ought not to be ruthlessly spent, but rather stewarded with care." At the same time, nature parks provided valuable recreational and educational opportunities, especially "for the inhabitants of large cities." In addition, nature protection had an aesthetic dimension, while continued access to natural objects and systems remained crucial to biological research. Wild nature even had important medical implications, since it provided many of the drugs used to treat illnesses and the animals used in laboratory experiments. And, finally, biological organisms served as an important source of inspiration for technological innovation: airplane design owed much to the study of birds, while ship builders drew insights from the shape of fish. One item curiously absent from Coolidge's list was the role that individual wildlife species played in maintaining the ecological integrity of biological communities, an argument that was becoming increasingly important by the time he was writing.

In the second half of his article, Coolidge first turned to a brief discussion of a handful of plants and animals suffering precipitous declines. "The most seriously threatened victims of civilization," he declared, "are the large animals with a limited range and slow rate of multiplication, and the species that have commercial value. . . . Nothing seems to make us fully realize the startling fact that we are witnessing the end of the age of mammals which is being brought about by our own efforts." [104] A handful of international organizations had sounded the alarm about these and other vanishing species, while several governments had created national parks—like Yellowstone, the Parc National Albert, and the Kruger National Park—that contributed to preserving them. Coolidge praised the London African Convention of 1933 as "perhaps the most significant event in the whole development of wild life protection through international agreement," summarized a few of its major provisions, and briefly highlighted the success of wildlife treaties in which the United States had become involved.[105] He concluded by declaring emphatically that "the perpetuation of the wild life of the world is a duty which nations in the forefront of civilization cannot ignore with due regards to the needs of mankind!"[106]

In April 1939, a special committee appointed by the governing board of the Pan American Union agreed on a plan to implement the Lima resolution on nature protection and wildlife preservation.[107] The special committee ruled that the Inter-American Committee of Experts should consist of a single delegate from each of the member countries, that it should convene at the Pan American Union building in Washington in April 1940 (to run concurrently with the Eighth American Scientific Congress), and that the Pan American Union should formulate a "draft convention" as the basis for discussion at that meeting.[108] The special committee also released a questionnaire (that Coolidge helped author)

requesting information on game laws, protected natural areas, and the status of vanishing fauna or flora in each of the American republics.

With a clear mandate to act, Coolidge arranged a meeting between the Pan American Committee of the American Committee—which included himself (as chair), Alexander Wetmore, William G. Sheldon, and Frederic Walcott—and representatives from the Pan American Union, the National Association of Audubon Societies, and two relevant governmental agencies. At the first meeting in May 1939, Coolidge, Wetmore, and Sheldon were joined by Manger, T. Gilbert Pearson, F. C. Lincoln (representing the Bureau of the Biological Survey), and Victor Cahalane, C. C. Presnall, and C. P. Russell (representing the National Park Service).[109] The purpose of this initial meeting was to begin blocking out the form for the proposed convention. Following a series of suggestions from Coolidge, the assembled naturalists and conservationists agreed to sections dealing with migratory birds (which incorporated features from the Canadian and Mexican treaties), national parks (which was modeled on the London Convention), the identification and protection of vanishing species, and various enforcement mechanisms. They decided to exclude fisheries and "other controversial topics of economic importance" from the proposed treaty. They also agreed to divide up the burden of crafting specific clauses for these and other sections, which were then circulated within the committee. The Pan American Committee completed a final draft of the convention during their second meeting in early October 1939.[110]

Even as plans for a Pan American convention on nature protection were moving forward, the Galápagos situation remained politically charged and divisive. Huxley and Moore continued to press the American Committee for stronger action in the archipelago. The committee's unwillingness to support the British Galápagos Committee plan to establish a research station on the islands and the decision to appoint a separate Pan American Committee irritated Moore, who tendered his resignation from the American Committee's Galápagos Committee in the summer of 1939.[111] In a series of exchanges with Julian Huxley, Coolidge argued that criticism in Ecuador should not be stirred up at this juncture because doing so might prejudice the delegate that nation would be sending to the upcoming Inter-American Committee of Experts meeting, thereby jeopardizing the proposed convention.[112] He reassured Huxley that the Galápagos Islands would come up for discussion during those meetings. When Huxley asked if representatives from Canada and governments with colonial possessions in the Western Hemisphere would be represented as advisors at those meetings, Coolidge dodged the question. He did, however, send a copy of the draft convention to Henry Maurice, president of the Society for the Preservation of Wild Fauna of the Empire, to gain his input and support. "It is most important that there should

be no feeling among our neighbors to the South, that this is something which the United States is trying to put over on them," Coolidge reiterated. "It may be that your diplomatic representatives could do a little quiet missionary work in the interest of promoting New World cooperation for National Parks and the protection of migratory birds. Your government has taken the lead in dealing with these problems in Africa, and you have plans for the same sort of convention for Asia. I think that we are the natural ones to take such a leadership as far as the New World is concerned."[113]

Another delicate situation involved dealing with T. Gilbert Pearson and the International Committee for Bird Preservation. Phillips had repeatedly complained to Audubon Society President John Baker about Pearson's ineffective administration.[114] He should step down from chairmanship of the organization, Phillips argued, because he lacked the social graces, the diplomatic tact, and the language skills necessary to serve in this important capacity.[115] Baker tended to agree with this assessment and by the middle of 1936 was actively working to terminate Pearson's connection with Audubon, a move that ultimately failed.[116] A year and a half later, when Phillips and Coolidge were searching for a way to shed the continued financial burden the American Committee represented, Baker suggested merging the American Committee and the International Committee as an Audubon department under new personnel. Although Phillips seemed interested in this proposal, the American Committee instead decided to move its offices to the New York Zoological Society early in 1938.[117]

AN UNCONVENTIONAL CONVENTION

After securing appointment as the official U.S. delegate to the Inter-American Committee of Experts, Wetmore conferred regularly with Coolidge. In one exchange, Coolidge suggested that it might be advantageous for Wetmore to criticize various aspects of the convention at the meeting as a strategy to convince other American republics that the agreement was not "one more case of a put up job by interests in the United States."[118] Coolidge and Wetmore also corresponded with Latin American naturalists and conservationists to address concerns and to bring as many of them as possible on board with the agreement. In the end, the extensive preparations paid off: the three-day gathering proceeded as planned in May 1940. In addition to the United States, seventeen Central and South American republics sent delegates, with only Honduras, Guatemala, and El Salvador missing. The final convention, approved unanimously by the Inter-American Committee of Experts, emerged little changed from the draft the American Committee had prepared earlier.[119]

The preamble for the Convention on Nature Protection and Wild Life Preservation in the Western Hemisphere (sometimes referred to as the Pan American Convention) began with essentially the same wording as the Lima Resolution, but the position of the first two paragraphs was transposed.[120] Twelve articles supporting the goal of preventing extinction of all species in the region followed. The first laid out a set of common definitions for the various forms of protected areas mentioned in the treaty—national parks, national reserves, nature monuments, and strict wilderness reserves—and provided a list of birds considered migratory. A particularly interesting item in this section was the idea of declaring not only regions or objects as inviolate "nature monuments" (a traditional use of this term) but also extending the designation to "a species of flora or fauna."

Article 2 called for the contracting governments to set aside protected natural areas as quickly as they could, while Articles 3 and 4 established a set of common rules for the management and perpetuation of those areas. A call for the "protection and preservation" of threatened organisms outside officially designated natural areas, along with similar measures designated "natural scenery, striking geological formations, and regions and natural objects of aesthetic interest or historic or scientific value," appeared in Article 5. The next article urged the contracting governments to support scientists engaged in research and field study in the American republics, while calling for exceptions in protective measures to allow for scientific research. Article 7 covered migratory birds and directed the contracting governments to adopt "appropriate measures for the protection" of those species of "economic or aesthetic value or to prevent the threatened extinction of any given species." Curiously, the language that many American conservationists found objectionable in the Migratory Bird Treaty with Mexico, which sanctioned utilization of migratory birds for "the purpose of sports as well as food, commerce, and industry," also found its way into this hemispheric treaty. An annex to the convention, mentioned in Article 8, provided a list of threatened species "declared to be of special urgency and importance" which were to be "protected as completely as possible." Article 9 set up a system to regulate trade of protected fauna and flora, including the creation of export certificates and prohibition on the importation of species protected by the country of origin. The final three articles established procedures for sharing information about nature protection, ratifying the convention, and withdrawing from it. The convention would go into effect three months after the deposit of not less than five ratifications with the Pan American Union.

The Pan American Convention was born in a wave of optimism. In an article for *Science* announcing that eight nations had signed the treaty on the first day it was opened for endorsement on October 12, 1940, Coolidge called the agree-

ment the "third great cooperative step taken by the United States to further wildlife protection by international treaty on the American Continent": "Science, art and literature have forged strong ties between the American Republics. This convention should add still another tie through its parks, reserves and monuments, which will help to bring about a common interest in the great masterpieces of creation in the Americas."[121] Newton Drury, the director of the National Park Service, lauded the convention as "the spark that may arouse to crusading vigor the preservation of superlative examples of nature throughout the Americas."[122] William G. Sheldon, a member of the committee that had helped author the treaty, also offered praise in *American Wildlife*, highlighting the fact that the clouds of world war made it especially important "to foster and develop greater cultural understanding between the North and South Americas." The "common heritage of great mountain ranges, rich forests and all the various species of flora and fauna found therein" provided a strong bond and a "stabilizing force" that, if nurtured could contribute to "cultural hemispheric unification." Sheldon looked forward to the day when similar treaties would be negotiated "in all parts of the globe."[123] The same sentiment was expressed by Lord Onslow, who wrote to Coolidge expressing his hope that "some day, though I fear it will be a long time ahead, there will be some sort of general agreement all over the World for the protection of Flora and Fauna."[124]

Continuing the active role he had assumed from the beginning, Coolidge lobbied vigorously to gain ratification for the new treaty. On the day it was opened for signature at the Pan American Union building in Washington, the United States and seven other nations formally endorsed the measure. Not long after the signing ceremony, Coolidge wrote to William Phillips urging him to use his Washington connections to push for "immediate ratification of this most important Treaty."[125] When Coolidge learned of the State Department's reluctance to forward the convention to the Senate without the annex of threatened species mentioned in Article 8, Wetmore assured him that the Pan American Committee could quickly generate an appropriate list.[126] The version that went to the Senate included the woodland caribou, sea otter, manatee, trumpeter swan, whooping crane, Eskimo curlew, Hudsonian godwit, Puerto Rican parrot, and the ivory-billed woodpecker. Early in January 1941, Coolidge wrote to the editor of the *New York Times* urging him to publish a story on the convention and indicating that he had been "working for almost three years with several others quietly and indirectly to bring this Convention into existence"[127] He wrote a similar note to the editor of the *Journal of Mammalogy* and one to Fairfield Osborn, urging him to publish an appropriate notice of the convention in the New York Zoological Society's *Bulletin*.[128] Coolidge's own announcement in *Science*, which appeared

in November 1940, was also part of the successful ratification campaign.[129] On April 7, 1941, the Senate passed the resolution authorizing ratification without debate. The treaty came into effect just over a year later, after Guatemala, Venezuela, El Salvador, and Haiti joined the United States in ratifying it.

Coolidge also scrambled for the funding and personnel needed to implement the treaty. Shortly after the Inter-American Committee of Experts met in May 1940, he approached the ornithologist and former editor of the National Audubon Society's *Bird-Lore*, William Vogt.[130] For the previous year, Vogt had served as consultant for the Peruvian Guano Administration, where his job was to study the population dynamics of the sea birds that nested on islands off the coast of Peru. As he described it, the goal of the project was to "increase the increment of excrement" from these birds, which was valuable for use as fertilizer. Coolidge thought Vogt would make an excellent point person for promoting the Convention on Nature Protection and Wild Life Preservation throughout Latin America.[131] He authored a multiyear proposal to finance Vogt and circulated it to Laurance Rockefeller, who had joined the American Committee's Executive Committee when the organization moved its headquarters to New York two years earlier. Coolidge hoped that Rockefeller would secure funding for his proposal through the Rockefeller Foundation or some other private agency.[132] While it failed to fund Coolidge's proposal, the foundation did provide a grant to the Committee for Inter-American Artistic and Cultural Relations, which hired T. H. Goodspeed, a professor of botany at the University of California, to lecture on scientific and conservation topics in Colombia, Peru, Chile, Argentina, Uruguay, and Brazil.[133] Vogt, on the other hand, secured a position as associate director of the Division of Science and Education at the Office of the Coordinator of Inter-American Affairs.

Coolidge continued to argue that a "trained biologist" ought to travel throughout Latin America to "gather information and offer advice on all problems dealing with conservation matters." He also maintained that this expert should serve in a newly constituted Conservation Section of the Pan-American Union, the mission of which was to "aid and encourage the conservation movement" within the region.[134] At their annual meeting in December 1942, the American Committee passed a resolution supporting the latter notion, and the next year, the Pan American Union obliged by creating a Conservation Section with Vogt as its head.[135] He spent the next seven years traveling in Central and South America and issuing reports on the relationship between resources and human population for the governments of Mexico, Costa Rica, El Salvador, and Venezuela. Vogt's Latin American studies became the basis for a Spanish-language textbook, *El Hombre y la Tierra* (1944), and a bestselling book, *Road*

FIGURE 38. William Vogt near Arequipa, Peru, 1939. This photograph was taken the year Vogt accepted a position as a consulting ornithologist for the Peruvian Guano Administration. He would spend the next decade in Latin America working on a variety of conservation and natural resource issues. Courtesy of the Denver Public Library, Western History Collection, CONS 225.

to Survival (1948).[136] The latter was a neo-Malthusian diatribe that warned how increasing populations were outstripping the food supply; it was translated into nine languages and read by millions throughout the world.

CONVENTIONAL WISDOM

Numerous factors converged to produce the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere. The successful negotiations that produced the London Convention of 1933, which provided a useful framework for African conservation, offered a beacon of hope that a similar agreement covering North and South America might also be concluded. At the same time, the Convention for the Protection of Migratory Birds and Game Mammals, which U.S. and Mexican officials negotiated just three years later, suggested that at least some Latin American nations might now be ready to sign on to a broad, multilateral conservation treaty. Roosevelt's decision to implement the Good Neighbor Policy eased tensions between the United States and nations to the south, providing a shot in the arm to the Pan American movement that had begun ever so halting several decades earlier. These critical developments

coincided with the outbreak of World War II, which not only limited European influence in the region but also bolstered a sense of hemispheric unity in that face of fighting in Europe and the Pacific. Clearly, the time seemed ripe for the Pan American Convention, but auspicious timing alone can only go so far in explaining the completion of this landmark agreement.

More than anything, the treaty owed its existence to a small group of foresighted naturalists and conservationists affiliated with the American Committee for International Wild Life Protection. Haunted by the specter of extinction, this small nongovernmental organization had formed in 1930 with a primary focus on African wildlife conservation. Within several years, however, it had shifted its sights to Latin America. Although he did not live to see the Pan American Convention concluded, John C. Phillips was the first to appreciate the possibility of a comprehensive hemispheric treaty, having been inspired to suggest the idea after attending the London Convention negotiations. Undoubtedly, his family connections within the Department of State played an important role in gaining federal approval to begin the process of crafting the treaty. No one knew more about the deteriorating situation for wildlife across Latin America than the world's leading authority on Central and South American birds, Alexander Wetmore, who chaired both the U.S. and the Inter-American Committees of Experts charged with finalizing the treaty. And no single individual did more to encourage, frame, and promote the Convention on Nature Protection and Wildlife Protection in the Western Hemisphere than Harold J. Coolidge.

All three were acutely aware of the difficult challenges involved in negotiating and implementing a conservation treaty in the face of ongoing political, economic, and social instability in the region. Through their extensive efforts to protect endangered wildlife in the Galápagos Islands, American Committee members had learned firsthand how changing administrations, foreign entanglements, and differential priorities often hampered efforts to rescue Latin America's rare and vanishing species. Despite this experience, Coolidge pushed for a broad, binding approach to the proposed hemispheric agreement, while Wetmore thought a more limited, flexible approach would prove more prudent. The final version of the treaty, which eleven nations had ratified by 1947, offered a mixture of both viewpoints.[137]

Has the Convention achieved its aim of advancing the cause of nature protection and wildlife preservation in the Western Hemisphere? The handful of scholars who have studied its implementation disagree on the legacy of this landmark agreement. On the one hand, the environmental lawyers Kathleen Rogers and James A. Moore praise the treaty as "ahead of its time in the strength and breadth of its commitments to protecting plants, animals, and their habitats."

But they also conclude that rather than living up to its initial promise, the agreement has languished, remaining "dormant and largely unimplemented since its inception."[138] The historian Kurkpatrick Dorsey seconds this generally negative assessment, while questioning the depth of the signatories' commitment to the values the treaty represented.[139] On the other hand, in a recent, detailed study using both U.S. and Latin American sources, historian Keri Lewis proves more optimistic about the impact of the treaty. She argues that this "comprehensive, flexible, and malleable agreement . . . laid the foundation for effective nature protection across the Americas." Latin American officials, for example, have repeatedly turned to the treaty for support and guidance in establishing protected areas, while the provisions calling for cooperation between scientists, conservationists, nongovernmental organizations, and governmental officials have bolstered nature protection throughout the Americas. The case of Costa Rica, Lewis notes, provides a particularly striking example of the treaty's power to promote conservation; shortly after ratifying the treaty in 1967, the government of that Central American nation initiated a national park system and began shifting its economic base from agriculture to ecotourism.[140]

Whether or not the treaty has achieved its full potential, it remains an important and underappreciated document that would have not been possible without the prodding and expertise of the American Committee. At a time when most conservationists in the United States remained firmly focused on trials and tribulations of North American wildlife, the committee recognized the importance of a more international approach to the problem of extinction. Three decades later, that approach would manifest itself even more forcefully in the Endangered Species Act of 1973, which cited the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere as a source of authority for the federal government to begin more aggressively regulating the taking of vanishing wildlife.

One thing the convention failed to do, however, was reference the science of ecology. Given the timing of the agreement, this is a rather curious omission. The naturalists and conservationists who drew up the treaty may have been innovative in their embrace of an international approach to wildlife conservation, but they remained largely disconnected from the emerging field of biology that took the study of organisms and their relations to their natural environment as its central subject matter. By the time the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere gained ratification, that science had already begun to make its mark on domestic conservation policy in the United States.

CHAPTER SEVEN

ENTER ECOLOGY

PRESERVING NATURE'S LIVING LABORATORY

Biologists, above all others, should be in a position to appreciate the loss to science which results from the destruction either of single natural species or of natural associations of species. They are in a unique position to give advice as to what particular species and associations are of greatest importance to science, and as to which ones are in most urgent need of protection.

FRANCIS B. SUMNER, 1921

In general, from a philosophical and practical viewpoint, the unmodified assemblage of organisms is more valuable than the isolated rare species.

VICTOR SHELFORD, 1933

A PLEA FOR PRESERVATION

In March 1920, the American naturalist Francis B. Sumner published a remarkable essay in the *Scientific Monthly*. The goal of his lengthy, impassioned plea was to convince his biological colleagues to undertake a "serious effort to rescue a few fragments of vanishing nature." According to Sumner, the natural world faced a relentless assault at human hands. While several authors had recently highlighted the need for "prompt and drastic action to save our native fauna, especially the birds and mammals," Sumner feared that those warnings about impending extinction remained overly narrow. "Forests are vanishing," he declared with alarm, "brush land [is] being cleared, swamps drained and desert irrigated." No place seemed entirely safe from the juggernaut of civilization, as even "the remotest mountain fastnesses and the wildest solitudes of the desert" were being

opened up to exploitation by the mass adoption of the automobile. While Sumner admitted that it was impossible to "arrest the march of progress" entirely, he proposed a sweeping expansion of the "conservation of our fauna and flora and natural scenery to an extent hitherto not contemplated by our people or our government." More specifically, he called for conservationists (and conservation policy) to move beyond a preoccupation with individual species and begin paying more attention to biological communities and habitat: "Large tracts of land, representing every type of physiography and of plant association, ought to be set aside as permanent preserves, and properly protected against fire, and against every type of depredation. Here would be included desert and chaparral, swamp land and seashore, mountain and prairie."

As practitioners of the "science of life," Sumner continued, biologists should staff the frontlines of an aggressive campaign to rescue at least some patches of nature from oblivion. But instead of promoting preservation, he found too many of his colleagues unmoved by the ecological devastation occurring around them: "One might conclude . . . that there are zoologists, and some of them occupying high positions, who would not be greatly disturbed if the entire natural fauna and flora of the earth, with a few specified exceptions, should be destroyed overnight." As long as they managed to obtain the limited repertoire of animals needed for their research—the fruit fly, sea urchin, mouse, and a few other organisms that had become standard experimental models—laboratory-oriented biologists seemed largely indifferent to "the worldwide assault upon living nature."[1] In a follow-up article the next year entitled "The Responsibility of Biologists in the Matter of Preserving Natural Conditions," Sumner again urged his colleagues to step forward to protect both endangered species and endangered biological communities.[2]

Sumner offered two general arguments in support of his plea for setting aside generous tracts of land. On the one hand was the aesthetic argument, a line of reasoning that romantic-oriented preservationists had long leaned on to make their case. By aesthetics, he meant not just "the appreciation of natural scenery" as traditionally construed, but also the "deep-rooted feeling of revolt . . . against the noise and distraction, the artificiality and sordidness, the contracted horizon and stifled individuality, which are dominating features of life in a great city." For Sumner, the aesthetic appeal of nature was similar to but also "vastly more compelling, than that of either music or poetry." Beyond a sentimental appeal to aesthetics were more hard-nosed scientific considerations. If biologists, especially field-oriented biologists, hoped to continue their research into the future, they needed to secure "from destruction the greatest possible number of living species of animals and plants" and to do so as "far as possible

FIGURE 39. Francis Sumner in the field. Trained as an ecologist, Sumner sought to combine the rigor of laboratory methods with extensive work in the field. He also sought to engage his colleagues in a campaign to broaden the focus of conservation from declining individual species to endangered landscapes. Courtesy of the Scripps Institution of Oceanography Archives, University of California, San Diego Libraries.

in their natural habitats and in their natural relations to one another." Here Sumner was not just talking about preserving research opportunities for old-school naturalists with their "traditional passion for naming species," but especially those biologists whose scientific interests centered on discerning larger relationships in nature. Chief among these were modern ecologists, concerned with what Sumner characterized as the "totality of animal and plant life in particular regions."[3]

Though perhaps more outspoken than his contemporaries, Sumner represented a new breed of Ph.D.-trained biologist who came of age in late nineteenth- and early twentieth-century America.[4] Following his birth in Connecticut in 1874, he spent the first ten years of his life on a small, isolated farm on the outskirts of Oakland, California. There he received formal instruction from his father, a schoolteacher and author of geography textbooks who encouraged his young son's interest in raising reptiles and collecting shells, birds' eggs, and insects. At the age of sixteen, he entered the University of Minnesota, where he earned his B.S. degree in 1894. Following graduation, Sumner spent the next few years on a trip to South America (undertaken in an effort to regain his frail health), an expedition to the Egyptian Sudan, and graduate work at Columbia University. His mentors included the embryologist Edmund B. Wilson, the paleontologist and museum administrator Henry Fairfield Osborn, and the ichthyologist Bashford Dean.

Sumner's 1901 doctoral thesis on the embryological development of fish typified the research completed in the graduate biology programs launched in America at the close of the nineteenth century. As historian of science Robert Kohler has ably documented, by the early twentieth century, a reaction against this kind of laboratory-based morphology, embryology, and cytology had begun to set in among some American naturalists. Biological reformers sought to carve out intellectual and institutional space for a "new natural history," an approach that blended the rigor of laboratory-based studies that had come to predominate in academic institutions with the older, field-based natural history.[5]

Sumner's subsequent research career exemplified this trend. Following lengthy stints teaching at the College of the City of New York and as laboratory director at the U.S. Fish Commission in Woods Hole, Massachusetts, he accepted a position at the Scripps Institution for Biological Research (later renamed the Scripps Institution of Oceanographic Research) in 1913, where he was to remain for the rest of his scientific career. There Sumner completed a long-term study of the deer mouse (*Peromyscus*) that secured his scientific fame. His murine research combined extensive fieldwork at multiple sites with the breeding of various subspecies (geographic races) under controlled laboratory conditions. Witnessing the impact of development on the once remote western locations where he captured his specimens undoubtedly contributed to Sumner's growing sense of alarm about human-induced transformations of the natural world. Extensive contact with Joseph Grinnell, the outspoken Berkeley naturalist who regularly decried the turn-of-the-century ecological devastation occurring in California, further fueled his emerging environmental consciousness. No ivory-tower biologist, Sumner believed that scientists had a solemn duty to apply their knowledge in the social and political sphere.[6]

He discovered several kindred spirits who shared his concerns, especially among those naturalists who identified with the emerging discipline of ecology. Although first coined in the 1860s, the term "ecology" failed to catch on until later in the nineteenth century, when American botanists adopted it to describe the broad study of the relationship between living organisms and their environment. By 1915, there was sufficient interest to found a separate institution, the Ecological Society of America (ESA), devoted to promoting the nascent field. One of the central players in this new institution was Victor Shelford, a Chicago-trained Ph.D. whose research and teaching helped put animal ecology on the map. Shortly after helping found the ESA, Shelford established the Committee for the Preservation of Natural Conditions within the fledgling organization. With Shelford's leadership and constant prodding, over the next three decades this committee compiled an extensive inventory of natural sites needing protec-

tion, it lobbied for state and federal protection of those sites, and it developed a new rationale for the preservation of nature. Beyond the aesthetic, economic, and recreational concerns that had long been central to conservation discourse, Shelford and his colleagues argued that individual species were crucial components of biological communities. Only through sustained ecological research on these communities could scientists hope to develop models of how healthy landscapes functioned in nature. Indeed, it was in his capacity as a cochair of Shelford's committee that Sumner published his 1921 article challenging his biological colleagues to become more active in the preservation of nature.

Today the term "ecology" has come to mean both the scientific study of the interrelationship between organisms and their environment and (more popularly) the broader social and political movement aimed at shielding the natural world from the full brunt of civilization. This chapter shows how Sumner, Grinnell, Shelford, and a handful of their ecologically oriented colleagues pushed to expand ecology beyond its original narrow moorings in academic biology. During the period between the First and Second World Wars, ecologists provided both a new set of lenses for viewing the natural world and a new set of arguments for nature preservation. At the same time, they highlighted the role of habitat protection in saving endangered species. One naturalist, Aldo Leopold, went further by trying to incorporate ecological ideas into a radical new ethic guiding human relations with the natural world. While ecologists achieved only limited success within conservation circles during the interwar years, ecological approaches and arguments would subsequently become central to the postwar environmental movement.

THE NEW NATURAL HISTORY

The science of ecology emerged during a period of reform fervor in American biology. Although natural history had always encompassed a diverse variety of practices, methods, and approaches, during the late eighteenth and early nineteenth century, taxonomy—the naming, description, and classification of organisms—began to predominate within the scientific study of flora and fauna.[7] By the 1880s and 1890s, however, a new laboratory-based embryology, cytology, and physiology eclipsed the descriptive, field- and museum-oriented, and taxonomically focused natural history.[8] The laboratory revolution in American biology began at about the same time that universities established the first doctoral programs in the United States, beginning with Johns Hopkins University in 1876. Where naturalists had once learned their craft through self-study, amassing collections, fieldwork, informal apprenticeships, and (less often) formal study at

the undergraduate level, over the ensuing decades graduate study in an academic laboratory increasingly became the entry point for serious research (much less careers) in the biological sciences. By 1910, the Ph.D. had become a standard credential for individuals hoping to fill a professional position not only in biology, but most other scientific disciplines as well.[9]

Even as experimental and laboratory-based biology gained in prestige and visibility in American institutions of higher learning, however, a backlash began to develop. By the early twentieth century, reformers began calling for a "new" or "scientific" natural history, a revitalization of that older tradition that sought to combine the rigor, control, and replicability of laboratory work with the excitement, immediacy, and close contact with nature that field research offered.[10] One of Shelford's classmates, the ecologist Charles C. Adams, published one manifesto of this reform movement in 1917. There he argued that a new generation of more diversely trained scientists filled the breach that had opened up between laboratory and field studies. "The new natural history," he continued, "is working on a higher level, with a broader outlook, and has a saner and closer contact with nature than was possible by either the laboratory or the older field method alone. It takes the laboratory into the field and brings the field problems into the laboratory as never before." Not surprisingly, for Adams the prime exemplar of the new natural history was his own chosen field of ecology.[11]

The term "ecology" had first been coined in 1866 by Ernst Haeckel, the inveterate neologist and leading German disciple of Darwin.[12] Finding inspiration in the *Origin of Species,* Haeckel defined ecology as "the science of the relations of living organisms to the external world."[13] Darwin's big book was brimming with examples of how living organisms interacted with one another in what he described as the "complex web of life." In one passage that bore a resemblance to the old nursery rhyme "The House That Jack Built," Darwin even discussed what would later be dubbed a food chain when he showed how the amount of clover growing in the area around his home was indirectly related to the number of cats (since cats devoured mice, which in turn consumed humble-bees, which fertilized clover).[14] Though a number of naturalists pursued research that would later be characterized as "ecological," the term itself failed to catch on until the until the early 1890s, when a group of American botanists interested in studying adaptation, geographical distribution, and physiology in plants picked it up.[15]

Once planted, the seed of ecology grew and blossomed in the fertile soil of modern American universities. One prominent ecological research school flourished at the University of Nebraska, under the supervision of the botanist Charles E. Bessey.[16] His most renowned student was Frederic E. Clements, a prickly figure whose methodological and theoretical innovations dominated

American ecology from the 1910s until World War II.[17] In 1897, Clements and one of his classmates, Roscoe Pound, developed the idea of the quadrat—a one- to five-square-meter patch of ground divided by evenly spaced grid lines. They hoped that meticulously conducted inventories of the plants growing in these carefully chosen plots would bring more precision and rigor into ecological research than the more casual sense impressions typically used to survey vegetation at the time. Strongly influenced by German phytogeographers, Clements also developed a dynamic approach to plant communities. He argued that those communities—which he viewed as a kind of superorganism—were subject to regular, predictable patterns of invasion from various species in a process known as succession. The final stage of this process he called the climax community, supposedly the most stable, diverse, and hence the most natural plant formation for a given set of environmental conditions.

By the early twentieth century, the leading training ground for American ecologists was the University of Chicago, which boasted one of the most innovative and productive biology faculties of any U.S. university at the time.[18] There the quiet but inspiring Henry Cowles trained a generation of students about plant succession through regular field trips to the sand dunes that bordered the shores of Lake Michigan.[19] The site provided a vivid demonstration of the process of succession, where "a pattern of ecological development *in space* paralleled the development of vegetation in time."[20] While repeatedly examining the varied flora that inhabited dunes of differing age, Cowles and his students also gained firsthand knowledge of how humans could radically transform a once remote, wild, and scientifically valuable location. In the early part of the twentieth century, the construction of a massive U.S. Steel plant in the area around Gary, Indiana, provided a striking example of how development could despoil a once beautiful, productive research site, in this case by transforming it into a sprawling industrial complex surrounded by a bustling new town.[21]

Initially, most ecological research centered on plants and plant communities, which—being relatively limited in number, visible, and static—were easier to study than more numerous, less conspicuous, and more mobile animals. In the 1910s and 1920s, however, several ecologists began laying the groundwork for the study of animal ecology. Prominent among those were two of Cowles's students at Chicago: Charles C. Adams and Victor Shelford, who each published pioneering books on the subject in 1913. Adams's *Guide to the Study of Animal Ecology* was a compact bibliographic and methodological textbook that emphasized survey work.[22] Shelford's *Animal Communities in Temperate North America* was a more ambitious and ultimately more influential book that was based on ten solid years of fieldwork.[23] Among those inspired by Shelford's study was

the British naturalist Charles Elton, who managed to synthesize animal ecology into a coherent subdiscipline.[24] Following research on fur-bearing animals in the Arctic, where the food relations between organisms proved much easier to unravel than in the more biologically rich, diverse temperate zones and tropics, Elton published his widely read *Animal Ecology* (1927). Declaring ecology to be a form of "scientific natural history," Elton first raised to prominence several key ecological concepts, including food chains, food webs, and the pyramid of numbers (i.e., the idea that the number of individual animals and their total weight decreased at each level of the food chain).

Ecology was (and has remained) a notoriously diverse field, with practitioners who pursue a bewildering variety of approaches and methods. Beyond the division between plant and animal ecology, there were also fundamental differences between ecologists who tended to focus either on terrestrial or aquatic species, saltwater or freshwater environments, individual species or entire communities, and basic or applied research. An apparently exasperated Cowles admitted in 1903 that "the field of ecology is chaos. Ecologists are not agreed even as to fundamental principles or motives; indeed, no one at this time, least of all the present speaker, is prepared to define or delimit ecology."[25] While Clements offered a theoretical framework that many plant ecologists found useful, it failed to provide much role for animals in the process of succession and its applicability to aquatic environments was equally questionable.

What ecologists lacked in uniformity of approach to their subject, however, they made up for in enthusiasm and numbers. By 1914, enough American scientists identified with some aspect of ecological research to contemplate establishing a national society.[26] Undoubtedly, the founding of a British Ecological Society a year previously helped plant the idea in the mind of Robert H. Wolcott, a professor of zoology at the University of Nebraska. In March 1914, Wolcott wrote to Shelford suggesting the formation of an ecological society that would primarily be devoted to guided field excursions, like the kind that Cowles regularly led with his students around Chicago. That exchange led Cowles to call for a meeting during the annual gathering of the American Association for the Advancement of Science (AAAS) later that year, where attendees agreed to create a small committee to further explore the idea. At the next meeting of the AAAS, in 1915, about fifty scientists voted to found the Ecological Society of America and elected Shelford as its first president.

During the next three decades, both the society and the larger discipline experienced impressive growth. By 1917, membership in the fledgling organization had reached 307 scientists, with nearly a third of those identifying plant ecology as their field of major interest, a nearly equal portion animal ecology, and about

15 percent forestry or entomology.[27] Not surprisingly given the position of the Chicago school of ecology, thirty-two of the members at the time were from Illinois; Washington, D.C., with its many federal bureaus, was second, with thirty representatives. By 1930, the ESA had grown to 653 members.[28] As another indicator of the scale of ecological activity during this period, the word "ecology" appeared in the titles of at least 27 dissertations and 133 American books during the 1920s; by the 1930s, those numbers had grown to 33 dissertations and 201 books.[29] Clearly, ecology had gained a firm foothold within American biology.

INSTITUTIONALIZING ECOLOGICAL ACTIVISM

In 1917, two years after the founding of the ESA, Shelford wrote to the new president of the organization, Ellsworth Huntington, suggesting the formation of a committee for the "Preservation of Natural Conditions for Ecological Study."[30] What prompted him to make this recommendation remains unclear, but the establishment of the National Park Service in 1916, which placed national parks and monuments under a single, unified management structure, may have influenced the timing of his proposal. Increasing mobilization for World War I, which led to calls to open up those parks for resource exploitation, may have also played a role.[31] Whatever the source of the idea, Huntington responded enthusiastically and suggested that the new committee not only grapple with relevant legislation aimed at preserving natural conditions but also create an inventory of "typical areas which ought to be preserved in various parts of the country." Shelford jumped at the opportunity, and for the next several decades, he worked tirelessly on behalf of this committee and its successors.

At the time he wrote Huntington, Shelford was one of America's leading ecologists.[32] Raised in rural western New York, he enrolled in West Virginia University as a premedical student at the age of twenty-two. There, his uncle, William Rumsey, a Cornell-trained entomologist affiliated with the Agricultural Experiment Station at Morgantown, took him on long hikes and exposed him to serious botanizing and insect collecting for the first time. After several semesters, Shelford transferred to the University of Chicago, where he received his B.S. in 1903 and his Ph.D. four years later. At Chicago, he fell under the spell of several gifted teachers, including the geneticist Charles Davenport, who nudged him in the direction of animal ecology; the developmental biologist Charles M. Child, who inspired him with long rambles through the countryside and taught him experimental techniques that would become central to his research; and especially the ecologist Henry C. Cowles, who introduced him to physiological ecology and enchanted him with regular field trips to the dunes of Lake Michigan.

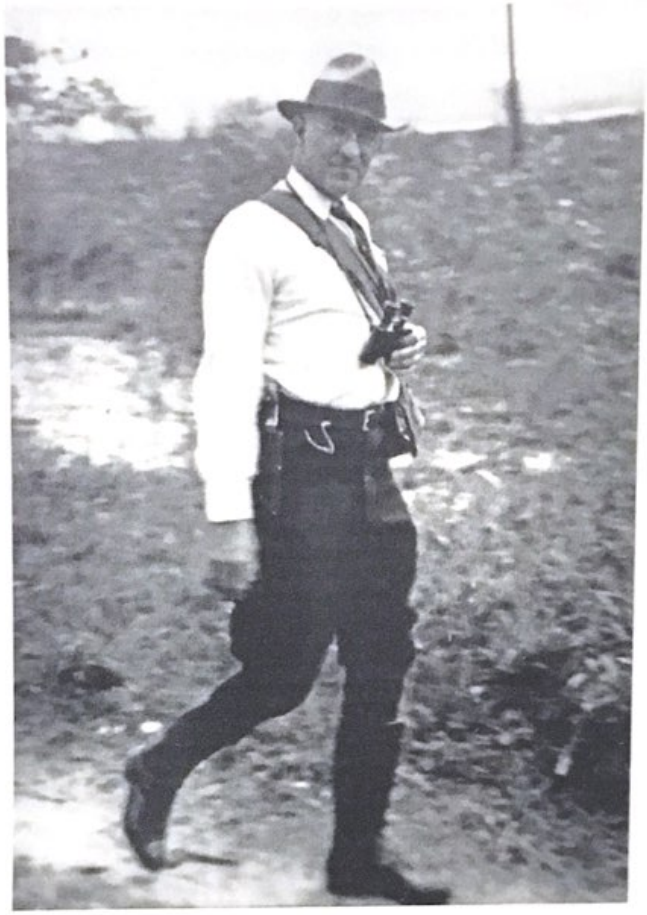

FIGURE 40. Victor Shelford in the field, Reelfoot Lake, Tennessee, 1937. Photograph by Eugene Odum. Shelford not only made important contributions to animal ecology but was also the primary force behind the Ecological Society of America's engagement with conservation issues for more than three decades. Courtesy of the University of Illinois Archives.

After graduation, Shelford remained an instructor at Chicago for seven years before accepting a faculty position at the University of Illinois, from which he was forced to step down in 1946 due to a compulsory retirement policy. Many of Shelford's colleagues considered him to be the "father of animal ecology in America," an accolade gained through his wide-ranging research and the more than two dozen doctoral students who worked under his supervision.[33] Despite a heavy schedule of teaching, writing, and fieldwork at Illinois, Shelford managed to devote countless hours to conservation.

Articulating a scientific rationale for nature preservation provided one initial focus for Shelford's committee, which numbered seventeen ecologists by the end of its first year. In 1913, Charles C. Adams had stressed that ecologists needed continued access to relatively undisturbed natural areas so they could gain an understanding of the "normal processes of nature": "We need what might be called a bionomic baseline, an idea of conditions which existed before man came upon the scene, the conditions which would again supervene if the human inhabitants were withdrawn." He warned that as civilization increasingly encroached upon

"habitats and associations," "the chances of preserving adequate records before their complete extinction" was becoming ever more remote.[34] Still, at this point, Adams failed to issue a formal call for political action to save the sites that remained. Similarly, in *Animal Communities in North America,* published that same year, Shelford himself stressed the need for a more complete knowledge of nature to inform policies about how to manage it properly: "We must know nature, not a part but the whole, if we wish to treat the simplest everyday problem of our relations to animals intelligently and justly.[35]

Willard G. Van Name, a curator of invertebrate zoology at the American Museum of Natural History and well-known gadfly in conservation circles, took the next step in a blistering editorial published in *Science* in 1919.[36] There he chided his fellow naturalists for failing to seriously engage with the issue of nature preservation, especially when rapid postwar economic expansion and improved transportation networks posed a grave threat to nearly "every part of the globe." Zoologists, botanists, and ecologists should play a more visible role in the struggle for the "preservation from extinction or destruction of hundreds of interesting species of animals and plants and the many places of unusual scientific interest that are being sacrificed for the selfish interests of a few." Biologists needed to become more politically active not only to ensure continued access to the specimens and sites they needed for their research, but also for moral and aesthetic reasons. Using language intended to resonate with an American audience still fired with postwar patriotism, Van Name compared the careless destruction of nature to the wartime destruction of culture: "We may be shocked and indignant at the vandalism of the Huns of ancient and modern times in respect to art and the results of human industry, but we ourselves act no better toward natural objects of unique interest, value and beauty, and more intelligent generations in the future who will find themselves deprived of much that it was our duty to preserve for them will not doubt regard us with the same kind of feeling as we look upon the despoilers of Belgium, France, and Serbia." Francis Sumner's declarations that naturalist had a duty to engage in nature preservation appeared soon after Van Name's critical editorial.

These publications, and the arguments they articulated, were all available to Shelford's Committee for the Preservation of Natural Conditions, which had grown to seventy members by the time they issued their first separately published report in 1921. Funded with a small grant from the National Research Council, *Preservation of Natural Conditions* was a heavily illustrated but only marginally effective pamphlet. Rather than offering a coherent narrative, the text presented a hodgepodge of quotations and previously published material only loosely strung together. The section offering "Some Reasons for Preserving Natural Areas,"

for example, included a variety of statements articulating the need to act quickly to save natural communities and habitat for aesthetic, recreational, cultural, economic, and scientific reasons. Here, among many similar declarations, was one of Francis Sumner's earlier calls for conservation: "The main thing is to recognize (as many biologists do at present) the need of concerted action. Without this, we shall certainly lose the greater part of material upon which our sciences of ecology, geographical distribution, taxonomy, etc. are based."[37] The pamphlet also warned that when it came to protecting undisturbed land, "Early action is always important, for the destruction of natural areas is continuous and progressive."[38] The site of Gary, Indiana, offered a compelling example. Fifteen years earlier, the biologically rich area had reverted to the state because of delinquent taxes. But rather than preserving it for recreation and scientific study, state officials had allowed much of the land to fall into private hands. Now "tall stacks and a cloud of smoke" marred the very landscape where so many Chicago students had first been introduced to the process of ecological succession.[39] To drive home the point, the committee's pamphlet included numerous before and after pictures depicting the young, bustling town of Gary.

Before the preservation committee could effectively act to save potentially endangered research areas, however, it needed a better sense of where the most important and imperiled sites were located. Creating an inventory of these areas proved one of the most time-consuming tasks the committee accomplished during its initial decade. As one of his first acts as chair of the preservation committee, Shelford had drawn up a natural area description card, which included space for identifying climax vegetation, animal populations, topography, and the potential objections to preserving a particular location. Over the next several years, he widely circulated the cards among his colleagues, urging them to complete them and to "DO IT NOW."[40] By the end of 1921, Shelford reported that he and his assistants had compiled most of their report, which was likely to contain descriptions of about a thousand areas that were either already preserved or worth saving.[41] The final report, which did not appear until 1926, represented the labor not only of its general editor, Shelford, but also seven associate and special editors, a "publication editor" (the ecologist Forrest Shreve), and more than seventy-five individual contributors.

Emblazoned with an American bison on the cover and touted as the "crowning achievement of the Committee on the Preservation of Natural Conditions," *Naturalist's Guide to the Americas* represented an impressive accomplishment.[42] In the book's preface, Shelford offered a brief history of the project while admitting that its coverage of invertebrates and lower vertebrates was unduly lacking. The first section contained nineteen short essays exploring the uses, values, and

policy issues associated with natural areas. In one of these, Shelford argued for the importance of ecology and the study of natural habitats more generally to various branches of biology. He predicted that soon not just ecologists but all biologists—both pure and applied—would "require preserves of natural conditions in connection with their various scientific interests."[43] The largest section of the book consisted of chapters on each state, Canadian province, Latin American country north of Brazil, and large West Indian island. The individual chapters included a brief account of the physical conditions, climate, and biota of each area under discussion. The authors placed particular emphasis on undisturbed places they considered "natural" or "virgin." To aid naturalists desiring to visit these sites, some chapters included practical advice on how to reach them and the available accommodations. A handy list of organizations interested in the preservation of natural conditions and two indices rounded out the ambitious publication.

SAVING NATURE IN NATIONAL PARKS

With this monumental project behind them, Shelford and his preservation committee mobilized to protect the areas with natural conditions ecologists needed to conduct their research. National parks and forests, which were already under federal management, seemed particularly strategic sites to fulfill this aspect of the committee's mission. A key challenge, though, was the fact that neither the National Park Service nor the Forest Service considered the preservation of relatively undisturbed nature as a primary goal. Despite a legislative mandate to manage national parks in a way that left them "unimpaired for the enjoyment of future generations," the National Park Service seemed more interested in protecting scenic vistas and maximizing recreation opportunities for visitors than in perpetuating intact biological communities.[44] Similarly, the Forest Service promoted a multiple-use management policy for the land under its jurisdiction, a policy that promoted timber extraction, grazing, and recreation.[45] Consistent with their overall goals, both agencies routinely effected drastic manipulations of the landscapes under their charge—including building roads, suppressing fires, destroying predators, managing game, and introducing nonnative species—actions that threatened to disrupt or decimate the natural communities that once inhabited those sites.

The ESA preservation committee pursued multiple strategies to safeguard examples of federally owned land from development. First, it pushed to have appropriate new sites incorporated into the national park system. Second, it lobbied to have minimally disturbed research areas carved out of existing national

parks and forests, areas where human intervention and public access would both be extremely limited. Finally, the committee sought to minimize intrusions in existing national parks and forests. During its nearly three decades of existence, the committee enjoyed limited success in all these areas.

The campaign to preserve Alaska's Glacier Bay as a national park—an area that was both scenically compelling and ecologically significant—represented the committee's first major entry into the political arena.[46] Dominated by a ramified fjord some sixty miles long, the site first became widely known following John Muir's visit in 1879. By the 1880s and 1890s, steamships regularly brought awe-struck tourists to gaze at the giant ice sheets that regularly calved into the bay from the three-hundred-foot-tall Muir's Glacier, the largest and most imposing of nine tidewater glaciers that bordered the region. As those glaciers slowly receded, the land behind them was laid bare, allowing plants to colonize. Thus, in a more compressed time scale than the Indiana Dunes, the site provided a vivid demonstration of the process of ecological succession.

In 1916, the ecologist William S. Cooper made his first trip to Glacier Bay.[47] An avid mountain climber, Cooper vacillated between an interest in the formal science of ecology and a more popular style of nature writing reminiscent of Muir. After dabbling in graduate study at Johns Hopkins, he transferred to the University of Chicago, where he imbibed in the gospel of dynamic ecology under Henry Cowles and accompanied his mentor on regular pilgrimages to the Indiana Dunes. Following graduation from Chicago in 1911, Cooper began searching for his own ecological promised land, a research site "where vegetational change and development were proceeding so rapidly that they could be studied with fair completeness in the span of the lifetime."[48] He found exactly what he was looking for after reading Muir's description of Glacier Bay in *Travels in Alaska* (1912). During the first of several trips to the region, Cooper installed a series of permanent one-meter quadrats to track how the area's vegetation changed over time.[49]

In 1922, when Cooper approached the ESA to explore the possibility of gaining formal protection for the area that had become central to his research, he found himself appointed chair of a subcommittee charged with exploring the idea.[50] Another member of that subcommittee, Robert Griggs, who had recently participated in a drive to have Katmai National Monument established in Alaska, suggested that a national monument designation might prove much easier to obtain than one for a national park. The former could be accomplished simply through presidential proclamation, while the latter required an act of Congress. The next year, the ESA formally approved the report Cooper's subcommittee presented to the membership. Included in that document was a resolution calling

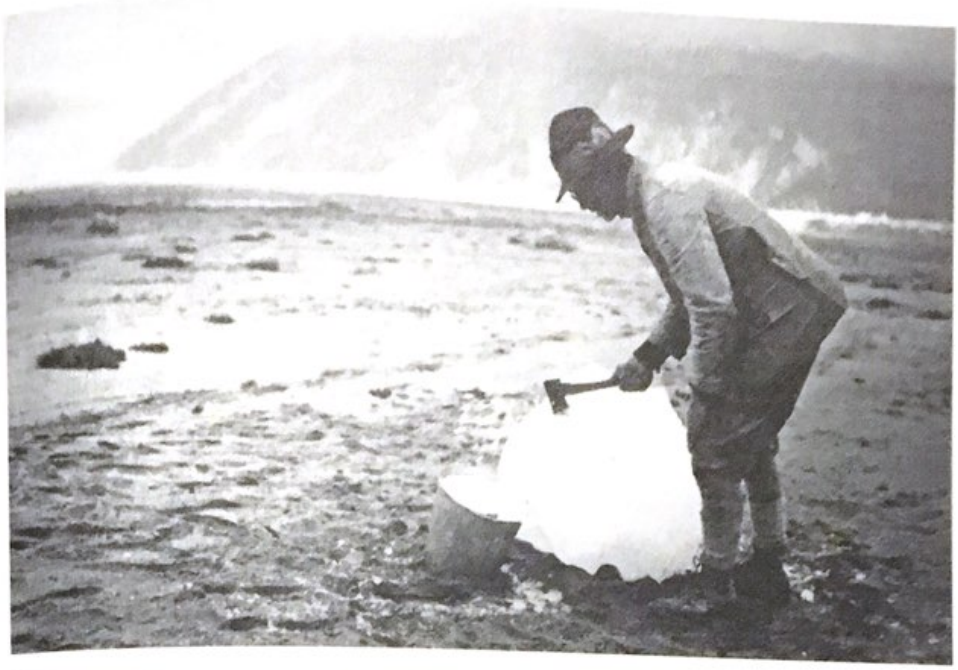

FIGURE 41. William S. Cooper at Taku Inlet, Alaska, 1916. After beginning research in Glacier Bay, Alaska, a region that provided a vivid demonstration of the process of ecological succession, Cooper led a successful campaign to have his study site declared a National Monument. Courtesy of the University of Minnesota Archives, University of Minnesota–Twin Cities.

for the "preservation" of Glacier Bay as a "National Monument for permanent scientific research and education, and for the use and enjoyment of people."[51] The committee then mounted a massive letter-writing campaign in support of the proposal. Beyond encouraging the other twenty-seven organizations represented on the Council on National Parks, Forests and Wildlife to champion the idea, the committee drummed up support using the list of local and national conservation organizations that had been compiled for the *Naturalist's Guide*. Impressed with this outpouring of support, in 1925, President Calvin Coolidge declared a 1,820-square-mile area as Glacier Bay National Monument. The proclamation accompanying Coolidge's executive order specifically noted the ESA's enthusiastic encouragement of the project and indicated that the new monument presented a "unique opportunity for the scientific study of glacial behavior and the resulting movements and development of flora and fauna."[52] In a letter to the editor of *Science* published nearly two decades later, Shelford singled out the Glacier Bay campaign as one of the most enduring achievements of the preservation committee.[53]

Shelford and the ESA preservation committee also participated, though less centrally, in the drive to establish Everglades National Park.[54] The Everglades