CHAPTER 4

Resource Management as a Democratic Process: Adaptive Management on Federal Lands

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Conflict has long been a key part of American environmental politics, and many people—both environmentalists and critics of environmentalism—think that is a very bad thing. Yet conflicts among different users of public lands have often improved resource management when they disrupted the hold of narrow orthodoxies on policy. This chapter explores two historical case studies, one in the U.S. Forest Service and one in the U.S. Fish and Wildlife Service.

The first case study examines conflicts over old growth forest management in the Blue Mountains of eastern Oregon. For most of the twentieth century, foresters attempted to use the best ecological research of the day to transform old growth forests into regulated, scientific forests. This attempt to bring order to forests backfired, helping to create a forest health crisis across the West (Langston 1995). The second case study examines conflicts over riparian management at Malheur National Wildlife Refuge in the northern Great Basin, where disputes between ranchers, irrigators, and environmentalists have challenged the ability of federal agencies to manage scarce resources.

These cases describe how federal resource managers tried to reduce ecological complexity in order to maximize output from public lands, hoping to minimize conflicts between different users who wanted access to scarce resources. In both cases, a strong sense of professional community within each agency helped create a sense of purpose and pride that led to remarkable results on the ground in early years. Yet, in both cases, professional boundaries helped give rise to orthodoxies in the management of timber, water, grazing, and fire. Recent efforts at adaptive management, however, have helped to bring a democratic process to resource management, breaking down professional insularity and embedding decision making within broader communities.[1]

1. My thanks to Robert G. Lee of the University of Washington for suggesting this approach.

Adaptive management is a messy process of developing a management scheme that incorporates multiple human perspectives while responding to changing scientific understanding of dynamic ecosystems. At its best, adaptive management is a way of paying close attention to what happens when landscapes are managed, then altering practices when old ways no longer produce the desired results. This, in effect, entails applying the scientific method to management. The critical step for management, however, comes after the research: the hard part is using all that information to change how one works with the land. It means a dialogue between people and land; it means people knowing the place where they work. Adaptive management at its best is an iterative process that yields new information about ecological and human systems, and then applies that information to develop policies that can respond to changing knowledge about a changing world.

Case Study One: Conflicts Over Old Growth Forests on National Forests

Community stability and a sustained yield of forest products have played important roles in the policy of the Forest Service since its inception. One of the early Forest Service's central goals was to assure a stable, continued, fair supply of resources for local use. Careful conservation of forests, water, and grasses was thought to assure local communities use of resources without depleting the sources of that potential prosperity. However, things did not go as planned. In the Western forests and grasslands, this dream turned into a nightmare for many communities.

Forest Service planners made their decisions with the best of intentions, not because they wanted to destroy the forests or the mills, but because they wanted to make both sustainable. We need to understand the mistakes they made, not so that we can blame them, but so that we can learn from their errors and their many successes. If we want to reach a fair and sustainable future for forests and the communities that depend on them, we need to understand our shared forest history.

When Euro-Americans first came to the Blue Mountains of eastern Oregon and Washington in the early nineteenth century, they found a land of open forests full of "yellow-bellied" ponderosa pines five feet

across. These were forests so promising that people thought they had stumbled into paradise. However, after a century of trying to manage the forests, what had seemed like paradise was irrevocably lost. The great ponderosa pines were gone; in their place were thickets of fir and lodgepole pine. The ponderosa pines had resisted most insect attacks, but the trees that replaced them were favored hosts for defoliating insects such as spruce budworm and Douglas fir tussock moth. As firs invaded the old ponderosa forests, insect epidemics swept the dry Western forests. By 1991, on the five and one-half million acres of Forest Service lands in the Blue Mountains, insects had attacked half the stands, and in some stands, nearly 70 percent of the trees were infested (Gast et al. 1991; Langston 1995).

Even worse in the view of foresters and many local citizens was the threat of catastrophic fires. Although light fires had burned through the open pines every ten years or so, few had become crown fires. However, as firs grew underneath the pines and succumbed to insect damage, more fuel became available to sustain major fires. By the beginning of the 1990s, one catastrophic fire after another swept the inland Western United States.

In 1991, the Forest Service acknowledged that its own past management had helped to create a crisis in forest health, necessitating that those practices be changed (Gast et al. 1991). Two dominant and contrasting hypotheses emerged to explain the origins of the forest health crisis. Many environmentalists claimed that things had gone wrong in the inland West because the Forest Service worked hand in hand with the lumber industry to cut trees as fast as they could, devastating the forests. Excessive harvests, soil compaction, high grading that removed ponderosa pines and left only firs behind, combined with even-aged management—all this had led to a simplified ecosystem that became increasingly susceptible to epidemics.

Many foresters had an opposing point of view. The forests had deteriorated, they argued, because the Forest Service had bowed to the demands of sentimental preservationists and refused to manage intensively enough to save the forests from their natural enemies—fire, insects, and disease. Because ponderosa pine is shade-intolerant, they argued, clearcutting, even-aged harvests, and intensive management would be the only applicable methods to assure that fir stands do not replace pine stands. In their view, the best way to make forests sustainable would be to manage them as intensely as possible (Langston 1995).

These two perspectives on the history of forest health problems led to radically different management prescriptions. Neither of these perspectives, however, encompasses the whole truth. Understanding what early federal foresters did in the Blue Mountains ("the Blues"), and why they did it, is critical for devising restoration strategies.

Old Growth Policies

At the turn of the twentieth century, America was in a furor over land management. Disposal of the vast tracts of Western land was often a corrupt process. The new forest scientists argued that science could offer a way out of the chaos of political corruption. By turning to the rules of science, foresters tried to avoid contentious politics. As scientists who had the interests of America and American forests at heart, they felt they were beyond criticism. They alone could serve the public well, they believed, as efficiency rather than short-term profit was their goal (Hays 1959).

To assure there would be forests for the future, the Forest Service believed it important to remove old growth and encourage the growth of young forest. At the turn of the century, foresters defined old growth forests (also called "over decadent" or "over mature" forests) as those in which annual growth did not exceed annual decay. In contrast, scientific regulated forests were young and still growing quickly, so that they added more volume in a year than they lost to death and decay. The scientifically regulated forests were growing in an orderly fashion, so that each year the exact same number of trees came available for harvest—ideally, for eternity (Parry et al. 1983). Scientific forestry, later known as sustained-yield forestry, required regulated forests, so that the annual net growth could be harvested each year, assuming that in a regulated forest, loggers could harvest the net annual growth forever without depleting the growing stock. The harvest was equal to the interest; the growing stock was equal to capital.

The logic of the new Forest Service was simple: if the United States was running out of timber, the best way to meet future demands was to grow more. Since, according to Forest Service surveys in the early 1900s, more than 70 percent of the Western forests were old growth

stands, Western forests were losing as much wood to death and decay as they were gaining from growth. To prevent the threat of a timber famine, old growth forests needed to be liquidated so that regulated, sustained-yield forests could be grown instead. The best way to make available the land for growing, regulated production was by promoting sales of old growth.

In 1911, C. S. Judd, the assistant regional forester for the Northwest region, told exactly this to the incoming freshman class of forestry students at the University of Washington. A timber famine was on its way, unless the Forest Service did something soon. As Judd put it, "The good of the forest . . .demands that the ripe timber on the National Forests and above all, the dead, defective, and diseased timber, be removed." The way to accomplish this was to "enter more actively into the timber sale business" and heavily promote sales. This would get rid of the old growth, freeing up land to "start new crops of timber for a future supply" (Judd 1911, unpaged document). As Frederick Ames, another Blues forester (and later Chief of Silviculture for the Forest Service) said in 1906: "From no point of view can we make any mistake in cutting timber of this class [old growth]. The more sales we make the better" (Ames 1910, unpaged document). The unregulated, old growth forest was something to be altered as quickly as possible for moral, not just economic, reasons, to alleviate what one forester in the Blue Mountains, Thorton Munger (1936, unpaged document), termed "the idleness of the great areas of stagnant virgin forest that are getting no selective cutting treatment whatsoever."

Armed with their conviction that old growth was decadent and wasteful, foresters set out to clean up the forest, to make it as productive as possible. Every sales contract and management plan stipulated that contractors had to remove all snags and dead wood, and all insect-and fungi-damaged trees from the cutting site (e.g., Miles 1911). Foresters believed that disease, dead wood, old growth, and fire all detracted from efficient timber production. They were assuming that the role of the forest was to grow trees as fast as it could, and that any element not directly contributing to that goal was bad. Assumptions such as these made it difficult for them to imagine that insects, waste, disease, and decadence might be essential for forest communities; indeed, that the timber-producing part of the forest might depend on the non-timber-producing part of the forest.

Liquidating Old Growth

For all the foresters' desire to remove old growth, the Forest Service sold minimal timber from the Blue Mountains until after World War 1 (Evans 1912; Clary 1986). Forest Service timber was inaccessible, prices were set so high that few contractors were willing to invest, and the lumber industry still had enough private stock to make sales of federal timber unattractive. After World War I, however, markets for National Forest timber opened up, and the Forest Service started to promote sales of ponderosa pine in the Blue Mountains. This enabled them to seriously begin the campaign to regulate the forests by liquidating old growth.

The Forest Service believed that to ensure local prosperity old growth forests needed to be converted to regulated forests, which could supposedly supply harvests forever. However, they also needed markets for timber, and railroads were needed to get the timber to the markets. The development of railroads, particularly after World War I, was extraordinarily expensive. Financing them required capital, which often meant attracting investments from Midwestern lumber companies. However, these companies would only be interested in spending money on railroads if they were promised sales large and rapid enough to cover their investments.

To encourage regional railroad development in the 1920s, Forest Service planners encouraged construction of mills that had annual milling capacities well above what they could supply on a sustained-yield basis. Two large sales during the 1920s from the Malheur Forest alone, for example, offered over two billion board feet of pine, out of only seven billion board feet of timber in the entire forest. Two mills followed after the Malheur mill—one capable of processing sixty million board feet a year; and another that could process seventy to seventy-five million board feet each year (USDA Forest Service 1922). With mill capacities reaching 135 million board feet per year, it would take only fifteen years—not the sixty years of the cutting cycle—to process the two billion board feet in these sales, and only fifty-two years to process all the ponderosa in the forest.

As the Forest Service tried to find contractors for their timber, they made extensive compromises. The Forest Service initially had a strong policy against high grading—the practice of cutting out only the most valuable ponderosa from a mixed stand and leaving behind the less-valuable firs and other trees to form the basis of the future forest.

However, correspondence between sales planners make it clear that contractors were refusing to cut less valuable trees. The Forest Service did not force the contractors to honor their contracts. Soon contractors began demanding a reduction in stumpage prices, claiming that they should be given a discount on ponderosa if they had to cut any other species at all. Starting in 1922, the Forest Service decided that continuing to insist on cutting firs would mean that no one would buy ponderosa, and so the policy against high grading was dropped (USDA Forest Service 1922).

In 1922 the Forest Service in the Blues also abandoned its ideal of light selective cutting and began allowing contractors to remove 85 to 90 percent of the mature forest in each sale, leaving only 10 to 15 percent as a reserve stand for the next harvest cycle. Loggers were now allowed to skid out the timber with caterpillar tractors, even though before 1922 the Forest Service had discouraged this because it damaged young growth. The Forest Service had originally required that big pines be left in the reserve stand as seed trees. However, in the 1920s, they abandoned this policy, and told contractors to cut all pine over fifteen inches in diameter on a sale area. Although many foresters now argue that light selective cutting and fire exclusion destroyed the ponderosa forests by encouraging fir, these silvicultural compromises of the 1920s also contributed (USDA Forest Service 1922).

Concern about the longer-term effects of intense harvests on local communities began to emerge in working circle plans during the late 1920s, even though foresters did not allow this concern to decrease their recommended harvests. In the Malheur River Working Circle Plan starting in approximately 1927, the planner attempted to calculate the annual yield that would be available for local mills beginning in the 1980s, during the second cutting cycle. He realized, with dismay, that harvests would drop by at least 40 percent in the 1980s if cutting continued at current rates (USDA Forest Service n.d.). The planner, however, thought that, because his calculations of growth rates were just rough estimates, perhaps they would turn out to be low; then there would more timber than expected. He also hoped that "utilization efficiency will greatly increase"—so less waste would mean more wood for future mills (USDA Forest Service n.d., unpaged document).

In the Whitman Forest, letters between sales planners, the forest supervisor, and the regional district forester show that, by 1927, the

Forest Service was worried about the mill capacities they had encouraged. E. A. Sherman, the acting regional forester in Portland, criticized a draft of the management plan for the Baker Working Circle, complaining that the mill at Baker was too large and was using up too much wood, in excess of annual allowable cuts. He wrote that "the present milling capacity at Baker of between 40,000,000 and 50,000,000 feet annually . . . greatly exceeds the possible sustained yield from the Government lands in this working circle . . . . It does not look as if a reduction in the milling capacity at Baker sooner or later could be avoided" (Sherman 1927, unpaged document). The sales planner who had prepared the plan Sherman was criticizing agreed that harvest reductions would certainly arrive by the 1980s. Nevertheless, he argued to Sherman that they should do their best to meet the mills' current demands to avert possible immediate closures, even though such harvests would come at the expense of the next cutting cycle. Sherman reluctantly agreed and high harvests continued (USDA Forest Service 1927).

Throughout the 1920s, foresters set up plans knowing that harvests would drop by at least 40 percent over the long term, leading to probable mill closures in the 1980s (USDA Forest Service n.d.). Mill closing is exactly what happened. Harvests collapsed at the beginning of the 1990s—not only because of environmental restrictions, but also because of decisions made in the 1920s. The planners' original motive, however, was not to gain profits from sales of old growth, but to reshape the forests to fit their dream of scientific efficiency. They initially believed their goals were purely rational and that their motives were untainted by desire for gain. What they failed to recognize was the degree to which their culture—a culture that stressed efficiency—had shaped their scientific definitions of an ideal forest.

In their drive to build local support for establishing forest reserves at the turn of the twentieth century, federal foresters had insisted on two beliefs: that Midwestern timber barons were out to steal resources from local people, and that the foresters were on the side of the locals. The federal foresters were going to save the forests, not for preserves, but for perpetual use and productivity. Inspection reports often intimated that outsiders had plundered the land with their wasteful logging techniques, and only the Forest Service could protect local industry from the depredations of out-of-state capital (Langston 1995).

The official policy in the region was to support and promote locally owned mills. However, internal memos reveal the Forest Service was actually not supporting local mills. As the Umatilla Hilgard Project Report (USDA Forest Service 1927) stated, the intent was to "vigorously discourage sales to small operators." Their "inability or unwillingness to adhere to contract stipulations," coupled with their financial instability, made the Forest Service reluctant to work with them. Primarily, small sales interfered "with efficient logging by the larger and more important operators" (USDA Forest Service 1927, unpaged document).

The emerging federal bureaucracies found it far easier to work with larger corporations. The larger lumber operators owned substantial private lands, and were better able to institute scientific forestry practices. Small mills and small logging operations were less efficient, and efficiency was something the Forest Service promoted. By the 1920s, the Forest Service discouraged small local mills and did their best to encourage big capital from out of state (Langston 1995). The intent was not to destabilize local communities, but to regulate the forests, and larger companies could, it was believed, do this more quickly than small companies.

Complexity and Adaptive Management

When foresters looked at old growth forests, they saw not diverse habitat for predators and prey, but instead a chaotic mess. Their hope was to make the forest less wasteful and more efficient by simplifying. As George Bright, a Wenaha Forest silviculturist, stated in 1913: "In the general riot of the natural forest, many thousands of acres are required to grow the trees that . . . under management, could be grown on far less land." At times, the impatience of many foresters became so great that they longed for the day when they finally had the money and the clout to raze the hills and plant exactly what they liked. As Bright argued, if only foresters could clearcut the old, inefficient forests, they could plant a better nature that would produce ten times the amount of useful timber (Bright 1913, unpaged document). Eventually, clearcutting did take place, but their efforts backfired, leading to increasing problems with fire, insects, disease, and conflicts among resource users.

Human communities depended, and still depend, on the forests. But what few early managers in the Blue Mountains realized is that people depend, not just on timber outputs, but indirectly on the ecological complexity that sustains those outputs.

Traditional resource management led to a series of unexpected effects and unintended consequences. When a manager tried to fix one problem, the solution created a worse problem elsewhere. The best of intentions often brought about the worst of outcomes. Attempts to manage natural systems could introduce an element of instability into the systems managers were hoping to control. For example, fire protection and insect control attempted to control natural disasters by eliminating the problem, thereby engineering it out of existence. Fire managers tried to prevent catastrophic fires by suppressing all small fires. Insect managers tried to control insect damage by killing all insects as soon as they appeared, or by simplifying individual stands so insects could not survive. In spite of their best efforts, attempts at fire and insect control only led to worse devastation. Suppressing fires led to fuel accumulations, slowed the growth of many forests, and made future fires more intense. Changing old growth stands to even-aged stands in order to control insects only eliminated insect predators, and contributed to the catastrophic insect damage now apparent in the Blues. A refusal to tolerate low-intensity fires made moderate fires behave more erratically, just as a refusal to tolerate low-intensity insect damage made future damage worse. Failures of fire and insect control generally led not to a re-evaluation of the enterprise, but to more engineering, more sprays, more fire fighters, and more intensive management to fix the problems management created.

As scientific understanding of forests changes, and as society's values change, forest managers have to negotiate some path that adapts to these changes without sacrificing the basis of the forests' future productivity. In the current debates over forest management, science can offer guidance and information as to outcomes of different alternatives, and identify biophysical constraints that define the range of possible alternatives. However, changing social values and priorities, not science alone, will be the primary determinants of sustainable forest management.

Case Study Two: Riparian Management at Malheur National Wildlife Refuge

During the 1980s and 1990s, conflicts over old growth forests were among the most bitter in resource management. Yet, in the first decade of the twenty-first century, conflicts over riparian management have proven even more intense, as water becomes an increasingly scarce and valuable resource. Conflicts over riparian areas have a long history in America, beginning more than a century ago, when drainage and reclamation efforts across the nation led to a noticeable decline in waterfowl, stimulating a national interest in conservation of these birds and their habitats (Vileisis 1997).

For thousands of years in the high deserts of the northern Great Basin, the Donner und Blitzen River moved across a vast floodplain, using a set of sinuous channels that changed from decade to decade, creating a system of shifting wetlands that supported millions of water birds each year. These riparian communities were not stable: floods, changes in rainfall, and changes in animal activities led to dramatic annual changes in the bottomlands. Some years the marshes were lush and green, and stretched from one end of the valley to another; the basin filled with water. Other years little snow fell on the surrounding mountains; by early summer the lowland streams ran down to a trickle, the riparian meadows turned brown, and the marshes slowly dried. Some years the water was so high that numerous pools and ponds formed in the valley, perfect for brooding waterfowl. Other years few pools formed, and available waterfowl-rearing habitat was minimal. Yet, because this basin was embedded in a much larger network of wetlands stretching from California to Canada along the Pacific Flyway, when droughts struck the basin, shrinking the ponds and pools, migratory birds could find other places to rest and feed.

By the 1930s, several decades of overgrazing, irrigation withdrawals, grain agriculture, dredging and channelization, followed by drought, meant that the former wetlands had become a dust bowl. Attempts to increase crop production by making wet areas drier and dry lands moister had stripped the willows and cottonwoods from the banks, imprisoned the Donner und Blitzen River in a ditch, and dried up the meadows and marshes. People did not fare much better than the land: ranches failed, livestock starved, homesteaders went bust, and a primary occupation in the valley became suing one's neighbor over water rights. Water control seemed an unmitigated disaster (Langston 2003).

Conservationists won a major victory in 1934, when failed cattle and irrigation empires along the Donner und Blitzen River were sold to the federal wildlife refuge system, beginning an expansion of a duck ecosystem at Malheur National Wildlife Refuge. Managers attempted to restore an ecosystem that appeared to have nearly been annihilated. In response to what they saw as a crisis, refuge managers adopted drastic measures to re-flood drained lands, re-route water courses, and essentially manufacture new breeding areas for bird populations that seemed on the verge of extinction. In place of a system of wandering channels, where in some years little of the valley might be wet, and other years floods might sweep over the entire basin, eradicating waterfowl breeding habitat, managers hoped to control the movement of water across the land. Hoping to maximize waterfowl production, managers attempted to dictate which ponds stayed full of water, and which meadows were allowed to dry out.

John Scharff, the manager of Malheur National Wildlife Refuge for three decades, led intensive efforts to restore the basin through irrigation engineering and water control. In 1937 alone, refuge staff and workers from three Civilian Conservation Corps camps built over 150,966 cubic yards of levees and dykes, fenced 95 miles with barbed wire, cleared out 83,938 cubic yards of channels, laid 34,680 cubic yards of riprap, and created 35 separate water control structures. Just a year after Scharff had begun work, he stated in his 1937 fiscal year report: "The creation of lagoons, ponds, dikes and canals in all parts of the refuge has indeed proven an incentive for the waterfowl to utilize practically all meadows and formerly dug fields as nesting areas" (Scharff 1937). Interspersed with these descriptions were photographs of marshes and ponds with captions such as "Man-made Water Areas where Waterfowl Romp," (Scharff 1937, 15). Scharff added underneath the photos, "Much better use was obtained from the available water this year owing to the facilities which have been constructed to properly handle the water upon its arrival," (Scharff 1937, 15). Scharff summarized this report with the statement: "It is gratifying to say the least, to see the increased numbers of birds using the facilities which have been provided by our early development work" (Scharff 1937, 15).

The restored wetlands of Malheur National Wildlife Refuge soon formed the centerpiece of a huge riparian marsh complex in southeast Oregon—one large enough to cover the same size area as

Massachusetts, Connecticut, and Rhode Island. By 1987, Malheur's refuge manager, George Constantino, could report that Malheur Lake was "the most important refuge" along the Pacific Flyway "for water-oriented birds." In the language of wildlife biologists, Malheur "produced" 84 percent of the Great Egrets, 55 percent of Snowy Egrets, and 68 percent of Black-crowned Night Herons, representing "a major production area in the Pacific Flyway," (USDI Fish and Wildlife Service 1987, 2). Malheur had become one of the critical feeding sites along the Pacific Flyway, the migratory route of millions of waterfowl and shorebirds.

However, for all its successes, Malheur National Wildlife Refuge has become an increasingly contested landscape. Irrigation and water control on the refuge and on the surrounding private lands have helped create an environment with much less variability than its condition before 1937, and this variability has proven to be critical for maintaining ecological productivity in wetlands. For example, wetlands that are always flooded cannot recycle nutrients as well as wetlands that are sometimes allowed to dry out. Water-control structures allowed managers to fix a set pattern of breeding habitat in place for ducks, but in the end, this decreased the health of wetlands and aquatic habitat, ultimately hurting ducks as well as aquatic species.

To understand these decisions, we need to remember the desperate conditions of migratory bird populations in the first decades of the twentieth century—and the equally desperate attempts ornithologists and conservationists were making to save those birds. In the early 1930s, severe droughts along the Pacific Flyway desiccated wetlands, habitat that had already been drastically reduced by three decades of drainage and reclamation. By 1934, the continental waterfowl population had dropped to a low of twenty-seven million birds; only one hundred fifty egrets and fourteen whooping cranes remained (Vileisis 1997). Conservationists were convinced that preservation of habitat alone would ultimately be powerless against land speculators, reclamation engineers, and drainage districts bent on creating farmland out of wetland. The bleakness of the situation led conservationists to advocate what were engineering solutions for the restoration of Malheur, borrowing the same techniques that had helped devastate the marshes in the first place.

Although the water-control system at the refuge quickly increased waterfowl habitat, trying to maintain the system led Malheur staff

into difficulty. Because the refuge's emphasis was on maximum water bird production, anything that seemed to detract from waterfowl production was eliminated. When coyote and raven populations soared, lowering duck nesting success, refuge staff set out poisoned bait, and then had to contend with increased rodent predation of eggs. When beaver returned to the valley and blocked irrigation ditches, staff trapped them out, even though the irrigation system was trying to replicate what beaver had created in the first place.

By the 1950s and 1960s, control of woody vegetation became another major objective for the refuge. Willows were cut, mowed, and sprayed with herbicide to remove predator habitat, make it easier for tourists to see the wildlife, increase mowing efficiency in the hay meadows, increase the number of acres that could be put into full cattle and duck production, and most importantly, to decrease competition for water. Woody riparian plants are phreatophytes, meaning that they extend their roots into the water table and consume a great deal of water. As one 1967 federal report on the Malheur Lake Basin argued, "Many people believe that the high consumption of limited water supplies by phreatophytes is one of the most serious problems in the West" (USDA Economic Research Service 1967, 87). Phreatophyte removal accelerated with the introduction of new herbicides—the 1955 *Yearbook of Agriculture* recommended that for complete control, one must repeat six sprayings of 2,4-D and 2,4,5-T, which later became notorious as Agent Orange (Meinzer 1927; Fletcher and Elmendorf 1955, 427; Robinson 1959). Water experts of the mid-1950s came to believe that they could create more water and control floods through such phreatophyte eradication programs.

Riparian hardwoods are thirsty plants, but using water does not always mean reducing the supply for everything else. Instead, riparian vegetation can maintain a high water table by absorbing runoff and allowing streams to continue flowing longer. Even while they consume water, riparian plants can increase the available supply to other plants. Riparian zones made the boundaries between water and land more complex, and John Scharff, like many other managers, believed that these complexities interfered with his efficient administration of nature, slowing water flow, keeping silt from clogging the streams. The leaves of these trees shade the streams, reducing water temperatures. Their branches and dead wood fall into the water, creating deep pools of scoured gravel where fish can spawn, trapping debris, and forming

dams. Refuge staff used to think all this was bad—the point of a stream was to move water from point A to point B as efficiently as possible. However, the more people tried to simplify streams by channeling them and piping them and cleaning them up, the more the waters dwindled away.

The most spectacular of all programs that Scharff initiated was the carp-control project. Pioneers had introduced carp into the nearby Silvies River during the late nineteenth century, hoping to create a reliable food supply (Duebbert 1969). Few people proved to like the taste of carp, however, and carp populations soon exploded, with a host of unintended effects. Carp made their way from the Silvies River into Malheur Lake, perhaps during the high water year of 1952, when floods flushed carp into the lake (USDI Fish and Wildlife Service 1955). As bottom feeders, carp churned up sediments and destroyed sago pondweed. Because sago pondweed was a critical food source for waterfowl, duck populations plummeted at Malheur. By 1955, sago pondweed was almost depleted from Malheur Lake, and by 1957, carp had made their way forty miles up the Donner und Blitzen River. This unruly bit of nature—an unnatural introduction, but profoundly natural in its unwillingness to abide by human rules—became a profound threat to water-bird management at Malheur.

Scharff responded by initiating a series of poisoning projects whose intensity and scope were made possible by two things: first, by technological advances that had resulted from the World War II; and second, by a world view that had declared war on any aspects of nature that refused to accede to human control. The refuge staff set out to control carp by dumping and spraying the fish poison rotenone throughout the system—an enormous project, for it involved treating the Donner und Blitzen River, the Silvies River, all their tributaries, and the lake itself. Several dry years meant the lake levels had dropped quite low, shrinking the lake surface (USDI Fish and Wildlife Service 1955). With water-control structures along the Donner und Blitzen River and the lake, the staff shrunk the lake even further, making carp control feasible.

In the fall of 1955, the poisoning began. With aerial applications of rotenone, followed by drums of toxicant dumped into the water, and finally with staff wading out into the marsh and hacking the heads off dying fish, the refuge killed one and one-half million carp. But two thousand carp escapedand spawned, and within three years, carp were more numerous than before—now that their competitors, native fish much less resistant to rotenone, had been poisoned (USDI Fish and Wildlife Service 1955; USDI Fish and Wildlife Service 1957). Control projects continued for several decades. Two more extensive aerial sprayings were undertaken during low water years, with equally limited success (USDI Fish and Wildlife Service 1977; USDI Fish and Wildlife Service 1987).

What decades of drainage efforts had failed to do, carp managed quite well: they transformed Malheur Lake from splendid duck habitat to something still magnificent but far less productive for waterfowl; introduced carp had inadvertently created another ecosystem, escaping from the bounds people attempted to place upon them. People were responsible for these hybrid ecosystems, but they had little luck controlling them. Eventually the refuge staff admitted defeat in the war against carp, and focused instead on keeping carp populations from increasing to the point that they displaced everything else in the marsh.

In the years since John Scharff retired, management of Malheur riparian areas has become less clumsy, but no less manipulative. Now, instead of using bulldozers to channelize the river, the staff is trying to figure out ways to use bulldozers to return the river to its old route. Willow are being planted instead of being removed, but herbicides still play a role, removing vegetation that might compete with desired native species. The irrigation and water-control system is growing more elaborate, since without it much of the habitat for rare and endangered birds would be lost. Flood irrigation still waters the meadows, but now it creates hay for bird cover, not just for cattle.

The most profound change in the Donner und Blitzen Valley is that refuge staff is no longer trying to fix a single pattern of ponds and meadows and wetlands in place. Instead, they are trying to manage variability back into the system by alternating which meadows are dry and which are wet. Yet, given the constraints of managing a wildlife refuge with extensive investments in structural improvements, this variability can be allowed only within strict limits. For example, the river is now encouraged to meander a little, but not enough to threaten the constructed canals and brood ponds.

Some critics of Malheur Refuge policy have argued that the water-control system should be dismantled, and natural variability should be allowed to dominate. However, is this possible in a world so dramatically

altered by people? Malheur's historical variability existed within an entirely different context. It was once only one of a long string of fertile, vast marshes stretching up and down the Pacific Flyway. If most of the Malheur Lakes Basin happened to be dry one year, the birds could stop elsewhere, because the Pacific Flyway consisted of numerous patches of desert, riparian, and wetland habitats. Now, however, the vast majority of those historical riparian areas and marshes are gone, replaced by agriculture, shopping malls, and highways. If natural variability were returned at Malheur, it might be disastrous for entire populations of ducks, sandhill cranes, and shorebirds.

Refuge managers believe that they cannot allow natural systems to be purely natural. They try to restore some natural variability, but not enough to threaten the water systems that have been painstakingly constructed. There is nothing ideologically pure about current refuge policy: it is not an attempt to return to pristine natural conditions, nor is it an attempt to gain complete control of nature.

Such a policy infuriates some environmentalists, who see little difference between John Scharff's regime and current refuge attempts to limit predators and regulate water. However, this critique does not consider some crucial ideas. Scharff, unlike current managers, aimed for ideological purity: his ethic was one of control and improvement. He rarely seemed to doubt that humans could and should take complete control of nature. Some modern environmentalists have an ethic that is equally ideologically pure: naturalness. A thing is good when it is natural, bad when it is not. Controlling predators or water is unnatural, so therefore it is bad.

In the world in which refuge staff actually has to work, neither ethic is particularly helpful. Refuge staff tries to find a reasonable path between extremes. The refuge managers are trying to act pragmatically, rather than ideologically. They are not trying to restore the refuge to some past set of pristine ecosystems; they are trying to adapt to change, making things work as best they can, while minimizing future complications. They are trying to practice adaptive management in an increasingly complicated world.

Conclusion: Lessons for Adaptive Management

Managers of both old growth forests and riparian landscapes once hoped that they could engineer the natural world to produce stable outputs of marketable resources. However, the natural world proved far too dynamic for this. No matter how many facts managers accumulate and how many theories they test, they will never have the knowledge to manipulate natural systems without causing unanticipated changes. Yet they still have to manipulate the environment, which presents a dilemma: how does one make decisions when one knows one will never be able to fully predict the outcome of those decisions?

Adaptive ecosystem management attempts to use some of the findings of dynamic ecology to manage natural resources, not for maximum commodity production (a traditional industrial forest), or for preservation of current conditions (a traditional reserve), but for the perpetuation of patterns and processes that allow ecosystem functioning. Adaptive ecosystem management rests on several critical principles: primarily, all ecosystems change, often in ways that are difficult for us to predict. Because humans have influenced ecological processes and patterns for thousands of years, it is important to understand human disturbances if we wish to understand current ecosystem functions. Management must therefore pay attention to the changing human framework, as well as to a changing natural framework.

In Malheur Lake Basin and the Blue Mountains, federal managers in the early twentieth century made reasonable decisions, given the limited information with which they had to work. Their goals were to assure a fairer distribution of increasingly scarce resources. They recognized that they knew little about how to manage wetlands, in Malheur's case, or ponderosa pine in the case of the Blue Mountains—yet they also recognized that they needed to do something quickly, in the face of accelerating losses. Their policies were at first experimental, a way of applying the scientific method to land management. Unfortunately, in both cases, policies that began as experiments soon became orthodoxy, and managers found it difficult to monitor ecological signs that things might be going wrong, and even more difficult to change policies once they were in place. The critical lesson from these case studies is not that early managers made mistakes—all managers will inevitably make mistakes, since no one can ever have

perfect knowledge of how ecological systems work. Rather, the critical lesson from these case studies is to make note of the difficulties resource managers faced when they needed to monitor and change policies. The challenge for modern managers is to devise processes that assure adaptive management can take place.

Nearly a century ago, Frederick Ames (1910), who first worked for the Forest Service in the Blue Mountains and then became chief of silviculture for the nation, warned his fellow foresters that they needed to practice something akin to what we now call adaptive management. Ames argued that before foresters could begin to manage the Western forests, they needed to recognize several things, including the fact that they did not understand the forests well enough to predict their response to management. Nevertheless, they had to manage; even doing nothing at all was a form of management. Therefore, what they had to do was treat "all of sales as a vast experiment," (Ames 1910, unpaged document). Ames outlined an extremely ambitious plan of monitoring: after each timber sale, they would go in every three years and record the response of the site to whatever experimental treatment they had devised. Over the next one hundred years, they could compare the effects of different kinds of logging, fire exclusion, and grazing on different forest conditions. Ames called for close attention to both the forest and the effects of human actions on the forest. In modern terms, Ames was telling his foresters that they needed to practice adaptive management and recognize that foresters could not always predict the effects of their actions.

This was an excellent idea, but unfortunately, it failed to work. Even when conscientious foresters gathered all the data Ames called for, these reports accumulated dust, first on the top of the supervisor's desk, then in the office's filing cabinets, then in cardboard boxes in the storage attics. No one knew what to do with all this information, and it continued to multiply exponentially while managers tried to discern a solution. When foresters did try to monitor the effects of their logging practices, superiors in the regional offices usually chose not to make recommended changes, often for political reasons. Caution seemed easier than adapting to uncertainties, given the pressures on foresters to make timber available for sale (Ames 1915; Langston 1995).

At its best, adaptive management is a way of paying attention to what happens when we cut trees, burn forests, favor pine, or do anything else. But what is most innovative and promising about

adaptive management is the way it tries to meet the challenges outlined in this chapter: how do you manage in a world where you know that your models of the forest are always much simpler than the forest itself? No matter how complex the forest is, one still has to manage it; there is no neutral position possible, no way to say we are simply not going to manage land. All attempts to manage are attempts to tell a story about how the land ought to be, and by definition, all these stories are simpler than the world itself.

As the first foresters in the Blues recognized, everything resource managers do is nothing more, and nothing less, than an experiment. The critical step for management, however, comes after the experiment: the hard part is using all that information to change how you work with the land, and this is where the young Forest Service found itself unable to resist pressures to continue business as usual. Monitoring does not necessarily mean big government programs; what it means is people being responsive to what the land is telling them, and being responsible for acting on that knowledge. It means a dialogue between people and land; it means people knowing the place they log, knowing the place they work.

At Malheur National Wildlife Refuge, refuge managers in the 1930s made reasonable engineering decisions in a desperate situation, but by the 1940s, they proved slow to respond to information that suggested their schemes were leading to trouble. Just as forest managers had found it difficult to change policies, when events at the refuge began to spiral out of control, managers did not question their own basic assumptions, but instead tried to hold the system under increasingly rigid control. As in the Blue Mountains, management techniques at Malheur that began as experiments soon became orthodoxy. In the 1930s, the refuge staff developed a set of powerful techniques that made excellent sense in a particular context, given the challenges waterfowl populations faced at the time. However, as Scharff gained power, those ideas became increasingly rigid.

People found it difficult to challenge the developing orthodoxy until outside events forced managers to take new perspectives seriously. In Malheur's case, these outside threats included floods, litigation by environmentalists, and the threat of an Endangered Species Act listing of redband trout. In the Blue Mountains, forest health problems, fire, and litigation played similar roles. In both cases, conflict forced people, institutions, and states to incorporate new ideas into their worldview.

For generations, foresters and refuge managers had enough power that they did not need to acknowledge viewpoints other than their own. Malheur refuge managers and Forest Service planners were reluctant to question their own ideologies until environmentalists used litigation against them. A set of escalating conflicts—conflicts which began as local issues and then became mediated by national institutions—eventually forced groups in Oregon to embrace a political process in which stakeholders coming from different perspectives had to jostle against each other, argue with each other, and listen to each other, in ways that modified each other's actions and beliefs. Because no one has perfect knowledge of how ecological systems work, this process moved us toward much better solutions than any one group could have found on its own.

What mattered most about litigation was that it forced a variety of stakeholders, with multiple voices, multiple stories, and multiple perspectives to communicate with each other. This led to new ideas and eventually new conditions. Federal resource managers ran into trouble when they were permitted to operate with the authority of state power reinforcing their assumptions. Only when political conflict forced managers to allow other stakeholders to have a voice did federal managers begin to question some of the problematic assumptions that seemed so self-evident when they essentially didn't have to answer to anyone else.

Yet, while state power and narrow scientific expertise can enforce rigid and dangerous orthodoxies, the answer is not to take power away from the scientists or the state, and simply give control back to the locals (Scott 1999). For all the mistakes made by technocratic, scientific experts, their expertise is useful and necessary. What is needed is a democratic process that creates a structure for useful conflict. A democratic process should empower multiple voices, and create a method for negotiating conflict. Democracy is not merely a form of external government, but a set of tools for "undertaking the ongoing reconstruction of social life" (Hickman 1998, xvi). Because the world is constantly changing and public values constantly shifting, the ways of providing for the individual and common good have to be experimentally determined (Parker 1996).

What should the role of state power and federal land managers become in such a democratic process? How can adaptive management help create a process that enables the interplay of diverse voices? Federal

managers can structure a process that enables different groups, with different amount of power in a local community, to come to the table and be heard. They can force the powerful to listen to the powerless. They can get issues on the table that have been ignored for centuries. They can disrupt orthodoxy.

Federal resource managers' path is now as indirect as the river's course once was. Legal battles constantly reshape refuge and forest policy, much to the eternal frustration of staff that is trying to get their job done. However, such outside influence is a good thing in the end, however annoying it is from day to day. Without constant criticism and political pressures and court cases, refuge management would be far more efficient—and in the end, far more dangerous.

Both the Forest Service and the Fish and Wildlife Service have long been staffed with professionals dedicated to their agency's missions. Often, professionals within each agency shared a common language and a common professional training with others within their agency. Common goals and scientific training united early managers, giving them a strong sense of professional community, and helping them delineate a strong sense of professional boundaries. Wildlife managers, like foresters, gained legitimacy through their ideals and their reliance on science. When critics objected to federal policies, often managers were unwilling to acknowledge that other perspectives might contain valuable insights, feeling that professional foresters or wildlife managers were the only ones who could know what was best for the resource. Managers developed a sense of insularity that gave rise to orthodoxies in the management of timber, water, grazing, and fire, as Ashley Shiff shows in *Fire and Water: Scientific Heresy in the U. S. Forest Service* (1962), and Herbert Kauffman explores in *The Forest Ranger* (1960). As Robert G. Lee (personal communication) has suggested, when the Forest Service was thrust into a larger democratic community, the agency lost its strong sense of a central mission and its espirit de corps, and it is still struggling with the resultant identity crisis.

When managers work in isolation, they can come to operate with the ideological certainties that drove John Scharff's plans or the plans of the Forest Service in the 1940s. Recent managers have had a far more difficult time getting things done than earlier managers ever did, for they have been bogged down in court cases, tied up in endless negotiations with different stakeholders, distracted by petitions to list native fish, and dragged into fights with hot-tempered neighbors. While

these are all enormous concerns, they offer a way for federal agencies to chart a responsive course in a changing political, social, and ecological landscape. For example, Malheur National Wildlife Refuge is now paying attention to native fish, calling into question many decades of single-species management that benefited waterfowl but harmed much else. This change has come about in large part because of the threat that redband trout might have been listed under the Endangered Species Act. Such legal threats have brought about new ideas, new conservation agreements, and new policies.

Dealing with ranchers, environmentalists, county commissioners, district court judges, tribal representatives, fisheries biologists, archeologists and engineers—this makes a manager's life complicated. The attempt to make different stakeholders happy makes for an intelligent, evolving, policy—not a perfect policy, but one that can respond to change, just as a healthy ecosystem responds to changes.

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CHAPTER 5

Human Values and Forests: Changes in the Great Lakes Wildlands

Samuel P. Hayes and Greg Clendenning

Environmental policies regarding the Great Lakes forest result from human choices. Alternative policies arise from differences in the perception and meaning of forests to different people and the values they place upon forested areas. These differing perceptions and meanings (the social construction of nature) reflect the often conflicting and dynamic symbolic meanings of nature, forests, and landscapes that have evolved over time in the United States (Greider and Garkovich 1994; Freudenburg et al. 1995). Environmental and conservation controversies revolve around disputes over such matters. Because the nature and meaning of a forest to people today is vastly different from what it was a century ago, so must both our knowledge about the forest and our interaction with it be different. Our biggest problems lie not so much in our knowledge about the way in which the forest has evolved but in our understanding of the evolution of the human choices that have been made with respect to the forest environment.

Through this perspective, this chapter analyzes changing human choices about the forested wildlands—that area of sparse but growing population beyond the city and the countryside—in the Great Lakes region between about 1840 and the present. This evolution has had three distinct stages: 1850 to 1910, when wood production predominated; 1910 to 1945, when out-migration took place and real-estate values declined drastically, and when these "lands that nobody wanted" were rescued by public ownership and management; and 1945 to the present, a time that has seen a revival of intense interest in the forest. The revolution in forest-related human values that has taken place since 1945 has been so fundamental that a historical approach must inevitably stress change rather than continuity. Such an approach emphasizes not so much the impact of the forest on people as the impact of people on the forest.