was a massive, biologically rich south Florida wetland famous for its subtropical flora and profusion of birdlife. The lifeblood of this sawgrass-dominated landscape—once aptly described as a "river of grass"—was the periodic sheet flow of water from Lake Okeechobee to Florida Bay in a band that averaged about forty miles wide. During the first several decades of the twentieth century, a series of roads, drainage works, and flood control projects disrupted the supply of water, gravely threatening the unique site. In 1928, a group of concerned Florida residents organized the Tropic Everglades National Park Association to promote preservation of the area as a national park. They met with stiff opposition not only from individuals who wanted to develop the land in question but also from unexpected quarters: conservationists who felt the site represented an unworthy candidate for that designation because it lacked the monumental grandeur of existing national parks. Typical of this latter viewpoint was William Temple Hornaday, who dismissed the Everglades as a mere "swamp" that was "a long ways from being fit to elevate into a national park, to put alongside the magnificent array of scenic wonderlands that the American people have elevated into that glorious class."[55]

As early as 1930, the ESA weighed in on the controversy when it passed a resolution calling for the "preservation" of the Everglades in its "essentially natural condition." The society endorsed the idea of a national park as what it termed a "nature preserve" or "museum of nature."[56] After a congressionally authorized committee and the National Parks Association each investigated the area and endorsed the project, Congress finally approved the proposal in 1934. The enabling legislation authorized the creation of Everglades National Park once title to sufficient acreage had been obtained by the state of Florida. It also declared that the area "shall be permanently preserved as a wilderness" and that no park development intended to facilitate visitor access should "interfere with the preservation intact of the unique flora and fauna and the essential primitive conditions." In the words of the landscape architect Ernest Coe, the tireless leader of the campaign to save the Everglades, Congress's action represented a turning point in conservation history. For the first time a concern about preserving "natural ecological relations" loomed large in the creation of a national park.[57]

CREATING NATURE SANCTUARIES

While pushing for the establishment of new national parks, the ESA and its preservation committee also sought to have areas within existing national parks and national forests set aside as more-or-less inviolate nature sanctuaries. As early as 1921, the ESA passed a resolution condemning the introduction of nonnative

plants and fish into national parks, both of which had become standard practices in a federal agency dominated by landscape architects rather than biologists. The rationale for this resolution centered on the claim that the National Park Service had a duty to "pass on to future generations for scientific study and education natural areas on which the native flora and fauna may be found undisturbed by outside agencies."[58] Four years later, the ecologist and longtime preservation committee member Barrington Moore amplified this general argument. In a brief chapter for a Boone and Crockett Club–sponsored publication on hunting and conservation, Moore lamented the fact that political support for national parks relied too heavily on the recreational benefits these areas provided. Rather than catering simply to tourists, however, national parks should be maintained as a kind of "nature's laboratory." The knowledge gained through the study of areas where the "balance of nature" remained intact was not only important for furthering the science of biology, but also for providing knowledge needed to maximize agricultural production.[59] That same year, the ESA preservation committee called for the "preservation of definite 'wilderness areas' in our National Parks and Forests" and created a separate subcommittee to study the idea.[60]

The committee's interest in maintaining natural conditions on federal lands received a considerable boost in 1929, when the biologist George M. Wright offered both to fund and help conduct an in-depth study of wildlife in national parks.[61] A former student of Joseph Grinnell, Wright had not only conducted extensive fieldwork in Yellowstone, but also long promoted a more ecologically sensitive management policy there and in other national parks. Among Grinnell's many other students and associates who pursued careers in the National Park Service were two biologists who joined Wright on the survey project: Ben Thompson and Joseph Dixon.[62] The team's first publication, *Fauna of the National Parks of the United States* (1933), was a landmark study that called for the park service not only to maintain existing natural conditions within national parks, but also to restore degraded park fauna to a "pristine state." While recognizing that nature was in a constant state of flux, Wright, Thompson, and Dixon nonetheless identified the "period between the arrival of the first whites and the entrenchment of civilization" as an appropriate baseline for "representing the original or primitive condition that it is desired to maintain."[63] Impressed with the research that went into the creation of the *Fauna of the National Parks*, in 1933 the National Park Service created a Wildlife Division, with Wright as the chief and Dixon and Thompson as staff biologists. One year later, the Park Service Director Arno Cammerer declared the report's findings as official policy of his agency, though they would never be fully implemented.[64]

Cammerer's declaration notwithstanding, the ESA preservation committee

FIGURE 42. George M. Wright (*left*), Ben H. Thompson (*middle*), and Joseph S. Dixon (*right*) in the field at Mono Lake, California, 1929. The authors of *Fauna of the National Parks of the United States* (1933), a groundbreaking report that called for managing national parks in a more natural state. All three had connections with the University of California at Berkeley, and all three were hired for the newly created Wildlife Division at the National Park Service. Courtesy of Pamela Wright Lloyd and the George Wright Society.

recognized that absolute preservation of all national parks was incompatible with the park service's primary goal of providing recreation opportunities for park visitors. As a result, the committee advocated establishing "research reserves" within the national parks, areas that would be maintained in as natural a condition as possible and open only to authorized scientists through a permit system. In the spring of 1931, Cammerer issued a research reserve policy to "preserve permanently" selected natural areas in parks "in as nearly as possible unmodified condition free from external influences."[65] By 1942, the park service had established twenty-eight research reserves in ten national parks. These ranged in size from about thirty-two thousand acres in Glacier Bay National Park to about seventy-five acres in Great Smoky Mountains National Park.[66]

The preservation committee also lobbied for the establishment of nature sanctuaries in national forests. As early as 1921, Aldo Leopold had called for the designation of a wilderness area within Gila National Forest.[67] He seemed

particularly concerned about the impact of road building and mass adoption of the automobile, which made previously remote and relatively undisturbed areas in the American Southwest accessible to unprecedented numbers of visitors. Initially, Leopold focused more on preserving opportunities for backcountry recreation than on maintaining intact biological communities, though he would soon become an eloquent spokesman for a more ecological approach to conservation. One year later, one of Leopold's colleagues, the forester G. A. Pearson, issued a call for the "Preservation of Natural Areas in the National Forests" in *Ecology*. There Pearson pointed out that the policy of "highest use" that governed the management of national forests "recognizes that although forests as a whole should be devoted primarily to timber production, specific areas may serve the public interest in better ways." One appropriate use for some remote sites would be to preserve them as "so-called natural areas where plant and animal life and natural features in general may remain undisturbed by human activities."[68] In 1928, the ESA passed a resolution declaring that "preservation of natural conditions for scientific, educational[,] aesthetic[,] and economic reasons becomes more urgent and insistent with the encroachment of civilization." More specifically, the society urged the Forest Service to create "representative sample areas within their boundaries, of such areas as will best pass on to future generations unimpaired the native plants and animals, as well as other features of unusual scientific and educational value."[69]

The Forest Service responded to this call by amending its official manual in 1929. Newly adopted regulation L-20 required the chief of the federal agency to establish a "series of areas of National Forest land known as Research Reserves, sufficient in number and extent adequately to illustrate or typify virgin conditions of forest growth in each forest region, to be retained, so far as practicable, in a virgin or unmodified condition for the purposes of science, research and education." Under this new regulation, natural conditions were also to be largely maintained in "Primitive Areas," which were set up primarily for public "education, inspiration, and recreation."[70] The sites within the National Forests formally designated as Research Reserves tended to be relatively small in size. By 1940, the Forest Service had established forty-one such areas, with an aggregate total of only about 47,549 acres out of nearly 175 million acres in the National Forest system as a whole. The wilderness areas carved out of national forest land, on the other hand, tended to be much larger. By 1940, thirty areas of over one hundred thousand acres had been formerly designated as wilderness, a total of nearly 12 million acres.[71]

The plethora of new natural area designations provided at least nominal protection to numerous sites, but it also led to much confusion about what was be-

ing protected and how those sites should be properly managed. To bring more clarity to the issue, Shelford organized a conference on nature sanctuaries in conjunction with the 1931 meeting of the ESA. The twelve naturalists, ecologists, and conservationists who attended the conference reached consensus on the importance of establishing "as nature sanctuaries or nature reserves, areas of natural vegetation containing as nearly as possible all the animal species known to have occurred in the areas within historical times." Preserved areas should be surrounded by buffer zones, only slightly modified areas that might be devoted to "experiments, recreation or game culture, etc." These buffer zones should be "left alone without management" except in the case of an emergency, when "control measures" might be undertaken "after most careful consideration and determination as to their practical necessity."[72]

A year later, Shelford published a lengthy statement on the "Preservation of Natural Biotic Communities" to flesh out the consensus reached at the nature sanctuary conference. In the introduction, he argued that while a desire to "preserve at least some of the original vegetation and wild animals" was nearly universal around the world, little had been done to actually achieve that goal. Vegetation other than forests had generally not escaped destruction, while the larger wildlife in most nations faced widespread persecution. National parks tended to be created from relatively undisturbed areas, but even they did not provide absolute protection; rather, a "large amount of modification" had gone on in those areas, both before and after they were supposedly protected.[73]

Shelford and his committee also decried the trend toward "specialization on particular objects or particular organisms" in teaching and research. Outside of "modern ecology and geography," biologists rarely attempted to deal with "the entire life of natural areas." Nature study in schools tended to suffer from the same shortcoming. As a result, the growing sentiment for protecting individual species had not yet translated into a proper concern about the ongoing degradation of entire communities. Yet, Shelford continued, "from a philosophical and practical standpoint, the unmodified assemblage of organisms is commonly more valuable than the isolated rare species." Both threatened individual organisms and extensive biological communities could be safeguarded in sufficiently large nature sanctuaries.[74]

The body of the report discussed the definition, size, and classification of "natural areas containing original plant and animal life." Here Shelford admitted that "just what original nature in any area was like from a biological viewpoint, is not known and never can be known with any great certainty." "'Nature' and 'natural areas' are purely relative terms," Shelford continued, terms that "can have significance only as averages, because the outstanding phenomenon of bi-

otic communities is fluctuations in numbers of constituent organisms or reproductive stages of organisms over a period of one to thirty or more years." Indeed, a nature sanctuary represented a place where "these fluctuations are allowed free play."[75] After running through a list of the various classes of nature sanctuary established in North America, Shelford reported that the ESA preservation committee recommended subdividing larger reserves into a sanctuary proper, a buffer zone of "partial protection," and an area managed for human use in cases when this was one of the aims of the reserve. These areas should be designed to provide the "best conditions for roaming animals within the buffer zone and the sanctuary." Among the animals most needing protection in nature sanctuaries were "the carnivores," which tended to be unpopular with farmers, ranchers, and sportsmen.[76] In this and other efforts to protect predators, the preservation committee found itself embroiled in one of the most divisive issues in wildlife conservation circles prior to the Second World War.

PROTECTING PREDATORS

Euroamericans had long feared large predators—especially the gray wolf (*Canis lupus*)—with an intensity that now seems disproportionate to the actual physical or economic threat these species posed.[77] As early as the seventeenth century, colonial governments in America began offering bounties on wolves in the hope of minimizing livestock losses to creatures they considered both evil and ravenous. Even without the economic incentives that local and state bounty programs provided, however, settlers rarely passed up the opportunity to kill these and other large predatory species using pits, circle drives, guns, and poisoned meat. As a result of ongoing persecution, by the 1850s the wolf had become rare in the East.[78] The settlers who poured into the West following the Civil War carried with them a keen desire to exterminate not only the wolf, but also its smaller, more numerous, and secretive western cousin, the coyote (*Canis latrans*). In addition to farmers and ranchers, sportsmen reviled these and other predators, which they blamed for the apparent decline in game populations over much of the United States. Even early wildlife conservationists generally shared a dim view of the gray wolf. In 1904, for example, William Temple Hornaday condemned the species as the most "despicable" creature in all of North America: "There is no depth of meanness, treachery, or cruelty to which they do not cheerfully descend."[79]

Buckling to mounting pressure from western ranchers, in 1915 Congress appropriated funds for the Bureau of the Biological Survey to begin an all-out war on the predators, especially the coyote. The Biological Survey was an agency

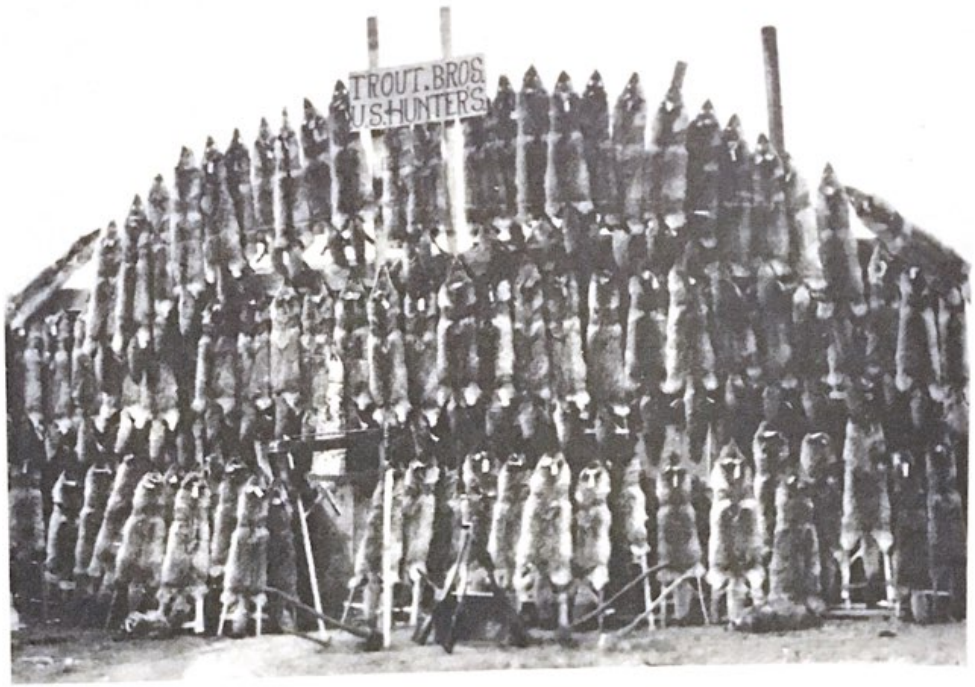

FIGURE 43. Coyote pelts gathered in Wyoming during November 1921. Beginning in 1915, the U.S. Bureau of the Biological Survey initiated a large-scale campaign to reduce the coyote population in the West. Critics soon charged that the agency was trying to eradicate the species, an accusation that federal officials vehemently denied. Courtesy of the National Archives and Records Administration, Record Group 22-WB, Box 55, Neg. no. B3575M.

within the Department of Agriculture that had first been established in 1885 and subsequently endured a series of reorganizations and name changes.[80] For decades after its founding, the agency was primarily staffed by old-school naturalists, most of whom had learned their science through self-study and apprenticeships rather than formal training. Although most of its early personnel during were interested in studying the taxonomy, geographical distribution, and life history of birds and mammals, particularly game species, from the beginning the agency also regularly conducted applied research in wildlife. Following the passage of the Lacey Act (1900) and the creation of the first federal wildlife refuges, the Biological Survey assumed a growing burden of enforcement and administrative duties as well. The agency's budget and staff remained modest, however, until Congress provided funds to expand its limited experiments in predator control in the early years of World War I. By 1931, three-fourths of the Biological Survey's budget was devoted to its burgeoning predator control program.[81]

Naturalists were the first to decry the federal government's widespread campaign to eradicate predators. Joseph Grinnell became an early critic of the popular program, though he refrained from publicly engaging in the issue to shield his

institution from the potential wrath of angry state legislators.[82] Open opposition to the Biological Survey's activities first surfaced at the 1924 annual meeting of American Society of Mammalogists, a professional organization that survey employees had created only a few years earlier. There, the ecologist Charles C. Adams and Grinnell's Berkeley colleague, Lee R. Dice, raised pointed questions about the goals and methods of the government's large-scale predator control program, while Survey mammalogists E. A. Goldman and W. B. Bell strongly defended the work of their agency.[83]

The mammalogists' continuing split on the issue of predator control is revealed in the deliberations of a small committee appointed to explore the issue after the 1924 meeting. No one was terribly surprised four years later when the five-member committee failed to reach consensus and issued two separate reports. On the one hand, Vernon Bailey and Goldman, both longtime staff members at the Biological Survey, argued that predators deserved preservation but only in select national parks and isolated parts of the public domain. On the other hand, Dixon, Adams, and Edmund Heller, director of the Milwaukee Museum, charged that under mounting pressure from western livestock interests, the Biological Survey was conducting "an eradication campaign against western wildlife that could not be defended on scientific or economic grounds." Stung by the ongoing criticism, Biological Survey Chief Paul Redington responded by claiming that his agency was merely "hastening the inevitable," since large predators were doomed wherever civilization held sway. Only specially designated sanctuaries provided any hope of preserving these species. While defending the need for control work, Redington vehemently denied the charge that his agency was intent on "exterminating" wildlife, though the term remained prominent in Biological Survey reports and discussions for several more years. A. Brazier Howell, another of Grinnell's colleagues, responded with a petition signed by 148 scientists that strongly condemned the predator-control program for threatening "the very existence of all carnivorous animals, including those valuable species which constitute the chief check upon injurious rodents and are a vital element of our fauna."[84]

In 1930, when the Biological Survey asked Congress for $1 million per year over the next decade to expand its campaign against predators, the ESA preservation committee finally entered the fray. Its initial foray came in the form of a tepid resolution the committee authored and the ESA membership approved at its annual meeting in late December 1930. While the preamble declared the organization to be "gravely concerned" about the proposed increase in appropriations for predatory mammal control, the resolution itself expressed sympathy for predator and rodent control measures, but only when they had been shown to

be scientifically necessary and in the interest of the "*general public.*" The ecologists argued that the ten-year plan under consideration in Congress failed to meet either criterion. The second part of the resolution called for dramatically increased funding for scientific research in wildlife management. There should be a "marked increase in the research functions of the Biological Survey, so that all its wild life activities may be conducted on the basis of science and intelligence, and with full regard for the interest of the general public."[85]

Concerned that in the politically charged atmosphere of the predator debate even this mildly worded resolution might create undue friction, at the same meeting, the ESA moved to split its old preservation committee. Henceforth, a newly created Committee for the Study of Plant and Animal Communities would have responsibility for selecting areas for preservation, studying management policies, and promoting scientific investigation. Government-employed naturalists, who were barred by law from lobbying and who wanted to avoid embarrassing the agencies for which they worked, could remain active in this large committee. A much smaller, five-person Committee on the Preservation of Natural Conditions would be responsible for lobbying Congress, state legislatures, and governmental agencies. The division proved largely symbolic since Victor Shelford initially chaired both committees.

As we have already seen, the issue of predators also loomed large in the discussions about nature sanctuaries that the preservation and study committees held over the next several years. The report on the "Preservation of Natural Biotic Communities" that the study committee published in 1933 defined "First Class Nature Sanctuaries" as "any area of original vegetation, containing all the animal species historically known to have occurred in the area (except primitive man), and thought to be present in sufficient numbers to maintain themselves." In establishing protection for such areas, "carnivores" were the animals "requiring first and most careful consideration." In particular, the range of these predators—up to fifty square miles for the wolf, twenty square miles for the coyote, and twenty square miles for the mountain lion—should be taken into account. "These animals are slated for general extermination" and can only be adequately protected in "larger well-buffered parks or remote wilderness areas of the national forests."[86]

In 1935, Shelford authored and the ESA passed another pair of resolutions dealing with the contentious issue of predator control. The first called on the federal government and individual states to fund "thorough studies of the life histories and ecology of the flesh-eaters, to serve as a basis for their scientific management." The second proclaimed "the larger wild animals, especially carnivores" as valuable in the "economy of nature, and therefore of importance in the

proper development in the science of ecology, which supplies information to be used in interpreting the past and predicting the future of biological events." The resolution reaffirmed the society's commitment to the establishment of "buffered sanctuaries" that would include all natural flora and fauna. A series of particular recommendations where such sanctuaries might be established in national parks and forests followed.[87]

While the ESA made inroads into its goal of having nature sanctuaries established on federal lands, it failed to effect fundamental change in the Biological Survey's predator control program. As historian Thomas Dunlap has documented, serious reevaluation of that program would not occur until the ecological ideas that Shelford and his committee had promoted began diffusing into the broader public in the post–World War II era. Even then, the issue remained contentious.

THE EDUCATION OF ALDO LEOPOLD

At the same time that Shelford and his colleagues fought for the creation of nature sanctuaries to preserve not only beleaguered species like the gray wolf but also intact biological communities and the opportunity for ecological study, at least one naturalist pushed to forge the science of ecology into a new conservation ethic. Although trained as a forester in the mold of Gifford Pinchot, over the course of his career Aldo Leopold moved beyond his narrow utilitarian perspective to articulate a radical new way of framing the relationship between humans and the natural world. Ecology proved central to Leopold's notion of the "land ethic"—the idea that human interactions with the natural world should aim to maintain the "integrity, stability, and beauty of the biotic community."[88] While today this idea is most closely associated with *A Sand County Almanac* (published posthumously in 1949), Leopold first began fleshing it out in a series of articles and essays that appeared in the 1930s and early 1940s.

Leopold was born in 1887, to an outdoor-loving family of German extraction.[89] From a young age, he developed a passion for hunting, exploration, and wildlife watching in the area surrounding his boyhood home in Burlington, Iowa, located along a major migratory flyway. When it came time to select a vocation, Leopold settled on forestry, one of a few suitable options then available for avid outdoor enthusiasts. After securing a master's degree in forestry from Yale in 1909, he joined the Forest Service and began work in New Mexico and Arizona territories. He cruised timber until 1913, when a misdiagnosed bout with nephritis nearly cost him his life. During his long period of recuperation, Leopold avidly read William Temple Hornaday's recently published diatribe, *Our Vanishing*

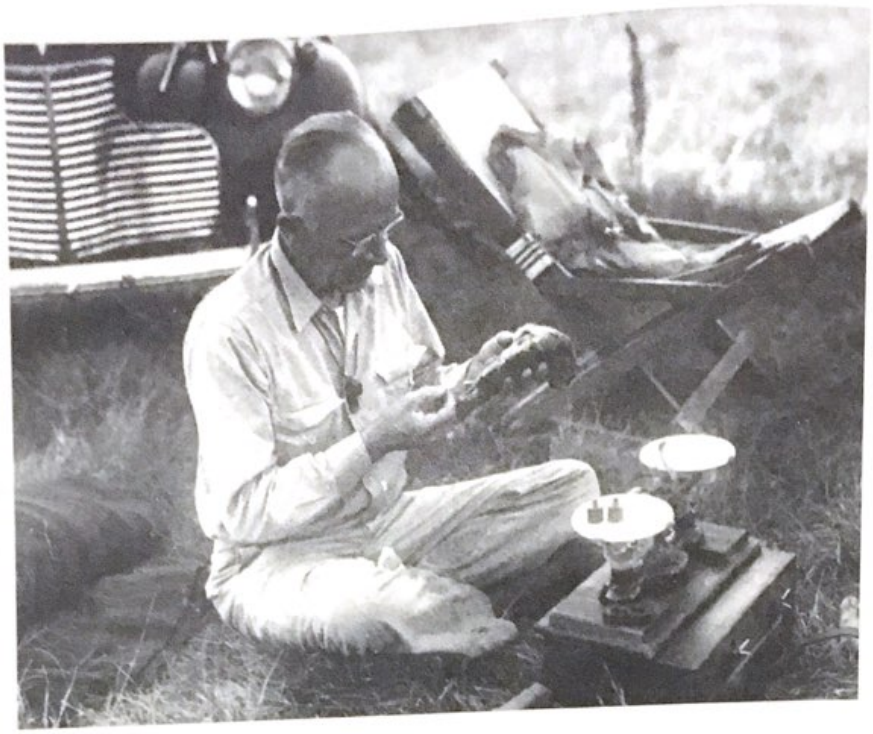

FIGURE 44. Aldo Leopold weighing woodcock, 1944. Photo by Robert McCabe. A pioneer in the field of wildlife management and conservation, Leopold also sought to develop an ecologically informed ethic governing humanity's relationship with the natural world. Courtesy of the University of Wisconsin–Madison Archives.

Wildlife. A personal visit from Hornaday two years later further galvanized his interest in endangered wildlife. From that point on, Leopold pursued numerous opportunities for work in recreation management and game protection within the Forest Service. It was during this period, for example, that he suggested an area at the headwaters of the Gila River be managed as a wilderness area or "national hunting ground." In 1924, the same year the Forest Service accepted this recommendation, he left the southwest for Madison, Wisconsin, where he would remain for the rest of his life.

Following a brief stint as an administrator at the U.S. Forest Products Laboratory, Leopold turned to wildlife research. Soon he was he was helping to professionalize the emerging field of game management. After conducting game surveys of several midwestern states, he published *Game Management* (1933), a widely adopted textbook that his biographer Curt Meine has praised as "the most extensive collection on wildlife conservation yet assembled, a masterful synthesis of management theory and techniques."[90] His pathbreaking research led to an appointment as professor of game management at the University of Wisconsin. It was the first such position in the United States, and over the remainder of his career, he influenced a generation of students. He also participated in the

formation of the Wildlife Society, an organization of professional wildlife managers, in 1936.[91]

Although *Game Management* was clearly oriented toward utilitarian conservation and it focused on game species rather than wildlife more broadly, Leopold's outlook had clearly begun to be shaped by ecological thinking. As early as 1930, he had begun referring to ecology as the "rock bottom of game management."[92] A year later, he met the British ecologist Charles Elton at the Matamek Conference on cyclic biological phenomena in Quebec, a meeting that Leopold called "the best thing of its kind that I have ever attended."[93] Indeed, it was Elton's research that had inspired the gathering in the first place. The two naturalists immediately hit it off and became lifelong friends.

Part of Leopold's growing interest in the science of ecology stemmed from a notorious failure of utilitarian wildlife conservation: the Kaibab deer crisis.[94] This classic episode, recounted in countless textbooks, involved an aggressive, misguided predator-control campaign undertaken in an effort to increase the supply of mule deer in the Kaibab National Forest, an island-like area on the North Rim of the Grand Canyon surrounded by steep canyons and desert. Beginning in 1906, the Biological Survey supervised the systematic destruction of wolves, coyotes, mountain lions, and bobcats on the one-thousand-square-mile site. Soon the predator-control program suffered from too much success: an explosively growing deer herd that was severely overgrazing the area. By the mid-1920s, disease and starvation struck the burgeoning herd, forcing a precipitous (and, to the Biological Survey, embarrassing) crash in its population. Leopold followed the situation closely, and ultimately, he would associate the Kaibab deer crisis with other human-induced wildlife irruptions that resulted from a fundamental failure to appreciate the interconnectedness of biological communities.

In "The Conservation Ethic," a landmark essay published in 1933, Leopold took the first step toward incorporating the science of ecology into an ethic dealing with "man's relationship to the land and to the non-human animals and plants that grow upon it."[95] Over eons of time, the "human community" had developed strongly held notions of right and wrong, first in the context of relationships between individuals and then in relationships between individuals and society. It was now time to take the next step: to develop a "land-relation" ethic that acknowledged the central role ecology had played (and continued to play) in human history. Among other things, the science of ecology offered the opportunity for a more informed and robust response to the problem of wildlife extinction: "Why do species become extinct?," Leopold asked rhetorically. "Because they first become rare. Why do they become rare? Because of shrinkage in the particular environments which their particular adaptations enable them to in-

habit. Can such shrinkage be controlled? Yes, once the specifications are known. How known? Through ecological research. How controlled? By modifying the environment with those same tools and skills already used in agriculture and forestry."[96]

Two years later, Leopold became a founding member of the Wilderness Society, a small but politically active organization devoted to the preservation of large tracts of wild nature.[97] Preservationists who treasured the aesthetic and recreational opportunities that wilderness areas provided initially dominated the group. As environmental historian Paul Sutter has shown, the Wilderness Society's founding members shared a particular concern about the impact of the automobile, which was opening up even the most remote wild areas to tourists, road building, and development. Leopold shared his colleagues' concern about the effects of the automobile, but he also pushed them to consider the ecological dimensions of wilderness preservation. Wilderness provided a baseline for measuring the experiment in civilization, he argued: "The long and short of the matter is that all land-use technologies—agriculture, forestry, watersheds, erosion, game, and range management—are encountering unexpected and baffling obstacles which show clearly that despite the superficial advances in technique, we do not yet understand and cannot yet control the long-time interrelations of animals, plants, and mother earth." Any such tinkering should be ecologically informed and undertaken with "an intelligent humility toward man's place in nature."[98]

In 1939, Leopold accepted an invitation to deliver the plenary address to a joint meeting of the Ecological Society of America and the Society of American Foresters. The topic he chose, "A Biotic View of the Land," reflected his ongoing struggle to develop a new way of perceiving nature that incorporated the latest findings from ecology.[99] According to Leopold, ecological research had demonstrated that previous attempts to label some species as "useful" and to dismiss others as "harmful" were doomed to failure because they failed to recognize the interdependence of organisms within biological communities: "The only sure conclusion is that the biota as a whole is useful, and biota includes not only plants and animals, but soils and waters as well."[100]

Drawing heavily from Elton's *Animal Ecology*, Leopold argued that the "biotic pyramid" offered a particularly useful metaphor for proper thinking about the land. He favored this idea over the older notion of "the balance of nature," which continued to dominate conservation discourse even though ecologists had begun to challenge it as overly static. Soil formed the pyramid's base, a plant layer rested on the soil, an insect layer formed on top of the plants, and so on up through the various groups of fish, reptiles, birds, and mammals. Preda-

tors formed its apex. Each successive layer decreased in overall abundance of its population. Energy, which plants captured from the sun, flowed up and down through the pyramid as organisms provided food and other services for those above and below it. Each individual species, humans included, formed a link in numerous individual food chains, so the overall pyramid was "a tangle of chains so complex as to seem disorderly." Closer examination, however, revealed "a highly organized structure" whose "functioning depends on the cooperation of all its diverse links."[101]

Recent human manipulations of nature represented a profound threat to this finely tuned structure. The pyramid of life had once been "low and squat," while the individual food chains that characterized it remained "short and simple." Over eons of time, evolution had slowly added layer after layer, thus elaborating its structure. The end result was a highly complex, highly interdependent edifice that functioned smoothly as an energy circuit. Humans equipped with technology, however, were now causing transformations of "unprecedented violence, rapidity, and scope." Predators were being "lopped of the cap of the pyramid," while "food chains, for the first time in history" were being "made shorter rather than longer." Poor agricultural practices, the proliferation of pollution, and the worldwide redistribution of organisms produced other transformations in the pyramid. While some biotas adjusted to this human-induced violence, others proved more fragile.[102] "Vanishing species, the preservation of which we now regard as an aesthetic luxury," might prove essential to the maintenance of the pyramid as a whole, Leopold warned. To understand the full effects of man-made changes in the land, therefore, it was critical "to preserve samples of original biota as standards against which to measure the effects of violence."[103]

Two years, later Leopold further elaborated on this idea in a short essay entitled "Wilderness as a Land Laboratory."[104] Here he argued that if humans hoped to understand how to more effectively maintain the health of the land and to respond appropriately to obvious signs of ecological ailment—like declining soil fertility and rodent irruptions—it was critical to preserve intact, fully functioning landscapes: "A science of land health needs, first of all, a base-datum of normality, a picture of how healthy land maintains itself as an organism." Wilderness areas—which paleontologists had shown existed for "immensely long periods" with only rare losses to its component species—provided the ideal "land-laboratory." Each "biological province" needed its own wilderness sites "for comparative studies of used and unused land." Although Leopold put a finer point on it, this was essentially the argument that Shelford and other ecologists had been making for two decades.

Leopold's most famous essay, first drafted in 1944 at the urging of one of his

students, shows how far his ideas had developed since his early years with the Forest Service.[105] "Thinking Like a Mountain" presents the poignant story of his encounter with a mother wolf and several of her grown pups while cruising timber in the American Southwest. "In those days," Leopold recalled, "we never passed up a chance to kill a wolf," so he and his party quickly emptied their rifles into the pack, fatally wounding the mother and striking one of her pups. His response to witnessing the mother wolf's death highlighted his sense that land-use policy needed to adopt a more ecological perspective: "We reached the old wolf in time to watch a fierce green fire dying in her eyes. I realized then, and have known ever since, that there was something new to me in those eyes—something known only to her and to the mountain. I was young then, and full of trigger-itch; I thought that because few wolves meant more deer, that no wolves would mean hunters' paradise. But after seeing the fierce green fire die, I sensed that neither the wolf nor the mountain agreed with such a view."[106] Though a powerful mea culpa, Leopold's story should not be taken literally; he experienced no one single flash of ecological insight. Rather, the story represents the distillation of his ideas about the ecological importance of intact biological communities, an idea that he had been groping toward for more than a decade.

ECOLOGICAL ACTIVISM AND ITS DISCONTENTS

Although the science of ecology made significant inroads in American conservation discourse and practice during the 1920s and the 1930s, it also experienced a number of disappointing setbacks as World War II loomed on the horizon. The preservation of landscapes for ecological research, for example, had always been fraught with difficulty. Decisions to safeguard a particular area could easily be reversed, and once a site had been radically transformed through logging, road building, or development, the biotic community it contained would inevitably be compromised.

As an example of the tenuousness of protection, in 1936 a windstorm blew down many trees in Andrews Bald, one of several research reserves that had recently been established in Great Smoky Mountains National Park. The park's superintendent and most of his staff wanted the area immediately cleaned up.[107] They argued the downed trees were not only unsightly but also presented an unacceptable fire hazard. Wildlife biologists, on the other hand, thought the fallen trees should remain untouched so the ecological effect of windstorms on grassy balds—open, mountaintop areas of grasses that had long been of scientific interest—could be adequately studied. The Park Service's acting director responded to the controversy by not simply granting permission for the trees to

be cleared but also by abolishing the research reserve on the site. By the time World War II began, the entire research reserve program seems to have become moribund, and those areas began to be routinely altered in the same way as other parts of national parks: through such practices as fire suppression, insect control, grazing, and fish stocking.[108]

Wildlife research and conservation programs could also be scaled back or entirely eliminated. By 1935, the National Park Service employed twenty-seven biologists in its newly created Wildlife Division.[109] Central to the division's success was its founder and chief, George Wright, a charismatic leader who managed to gain a hearing for a more ecological approach to park management in a federal agency firmly committed to the proposition that parks existed for the recreational benefit of people. When Wright died in an automobile accident in 1936, the Wildlife Division languished. By 1938, the number of biologists had dwindled to only ten. A year later, as part of an overall reorganization of conservation-related agencies within the Roosevelt administration completed at the urging of Secretary of the Interior Harold Ickes, the remaining biologists in the Wildlife Division were transferred to the Biological Survey, which had been reconstituted as the Fish and Wildlife Service. Although they retained a connection with the National Park Service, their influence diminished. And even though the decision was reversed following World War II, it would be two more decades before scientifically based resource management in the national parks would experience a renaissance.

Obviously, the biologists affiliated with the National Park Service did not remain completely inactive. For example, in the late 1930s and early 1940s, the naturalist Daniel B. Beard, who would later become the first supervisor of Everglades National Park, conceived of and saw through publication a popular volume on North America's endangered wildlife. Completed with the aid of a five-member committee that also included Ben Thompson, *Fading Trails* (1942) began with an introductory chapter documenting what seemed like a limitless supply of American animals before European contact, an "abundance of wildlife never recorded in the history of any other continent."[110] The second chapter, "Civilization's Heavy Heel," revealed how the depredations of "commercial market hunters" and the "change of environment by the hand of man" had resulted in a dramatic reduction of North American wildlife like the bison and the demise of the passenger pigeon.[111] The bulk of the book consisted of vignettes treating about three dozen animals that had "approached the brink of extinction" and now stood "ready to follow a fading trail down into the twilight."[112] Like most other wildlife conservation literature at the time, the volume stressed birds and mammals rather than the full panoply of endangered flora and fauna, and

it focused on individual species rather intact biological communities.[113] It did, however, devote attention to what one reviewer called "the ecological problems involved in the perpetuation of certain birds and mammals."[114]

Private preservationist-oriented organizations were no less immune to changes in priority or internal policy shifts than governmental agencies like the National Park Service. Perhaps the most dramatic example was the ESA preservation committee itself, which had long served as the leading voice for ecologically informed nature preservation. At least twice before, in 1928 and 1935, the committee's lobbying activities, controversial conservation stands, and ongoing funding demands had prompted reviews of its activities.[115] On both occasions, ESA officials decided to continue its work, but never with the financial backing Shelford thought necessary to do the job properly. In an effort both to secure that support and to counter growing dissatisfaction with the preservation committee among the ESA's leadership, in 1943 Victor Shelford published an account of the committee's achievements that included yet another plea for adequate funding. "With wartime and post-war pressure to destroy nature mounting," Shelford warned, "it is well for those interested in its preservation of nature for scientific purposes to look over the machinery by which some of it may possibly be saved."[116] He then circulated a reprint of his account with a ballot asking ESA members what they thought of the committee and its activities. Among the approximately 690 members of the ESA, about four hundred replied, with 85 percent of those indicating that the work of the committee was as important as the society's annual meetings and journals. Encouraged by the strong show of support, Shelford then called for an amendment to the society's constitution that would guarantee the funds needed to continue its activities.

Given the favorable response from his recent survey, Shelford and his supporters were stunned when the ESA's executive committee proposed discontinuing the preservation committee at the next annual meeting later that year. Opposition seems to have stemmed from the feeling that it was improper for a scientific society to act as a political pressure group.[117] Attendees at the business meeting decided to put the issue before the full membership in the form of a referendum. Despite Shelford's pleas, in the summer of 1945 the ESA membership overwhelming supported an amendment to the society's bylaws that continued the preservation committee but barred it from taking "direct action designed to influence legislation," including presenting resolutions or taking part in "political, pressure group, or propaganda activity."[118] The next year, the society decided to abolish the preservation committee altogether. Just over two decades after Francis Sumner had issued an impassioned plea for naturalists to become more involved in the preservation of nature, the ESA abandoned its long-standing

institutional commitment to political activism. Ironically, that repudiation came just as the physicists who had created the atomic bomb began calling on their colleagues to assume a greater sense of social responsibility for their scientific research.[119]

Disappointed but undaunted, Shelford and a number of his supporters decided to organize a new group, the Ecologists' Union, whose objective was the "preservation of natural biotic communities, and encouragement of scientific research in preserved areas."[120] By December of 1946, 158 ecologists had joined the fledgling organization, which continued to lobby Congress and federal agencies on behalf of preservation causes. One Ecologists' Union officer, the botanist and former Shelford student George Fell, soon argued for an expansion of the society's membership beyond scientists. He and his wife also put together a list of one hundred natural areas that they felt must be preserved. In 1950, members of the Ecologists' Union voted to reconstitute the group as the Nature Conservancy, which has since grown into the largest and most successful nature preservation organization in the world.

Although the ESA abandoned its institutional commitment to political activism on behalf of nature, by the 1930s and 1940s ecological ideas had begun slowly making their way into conservation discourse. Increasingly, wildlife supporters described threatened species not only as aesthetically interesting and useful objects but also as vital components of ecological communities. Indeed, this transformation is evident in a revealing exchange between the ecologist and former Shelford student Charles Kendeigh and John Baker, the executive director of the National Audubon Society. In 1944, Kendeigh wrote to Baker arguing that the Audubon Society was primarily interested in the "preservation of species," while the ESA was concerned with the "preservation of biotic communities." Baker immediately fired back: "While you are right that our Society is vitally concerned with the preservation of species, we have come to recognize that that objective is probably only to be obtained thru [*sic*] our being vitally concerned with the preservation of habitat and therefore, soil, water and plants as well as wildlife."[121] While the depth of Baker's commitment to ecological ideas might be questioned, National Audubon's ongoing campaign to repair the tarnished reputation of the predatory birds provides evidence that Shelford and his colleagues had enjoyed at least limited success.

CHAPTER EIGHT

RECONSIDERING RAPTORS DURING THE INTERWAR YEARS

It seems true wisdom to preserve even apparently injurious species from wanton destruction. What moral right has man to decree the extermination of any bird which at worst merely reduces the number of some of its fellows? As biologists can we believe that the earth and all its inhabitants exist solely for the benefit of man?

JAMES CHAPIN, 1932

The time to protect a species is while it is still common. The way to prevent the extinction of a species is never to let it become rare.

ROSALIE EDGE, 1934

SAVING THE BALD EAGLE

In 1940—as American participation in World War II loomed on the horizon—the Bald Eagle Protection Act finally became law. This step came more than a century and a half after the Continental Congress had chosen this majestic bird (known to science as *Heliaeetus leucocephalus*) as the centerpiece for the first official seal of the United States. As the only eagle with a range restricted to North America, the species soon became commonly known as the American eagle and widely adopted as an emblem of the young nation's freedom, power, and sovereignty. Yet, despite the nationalistic symbolism associated with this quintessential example of charismatic megafauna, the move to grant federal protection to the bald eagle was long in coming and remained controversial even when it finally passed.[1]

FIGURE 45. Lithograph of the bald eagle, 1893. Drawn by Robert Ridgway. Despite the majestic symbolism associate with the species, like other raptors, it was often subject to systematic persecution at the hands of farmers, ranchers, sport hunters, and game managers. Not until the Bald Eagle Protection Act of 1940 did the bald eagle finally receive federal protection. From Albert K. Fisher, *The Hawks and Owls of the United States in Their Relation to Agriculture* (1893), 96.

Although the ominous clouds of military conflict clearly played an important role in rallying support for bald eagle protection, its success was not simply a manifestation of war-fueled patriotism. The act, which countered a tradition of treating the eagle and other birds of prey as pariahs, represented the culmination of a long campaign. For two decades preceding its passage, raptor enthusiasts had struggled to repair the tarnished reputation of predatory birds, to fight bounty laws aimed at reducing their numbers, and to secure legislation to protect them from continued harassment at the hands of farmers, ranchers, sportsmen, and others who considered them "vermin," fit only for systematic obliteration from the landscape. Although the Bald Eagle Protection Act fell short of achieving its supporters' ambitious aims, it nonetheless stands as a landmark piece of federal wildlife legislation that has yet to gain the historical attention it deserves.[2]

Persecution of the bald eagle and other raptors was part of a much broader antipredator campaign waged by private citizens, sportsmen's clubs, arms and ammunition manufacturers, and local, state, and federal officials. As we saw in

the previous chapter, by the 1920s, the Bureau of the Biological Survey's growing involvement in that campaign provoked a schism in the wildlife conservation community. On one side of the debate were those who viewed predators as a significant threat to game and livestock. For them, systematic predator control seemed a rational, efficient means to protect vulnerable animals, a way for humans to improve upon a disorderly and sometimes dangerous nature. On the other side of this contentious issue were the scientists, humanitarians, and nature lovers who initially opposed predator control largely because of their romantic commitments or concerns about minimizing suffering in wild animals and who later turned to the science of ecology to find support for their position.

Much has been written about the long-standing controversies surrounding mammalian predators, especially wolves and coyotes.[3] This chapter explores an analogous debate over avian predators that raged in the interwar years and culminated in the Bald Eagle Protection Act of 1940. What this story reveals is an active, increasingly vocal community of dedicated bird enthusiasts—primarily scientific ornithologists and serious amateur birdwatchers —who challenged private and governmental conservation authorities in an attempt to gain protection for all manner of hawks and owls, including the bald eagle.

Several concerns motivated these bird enthusiasts to action. First was their aesthetic interest in bird life of all kinds, including predatory species. In private correspondence and public debate, raptor enthusiasts repeatedly declared that the substantial pleasure they gained from viewing predatory birds in the wild deserved as much consideration as the sportsmen's and farmers' interest in destroying them. For example, in the mid-1920s, when a prominent wildlife defender declared the "wanton annihilation of a species" to be a "real crime," he used language that metaphorically linked wild animals to artistic masterpieces: "The destruction of a great work of art calls forth genuine condemnation, in spite of the fact that it may conceivably be reproduced, or even excelled. But how about the creature that has been millions of years in the making, which, once gone, is gone forever?"[4] When asked by a friend, "What do you *do* when you look at a bird?" a birdwatcher from this period responded, "What do you do when you see a great painting?"[5] The rise of birdwatching in the late nineteenth and early twentieth centuries produced a growing constituency of middle- and upper-class Americans who regularly ventured out into the nation's fields and forests to experience nature in nonconsumptive ways. Having developed strong emotional and aesthetic bonds with avian species, birdwatchers increasingly challenged the many forces that seemed allied against those species.

A profound unease with the implications of human-induced extinction also

moved bird enthusiasts to action. At least since the publication of George Perkins Marsh's *Man and Nature* (1863), conservation-minded individuals had been warning that the New World's natural resources were not limitless, as had once been widely assumed. Not until the end of the nineteenth century, however, with the near demise of the once ubiquitous bison, did the message that humans might drive species to oblivion finally begin to receive a broader hearing. The subsequent loss of other species—the last passenger pigeon in 1914, the last Carolina parakeet only four years later, and all but a handful of heath hens by the 1920s—provided other sobering reminders that humans could drive once abundant wildlife populations over the brink of oblivion. The language of eradication that the most strident control advocates deployed proved especially troubling for predator control critics. In the eyes of the individuals who defended predators, to willfully destroy a species, even one that many considered a pest, represented a deplorable act against present and future generations.[6]

Finally, bird enthusiasts repeatedly claimed that predator control advocates had failed to make a convincing scientific case proving that raptors were necessarily harmful to wildlife or livestock populations. Initially, bird-of-prey advocates looked to the science of economic ornithology to find support for their position. Through analysis of the stomach contents of various avian species combined with field observations of their feeding habits, economic ornithologists sought to determine their diets and make authoritative judgments about their worthiness for protection. They tended to do so within a framework that explicitly designated species as either "good" (and therefore worthy of protection) or "bad" (and deserving of persecution) based on whether they were directly beneficial or harmful to human interests.[7] By the mid-1930s, critics of avian predator control also began to turn to arguments from the newly emerging science of ecology to bolster their position. As we have already seen, the new ecological framework portrayed all species as crucial components of biological communities.

The campaign to protect avian predators represents an important episode in the history of American wildlife conservation. In addition to shedding light on the origins of the Emergency Conservation Committee (ECC), a radical wildlife organization that, among other accomplishments, forced a series of reforms within the National Association of Audubon Societies (NAAS), the campaign reveals the extent to which concern about human-induced extinction had become central to wildlife discourse by the 1920s and 1930s. Long before the passage of the Endangered Species Act, a significant number of Americans began to be haunted by the specter of human-induced extinction and to take steps to address the problem.

The continued vulnerability of predatory birds received graphic confirmation in 1917, only a year after Congress passed the enabling legislation for the Migratory Bird Treaty. As we have already seen, that landmark agreement granted U.S. and Canadian officials the authority to regulate the hunting of migratory game birds and declared a permanent closed season on most nongame birds. But it excluded birds of prey from its purview, for treaty supporters feared that protection for raptors, even if they were migratory, would diminish support for the already controversial measure.[8] Taking advantage of this loophole, the Alaskan Territorial Legislature began offering a fifty-cent bounty on the bald eagle. The move came in response to concerns about rising food prices during World War I and to pleas from salmon fishers and fox farmers, who claimed that eagles posed a threat to their livelihood.

Once stateside bird enthusiasts caught wind of the legislation, they responded with alarm. For example, in 1920, a group of naturalists at the American Museum of Natural History in New York petitioned the American Ornithologists' Union (AOU)—the nation's most prestigious ornithological society—to take a public stand against the Alaska eagle bounty. According to the petitioners, the legislation placed the bald eagle in "serious danger of extinction." Yet the AOU, the National Association of Audubon Societies, and the Bureau of the Biological Survey had failed to raise a voice in protest, even though more than five thousand birds had already fallen victim to the bounty and the Bureau was on record as opposing bounties on predatory birds. A. K. Fisher, head of the AOU bird protection committee and longtime employee of the Bureau of the Biological Survey, responded that eagles posed a genuine threat to young blue foxes just after they had left the den and to salmon on their spawning grounds. Though he regretted the necessity of controlling these and other predators, Fisher argued that it was simply a case of "wild life and economics run amuck."[9]

Fisher's response to the petition contained more than a little irony since his 1893 book, *The Hawks and Owls of the United States in Their Relation to Agriculture,* had long served as a source of information and inspiration for wildlife conservationists hoping to rehabilitate the negative image of predatory birds. In 1885, C. Hart Merriam convinced Fisher, his friend and medical school classmate, to join him at a newly created federal wildlife agency, the Division of Economic Ornithology, which eventually became known as the Bureau of the Biological Survey. Under Merriam's leadership, this organization quickly established itself as the primary center for the practice of economic ornithology and mammalogy in the United States. Fisher's book, which was based on stomach-content analy-

sis of some 2,700 birds of prey, was the agency's third major publication. While quite willing to condemn a handful of predatory birds as largely harmful, most species Fisher declared to be either beneficial or neutral in their overall effects. The bald eagle he placed in this later class. In a letter of transmittal accompanying the book, Merriam proclaimed that Fisher's research conclusively demonstrated that "a class of birds commonly looked upon as enemies to the farmer, and indiscriminately destroyed whenever occasion offers, really rank among his best friends, and with few exceptions should be preserved, and encouraged to take abode in the neighborhood of his home." Fisher's work also showed "the folly of offering bounties for the destruction of hawks and owls."[10]

While bird enthusiasts continued to decry the Alaskan eagle bounty in editorials and magazine articles, they initially failed to interest any major private or public conservation organization to take up their cause, even after the bounty was raised from fifty cents to one dollar in 1923.[11] Undaunted, a handful of bird-of-prey advocates kept pressure on the National Association of Audubon Societies and the Bureau of the Biological Survey, while working behind the scenes to construct a network of like-minded supporters. Their goal was not simply to repeal the troublesome bald eagle bounty in Alaska, but also to arouse wider public sympathy for all avian predators, which continued to be subjected to local and state bounties, routinely exempted from bird protection laws, and persecuted by farmers, sportsmen, and even bird sanctuary organizers.

A series of events in the mid-1920s galvanized concern about predatory birds. During this period, critics of the Bureau of the Biological Survey's expanding predator-control program became increasingly vocal in their opposition to federal campaigns designed to eradicate mammalian predators in the West. At the 1924 meeting of the American Society of Mammalogists, for example, Biological Survey naturalists found their agency's predator policies under attack, despite the fact that they had dominated the organization since its founding five years previously.[12] This initial skirmish signaled the beginning of a protracted battle that continued to divide professional mammalogists for the next several decades. It also emboldened sympathizers of predatory birds to speak out.

The predator-control campaigns that sport hunters mounted in an effort to bolster game populations further fueled the concerns of bird-of-prey enthusiasts. Despite decades of state and federal game protection, the prospects for many game species failed to improve by the mid-1930s. Many ducks and upland game birds even seemed to be declining in population rather than increasing.[13] While the causes of these declines were complex, sport hunters often focused their ire on the wildlife that preyed on game. Sportsmen's clubs, state game officials, and arms and ammunition manufacturers routinely offered bounties on mammalian