in refuge Comprehensive Conservation Plans.

Additionally, I've directed all USFWS staff with wilderness responsibilities to enroll in wilderness stewardship training. The training will explain the new policies to our employees and hopefully instill an appreciation of the National Wilderness System. The USFWS is also expanding its support for the Arthur Carhart National Wilderness Training Center and the Aldo Leopold Wilderness Research Institute.

These efforts will enable us to shield the resource values of wilderness areas from the threats surrounding them. At the same time they must serve to integrate these values into those broader perspectives of which Leopold, Murie, and Zahniser spoke. So we strive to learn more about how wildlife and ecological values can coalesce with the evolving social and psychological meanings of wilderness to protect special places like Izembek and Pelican Island.

I believe we are answering the challenge that the Great Swamp wilderness first presented us: to preserve what is unseen in the landscape ... the essence, the "ness" of wilderness. And as we do, all refuge resources will benefit from the encompassing aura of wilderness character, the quality that transcends the physical boundaries of

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## The framers of TWA believed that contact with wild landscapes was a defining element of our national character.

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wilderness to connect the millions who will never come, but who find inspiration and hope *just in knowing* that some places are—and always will be—natural, wild, and free. **IJW**

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### REFERENCES

- Leopold, Aldo. 1924. Wilderness as a form of land use. In *The River of the Mother of God and Other Essays* by Aldo Leopold. Ed. by S. L. Flader and J. B. Callicot. 1991. Madison: The University of Wisconsin Press.
- Leopold, Aldo. 1949. *A Sand County Almanac and Sketches Here and There*. New York: Oxford University Press.
- Murie, Margaret. 1959. Testimony before the Merchant Marine and Fisheries Subcommittee on S. 1899, *A Bill to Establish the Arctic Range*. U.S. Senate Committee on Interstate and Foreign Commerce. 86th Congress. 1st session, part 1, 1969. Washington, D.C.: GPO, 1960: 59–60.
- Murie, Olaus. 1959. Testimony before the Merchant Marine and Fisheries Subcommittee on S. 1899, *A Bill to Establish the Arctic Range*. U.S. Senate Committee on Interstate and Foreign Commerce. 86th Congress. 1st session, part 1, 1969. Washington, D.C.: GPO, 1960: 58–59.
- Murie, Olaus. 1961. Wilderness philosophy, science, and the Arctic National Wildlife Range. In *Proceedings, Twelfth Alaskan Science Conference, Alaska Division, American Association for the Advancement of Science*, edited by G. Dahlgren Jr. College: University of Alaska.
- Nash, Roderick. 1976. Wilderness: To be or not to be. In *Nature and Human Nature*, edited by W. R. Burch Jr. Yale University: School of Forestry and Environmental Studies, Bulletin No. 90. New Haven, Conn.: Yale University: 27–39.
- Zahniser, Howard. 1956. The need for wilderness areas. *The Living Wilderness* Winter-Spring, 1956–1957 (59): 37–43.



New Jersey's Great Swamp National Wildlife Refuge became the Department of the Interior's first designated wilderness area. Photo courtesy of USFWS.

# Managing Campsite Impacts on Wild Rivers

## Are There Lessons for Wilderness Managers?

BY DAVID N. COLE

**Abstract:** Campsites on popular wild rivers in the United States are heavily used by large groups, creating extremely large campsites surrounded by webs of social trails and satellite sites. Many rivers carrying seasonally high volumes of water have extensive beach deposits below the high-water line that make highly durable camping surfaces. Along with the success of low-impact education and requirements to carry fire pans and portable toilets, high site durability has tempered some impact problems along rivers.

More people floated the Colorado River through the Grand Canyon in 1972 than ever before. Campsites along the river showed it. White sandy beaches were gray from the charcoal and ash of campfires. Webs of user-built trails led to piles of human waste. Toilet paper blooms and the aroma of urine were ever-present. In the year 2000, river use has increased 50%, but the trails only wander from beaches to tent pads and the beach sand is white again; the white blooms are the blossoms of datura and primrose, and the smells are of desert scrub.

Despite heavy use and its subsequent impacts along many wild rivers, impact management has enjoyed unprecedented success in the United States. To illustrate some of the problems and opportunities that are unique to river management, I use data on the condition of campsites along the Middle Fork and Main Salmon rivers in Idaho—data that were collected as a baseline for monitoring of long-term trends in condition. Lessons learned from wild-river management might be important to wilderness managers.

### The Middle Fork and Main Salmon Rivers

The Middle Fork and Main Salmon are “wild” rivers, as defined by the Wild and Scenic River Act of 1968. Each segment offers opportunities for week-long, whitewater float trips through the Frank Church River of No Return Wilderness in central Idaho. About 10,000 people per year float the Middle Fork, while about 8,500 people per year



Article author David Cole with his children, Kristin and Dylan. Photo by Linda Henderson.

float the Main Salmon. On both river segments, commercial passengers outnumber private boaters, primarily because they travel in larger groups. For example, the average group size on the Middle Fork is about 24 for commercial groups and 10 for private groups. Guests on commercial trips book and pay a river outfitter. Private boaters must enter a lottery for a permit. The success rate for obtaining a private launch permit is about 4% on the Middle Fork (even less during the best floating season) and 12% on the Main

Salmon. On both rivers, boaters must carry fire pans and portable toilets, and pack out all human waste and campfire refuse. On the Middle Fork, boaters must camp in designated campsites, assigned for each night of the trip. On the Main Salmon, boaters can camp anywhere they want, except for a few locations where camping is not permitted. A few campsites are reserved for large groups.

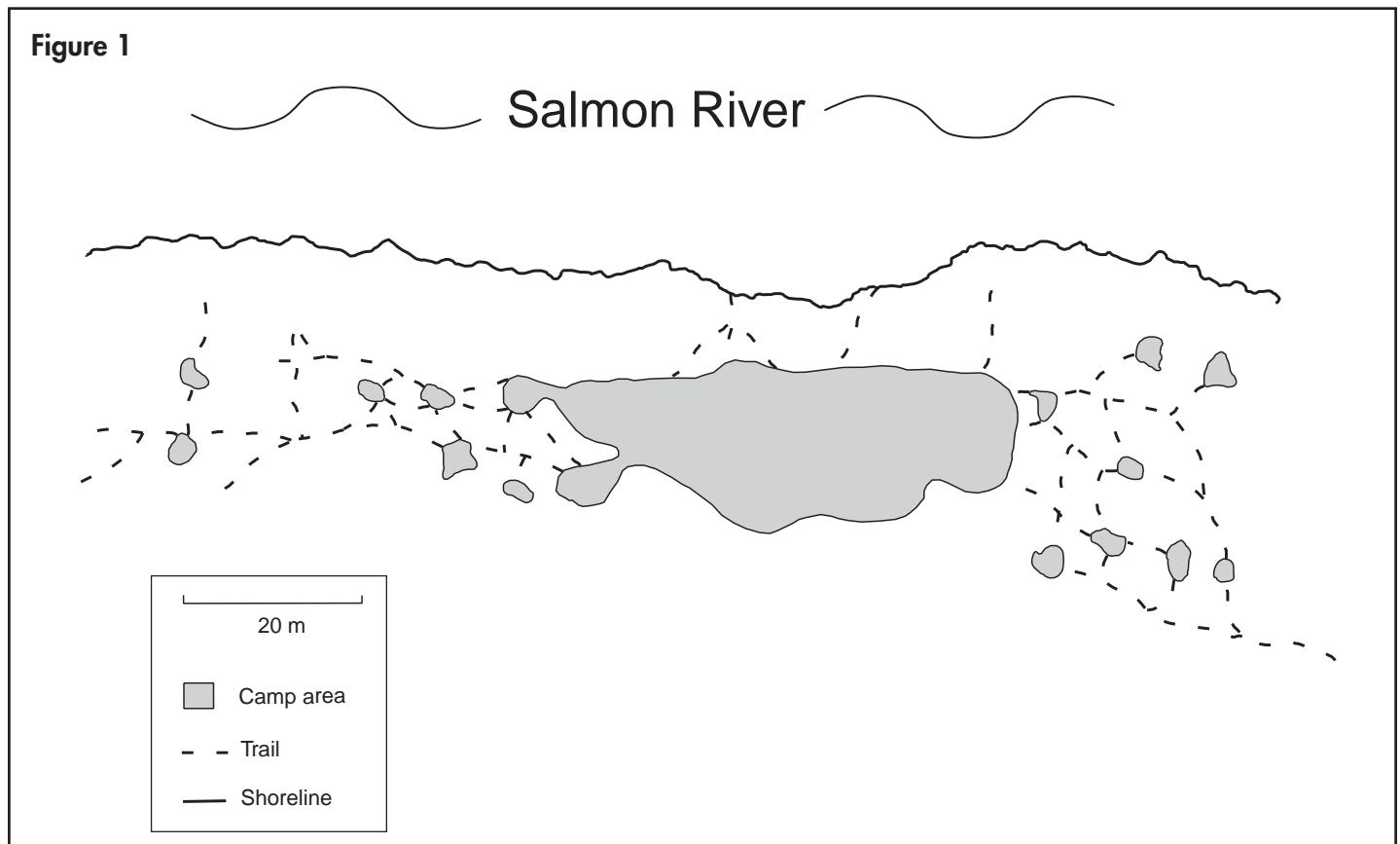
### Campsite Condition Survey

The Middle Fork and Main Salmon have about 100 campsites each, depending on the water level. In 1995–1996 I worked with a team to conduct a 10 to 15% systematic sample of these campsites. We collected detailed information about the condition of 11 campsites on the Middle Fork and 13 campsites on the Main Salmon.

We adapted established techniques used to assess campsite impacts in terrestrial wilderness (such as Cole 1983; Cole and Hall 1992). Challenges included the large size of river campsites, the complex maze of social trails and satellite tent pads, and difficulty in defining the edges of the camps. One edge is the river that fluctuates in height. We quickly realized that for ground-cover parameters (such as vegetation), it would be impossible to assess the amount of impact that had already occurred. Normally, impact to such parameters is assessed by comparing campsites with adjacent control sites. Good controls are hard to find along these rivers because any place with the characteristics of a campsite is already a campsite. Nevertheless, we did collect some data from undisturbed “controls.”

We established one (or more) center point(s)—a buried nail located above high water and referenced to three distinctive features. On the campsite perimeter we placed 15 to 25 flags where the boundary changed direction. Then, from the center point, we recorded azimuth and distance to each flag. Such measures are replicable and can be used to calculate campsite areas (Marion 1995).

Within the campsite perimeter, delimited by straight lines drawn between flags, we estimated the proportion of the site in the following ground-cover classes: vegetation, litter, mineral soil, sand, and rock. For each live tree within campsite boundaries we assessed tree damage as either none/slight, moderate (two or more nails, numerous small trunk scars, or exposed roots), or severe (numerous



**Figure 1**—The Tumble Creek campsite on the Middle Fork of the Salmon River illustrates the large disturbed area and web of trails and satellite tent sites characteristic of many river campsites.

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## The most compelling lesson from rivers is the success of programs to manage campfires and human waste.

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substantial trunk scars or girdled trunks or roots). We counted tree snags and “natural” stumps as well as stumps clearly cut by visitors. We counted the number of fire rings, ash piles, scorched sand sites, human waste sites, and constructed structures, and we measured the volume of garbage, in liters.

We mapped and measured the length of each user-created social trail that left the campsite perimeter, dividing each into segments according to the following condition classes: (1) worn, but with vegetation in the tread; (2) well-worn, with no vegetation in the tread; and (3) deeply worn, no vegetation, and tread eroding. At each satellite site (usually a tent pad), we estimated area, as well as percent cover of vegetation, litter, mineral soil, sand, or rock.

### Campsite Conditions

The most notable characteristic of these campsites was their huge size and web of social trails to satellite sites (see Figure 1). For the Middle Fork, the median main camping area was 544 m<sup>2</sup>, and satellite sites added another 126 m<sup>2</sup> (see Table 1). There were more than 250 m of social trails. On one site, the total camping area exceeded an acre, and the length of the trail web approached three-quarters of a mile. Main Salmon campsites typically had larger main sites (median of 905 m<sup>2</sup>) but fewer social trails and satellite sites. This difference between rivers results from Main Salmon campsites typically having more camping space below the high-water line; beach areas are typically larger. Along the Middle Fork, there is typically less camping area below the high-water

line. Large groups spread out above high water, creating a more extensive system of trails and satellite sites. The Middle Fork is also used more during peak flow periods, when camping areas below high water are unavailable. These conditions can be compared with typical camp areas of 200 m<sup>2</sup> in the Eagle Cap Wilderness, Oregon (Cole and Hall 1992), and 200 to 300 m<sup>2</sup> along several rivers in the eastern United States (Cole and Marion 1988). The larger Salmon River sites are similar to horse outfitter camps in the Bob Marshall Wilderness, Montana, where the combined area disturbed by cooking, tenting, and holding pack stock ranged from 400 to 10,000 m<sup>2</sup> (Cole 1983).

Although vegetation cover is sparse on these campsites (see Table 2), vegetation was probably never continuous on these sites prior to recreation use. Mean vegetation cover on the best “control” sites we could find was 56% on the Middle Fork and 42% on the Main Salmon. Along the Main Salmon, the typical campsite is mostly sand and rock below the high-water line. Such substrates are highly durable. They can be frequently used without substantial impact. On the typical Middle Fork site, however, more of the site extends above high water. Mineral soil, which was negligible prior to recreation use, is exposed over 36% of the median campsite.

Despite the huge area disturbed by camping, these campsites are clean and relatively undamaged. Most campsites had no evidence of fire-related impacts, no userbuilt structures, no evident human waste or toilet paper, virtually no garbage, and no significant tree damage. In contrast, most campsites elsewhere will have fire rings (often more than one), ash piles, and structures. Along several eastern rivers (Cole and Marion 1988), sites



**Extensive deposits of unconsolidated sand, scoured every few years by seasonal floods, provide highly resilient surfaces for minimal impact camping. Photo by David Cole.**

**Table 1—Campsite area and extent of satellite sites and social trails.**

	Camp Area (m <sup>2</sup> )	Satellite Sites		Social Trails	
		(#)	(m <sup>2</sup> )	(#)	(m)
<b>Middle Fork Salmon</b>					
<b>Median</b>	544	5	126	22	257
<b>Maximum</b>	4,244	27	816	34	1,112
<b>Main Salmon</b>					
<b>Median</b>	905	3	41	4	89
<b>Maximum</b>	3,342	11	735	25	259

Median and maximum areas for 11 campsites on the Middle Fork and 13 campsites on the Main Salmon Rivers.

typically had evident human waste, more than 10 liters of garbage, and more than 20 damaged trees.

### River Recreation Impact and Management

These results illustrate four points about recreation impacts and management along popular rivers. First, use levels are extremely high. Impacts would be even higher if management had not restricted use and implemented educational programs. Some campsites on rivers are used more than 100 nights per year. Without proper management such sites can degrade severely. Even with proper management, certain types of impacts will inevitably be severe.

Second, campsite conditions are strongly affected by the type of use

these rivers receive. Campsites along these rivers are unique in their large size and in their complex web of social trails and satellite sites. The significance of such impacts increases to the extent that such impacts occur above high water on terraces with better soil and vegetation but that are not “rejuvenated” by periodic floods. Although never formally studied, it seems intuitively clear that large groups and groups consisting of unaffiliated subgroups are particularly likely to cause such impacts. Large groups simply cannot be accommodated in a small campsite. They must spread out over a large site and, if that site is not large enough, disperse to satellite tent sites. Such dispersal is more likely when the group consists of numerous unaffiliated subgroups

(individuals, couples, families) as opposed to close family and friends. Privacy is often greater above the high-water line where screening vegetation is denser. Most outfitted groups are large and consist of unaffiliated subgroups, suggesting they may be particularly prone to causing such impacts. However, as permits become increasingly difficult to obtain, the size of private groups is also increasing, as is the likelihood that private groups will include unaffiliated subgroups.

Third, on high volume rivers like the Salmon River (particularly the Main Salmon), extensive beach deposits below high water create highly durable camping surfaces. This favorable attribute compensates substantially for the high impact potential of heavy use by large groups. Generally lower impact

**Table 2—Ground cover on campsites.**

	Vegetation	Litter	Mineral Soil	Sand	Rock
<b>Middle Fork Salmon</b>					
<b>Median</b>	17	16	36	12	13
<b>Maximum</b>	38	42	80	84	33
<b>Main Salmon</b>					
<b>Median</b>	16	3	3	56	15
<b>Maximum</b>	63	38	41	86	61

Median and maximum ground cover in percent for 11 campsites on the Middle Fork and 13 campsites on the Main Salmon Rivers.

on the Main Salmon, compared with the Middle Fork, results from larger camping beaches along the Main Salmon, as well as less use during peak flow periods, when the only option is to camp above the high-water line. River managers should discuss the desirability of confining use below the high-water line for all visitors. This may mean convincing subgroups to set their tents up closer to each other than they might prefer, and limiting group size so that tent sites are unnecessary above the high-water mark. With cooperation from boaters, managers could take actions to reduce the size of campsites, closing unnecessary trails and satellite sites and building subtle barriers to define the edge of the site.

Finally, Leave-No-Trace education and behavioral restriction (fire pan and portable toilet requirements) are readily accepted by river boaters. Their implementation has succeeded in nearly eliminating unnecessary high impact behaviors. Campfire remains and improperly disposed waste have largely disappeared along rivers. Such efforts should be continued.

### Lessons for Wilderness Management

This analysis of campsite condition along rivers illustrates how camping on durable surfaces and appropriate

visitor behavior can keep certain impacts to minimal levels even where use pressure is extremely high. It also illustrates the unique problems created by extremely large groups, especially when the individual group members are unaffiliated. Concentration of use on durable surfaces is the most effective means of minimizing trampling impacts (Cole 1994). Large groups spread out more and, therefore, are more likely to impact fragile surfaces.

The most compelling lesson from rivers is the success of programs to manage campfires and human waste. Away from rivers—among backpackers and stock groups—such efforts have been much less successful. Why have river programs been more successful? First, management actions on rivers are more aggressive. Each group of boaters is informed of appropriate behaviors and required equipment prior to their trip. Required equipment is checked and an educational message is usually given before they launch. Second, it may be easier for boaters to transport low-impact gear such as fire pans and portable toilets. And third, boaters may simply be more committed to minimizing their impact than other recreationists.

Why would boaters have a higher level of commitment? The answer may lie in the difficult process of obtaining

a permit. Private boaters must plan far ahead. Most feel lucky to obtain a permit, feel their trip is a privilege, and are more likely to be granted a permit again if they take care of the river. If this is true, it suggests that there is value in portraying wilderness as a special, fragile place, a place one should feel privileged to visit. It also suggests that more wilderness managers should consider implementing permit systems. **IJW**

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### REFERENCES

- Cole, David N. 1983. Campsite conditions in the Bob Marshall Wilderness, Montana. *USDA Forest Service Research Paper INT-312*.
- Cole, David N. 1994. Backcountry impact management: lessons from research. *Trends* 31(3): 10–14.
- Cole, David N., and Troy E. Hall. 1992. Trends in campsite condition: Eagle Cap Wilderness, Bob Marshall Wilderness, and Grand Canyon National Park. *USDA Forest Service Research Paper INT-453*.
- Cole, David N., and Jeffrey L. Marion. 1988. Recreation impacts in some riparian forests of the eastern United States. *Environmental Management* 12: 99–107.
- Marion, Jeffrey L. 1995. Capabilities and management utility of recreation impact monitoring programs. *Environmental Management* 19: 763–771.

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Despite heavy use and its subsequent impacts along many wild rivers, impact management has enjoyed unprecedented success in the United States.

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# The San Marcos River Wetlands Project

## Restoration and Environmental Education in Texas

BY THOMAS L. ARSUFFI, PAULA S. WILLIAMSON,  
MARTA DE LA GARZA-NEWKIRK, and MELANI HOWARD

**Abstract:** Spring Lake, the headwaters of the San Marcos River, is fed by springs from the Edwards Aquifer. These springs are the second largest in the Western Hemisphere, and the headwaters are believed to be among the oldest sites in North America continuously inhabited by humans. The people of Texas are committed to preserving and protecting the sensitive headwaters of the San Marcos River.

### The Importance of Wetlands in Texas

San Marcos, a city of nearly 40,000, is located in central Texas, between the Blackland Prairie to the east and the limestone Hill Country to the west. The San Marcos River, one of the world's clearest rivers, arises in San Marcos on the campus of Southwest Texas State University (SWT), a comprehensive public university with 22,000 students. The San Marcos River flows through the city, is joined by the Blanco River a few miles downstream, and continues to its confluence with the Guadalupe River 78 miles downstream at Gonzales. Spring Lake, the headwaters of the San Marcos River, is fed from springs arising from the Edwards Aquifer, flowing at 150 million gallons per day.

Aquifers represent a major source of drinking water (50%) for many parts of the nation. Due to the threat of contamination and depletion, there has been a surge of interest in the ecology and management of groundwater ecosystems. The Edwards Aquifer is confined karst (limestone), and is 290 km long and 50 km wide. It is the sole source of water for 1.7 million people. San Antonio, the 10th largest metropolitan area in the United States, is the largest city in the world that obtains its entire water supply from a single aquifer. The Edwards Aquifer is considered the most biologically diverse aquifer ecosystem in the world, with more than 40 endemic faunal species (Longley 1981). The aquifer is also home to an endangered species, the Texas blind salamander (*Typhlomolge rathbuni*). The Edwards Aquifer has been the subject of much controversy concerning



Article authors (left to right) Thomas Arsuffi, Melani Howard, Paula Williamson, and Marta de la Garza-Newkirk. Photo courtesy of Thomas Arsuffi.

overdrafting, possible contamination, and impact on endangered species (Bowles and Arsuffi 1993). There are at least five competing water interests (agricultural, large city, small cities, downstream industries, and estuarine fisheries) with opposing political agendas. The issues involve private property rights, economic growth, tourism, endangered species, maintenance of a viable water supply, and sustaining aquatic ecosystems (Votteler 1998).

Spring Lake is 16 acres, about half of which is a shallow slough. The spring and river system is considered one of the most unique systems in the world due to its clear, thermally constant (22°C, 72°F) water, which flows continuously and provides habitat for a diverse group of aquatic organisms,



Hand-removal of water hyacinth avoids the negative effects of herbicides. Photo by Thomas Arsuffi.

including four federally listed endangered species: fountain darter (*Etheostoma fonticola*), San Marcos gambusia (*Gambusia georgei*), Texas wild rice (*Zizania texana*), and Comal Springs water beetle (*Heterelmis texanus*); and one threatened species: San Marcos salamander (*Eurycea nana*).

Spanish explorers found the springs more than two centuries ago on St. Mark's Day and named the site San Marcos. With artifacts dating to more than 12,000 years old, it is believed to be one of the oldest sites continuously inhabited by humans in North America. In 1946 the site was developed into Aquarena Springs, a theme park with glass-bottom boats, an underwater theater, and "Ralph" the swimming pig. SWT purchased Aquarena Springs in 1994 with the goal of transforming it from a theme park to a multipurpose environmental education and research center.

Wetlands are among the most productive ecosystems on Earth. They serve as habitat for many species of plants,

fish, birds, and invertebrates. They also function in flood and erosion control, water purification, and annually provide more than \$4 trillion worth of ecosystem services in the United States alone (Costanza et al. 1997). Unfortunately, between 1700 and 1970, nearly 75% of the wetlands in parts of the United States were lost to development. In the state of Texas, more than half of all wetlands are gone. Preservation of existing wetlands and education of the public about the importance of wetlands are critical to conserving this limited natural resource.

### Meeting the Challenge

SWT had a grand vision for Aquarena, but the university needed help. In the fall of 1996 SWT requested the assistance of the U.S. National Park Service (USNPS) through its Rivers, Trails, and Conservation Assistance Program (RTCA).

RTCA provides planning and technical assistance to state and local groups on locally initiated conservation

projects. The mission of RTCA is to encourage community-based conservation action. Through a network of field staff, RTCA assists communities in all 50 states with trail and greenway planning, river restoration, watershed planning, cultural landscape preservation, and other natural and cultural resource conservation projects. Together, SWT and RTCA developed a simple strategy for the Wetlands Project and formed the Wetlands Project Team (WPT) to manage it.

The WPT identified those groups and organizations with a stake in the future of Aquarena, as well as those that might have resources to contribute. Many of these groups had already expressed interest in and offered support for the Wetlands Project. The WPT identified and secured funding sources, coordinated demonstration projects, defined long-term actions, developed site specific plans and designs, and developed early partnerships. The WPT hoped the demonstration projects would allow the community a glimpse of what the restored Spring Lake wetlands would look and feel like. Demonstration projects included: (1) the Statewide Teachers Exhibit, a temporary and portable exhibit to inform Texas teachers of the educational opportunities at the new Aquarena Center; (2) the Wetlands Painting, an artistic view of the transformation of Aquarena theme park to an environmental education center; (3) the Demonstration Pond and Boardwalk, a 50-foot long boardwalk segment, constructed of recycled plastic lumber, situated over an artificial wetland pond; and (4) Water Hyacinth Removal and Conservation Days, a series of volunteer-based efforts to control an invasive macrophyte species and restore native vegetation.

RTCA assisted SWT in identifying funding sources, large and small,

public and private, for each of these projects. SWT then set out to secure funding. The results were impressive: \$775 from the Syntal Corporation; \$1,000 from the San Marcos River Foundation; \$1,000 from the MarshMALLOW Program; \$1,150 from Texas A&M University's Adopt-a-Wetlands Program; \$2,500 from the USNPS's RTCA program; \$5,000 from the National Fish and Wildlife Foundation; \$10,000 from SWT's Merrick Funds; \$17,000 from private donors; and \$19,000 from U.S. Fish and Wildlife Service's Partners for Wildlife Program. And in March 1998 the biggest grant of all, \$500,000, was given by the Meadows Foundation of Texas. Then in partnership with Texas Parks and Wildlife Department, an additional \$130,000 was obtained for riparian exotic tree removal (e.g., Chinese tallow), native plant acquisition and education/interpretation development. With funding secured, the WPT began to form partnerships around the demonstration projects. Americorps offered cost-effective labor for plant removal, boardwalk construction, and trail construction. Hays County Master Gardeners offered landscape design for the demonstration pond. Private donors offered boardwalk design assistance and plant and material donations.

## The Vision

Aquarena is a tremendous resource, however the physical and biological character of the habitat has been dramatically modified by humans. Historical records indicate a dramatic change in plant and animal communities in Spring Lake and the slough during the past 65 years. In particular, a large number of plant and animal species were introduced, and today about 25% of species in Spring Lake are exotic.

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## Removal efforts have been a success; presently the slough is 99% free of water hyacinth.

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Animal species (nutria, swan, geese, and giant rams-horn snails) introduced into Spring Lake increased in abundance due to domestication and ability to adapt to disturbances. These introduced herbivores may significantly reduce stands of Texas wild rice and other native plants (USFWS 1996).

The slough area of Spring Lake was historically vegetated with cattails and other emergent tall grasses that provided habitat and forage for native wildlife. Today, most shoreline areas of the San Marcos River have been taken over by *Colocasia esculenta* (taro or elephant ears), a plant native to India and southern Asia. The plant tolerates bright sun to deep shade, readily reproduces vegetatively, and exhibits allelopathic properties (Wang 1983)—characteristics that enable it to be highly invasive. Consequently, diver-

sity of native species in littoral zones of the river has diminished. Elephant ears are also thought to decrease habitat suitability for the San Marcos gambusia, thus contributing to its decline (USFWS 1996). Another effect of elephant ears on the San Marcos River ecosystem is their impact on water quantity. The broad-leaved morphology of the plant suggests it is a high water user. As much as 17,500 acre-feet of water are lost annually in the upper five-mile section of the San Marcos River through elephant ear evapotranspiration.

The first step in restoration of the wetlands is removal of exotic species. Removal of exotic animal species is accomplished by baiting and trapping methods. Removal of exotic plant species has been ongoing for the past two years. Open areas



The San Marcos River, one of the world's clearest rivers, arises on the campus of Southwest Texas State University. Photo by Thomas Arsuffi.



The people of Texas are committed to preserve and protect, for public use, the sensitive headwaters of the San Marcos River. Photo by Thomas Arsuffi.

of the slough were covered with *Eichornia crassipes* (water hyacinth). The dense, floating water hyacinth shades out developing shoots of Texas wild rice and other native aquatic plants. These floating mats also preclude waterfowl access to the slough. Additionally, when freezes occur large quantities of water hyacinth die and decompose, causing severe oxygen depletion that results in fish and invertebrate kills. Water hyacinths are commonly controlled using aquatic herbicides. Although herbicides are effective, they have undesirable side effects. Herbicide drift may impact other organisms, and cause nutrient enrichment and serious oxygen depletion associated with decaying plant matter. Water hyacinths are free-floating plants easily removed by hand. Employing this method avoids the negative effects

of herbicides. Harvested water hyacinths are donated to the community for composting. Removal efforts have been a success; presently the slough is 99% free of water hyacinth.

Elephant ear seed production is considered rare, and seeds and seedlings have a low viability (Nyman and Arditti, 1985) therefore complete eradication by removing existing plants is possible. Three methods of removal (hand removal of corms, cutting above ground plant parts, and wicking) are under investigation to determine the most effective technique. Hand removal of the corms is effective but labor intensive and difficult because the plant produces calcium oxalate crystals, which cause skin irritation in humans (Wang 1983). The plants readily resprout from underground corms. Therefore,

cutting or mowing the plants requires repeated efforts over time to accomplish eradication. We are testing the wicking technique (direct touch application), using glyphosate herbicides (e.g., Rodeo), an herbicide approved for aquatic use that is quickly absorbed by the plant. This method minimizes chemical drift and reduces both impacts on nontarget species and contamination of the river. Vegetation along the bank, however, is necessary to control bank erosion and reduce the rate of sedimentation in the river. Therefore, prior to full-scale removal of elephant ears, pilot studies are being conducted to determine which native species can successfully be used to revegetate and restore the bank.

The next phase of restoration is to use historical vegetation records as a guide to revegetate target areas of the slough with native aquatic plants. Native plants will be grown from noncontaminated stock to prevent accidental introduction of invertebrates with the plants. Plants, including *Cabomba*, *Ludwigia*, *Vallisneria*, and *Sagittaria*, that are of high quality for fountain darters and other native animal species will be used. This project will restore the habitat for many wetlands birds, fish, and invertebrates. An added benefit will be the improvement of important wetlands functions such as water purification and sediment control. This will help maintain high water quality in Spring Lake and the San Marcos River.

## Educating the Public

To educate the public about the importance of wetlands it is essential to provide hands-on experiences in nature. To accomplish this goal, a wetlands boardwalk trail system will be constructed in the slough area.

This will allow increased visitation to the wetlands while protecting the fragile ecosystem. The area is and will remain protected because fishing, swimming, and boating is prohibited. Aquarena has high public accessibility, located within a mile of an interchange with 65,000 cars passing daily. We expect 300,000 people will visit the Aquarena wetlands and nature trail system each year. Most people would not visit a wetlands on its own merits. But in this case, the boardwalk and nature trail would be one of the many environmental attractions Aquarena has to offer.

The boardwalk will feature interpretive signage, bird-viewing platforms and observation points, and will be accessible to the disabled. The boardwalk will traverse an ecological gradient of three wetland habitats: riparian, littoral/emergent, and open water.

An educational/interpretive kiosk will be located at the start of the boardwalk trail. This kiosk will emphasize the ecological structure and processes that occur in wetlands, the importance of wetlands restoration and preservation, the economic and ecological value of wetlands, and the significance of endangered and threatened species in the San Marcos Springs ecosystem. Other interpretive kiosks will be positioned at key educational points along the boardwalk to explain riparian, emergent and open habitats, native wildlife, and important anthropological features of the area and lake.

## Conclusion

The Wetlands Project will take many years to realize and will require long-term partnerships with stakeholder groups and the community at large. The WPT recognizes that for the

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## The Edwards Aquifer is considered the most biologically diverse aquifer ecosystem in the world, with more than 40 endemic faunal species.

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project to be successful, Aquarena Center must offer innovative and interactive educational programs for students of all ages and abilities; preserve and protect the sensitive natural resources of the Aquarena site and its surrounding watershed; and serve as a model for other wetland and watershed conservation efforts in Texas and the United States. **IJW**

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## REFERENCES

- Bowles, D. E. and T. L. Arsuffi. 1993. Karst aquatic ecosystems of the Edwards Plateau region of central Texas, USA: a consideration of their importance, threats to their existence and efforts for their conservation. *Aquatic Conservation: Marine and Freshwater Ecosystems* 3: 317-329.
- Costanza, R. et al. 1997. The value of the world's ecosystem services and natural capital. *Nature* 387: 253-260.
- Longley, G. 1981. The Edwards Aquifer: Earth's most diverse groundwater ecosystem? *International Journal of Speology* 11: 123-128.
- Nyman, L. P. and J. Arditti. 1985. Germination of taro seeds. *Ariodeana* 8: 83-88.
- U.S. Fish and Wildlife Service. 1996. San Marcos/Comal (Revised) Recovery Plan. Albuquerque, New Mexico: x and 93.
- Votteler, T. H. 1998. The little fish that roared: the Endangered Species Act, state groundwater law, and private property rights collide over the Texas Edwards Aquifer. *Environmental Law* 28 (4): 845-879.
- Wang, J. K. 1983. *Taro: A Review of Colocasia esculenta and Its Potentials*. Honolulu, Hawaii: University of Hawaii Press.



The wetlands area crowded with vegetation before removal. Photo by Thomas Arsuffi.

# Voyage of Recovery

## Restoration of the Wild and Scenic Missouri River

BY ANNIE STRICKLER

**Abstract:** U.S. President Thomas Jefferson sent the Corps of Discovery west in 1804 to map a transcontinental route through the lands of the Louisiana Purchase—the elusive Northwest Passage. Captains Meriwether Lewis and William Clark led the corps up the Missouri River, recording its path, tributaries, and its flora and fauna. An American Rivers campaign aims to restore pieces of what Lewis and Clark found 200 years ago.

### History Flows along the Missouri

The Missouri River, named after a tribe of Native Americans, is considered the “historic lifeline of the American West.” In 1804 Lewis and Clark’s Corps of Discovery found a river teeming with life. Fish, birds, and other wildlife thrived on the river in a rich mosaic of braided channels, sandbars, side channels, floodplain forests, wetlands, and prairies—all in a constant state of change. They identified hundreds of species of plants and animals previously unknown to science, including cutthroat trout, white-tailed deer, and mountain lions. Lewis and Clark marveled at the unspoiled landscapes that enveloped each footstep and paddle stroke. Clark described the river floodplain as “one of the most butifull Plains, I ever Saw, open and butifully diversified with hills and vallies all presenting themselves to the river.”

Today, Lewis and Clark would not recognize most of the Missouri River. Not long after their journey, engineers began efforts to tame the “Big Muddy,” a nickname earned from its constant wrenching of trees and earth from its riverbanks—characteristics of an unfettered river. Damming and channeling the river for barge navigation and flood control changed its essential qualities and wiped out critical wildlife habitat. This same river of such staggering beauty in 1804 has been on American Rivers’ Most Endangered Rivers list since 1994.

As the nation prepares to celebrate the 200th anniversary of Lewis and Clark’s Corps of Discovery, we have the opportunity to restore the Missouri River and revitalize riverside communities. American Rivers is embarking on a Voyage of Recovery to recreate a river that supports wild-life, recreation, and tourism and is an invaluable asset to



Article author Annie Strickler. Photo courtesy of Annie Strickler.

the communities along its banks—a conservation legacy in commemoration of Lewis and Clark’s epic journey.

### The Missouri River Today

The Missouri River drains one-sixth of the United States, or about 529,350 square miles, and stretches 2,341 miles

from its headwaters in the Rocky Mountains at Three Forks, Montana—the confluence of the Gallatin, Madison, and Jefferson rivers—to its confluence with the mighty Mississippi River at St. Louis. Despite its wild tendencies, the “Mighty Mo” is now just a remnant of its storied past.

Today’s Missouri River is 127 miles shorter, one-third as wide, and significantly deeper and faster in areas than the waters Lewis and Clark paddled. One-third of the river lies sequestered behind giant earthen dams, and another third has been channeled, stabilized, and cut off by flood-control levees. Dam operations, livestock, and private bank stabilization heavily influence the remaining third. These “improvements” eliminate critical wildlife habitat, setting off a tragic domino effect for the species depending on natural cycles. One of these cycles critical to fish reproduction is the pattern of natural high and low water flows. The Army Corps of Engineers (ACE) has changed these flows to support year-round barge operations, producing spring flows rarely high enough to trigger spawning.

Reduction of habitat, poorly gauged dam releases, and changes in water temperature, depth, velocity, and turbidity have nearly eliminated the pallid sturgeon during the past half-century, a species that has been on Earth for more than 70 million years. More than 30 species native to the Missouri have been placed on state and federal watch lists. The decline of paddlefish, sturgeon, sauger, blue sucker, flathead catfish, flathead chub, sicklefin chub, speckled chub, sturgeon chub, and silver chub is a result of habitat loss and poor dam management.

Damming the river has also reduced sandbars and nesting habitat for the least tern and piping plover, considered endangered and threatened, respectively,

by the federal government. Also declining in numbers are nearly 60 other shorebirds, waterbirds, and wading birds that depend upon the Missouri’s sandbars, islands, and shallow water habitat. This includes the great blue heron, killdeer, sora rail, sandpiper, and mountain plover. Many neotropical migrant birds also depend on the river and adjacent lands for their migratory flyways.

The plight of the cottonwood tree along the banks of the Missouri has had an ecosystem-wide effect. High spring releases of water are imperative to the reproduction of cottonwoods by depositing a layer of alluvium in which seeds can germinate. Cottonwoods provide primary roosting and nesting spots for our national emblem—the majestic bald eagle. Unlike the increasing eagle populations nationwide, wintering populations of bald eagles on the Missouri River have continued to decline due primarily to the absence of perching, roosting, and nesting habitat. A recent survey found only 600 of the nation’s approximately 12,000 bald eagles along the Missouri River or its tributaries.

The wild Missouri River has suffered in the name of progress and protection. Originally forecast to carry 12 to 20 million tons of cargo annually, barge traffic on the Missouri River peaked at 3.3 million tons in 1977 and has fallen to just 1.5 million tons, generating \$7 million in annual benefits. Navigation accounts for just 1% of the economic benefits produced by the



A lone cottonwood tree on the upper Missouri River. Photo by Sam Able.

Missouri. Recreation produces 10 times as many economic benefits for riverside communities as commercial navigation, according to the ACE. And flood protection has, in some instances, been even more elusive. The great flood of 1993 mocked our attempts to command the river, leaving in doubt the ability of technological innovation to control nature.

## Bequeathing a Conservation Legacy—The Voyage of Recovery

This Voyage of Recovery is a rare chance to honor our natural heritage while teaching young and old alike about the intricacies of river conservation. This campaign is based on the following goals.



The mighty Missouri River. Photo courtesy of American Rivers.

### **Restore Natural Places and Reduce Flood Losses**

After the 1993 flood cost taxpayers an estimated \$16 billion, and 1995 floods caused more damage, people realized nature can help out when the river rebels. American Rivers is working with landowners and river managers to create a string of natural places along the Missouri—often likened to a “string of pearls”—including pockets of floodplain forest and prairie, side channels, sandbars, and islands. One aspect of this process is the acquisition of chronically flooded farmland from willing sellers. In addition to providing habitat for wildlife, protecting and restoring the Missouri’s floodplain forest reduces the damage and cost of future floods by acting as a natural sponge. The river has more room to spread out, eliminating future disaster payments.

### **Manage Dams for Wildlife and People**

American Rivers is working with government officials and private dam owners to promote dam releases that support recreation, wildlife, and riverside communities. The Missouri’s dams should be operated to provide rising flows in the spring to trigger fish reproduction, build sandbars, and regenerate cottonwoods, followed by declining flows during the summer to support nesting wildlife and recreation.

### **Revitalize Riverfronts and Improve River Access**

With the bicentennial of Lewis and Clark’s epic voyage approaching, many towns along the route can capitalize on the river’s potential as a community center by establishing parks, creating trails and greenways, and protecting historic riverfront buildings. In Omaha,

a coalition of private and public groups is building a 64-mile system of riverside trails that connects wetlands, forests, and prairie. Enhanced boat access in the area increased use of the river by 72%. American Rivers is working with riverside communities to promote riverfront revitalization projects and link community leaders with riverfront funding and expertise. With the proper implementation of riverside development based on ecological design principles, we will truly be “putting the river back in riverfront.”

### **Reduce the Impacts of Grazing**

To allow cottonwoods to regenerate, new programs will prevent livestock from eating or trampling seedlings. Poorly controlled riparian grazing has led to a partnership among American Rivers, a private landowner, and the conservation district along a stretch of the Upper Missouri National Wild and Scenic River. The operation consists of a solar pump, waterline, tanks, and corral in the upland area, and a fence to isolate a substantial riparian area downriver. It pumps water to parched livestock who would otherwise migrate to riparian areas to drink. This and similar projects may help reverse scientific predictions that cottonwoods will soon be virtually absent from the 149-mile Wild and Scenic segment in Montana.

### **Fruition of River Restoration**

Imperative to the success of river restoration is a strong conservation presence on the ground—local initiatives led by those intimate with the waters and the community. In 1994 American Rivers formed the Missouri River Coalition (now 39 groups strong) “to provide a unified voice in the basin.”

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Today, Lewis and Clark would not recognize most of the Missouri River.

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The coalition brings together “conservation, recreation and tribal organizations dedicated to promoting the natural, recreational and cultural values of the Missouri River.”

Several projects exemplify this type of awareness and innovation. Daniel Botkin described some of these endeavors in his book, *Passage of Discovery* (Penguin Putnam 1999), including efforts to combat the plight of the cottonwood. The cottonwood rapidly regenerates in the early successional stage of a forest. The cottonwood’s resilience, productivity, and self-restoration under the right conditions are astounding. Yet harnessing the energy and natural flow of a river with dams, levees, and stabilized banks doesn’t favor tree growth. A few decades after Lewis and Clark wove through dense stands of cottonwoods, floodplain forest covered three-fourths of the Missouri floodplain. By 1972 only 13% remained, due mostly to clearing the land for agriculture. Channelization reduces spring flooding and, without that annual spring rise in water levels and newly renewed soil, cottonwoods cannot flourish and, consequently, neither can certain wildlife.

After the 1993 flood inundated agricultural lands in the Arrow Rock State Park area of Missouri, hundreds of acres of young cottonwoods sprung up. This is a strong argument in favor of the corps’ revision of the *Missouri River Master Water Control Manual*, the guide to management of the river’s six big dams. With a split-navigation season, high spring waters would replenish tree stands and support viable wildlife populations.

With more than 90% of the original floodplain wetlands, forests, and prairies converted to agriculture or no longer functional because of channelization, projects are underway to restore key segments to their natural

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## Imperative to the success of river restoration is a strong conservation presence on the ground—local initiatives led by those intimate with the waters and the community.

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condition. Indicative of the goal to restore natural places is the Big Muddy National Wildlife Refuge (BMNWR), southeast of Columbia, Missouri. The BMNWR reflects a shift away from the dominant ideology of the last century back to a concern for wildlife and habitat. It was created in 1994 to help preserve backwaters, chutes, sloughs, sandbars, emergent wetlands, and other riverine habitats. As part of several mitigation projects, the ACE is teaming up with the United States Fish and Wildlife Service, state agencies, businesses, and nonprofits to expand the refuge as part of an ecosystem-level management approach. The project will increase refuge acreage to 60,000

acres, creating a chain of floodplain lands along the lower Missouri in the state of Missouri similar, Botkin says, to “beads on a necklace of river.”

### Safeguarding Rivers and a Wilderness Ethic

Barges will not grind to a halt, dams will not be altogether removed, political wrangling will not dissipate, and people will not evacuate riverside property simply for the sake of the Lewis and Clark bicentennial. Nor, when faced with economic anxieties, will these things happen for a single species. Solutions must work for both the rivers and the people who live near them. Thus, community-based efforts



American Rivers is working with landowners and managers to create a string of natural places along the Missouri. Photo courtesy of American Rivers.

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## As the nation prepares to celebrate the 200th anniversary of Lewis and Clark's Corps of Discovery, we have the opportunity to restore the Missouri River and revitalize riverside communities.

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and tailor-made management strategies that complement one another and account for the needs of both the human and wild elements will be of great consequence.

While many of these initiatives reflect utilitarian values, there is a deeper meaning to river restoration that transcends economic motivations, one that strikes a chord with the very fiber of our existence. When a species is at the brink of extinction or a forest on the verge of destruction, we, as part of the web of life, have

failed unless we recognize the potential ramifications and attempt to remedy the situation. The pallid sturgeon survived more than 70 million years in the Missouri. At one point the fish supplied so much freshwater caviar to the developing West that bars served the salty fish eggs for free, like peanuts. It took just 50 years of river management by the ACE for the sturgeon to become functionally extinct. We now have occasion to reverse the damage we have done and do right by ourselves and by wildlife.

With millions of Americans preparing to retrace the legendary footsteps of Lewis and Clark during the bicentennial celebration of 2004 through 2006, it is time to embrace a restoration strategy that evokes environmental stewardship and sustains wildlife, recreation, and tourism. We must act now to liberate the river and its wildlife. The ultimate goal is to restore critical segments of the Missouri and other rivers to a condition that Lewis and Clark would recognize. Just as they embarked on an epic journey of adventure, we, too, can launch a praiseworthy journey of recovery. **IJW**

**ANNIE STRICKLER** worked as a summer 2000 press assistant intern at American Rivers in Washington, D.C. She is a graduate student at the University of Florida in the College of Journalism and Communication. For more information on American Rivers and the Voyage of Recovery campaign, visit [www.americanrivers.org](http://www.americanrivers.org).

### At the Mouth

Where river meets the lake, I stand & gaze  
On shallows not quite river not quite lake.  
These currents, stilled and dying, find their ease,  
Meandering among the flats of mud  
In a delta country, graveyard of the creeks  
And streams & mountain rivers of the west  
Where stone & water wage an age-old war.

To stone the river speaks: "You cannot stay;  
You must go down with me & leave this place."  
But stone responds, "I'll stay until you wear  
Me out, destroy me with your liquid teeth  
And bury me in suffocating beds  
Of ancient mud deep in the delta plain."

—Chris Benson

Chris Benson is a research associate for the Thurmond Institute at Clemson University and editor of the *Bread Loaf Teacher Network* magazine. Bent Stone Press published his book of poems, *Ashes at the End of Day*, in 2000.

# A Community-Based Wilderness Education Partnership in Central Oregon

BY LES JOSLIN

The Three Sisters and Broken Top—a cluster of major volcanic peaks—dominate the 285,202-acre Three Sisters Wilderness area in central Oregon. Accessible from the populous Willamette Valley to the west and the growing central Oregon region to the east, this popular wilderness area is in real danger of being “loved to death.”

In the 1960s I worked summers on the Toiyabe National Forest and patrolled the Hoover Wilderness as part of the fire control job that financed my college education. Thirty years later, in 1990 and 1991, following a 20-year career as a naval officer, I volunteered on the Deschutes National Forest and patrolled the trails in the Three Sisters Wilderness. After a long hiatus, I was back in the wilderness and loving it—especially the public contact work. But things were different. I noticed right away that a lot more people were visiting wilderness than in my early days. I could see that a bigger effort was needed.

So on July 1, 1992, I opened the Green Lakes Trailhead Information Station (GLTIS), which I've run every summer since with a small team of volunteer wilderness information specialists. That trailhead information and education effort, along with an annual wilderness education course sequence I've taught since 1994 at Central Oregon Community College (COCC) in Bend, are the centerpieces of the Central Oregon Wilderness Education Partnership (COWEP). This partnership between the national forest and the college has helped advance wilderness education in the region, and has the potential to be adapted in other communities.



Article author Les Joslin. Photo by Pat Joslin.

## The Wilderness Information Specialist Program

After pioneering the GLTIS in 1992, I recruited, trained, and supervised a small group of six volunteer wilderness information specialists for the summer of 1993. Since the summer of 1994, the group has averaged about 12 volunteers each season. Some of the members have been student interns enrolled in the COCC wilderness course sequence

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A good program can solve agency problems and benefit the volunteers and the public they serve. A bad program can damage the agency and alienate its volunteers and its public.

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described below. These volunteers come from all walks of life and range in age from 18 to almost 80. They've been college students, teachers, and retirees of all sorts including academics, corporate executives, armed forces officers, and even a former U.S. Air Force under-secretary. All have trained to serve as uniformed representatives of the U.S. Forest Service (USFS) and the wilderness, and all have subscribed to the "friendly face and helping hand" approach to assisting Three Sisters Wilderness and other Deschutes National Forest visitors. Each is asked to serve a minimum of eight full days during the summer season.

Some serve more. While some serve only one summer, others return summer after summer.

These volunteers work according to the pattern established at the GLTIS in 1992. Working alone or in pairs, they assist wilderness users and other national forest visitors by providing information about wilderness travel and regulations, and help with the wilderness permit and user fee systems. They squeeze low-impact hiking and camping messages into their usually brief visitor contacts whenever they can. They gather visitor statistics and maintain trailhead facilities. And they assist in

emergencies such as missing persons, wildfires, motor vehicle accident reports, and rounding up lost pets and saddle and pack stock. Some supplement the small wilderness ranger force by patrolling trails and performing other duties for which they are qualified. The volunteers contact between 6,000 and 8,000 visitors at the Green Lakes Trailhead each summer. They contact hundreds more when staffing additional trailheads on weekends in the Three Sisters Wilderness. Their presence in the wilderness sends a positive message to the public that the USFS, true to its "caring for the land and serving people" motto, really cares about them and their wilderness.

Volunteers sign a USFS volunteer agreement (pursuant to Public Law 92-300, the Volunteers in the National Forests Act of 1972) and, while not federal employees, receive legal protection as well as insurance for work-related injuries. If funds are available, they are reimbursed for some expenses.

A good volunteer program requires a major investment of time and effort by a dedicated leader who can recruit, equip, train, qualify, schedule, and supervise volunteers. The leader must also be willing and able to meet these same commitments when a volunteer is not available. A good program can solve agency problems and benefit the volunteers and the public they serve. A bad program can damage the agency and alienate its volunteers and its public.

## The Wilderness Education Course Sequence

As a part-time instructor of geography and political science at COCC since 1989, it occurred to me that a college course coupled with a field internship was a natural step for wilderness education in the community. My proposal



Volunteer wilderness information specialists present a "friendly face and a helping hand" to the public. Photo by Barbara Merlin.

for a two-course sequence (a one-credit classroom course and a two-credit field internship) was accepted, and I began teaching the classroom course during the 1994 spring term. I have taught the sequence annually since.

Each course may be taken for either forestry or geography academic credit. The one-credit spring term course, Forestry/Geography 195WC: The Wilderness Concept and the Three Sisters Wilderness, introduces the concept of wilderness and the management principles and issues associated with applying that concept to National Wilderness Preservation System (NWPS) units. It surveys the nearby Three Sisters Wilderness as a basis for application of these principles and discussion of these issues. The course provides an academic introduction to wilderness management and orientation for service to and enjoyment of wilderness. Usually an elective, the course is required for students in the recreation leadership associate's degree and transfer programs.

Supported by a small grant from the college, I wrote and published a 164-page book, *The Wilderness Concept and the Three Sisters Wilderness* (ISBN 0-9647167-3-9, Wilderness Associates 2000) in April 2000. The course textbook is geared for students, but serves a general readership as well (see review in this issue of *IJW*).

The content of this course has been adapted to other instructional situations. In June 1995, for example, it was used as the basis of a three-day wilderness ranger training program I conducted for the Deschutes, Willamette, and Mt. Hood National Forests. And in the spring of 1998 I presented a noncredit version of the course at the Sunriver Nature Center. The spring term classroom course is a good recruiting and training venue for student interns who serve as wilderness infor-

mation specialists. Students who complete the course with a grade of "B" or better and gain the permission of the instructor may enroll in the two-credit summer sequel, Wilderness Internship. These student interns, who also sign a USFS volunteer agreement, are integrated into the wilderness information specialist team and complete a minimum of 72 hours of supervised wilderness service.

This combination of classroom instruction and field service may be adapted in areas throughout the United States where colleges are close to wilderness areas. The wilderness course syllabus and the textbook mentioned above might also be useful templates for developing similar courses and books at other colleges and wildernesses.

## **COWEP and Wilderness Education in the Future**

Effective wilderness education must occur in urban areas as well as at wilderness trailheads and in the wilderness. Partnerships such as COWEP can also incorporate additional community entities and develop "off-site" urban center wilderness



**Volunteer wilderness information specialist at Green Lobos Trailhead Information Station. Photo by Les Joslin.**

education programs targeted at user populations. Although visitors to the Three Sisters Wilderness and other central Oregon units of the NWPS come from all over the Pacific Northwest, the United States, and many foreign countries, visitors to this wilderness, like most others, are primarily residents of the nearby region.

Across the nation, wilderness education will most likely remain a community-based effort, and this is logical. With national and regional guidance, each national forest and ranger district

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**Effective wilderness education must occur in urban areas as well as at wilderness trailheads and in the wilderness.**

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Volunteer wilderness information specialists are trained to assist in emergencies and communication with district dispatchers. Photo by Les Joslin.

with wilderness management responsibilities (and therefore wilderness education) is usually left to develop and implement its own program to address the challenges of their areas. Such programs, of course, require available talent and funds. But wilderness education is the great challenge of wilderness management. COWEP, as a successful example of an approach in central Oregon, may help other communities meet that challenge. **IJW**

LES JOSLIN, a retired U.S. Navy commander and former U.S. Forest Service firefighter, teaches wilderness education at Central Oregon Community College and runs the Central Oregon Wilderness Education Partnership. He is author of *The Wilderness Concept and the Three Sisters Wilderness* (2000), *Uncle Sam's Cabins* (1995), and *Toiyabe Patrol* (1993). He edited *Walt Perry: An Early-Day Forest Ranger in New Mexico and Oregon* (1999). Telephone: (541) 330-0331. E-mail: lesjoslin@aol.com.

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### Bookreview of *The River Reader*, continued from page 48

one of his friends put it, "From where there ain't no black folks to where they still don't like us much."

In his essay "Gone Back into the Earth," Lopez captures the miracle that is the music of Paul Winter on their trip through the Grand Canyon. He writes, "Some parts of the trip will emerge one day on an album. Others

will be found in a gesture of friendship to some stranger in an airport, in a letter of outrage to a planner of dams, in a note of gratitude to nameless faces in the Park Service . . . ."

*The River Reader* is a celebration, reminding us of the vital role rivers play in the health of the land and its people. Murray summed it best in his intro-

duction: "Pick a river, any river. If you sit beside it long enough you will hear many things, and most of them are worth waiting for."

Reviewed by CHRIS BARNES, BLM representative, Arthur Carhart National Wilderness Training Center. Telephone: (406) 243-4625. E-mail: Chris\_Barnes@blm.gov.

# Wilderness as Teacher

## Expanding the College Classroom

BY LAURA M. FREDRICKSON and BAYLOR L. JOHNSON

*I think I got more than I expected from this academic experience. Most of what I learned wasn't related directly to the classroom experience, and my revelations were probably only distantly related to the actual lectures and discussions of traditional ethics. Experiential learning is the way I do things best, and wild nature, what a teacher! Societies and culture impose certain guidelines, but we are the ones expected to fill in between the lines in order to develop our own personal ethics. I guess what I mean is that out here you can't hide—not from your own actions or thoughts, not from each other, and certainly not from the environment.*

—a student in *Ethics and Wisdom*, St. Lawrence University, 1998.

**Abstract:** Ethics as Wisdom, a summer course at St. Lawrence University in northern New York, supplements classroom teaching with wilderness experience to test and demonstrate that life can be good, profoundly satisfying, and deeply rewarding. The course seeks to prove that with knowledge, good companions, effort, skill, and a bit of luck, we can and must create our own happiness.



Article co-author Laura Fredrickson. Photo courtesy of Laura Fredrickson.



Article co-author Baylor Johnson. Photo courtesy of Laura Fredrickson.

### Introduction

The epigraph for this article was a student's final assignment in Ethics as Wisdom to write a hypothetical letter to their best friend outlining what they learned in the course. What this student learned about ethics went beyond classroom discussions because it was deepened and tested by powerful personal experience in mountain wilderness.

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In the wilderness ... students cannot move away or move on. Fences have to be mended, or everyone sees the consequences. And when someone helps us through a hard time, we know it, and feel our debt.

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### Course Overview

The first 10 days of the course meets on campus for six hours each day, with reading and writing assignments outside of class. Students read classic ethical authors such as Aristotle (1945), Kant (1948), and John Stuart Mill (1907), and more contemporary authors like J. L. Mackie (1977) and Abraham Maslow (1968). These assignments acquaint students with key ideas from Western moral theory and provide a framework for discussing ethical living. Students also watch videos about the Scott-Amundsen race to the South Pole, and two films: *Carlito's Way* and *Antonia's Line*. The videos and

films are examples of moral character and the impact of that character on the quality of the individual's life and the lives of those around them.

The course is grounded primarily in two ethical traditions: virtue theory and social contract theory. Both traditions are long and complex. From contract theory we draw primarily these ideas: that ethics is a human creation, not a mysterious or supernatural phenomenon; that its purpose is to guide human conduct, especially in circumstances where the individual's immediate or apparent self-interest conflicts with the condition of a good life considered from a more encompassing

perspective; that ethical ideas can be rationally examined and criticized by considering how well they serve to promote long-term happiness and welfare of those who live by them.

From the virtue ethics tradition we take primarily these ideas: that while ethical life is unimaginable without ethical rules, these rules must be interpreted and applied in concrete situations; that interpretation and application depend upon tacit knowledge and intellectual and emotional capacities that cannot be reduced to rules or precisely articulated; that these capacities are developed through experience, especially observation, imitation, and habituation; that character, perception, skill, and practical "know-how" are at the core of living well.

After the on-campus segment, the course moves to Durango, Colorado. The remaining 10 days are spent backpacking through the Weminuche Wilderness of the San Juan Mountains. Some elements of traditional education continue in the field, such as journal writing and structured discussions and written assignments around a small packet of readings. However, the focus is experiential education. Group living in the wilderness setting becomes the major teacher.

The intensive course seeks to deeply impact student thinking about questions such as:

- Is anything really right or wrong?
- How can it be true that morally a person ought to do one thing rather than another?
- Are there ethical guidelines that everyone ought to follow, or are ethics only arbitrary local customs that vary from culture to culture?

### Background Assumptions

Focus on these questions derives from the assumption that students are influenced by four common beliefs. These



Ethics as Wisdom students in the San Juan Mountains of Colorado. Photo by Baylor Johnson.

are (1) that ethics consist primarily of a set of rules; (2) that these are imposed by some alien authority; (3) that the result is a set of unwelcome and restrictive prohibitions. Students often also believe (4) that these rules are arbitrary and worth the individual's allegiance only to avoid punishment.

Ethics as Wisdom proposes an alternative to each of these beliefs. First, ethics is not primarily knowledge of external rules but internal knowledge about how to live a rich and satisfying life. Second, ethics come not from without but from one's own wisdom about how to live. Third, thus perceiving ethical living as a series of limitations is largely a result of failing to fully understand how the individual benefits from ethical living. Finally, while the details of ethics will vary in response to different cultural and natural circumstances, the degree of variation is limited by the shared requirements of a rich and satisfying life.

A metaphor related to human sustenance might best convey this last idea. Despite some differences, the basic nutrients humans need are much the same for all. Deficiencies in diet can limit individuals, and may produce illness and even death. Nonetheless, many different cuisines, built around quite different staples (meat, fish, wheat, rice, corn, etc.) can meet human nutritional needs if the right basic elements are combined in the right proportions. Underlying the seemingly endless variety of the world's cuisines is a hidden commonality—their ability to supply the common nutritional requirements for human health.

Ethics is similar. A great many different ways of living can supply the basic requirements of human happiness, but, as with cuisine, a chance combination of elements will not work. Many ways of living are good, but many more will be somehow deficient. There is a limit to the variety and the elements of

a satisfying way of life. They must be internally coherent and compatible. Otherwise, just as nutritional deficiencies will produce symptoms ranging from a slight loss of energy to death, so a flawed ethic will produce results ranging from a slight loss of opportunity for happiness to cultural extinction.

Because of its intensive format, Ethics as Wisdom aims to make only a few basic points, but to make sure these sink in deeply. These few points contribute in turn to one main purpose: to affect the students' attitude toward ethics, and to help them see that ethical wisdom is something they should seek, for it is nothing less than the knowledge of how best to live, how to achieve rich and lasting happiness.

For these purposes, lessons must be intellectually coherent, but they must also motivate action. Students learn to value and seek ethical knowledge and behavior not only using their intellect, but also through experience and emotions. The wilderness trip adds the certainty of personal experience to intellectual arguments.

### **Wilderness Travel as Teacher**

The experience of traveling as a small group in the wild and rugged Weminuche Wilderness provides students with an experiment against which to test key ideas of the course. One of the principal reasons students misunderstand the nature of ethics and its importance to their lives is that modern society is so big and complex, insulating them from the consequences of theirs and others' actions. If we mess up one place, we can move to another.



**In the San Juan Mountains of Colorado, St. Lawrence University students learn that wilderness is a powerful teacher. Photo by Laura Fredrickson.**

We can fail old friends and substitute new ones. The immense infrastructure of social services aims to protect us from the worst consequences of our mistakes. Simultaneously, by delivering benefits impersonally, this infrastructure prevents us from feeling the debt we have incurred in receiving this help.

During the field experience, personal needs are stripped to the essentials—in numbers of persons, comfort and satisfaction, and in the transparent correlation between how one behaves and what results from it. This presents students with a microcosm of human life against which to weigh and test the theses of the course. The students cannot move away or move on. Fences have to be mended, or everyone sees the consequences. And when someone helps us through a hard time, we know it, and feel our debt, and see how we are the



A student learns about beauty and the sublime in Colorado's San Juan Mountains. Photo by Laura Fredrickson.

beneficiaries of their ethical wisdom and generosity. These experiences are often far richer in the wilderness than they are in the classroom.

## Beauty and the Sublime as Teachers

"Beauty" here means not only the sensuous beauty of the mountain vistas, the setting sun, the fragrance of the forest, and the song of wind and birds. It means all the simple pleasures, all the feelings that life is good that we associate with a well-planned trip in wild nature. It means the grateful ease of rest much needed, the rich taste of food well earned, the peace of a world of gentle sounds and deep silence, the satisfaction of personal limits transcended, and hard tasks accomplished. Not least, it means the quiet calm of a simple, uncluttered, and deeply satisfying life.

The Romantics, those pathfinders for the modern relationship with wild nature, found two faces in the wilderness: beauty and the sublime. Beauty is pleasing. The sublime, by contrast, is awesome, overpowering, and even frightening. In *Ethics as Wisdom*, the wilderness speaks to students with both of these voices. The beauty of life there reveals the rewards of ethical wisdom, of knowing how to make life good. The sublime by contrast challenges the unthinking routine of modern life. It reminds us of the great mysteries of life in the face of which our comfortable acceptance of routine seems like a kind of hypnotic state.

While traveling in the wilderness, the sublime—the immensity of the heavens, the fathomless sweep of time in the ancient mountain stones, the timeless rhythms of the natural world—reminds us constantly of the wonder and mystery of the human situation. It calls ceaselessly: "Who are you? Where are you going? What does it all mean?" It calls us to sincere and serious ethical reflection, for these are the attitudes with which the truly ethical life begins: openness, deep wonder, a feeling that one might need and want to live in a radically different way. Such attitudes are as hard to produce in an ordinary campus classroom as they are hard to avoid in wilderness. This is why expanding the classroom to wilderness is so vital to teaching *Ethics as Wisdom*.

## Conclusion

The St. Lawrence University course *Ethics as Wisdom* uses the power of wilderness experience to speak to students more deeply and fully than is possible in the classroom. Its purpose is to engender a new attitude toward ethics and the study of ethics, an atti-

tude of openness and a readiness to commit—or to recommit—to living consciously and conscientiously. Because wilderness can foster this attitude, we seek both its beauty and its spirit of the sublime.

In nature students feel the message that life can be good, profoundly satisfying, and deeply rewarding. With knowledge, good companions, effort, skill, and a bit of luck, we can and must create our own beauty and happiness. The wilderness experience is a test and demonstration of this ethical idea. By the end of the trip the beauty, peace, and satisfaction of this life in the wild sings within all participants. The message of the song is unmistakable. If we learn to live with wisdom, we can live in joy and happiness. We can find beauty in the heart of the sublime. **IJW**

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## REFERENCES

- Aristotle. 1945. *The Nicomachean Ethics*, translated by H. Rackham. Cambridge: Harvard University Press.
- Kant, I. 1948. *The Fundamental Principles of the Metaphysic of Morals*, translated by H. J. Paton. New York: Harper Torchbooks.
- Mackie, J. L. 1977. *Ethics: Inventing Right or Wrong*. New York: Penguin Books.
- Maslow, A. 1968. *Motivation and Personality*, 2nd ed. New York: Harper & Row.
- Mill, J. S. 1907. *Utilitarianism*. London and New York: Longmans.

# The Central and Southern Sierra Wilderness Education Project

## An Outreach Program That Works

BY BARB MIRANDA

The 27 wilderness areas that stretch from Lake Tahoe to the Mojave comprise some of the most highly visited wildernesses in the United States. With the human diversity in nearby urban and rural population centers matching the natural diversity of this wild expanse, wilderness education is a challenge. The interagency Central and Southern Sierra Wilderness Education Project (WEP) is meeting this challenge.

More than 25 years ago, wilderness managers from central Sierra National Parks, Forests, and later the Bureau of Land Management Resource Areas realized that wilderness visitors and the wilderness resource would benefit if they worked together on managing these special places. They formed the Central and Southern Sierra Wilderness Managers Work Group to tackle common issues and to work toward a shared mandate of managing “an enduring resource.” From restoration and research, to group size and campfire regulations, this group sought justifiable and uniform management solutions.

In 1990 that partnership grew into another arena: wilderness education. The members of the group had long realized that effective education is one of the keys to a successful wilderness management program, especially when the majority of visitors come from urban areas like Los Angeles, San Francisco, Sacramento, Reno, and Las Vegas. Education, however is also the first program to be cut when budgets go on their annual roller-coaster rides. Their solution: an interagency approach to wilderness education. Why not pool resources and develop



Article author Barb Miranda. Photo courtesy of Barb Miranda.

an interagency program to manage this magical portion of the National Wilderness Preservation System? With the help of a Forest Service Challenge Cost Share Grant the wilderness managers hired me as a full-time program coordinator in November of 1995. Keeping the interagency flair, I wear a Sequoia National Forest uniform but work in an office in Yosemite National Park.

**The Central and Southern Sierra Wilderness Education project is a partnership between the following organizations:**

Sequoia-Kings Canyon National Park  
 Eldorado National Forest  
 Sequoia National Forest  
 Stanislaus National Forest  
 BLM Caliente Resource Area  
 BLM Bishop Resource Area

Yosemite National Park  
 Inyo National Forest  
 Sierra National Forest  
 Toiyabe National Forest  
 BLM Ridgecrest Resource Area



Members of the first WildLink Team at Chain Lakes in Yosemite's Wilderness. Photo by Barb Miranda.

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The first WildLink Team in the Sierra Nevada. Photo by Barb Miranda.

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When I arrived in Yosemite, I was promised a year of funding and handed a job description for the WEP program coordinator that had a heavy emphasis on fundraising. I realized that with only one year of guaranteed funding I'd better spend more time on implementation than development if we wanted to prove our worth to potential donors and funding partners. To this end, we begged and borrowed three established and successful target programs from other parts of the country. Two of these programs, Scouting Ahead (now Project Leave No Trace) and Wilderness Riders, targeted existing visitors, and one (the Wilderness Box) targeted school children. All the programs focused on training trainers to stretch the WEP's limited resources.

## WildLink to High Schools

That was five years ago. Today we have more than 3,000 scout leaders trained in Leave No Trace skills, an established cadre of 50 horsemen and women, who in 1999 alone educated 6,000 stock users in minimum impact skills, and an annual budget of more than \$100,000. I feel we can call the program a success. (Formal program evaluations of Project Leave No Trace and the Wilderness Riders are currently underway). With much of the individual program logistics overseen by our partners, my attention is drawn now to a different arena: educating California's diverse population about the relevance of wilderness through a web and experiential based program called WildLink.

WildLink endeavors to reach culturally diverse high school students in California's Central Valley, Los Angeles, and the eastern Sierra with lessons in science, geography, social studies, and language arts. The program hopes to increase student interest in

wilderness through WildLink Teams made up of students from the participating schools, and web lessons consisting of online journals, pictures, and artwork developed in wilderness by their peers. Lessons are molded from the Arthur Carhart Wilderness Training Center's high school Wilderness and Land Ethics Curriculum to fit the web medium as well as state and national academic standards. Special web-based projects like *Shadows in the Range of Light: Buffalo Soldiers of the Sierra Nevada* ([www.shadowsoldier.org](http://www.shadowsoldier.org)) flesh out the historical context of wild places from culturally diverse American perspectives. View WildLink's progress at [www.wilderness.net](http://www.wilderness.net).

The WEP is a model that works for California. It costs each participating agency \$2,000 to \$6,000 to fund the program and would work in areas with urban proximate wilderness and multiple agencies to spread the burden of the cost. **IJW**

WEP Program Coordinator BARB MIRANDA has a BS in forest management from Colorado State University. A long-time wilderness ranger and educator, Barb has worked in the Sierra, the Cascades, and the Bighorn Mountains in the United States and the Harz Mountains in Germany. Telephone: (209) 372-0735. E-mail: [Barbara\\_Miranda@nps.gov](mailto:Barbara_Miranda@nps.gov).

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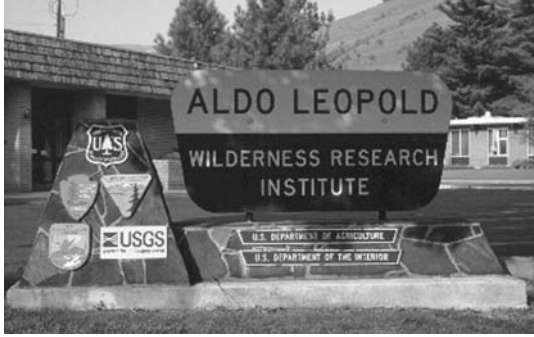


The WildLink Team deep in the wilds of the Sierra Nevada. Photo by Barb Miranda.

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WildLink endeavors to reach culturally diverse high school students in California's Central Valley, Los Angeles, and the eastern Sierra with lessons in science, geography, social studies, and language arts.

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# PERSPECTIVES

## from the Aldo Leopold Wilderness Research Institute

### Wilderness Monitoring—New Directions and Opportunities

BY PETER LANDRES

Are the decisions and actions taken to protect the benefits of wilderness producing their intended outcomes? All the best intentions and planning mean little if federal agencies are unable to assess the effectiveness of their management policies.

Monitoring is simply collecting data describing how trends are changing over time, and there are two wilderness-specific monitoring goals. First is taking care of wilderness today and in the future. This goal requires management monitoring and national system monitoring. Management monitoring provides information on resource conditions and public perceptions to improve the management of a specific wilderness. In contrast, national system monitoring provides information on the overall status and trends of wilderness conditions and public perceptions within a region or the nation. This system information is used for managing regional and national wilderness programs as well as setting policy. The second wilderness monitoring goal is learning from wilderness. This goal requires benchmark or reference monitoring of ecological and social conditions in wilderness and seeking information to understand the subtle (and sometimes not-so-subtle) and long-term changes caused by human activities.

Although the importance of monitoring has long been recognized, no comprehensive wilderness monitoring program has ever been established in the four federal wilderness agencies. These agencies have long monitored particular resources of interest, but for a variety of reasons

this information is typically of limited use to wilderness managers.

Several new agency efforts may improve wilderness monitoring. The Forest Service's (FS) most recent national wilderness agenda includes strategies for wilderness monitoring, including an information needs assessment to link wilderness monitoring to agency-wide database efforts, and a committee to develop programmatic recommendations for such monitoring. The National Park Service (NPS) is developing a database for reporting on the status of its wilderness. The NPS inventory and monitoring prototype is expanding to include additional parks and types of information that will be useful to NPS wilderness managers. Both the Bureau of Land Management (BLM) and the Fish and Wildlife Service (FWS) monitor site-specific resources of interest, and both agencies have new programs that should support expanded monitoring in wilderness. The FWS's new strategic vision, *Fulfilling the Promise*, strongly supports both wilderness and monitoring. Likewise, the BLM's new National Landscape Conservation Lands program will likely require increased monitoring in wilderness.

All the agencies are developing new and better information for wilderness planning and management, and monitoring is included. The Leopold Institute is deeply involved in the FS's monitoring efforts and will continue to advocate and work toward well-planned, integrated, and practical wilderness monitoring. **IJW**

PETER LANDRES is a research ecologist at the Aldo Leopold Wilderness Research Institute. E-mail: [plandres@fs.fed.us](mailto:plandres@fs.fed.us).

# Autonomous Agents in the Park

## An Introduction to the Grand Canyon River Trip Simulation Model

BY TERRY C. DANIEL and H. RANDY GIMBLETT

**Abstract:** A computer simulation model predicts interactions among recreational river trips in Grand Canyon National Park. Empirical data and artificial intelligence modeling techniques combine to predict responses of river-trip parties to alternative management policies (particularly launch schedules). Animated computer visualizations allow examination of impacts on the environment and recreation experiences. System performance confirms the benefits of autonomous agent architectures for modeling complex recreator-environment interactions.



Article coauthor Terry C. Daniel. Photo courtesy of H. Randy Gimblett.



Article coauthor H. Randy Gimblett. Photo courtesy of H. Randy Gimblett.

Millions of visitors travel to the Grand Canyon every year. A much smaller number hike into the canyon. Fewer still obtain a permit and spend several days exploring the network of formations and side canyons. But the ultimate and most exclusive experience is to float the 226 miles of the Colorado River through the heart of Grand Canyon National Park.

About 20,000 people a year float the Colorado River. The principal river corridor is not officially designated wilderness, but it has been managed with concern for wilderness values. Thus, the number of visitors has been strictly limited to protect the more fragile components of the can-

yon and river environment. Of equal importance, and perhaps posing even greater constraints on visitor numbers, is the desire to protect the “wilderness character” of the river-trip experience. The Grand Canyon is a national (perhaps more accurately, global) public resource, so there is a need to assure as much, and as equitable, public access as possible. But what levels of access are required to provide an equitable distribution of use opportunities across the publics that desire this unique experience?

Recently, about 300 commercial trips, with a maximum of 36 people each, have served about 19,000 visitors each year (approximately 80% of total visitors). More than 250

of the 300 commercial trips use motorized watercraft, accounting for virtually all of the short trip (six to eight days) opportunities on the river. Trips are expensive (\$1,500 to \$1,800 per person for a seven-day trip), require a minimum of one week, and reservations must be confirmed at least one year in advance. Still, spaces available on commercial trips are often booked within hours of opening.

Privately organized trips are limited to 16 people, and account for about 3,000 visitors per year. These trips are typically longer than commercial trips and only very rarely employ motorized craft. Private trips require a remarkable amount of advanced planning and commitment—the typical waiting time on the reservation list is currently more than 15 years.

The challenge for the park is to balance the public demand for recreation use with mandated environmental protection and increasing calls for the river corridor to be managed as (and perhaps officially designated as) wilderness. Wilderness policies could prohibit the use of motorized watercraft, eliminating the shorter commercial trips that currently accommodate 70% of all visitors. Because longer trips require more time and are more costly, this policy would almost certainly limit the river-

trip experience to even fewer people. It is less clear whether pursuit of wilderness policies would result in substantial, or any, reductions from the current numbers of trips or total numbers of visitors.

## River Trip Simulation

The Grand Canyon River Trip Simulation model (GCRTS) helps managers understand the effects of river trips on environmental and social conditions and to judge the effects of changes in launch schedules and other management policies. Previous modeling efforts (e.g., Borkan and Underhill 1989; Gimblett et al. 1994; Shecter and Lucas 1978; Underhill et al. 1986) provided a conceptual basis for the GCRTS. Detailed trip diaries/itineraries were collected for more than three hundred trips in 1998 and 1999. Commercial outfitters and private boaters also provided trip summaries extending back several years. These empirical data were augmented by interviews with experienced river guides, trip outfitters, and private boaters. Interviews outlined typical trip “profiles” and identified a number of general “rules” or guidelines that affect trip progress (see Figure 1).

Statistical analyses of the trip report database and interpretation of the ex-

pert interviews guided the development of the basic river-trip model in the form of an interactive computer system. Many types of queries and reports are possible for park managers, but they also may be useful for trip outfitters and for individuals planning trips. The system and implementation have been described previously (e.g., Gimblett et al. in press (a) in press (b) Roberts and Gimblett 2000). The following brief, nontechnical description is primarily directed at introducing recreation researchers, managers, and others to some of the issues that must be addressed in modeling river trips.

## Model components

Design of the GCRTS was largely defined by and limited to those conditions over which managers have some control, and/or about which they have some means of knowing. These include the launch schedule (which specifies which trips can be launched on what days), the take-out day and location, and any scheduled passenger exchanges along the way. Regulations were also considered, such as the maximum distances groups are allowed to travel within a day, camping and layover restrictions, and areas in the canyon where stopping is prohibited. Beyond these few restrictions, groups are free to individually determine their progress—they are “autonomous agents,” deciding where to stop, and for how long, and how far to float on the river on a given day. Encounters between trips is a key output of the model, including where encounters occur, between what parties (what types of trips), and the nature of the contact (on-river, off-river, visual only). Encounters also represent one of the major variables affecting trip progress, as groups alter plans in response to the presence of other parties at attractions and campsites.

**Figure 1—Trip profiles and rules gleaned from expert interviews.**

### Trip profile

- Launch from Lees Ferry, preferably by 9:30 A.M.
- Lunch between river mile 10 and 13, most likely at 13 due to shade
- Camp at one of the sites between river mile 19.1 and 29.3 somewhere between 4:00 and 5:00 P.M.

### Trip decision rules

- River mile 31.6, stop at archaeological site, unless we hiked that morning or there is another group already there
- River mile 61.4 (Little Colorado), always stop here (even if there are other parties present) unless it is muddy
- River mile 62.6, camp unless it is occupied, then go to mile 65.5 or 68.2, but do not go lower than mile 72.3

Existing data and management practices dictated the “trip” as the primary modeled unit. Because many trips are composed of more than one watercraft, the model actually projects the locations of idealized “trip centroids.” There are restrictions regarding the extent to which individual watercraft associated with a given party can disperse on the river, and all members must camp together. Therefore, encounters are defined by relations between trip centroids, rather than between individual watercraft.

## Geo-temporal Scale

Modeling 226 river miles favored a relatively coarse geographic scale; however, to achieve reasonable accuracy in determining encounters between trips, a relatively fine scale was required. As the river winds and turns, contact between two parties can depend upon tens of meters of separation. The GCRTS divides the 226-mile (363,702-meter) river into more than 4,000 ninety-meter cells, and each trip is modeled as passing into and out of these 90-meter segments of the river. Similarly, riverside attractions and campsites are assigned to the nearest cell(s), with the addition of a river-right, river-left designation where appropriate.

The model also needed to accommodate trips from six to thirty days in duration, occurring over the 11 months of the primary and secondary use seasons, while handling encounters that have typically been as short as five minutes. When two trips make contact, an encounter is recorded. If the trips separate for five minutes or more and then again make contact, this is recorded as a second encounter. Further, watercraft could pass through a 90-meter river cell in a matter of a few minutes. Thus, the model was set to handle minute-to-minute

calculations of trip locations. The GCRTS, then, represents a seven-day trip as 10,080 minutes.

## Modeling Trip Progress

The trip-type determined the “initial conditions” for individual trips. That is, to model a particular trip (e.g., a 12-day commercially outfitted oar trip), the trip is first assigned the appropriate type-plan. Each trip is assumed to follow the assigned plan (with some random variations in parameters such as start times, float speed, time into overnight camp, etc.) until an event/situation is encountered (e.g., the campsite specified in the plan is found to be occupied by another modeled trip) that triggers one of the rules. The applicable rule is then applied to affect an appropriate deviation from the plan.

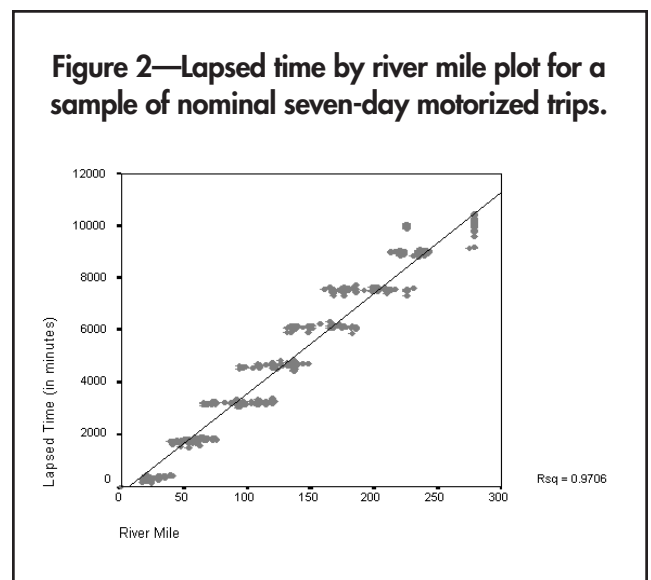
The autonomous agent modeling architecture represents each trip as an individual object that responds (e.g., stop, slow down, speed up) according to an assigned set of rules. Rules are based on time and location, and are relative to the assigned trip plan, features of the river environment (campsites, attractions), and features of other groups that are encountered. Behavior of each trip agent depends upon how given temporal, environmental, and social conditions relate to a hierarchically ordered set of decision criteria.

Trips proceed down the river encountering potential campsites, attractions, and other trips, evaluating the relevant criteria and probabilistically deciding whether to stop or continue down the river. Actions move each trip away from and then back toward the assigned plan. Decisions

made upstream affect conditions/criterion values downstream, which in turn affects downstream decisions and actions. As the time for getting into a campsite for the night or the designated take-out day approaches, opportunities for stops at attractions become more constrained.

## Representing River Trips

After exploration of a number of more complex methods, the data for each of the different trip-types were found to be well represented by a linear regression equation relating river trip locations (cells/river miles) to elapsed time (minutes) from launch (see figure 2). All major trip-types were fit by regression equations, with slopes varying according to the duration of the trip. For example, relative to the seven-day trips, 18-day trips have a steeper slope—taking more time to cover the same number of river miles. The fit of any individual trip to the appropriate trip-type is gauged by the sum of the squared deviations of that trip’s times-by-locations from the bivariate mean times-by-locations (the regression line) for that class of trip. The smaller this sum, the more “typical” that trip is of the reference type.



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## The Grand Canyon River Trip Simulation model (GCRTS) helps managers understand the effects of river trips on environmental and social conditions and to judge the effects of changes in launch schedules and other management policies.

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The launch schedule for each day has very important and complex effects on the interactions among trips. Currently up to six trips launch at Lees Ferry each day of the main summer season. These trips may range from six-day to 18-day durations.

Figure 3 shows a sample of the mix of trips launched within a five-day window. Some longer trips from previous launch dates are overtaken by shorter trips from later launch dates. Calculating and representing how these interactions/encounters between trips affect the subsequent progress of each trip is an important process in the GCRTS model.

Interactions with other trips affect the progress of all trips involved, so it is not possible to model any single trip

in isolation. Each trip responds to the context of other trips on the river in the same time frame, and other trips respond to that trip as well as to each other. Thus, model projections are probabilistic, and multiple runs of the model are required to assess the effects of each management scenario. General outcomes for individual or multiple trips can be represented meaningfully by averages in statistical reports, but averages are inappropriate for representing detailed time-by-location outcomes for individual trips. For example, the average location for a given trip's overnight camps over multiple model runs will tend to fall between the actually available campsites. Therefore, the time-by-locations outcome for any individual trip is repre-

sented by the most typical outcome (determined by the regression line fit analysis described above) over multiple model runs.

### Visualization

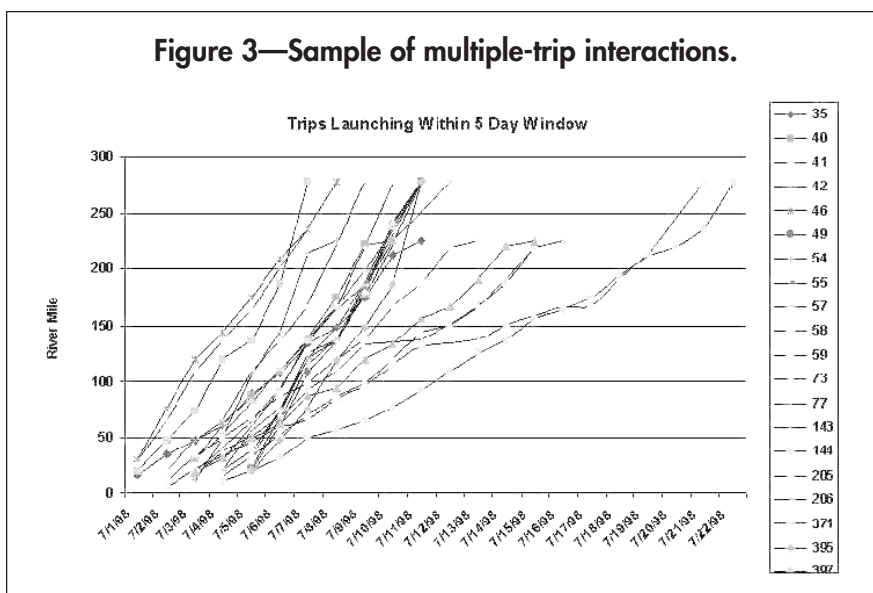
In addition to conventional statistical reports, charts, tables, and graphs, the GCRTS provides an animated visualization of multiple "typical" trips as they proceed (virtually) down the river. Individual trip centroids move along a geographically accurate map of the river, which includes key attractions and campsites. Trips encounter one another at times and locations typical for the specified launch schedule/management scenario. A static illustration of the visualization component of the system is presented in Figure 4.

As encounters and other factors affect trip progress, trip centroids stop or move ahead accordingly. The visualization can be stopped to provide snapshots of "who is where when" on the river. A window can be set at a particular campsite to focus attention on the number and timing of trips (and people) camping at that site. Individual river locations can be queried to reveal important environmental features (size, beach condition, vegetation conditions, etc.) and recreation-use features (number of nights occupied, cumulative camper-nights, number of encounters, etc.) can be reported. As features of trips and river sites change over the course of the model runs, reports are immediately updated.

### State of the System

The autonomous agent architecture has proven advantageous for modeling complex, dynamic interactions among multiple trips at the Grand Canyon. Each party proceeds according to the appropriate trip-type plan and responds to other trips and envi-

**Figure 3—Sample of multiple-trip interactions.**

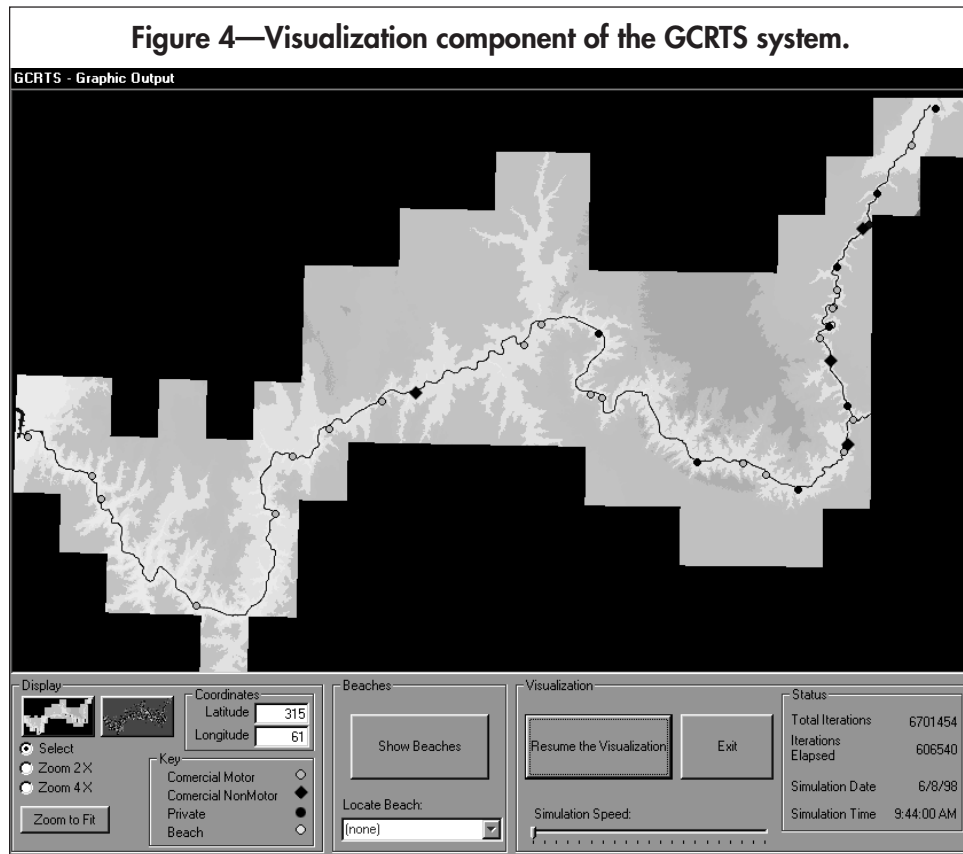


ronmental conditions according to the relevant rule base and decision criteria. The architecture allows features of the environment and interactions among trips to affect progress of each trip minute by minute. There is no need to simultaneously solve for the locations and actions of all trips at once. The collective behavior emerges as a product of the individual (autonomous) actions of each trip.

The GCRTS system is currently functional, but not yet adequately tested. Of particular concern is the lack of sufficient tests to confirm the veracity of the rules and decision criteria used in the model. Caution is particularly required when launch schedules and other specifications of input conditions differ from those in force when the 1998–1999 trip itinerary data were collected. Still, the system does provide a considerable advance in river management decision support for the park and confirms the benefits of the autonomous agent approach for modeling complex social-environmental interactions in wilderness recreation settings. **IJW**

## Acknowledgments

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## REFERENCES

- Borkan, R. E., and A. H. Underhill. 1989. Simulating the effects of Glen Canyon Dam releases on Grand Canyon river trips. *Environmental Management* 13: 347–354.
- Gimblett, H. R., G. L. Ball, and A. W. Guisse. 1994. Autonomous rule generation and assessment for complex spatial modeling. *Landscape and Urban Planning* 30: 13–26.
- Gimblett, H. R., T. C. Daniel, S. Cherry, and M. J. Meitner. In press (a). The simulation and visualization of complex human-environment interactions. *Landscape and Urban Planning*. Elsevier Science Publishers. The Netherlands. 2000.
- Gimblett, H. R., C. Roberts, T. C. Daniel, M. Ratliff, M. J. Meitner, S. Cherry, D. Stallman, R. Bogle, D. Kilbourne, J. Bieri, and G. O'Brien. In press (b). Intelligent agent modeling for simulating and evaluating river trip scheduling scenarios for the Grand Canyon National Park. In *Integrating GIS and Agent Based Modeling Techniques for Understanding Social and Ecological Processes*, edited by H. R. Gimblett. New York: Oxford University Press. 2000. Pgs. 245–275.
- Roberts, C., and H. R. Gimblett. 2000. Computer simulation for rafting traffic on the Colorado River. *Proceedings of 5th Biennial Conference of Research on the Colorado Plateau*. U.S. Dept. Interior, U.S. Geological Survey.
- Shecter, M., and R. L. Lucas. 1978. *Simulation of recreational use for parks and wilderness management*. Washington, D.C.: Johns Hopkins University Press for Resources for the Future.
- Underhill, A. H., A. B. Xaba, and R. E. Borkan. 1986. The wilderness simulation model applied to Colorado River boating in Grand Canyon National Park, USA. *Environmental Management* 10: 367–374.

# Announcements & Wilderness Calendar

## National Wilderness Summit Addresses Wilderness Management

The Pinchot Institute for Conservation convened a National Wilderness Summit in Washington, D.C., on May 17, 2000, for wilderness constituents and representatives of the four federal agencies (Forest Service, National Park Service, Bureau of Land Management, and the Fish and Wildlife Service) who manage the National Wilderness Preservation System (NWPS). The summit supported the wilderness panel of experts currently evaluating planning and management of the NWPS. The Wilderness Panel, headed by Dr. Perry Brown, Dean of the School of Forestry at the University of Montana, held their first meeting in December, 1999, and will publish a final report in 2001 outlining key issues and making recommendations for planning and management of the NWPS (see *IJW* August, 2000).

Key discussion points included interagency and intra-agency policies and processes to implement The Wilderness Act of 1964, how to balance recreation use with protection of the resource, and how to effectively inform and educate users about wilderness and appropriate behaviors and activities. While the public continues to be supportive and committed to the concept of wilderness and the NWPS, federal agencies are concerned that resources allocated to protecting and managing the NWPS have not kept pace with new wilderness des-

ignations and increased use. The panel, and discussion at this meeting, confirmed that managing wilderness resources deserves more attention if we are to achieve the goals of The Wilderness Act of 1964.

## Dr. Roderick Nash Honored for Wilderness Teaching

Dr. Roderick Nash, Emeritus Professor of Environmental History at the University of California at Santa Barbara, was honored by the American Society for Environmental History for his early



Roderick Nash. Photo courtesy of Roderick Nash.

teachings in wilderness and environmental studies. In the 1960s and 1970s, Dr. Nash paved the way for college and university courses and programs in wilderness and environmental studies. He has published widely on the subject, and of particular note is his best-selling book *Wilderness and the American Mind*. Now retired from university life, Dr. Nash continues to contribute to wilderness as a consultant, lecturer, advisor to environmental organizations, and as a wilderness river guide. He is a charter associate editor of *IJW*, and we congratulate him for this well-deserved recognition.

## SUNY at Syracuse Celebrates Bob Marshall's 100th Birthday

In January 2001 the State University of New York College of Environmental Science and Forestry at Syracuse (SUNY-ESF) will celebrate the 100th birthday of one of its best known alumni, Bob Marshall. Marshall's involvement in the college as an undergraduate forestry student, and his work in New York State's wilderness movement are focal points of this two-day event. Other activities include lectures and a wilderness field trip in the Adirondacks retracing routes Marshall hiked in the 1920s.

The Faculty of Forestry has started a Bob Marshall Fund to support a fellowship in wilderness studies at SUNY-ESF. "Bob Marshall Fellows will be a living testimony to Marshall's intellectual and spiritual legacy at ESF," said William R.



**Bob Marshall on a trip in the Quetico-Superior area in 1937. Photo by Sigurd Olson.**

Bentley, chair of the faculty. For more information, contact Chad Dawson (E-mail: cpdawson@esf.edu) or William Bentley at SUNY-ESF, One Forestry Drive, Syracuse, New York, USA, 13210. Phone: (315) 470-6567.

## **BLM Creates National Landscape Conservation System**

BLM director Tom Fry has announced the establishment of a new National Landscape Conservation System (NLCS) to manage BLM's special areas. The NLCS will consist of BLM's Wilderness, Wilderness Study Areas, National Monuments, National Conservation Areas (including the California Desert Conservation Area and the Headwaters Forest Reserve), Wild and Scenic Rivers, and National Trails (both historic and scenic). These areas have all been recognized as special landscapes that deserve special management attention, and the NLCS is designed to increase the public's awareness and appreciation of them,

and to help BLM focus management attention and resources on them.

Although each has site-specific authorities, the units share common elements. Management will focus on conservation, and while visitation will be allowed, there will be no major facilities located within these areas. Visitor facilities will be located in adjacent communities or at the periphery of the units. Multiple-use activities, such as grazing and hunting, will continue provided they are consistent with the overall purpose of each area. A small office in Washington, D.C. has been established to manage the new system.

## **Wilderness Conference to Be Held in Britain**

Wilderness Britain will convene a critical mass of academics, professionals, and users who share a common interest in wilderness and the wild areas of Britain. The three-day conference (March 26 through 28, 2001) will be held at the University of Leeds. The focus will be on the social and environmental perspectives of the wilderness ideal within the British Isles, with emphasis on generating policy recommendations for recreation and conservation. For information about participation or paper presentation, contact Wilderness Britain Conference Committee, School of Geography, University of Leeds, Leeds, UK LS2 9JT. Or try the conference website at <http://www.geog.leeds.ac.uk/conferences/>.

## **Lawsuit Charges FS with Mismanagement of Sierra Wilderness**

The High Sierra Hikers Association, Forest Service Employees for Environmental Ethics, and Wilderness Watch filed a federal lawsuit against the U.S. Forest Service (USFS) for mismanagement of the Ansel Adams and John

Muir wilderness areas in the Sierra Nevada of California. The lawsuit charges that the USFS illegally allows commercial outfitters to violate wilderness regulations, especially use quotas, in order to increase business. The lawsuit charges that increases in commercial wilderness recreation use during weekends and the summer has led to unacceptable damage to the ecosystem, and that while commercial use is allowed to increase, the USFS is limiting private use, an unfair and unethical practice. For more information contact Bob Dale (541) 484-2692, Gary Guenther at (760) 934-6801, or Julia Olson at (415) 561-2222, x 118. Source: *Wilderness Watch listserve Wildnet: wild@wildernesswatch.org*

## **Tighter Regulations on Flights over Grand Canyon National Park**

President Clinton announced tighter limits on sightseeing flights over Grand Canyon National Park to help restore natural quiet. The number of flights per year will be capped at 90,000, and 75% of the park (it was 45%) will be off-limits to planes and helicopters.

## **Adult California Condor No. 8 Released into the Wild**

The California condor known as Adult Condor No. 8 was released into a wilderness area northwest of Los Angeles after almost 14 years in a captive breeding program. After helping to save her species from extinction, biologists hope the older bird will mentor the younger birds. When she was captured in 1986, No. 8 was the last female and one of only six California condors in the wild. She has since produced 12 offspring in captivity. Thanks to an expensive federal breeding and reintroduction program, 49 California condors fly free in California and Arizona.

## Ken Cordell and Michael Jenkins Share Wilderness Research Award

**Dr. Ken Cordell** of the U.S. Forest Service (USFS) and **Dr. Michael Jenkins** of the National Park Service were awarded the 2000 "Excellence in Wilderness Research Award" for their major studies advancing knowledge important to managing wilderness resources. The award is cosponsored by *IJW* and USFS. *IJW* also salutes research award nominees **Joseph Flood** and **Dr. Leo McAvoy** of the University of Minnesota, and **Shannon Meyer** of the inter-agency Aldo Leopold Wilderness Research Institute. The editorial board of *IJW* serves as referee for the award from nominations submitted through the interagency Arthur Carhart National Wilderness Training Center (contact Chris Ryan).

Co-award winner Dr. Ken Cordell is recognized for U.S. public survey and data analysis on citizen attitudes understanding and use of wilderness. Major findings of the research include documentation of increasing wilderness recreation use (Cordell and Teasley 1998, *IJW* vol. 4, no. 1), and broadening public support for wilderness based primarily on ecological and environmental quality (off-site) values and to a lesser extent, on-site values, including secondary effects such as economic benefits (Cordell et al. 1998, *IJW*, vol. 4, no. 3). This peer-reviewed research is proving valuable in helping shape national policies and planning for wilderness and related wildlands.

Dr. Cordell is leader of the Forestry Sciences Laboratory of the USFS, Southern Forest Experiment Station in Athens, Georgia. E-mail: kcordell\_athens@fs.fed.us.

Co-award winner Dr. Michael Jenkins is recognized for Geographic Information System (GIS) applications to determine landscape history of the Charles C. Dean Wilderness in Indiana (Jenkins and Parker, 2000, *Natural Areas Journal* vol. 20, no. 1). Dr. Jenkins' major study analyzed aerial photos from 1939, 1974, and 1990, documenting that the forest ecosystem of the Dean Wilderness is still recovering from past disturbances from agriculture, grazing, and logging. This research, advised by an interdisciplinary graduate committee of Purdue University scientists, is especially important as the Dean Wilderness is representative of the land use history of most eastern hardwood forests prior to their becoming national forests and/or wilderness. Dr. Jenkins' study provides valuable information about ecological recovery of previously disturbed wilderness in the eastern United States. Dr. Jenkins now works at the Twin Creeks Natural Resource Center, Great Smoky Mountains National Park in Gatlinberg, Tennessee. E-mail: mike-jenkins@nps.gov.

*IJW* also recognizes award nominee **Joseph Flood** of the USFS for his study of the influence of site restoration programs on

wilderness visitor experiences and visitor perceptions of managers. The study, a basis for his masters thesis at the University of Minnesota, documented reduced quality of visitor experiences from damaged wilderness campsites, and improved quality of experiences and more positive views of wilderness managers following ecological restoration efforts (Flood and McAvoy 2000, *Proceedings: Wilderness Science in a Time of Change Conference*). Flood is currently pursuing a Ph.D. at the University of Minnesota and continuing his commitment as a seasonal wilderness ranger at the Mission Mountains Wilderness in Montana. E-mail: flood002@tc.umn.edu.

*IJW* recognizes award nominee **Shannon Meyer** of the Aldo Leopold Wilderness Research Institute for her thesis study at the University of Montana on "The Role of Legislative History in Agency Decision Making (Meyer 1999, *IJW* vol. 5, no. 2). Meyer's research provides wilderness managers with a method for discerning potential congressional direction for so-called "non-conforming uses of wilderness" from legislative history, agency policy, case studies, and court cases providing judicial interpretation. Ms. Meyer is the executive director of the Carbondale Agriculture Heritage Foundation in Carbondale, Colorado. E-mail: wcajf@rof.net. **IJW**

### Three African Nations Sign Historic Conservation Agreement

Mozambique, South Africa, and Zimbabwe have signed an historic agreement to create a massive wildlife park. The three nations have agreed to remove fences joining some 38,000 square miles of wildlands in order to protect elephants, leopards, rhinos, lions, and buffalo. To help with the project, inter-

national donor agencies have pledged millions of dollars, and additional funding from private investors is expected. The three countries hope the new park will boost ecotourism in the region.

### Four Wyoming Men Plead Guilty to Riding Snowmobiles in Wilderness Area

Tom Phipps, Vincent Kalkowski, Paul Leroux, and Ryan Eskeli of Wyoming

have pleaded guilty to riding snowmobiles illegally in the Absaroka-Beartooth Wilderness Area near Yellowstone National Park in April 2000. The four men paid a total of \$12,500 in fines for their offense. The men were accused of moving wilderness boundary signs, riding in the wilderness, and then evading uniformed federal officers who tried to stop them on their way out of the area. **IJW**

# Book Reviews

***The Wilderness Concept and the Three Sisters Wilderness* by Les Joslin. 2000. Wilderness Associates, Bend, Oregon. 171 pp., \$14.95 (paperback).**

*The Wilderness Concept and the Three Sisters Wilderness* is not just another trail guide, but a guide to a more profound wilderness experience. It's a book about the natural and cultural history of the Three Sisters Wilderness and the philosophical, legal, and management concepts that help protect it.

"Wilderness," according to author Les Joslin, "is a word and an idea that Americans are still learning, and that means different things to different people." Joslin, who has served in the Three Sisters Wilderness since 1990

and has directed a wilderness course sequence at Central Oregon Community College in Bend since 1994, has taken on the job of explaining Oregon's most popular wilderness in terms of this wilderness concept.

In three chapters, his book explains how the idea of wilderness came to provide legal protection to the Three Sisters Wilderness and more than 650 other such areas around the country. It interprets both the natural and cultural history of this unique area, and summarizes U.S. Forest Service man-

agement policies and activities. More than fifty photographs, maps, and diagrams contribute to the book's usefulness. Readers of this new book will look at the Three Sisters Wilderness through new eyes. It's a model wilderness education tool for other wilderness areas to follow in their stewardship efforts. The book is a valuable resource for both wilderness managers and visitors.

Reviewed by JOHN HENDEE, *IJW* editor-in-chief. E-mail: hendeejo@uidaho.edu.

## Keith Corrigan Wilderness Stewardship Award

*IJW* is establishing the Keith Corrigan Wilderness Stewardship Award for Ex-



Keith Corrigan in 1993 at the 5th World Wilderness Congress, Norway.

cellence in Wilderness Stewardship in honor of the late Keith Corrigan. Financial contributions from friends and colleagues will be placed in a special *IJW* fund to defer the modest costs of administering the award.

Keith Corrigan worked as the wilderness branch chief for the Bureau of Land Management during the formative years of that agency's wilderness program (mid-1980s to mid-1990s). Keith was a strong leader and advocate for wilderness education, protection of wilderness and wilderness study areas, low-impact use of all public lands, and wilderness skills training. His influence extended to all the wilderness agencies, universities, and environmental organizations. Keith's quiet determination, passion, and high standards for wilderness and all resource management provided leadership and

mentoring to all his colleagues and co-operators. Rarely outspoken, he set an outstanding example of dependability, vision, and professionalism that charted direction and fostered cooperation.

The Keith Corrigan Award for Excellence in Wilderness Stewardship will be given annually to an individual or team of persons whose efforts to protect and/or steward wilderness is worthy of special recognition. Nominees may be professionals or citizens involved in wilderness work. Nominations for 2001 may be made through June 30. Submit a 500-word statement and seconding letter to *IJW*, Corrigan Award, University of Idaho, Wilderness Research Center, Moscow, Idaho, USA 83844. E-mail: wrc@uidaho.edu. Be sure to include contact information for both the nominee and the person(s) making the nomination. **IJW**

***Requiem for Nature* by John Terborgh. 1999. Island Press, Washington, D.C., and Covelo, California. 232 pp., \$24.95 (hardcover).**

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I found John Terborgh's *Requiem for Nature* wonderfully frustrating. Terborgh, an acclaimed field biologist and codirector of the Center for Tropical Conservation, addresses the preservation of tropical biodiversity based on his 25 years of experience in Manu National Park in the Amazonia region of Peru.

Terborgh tackles a fascinating, complex issue without mincing words or proposing startling potential solutions. But many of Terborgh's proposals seem impossible to implement and based on the human dimensions of conservation. For example, in discussing the critical issue of indigenous peoples in the conservation of tropical forests, he boldly suggests a "carefully constructed and voluntary relocation program" (p. 56). Terborgh goes on to suggest that the elderly would probably choose to remain in their homelands, but, "because they are largely beyond their reproductive years, members of the older generation would not constitute a demographic threat to the park" (p. 56–57). While

this statement may be true biologically, it ignores the critical role of elders in indigenous societies in preserving and transmitting tribal culture, i.e., history, language, customs, and traditional ecological knowledge. Moreover, losing the traditional ecological knowledge held by elders may very well impact our ability to manage these areas in a sustainable manner.

While I believe Terborgh misses the mark on some issues, he is on target on many. He makes it clear that the conservation of the world's tropical forests is incredibly complex, and more social, economic, and political than scientific. Terborgh takes aim at overpopulation, governmental corruption, and industrial greed and their role in the destruction of tropical biodiversity. He also attacks the mantra of sustainable development stating "that [the idea] that sustainable development will lead inexorably to the harmonious coexistence of humankind and nature . . . is patent nonsense" (p. 18).

Terborgh's proposed solutions are even more provocative e.g., the "inter-

nationalization of nature protection" (p. 198). He proposes internationally financed "elite forces" (p. 199) to guard parks and allow independence from local and national political influence (but not, it would seem, from international political influence). He suggests the creation of a "Nature Corps," much like the Peace Corps, though neglects to mention the similar mid-20th-century American example: the Civilian Conservation Corps.

*Requiem for Nature* is easy to read, provocative, and full of surprises, both positive and negative. As often as I was disturbed by Terborgh's sweeping generalizations, lack of detailed knowledge, and grandiose proposals, I was impressed by his focus on the heart of the matter and hard-hitting solutions to extremely complicated issues. I recommend *Requiem for Nature* to readers interested in the debate over the fate of the tropical forests.

Reviewed by JOHN SHULTIS, *IJW* book review editor. E-mail: Shultis@unbc.ca.

***The River Reader*. edited by John A. Murray. 1998. The Lyons Press, New York. 304 pp., \$17.95 (paperback).**

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Murray's *The River Reader* includes pieces by Meriwether Lewis, Thoreau, Powell, and Mark Twain, plus articles about rivers on other continents. Murray excludes Asia. Frank Vincent, known in the late 19th century as the Stanley of Southeast Asia, wrote marvelous descriptions of the upper Irrawaddy and lower Mekong Rivers in *The Land of the White Elephant*. Perhaps Edward Abbey was excluded because he will be included in a desert volume? And where is Norman

Maclean? Regrettably, with the exception of Joseph Conrad, all the authors are American.

These are small detractions from an otherwise inspiring collection. Many of the contemporary selections are profound, made all the more so by their juxtaposition with pieces written as long as 200 ago. I particularly liked the pieces by Rick Bass, Eddy Harris, Kathleen Dean Moore, and Barry Lopez.

Bass's piece is a straight-up preservation plea for the Yaak: "I know you're

not going to travel that far to catch an eight-inch rainbow. But maybe you can travel over to your desk and pick up a pen. Sort through the papers until you find a stray postcard and write [Montana's] three congressmen."

Harris paddled a canoe the full length of the Mississippi—alone. He bluntly points out that not many blacks canoe alone down the Mississippi River. Why? It is a journey, as

***Bookreviews, continued on page 30***