

COPYRIGHT NOTICE:

Robert E. Kohler: All Creatures

is published by Princeton University Press and copyrighted, © 2006, by Princeton University Press. All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from the publisher, except for reading and browsing via the World Wide Web. Users are not permitted to mount this file on any network servers.

Follow links for Class Use and other Permissions. For more information send email to: permissions@pupress.princeton.edu

Nature

WE HUMANS are one in a million: to be exact, one species among 1,392,485, according to a recent tally by the zoologist Edward O. Wilson. Those are the ones we know: estimates of the total number of living species range from five to thirty million and up, depending on how one reckons.¹ A substantial majority of Earth's species are insects: something like 751,000 by Wilson's tally. Plants account for another 248,428, the vast majority being flowering plants (which coevolved with insect pollinators). Among the vertebrates, bony fishes are the largest group, with 18,150 species, leaving aside the 63 species of jawless fishes and the 843 cartilaginous fishes (lampreys, sharks). Amphibia and reptiles account for 4,184 and 6,300 more species; birds for 9,040, and mammals for 4,000, give or take. Not to mention invertebrates other than insects: tunicates and cephalochordata (1,273), molluscs (roughly 50,000), and arthropods (12,161). And single-cell organisms: algae (26,900), fungi (46,983), protozoa and microbes (36,560).² Of our fellow vertebrates we have an inventory that is nearly complete—over 90 percent, it is estimated. On the plants and invertebrates, however, we may only have made a start. We earthlings sail through the void on an ark that is impressively biodiverse.

Biodiversity is a lively issue these days, mainly because of the number of species that are going extinct, either by natural causes, or because we space-hungry humans are destroying their habitats. Wilson estimates that perhaps 17,500 species (mostly insects) go extinct each year in tropical forests, and that we humans have accelerated the historical rate of extinction by a factor of one thousand to ten thousand.³ Biologists and conservationists are concerned that vast numbers of species may be forced into extinction ahead of schedule (extinction is the ultimate fate of all species) before they can be found and classified. There is concern, too, that in our ignorance we may be destroying species vital to the fabric of ecosystems on which we depend for our own survival.

Systematic biology, or taxonomy, is reputed to be a humdrum, cataloging science—a reputation entirely undeserved, let it be said.⁴ We depend on those few among us who collect, describe, name, and classify our fellow passengers on the global ark. But how exactly do we find, collect, identify, and order those millions of species? That is my subject here: not the biology or the ethics of biodiversity, but its practices and their history. Though people have always named plants and animals, the science of species inventory is relatively new, beginning with the big bang of Carl von Linné's invention of the (Linnaean) binomial system of naming in the mid-eighteenth century.⁵ And though much has been written on theories of species, relatively little is known of the practical work that produced the empirical base for theorizing. When and how were those inventories created and made robust? Who organized and paid for collecting expeditions, collected and prepared specimens in the field, compiled lists, built museums and herbaria, and kept vast collections in good physical and conceptual order? Of these practical activities we do not as yet know much. This book is a step toward acquiring such knowledge.

The history of our knowledge of biodiversity is first and foremost a history of collecting and collections. Remarkably little has been written about the craft and social history of scientific collecting: it remains a “black box,” as the historian Martin Rudwick observed a few years ago, an activity that has “barely been described by historians, let alone analyzed adequately.”⁶ There are now signs of a growing interest in the history of collecting science, but it is perhaps understandable why this black box is only now being opened. Although collecting is a widespread and varied obsession, modern scientific collecting is sober and businesslike, not irregular or idiosyncratic. It is done en masse and methodically, because modern taxonomy requires large and comprehensive collections. Scientific collecting is exacting and quantitative science, as methodical and organized as taking stock of galaxies, subatomic particles, or genes. Modern specimen collections are quite unlike the romantic “cabinets of curiosities” of earlier centuries. Modern herbaria consist of cases filled with hundreds of thousands of large folios of pressed plants in paper. Museum study collections are rooms of metal boxes, each with trays of animal skins and skulls in neat rows neatly labeled—all seemingly humdrum and unromantic.

Yet the scientific visions that inspire collectors to go afield, and the varied activities that go into making large collections, are anything but humdrum. Collecting is an activity that has engaged diverse sorts of people—unlike laboratory science, which is restricted to a relatively few approved types.⁷ The botanist Edgar Anderson once did an experiment, in which he took a manila folder at random from an herbarium case (a Southwestern grass, it turned out to be), to discover the kinds of people who had collected the specimens. It was an amazingly diverse lot: a botanist on the Mexican Boundary Survey of the early 1850s; an immigrant intellectual German who had come to America in 1848 to escape political persecution; the wife of a mining engineer stationed in a remote mountain range, who dealt with the isolation by studying the local flora; a Boston gentleman, who made collecting trips to New Mexico for thirty years; a Los Alamos scientist and amateur botanist; university professors of botany; and college students who bought a second auto and spent a summer holiday collecting. “Though they have sometimes been contemptuously referred to as ‘taxonomic hay’ by other biologists,” Anderson concluded, “herbarium specimens can be quite romantic in their own dry way.”⁸

Anderson’s experiment is easily replicated: page through museums’ accession lists, and you will see hundreds of names of people who contributed specimens to scientific collections, from a few odd skins to tens of thousands. Read taxonomists’ checklists—which give for each species the name of the naturalist who first described it, and when—and you will glimpse a living community of collectors and naturalists stretching back 250 years, in which amateurs have the same honor and dignity as the most eminent professionals. Species collectors are as diverse as the species they collect, and no other community of scientists preserves such a deep sense of its collective identity and past. Taxonomists’ elaborate system of keeping track of names, which anchors each species to the name historically first given to it and to the actual specimen first described—the “type” specimen—keeps the past forever present. All sciences have their heroes and founding myths, but taxonomy is about the only one with a living memory of all past contributors, famous and obscure.

Scientific collecting was (and is) also an unusually complex and varied kind of work. Collecting expeditions are more complex socially than anything one might find, say, in a biochemistry or gene-sequencing lab. They require a great deal of book knowledge, but

also practical skills of woodcraft and logistics, as well as firsthand experience of animal habits and habitats. Modern natural history is an exacting science whose practitioners must also cope and improvise in difficult field conditions. Collecting expeditions afford an experience of nature that mixes scientific and recreational culture in a way that lab sciences never do. Collecting parties usually travel light and depend on local inhabitants for information and support, making survey collecting a diversely social experience. And because of that diversity, the identity of scientific collectors has been less fixed than that of laboratory workers. In the black box of modern expeditionary collecting, there is much of interest.

We know nature through work, the environmental historian Richard White has observed, whether it is poling canoes against the current of a great river (his particular case), or building dams across it to tap its energy, or hauling fish out of it, or diverting its waters for irrigated farming—or, historians may add, studying its hydrology and natural history.⁹ So too is our scientific knowledge of nature acquired through the work of mounting expeditions; observing plant and animal life; and collecting, preparing and sorting specimens. Historians have only recently begun to address the work of field science.¹⁰ And of all the field sciences, natural history survey is an exceptionally inviting subject—because the work of systematic, scientific collecting is so varied.

One is also struck, paging through scientific inventories of species, by the lumpiness of the history of their discovery. Species have accumulated steadily, but more rapidly in certain periods than in others. The first such period of discovery was the Linnaean: roughly the second half of the eighteenth century. Then, after a pause of a few decades in the early nineteenth century, another period of rapid discovery set in from the 1830s to the 1850s, which I shall call “Humboldtian,” after the encyclopedic author of *Cosmos*, Alexander von Humboldt.¹¹ Following another pause, the pace of finding and naming again quickened from the 1880s into the 1920s, by which time a substantial proportion of vertebrate species had been found and named. Since the mid-twentieth century the pace of discovery of new vertebrate species has been a fitful trickle (though lists of invertebrates grow ever longer).

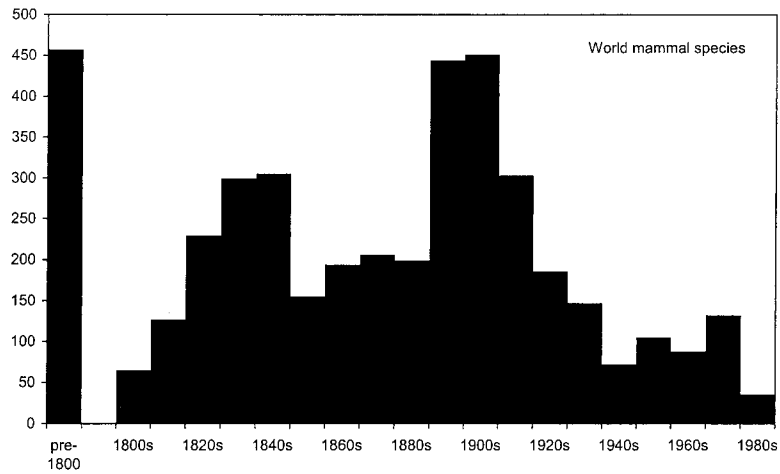
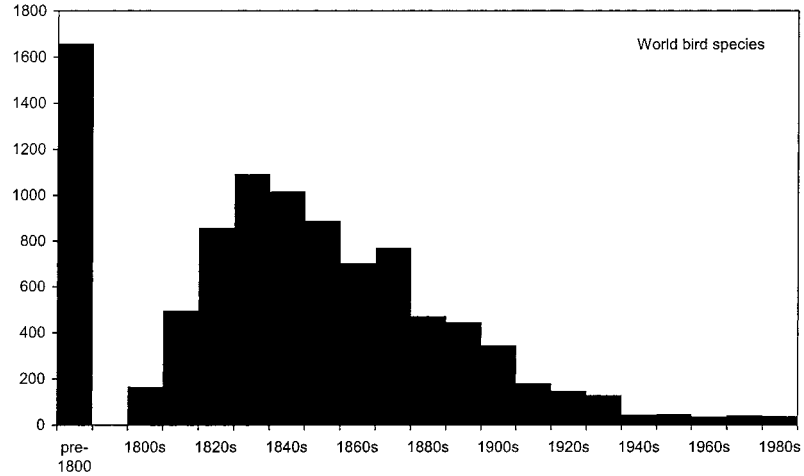
These cycles of collecting and naming vary a good deal from one group of animals to another, depending on their accessibility and interest to us. Those that are large, fierce, freakish, beautiful, edible,

lovable, or dangerous were inventoried early on. These include birds, carnivores, primates, and large game. Inconspicuous or insignificant creatures, or those that do not appeal—because they are slimy, cold-blooded, annoying, nocturnal, or just very good at avoiding our notice—were not fully inventoried until the surveys of the late nineteenth and early twentieth century or even later. These groups include rodents, bats, insectivores, amphibians, and reptiles.

Birds—those visible, audible, and beloved objects of watchers and collectors—were so well inventoried in the Linnaean and Humboldtian periods that the discoveries of the later survey phase show up as mere blips on a declining curve of discovery.¹² (Fig. 1–1.) In contrast, discoveries of mammalian species display the most pronounced cyclic pattern, with marked activity in the first two phases, but the most productive collecting in the survey period.¹³ (Fig. 1–1.) The pattern for North American mammals is even more pronounced, with discoveries more concentrated in the 1890s, and the earlier peak shifted from the 1830s and 1840s to the 1850s and 1860s. Different groups of mammals show some variation in this basic pattern. Most carnivore species were described in the eighteenth century, and most of the rest in the 1820s and 1830s—we humans have taken a keen interest in our closest competitors. Rodents, in contrast, were hardly known to Linnaean describers and not fully known to science until the age of survey, when it first became apparent just how prolific of species this group has been—it would appear that the Creator loves rodents as well as He does beetles. (Fig. 1–1.) Insectivores display the same strikingly lumpy pattern of discovery; as do also Chiroptera (bats), though with a stronger period of discovery in the mid-nineteenth century and a less striking peak in the early twentieth. Discoveries of North American reptiles and amphibians also display this periodicity, though less markedly: relatively few were described before 1800, most in the 1850s, with small peaks in the age of survey and after.¹⁴ (Data on world species of these groups is either absent or harder to tabulate.)

These distinctive periods in the pace of collecting and describing suggest that the process of discovery was not random and individualistic, but that individual efforts were synchronized by larger cultural, economic, and social trends. This is not a novel thought. It is a commonplace (and doubtless true, as well) that early modern naturalists were inspired by the flood of new knowledge that was

CHAPTER 1



a by-product of the expanding global reach of European trade and conquest.¹⁵ And we now also know that Linnaean taxonomy grew out of the widespread interest in Enlightenment Europe in state-sponsored agricultural improvement, including schemes for acclimatizing exotic species to northern countries.¹⁶

It is also clear that the early-nineteenth-century flowering of collecting and naming resulted from the greater affordability of transoceanic steam travel and from European imperial expansion and settlement, especially in the rich tropical environments of the

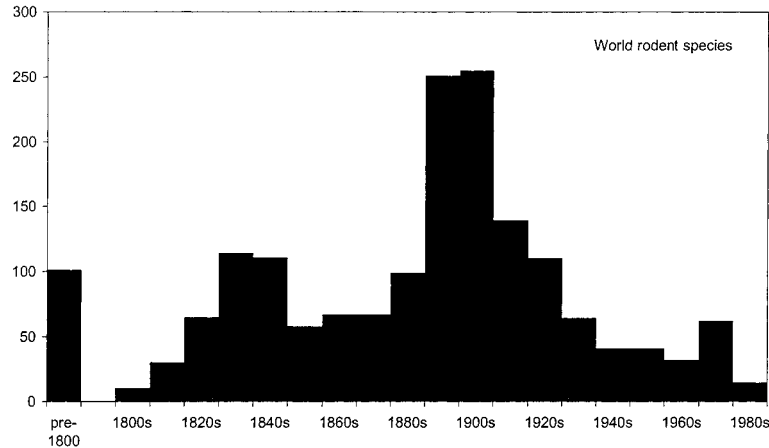


Fig. 1–1. First descriptions of bird (1a), mammal (1b), and rodent (1c) species, by decade, showing peaks of collecting and discovery. Sources: Charles G. Sibley and Burt L. Monroe, Jr., *Distribution and Taxonomy of Birds of the World* (New Haven: Yale University Press, 1990); and James H. Honacki, Kenneth E. Kinman, and James W. Koepl, *Mammal Species of the World: A Taxonomic and Geographic Reference* (Lawrence, Kans.: Allen Press, 1982). Graphics courtesy of Jack Kohler.

southern hemisphere.¹⁷ In North America, naturalists like John James Audubon followed the military frontier into the species-rich environments of the southeastern United States. And the western boundary and transport surveys of the 1850s took naturalists like Spencer Baird into the faunally diverse and virtually unworked areas of the American West.¹⁸ No one has tried to map the historical geography of taxonomic knowledge onto that of imperial expansion and settlement, but I would expect a close correlation. If trade has followed flags, so also have naturalists and collectors. Access was crucial: wherever improved transportation technology and colonial infrastructure afforded ready access to places previously expensive or dangerous to reach, there the pace of discovery of new species will soon pick up.

The third of these cycles of collecting—I have without fanfare been calling it “survey” collecting—is the least well known and the most surprising. We do not think of the late nineteenth and early twentieth centuries as being a great age of discovery in natural his-

tory; but they were. One need only peruse the annual reports of national and civic museums to appreciate the enormous enthusiasm for expeditions and collecting. In the United States alone dozens or scores of collecting expeditions were dispatched each year to the far corners of the world between 1880 and 1930: hundreds in all, or thousands—perhaps as many as in the previous two hundred years of scientific expeditioning.¹⁹ They certainly produced as much knowledge of the world's biodiversity as any of the earlier episodes of organized collecting.

It was in the age of survey that scientists became fully aware of the world's biodiversity. In places that were explored but not intensively worked, like the American West or much of South America, faunas and floras that had seemed closed books were reopened and vastly expanded. In its first two years of operation in the western states, the U.S. Biological Survey turned up seventy-one new vertebrate species—an abundance that some zoologists found hard to credit.²⁰ Inventories of vertebrate animals became so complete that subsequent discoveries of new species became media events. Why, then, has this phase in the discovery of biodiversity remained the least well known?

One reason is that collecting expeditions were mostly small and unpretentious, unlike the grand voyages of imperial exploration. Scientific collecting in the age of survey was accomplished mostly by small parties (three to half a dozen) whose purpose was to send back not exotica and accounts of heroic adventure and discovery, but rather crates of specimens. It is the dramatic explorations of the earlier periods that have caught the eye, because they were designed to catch the eye—of investors, princes, publishers, readers, chroniclers.²¹ It is no accident that the heroic voyaging of eighteenth- and early-nineteenth-century explorers—Cook, Vancouver, Lapérouse, Humboldt, Bougainville, Murchison—is well documented and remembered. Or that historians have dwelt on the feats of American explorers from Lewis and Clark to later ventures like the Harriman Alaska Expedition, or the adventures of polar explorers, rather than on the more numerous but less flashy modern discoverers of biodiversity.²² Still, this imbalance needs to be set right, and I hope this book will help do that.

My version of this history is of necessity an exploration, not a survey, because the empirical foundations for a more comprehensive treatment have yet to be laid. I deal not at all with the earlier

episodes of collecting and inventory, only with the survey period of the late nineteenth and early twentieth centuries. Nor do I offer a global and comparative history of natural history surveys, but treat only those organized by American institutions. Many of these surveys took place within the United States and its North American neighbors, in part because state and national governments supported only surveys of their own political territories. Civic museums, however, did have a global reach, and I have made use of historical evidence from expeditions to South America and elsewhere, because the evidence is rich and pertinent. My subject is American natural history collectors and collections—not collections of American animals.

Globalism and cross-cultural comparison are in vogue these days among historians, but these ideals should not deter us from studies of a particular time and place. Comparative methods are for subjects that have a well-developed history, which this one decidedly does not have. Besides, survey and collecting, even more than most scientific practices, are specific to particular natural and cultural environments. They can be properly understood only by intensive study in their particular contexts. For example, histories of Linnaean or Humboldtian collecting will necessarily focus on western Europe and its empires; here American work is the sideshow. Transcultural and transtemporal comparisons will be highly rewarding, but for now they are beyond our empirical reach. We have not yet entered a survey period in the history of natural history.

Another limitation of this history is that it treats mainly vertebrate zoology and some botany, but insects and other invertebrates hardly at all. (The “all” creatures of the title should not be taken too literally.) This is not an arbitrary limitation: survey collecting in my period, especially by museums, concentrated on vertebrate animals, because scientific fieldwork piggybacked on collecting for exhibits of vertebrate animals. (Insects, plants, and mollusks did not have quite the same potential for eye-catching displays.) In addition, invertebrates are discouragingly numerous for comprehensive survey inventories, and they remained the province of amateur specialists long after vertebrate animals became the objects of organized survey. Invertebrates have recently become the object of systematic inventory, but in ways quite different from earlier surveys.

CHAPTER 1

Like any scientific (or any cultural) practice, natural history survey had its particular period and life cycle. It arose out of a particular set of environmental, cultural, and scientific circumstances; ran its course; then gave way to new and different ways of studying nature's diversity. It was especially well developed in the United States, though not exclusively there. My aim is to describe what natural history survey was in its heyday, the reasons it flourished where it did, and how it worked in practice.

Readers should approach what follows not as the last word on the subject, but as a reconnaissance. I hope it may inspire further study, and one day perhaps the full, comparative survey that the subject deserves.

NATURAL HISTORY SURVEY

But what exactly was natural history survey, and how did it differ from other, earlier modes of collecting? It was organized, systematic, and sustained, in contrast to sporadic individual efforts; at least, that was the ideal. In practice, natural history surveys varied widely. Some were little more than summer projects of college professors and their students, who set out to inventory the plants and animals of their state or region. The Nebraska Botanical Survey organized by Charles Bessey and Roscoe Pound was the best of this type, but there were many lesser ones. Other surveys were more public and institutionalized, like the U.S. Biological Survey founded by C. Hart Merriam, which was in animal biogeography what the U.S. Geological Survey was in topographical and geological mapping. Research museums like the Museum of Vertebrate Zoology at Berkeley or the University of Michigan's museum undertook systematic survey collecting of a region or state. Finally, large civic museums like the American Museum of Natural History in New York or the Field Museum in Chicago organized systematic collecting of animals and plants not just in North America but in South and Central America, Oceania, and other parts of the world. But whether it was the private passion of one man or an official government project, and whether it lasted months or decades, natural history survey was organized, planned, and long-term. It aimed at a comprehensive, total inventory. Survey expeditions produced vast public collections, in the millions of speci-

mens, all prepared and arranged according to standardized procedures (again, the ideal).

It is useful to contrast survey with exploration, though the categories overlap. Explorers liked places little known to people of the West: places that were hard to reach and where the infrastructure of modern travel and communication did not yet extend. Exploration was an activity of world frontiers, where agricultural and commercial societies were pushing into regions of hunting-gathering or swidden farming. Often exploration was prologue to war, trade, or settlement, and voyages of exploration served mainly commercial, military, or political ends, and only incidentally scientific ones. Scientists attached to exploration parties were frequently guests and hangers-on, more tolerated than encouraged, and their collecting was catch-as-catch-can. Of course, we should not underrate the role of pure (or impure) curiosity: Europeans are a famously curious people and attracted to the exotic, and voyages of exploration were often voyages of discovery as well.²³ But scientific discovery was more a by-product of exploration than its intended purpose.

Survey collecting expeditions, in contrast, were primarily scientific ventures, dispatched to map and inventory the world's flora and fauna. Although economic and nationalistic rationales were often deployed to get funding for surveys, their aim in practice was to gather facts about the earth and its natural history. The trend was toward science. In the United States, for example, the Mexican Boundary Survey and railway surveys of the 1850s were primarily military and political and only incidentally—though very productively—scientific. The great western surveys of the 1870s were officially economic and imperial but three of the four were led by naturalists pursuing knowledge of the region's natural history. A decade later the U.S. Biological Survey began officially as a project in economic biology but soon became openly what it was always intended to be: an all-out faunal survey. Survey expeditions in their heyday were generally organized by universities or civic museums, and staffed by curators and biologists who could set itineraries and schedules to suit their own aims, not someone else's. Whereas exploratory collecting was catch-as-catch-can, survey collecting was methodical and guided by scientific agendas. Whereas amateur and commercial collectors valued novelties most highly, survey collectors put equal value on full and exact knowledge of known and common species and on detailed mapping of the ranges of all the

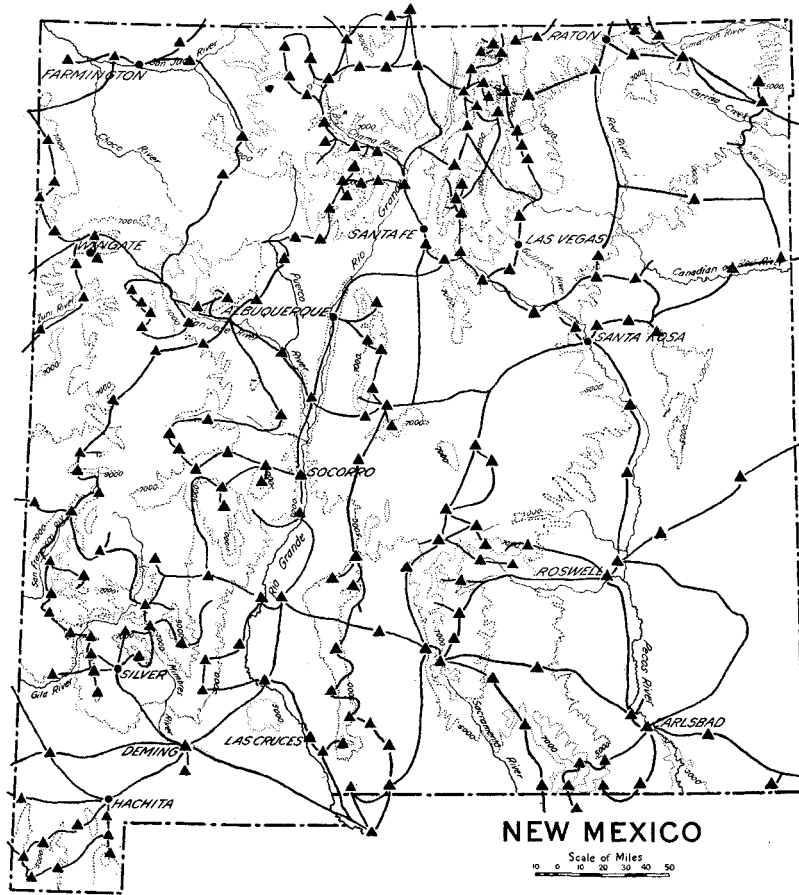


Fig. 1-2. Routes and collecting stations of U.S. Biological Survey parties in New Mexico, showing the crisscross pattern typical of intensive survey (prepared by Vernon Bailey). In Florence M. Bailey, *Birds of New Mexico* (Albuquerque: New Mexico Department of Fish and Game, 1928), p. 14.

species within biogeographic regions. Explorations typically skimmed the cream of nature’s biodiversity; surveys were as thorough and complete as time and hard work could make them. Explorer-collectors were opportunists; survey collectors made plans and executed them as best they could.

Most important, survey collecting was both extensive and intensive. Field parties surveyed whole regions but paused regularly at collecting sites or “stations,” where they worked intensively for days

or weeks. And they returned repeatedly to a region until its biodiversity was thoroughly inventoried and its biogeography mapped in detail. Explorations, in contrast, were extensive but generally not intensive. Their itineraries marked out linear projections across territory for the purpose of reconnaissance, not complete inventory; they meant only to sample. Survey collecting also differed from the practices that later became the dominant mode of field biology from the mid-twentieth century. These practices were intensive but not extensive and addressed some particular theoretical issue (say, in population genetics or ecosystem ecology) rather than making an inventory. It was the combination of both extensive coverage and intensive local work that gave natural history survey its distinctive character. It was a transitional, mixed practice, combining the extensive element of exploration with the intensive features of modern, empirical science. This combination of extensive and intensive practices is a point on which much will hang.

I want to say that natural history survey was an “exact science” but cannot, because that term has come to refer more narrowly to the sciences that can be reduced to mathematics, like mechanics or astronomy. So I can only say that natural history survey employed exact methods, and that it was an “*exacting*” science. The word gets the idea across without claiming too much: survey was methodical, systematic, and disciplined. Although the term “*exacting science*” is not an actors’ category, it is not an anachronism either. The terms “exact” and “exact method” were widely applied to all the empirical sciences in my period, including sciences of the field, and exactness seems to have been understood as the hallmark of modern science.

Exploration and survey were also carried on in different kinds of places. Although unexplored regions were tempting to survey collectors, because they were likely to harbor undiscovered species, most expeditions were dispatched to places that were already known and partly settled by Europeans; places that were still wild but also accessible. It is one thing for explorers to transit uninhabited or hostile territory, but quite another for field parties to carry out intensive survey collecting beyond the infrastructure of settled society.²⁴ The logistics of receiving regular shipments of supplies and returning bulky shipments of specimens kept collecting parties close to railroad and telegraph nets. If exploration was an activity

of frontiers, biological survey was distinctly one of “inner frontiers”—a concept I will explain shortly.

Survey and exploration also gave participants different experiences of place. Explorers were always just passing through; survey collectors lingered and revisited. Explorers treasured the exotic; survey teams aspired to make places familiar, to know them as well as if they lived there (though they could never quite do that). Survey collecting lost none of its cultural worth, as exploration did, by being carried on in semidomesticated places, because adventure was not one of its purposes, as it was of exploration. It was the display of courage and resourcefulness that gave authenticity to explorers’ efforts to know the world. For survey naturalists it was the other way around: if a survey turned into an adventure, it was a sign that something had gone wrong in its planning or performance. Survey knowledge was local or “residential” knowledge made systematic and scientific.

Finally, survey collecting was carried on in a particular scientific context. It was a practice of the downward slope of the discovery curve—recall the graphs of the rates of species discovery. It was collecting in a situation where many or even most species were already known and described. It was not filling in the very last gaps (which requires more serendipity than system), but making maps and inventories essentially complete—say, 90 percent. Survey collecting was a mode of fieldwork suited to a situation in which a complete inventory was a realistic aim, but where the species remaining to be discovered and described were not excessively rare. That is one reason why survey collecting was both intensive and extensive: for complete stocktaking, collectors could leave no corner unexamined and no stone unturned.

Collecting in other periods was quite different: for the Linnaeans it was often a matter of mining existing collections and texts. All those known species ready for proper scientific names and pigeon holes—it was hardly essential to go afield at all (though many naturalists did, or ran networks of local collectors). Collecting on the upward trend of discovery, in a Humboldtian mode, required fieldwork but was more extensive than intensive. In places newly opened to naturalists, collectors did not have to be systematic and exacting to reap rich rewards of new species. Opportunistic cream-skimming—collecting whatever was most easily collected—was more cost effective than trying to get every last, hard-to-get species.

(Much collecting in this period was done by commercial collectors, for whom time was money.) And after the survey period, when inventories of species were substantially complete, collecting tended to be intensive, local, and focused on solving some particular problem—“project” collecting, we might call it. When only a few percent of species remained to be collected and described, the rewards hardly justified full-scale survey. Natural history survey was poised between cream skimming and gleaning. Earlier it was not necessary; later it did not pay.

Little has been done to classify and compare different kinds of collecting practice, but one thing is sure: that they will differ depending on the degree to which inventories are already complete. Collecting is not one activity but a diverse family of practices—and a subject ripe for historical survey.

Why did natural history flourish when it did in North America and elsewhere? What kind of society would invest in comprehensive collecting and inventory, and what kind of scientists invested careers in survey fieldwork? How were expeditions justified and financed, and how did they operate in the field? These are the themes of the story I want to tell, and it turns out to be a more complex story than one might imagine. To tell it requires a mix of historical genres: environmental history of “inner frontiers,” to begin with; then a social history of nature-going; and some cultural history of artistic representations of nature. Institutional history is also required: of the museums that organized collecting expeditions, and of the patrons who paid for them, and of changes in curators’ professional role that allowed them to go afield as collectors. Methods of science studies and history of science are required to deal with field practices, and methods of intellectual history to explain how taxonomic categories changed with collecting practices.

The practices of survey collecting depended on a whole set of environmental and social conditions. One was a continent (North America) and a world that had only recently been knit together by cheap and rapid steam transport, making nature physically accessible. Another was a culture whose interest in nature was becoming more naturalistic than sentimental, and that made survey science seem familiar and (so to speak) natural. Third, scientific institutions evolved (universities, museums, government agencies) that supported field collecting that was both far-ranging and exact. And finally there was a taxonomic science that for the first time had

data that were more or less complete and could turn new facts from the field reliably into scientific discoveries and careers. The practices of survey science were specific to these circumstances, as those of Enlightenment and Victorian natural history were to the institutions, cultures, and events of European exploration and expansion. None of these elements—an abundant nature, the cultural incentives to scientific study, and institutional rewards for discovery—by itself accounts for the popularity of natural history survey: but taken together, they do. That in a nutshell is the message of this book.

As history, natural history survey is doubtless a harder sell than either exploration or experimental field science. On the one side it lacks the romantic appeal of exploration, with its grand voyages, its cast of flamboyant, self-fashioning characters, and its aura of heroism and imperial power. On the other side, survey lacks (or seems to lack) the grand theories and exact experimental methods that we now accept as exemplary of modern science. Few survey naturalists and collectors have brand-name recognition, and many are obscure figures who passed inconspicuously across the stage of history. The creatures that fired their interest were likewise often rather unromantic: weedy plants, lizards and snakes, small nocturnal rodents that few of us could find even if we wanted to and could not tell one from another if we did. We associate survey work with “mere” collecting, observing, record keeping, and pigeonholing: practices often taken to be a lower kind of science—what scientists do before they are able to do proper experiments or theoretical modeling.

Yet it is these very qualities that make natural history survey a particularly rewarding historical subject. Its varied cast of characters, its intimate relation with the culture of vacationing and outdoor recreation, its combination of high science and craft practices, the ambiguous careers and scientific identity of its practitioners—all pique historical interest. Besides, as the distant descendents of Adam and Eve, the first people to survey and name, we should know how we have become acquainted with our fellow passengers on our biodiverse celestial ark.

Let us begin then with nature: the ambiguous, liminal nature of the inner frontiers.

INNER FRONTIERS

In 1893 the historian Frederick Jackson Turner famously declared that the frontier of Euro-American settlement had become history. He took his cue from the U.S. Census Bureau, which in 1890 announced that the westward-moving frontier of settlement was so broken up by scattered pockets of settlement that it was no longer a line at all. The frontier had ceased to be a significant feature of North America's human geography.²⁵ With the end of the Indian wars in the 1870s, no part of North America except the taiga and the polar north was occupied by migratory hunter-gatherer societies. Every part of the American West was inhabited by Euro-American agriculturalists: the Hispano-American settlements of the Southwest; the expanding homesteading areas of the high plains; the Mormon irrigation settlements in the Great Basin; the coast and valley farms and orchards of Oregon and California; the mining and logging camps of the western mountains.²⁶ Farther east, older settled areas of New England and Appalachia were being unsettled, as hill farmers sold up and moved west to homestead. The North American landscape was becoming a mosaic of intermingled settled and uninhabited areas—a continent not of one linear frontier but of varied inner frontiers.

Historians ever since Turner wrote his famous essay have been much exercised over the significance of the “closing” of the free-land frontier—in modern terms, the displacement of mobile hunter-gatherer societies by intensive agricultural ones. Although Turner's views of the formative influence of the frontier on American society and politics have long been discarded, his ghost still haunts American history. Environmental historians still begin with Turner, if only to signal that they are untainted with the academic heresy of geographical “determinism.”²⁷ But perhaps Turner's ghost is hard to exorcise because he was on to something. How people settle, inhabit, and experience places does profoundly shape their culture and politics.²⁸ The human geography of America did change in fundamental ways a century ago, with the transition from a two-zone to a mosaic landscape. However, it was not the end of geographical influence, as Turner believed, but a transition from one kind of geographical influence to another: from the sharp

gradient of a settlement frontier to the shaded gradients and ambiguous landscapes of inner frontiers. The experience of these inner frontiers was crucial to Americans' evolving conceptions of nature and culture, I believe—and also to field naturalists' changing ideas and practices.

Here is the argument. For a period of some four or five decades, from the 1870s to the 1920s, the landscape of North America afforded an unusual intimacy between settled and natural areas. Densely inhabited and wild areas were jumbled together. Areas of relatively undisturbed nature, with much of its original flora and fauna intact (except for large game animals and predators), were accessible to people who lived in towns and cities, with their cultural and educational institutions. It was this combination of wildness and accessibility that defined the inner frontiers. No longer were densely settled and cultivated landscapes separated from relatively unsettled ones by a demographic and cultural line, as had been the case for more than two centuries. Nor was the landscape—yet—so extensively occupied that natural areas were reduced to small relicts and artificially preserved parks and refuges, as was increasingly the case in much of North America after the mid-twentieth century. To experience nature in the inner frontiers one did not cross a line where the infrastructure of settled society stopped and travel became suddenly much slower, more expensive, and hazardous. Nor was it—yet—a problem for biologists to discover places to study nature *au naturel*, rather than as isolated and degraded preserves.

In the intermingled landscapes of the inner frontiers, the boundaries between wild and settled were unusually extensive and permeable. Opportunities for working and knowing nature and rethinking its cultural meanings were unusually rich, especially in natural science but also in other outdoor pursuits, like hunting and camping. Some of the best evidence of what life was like in the inner frontiers comes from popular sport and recreational magazines, and naturalists' reports.

What made the inner frontiers so extensive in this period was the inflationary way that the western half of America was settled after the end of the Civil War. This was the age of railroad booms and homestead and timber acts, which constituted one of the greatest giveaways of state lands in modern history. It was comparable in scale to the medieval forest clearances in Central Europe, and

much faster. The politics of sectionalism and manifest destiny; the expansive dynamism of an intercontinental market economy; and a commercial culture that put the highest value on owning property and turning natural resources as quickly as possible into money—these elements combined to produce a period of rapid, unregulated, and ragged settlement and cycles of land exploitation and abandonment.²⁹

The historical geographer Carville Earle has argued that American frontier expansion was always cyclical, with periods of inflationary geographical expansion alternating with periods of relative stability. These cycles of restlessness and land speculation were driven by macroeconomic business cycles, Earle argues, and came to an end in the 1840s, when population growth in the most densely settled areas outstripped that in newly opened frontier areas.³⁰ However, the expansion of the late nineteenth century in the West appears to be another of these inflationary pulses—it was simply the first to take place in an urbanizing world.³¹ Earle's schema seems quite consistent with the concept of inner frontiers.

It was not population pressure in eastern urban areas that drove the inflationary westward-driving phase of settlement, but economic and cultural forces: nationalist zeal and the quest for quick speculative profits. The social machinery of rectangular survey and wholesale land grants to states, railroads, projectors, and homesteaders were designed to encourage rapid occupation.³² This period of inflationary settlement was characterized by homestead bubbles in marginal dry lands, boom-and-bust mining and timbering, and a transportation infrastructure built out well in advance of economic or demographic demand. Some areas were settled too rapidly, while others were too hastily abandoned. The result was a mosaic landscape of dense settlement mingling with lightly occupied or abandoned areas.

Some of these inner frontiers were places unsuited to intensive human uses—too dry, too wet, too sandy, too rugged. The Lake Michigan dune area east of Chicago was such a place—a lightly inhabited island left behind in a sea of cornfields and expanding suburbs.³³ The sand region of central Illinois was another such place. Here a tributary of the Illinois River had piled up a large inner delta of sandy glacial outwash, which was too dry and infertile for cornbelt farming, and too forbidding (with local names like “Devil’s Neck” and “Devil’s Hole”) even for the vacationers and

nature worshipers who flocked to the lakeshore dunes. Such areas remained inner frontiers in the middle of one of the most intensively cultivated regions in the world.³⁴ Farther west on the semi-arid high plains were the large badland areas of the Dakotas and other places, bizarrely etched and rapidly eroding areas in which few plants can grow and/or humans live—wild islands in a sea of productive ranchland. Farther east there were the sandy pine barrens of southern New Jersey, a mazy wilderness in an area of intensive truck farming, where outsiders were almost certain to lose their way.³⁵

Another island of nature in the agricultural heartland was the so-called driftless area centered in southwest Wisconsin. Once an island between two lobes of the continental ice sheet, this area is a preglacial landscape of wooded ridges and valleys. Less fertile than the sheets of glacial till that surround it and too hilly for machine agriculture, this area remained a refuge for plants and animals, as it was surrounded by a rising sea of agriculture—a kind of human glaciation.³⁶ The cold and rugged uplands of the Adirondack and Catskill mountains likewise remained islands of wild and semiwild country—tourist islands, eventually—in a landscape webbed by towns, canals, and railroads.³⁷

Actual islands are relatively rare in the interior of North America, but they too can afford protection against human change. Isle Royale in Lake Superior, for example, was protected by its isolation and rugged terrain from clear-cut logging and the spectacular fires that scorched the northern cut-overs. The copper-mining boom of the 1840s was short-lived and relatively undestructive; and relicts of mining and lake shipping, plus a growing tourist industry, provided access and ready-made facilities for visiting naturalists.³⁸

Great swamps like Virginia's Great Dismal Swamp, or the Everglades and Okefenokee in Florida, or much of the Gulf coast constituted another kind of inner frontier: islands of wild and inaccessible nature close to coastal cities.³⁹ These were created when rising postglacial sea levels flooded estuaries and low peninsulas. But the greatest areas of marsh and swamp were in the glaciated regions of the upper Mississippi Valley and Great Lakes, where they covered much of northern Indiana, northeast Ohio, southeast Michigan, and parts of northeast Illinois. This vast wetland was created in the most recent advance and retreat of the Laurentide ice sheets, which bulldozed established drainage systems, then covered them



Fig. 1-3. "Mountain Resorts of New York" (1884), showing the pockets of wild nature within an enveloping transportation web, characteristic of inner frontiers. In Walton Van Loan, *Van Loan's Catskill Mountain Guide* (New York: Walton Van Loan, 1888).

with moraines and layers of till. Stream and river systems were slow to reform because in this flattened terrain back-cutting erosion was very slow. Differences of just a few feet of elevation could send waters to the Atlantic or the Gulf of Mexico. Bypassed in the early westward migrations, these wetlands remained largely intact in the late nineteenth and early twentieth centuries. Likewise the glaciated regions of northern Iowa, Minnesota, and the Dakotas, with their marshy sloughs and countless prairie pothole ponds. Much of northern Minnesota, with its thousands of interconnected lakes, is a low indefinite watershed—three, in fact: north to Hudson Bay, east to Lake Superior, and south to the Mississippi.

These coastal and interior wetlands were potentially rich agricultural areas, but expensive to drain; in effect, humans had to do in a few decades what it took nature ten or twenty millennia to achieve. There may originally have been 125 million acres of swamp and seasonally flooded land in the United States—an area the size of France—of which an estimated 80 million acres remained undrained in 1915.⁴⁰ Some had simply been bypassed for more accessible land farther west; in others, speculators “preempted” huge tracts and set them aside unused for decades until rising land prices made drainage projects economical. Thanks to the quirks of American land and tax laws, large areas were not drained and plowed until the 1910s; meanwhile they remained pockets of undisturbed nature teeming with wildlife—a vast inner frontier to entice naturalists and collectors.

In the Central Valley of California in the 1910s, where large-scale reclamation projects were rapidly transforming delta and desert into irrigated monoculture, Joseph Grinnell could still find patches and strips of “waste” land that harbored their original rosters of small mammals.⁴¹ In the lake and swamp district of northern Indiana, despite decades of draining and road building, the zoologist Carl Eigenmann could still report in 1895 that the whole region “gives one the impression that it has changed but little since the ice left it.” It was hardly pristine: dams and ditches had turned swamps into ponds and streams; but enough was left to attract sportsmen and naturalists.⁴² The Huron River valley in southeastern Michigan, with its kettle ponds, moraines, bogs, and swamps, was an outdoor ecological preserve for biologists at the University of Michigan, and just minutes away by urban trolley.⁴³

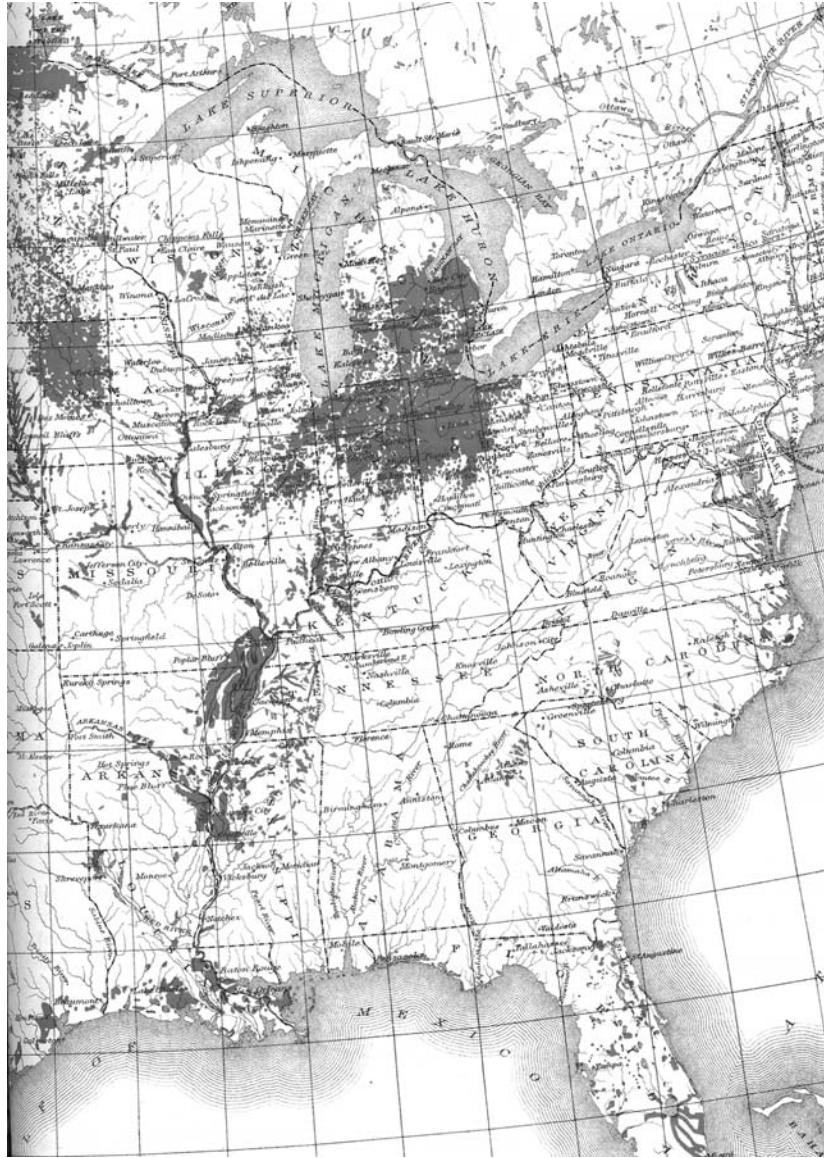


Fig. 1-4. Wetland drainage operations active circa 1920, indicating immense area of wetlands close to densely settled areas, especially in the upper Middle West. In "Irrigation and Drainage," vol. VII of *The Fourteenth Census of the United States, Made in 1920* (Washington: Government Printing Office, 1922), p. 348.

The largest remaining areas of wetland in 1920 were in the Southeast and Gulf Coast states, especially Florida; but significant portions of the marshes of the North Central states still survived, though the more accessible parts in Ohio and Indiana had been drained.⁴⁴ A map of active drainage projects circa 1920 vividly reveals both the vast size of the original wetlands and the monumental efforts that were made in the 1910s to turn these inner frontiers into productive agricultural landscapes.⁴⁵

Large river floodplains were also extensive inner frontiers before reclamation enclosed and destroyed them in the 1910s and 1920s. The Mississippi Valley was one of the great flyways of North America, providing continuous and relatively undisturbed habitat for animals and huge flocks of migrating birds. The Illinois River, before it was leveed in the 1910s, was an important commercial fishery and a popular center for sport fishing and fowling, just a few hours train ride from Chicago. Its floodplain forests had been timbered but only selectively, leaving much intact, and floodplain fields produced alternating crops of fish and corn as they flooded and dried out in an annual cycle.⁴⁶ River towns with a well-developed infrastructure of boat building and repair gave sportsmen and collectors ready access to a wilderness of sloughs, swamps, and oxbow and fluctuating lakes—an inner frontier. So did other major deltas and floodplains, for example, the delta of the Sacramento and San Joaquin rivers in California, where in 1918 the mammalogist Joseph Grinnell worked “the frontiers of reclamation” and tried to stay one step ahead of the dredgers and dikers.⁴⁷

The roster of inner frontiers could be extended: for example, to the deserts of the Southwest and Southern California; the canyon country of the Colorado Plateau; and the caprock canyons of west Texas, where southern and northern faunas mingled.⁴⁸ The well-watered mountain massifs rising like islands out of southwestern deserts remained, because of their desert isolation, remote and untouched even as large cities grew nearby. The San Francisco Mountains of Arizona, for example, were a popular resort for naturalists decades before becoming a tourist mecca. Scouting Arizona’s deserts for a site for a field station in 1903, botanists Daniel MacDougal and Frederick Coville were attracted to these peaks: “charming situations in the mountains of the desert, remote from civilization, rich and remarkable in their flora, furnished with an abundance of pure, never-failing water, and altogether delightful



Fig. 1–5. The Illinois River at Havana, a sport and commercial fishing area in the middle of one of the most intensely farmed regions of the world. A kind of inner frontier. Courtesy of the University of Illinois Archives, Urbana-Champaign, Illinois, Record Series 39/2/20, photo file ADA 12–2.

in their surroundings . . . treasure spots for the camping naturalist.” (They settled for a more accessible and convenient site on the outskirts of Tucson.)⁴⁹ The Panamint and other mountains arising out of the California deserts were similar places, and the rugged high country of the Sierra Nevada and Rocky mountains remained quite wild, yet accessible to visitors via old trails and stage roads. Farther north, dense coastal rain forests were more forbidding islands of nature (some interior parts of the Olympic Mountains and Vancouver Island were virtually impassible), but at the heart of an urbanizing region.

The deciduous forests of the southern Appalachian Mountains were another inner frontier, preserved in part by the rugged, unglaciated terrain, and in part by local land-use customs. Hardscrabble hill farmers occupied mainly the bottom lands of valleys and their lower slopes, using the wooded mountain slopes lightly for foraging pigs and livestock, hunting, and selective timbering, and for

operating illegal moonshine stills. The result was a forest area lightly inhabited and used, but well supplied with trails. Residents notorious for their suspicion of outsiders further increased the region's isolation. It was biotically very rich—for a million years and some seventeen ice ages it had been a refuge for northern species forced south by cold—yet remained incompletely known into the 1920s and 1930s.⁵⁰

An inventory of remnant old-growth forests in 1920 showed substantial areas in the Pacific Northwest and western Montana; in coastal Florida, especially the panhandle; and in the lower Mississippi River Valley. Smaller areas remained in the mountains of central Appalachia, in Northern Michigan and Minnesota, and in the mountains of the Northwest. Eastern old-growth forests were mere vestiges of the vast forests that covered much of the region in 1850, but in places like the Adirondacks or White Mountains they constituted islands of wild nature in a largely humanized landscape.⁵¹

Other inner frontiers were created by quirks of capitalist economics and landholding laws that gave access to wild places without (for a time) completely transforming them. There was no more powerful force creating inner frontiers than railroads and interurban trolleys. The peculiar economics of the highly capital-intensive railroads made it rational for railroad companies to build lines into areas well before there were any people there to use them. It was better to lay down track and take losses up front than to leave potentially profitable areas open to competing roads. This “logic of capital,” as William Cronon has termed it, was especially marked in the roads fanning out into the western prairies from Chicago. The western transcontinental railroads, which became vast landholders as a result of huge grants of public land, also became powerful promoters of rapid settlement in the agriculturally marginal areas of the prairie-plains transition. To stimulate settlement—or to simulate it—railroads plopped down standardized “towns” at regular intervals, hoping that they would become centers for the collection of freight, and built dense networks of feeder lines across thinly settled countryside.⁵² This premature infrastructure gave people from cities and towns easy access to areas that had very recently been reachable only by stage-coach or on horseback and were still relatively wild, but now just hours away from cities to the east and west.

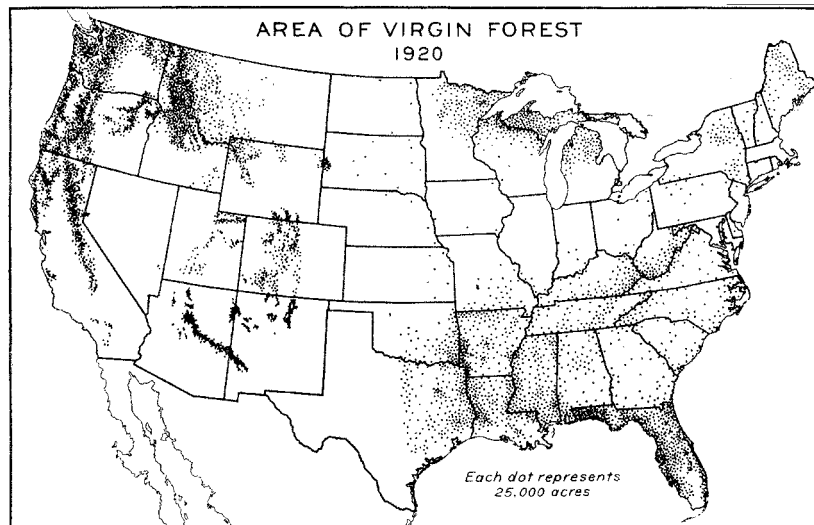
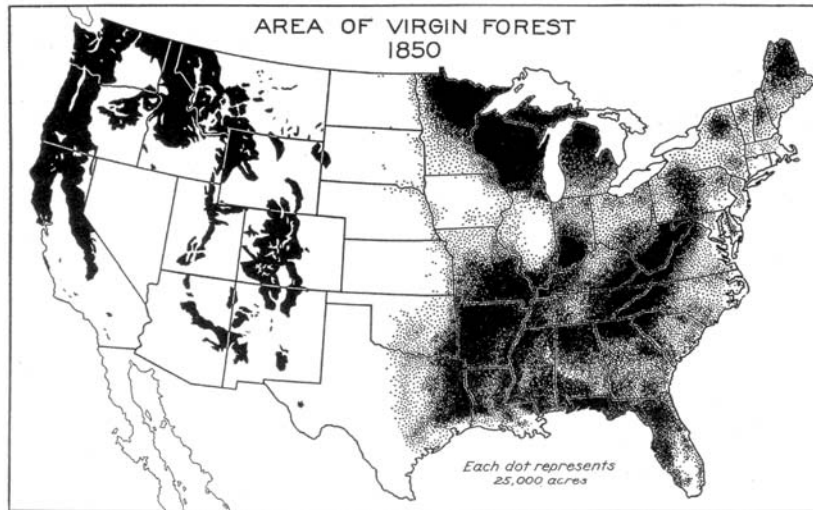


Fig. 1-6. Old growth forests remaining in 1850 and 1920—an indicator of vestigial inner frontiers. In William Greeley, "Relation of geography to timber supply," *Economic Geography* 1 (1925): 1-11, pp. 4, 5.

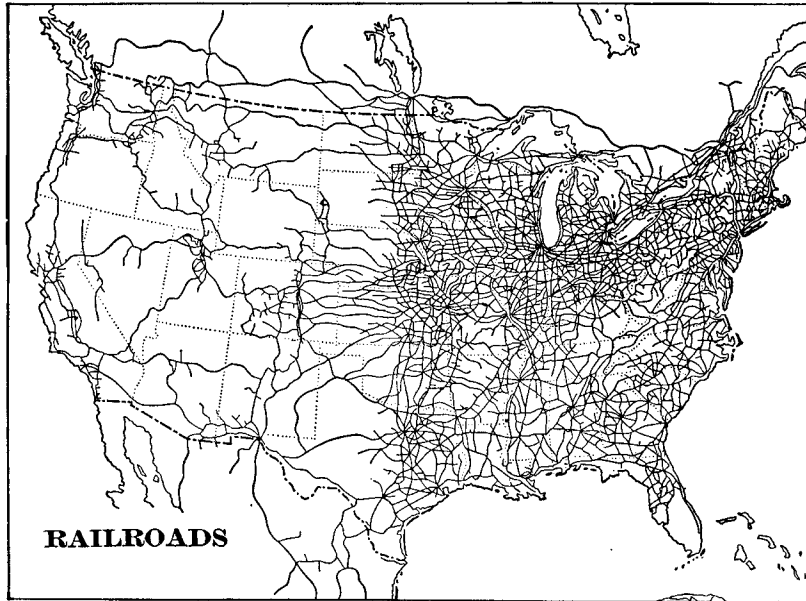


Fig. 1-7. Trunk railway lines, late 1890s. Note the islands of relative inaccessibility in the West, Southeast, New England, and the upper Midwest. In Jacques W. Redway and Russell Hinman, *Natural Advanced Geography* (New York: American Book Co., 1901), p. 60. This map was evidently adapted from "Gray's New Trunk Railway Map of the United States" (New York: Charles P. Gray, 1898).

In 1887, for example, a local botanist in Hastings, in south-central Nebraska, found a stretch of original prairie just five miles from town, where the only signs of human presence were an old wagon track and abandoned sod huts. This biotic island was created by the hop-skip geography of prairie settlement. The earliest settlers took homestead claims in the Platte River valley, believing that to be the best land (because it was wooded); the second wave, arriving on the transcontinental railroad, settled along the rail line, where land was cheap and well advertised. In between river and railroad, strips of untouched prairie remained within a few miles of a city of twelve thousand.⁵³

A similar process played out in the regions of boom-and-bust logging and mining. In the pineries of the upper Great Lakes, which were cut from the early 1870s to the mid-1890s, networks of local railroads built to haul out lumber remained in place when the pines were gone and the loggers moved on, to haul in sportsmen and

naturalists.⁵⁴ Here too railroads were active promoters of settlement and of the recreational industry that replaced logging as an economic mainstay after the pineries were stripped. Natural areas that just a few years before had been accessible only by logging parties or sportsmen with Indian guides could be reached comfortably in less than a day and at reasonable cost from urban centers. And as the outer fringes of the railroad frontier pushed into ever more remote areas of North America, naturalists were never far behind. When a line was built in 1931 to the edge of the arctic tundra at Churchill, on Hudson Bay, parties of naturalists arrived soon after, to see a biome that until then would have required a full-fledged expedition to visit.⁵⁵

Railroads encouraged tourists and naturalists by offering cheap excursion fares, building hotels and roads in prime recreational areas, lobbying for national and state parks, and providing information on transportation and lodging in tourist regions.⁵⁶ They also on occasion provided information to amateur and commercial collectors, publishing lists of rare plants and directions to find them—much to the dismay of botanists, who often found only the holes where rare species had been dug out.⁵⁷

Areas of logging, mining, and commercial fishing remained surprisingly natural even as they were cut down, dug up, and fished out. The archaeologist Harlan Smith recalled his boyhood summers at Bay Port, Michigan, on the western shore of Lake Huron in the late 1870s and early 1880s, when extractive logging and fishing were in full swing. The signs of human depredation were everywhere: “The beach was strewn with drift wood from the mills perhaps ten feet wide and continuous. The heads of dead sturgeon were so close together on the beach that you were seldom out of smelling distance.” Yet the wildlife was abundant—turtles, snakes, even bears. The real change came when the place became a summer resort. Revisiting the place in 1910, Smith found it, in effect, gone: “the country had so completely changed in appearance and was so much fenced up that it simply made me sick,” he recalled. The beach was so built up that he could not land a boat.⁵⁸ The initial assaults of loggers and commercial fishers had created a landscape that was nothing like the aboriginal landscape of Indian hunter-gatherers; but it was still biodiverse and could recover quickly in a natural succession. After all, die-offs and clearances by fires and blights are natural occurrences. Suburbs are not.

CHAPTER 1

The history of the Illinois River illustrates the same point. In 1900 the City of Chicago opened the Chicago Drainage Canal, which redirected the city's raw sewage away from Lake Michigan and into the upper reaches of the Illinois River, down which a putrid tide oozed slowly south to the Mississippi. Although the initial impact of this assault damaged river wildlife, a decade later an ecological survey showed that the river had largely recovered. Indeed, the influx of nutrients seemed to have increased the river's fish populations. The greater danger, the ecologist Stephen Forbes warned, was the headlong draining and leveeing of the river's floodplain (from 6,700 acres in 1899 to 124,205 acres in 1914) that was already destroying the rich river fisheries by draining seasonal breeding grounds and turning the river into a barren and unhealthy drainage ditch.⁵⁹ Boom-and-bust exploitation of natural resources created the inner frontiers; permanent settlement and landscape engineering brought their era to a close.

TWILIGHT ZONES

Closer to town, access to rural countryside was also eased by the massive building of suburban and interurban electric trolleys from the 1870s on. Here too the logic of capital prevailed, as trolley companies extended their routes into the deep countryside well before there were large numbers of suburbanites there to ride them into town. It was cheaper to lay down track and run cars where no one yet lived than to buy out competitors later. Companies also banked on the fact that cheap transport would draw commuters to their catchment areas and eventually give them a profitable monopoly—which it did. The result was an inflationary expansion of suburban zones. By 1870 cities were surrounded by suburban fringes fourteen times the size of the inner walking city. By 1900 this zone had doubled again in area and extended five to fifteen miles out. This process was further accelerated between the wars by the advent of the family automobile and paved roads.⁶⁰

Eventually, of course, exurban fringes became suburbs, and suburbs became city neighborhoods, obliterating the natural environments that had attracted people to the fringes in the first place. But for a brief period the logic of capital gave town and city dwellers ready access to what was still deep countryside. In just a few hours



Fig. 1–8. A “twilight zone” on the exurban fringe of Colorado Springs, Colorado, showing a relict patch of bunchgrass prairie. In Frederic E. Clements, “The relict method in dynamic ecology,” *Journal of Ecology* 22 (1934): 39–68, p. 42.

on interurban trolleys, city dwellers could ride to collecting areas that previously could be reached only laboriously by horse and carriage on unimproved roads.

The “twilight zone between town and country,” as the ecologist Frederic Clements once called it, was a good place to find vestiges of presettlement floras—sometimes the only place. In corn or wheat belts, mechanized agriculture had so thoroughly destroyed the original savanna and prairie vegetation that suburbs and vacant lots were the last refugia of the region’s native plants. The ecologist Arthur Vestal was amazed to find a patch of original California prairie in the vacant lot just a few doors from his home in Stanford.⁶¹ Twilight zones were hardly picturesque, to be sure, but they afforded an “intriguing” experience of nature as both wild and humanized.⁶²

The nature writer John Burroughs, who worked as a government clerk in Washington in the 1860s and early 1870s, found the city and its environs a naturalist’s paradise. Unlike northern commer-

cial cities, the capital city had not yet sprawled, “and Nature, wild and unkempt, comes up to its very threshold, and even in many places crosses it.”⁶³ Diverse species of birds inhabited the grounds of the government buildings, and the ravines of Rock Creek, between Washington and Georgetown, were semiwild areas full of wildlife. “There is, perhaps, not another city in the Union that has on its very threshold so much natural beauty and grandeur, such as men seek for in remote forests and mountains,” Burroughs rhapsodized. “There are passages . . . as wild and savage, and apparently as remote from civilization, as anything one meets with in the mountain sources of the Hudson or the Delaware.”⁶⁴

In the mid-1880s the ornithologist Frank Chapman pursued his avocation while commuting to a job as a bank clerk in New York City; his commuter stop was right in the middle of one of the best birding areas in the region, at least in migration seasons. The experience was as interesting and exciting as any in his subsequent career.⁶⁵ Naturalists were delighted when the American Association for the Advancement of Science decided to hold its 1886 meeting in New York City, because of the “wealth of attractive places for collecting near at hand,” especially in the “New Jersey collecting grounds.” A decade later the biologist Henry Linville found abundant animal life for his students in the Fort Lee Woods, just across the Hudson River from Manhattan, and in the wilds of Staten Island.⁶⁶ Hard to believe now, winding in heavy traffic through the endless subdivisions, but so it was, and not all that long ago.

And in Chicago too: the city made by railroads and the paradigm of rapid urban sprawl.⁶⁷ In the early 1900s an ornithologist friend of Joseph Grinnell’s, Frank S. Daggett, found excellent bird collecting in the suburbs and surrounding country, a few hours away by trolley. Or he would take a train thirty or forty miles out and float back to town down the Des Plaines River in his folding boat, observing and collecting. In the migration season Daggett did not have to go farther than the local city parks, so abundant was the bird life. “These are great migration times here nowadays,” Daggett wrote Grinnell in spring 1904, “the parks are loaded with birds . . . and people shooting them with opera glasses.”⁶⁸ Harry Swarth, another Grinnell protégé, who worked at the Field Museum, would leave his house at about nine, ride an hour and a half on the street car, and return by four-thirty with twenty-five birds or more. Fox Lake, which was a few hours away by railroad, was

a center of sport hunting and also a fine place to collect small mammals; the woods were full of shrews, mice, chipmunks, and gophers. Swarth spent three months collecting on the estate of the museum's president just forty miles south of the city.⁶⁹

In the early nineteen-teens collectors found rare animals and even new species in the Sacramento delta, not too far from San Francisco. And Joseph Grinnell collected successfully on the fringes of Central Valley towns—so long as he stayed outside the patrolling range of resident cats.⁷⁰ Florida at the turn of the century was a naturalist's and collector's paradise—a vast island of almost untouched nature readily accessible from major towns. Here is Frank Chapman's description of a farmstead where he collected, just five miles from downtown Gainesville:

It is a beautiful place, surrounded by ground of almost every character, pines, scrub-oak, low hummocks, and the old clearings, and is thus an excellent place in which to trap. There is probably no wilder region in the vicinity. . . . [H]ere the family have their home, a magnificent large log house, and a mile further on, their orange grove, the finest in this region.⁷¹

Not all inner frontiers were unintended. National forests were set aside for future use or recreation. Amounting to just a few million acres in 1890, mostly in the Sierra Nevada and Cascades, national forests expanded by 1910 to some 200 million acres, mostly in the western mountains. A further 40 million were reserved in the northern Great Lakes, Ozarks, central Appalachians, and New England.⁷² In these eastern regions underused or abandoned areas reverted to public ownership through default and purchase. The Adirondack National Park was created in this way in a region still partly forested and wild, and the Green Mountain National Forest (in the late 1920s and 1930s) in a state that just a generation earlier had been largely open land.⁷³ In effect a national commons, national parks and forests were generally accessible (eastern forests were laced with walking trails), but off the beaten tracks they remained quite wild.⁷⁴ Private game parks were another kind of nature preserve, numbering at least 500 in 1910 and some as large as 60,000 acres, though not always accessible to scientific collectors.⁷⁵

Rural cemeteries and school yards were other places where vestiges of nature could be found, as were Indian reservations, if they were not overgrazed. Also railroad rights-of-way, because they

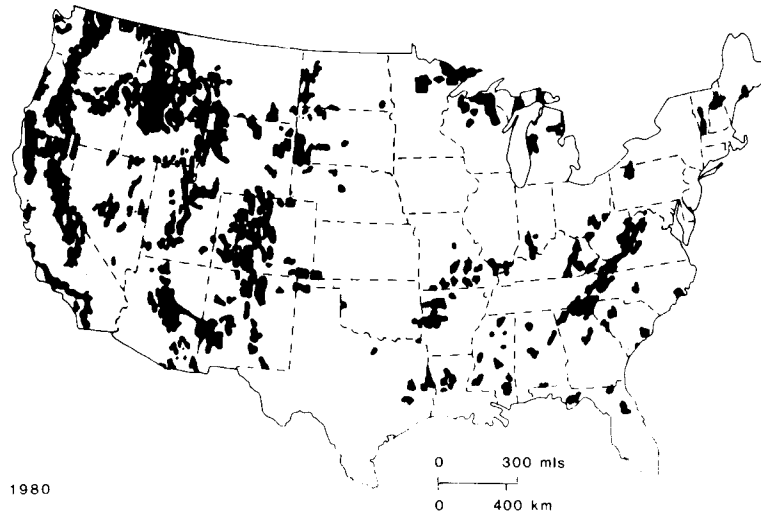


Fig. 1-9. National Forests in 1980. In Michael Williams, *Americans and Their Forests: A Historical Geography* (New York: Cambridge University Press, 1989), p. 408.

were fenced and regularly burned, as the original prairies had been by Indian firing, but with coal-fired locomotives now providing the sparks. Town parks and unkempt rural roadsides were other refugia in the exurban “twilight zone.” Roadsides were ready made for ecological survey transects.⁷⁶ Such vestigial bits of nature might seem poor places for systematic collecting, but for a few decades there were enough of them around rural towns to serve the purpose. In 1916 a group of ecologists selected Charleston, Illinois, for the site of a survey of invertebrate fauna and found all they wanted in railroad rights of way, an old-growth woodlot (clear-cut just a few years later), and bluff and floodplain forest.⁷⁷ Of course, these vestiges of nature were a vanishing resource. Exurban frontiers were relentlessly on the move, engulfing fields and filling in vacant lots. But between 1880 and World War I this twilight zone was a prominent feature of America’s inner frontiers.

The opening up of underpriced farmland in the West also created inner frontiers by drawing population from settled areas farther east. Watching suburbs engulfing farms and forests has made us unused to thinking of abandonment and depopulation as common events in history (except in inner cities); but they are a recurring

feature of the periodic waves of aboriginal dispossession and westward movement. For example, this cycle played out in South Carolina in the 1820s and 1830s, as leading planter families moved west en masse to newly opened lands in Georgia and Alabama.⁷⁸ Nor was abandonment a phenomenon only of places people left. Settlers in frontier areas often bought land that was poor for farming because it was cheap, and because in the feeding frenzy of land rushes they wrongly assumed that the price of any land must rise, and then learned the truth the hard way. So in many areas settlement and abandonment were concurrent processes.⁷⁹

The late nineteenth century was another time of mass migration and abandonment, driven this time by western homesteading after the end of the Plains Indian wars. Homesteading had long been the favored way to get public lands into private hands quickly. It had always been speculative and volatile, making large tracts of land available at prices well below their actual value, spreading the virus of land fever. And as homesteading expanded into the western prairies and semiarid plains, it stimulated a large-scale abandonment of the poorer agricultural regions of the Northeast.

New England (though never depopulated) was the region where wholesale abandonment was most marked, from the 1870s or even earlier. The original settlers of interior New England had preferred to situate their farms on hills than in river valleys, owing to the easier transport on high ground. But as the thin upland soils gave out, people moved into valley towns, leaving the hillsides to revert to woodland. Then as cheap land beckoned in the west, farmers moved out altogether. The state of Vermont, once wholly cleared, reverted to forest within a matter of decades.⁸⁰ A study of farm abandonment in New York State in the 1920s showed that the acreage of farmland in 1924 was just 81 percent of what it had been in 1880; and the pace of abandonment was accelerating (60,000 acres per year between 1880 and 1910; 140,000 in the 1910s; and 270,000 in 1920–25). Near cities, farms became suburbs, but in the Catskill and Adirondack mountain areas and the hilly country of south-central New York they became forest.⁸¹

A Depression-era survey reckoned that 2.3 million acres of cleared land reverted to forest or was suburbanized in New England between 1880 and 1910, plus 0.77 million in the Mid-Atlantic states. Another 13 million acres were abandoned by 1930. The greatest percentage declines in cleared land were in New England

and New York, eastern Michigan, eastern Virginia, and the interior Southeast.⁸² The shift from wheat to dairy farming, first in New England and New York, then in Wisconsin, produced a mosaic landscape of pasture and second-growth forest.⁸³

A few decades later massive abandonment also occurred in the western plains, as the homestead frontier pushed into the semiarid zone west of the hundredth meridian, where cultivation gave way to ranching. In this climatically volatile region, a thirty-year cycle of wet and drought first lured farmers into marginal areas, then drove them out. One such cycle coincided with the inflationary phase of homesteading in the 1880s; another produced the great plow-up of the southern plains in the 1920s and the subsequent dust-bowl out-migration. Another is presently under way in the northern high plains.⁸⁴ Traveling the American west in 1913 on an ecological survey, Frederic Clements counted hundreds of abandoned farms—“dead homes”—and ghost towns in central Oregon, southern Idaho, and South Dakota. Areas a hundred miles across were almost entirely depopulated, and it was even worse in the southern plains. (The “live homes” were even more distressing than the dead ones, Clements felt: bare one-room shacks in bleak and hopeless situations.)⁸⁵ Cheap-land frontiers thus became inner frontiers: object lessons in human hubris and favored sites for natural history surveys.

The same pattern of settlement and abandonment occurred in logging and mining areas in the forests of New England, the upper Great Lakes, and the Rocky Mountains, as well as in river fisheries. It was not homesteading that drove the boom-and-bust cycles of resource use, but the legal system that sold rights to cut or mine public land for a pittance. Boom-and-bust harvesting of resources reached a crescendo after the Civil War, when market competition caused loggers, miners, and fishermen to treat natural resources as placer deposits, to use or lose, rather than as bases for sustainable livelihoods. The western public lands resulted from the way that the United States had grown politically, by huge purchases or expropriations; and Americans’ devotion to states’ rights and laissez-faire political economy made these lands a virtually unregulated commons. The result, as is usual where there is no customary system of usufruct rights and mutual obligations, was a commons tragedy.⁸⁶ Clear-cut logging and abandonment from the Great Lakes pineries to the rain forests of the Pacific Northwest; mining

booms and busts in the Rockies and Sierra Nevada; fishery cycles of bonanza and collapse in the Sacramento and Columbia rivers—all left behind stump lands and depleted soils, ghost towns and valleys choked with mining debris, and half-emptied and impoverished coastal villages.⁸⁷

Logging and mining towns were built and briefly inhabited by people who came not to stay and make a life, but to make their fortunes as quickly as possible and leave. Marginal homesteads were occupied by farmers who expected to “improve” the land, sell at a profit, and move on within a few years. The extractive industries of the late nineteenth century (including tillage agriculture) depended on resources that had accumulated over centuries and millennia and afforded once-only chances to make a financial killing. Placer gold deposits are the classic example, but it is equally true of white pine forests, loess soils, and mountain forests, which follow (respectively) large fires, melting continental ice sheets, and rains of volcanic ash. Tillable high plains are likewise a temporary gift of recurring climate cycles.

Americans’ boom-and-bust practices of settlement and land use thus produced a patchwork landscape of densely and lightly settled areas. Whether skipped over, newly settled, or recently abandoned, these inner frontiers were served by a transportation infrastructure more than adequate to the needs of recreationers and visiting naturalists. In such places, town dwellers could experience nature without setting aside urban perceptions. And out of this meeting of culture and nature came new conceptions of their relation. Only rarely has so much semiwild nature been so accessible as between 1870 and 1920; nor is it likely to recur, barring some catastrophic change in global climate or the natural history of human epidemic diseases. As the cheap-land frontier shaped American culture before 1870, so too did the inner frontiers of the 1880s to 1920s, in ways we are only beginning to understand.

IMPRESSIONS

What was it like to visit the inner frontiers? What did they look and feel like? Ecological journals are full of photographs of such places; but photographs, especially those made artlessly as a scientific record, quite fail to evoke the experience of places so far from

town culture yet so near. To capture the meaning of such liminal places, literary documents—word pictures—are more evocative and revealing.

For example, the stories told by hunters and fishermen in sporting journals offer vivid glimpses of what life was like along the railroads that were pushing into the northern plains and north woods in the 1870s and 1880s. Sportsmen were among the first urbanites to take these lines into the inner frontiers, and they possessed literary genres—the fish story and sporting travelogue—designed to evoke their experiences for armchair readers. Sportsmen are famous for stretching the truth, and the credibility of their exploits depended on their ability to give detailed and vivid evocations of natural places and phenomena (more on that in chapter 2). So they make engaging witnesses.

In 1877 the angler-writer “Will O’ the Wisp” reported on a trip on the Wisconsin Central Railroad’s newly completed line to Lake Winnebago and Ashland, in the North Woods. Winnebago, he discovered, offered good fishing but it had already been claimed by “the noble army of tourists.” The country northwest to Stevens Point was beautiful agricultural country, but ruffed grouse had been exterminated by cultivation, and prairie chicken (which thrived in the patchwork landscape of woodlots and fields) had yet to appear. Farther north, conifer forests were being cut, but with Indian guides, the fishing and hunting was good, though not quite what was claimed by tourist promoters. “Will O’ the Wisp” found the country unimpressive but provided with good accommodations and not overrun by hunters, and it was an easy trip from Chicago.⁸⁸ “Will Wildwood” took the same trip and reported a landscape altered by logging and railroads, yet still attractive to vacationers and sportsmen. It was stripped of its white pine, but islands of hardwood remained among the boreal conifer, and the woods were dotted with lumbering hamlets and camps.⁸⁹

About the same time, another sportsman-writer, “Ingomar,” wrote of a trip on the Northern Pacific Railroad into northern Minnesota and Dakota Territory. Before the railroad, Ingomar recalled, this region was virtually inaccessible, and hunting and fishing “was the hardest of hard work; nothing but trails to travel on, without a house or white man’s habitation from Lake Superior to the Mississippi River.” Now, Pullman cars took sportsmen and their wives and families to hamlets that afforded good hotels, teams and

guides, and reasonably priced weekly stage service into the deep boreal forest along the Canadian border, which was “one vast game preserve.”⁹⁰

Such reports, even discounting sports writers’ hyperbole, give some sense of what it was like to gain access to vast stretches of nature that just a few years before had been the domain of Indian hunters and the most well-heeled and adventurous sportsmen. There was a sense of a new world of nature suddenly opening up; of a world that had before been experienced virtually, through the memoirs of big-game hunters and heroic naturalists, now accessible to middling sorts. There was a sense of the immediacy of nature, and its diversity and richness; and of the intimacy of being so easily in the middle of it all. What had once been accessible through books and travelogues became immediate, lived experience for a generation or two of sportsmen and naturalists.

Many naturalists who came of age in this period later recalled their childhood experiences of twilight zones. Francis Sumner, for example: he grew up on a small orchard farm in the hilly fringe of Oakland, California, and spent his days (he was schooled at home) roaming the hills and ponds; making pets or specimens of birds, eggs, toads, and small mammals; poking sticks in ant hills; and observing the hidden life of nature. (Returning thirty years later he found the place a tawdry, jerry-built development.) As a preteen living in the inexpensive outskirts of Colorado Springs, then a village of 2,500, Sumner hiked in the canyons of the nearby Front Range and collected fossil ammonites and Indian artifacts. As a teenager in Minneapolis, again on the sparsely settled outskirts of the city (the best his impecunious family could afford), he roamed the woods and lakes with shotgun ready, observing the wildlife and feeling “the thrill of real exploration,” and later trying his hand at taxidermy. It was not science that intrigued him then—it never occurred to him to consult books of natural history—but nature and the pleasures of discovering it for himself.⁹¹

The ecologist Henry Gleason recalled his boyish rambles in the outskirts of Decatur, Illinois: “We were not interested in any phase of science or nature study. We merely absorbed nature-lore without books or teachers. We were the only boys who knew where to find the big ‘river-bottom’ hickory nut or the coffee tree. We knew where the ground robin nested and we picked up crinoid stems from the gravel banks.”⁹² The political cartoonist and conserva-

tionist Jay “Ding” Darling had similarly vivid memories of the vast wetland areas of the Dakotas:

The potholes and marshes of eastern South Dakota were the chief points of interest when I was a kid. . . . As soon as school was out and I was old enough to be turned loose on my own, I spent all my summers riding our old family horse out of Sioux City across the Big Sioux and into South Dakota and herding anybody’s cattle who would give me a job. . . . [T]he lakes and marshes of eastern South Dakota . . . still form my pleasantest recollections. It was the disappearance of all that wonderful endowment which stirred the first instincts I can remember of Conservation.⁹³

The naturalist Paul Errington counted himself lucky to have been just old enough to experience, as a boy in the late 1910s, “the last of the primitive abundance of the Dakota prairies, and the irreparable changes since then are most disheartening to a naturalist of my taste.”⁹⁴ This was the quintessential experience of the inner frontiers: a sense of abundance and endless novelty, yet readily accessible—not a resource to be exploited, or a wilderness to be fought and tamed, but a place to be discovered and understood.

A fixture of biologists’ reminiscences and obituaries, such stories are a literary trope: a foretelling of the future scientist in the curious youth. But they also bear witness to experiences of actual places and of a particular time in the environmental history of North America. They are stylized recollections of what it felt like to inhabit the twilight zone, where wild (or wildish) nature was experienced through the ideals of town culture. So it is no surprise that the trope of the boy-naturalist especially appealed to the naturalists whose careers happened to intersect with the inner frontiers. It was an element out of which scientific identities were constructed.

Abandoned regions also had a special feeling. Vestiges of a human presence in vacant places were melancholy reminders of nature’s power to outlast us and to reclaim lost terrain. Joseph Grinnell found himself in such a place in 1918 in the coastal hamlet of Morro, halfway between San Francisco and Los Angeles. It was an old dilapidated town, nothing like the usual resort towns, inhabited by Swiss and Portuguese who grew beans and cattle and lived amid some of the most abundant bird life Grinnell had ever seen. “One refreshing feature of the country,” Grinnell noted, was “the total lack of no-shooting signs. . . . Beach, marsh, sand dunes, tule

swamp, brush lands—all are open ground.”⁹⁵ (Most collecting areas were private property, and collectors were trespassers.) A few years later in Baja California Grinnell found a landscape once densely inhabited and worked and now depopulated and forgotten, but again about to change:

When you look on the map you will see various place-names, but for the most part these now apply only to ruins or merely to situations with no living person near. This is a country of the past; but there are signs of re-awakening, or rather, invasion. I saw an oil-well drilling outfit in operation near Cape Colnett! Also there is a marble quarry in action below San Quentin; and old mines are being prospected vigorously.⁹⁶

Ecologists surveying the semi-arid plains in the early 1900s were struck by the broad wagon “roads” or parallel ruts that had been abandoned a generation earlier when the railroads came through and now stood out vividly on the landscape as bands of yellow sunflowers.⁹⁷ Roads to a vanished Oz.

The north woods were full of such ghostly places. The University of Michigan’s field station at Douglas Lake was set in a landscape that had been cut and burned. “Gaunt black stubs twenty to fifty feet high were a prominent feature of the landscape, and huge pine stubs showed that a magnificent pine forest had been removed some thirty years earlier.”⁹⁸ Ulysses Cox, working at Lake Vermillion, in Minnesota’s north woods, improvised camp tables and a darkroom from remnants of a shack abandoned by one of the many homesteaders who had finally despaired of making a living in such a poor place and had moved on.⁹⁹

The hill country of the Northeast is famously endowed with signs of abandonment. John Burroughs encountered many such places in his rambles. Near the village of Highlands in the Hudson Valley, for example, he found

a rocky piece of ground, long ago cleared, but now fast relapsing into the wilderness and freedom of nature, and marked by those half-cultivated, half-wild features which birds and boys love. It is bounded on two sides by the village and highway . . . and threaded in all directions by paths and byways, along which soldiers [it was 1863], laborers, and truant schoolboys are passing at all hours of the day.¹⁰⁰

In the mid-1920s geographers studying abandonment in New York State described a poignant twilight zone: “Disintegrating

houses and barns were seen in all directions. Many buildings had disappeared entirely, and nothing but the foundations marked the site. In even more cases the former site could be located only by an old orchard or a clump of lilac bushes.” In one typical area, houses were gone on two-fifths of the farms, three-fifths of cleared land was idle, and residents lived by logging second-growth forest.¹⁰¹ Stone walls and cellar holes are a familiar and still haunting sight in the forests of the Green Mountains. These are landscapes full of ghosts and poised between cycles of human coming and going.

The notion of an inner frontier bears a family resemblance to Leo Marx’s conception of “middle landscape.” An intellectual historian, Marx invoked the idea to explicate the knot of political and social ideals that shaped American culture in the early nineteenth century: the hope that universal ownership of land would make Americans virtuous; that America could industrialize without losing its agrarian character; and that the free-land frontier would guarantee a democratic future. These ideals, Marx found, were expressed less powerfully in formal political philosophies than in literary and especially artistic representations, and most strikingly in George Inness’s painting *Lackawanna Valley* of 1855. Commissioned by the Lackawanna Railroad Company (and accepted with some misgivings by the painter of romantic landscapes), this work depicts a pastoral landscape, evidently not far from a frontier (stump-land is foregrounded), and with railroad, steam locomotive, and workshops in peaceful harmony with rural nature. In this image Inness captured the ideal of an agrarian democracy based on new land, steam-powered machines, and nature. As Marx suggested, Turner’s frontier thesis was another expression of this ideal.¹⁰²

For Marx this middle landscape was not a real but a symbolic place, a cultural and moral order embodied in an imagined landscape. Marx was dealing not with physical but “moral geography,” as he put it, because the ideals of social and environmental harmony embodied in Inness’s painting were not descriptive of American society of that or any period. In the end machines would dominate nature, and property would corrupt democratic ideals, so middle landscapes could only be places of the mind—false dreams.¹⁰³

But is the middle landscape a purely imagined place? To be sure, the scene Inness conjured up is not a particular place, but it may depict an actual *kind* of place. I have in mind interior New England in the early industrial period, when machine manufacture de-

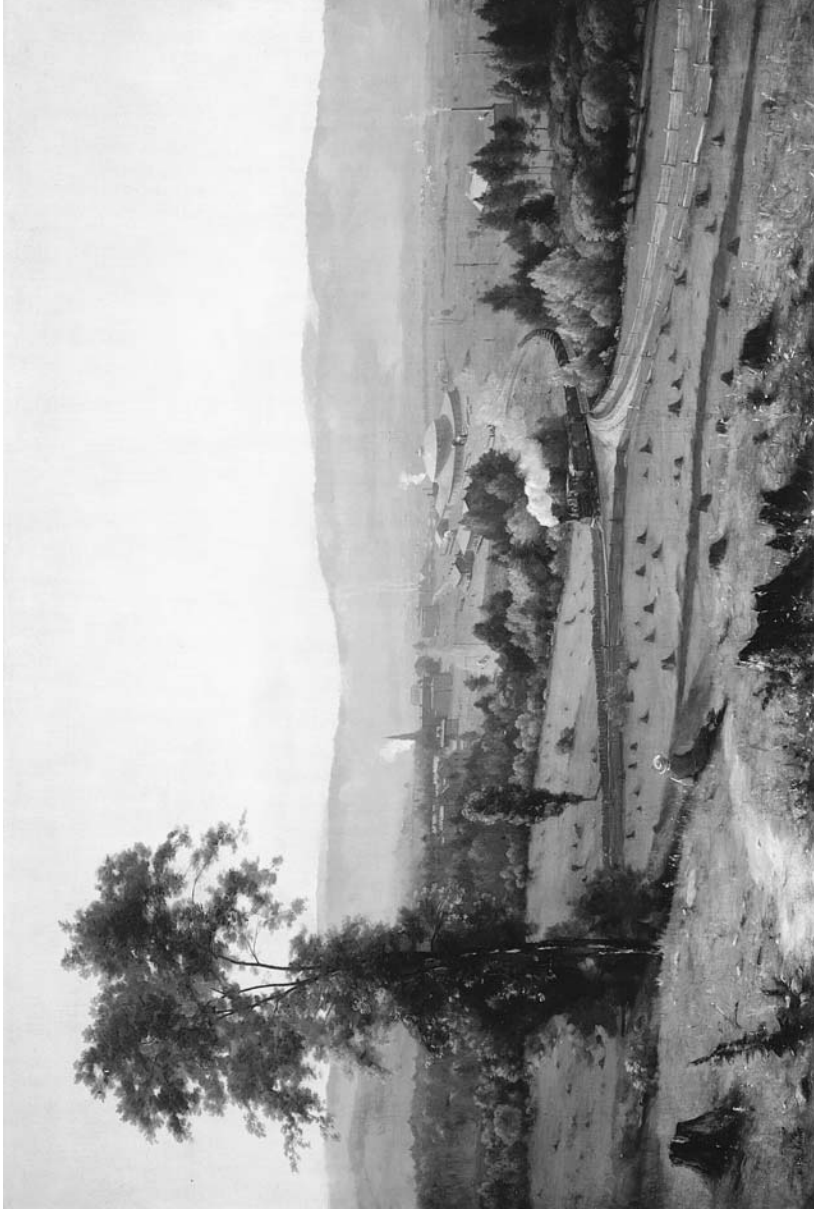


Fig. 1-10. George Inness, *The Lackawanna Valley* (circa 1855). An artistic representation of a “middle landscape,” in which nature and industry intermingle. Courtesy National Gallery of Art, Washington, D.C.

pended on water power, and factories were located wherever streams and rivers were unused, which was increasingly in the deep countryside. Steam power would soon reverse this rural dispersal; but for a few decades, there existed a middle landscape or inner frontier in which machines and nature were in fleeting intimacy. Is it fanciful to think that the experience of such places fostered an optimistic view of industrialization like Inness's vision in *Lackawanna Valley*, or Ralph Waldo Emerson's vision of a working nature?¹⁰⁴ Likewise with the inner frontiers created a generation or two later by the forced expansion of railways, suburbs, and homesteading: they too, I think, shaped Americans' perceptions of their natural world.

The point is simply that landscapes embody cultural values, as landscape historians have repeatedly demonstrated.¹⁰⁵ And partly humanized landscapes may be especially potent in evoking such sentiments, because they visibly display both our own and nature's power at the same time. If water mills in rural outbacks could foster an optimistic view of industrialization, so too might the landscapes transformed by steam technology inspire an image like Inness's *Lackawanna Valley*, with engines in the place of vanished water mills. Moral landscapes may be real in experience as well as in memory.

Historians who have used and extended Marx's concept have applied it quite convincingly to particular places. Thomas Schlerith characterizes the campground headquarters of the Chautauqua movement—a quasi-religious intellectual revival—as a “middle landscape of the middle class.”¹⁰⁶ And the historian Susanna Zetzel wittily likens Frederick Law Olmsted's Central Park to a “garden in the machine”:

[L]ike the railroad paintings and literary pastorals, it occupies a middle ground between the two extremes of pastoral ideal and urbanism. . . . From the point of view of the “frontier” the park represented civilization; from the point of view of the “city” it represented rural values. It was, in short, a pastoral “middle landscape.”¹⁰⁷

Olmsted's naturalistic urban parks were not, as many scholars have asserted, a nostalgic and phony “wilderness” into which stressed-out bourgeoisie could escape from urban turmoil. In fact, Olmsted meant parks to encourage people of all sorts to socialize, in a way that neither artificial promenades nor rural countrysides

could do. Artfully naturalistic settings, with winding walkways and greenswards, were designed to strengthen, not escape, urban folkways. They were an inner-urban twilight zone in which nature served as symbolic guarantee that urbanity was consistent with older rural values. College campuses, whose design was powerfully influenced by Olmsted's ideas (especially land-grant college campuses), were another such place.¹⁰⁸ Here parklike surroundings reassured collegians that intellect and knowledge—including knowledge of nature—had a place in a striving commercial and industrial society.

In the same way, I would argue, the mosaic landscapes of the inner frontiers encouraged Americans to see nature neither as a commodity to be used up, nor as a wilderness to be left alone, but as a place of cultural and scientific interest, to be surveyed, collected, conserved, and understood. My version of the Turner thesis.

CONCLUSION

The period of the inner frontiers was a brief moment in the environmental history of North America, spanning just a little more than half a century, and the same forces that created them worked to destroy them. Demographic pressure and a commercial society's hunger for property and profit drowned islands of nature in a rising tide of development. Tourist and vacationing economies in time did as much to alter as to preserve semiwild outbacks. And then there is automobility: nothing was as destructive of inner frontiers as the family auto and state-subsidized systems of improved roads, as countrysides were engulfed in waves of suburban sprawl.

But during the time that the inner frontiers were a dominant feature of the landscape, they made the natural world accessible in a way it had not been before. And among those who took advantage of that accessibility were collectors and survey biologists, the Noahs of nature's diversity. The surveys of the late nineteenth and early twentieth century were made possible by the new ease of getting to places that had not hitherto been intensively surveyed and collected. As the infrastructure of global trade and imperialism had opened new areas of the world to European collectors in the early nineteenth century, so did the infrastructure of national expansion and settlement open new areas to American naturalists in the age

of inner frontiers. Survey was a mode of scientific practice especially suited to such places, and place and practice arose and declined together.

But physical accessibility is only half the story. Places may be easy to get to, but if people do not have reasons to go there, places will remain unvisited and unknown. Of course, naturalists and collectors always have a compelling reason to visit places they have not yet seen: to find new things. But survey collecting involved more than trips by a few professional collectors. Expeditions required money, organization, institutional support; they depended on public interest. And comprehensive collections could not exist without large museums and herbaria to house them. Survey naturalists operated in a complex web of social relations, and many sorts of people required reasons of their own to take an interest in sending groups of collectors into the inner frontiers.

It was the inner frontiers' intimate mix of town culture and semi-wild nature that got Americans to take a scientific interest in nature's biodiversity. Accessibility brought people of various sorts into contact with deep nature, enabling them to experience nature as a part of town culture: the culture of schools, colleges, and amateur natural history societies. The closeness of inner frontiers to towns thus encouraged a more naturalistic interest in the natural world. Where the cheap-land frontier encouraged a view of nature as a commodity and exploitable resource, the inner frontiers encouraged Americans to see nature as a resource for intellectual work. In the one kind of place, nature seemed boundless for the taking; in the other, visiting naturalists were never unaware that this resource was fleeting. It was this new (or newly prevalent) way of experiencing nature that inspired patrons, museum builders, and collectors to survey America's and the whole world's flora and fauna in an organized and comprehensive way.