



Above: Western bluebird
(*Sialia mexicana*) in the
Bosque del Apache
National Wildlife Refuge,
New Mexico.

Opposite: Cottonwoods
greening up along the
San Pedro River in
southern Arizona.

4. The Human Touch

CARRYING WATER

Morning sun glints on the waters of the Infiernillo channel across which we've just come in the open fishing skiff. This Seri Indian man with erect dignity and a deeply creased face tells me of his ancestors who lived here centuries ago, who made the pots that now lie shattered at our feet. I pick up a ceramic fragment and turn it in my hand; I feel the determination of those who carried water here in these jugs from the spring hidden in the far hills, where we prepare to hike this January morning. My companion lived here himself until he was about the age of my *hijo*—he gestures toward my son who stands nearby, alert, shyly watching.

For uncounted centuries these people lived on this island, where desert encounters sea. To do so successfully required a joyous spirit—still much in evidence—and a deepening knowledge of the plants and animals that share this homeland. The Seri have named over four hundred types of plants and incorporated a quarter of these species into their diets.²³ Their intimate knowledge of animals from both desert and sea is no less impressive. But above all else living here necessitated a proper relationship with the most limited and crucial resource of all—water. This island, the largest in México, has two entire mountain ranges and over a hundred miles of shoreline, but freshwater exists in only a few small springs tucked into the mountains' folds. All water had to be toted several miles



Left: San Pedro River in southern Arizona is a critical north-south wildlife corridor.

Opposite: Whooping cranes (*Grus americana*) in the Aransas National Wildlife Refuge, Texas. Just over 200 survive in the wild.

from those springs back to the village on the shoreline, at the site where we now stand. I ask my friend how often he made that journey when he was a boy; he shrugs and says two, three times a week.

We turn away from the glittering sea and head toward the mountains, where the fresh water lays hidden. People have walked this path for a thousand years, yet

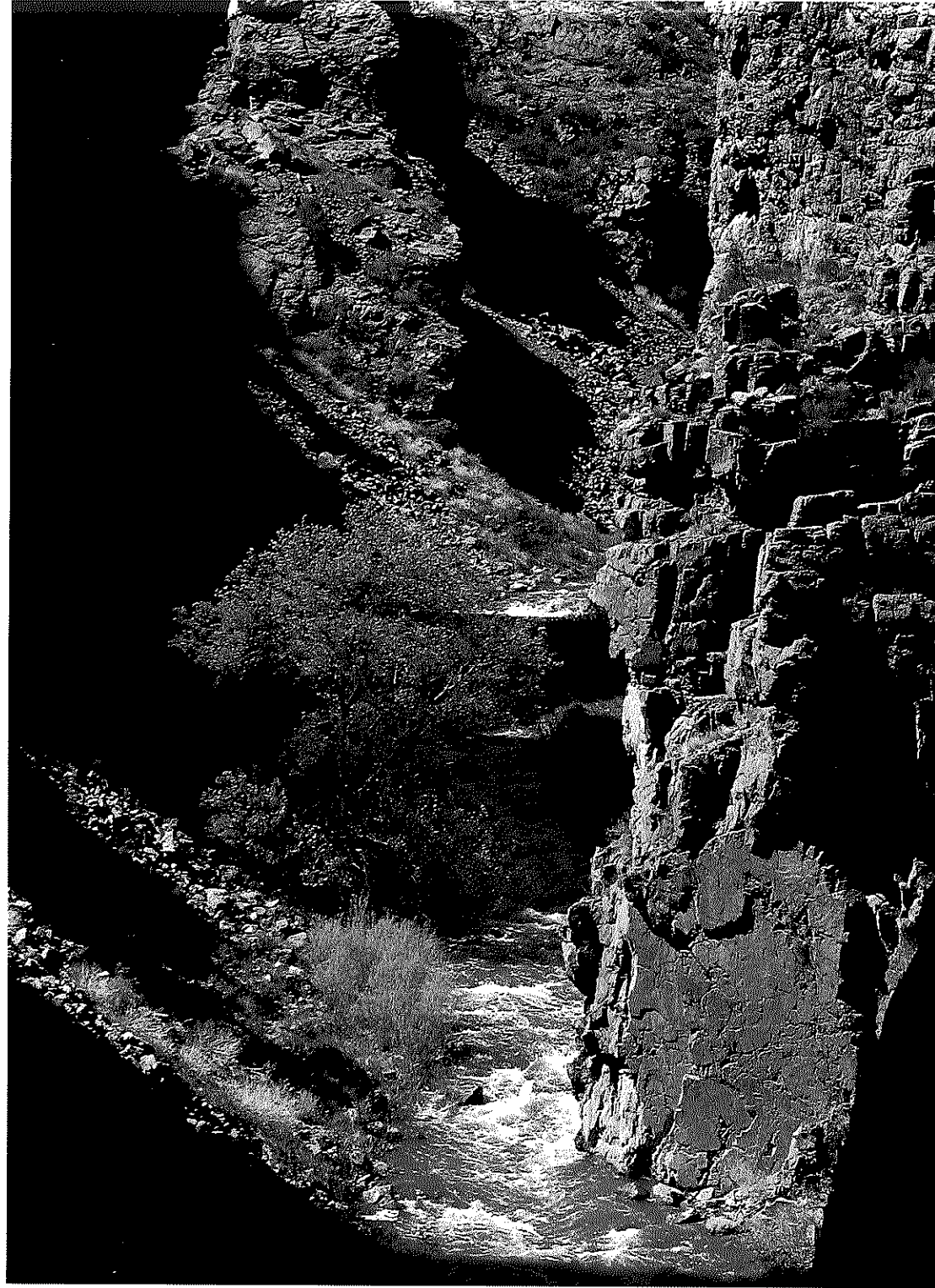
there *is* no path, no trampled ground. We hike through the open desert and tuck under the thorny trees along washes as midday approaches. Finally, as we wind our way into the occasional shade of the dry hills and draw closer to the spring, palo blanco trees, with their slender white trunks and grass-like leaves, grace the hillsides.

After three hours of walking we turn a corner in a dark-walled canyon and find the carrizo—reeds twice as tall as me emerging from damp soil. The last time I was here, in a wetter winter, water gurgled in a real stream. Today, though, dampness is enough—the only surface water for many miles. We relax in the cool shade before heading back towards our boat.

Rio Guadalupe, north of Gilman
in the Jemez Mountains, flows
into the Jemez River, then to the
Rio Grande, New Mexico.

Unlike past generations, we fill no jugs, heft no burdens to our backs for this return trek. I cannot but think, though—how might it be to live in a desert culture that so viscerally understood what a gift water represented? How might our relationship to water and all the life it supports differ if we carried each drop in our hands or in a basket on our back?

This modest emergence of water, most precious of desert substances, has sustained this people for many hundreds of years. Without this great liquid gift, there would be no Seri language, no Seri baskets; we would lack this profound indigenous understanding of the plants of this desert coastline. We in the United States have been bestowed greater gifts of water but



A kayak at Arivaca
Lake, Arizona.



have squandered them more rashly. We, too, must learn that we have no greater treasure than water that arises in the middle of the desert.

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The vision of the blessed afterlife for the Chiricahua Apache was “a beautiful place beneath the ground, where a nice stream of water flows between banks that are lined with cottonwood trees, and everything is green.”²⁴ This indige-

nous view—that a healthy riparian ecosystem essentially represents heaven on earth—conflicts dramatically with our standard treatment of desert wetlands during the past century. Rather than seeing wetlands as ideal and

Arivaca Ciénega and Creek (Arizona)

One of the most accessible remaining ciénega habitats (and the westernmost) is the Arivaca Ciénega, just outside the town of Arivaca, Arizona, roughly an hour south of Tucson. The ciénega, and Arivaca Creek that flows from it, are both part of the Buenos Aires National Wildlife Refuge, the majority of which is comprised of extensive desert grassland, habitat for the reintroduction of the masked bobwhite quail. What makes this portion of the Altar Valley special is that it is one of the largest grasslands free of grazing in the United States. Even more unusual, fire—a natural ecological feature in most grasslands—has been reintroduced as livestock have been eliminated. The wetlands of Arivaca Ciénega and Creek, then, provide a lush counterpoint to the dry, open country that makes up most of the refuge. The Fish and Wildlife Service has constructed a two-mile trail (a boardwalk in places) that weaves past the seven springs, pond, and seasonal wetlands of Arivaca Ciénega. Open country of sedges and grasses is interspersed with patches of rich cottonwood-willow riparian forest. This ecological interfingering provides bountiful habitat for birds and butterflies. Vermilion flycatchers, gray hawks, and many other borderland specialities are commonly seen here. A few miles downstream from the ciénega area there is also easy public access to the canopy of giant cottonwoods along Arivaca Creek.

For more information contact the U.S. Fish and Wildlife Service, Buenos Aires National Wildlife Refuge, P.O. Box 109, Sasabe, AZ 85633.



Vermilion flycatcher
(*Pyrocephalus rubinus*),
San Pedro River, Arizona.

inviolable, Euro-American settlement of the Southwest proceeded by treating water as a tool and wetlands as irrelevant at best. Ciénegas were drained; riparian trees were cut down and streambanks trampled to dust by huge herds of livestock; dams plugged stream after stream, killing living rivers with impoundments; pumping and irrigation canals caused groundwater levels to plunge deeper and deeper below the surface, allowing so many wetlands to wither and die. In short, heaven, too often, turned into ecological hell.

Pied-billed grebe
(*Podilymbus podiceps*),
Bosque del Apache
National Wildlife
Refuge, New Mexico.



FORSAKING HEAVEN

Close to half a century ago eminent fisheries biologist Robert Rush Miller lamented what had befallen aquatic ecosystems of the Southwest: a great shift from clear, dependable streams to deeply gouged channels that flowed only intermittently. These new streams were more vulnerable to flash floods and their heavy loads of silt. The surviving water—when there was any—tended to be warmer due to the overall loss of volume and the destruction of adjacent vegetation. Smaller creeks, springs, marshes,

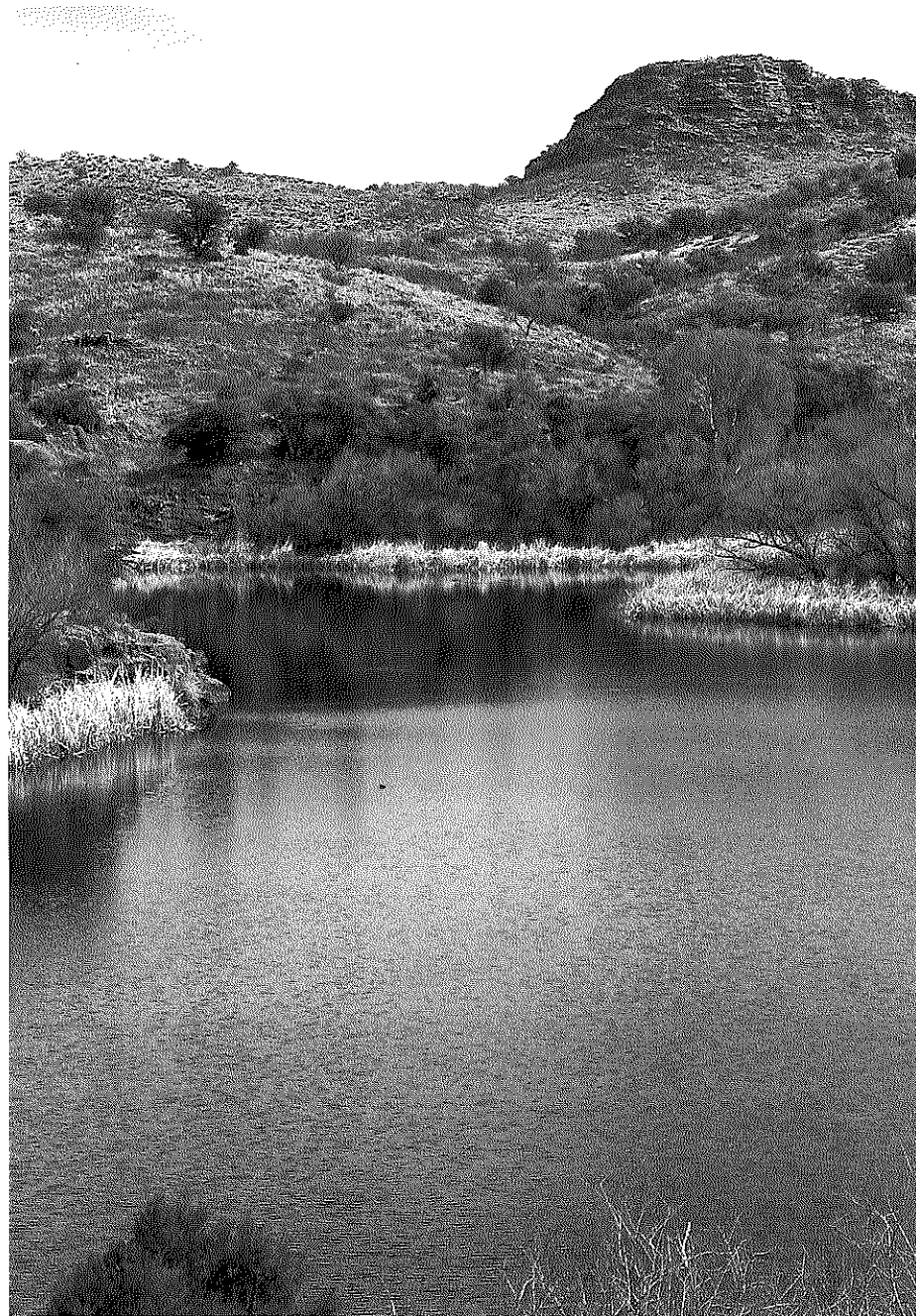
and lagoons, he reported, had largely disappeared, due at least in part to the lowering of the water table. Stories of individual rivers bore out this story. When Anglos arrived in the region, the Gila River was a permanent stream with clear to “sea-green” water rushing in a narrow channel, flanked by abundant cottonwoods, willows, and reeds so dense that approach was rendered difficult. A myriad of lagoons and extensive marshlands, full of geese, ducks, deer, and beaver, accompanied the course of the river. By 1920 these once-rich areas had

become “desolate wastes of sand and silt.” The upper Rio Grande once was a large enough river to support fishes such as the sturgeon caught near Albuquerque in the 1870s. By the beginning of the twentieth century, however, it often went dry, flowing only after storms. The once mighty Colorado River was tamed behind a series of dams, completely changing character from a silty, warm river with wildly fluctuating flows (records just upstream from its delta before the construction of Hoover Dam varied from sixteen to a quarter-million

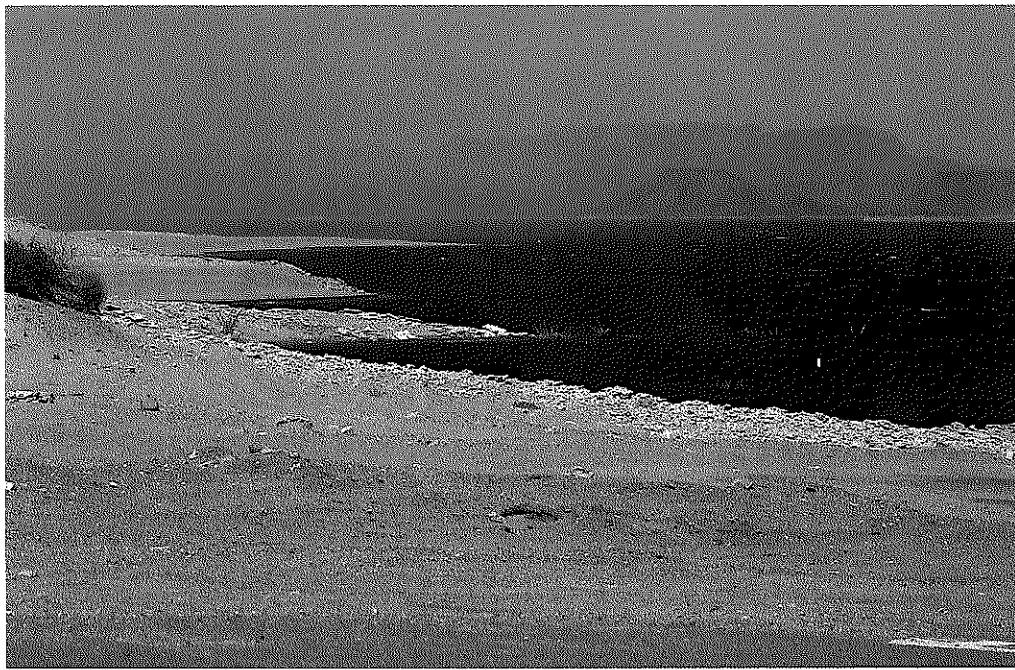
cubic feet per second) to a series of chilly, sediment-free reservoirs stocked with non-native trout. The river itself rarely reaches the sea anymore.²⁵ Freshwater life is imperiled—though often ignored—throughout many parts of North America, but freshwater ecosystems of the bi-national Southwest are among the most critically threatened on the continent. After amphibians, freshwater fishes represent the most threatened group of vertebrate animals in the world.²⁶

We could go on and on with these tales of degradation. But rather than drag our hearts through the dust, let's try to understand what caused these changes.

Three main types of human activities have proven to be less than benign and led to the dramatic changes we've just discussed: shifting patterns of water distribution with



Pena Blanca Lake, Arizona.



Top: Elephant Butte Lake in New Mexico.



Bottom: Female ring-necked pheasant (*Phasianus colchicus*) on Farm Loop in the Bosque del Apache National Wildlife Refuge, New Mexico.

dams, diversions, and pumping; disruption of watershed processes by livestock grazing; and introduction of exotic (non-native) species into both aquatic and adjacent terrestrial habitats.

Water has been diverted to new tasks throughout the Southwest as long as humans have lived here, but the technology has grown more and more sophisticated. In present-day Phoenix one can still find traces of an immense system of irrigation canals constructed by the Hohokam a millennium ago. Until the past century such developments remained relatively rare and localized. During the twentieth century, however, the situation changed dramatically. With the rush of Euro-Americans into the Sun Belt, population densities soared, intensifying demands on water resources. Technological innovations



Left: Black-crowned night heron (*Nycticorax nycticorax*) on Pond Loop in the Bosque del Apache National Wildlife Refuge, New Mexico.

Opposite: Snow geese (*Chen caerulescens*) migrate from the Arctic, arriving in November and departing for the north in March, Bosque del Apache National Wildlife Refuge, New Mexico.

allowed sweeping changes in patterns of water distribution unimaginable to those, such as the Hohokam, who had to dig every irrigation trench by hand. New earth-moving machines, powered by new fossil fuels, enabled dams to control the flow of the majority of rivers in the Southwest. The even newer technology of pumping groundwater to the surface constituted an agricultural miracle. Within a few decades, few aquatic habitats in the Southwest escaped human manipulation, as dams and diversion channels bled water from streams, and springs, *ciénegas*,

and other isolated wetlands dried up and disappeared as groundwater pumping caused the water table to plummet.

Dams and water diversions are so common in the Southwest that we sometimes have trouble remembering what a fundamental change we have imposed upon the landscapes of this region. Tens of thousands of cars race across freeway bridges in Phoenix every day, seemingly oblivious to the startling sight below: the “river” seen is made of concrete, while the real Salt River is more full of tire tracks than water.

From the perspective of riparian plants, dams and diversions present two problems. In a great many cases riparian forests wither and die because so much water is drained away that it is simply too dry. But even when enough water remains, cottonwoods and their kin can die off. The problem is that in regulated rivers, floods come at the wrong time for seeds to germinate or are of the wrong intensity. Cottonwood groves have often declined after their rivers have been dammed. This becomes alarming when one realizes that Utah’s

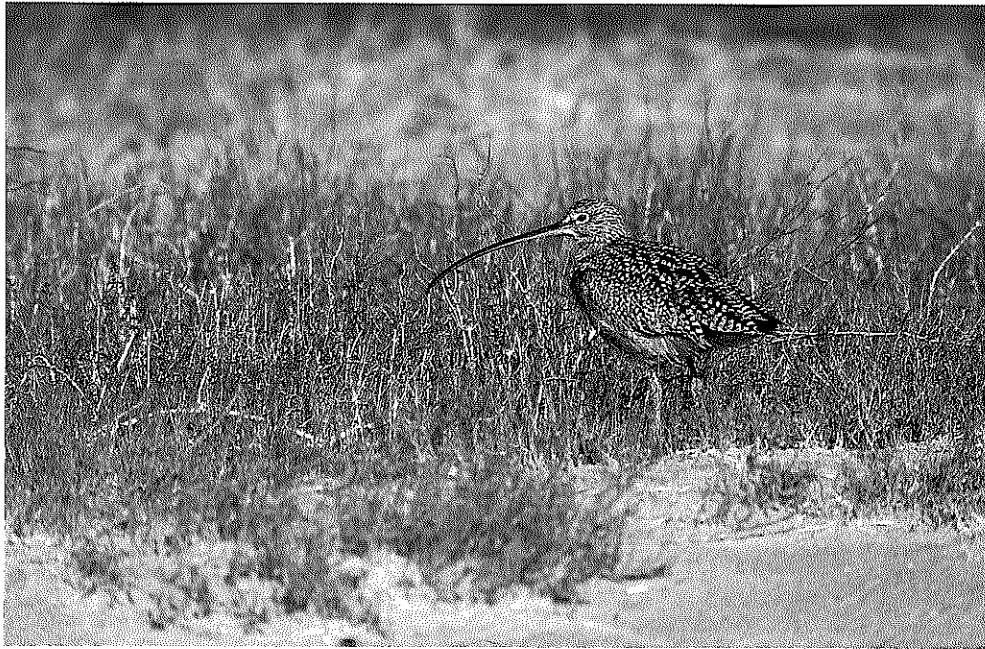
Escalante and Arizona's San Pedro and Verde are the only major undammed rivers left in the Southwest.

Grazing by domestic livestock—mostly cattle—is the most ubiquitous influence on native ecosystems of western North America. No other form of land use even comes close: approximately 70 percent of the eleven western-most states is grazed. Cattle are not terribly intelligent, but they are not as dumb as we sometimes think—they prefer riparian areas for the same reasons we humans do: shade, cooler temperatures, and water, not to mention more abundant food. While public lands grazing allotments may stretch over thousands of acres, livestock spend a disproportionate amount of their time in riparian zones. Riparian

habitats are not only biologically rich, as discussed earlier, but also easily damaged. The U.S. Environmental Protection Agency recently concluded that riparian conditions throughout the West are the worst in American history. Over 90 percent of Arizona's original riparian habitat is gone; cottonwoods along the Rio Grande in New Mexico are being replaced by exotic shrubs. A few years back a committee of biologists from several government agencies quietly concluded that grazing was the most important factor degrading wildlife and fisheries habitat in the West. Such conditions led three major scientific societies—the American Fisheries Society, the Society for Conservation Biology, and The Wildlife Society—to call for a major overhaul of grazing practices in the West.

The Smithsonian Migratory Bird Center recently stated that grazing “remains the single most destructive force that can be practically and significantly reduced” to benefit Neotropical migrant birds. A recent synthesis of research in seven riparian ecosystems in five western states concurred: protecting more riparian areas and “reducing cattle grazing is likely to produce the greatest benefits for bird species dependent on western deciduous riparian habitats.”²⁷

So how do cows cause so much trouble? Livestock alter riparian communities in several ways. Their heavy-bodied trampling compacts soil, turning it into something more akin to pavement—rainfall runs off rather than soaking in where it can be used by plants. By munching green leaves and



Left: Long-billed curlew (*Numenius americanus*) in the Laguna Atascosa National Wildlife Refuge in Texas.

Opposite: Rio Chama River in Abiquiu, New Mexico.

stems livestock remove much of what shelters the ground from intense solar radiation; as a result, evaporation rates increase, and the riparian habitat becomes distinctly more desert-like. Livestock can bring cottonwood regeneration to a screeching halt—cattle selectively eat the tender saplings, leaving none to become adults. They physically damage vegetation by rubbing, trampling, and browsing, and they can alter the growth form of plants by removing terminal buds, which stimulates lateral branching—a sort of bovine bonsai project. Cattle activities

especially damaging to native fishes are the removal of vegetative cover and the trampling of overhanging streambanks. Without shade, stream temperatures rise; without overhanging banks, native fishes lack cover from predators. Livestock, in essence, create entirely new aquatic ecosystems by changing water chemistry (via feces) and temperature of streams, disturbing streamside vegetation, trampling streambanks, and changing the shape of the water column.²⁸

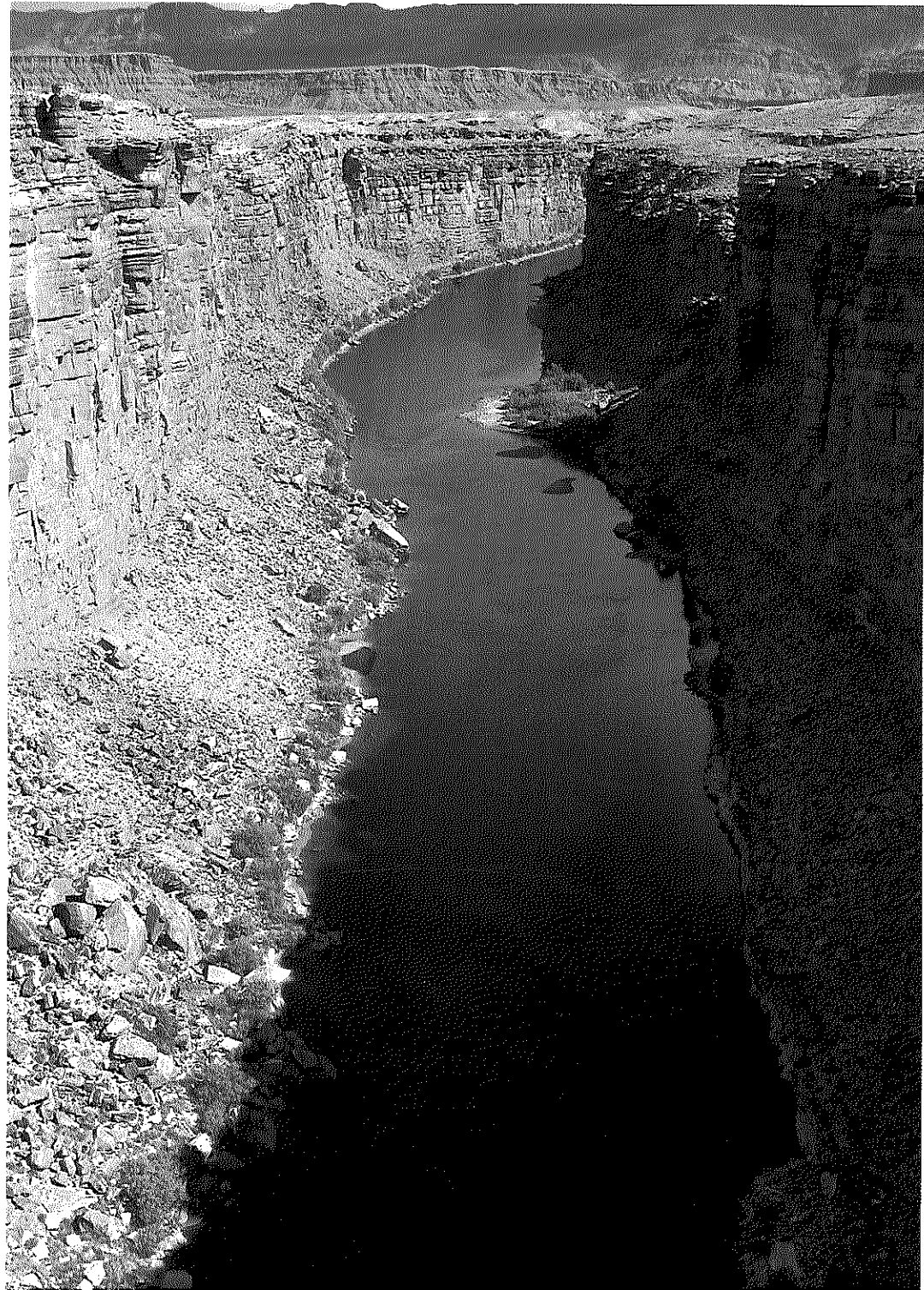
The visionary ecologist Aldo Leopold once wrote, “To be an ecologist is to live

alone in a world of wounds.”²⁹ Perhaps the wounds least visible to the general public, but painfully evident to ecologists, are those inflicted by exotic (non-native) species, because they may be the least fixable. The fate of a new plant or animal introduced into an area, whether by intention or accident, is most often to perish. But occasionally, through ecological coincidence, the newcomer is pre-adapted to flourish in its new habitat. Its good fortune always comes at the cost of native species and processes.³⁰

Two exotic trees—tamarisk and Russian olive—are rapidly colonizing

The Colorado River
at Lee's Ferry leading
toward the Grand
Canyon, Arizona.

riparian zones throughout the Southwest at the expense of native cottonwoods and willows. Bird diversity is lower in riparian zones composed of these exotics than in the native forests. Tamarisk was intentionally introduced to North America from Eurasia in the late-eighteenth century but didn't start escaping cultivation in a big way until the early twentieth century, when it began to be planted more widely for erosion control. In Utah it spread especially rapidly from the mid-1930s to the mid-1950s, an unwitting beneficiary of Euro-American habits. Its seeds began to spread at the same time that native riparian communities were being cut down for firewood, roof-beams, pasture, and cropland. Even though tamarisk seedlings actually grow more slowly than many native riparian trees





Left: Morning frost, Pond Loop in the Bosque del Apache National Wildlife Refuge, New Mexico.

Opposite: A mountain bog in the Sangre de Cristo Mountains in southern Colorado.

(including cottonwood), they have an edge in other ways. Their seeds can germinate within a day of being wet. And—unlike most native riparian species—they can survive indefinitely in unsaturated soil. Furthermore, whereas cottonwoods flower at one time in the spring, tamarisks bloom almost continuously for half the year, and thus can be producing seeds throughout that time. And salinity—which tends to increase

over time on degraded floodplains—favors tamarisk because it discourages the germination of cottonwood seeds. Tamarisks, then, have tended to take over riparian sites which have been abused by livestock or where dams have altered flood regimes—which is to say, along most streams in the Southwest. Another introduced tree, the Russian olive, is also rapidly destabilizing Southwestern riparian habitats. Although it has been stud-

ied much less than tamarisk, Russian olive is spreading swiftly throughout the entire West. Along some streams it is becoming established more extensively and quickly than tamarisk.³¹

Even less visible to most observers, the introduction of exotic fishes into streams and pools can spell disaster for natives. The native fish fauna of the Southwest is highly unusual—while overall diversity is low, many of the

Fall in the Bosque del
Apache National Wildlife
Refuge, New Mexico.

species that exist here are relicts of earlier climatic regimes, are the only representatives of their taxonomic groups, or live in geographically tiny habitats. Having evolved with reduced competition and predation pressure, these native fishes lacked defense mechanisms and were particularly vulnerable to more aggressive exotic fishes. Well over half of the fishes on the Endangered Species list are found in the southwestern United States and adjacent México.³²

As sobering as this may be, management of exotic fish species has progressed in the past few decades. Native fish species are still tremendously undervalued by many fisheries biologists—who have often been trained to supply trout for fishermen at all costs—and by the larger society, often unaccustomed



Juniper berries (*Juniperus osteosperma*) in the Grand Staircase-Escalante National Monument, Utah.



to considering fish as anything more than recreational subjects or culinary objects. But just four decades ago government biologists collaborated in a grand management scheme that seems—thankfully—unthinkable today. In 1962 more than one hundred people labored for three days to accomplish a management goal that was startling in its simplicity: to poison four hundred

miles of the Green River system so that native fishes could be cleared out to make room for the non-native trout favored by the fishing public. For three days toxic levels of rotenone were dribbled into the river system at fifty-five different stations. Sure enough, the natives—some of which are now considered endangered—were vanquished. Although we still introduce exotic fish

species for recreational purposes, it is much less common that we intentionally annihilate natives.

Nevertheless our neglect often leads to the same result. Several fish species that lived in localized springs went extinct in the face of the juggernaut of real estate development. As biologists sadly noted later, there was “little evidence to suggest that the fishes were



Pond Loop in the Bosque del Apache National Wildlife Refuge, New Mexico.

given more than a passing thought.”³³ Managing exotic species does not always involve such ecologically clear rights and wrongs, however. Along a number of rivers, for example, the endangered Southwest Willow Flycatcher has begun

nesting in tamarisk—which, as we have seen, can be a great destabilizer of riparian communities. In such cases biologists are left with a confounding dilemma: which matters more, endangered species or endangered ecosystems?³⁴

Different types of impact and disturbance often spiral together in a negative turbulence. Trampling and munching by cows can accelerate establishment of non-native plants. Destruction of overhanging streambanks by rumbling cattle

Ramsey Canyon
stream in southern
Arizona beneath the
Huachuca Mountains.



eliminates shady hideouts for native fishes—as a result, water temperature rises and fishes are more vulnerable to predation. When dams harness stream flows, cottonwoods cannot successfully reproduce and must yield to tamarisks, which are better adapted to drier conditions. Yet another example: while fires are a natural disturbance factor in many plant communities, wildfire was rare in riparian communities dominated by native cottonwoods, willow, and mesquites. Fire remains rare in riparian communities where tamarisk has not yet

arrived. However, fire has become more common in riparian habitats where tamarisk has gained a foothold. In the aftermath of fire, with dried-out soils and altered soil chemistry, tamarisk fares better than the native trees.³⁵

The negative effects of land use can persist for longer than we might guess. A study of an eastern riparian habitat found that the current fauna of fish and invertebrates correlated more closely with land use several decades earlier than with more benign management of the past decade. This “ghost

of land use past”³⁶ could serve as a cautionary tale, reminding us that it is easier to take ecosystems apart than to reassemble them.

THE CONVICTION TO CARE

Unfortunately, in the intervening years since Robert Rush Miller’s report, most of the demoralizing trends he noted have only continued to worsen. But the exceptions to the rule shine a light upon a more hopeful path, showing that we *do* have the capacity to do things right.



Left: Bottomless Lakes State Park, New Mexico.

Opposite: A sandhill crane (*Grus canadensis*) foraging for food, Bosque del Apache National Wildlife Refuge, New Mexico.

Miller's 1961 account of southern Arizona's San Pedro River was largely a requiem for lost fish species. I first visited the river in 1989 but must confess I hardly remember it—just one more bridge over one more blown out Southwest river. Unbeknownst to me, however, profound and heartening changes were afoot in this watershed. Just a few months earlier Congress had passed the Arizona-Idaho Conservation Act, which created a new legal entity: the San Pedro Riparian National Conservation Area. The new reserve was

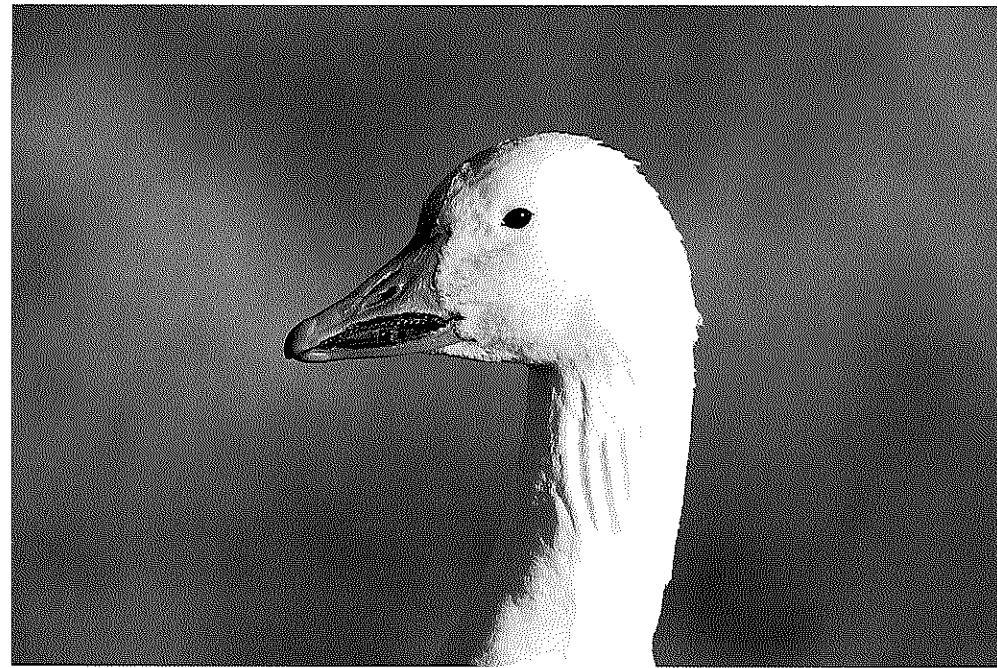
to be managed by the Bureau of Land Management (BLM) who, with the help of The Nature Conservancy, had successfully cobbled together over 56,000 acres along forty miles of river and riparian corridor through land exchanges or purchases from willing private landowners. Although changes were not yet evident on the ground that afternoon I crossed the river in 1989, they soon took shape. With its new management plan for the area BLM took a bold stand for biodiversity. In spite of vocal political pressure to the contrary, livestock and

off-road vehicles were excluded from the new conservation zone.

Today the San Pedro is justly held up as a model of successful conservation and collaboration. The area has one of the highest bird diversities for its size of anywhere in North America: close to four hundred species have been seen in the upper San Pedro River valley—almost half the species found on the continent! Its geographic location near the Rocky Mountains, its north-south orientation, and—especially—the rarity of healthy riparian habitat have all contributed to its

Right: Snow goose (*Chen caerulescens*) on Farm Loop in the Bosque del Apache National Wildlife Refuge, New Mexico.

Opposite: Farm Loop at Bosque del Apache National Wildlife Refuge, New Mexico.



importance as a key corridor for Neotropical migrant songbirds. Between one and four million individuals of fifty different songbird species migrate through this riparian corridor each year. In 1995 the American Bird Conservancy designated the San Pedro as the first Globally Important Bird Area in North America, and The Nature Conservancy listed it among its “Last Great Places.” The San Pedro also hosts one of the richest assemblages of mammals in the world, as well as harboring endangered species such as the Southwest Willow Flycatcher and

Yellow-billed Cuckoo, and three threatened plant communities.

Riparian habitats are remarkably forgiving and, unlike arid uplands, have the capacity to heal, at least partially, rather quickly. Protection from damage by cattle and dune buggies gave the San Pedro riparian corridor a fighting chance for recovery, and it responded by becoming one of the premier wildlife habitats in the United States. In spite of this encouraging recent history, however, the San Pedro remains at risk. The lifeblood of any wetland—water—is in great

demand as the nearby city of Sierra Vista grows by leaps and bounds, and along with the Army’s Fort Huachuca, uses more and more of the basin’s groundwater. If the lowering of the water table doesn’t halt soon, the river at the center of this emerald ribbon of biological diversity could simply dry up. Recent ecological studies confirm that access to groundwater is the most important factor determining the structure of vegetation along the San Pedro.

Because the San Pedro River remains undammed, a natural flood

disturbance regime still prevails, which helps keep native plant communities intact, thus discouraging invasion by exotic species. Only a few other rivers in the desert Southwest run free—notably, the Verde in central Arizona and the Escalante in southern Utah. The Escalante River—the most remote undammed river in the Lower 48—offers a story of hope not unlike the San Pedro's. In contrast to the San Pedro, the Escalante was shielded from human impacts along much of its length due to its remoteness (in fact, it was the last discovered river in the contiguous United States). One great exception cracked this shield, however: livestock grazing impacted virtually every square foot of the cottonwood-willow riparian habitat tucked away

inside deep canyons. When the river gained National Park Service protection in the early 1970s, grazing practices were unchanged. As recreational use increased in the 1980s and 1990s, though, hikers' incessant complaints about cattle devastation widened the dialogue on grazing and led to some reforms. Restoration of native riparian habitat directly followed the removal of cows from canyon after canyon along the Escalante. Recently, the nonprofit Grand Canyon Trust helped broker an agreement between ranchers and the government to remove cattle from much of the Escalante's riparian habitat.³⁷

Both the San Pedro and the Escalante rivers, then, present hope—and lessons. First, that healing can be accomplished so much more easily

along rivers that lack dams. Along these free-flowing watercourses, natural floods can continue their essential work, which deters the establishment of exotic species. And without impoundment, draining and diversion of water from a stream are less likely. Even regulated rivers, however, can do a better job of maintaining native riparian vegetation by mimicking natural flood regimes.³⁸ Second, removal of livestock from riparian habitats—simple logistically, if not politically—allows ecological recovery to commence immediately. This requires no great investment of technology or cash, just an exertion of political will. And third, exotic species make non-negotiable demands on any ecosystem they enter. The best strategy against this accelerating menace is to attempt to



Sitting Bull Falls, an oasis in southern New Mexico near the Guadalupe Mountains.

keep them from gaining an initial foothold in any given watershed. Admittedly, this is impossible to succeed at completely, but maintaining natural conditions—with native floods and without exotic grazers—goes a long

way. Finally, and perhaps most importantly, we can learn this simple lesson: we *can* manage desert wetlands wisely.

More generally, a number of laws and federal regulations have been asserted in

defense of wetland ecosystems. For well over a century the policy of the United States towards wetlands was to drain them, and by the mid-1970s over half the wetlands in the Lower 48 states had, indeed, been drained. About this time,



Pond at Inscription Rock,
El Morro National
Monument, New Mexico.

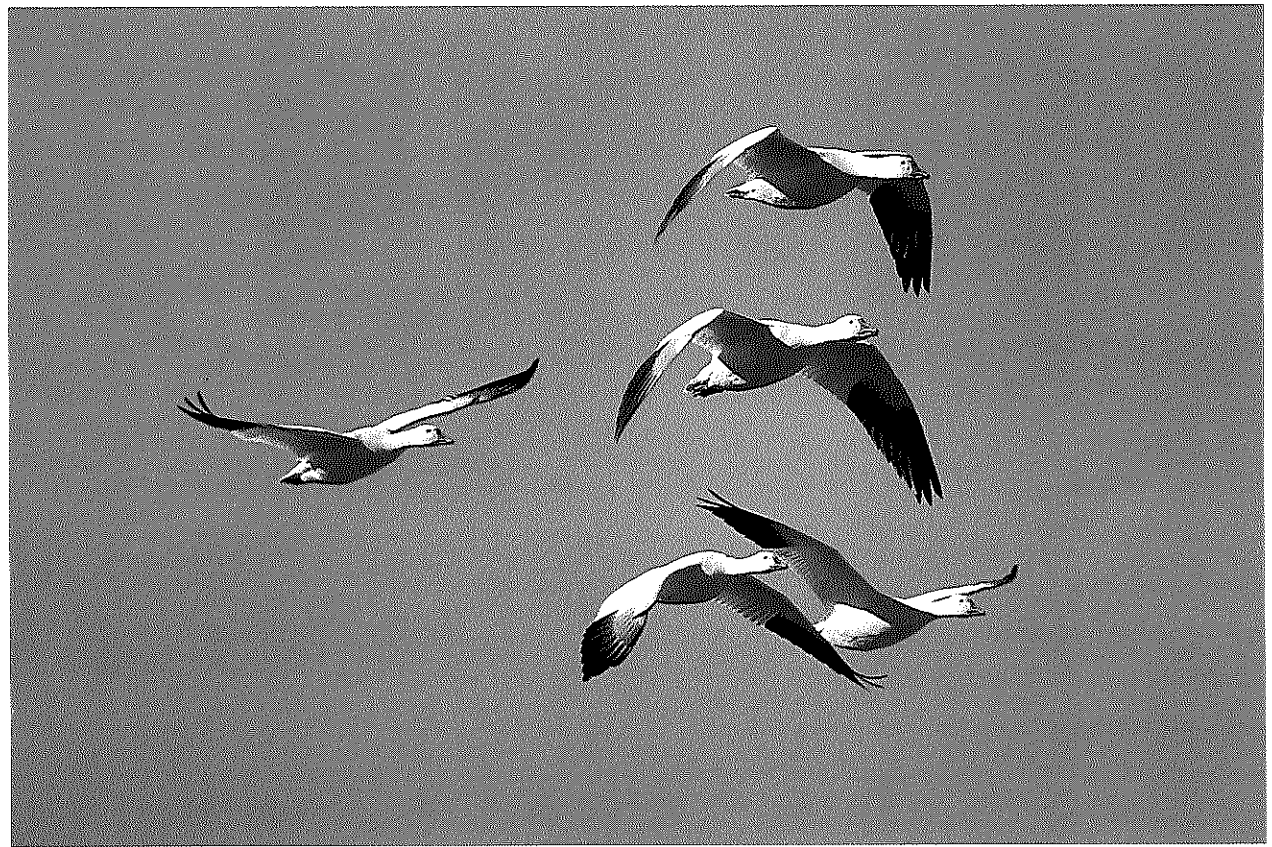
though, public consciousness about the importance of wetland habitats grew, as scientists began to recognize and articulate their ecological value. In 1977 President Carter issued two Executive Orders that together established protection of wetland and riparian ecosystems as the official policy of the federal government. Earlier that decade, the Clean Water Act had become law. Its

Section 404 required anyone dredging or filling “waters of the United States” to obtain a permit from the Army Corps of Engineers. Initially, the Corps interpreted this law narrowly to refer only to navigable waters. However, a pair of court cases in the mid-1970s clarified that the law also applied to wetlands.

Following these legal developments, conservationists, real estate developers,

and landowners shared at least one concern: how to determine what was and wasn't a wetland? In 1987 the Army Corps published a technical manual to address this question of wetland “delineation,” which specified three mandatory criteria—hydrology, soils, and vegetation—for a piece of land to be declared a wetland in the legal sense. Two years later the four federal agencies involved

Snow geese (*Chen caerulescens*) flying at the Bosque del Apache National Wildlife Refuge, New Mexico.



in wetland management co-published a unified, revised version of this manual. This new version still insisted upon the same three mandatory criteria for wetlands, but allowed one criterion to infer another—saturated soils, for example, could be taken as strong evidence of wetland hydrology (how else could the soils become saturated, after all?). This seemed too lenient to commercial interests in real estate, agriculture, and

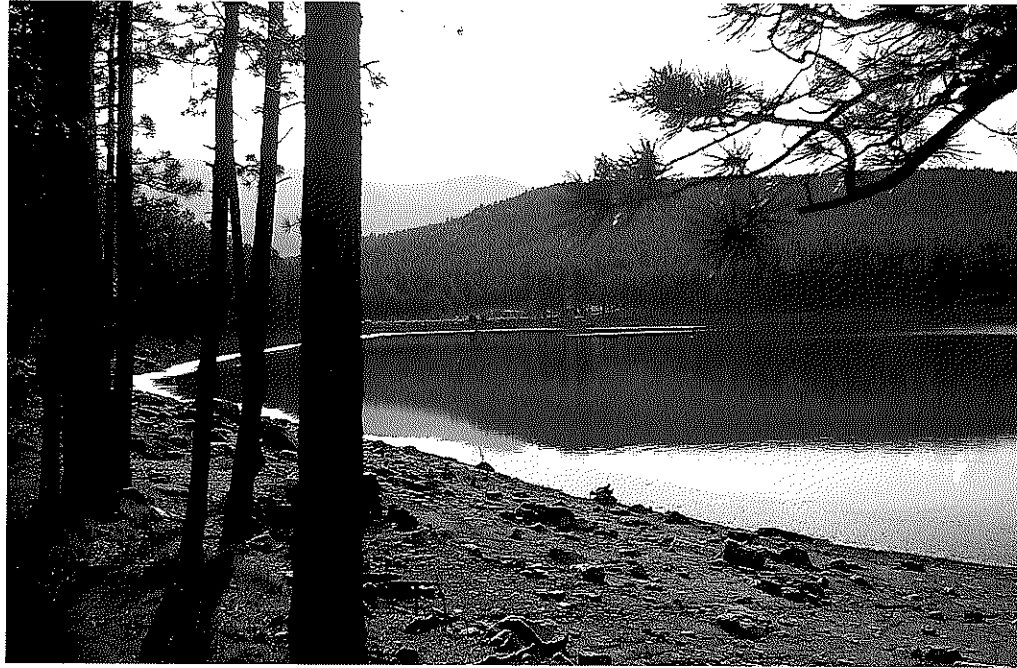
industry, who had been fighting all along to limit the legal scope of wetland delineation. They intensified their lobbying efforts and were rewarded by the Bush Administration in 1991 with a substantially weakened wetland delineation manual. It was soundly and immediately denounced, however, for its lack of scientific credibility and was abandoned the following year. Since that time the original 1987 manual has

again been used to resolve questions about what was or wasn't a wetland. (In the early 1990s the National Academy of Sciences affirmed that this had scientific merit.)

The 1970s also began an international thrust toward wetland conservation. A conference in Ramsar, Iran, in 1971 provided a framework for the international protection of wetlands. Since that time 117 nations have signed on to

Top: Morphy Lake State
Park in New Mexico.

Bottom: Lesser yellowlegs
(*Tringa flavipes*) on Pond
Loop in the Bosque del
Apache National Wildlife
Refuge, New Mexico.

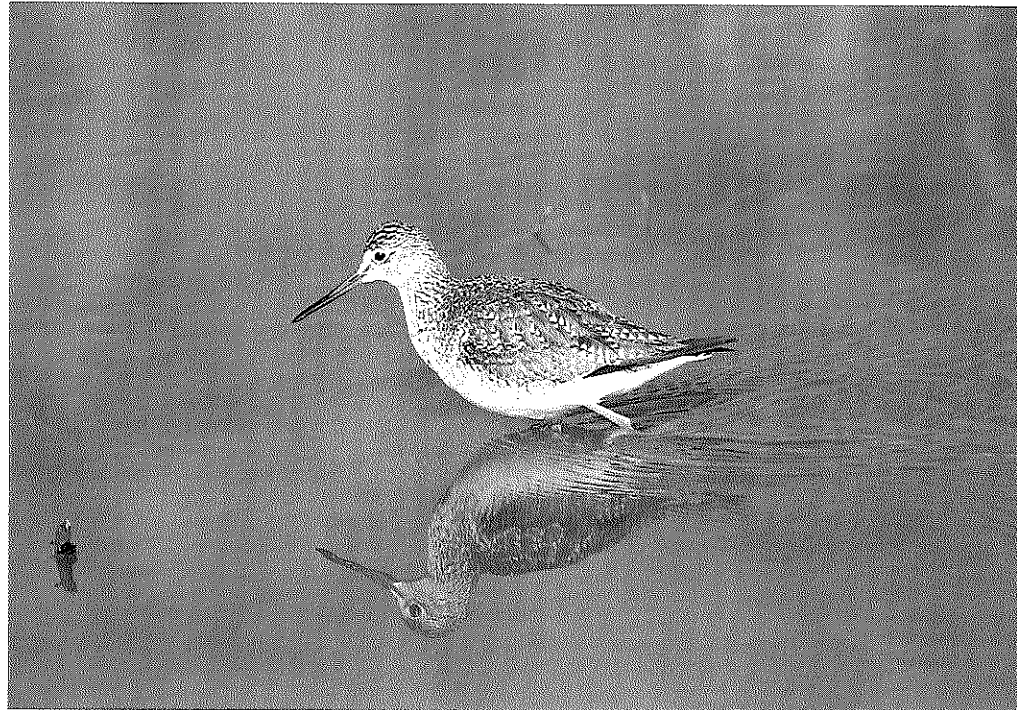


the agreement, and a permanent secretariat has been established, associated with the International Union for the Conservation of Nature, in Switzerland.

Laws and treaties for wetland conservation, as reflections of public will, have been great steps in the right direction. But, depending on the gusting of political winds, laws can be undermined. For example, instream flow rights are granted for fish and wildlife habitat in most western states, but these rights often have lower legal precedence than others.

(Instream flow rights simply refer to the legal right for water to stay in a stream—the fact that this is a contested area of law speaks volumes about our relationship to water in this part of the world!)³⁹

As I write, the Southwest withers. This is the driest year in recorded



A frosty, misty morning
in Bosque del Apache
National Wildlife
Refuge, New Mexico.



history, yet we continue to take our remaining desert wetlands for granted. Ultimately, then, saving these precious habitats will require more than laws. The needed changes lie deeper—in the realm of ethics and social values. Perhaps we need to once again see wetlands in the desert as a piece of heaven.

Homo sapiens wounds the world with greater ferocity than any other being. Yet at the heart of our nature dwells a psyche with two capacities. We are

wired not just for destruction, but for healing, grace, and compassion. From this deeply rooted potential, then—evident in the tenderness of a parent for child, the offering of food to the homeless, or the inclination to stare into the throat of a wildflower for the simple sensation of beauty—we can take heart and justly feel hope. Remembering that our bodies are built of clear water, borrowed from the fluid of earth, is a place to start.

Ethics, by its very nature, involves choosing to *not* do what we *can* do. An

ethical relationship with water in the arid Southwest would entail leaving some in the ground even though we have the know-how to suck aquifers dry. It demands leaving remaining wetland ecosystems intact even though we can desiccate them without blinking. Do we have the courage to look at water as we would if we carried every drop on our backs beneath the desert sun? Can we summon the wisdom to acknowledge this planet's primary truth: that life is mostly made of water?