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The conservation landscape: trees and nature on the Great Plains

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The conservation landscape: Trees and nature on the Great Plains

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Introduction—Constructing the Conservation Landscape

For over two centuries Americans have been apprehensive about the suitability of the Great Plains for intensive agriculture, and while they devised and implemented many schemes to "fix" the landscape, their worry remained. Americans worried about the Great Plains because the land was arid and prone to recurring droughts that brought dust storms, crop failures, economic ruin, and abandonment. This made agriculture tenuous at best and disastrous at worst. To fix these troubles Americans experimented with tree planting, plowing, and a variety of cultivation practices. Congress passed repeated acts in support, from the Timber Culture Act of 1873 to the Conservation Reserve Program of 1985. University and federal experts taught farmers how to farm—to plant trees in blocks, to plant trees in wide rows, to plant trees in narrow rows, to plant on the contour, to leave crop stubble, to plow deep, and not to plow. Farmers offered their fields to these measures and helped install them. They learned to file paperwork for government assistance, and they developed their own methods and theories. When private initiative seemed insufficient, Americans created conservation agencies to undertake tree planting, grassland restoration, emergency plowing, and other direct measures. Despite these actions, Americans failed repeatedly and dramatically to impose the stability and order they desired. They tamed, at least temporarily and with great effort, some aspects of nature, but agriculture on the Great Plains today still lives in fear of the next drought.

Of all the schemes to transform the environment, the longest lasting and most persistent was tree planting. Social forestry was the belief that trees had agronomic, climatic, and social benefits. Early boosters used social forestry to inform the world that tree planting

increased rainfall and that the Great Plains was becoming America's Garden. In this newly planted Garden, settlers would find an improved version of the Eastern United States. The droughts of the early 1890s crushed facile assertions of climatic change, but, instead of abandoning trees, a new group of individuals emerged to promote planting. Professional foresters called for systematic and sustained planting. They planned to combine scientific expertise with federal power to build a series of forest reserves. Once covered with trees, these reserves would stabilize the environment and secure their professional authority. The great difficulty foresters encountered in growing trees, however, crushed their hopes of expanding the reserve system, and Plains forestry withered into a small, unglamorous field of science.

These trends seemed to reverse when drought returned in the early 1930s, and Americans once again searched for solutions to dust and economic ruin. In cooperation with President Franklin Roosevelt, foresters proposed literally to divide the nation in half with a Great American Wall of trees. The Shelterbelt Project, as it was called, at first planted more controversy than trees, and Americans and professional foresters began debating the future of tree planting on the Great Plains. The emergence of such a systematic, massive plan offered foresters an opportunity to reengineer the mistakes of nature, culture, and history, but in moving from plan to practice foresters found that planning and science had not escaped culture or history. Both were instead intimately bound together. Grandiose plans began to fade, but even as foresters downshifted to creating technical guidelines for smaller landscapes, they could not extract social, political, and natural conclusions from their science. When foresters looked out from their miniature forests, they saw another group of experts, agronomists, providing farmers with conservation assistance on the Great Plains.

Agronomy, with its greater mixture of populism and patina of comity, emerged victorious as the dominant approach to managing Plains landscapes. Agronomy was sorely tested by repeated drought cycles, but with the help of irrigation, it would remain the favored method of stabilizing the Great Plains landscape into the new millennium.[1]

Part of the difficulty Americans faced on the Great Plains was the environment. In its most expansive definition, the region stretches from Canada, through Montana, North Dakota, and the edge of Minnesota, Wyoming, South Dakota, Iowa, Nebraska, eastern Colorado and New Mexico, Kansas, western Oklahoma and Texas (Figure I.1). The region is characterized by flat, eastward rolling plains and tablelands that stretch in a broad belt across the central United States. While notable for its flatness, valleys, canyons, isolated mountains, badlands, and sandhills divide the region. The shortgrass prairie east of the Rocky Mountains consists of short, sparse bunch grasses, but varies from semi-desert to woodland. Vegetation on the eastern edge is a mixture of shortgrass and tallgrass species with cottonwood and red cedar forests common along floodplains. During the last 200 years, Americans replaced much of this native vegetation with domesticated annuals. Wheat growing dominates North Dakota and is frequent throughout the shortgrass region, as is grazing. On the eastern borders or where irrigation is available, however, corn, soybeans, and cotton dominate.[2]

Natural climatic variations created the diverse flora of the Great Plains, and the region's conversion to market agricultural only underscored that variability. Winters and summers can be extreme, even if the average annual temperatures are about 40° F in the north and 60° F in the south. The frost-free season ranges from 120 days in the far north to 235 days in the south. Average annual precipitation falls mainly during the growing season and ranges from a high of nearly 40 inches to below 14 inches. Precipitation grows lighter

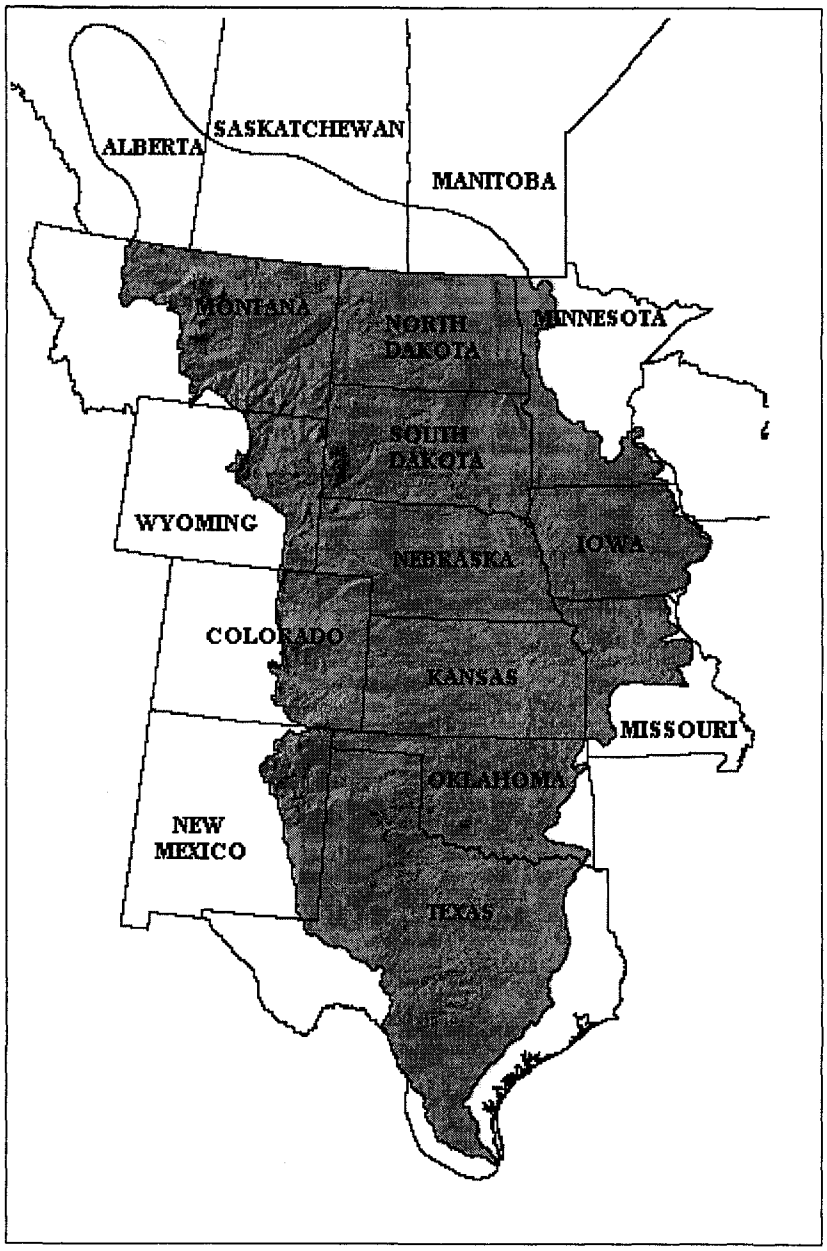

Figure I.1—The Great Plains.[3]

from east to west approaching the foothills of the Rocky Mountains, but it also varies with distance from the Gulf of Mexico and elevation. Drought is a periodic reality. Large droughts follow roughly thirty-year cycles, but shorter and smaller-scale dry periods are common within the larger cycles. Sustained droughts struck during the 1860s, 1890s, 1930s, 1950s,

and late 1980s, but of these the drought of the 1930s was by far the most severe and long lasting. Under extreme conditions even native grasslands suffered declines in cover and productivity, and the less drought-tolerant, human-introduced grasses often failed completely.[4]

It was these environmental features that inspired American efforts to transform the region. Historian William Cronon has warned against environmental histories that simply recite "innumerable minutiae about climate, soil, and vegetation without the slightest indication of why they matter to history." But natural geography has always been central to Great Plains history. When Americans first explored the region, they viewed nature as flawed and questioned its ability to support traditional agriculture. Historian Walter Prescott Webb has described how Americans eventually adapted some of their agricultural techniques to the region, but they also hoped to adapt the region to their agriculture. In the 1870s tree boosters argued that Nebraska would soon have a climate similar to Cuba, and in the 1930s serious scientists insisted that a wall of trees would turn Kansas into Indiana. While these pronouncements had no effect on nature, they did encourage settlement, and when drought struck, settlers found that they had sorely misjudged nature's malleability. Decades later when professional foresters worked on the Prairie States Forestry Project, they learned again that the Plains was not as uniform as it appeared and that its intricacies—from soil types to wind patterns—exerted irresistible influences. Perhaps most disturbing, even after careful study foresters could rarely provide assurances about nature.[5]

Science legitimized Plains forestry and soil conservation, but it was never very good at solving the Great Plains central problems. Foresters idealized science as separate from politics, culture, history, and nature. They hoped that science would reach universal and

efficient solutions. When it did not, they blamed the problem on a lack of scientific expertise, but better science could never solve problems that were at their root social, political, and natural. Foresters repeatedly moved the zone of planting to accommodate politics, rain and soil patterns, and public opinion. They justified these moves as technical decisions, but in the end they recognized that their technical estimates were often political approximations that also reflected various institutional biases. Plans for forest reserves and wide, forest-like belts were as much about profession building as science. Soil conservation on the Great Plains today still suffers from the same tendency to hope that science will solve difficult social, political, and natural troubles.

This failing of foresters and science also tells us much about how Americans viewed science and approached difficult decisions. Americans hastily settled the Plains and resisted foresters' efforts to reserve portions for the public good. Foresters' justification for creating the reserves were flawed, but had they been given time to learn this, they might have offered some useful advice for the many Americans who wanted to settle nearby lands. During the 1930s, however, Americans were in a desperate hurry to see improvement. Thus, foresters relied heavily on cottonwoods because the trees were fast growing, cheap, and attracted public attention. Unfortunately, cottonwoods were a poor choice on many sites, and the trees reduced the long-term effectiveness of the project. Perhaps most damning, Americans resisted all calls for public ownership of afforested lands. Landowners benefited from federal assistance on conservation measures, but when these same farmers plowed under trees after the rains returned, they also robbed the many Americans who paid for these measures.

The complicated story that emerges from the interplay of public opinion, science, and nature undermines traditional accounts of Plains forestry and conservation. Most narratives

have reinforced the ideal of scientific progress by framing climate-change theories as quirks of the nineteenth-century. When links between climatic change and trees were discussed in the twentieth-century, historians portrayed these debates as archaic holdovers. Real science had progressed beyond such questionable claims, yet climatic theories in fact persisted into the 1930s and beyond. In part the persistence reflected institution and reputation building. The Forest Service and scientist Raphael Zon repeatedly emphasized the potential links of trees and climate, but these claims also exposed the fundamental uncertainties of science. Even today the exact relation between land cover and climate remains a contested issue. Few "respectable" scientists would claim that massive tree planting on the Great Plains would increase rainfall, but they have had great difficulty agreeing on what other effects such a transformation might have.[6]

Historian Joseph Taylor counseled that the "persistence of simple stories about the past has been an obstacle" in environmental policy debates. This problem extends to discussions of soil conservation on the Great Plains. During the late nineteenth- and early-twentieth-century, foresters recommended planting more trees, and blamed previous failures on a lack of scientific expertise. It was not that they were insincere in their concern for settlers, but their proposed solution reflected their institutional goals rather than a careful analysis of settlement and nature. When the Dust Bowl and the scientific controversy surrounding the Shelterbelt crushed their claim, a new group of experts blamed the "plow that broke the Plains" and called for new programs aimed at educating and assisting farmers. These experts also asked the wrong questions of history. They constructed the problem of Plains settlement as resulting from farmers' unwillingness to adopt newer, more scientific technologies, but evaded environmental complexities and institutional influences. Today

most farmers have adopted conservation tillage and unsustainable irrigation, and the threat of drought remains.[7]

The history of tree planting on the Great Plains, suggests that soil conservation has long been an interaction of socially constructed conservation policies and natural processes. Institutional goals, public policies, local demands, professional and scientific agendas, and party interest all dictated the application of soil conservation policies, yet all were inextricably entangled with a natural world that alternately empowered and constrained their application. On the Great Plains, humans have still only partly to come to terms with an environment that is harsh and unpredictable. Conversely, it is *au courant* to advocate searching for ecological equilibriums or grassland stabilizations without confronting just how intertwined such ideas are with human history. Historian Donald Worster was almost certainly correct when he noted that "viewed as a contribution to the plains' ecological recovery, [the Shelterbelt Project] was of little utility; the money might have been better used to buy more abused lands, revegetate them, and set them aside as scientific and wilderness reserves," yet any alternative would have been equally embedded in institutional and professional rivalries as the Shelterbelt. And it too would likely have been shuffled, modified, and rearranged by political and social forces. Ecological recovery is a fine idea, but it, like the phrase nature, also carries "an extraordinary amount of human history."[8]

Notes—Introduction

[1] Shelterbelt describes any long row or "belt" of trees intended to shelter people, livestock, and crops. Windbreak is often used interchangeably with shelterbelt. In recent years conservation planners have favored using windbreak, or field windbreak, and abandoned the term shelterbelt. This paper adopts the older logic of referring to windbreaks as barriers planted around homes and livestock and shelterbelts as barriers planted to protect fields. This will help avoid confusion with the sources.

[2] Brian Blouet and Frederick Luebke, *The Great Plains: Environment and Culture* (Lincoln: University of Nebraska, 1977); B. L. Turner II, et al., *The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere Over the Past 300 Years* (New York: Cambridge Press, 1990); S. R. Johnson and Aziz Bouzaher, eds., *Conservation of Great Plains Ecosystems: Current Science, Future Options* (Boston: Kluwar Academic, 1995).

[3] This is a modified version of the United States Geological Survey, Earth Resources Observation System, Data Center, "Digital Elevation Shaded Relief Map of the Great Plains."

[4] Blouet and Luebke. See also, James C. Malin, *History & Ecology: Studies of the Grassland* (Lincoln: University of Nebraska, 1984), and James C. Malin, *The Grassland of North America, Prolegomena to its History* (Lawrence, Kansas, 1947).

[5] William Cronon, "Kennecott Journey: The Paths out of Town," in *Under an Open Sky*, William Cronon, George Miles, and Jay Gitlin, ed,, (New York: Norton, 1992): 33; Walter Prescott Webb, *The Great Plains* (Boston: Ginn, 1931).

[6] Thomas Wessel, "Prologue to the Shelterbelt, 1870 to 1934," *Journal of the West* 6 (January 1967): 119-134; Thomas Wessel, "Roosevelt and the Great Plains Shelterbelt," *Great Plains Journal* 8(2) (1969): 57-74; Wilmon Droze, "Changing the Plains Environment: The Afforestation of the Trans-Mississippi West," *Agricultural History* 51(4) (January 1977): 6-22; Wilmon Droze, *Trees, Prairies, and People: A History of Tree Planting in the Plains States* (Denton, Texas: Texas Women's University, 1977). The subject of trees and rainfall is complex, but for a start look at Helen Pearson, "Felling Trees Has Sky-High Price: Deforestation is Drying out Cloud Forests," *Nature* 19 (October 2001): 78-91; R. W. A. Hutjes et al., "Biospheric Aspects of the Hydrological Cycle," *Journal of Hydrology* 212-213 (1998): 1-21; W. R. Cotton and R. A. Pielke, *Human Impacts on Weather and Climate* (Cambridge: University Press, 1995); Clark A. Miller and Paul N. Edwards eds., *Changing the Atmosphere: Expert Knowledge and Environmental Governance* (Cambridge, Mass.: MIT press, 2001).

[7] Joseph Taylor III, *Making Salmon: An Environmental History of the Northwest Fisheries Crisis* (Seattle: University of Washington Press, 1999); Peter Rollins and Harris Elder, "Environmental History in two New Deal Documentaries," *Film and History* 3(3) (1973): 1-7; P. J. Nelson, "To Hold the Land: Soil Erosion, Agricultural Scientists, and the Development of Conservation Tillage," *Agricultural History* 71(1) (Winter 1997): 71-90.

[8] Donald Worster, *Dust Bowl: The Southern Plains in the 1930s* (New York: Oxford University Press, 1979), 223; Raymond Williams, "Ideas of Nature," in *Problems in Materialism and Culture*, Raymond Williams, ed., (London: Verso, 1980), 67.

Chapter One—Idealized Landscape: building a case for Plains forestry

Untroubled by past failures, the first generation of thinkers to approach the issue of climate on the Great Plains—and the role of forests in that climate—were able to imagine the region transformed into a Republican Garden with minimal need for government assistance or scientific expertise. They would replace short grass, cattle and bison with small stable farms, towns, and scattered woodlots for fuel, timber, and aesthetics. At first they saw little need for special methods of cultivation—for crops or trees—and it was only gradually after the disappointments of the depression and droughts of the mid-1870s and 1890s that attitudes changed. From the perspective of the 1860s and early 1870s, individual initiative, hard work and perhaps a dose of federal encouragement would be enough to transform the "Great American Desert" into a garden.

Replacing desert images with a Republican Garden on the Great Plains was not without risks. Henry Nash Smith attributed the image of the Plains-as-garden to eastern boosters, such as William Gilpin, who sought to promote settlement. Leo Marx, Roderick Nash, and David Emmons built on this interpretation by showing the important function that the idea of a garden-like frontier played in nineteenth-century America. When settlers reached the Great Plains they found a new environment. Desert and wilderness could not support the yeoman farmer that had made America great. America had either to rethink its commitment to agrarian values and an ever-expanding frontier, or remake the West. On the Great Plains, Americans decided to recast the image of the Plains, and proposed large-scale alterations of nature.[1]

One of the most enduring methods of altering nature was tree planting, and as Americans settled the Midwestern prairies and then the Great Plains beyond the Missouri River, interest in tree planting increased. At a personal level, the most obvious explanation for widespread curiosity about afforestation was that settlers "missed" the presence of trees they had become accustomed to in the Eastern United States and Europe. This explanation fits what Edward Wilson has called the "biophilia hypothesis," that humans have possessed an affinity for certain types of landscapes. In their writings and discussions, however, settlers' impulse to "Easternize" the Plains was only a partial explanation. Although the landscape Americans imagined did in some ways resemble Eastern ones, ultimately they were searching to improve on the East, not simply to replicate it.[2]

In the second half of the nineteenth century, the most powerful explanation for afforestation was that trees and civilization where fundamentally intertwined—particularly through the influence trees exerted on climate and soil, but also through their supposed moral influences. In the 1860s, George Perkins Marsh linked deforestation with economic and social decline. Other writers, scientists, foresters, and settlers built an optimistic corollary of Marsh's observation that afforestation would lead to economic and social progress. This group of influential writers spun a new American myth. They argued, as did Marsh and others, that deforestation was equated with "despoliation." Cutting down the forests of the Eastern United States was leading to economic, moral, and social decline, but then they moved beyond to declare that planting trees on the Great Plains would help insure the moral, economic, and climatic future of the region. Modern readers may find claims about trees and climate quaint, but they should recall that a great deal of scientific research still analyzes the relation of tropical deforestation to climate.[3]

When pressed about the specifics of how trees could modify climate, tree advocates such as Joseph Wilson and Richard Elliott turned to Marsh for inspiration. Marsh argued that the link between deforestation and the decline of ancient civilizations arose from the effects of forests on climate, erosion, and rainfall. He followed the lead of Alexander Von Humboldt, who in the 1840s theorized that forests increased humidity and thus evaporation. Living in Italy at the time of his writing, Marsh was especially struck by the complete desertification of formerly fertile sites in North Africa and the Levant. This "realm of desolation…no longer capable of affording sustenance to civilized man" was a stark warning about what could happen when society abused the natural world. On the Great Plains of the United States "forestry boosters" extended Marsh's argument: if forests increased humidity, then increased evaporation would lead to increased precipitation; if deforestation led to desertification, then reforestation might transform deserts into fertile land.[4]

Making the intellectual case for Plains forestry went hand in hand with developing practical methods of growing trees. During the nineteenth century, this meant encouraging individuals and corporations to do the planting. In 1870, Richard Elliott and the Kansas Pacific Railroad built three "experiment stations" in Kansas for testing tree and crop cultivation. Robert Furnas and J. Sterling Morton advocated tree planting as a civic duty and eventually inspired public recognition as Arbor Day. The new tree-planting holiday was popular enough that, by the end of the decade, it had spread to other Plains states and eventually to the entire United States. Finally, the United States Congress underwrote tree planting through the Timber Culture Act of 1873, offering settlers up to 160 acres of public land in return for planting 40 acres to trees. Together these early efforts assembled the social and narrative groundwork for future afforestation programs. Plains residents and educated

observers of Plains settlement imagined an interaction of theory, labor, and nature that would reform the Great Plains landscape. The Garden landscape they imagined in 1870 seemed within reach for two decades but then violently came apart.

In the first half of the nineteenth century, most observers of the Plains were skeptical about the potential future of the land. Zebulon Pike's (1806-1807) army expedition described the region as "barren soil, parched and dried up for eight months of the year [without] a speck of vegetation." Pike suspected the land would always remain the home of nomads and savages. Thirteen years later, Major Stephen Long's expedition confirmed Pike's views. Long described the region as "wholly unfit for cultivation, and...uninhabitable by a people depending upon agriculture." The view that Pike and Long presented achieved wide enough acceptance that many maps of North American began describing the present Central and Southern Great Plains as the "Great American Desert" (Figure 1.1).[5]

Several authors have explained the classification of the Great Plains as a desert. Martyn N. Bowden, a geographer, has argued that most Americans never completely accepted the idea of a desert and that it was later authors who circulated the idea that most Americans had believed the desert myth between 1820-1870. Bowden's research revealed that opinions varied according to sectional background, political affiliation, and cultural values. The desert image lasted the longest, and had the most influence in New England, where the rapid expansion of the American West threatened the old Federalist-Whig establishment. However, many Missourians never totally accepted the idea that the region

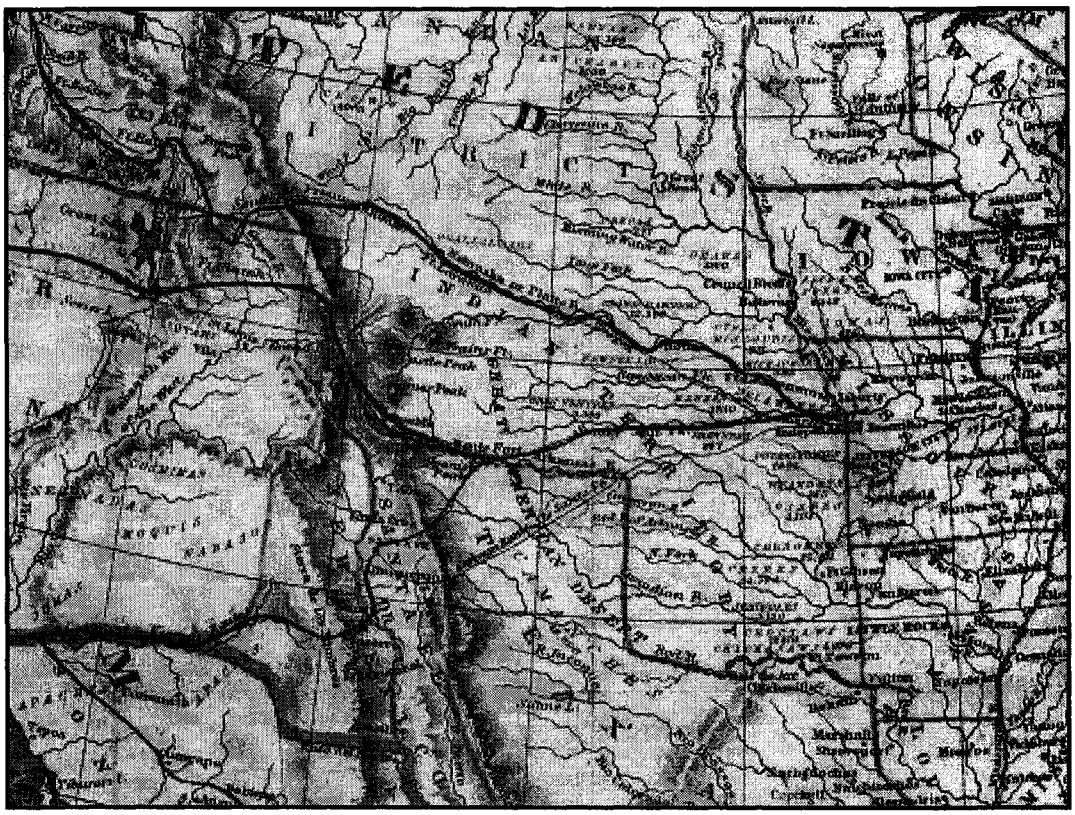

Figure 1.1—The "Great American Desert" 1849.[6]

was a desert, or at least not a "real" desert. Bradley Baltensperger, also a geographer, has added to Bowden's explanation by showing how many Plains settlers and boomers during the 1870-80s promoted the desert myth as a means of self-promotion; contrasting current conditions with a mythical desert past allowed promotional literature to claim human actions could modify the environment. Merlin Lawson and Charles Stockton took a different route and used tree-ring data to show that Pike and Long probably experienced exceptionally dry conditions during their expeditions. Their description of the region as desert was thus a reflection of drought conditions.[7]

Clearly cultural values and nature played a huge role in labeling the Plains a desert—just as they would in later labeling it a garden—but if we remove the word *desert* from the early accounts and focus instead on descriptions of aridity and unsuitability for crop agriculture, we find a description of the Great Plains that is surprisingly consistent. In the early nineteenth century, Pike and Long felt the region was too dry and windswept to support the type of civilization to which Americans and Europeans were accustomed. In the second half of the century, many boosters, town builders, and foresters understood the Plains were arid or desert-like; they simply believed this could change. Less sanguine observers, such as John Wesley Powell, told anyone who would listen that western aridity would require a different approach, that the land could not support Eastern-farming practices. In the 1930s, filmmaker Pare Lorentz and ecologist Paul Sears once again questioned the ecological suitability of farming such dry lands. Most recently, Deborah Popper and Frank Popper predicted that the region was too arid to support intensive agriculture.[8]

If the actual nature had a certain consistency, then part of the explanation for why labels attached to the Plains changed rested with transformations in the meaning of the word "desert." In the early nineteenth century most Americans had never experienced a desert. Educated Americans would have read about, and a few might even have visited the deserts in Africa and Asia, but deserts were a biblical curse for the vast majority of Americans. Compared to the well-forested and watered lands of the Eastern United States, the Plains (even vicariously) must indeed have felt like a desert. As Americans began to experience or read about the even more arid climates in New Mexico, Arizona, California, Colorado, and Utah, however they gained a more nuanced appreciation of what constituted a desert. In the

second half of the nineteenth century, calling the Plains a "desert" seemed for many an exaggeration, yet a few observers continued to regard the analogy as uncomfortably close.

A further consideration needs to be made about the time and area of the Plains traveled through. When Lewis and Clark traveled the Missouri through the states that would become Nebraska, the Dakotas, and Montana, they offered a far more positive assessment of the region than Pike and Long in later years. Well supplied with water and game along the Missouri, Lewis and Clark noted the fertility of the soil and the beautiful landscape. Zebulon Pike's second expedition left St. Louis on 6 July 1806. It traveled through the future states of Kansas and Nebraska before crossing into Colorado. Pike's party spent the hottest part of the year—July and August—crossing the Plains without significant rainfall. In 1819-20, Stephen Long again traveled out of St. Louis and headed through the future state of Nebraska, Colorado, Texas, and Oklahoma. Not only did this southerly route expose them to greater heat and drier conditions than Lewis and Clark; Pike and Long also had to make extended *jornadas*—waterless passages—as they crossed between river valleys. Long had special reason to view the whole area negatively since he had not successfully completed his mission. He was unable to find the headwaters of the Arkansas River, and mistook the Canadian for the Red River. Losing his expedition notes and then recreating them while surrounded by Eastern civilization probably did little to improve his overall opinion of the region.[9]

Comparing Pike or Long's expedition with the journeys of John C. Fremont, in the 1840s helps to expose a further source of bias. Geographer Merlin Lawson in his study of Pike's writings contended that Pike's view changed because of his connection to the Wilkinson-Burr scheme to separate the southwestern portion of the Louisiana Territory from

the United States. On his outward journey, while still on favorable terms with Wilkinson, Pike's journals contained only one reference to the word desert describing an area by the Great Bend of the Arkansas River. Four years later in the published version of his journals, he changed his tone and wrote "these vast plains of the western hemisphere, may become in time equally celebrated as the sandy deserts of Africa...on which not a speck of vegetable matter existed." Lawson suggested that the change occurred out of Pike's disillusionment with the Wilkinson-Burr scheme and as an attempt to appeal to Jeffersonian Republicans who sought to limit American's "rambling" character.[10]

Long had similar motives when he made his journey for the American Philosophical Society in Philadelphia, and under the sponsorship of Secretary of War John C. Calhoun. From a military and developmental perspective, it was appealing to exaggerate the value of the Plains as buffer that might help contain the westward spread of American settlement, allowing the federal government time to extend its control over an already sprawling frontier. Despite the diplomatic success of John Quincy Adams dealing with Spain and Great Britain, the frontier of the 1820s was still a risky place; Aaron Burr's infamous 1806 plan to create an independent confederacy south of the Ohio was recent history, and Native American tribes still held considerable power.

By the 1840s, Americans had filled up the most desirable portions of the Midwest, and the desert buffer of previous decades became a liability. The expansionist sentiments that pushed the United States into war with Mexico also redefined the western plains of the Louisiana Purchase. Like most Missourians Senator Thomas Hart Benton realized that the land to the west was not really a desert and that settlers would soon begin to invade the region. Like most expansionist leaders, Benton believed it was his duty to assist the spread of

American settlement. After Fremont married Benton's daughter, Benton sponsored Fremont's expeditions and his daughter rewrote her husband's expedition notes into glowing accounts of the West that Benton had printed as government reports. While officially just survey expeditions, Fremont was far from an objective observer. He presented a more positive view of the Plains and the West in general, despite traveling across some of the very same territory and experiencing summertime heat.[11]

What emerges from these early accounts was an intertwining of culture and nature in defining Plains landscapes. Personal inexperience with desert conditions, political and cultural desires, and dry weather encouraged early explorers to label the Great Plains a desert unsuitable to permanent settlement. The hot dry summer weather had done little to dissuade such an opinion. Later travelers had more experience with desert conditions and every political and personal desire to paint a positive picture. The nature they saw spawned endless herds of bison, rich grasses, shaded river valleys, and thick fertile soils. It was not that each group was simply imposing their own cultural definition on the landscape. In each case they described a very real natural world, but their personal perspective, encouraged them to notice different aspects of the natural world. The treeless Central Plains that Pike and Long observed were too hot and dry and the soil too poor to support crop agriculture, when Fremont saw the same area a few decades later he saw land ready to become a fertile garden. Gradually, under the influence of need and science, the Plains lost status as a true desert and geographers reserved the term for the even drier lands beyond the Rocky Mountains. However, the Plains were not simply an extension of the East. They were a fundamentally different place: they were drier, wide areas between river valleys were completely treeless,

and they were windy and flat. Americans spent most of the nineteenth century trying to decide the exact nature of the Plains, and never reached a satisfactory answer.

Richard White has settled on a useful metaphor to describe this interchange between human ideas, perceptions, expectations about nature, and actual nature. White thought the act of discovery and naming was part "of a protean conversation involving Europeans, and later Euro-Americans, Native Americans (though far more rarely), and nature." The term "conversation" to describe the interaction of culture and nature in defining a landscape is especially appropriate because it accounts for the ability of actors to build on or modify previous definitions, and how their definitions entered a dialectic with the natural word. Pike and Long began the conversation by describing a Great American Desert, but later observers moved away from that label by highlighting other natural features. Even new labels, however, remained hostage to natural conditions.[12]

Plains nature was highly variable and it was difficult to discuss in terms of "averages," or even "trends." Averages would never be very useful in describing the highly irregular rainfall of the Great Plains, but they were even more problematic given the very limited number and precision of early measurements. Trying to create statewide, or even regional measurements was also difficult since rainfall, temperature, and wind speed varied considerably, occasionally over even short distances. Gradually, meteorologists would begin to think in terms of trends, or cycles, of wet and dry weather, but this was also problematic since droughts could occur at critical seasons or in the middle of wet trends, and vice versa. The best climatologically records for the area were in places, such as Fort Leavenworth, Kansas, where the War Department kept some records and where later the Smithsonian Institute and then the Weather Bureau took over record keeping. Unfortunately, early

explorers did not even have this limited record to inform their impressions, and could thus come away with opinions based on one or two years experience.[13]

Merlin Lawson and Charles Stockton have recreated the best early estimate of plains climate using tree-ring data. While there are technical issues involved with the method, such as gathering sufficient samples of known origin from the right locations, the indices that Lawson and Stockton created revealed a definite natural component to explorer's observations. Pike experienced dry conditions on his outward journey, but wet conditions during his return to the United States in the summer of 1807. Long underwent much drier conditions, and "in relative terms, the region identified by Long as the Great American Desert was experiencing drought stress exceeding that of the 1930s." Although Lawson and Stockton did not analyze Fremont's expeditions, their evidence suggests that in 1843 Fremont had only slightly drier than average conditions, but that his 1846 expedition coincided with extremely dry conditions. Taken as a whole natural factors do not explain every individual's impressions of the region, but they did support certain impressions. Long's description of the region as a desert was not far from the truth, at least in 1820.[14]

While the exact nature of the Plains remained debatable, most observers understood that the region was a very different place than the East that presented serious challenges to settlement. As early as the 1850s, Americans began to speculate on potential solutions to the problem of aridity. Some reasoned that crisscrossing the region with railroad tracks and telegraphs lines would attract rainfall. Another popular theory held that irrigation works would increase evaporation and result in precipitation, thus increasing the overall rainfall. Closely related were ideas about cultivation releasing moisture that then became part of the meteorological cycle. This theory, known as "Rain Following the Plow," eclipsed tree

planting in popularity for a time. Finally, one group looked to afforestation as the most likely route to increase rainfall. Not incidentally, afforestation promised to solve not only climatic failings, but also to provide timber for fuel and perhaps construction.[15]

Of these many theories the final one—trees—was both the first and the last to have widespread currency. Western Civilization had a long history of associating trees with precipitation and humidity, and when American's began thinking about how to settle the Plains, they tied into this long tradition. Theorists began by arguing trees would improve climate, but often supported other methods as well. By the early 1870s, the more enthusiastic boosters had become so convinced of the success of the various methods that afforestation almost became unnecessary. Settlers did not need to plant acres and acres of trees if plowing the land and putting it to crops was sufficient to alter the climate. By the late 1880s, however, attitudes had changed, because the climate did not change. In the chaos and drought of the late 1880s and early 1890s, only the original theory—trees—held any currency and then only among certain, albeit among of the most influential, foresters. Before Americans could realize the inadequacy of early theories about climatic change, though they had to come to an understanding of the Plains.

Although the rush to settle the higher and drier reaches of the Plains was several decades away, the 1850s and 1860s were critical decades in focusing attention on the region as central to the future of the United States. The Kansas-Nebraska Act of 1854 opened the Central Plains to settlement, and both North and South invested enormous political importance in settling the region. The Republican Congress that came to power during the Civil War began making good on their "free soil" rhetoric by enacting the 1862 Homestead Act, which subsidized westward expansion by making "free" land available to settlers. The

same year Congress finally passed a bill creating a transcontinental railroad, in the process granting huge swaths of Western lands to the Union Pacific and Central Pacific lines. Their lines provided market connections that made farming away from navigable streams more appealing. Perhaps most importantly, government officials, private citizens, and railroad employees had imagined the Plains as something more than an obstacle to westward movement. Technology and policy melded to invigorate the region as the Nation's new farming frontier.[16]

Increased political and public interest in the western half of the Louisiana Purchase encouraged Joseph Henry to advocate afforestation as a means of modifying climate. Henry was a widely respected scientist and the director of the Smithsonian Institution from its founding in 1846. Henry's advocacy was heavily influenced by the climatic theories of Alexander von Humboldt's *Cosmos: A Sketch of a Physical Description of the Universe.* Humboldt speculated that extensive woodlands significantly increased evaporation by drawing water from the ground and gradually emitting it into the atmosphere. He went on to describe the potentially disastrous effects of deforestation leading to diminished precipitation. Henry interpreted Humboldt's observations to mean that if deforestation decreased rainfall, then afforestation would increase rainfall. He reasoned that humans could cultivate plants and trees in such as way as "to produce artificial atmospheres, and to so temper the impulses from the sun that the effects of variations in latitude and the rigor of the climate may be obviated." Writing in the 1850s before settlement had extended beyond the wooded river valleys of the Plains, Henry spent more time worrying over the possible negative effects of deforestation, and even suggested the "judicious reservation of trees along the boundaries of certain portions of land" to help maintain the climate. But Henry's

assertion that humans could alter the physical environment to produce climatic change offered an appealing solution to the problem of Plains aridity.[17]

It would be a mistake to attribute too much influence to Henry's early speculation. Forestry issues consumed only a small portion of Henry's writings, and even these passages were hesitant and intended more as an affirmation of society's ability to modify nature than as a blueprint for doing so. Henry also never tried to popularize his ideas. He was content to publish them in Smithsonian reports that reached a limited, if very influential, audience. A careful reading of Henry's published sources also suggests that he probably never intended his early musings to be applied to the Plains, and that his ideas reemerged in the 1870s when theories about using trees to improve climate were widespread.[18]

Living and writing in Italy, George Perkins Marsh was also not particularly concerned with the possible affects of afforestation on the Great Plains when he published his landmark 1864 study, *Man and Nature, or Physical Geography as Modified by Human Action.* Yet many of Marsh's conclusions became fundamental to Plains forestry, in the hands of less careful authors. At over four hundred pages, *Man and Nature* made a detailed and scientifically compelling case for forestry as a central institution of civilized society. Marsh explained the many ways that humans had changed the face of the earth from ancient Rome to the modern United States. He also made a gripping case that tyrannical civilizations would abuse their environment and then suffer decline. In his final chapter he set out guidelines for modifying societies' approach to nature through conservation.

While a firm believer that humans had altered natural environments, Marsh was skeptical about the relation of forestry to rainfall. *Man and Nature* included a section on the "Influence of the Forest on Temperature and Precipitation" which began by noting that "it

does not seem probable that the forests sensibly affect the total quantity of precipitation, or the general mean of atmospheric temperature of the globe, or even that they had this influence when their extent was vastly greater" and concluded fifteen pages later that "we cannot positively affirm that the total annual quantity of rain is diminished or increased by the destruction of the woods." Marsh quoted a number of forestry experts on both sides of the issue, but the majority supported Marsh's opinion that forest cover, while influencing a variety of factors, probably did not increase rainfall.[19]

Marsh's description of humankind's wider role in modifying the environment was ultimately more influential than his discussion of forests and rainfall. Marsh portrayed a world that was surprisingly malleable in the hands of humankind. Forests, fields, and streams shrunk and swelled according to human interventions. Humans drained swamps and opened new lands to cultivation while allowing other lands to erode away to bare rock or sterile soil. Marsh considered many of these changes negative, but he continually stressed "the possibility and the importance of the restoration of disturbed harmonies and the material improvement of waste and exhausted regions." He did not have to apply this logic to the Great Plains specifically, for the knowledge and endeavor he advocated was universal. Against such an activist stance, Marsh's cautious discussion of forest and rainfall seemed almost an afterthought, and it is not surprising that many later writers brushed over the details and instead focused on the larger vision.[20]

Underlying Marsh's positive endorsement was a warning about the failure to act. Living and writing from Italy, Marsh was particularly fascinated and troubled by the apparent destruction of the Mediterranean Basin and Levant. Both regions seemed to offer unequivocal evidence of human-inspired environmental destruction and its role in the

collapse of civilization. Across "more than one half of their [Roman Empire and parts of the Old World] whole extent—including the provinces most celebrated for the profusion and variety of their spontaneous and their cultivated products, and for the wealth and social advancement of their inhabitants—is either deserted by civilized man and surrendered to hopeless desolation," or greatly reduced in population and production. Lest the reader be uncertain about the cause of this destruction, Marsh went on to describe how forests had disappeared from mountains, how the soil once held by those forests had eroded, how surrounding fields and pastures had washed away, and how irrigation works lay dry and broken. In Marsh's eyes, the chain of destruction that flowed from the Old World's denuded mountains left no natural feature untouched: "rivers famous in history and song have shrunk to humble brooklets," "the entrances to navigable streams are obstructed by sandbars, and harbors of the rivers at whose mouths they lie," and formerly fertile deltas had become "unproductive and miasmatic morasses."[21]

The environmental destruction that Marsh described was troubling enough, but he also hinted at the great social and moral decline that the people of the worst effected regions underwent. Areas that had formerly been centers of learning and civilization were at best "thinly inhabited by tribes too few in numbers, too poor in superfluous products, and too little advanced in culture and social arts, to contribute anything to the general moral or material interests of the greater commonwealth of man." Describing Europe, he linked Catholicism with environmental destruction and argued that the decline of the Roman Empire left behind a "superstitious," "nominal Christianity" that "perpetuated every abuse of the Roman tyranny" and left the great mass of people locked in servitude as serfs. In both cases,

according to Marsh, environmental destruction and the decline of civilization went hand in hand.[22]

Environmental destruction had not yet proceeded far enough in the New World to threaten civilization, but Marsh argued that it soon would if left unchecked. European colonization degraded New World landscapes after only two centuries, and the land was beginning "to show signs of that melancholy dilapidation which is now driving so many of the peasantry of Europe from their native hearths." In New England "the ground was growing drier and drier." Certain trees, such as the plum had almost disappeared from land where they had been numerous, and "the peach, which, a generation or two ago, succeeded admirably in the southern portion of the same States, has almost ceased to be cultivated." At the end of his chapter on forestry, Marsh included a short section on "Instability of American Life" that criticized American's restless and nomadic nature. Americans seemed to love change and to have a reckless affection for felling trees even when sufficient cleared land already existed. In Marsh's opinion, maintaining some form of fixed ratio between ploughed and wooded land would stabilize the American character and create "a well-ordered and stable commonwealth, and not less conspicuously, a people of progress."[23]

Few Americans would have argued with Marsh's affection for "a well-ordered and stable commonwealth," but most had very different ideas about how to get there. In the 1860s, railroads, most politicians, and the majority of the American people were firmly committed to rapid westward expansion. They saw little need for restrictive land use laws in the East. The railroads had every incentive to encourage rapid settlement to benefit from the sale of land and the hauling of goods. Unlike in the eastern United States, on the Great Plains the railroads proceeded settlement and undertook the development of the regions through

which they passed as part of their business plan. With their financial futures firmly bound to rapid development, the railroads saw "a well-ordered and stable commonwealth" as one that moved as quickly as possible to take up any and all vacant lands. If there were not enough prospective settlers in the East, then more settlers would have to be found in Europe.

With the South defeated and the Republican Party triumphant, political sentiment favored rapid western expansion. Partially this was a continuation of older ideas about Manifest Destiny, but it also reaffirmed of the Republican's free soil rhetoric. Unlike conflict over Reconstruction, or trade, western settlement was a relatively easy issue for Republican politicians. They were able to make good on their "free soil" rhetoric through homesteading laws, railroad acts, and Indian wars. They created a "safety-valve" for discontented or "excess" Eastern workers which, in theory, pleased both the workers who could escape Eastern cities to start up a farming life in the West, and the Eastern industrialists who would be rid of urban discontents. The fact that the safety valve operated mostly on Eastern rhetoric and emotion rather than as an escape for urban workers did not diminish its significance to nineteenth-century Americans.[24]

During the 1860s, the Civil War, Indian wars, and drought slowed settlement of the Plains, but this at least gave government time to begin surveying the region and making plans for its future. Perhaps the most important official during the decade to address the settlement of the region, and certainly the one that made forestry an official goal, was Joseph Wilson, the Commissioner of the General Land Office. Charged with overseeing the dispersal of public lands, Wilson saw the great empty spaces of the Plains as a potential stumbling block to national prosperity. Fortunately, Wilson believed he had found the solution to Western aridity in the writings of George Perkins Marsh. Rather than slow settlement or change land

use patterns, Wilson argued that humans could alter the nature of the Plains through forest plantings, artesian wells, and other methods. Wilson found Marsh's assertion that humans could influence nature enormously empowering.[25]

Later boosters claimed that the Great Plains had been misunderstood, that it had never been a desert. Wilson too was tempted by this explanation, but writing in the 1860s, he remained uncomfortably close to the region's problematic reputation as a desert. Although settlement had not proceeded far, and the looming political storm obscured it, the drought of 1860 was severe on the Central Plains. In Wyandotte County, Kansas during "the fall and winter of that year, there were many steamboat loads of provisions landed on the levee, for the hungry people in the interior" who had "been thirteen months without a drop of rain, and raised nothing. Often their families were left with only enough cornmeal to last while the trip was made to the river." Horace Greeley, writing for the *New York Independent* of 7 February 1861, wrote: "Drought is not unknown to us; but a drought so persistent and so severe as that which devastated Kansas in 1860 is a stranger to the states this side of the Mississippi. No rain, or none of any consequence, over an area of 40,000 square miles from seed time to harvest. Such has been the woeful experience of seven-eighths of Kansas during 1860."[26]

Conditions improved during the decade but in his reports Wilson sometimes referred to the region west of the Mississippi and east of the Rocky Mountains as the "Barrens" or "inarable lands." Wilson's plans of climatic modification were an implicit admission that something was wanting in the climate. He also understood that settlers had mostly avoided the region, as "the abundance of unoccupied fertile acres to be found in the productive Mississippi Valley" had been sufficient to prevent "encroaching upon these wide-spreading and uninviting regions." Even in 1868, it was clear that with "the rapidly-increasing

population, attention will be directed to the feasibility of transforming the inarable portion of the plains into resources of wealth and prosperity." The rapidly expanding mining districts in Colorado, and the construction of railroads across the Plains further required the settlement of the region.[27]

By 1866, Wilson was offering a solution to the dilemma of how to settle the Great Plains. He combined American frontier optimism with Marsh-like environmental manipulation. First, Wilson invented his own version of climatic history by claiming that "in every locality where the improvement of settlers, even for so short a period as ten years, has resulted in adding considerably to the number of trees; attesting not only the extraordinary importance of the forest in rural economy, but the readiness of nature to second the operations of man in respect to climate, and other agencies affecting the productiveness of the soil." Wilson had little evidence for this assertion, but it fit the general feeling of frontier optimism and could remain largely unchallenged as long as drought did not strike.[28]

Second relying on his interpretation of Marsh, Wilson argued for a program of vastly increased forest planting on the Plains:

> Mr. Marsh has collected nearly all the historical facts bearing upon the question, in his excellent work published in 1864, entitled "Man and Nature," and from the great variety of the illustrations presented, there appears to be but little room to doubt the general accuracy of the position assumed, that the climate of a country is influenced in a most important respect by the extent and distribution of its forests.

Wilson's writings also shared Marsh's concern over the apparent reckless deforestation that had taken place in the Old World and subsequent natural and social problems that both men feared might be repeated in the New World.[29]

Where there was no forest to influence climate and culture—like the Great Plains—Wilson proposed covering "one-third the surface" with forests. Wilson's number was arbitrary but also a future red flag, since locking up such a huge amount of land would inevitably create tensions. The cattle barons were expanding northward rapidly in the late 1860s, and such plans would clearly conflict with other interests in a region of grass. The Plains states themselves could also become potential opponents since locking large areas in forests could hinder development and the growth of tax rolls. Although the plans were offered to assist farmer, later events proved that even they could be halfhearted supporters if they viewed reserves as locking up good farmland. Wilson's number also conflicted with his own earlier claim that the haphazard planting of settlers in the Plains border states, such as Iowa, had already seen their efforts lead to significant alterations of climatic conditions.[30]

Although Wilson did not indicate it at the time, the obvious explanation for the "one-third" figure was that Wilson had a much better understanding of Plains climate and of Marsh than was apparent in his other proposals. The monumental undertaking of foresting one-third of the Plains was a clear acknowledgement of the colossal problem that Wilson felt American farmers faced on the Plains. It was also clearly more in tune with the doubtful and speculative claims of Marsh about forests and rainfall. Marsh had always indicated that any potential increase in moisture from tree growth would be slight and that the mechanical benefit of reduced wind velocity required forests at very frequent intervals. As a booster for settlement and therefore forestry, Wilson could not build a case on "uncertainty" and therefore stuck to positivistic and dramatic claims.

The state of knowledge about the effects of forests on climate was illustrated by Wilson's use of examples from Marsh to justify domestic programs. Just before revealing his

dramatic plan to cover one third of the Great Plains with forests, Wilson explained that "the redemption of sterile and desert lands is one of the growing ideas of the times." He then offered several fragmentary examples to prove his point. There was little to unite these examples, other than Wilson's conclusion that forests were successfully redeeming sterile lands. The French were restoring the Algerian desert to "fruitfulness" while Egypt was planting of "over twenty millions of trees in the valley of the Nile, thereby greatly extending its cultivable area." In Eastern Europe the Czar was undertaking the reclamation of the steppes and in many parts of Western France and Central Europe reclamation projects were turning "worthless sterility and sandy wastes" into fertile land. By Wilson's account, fundamental alterations of entire regions to make them more amenable to human habitation were almost commonplace. While Wilson tried to make such plans seem well established, the cases he cited were poor examples. Stabilizing sand dunes in Prussia might be labeled a success story, but it offered little information about how to afforest hotter, drier plains. Likewise, Wilson's open admiration for the planned forestry of various German provinces offered little evidence on how to *afforest* a region. French efforts at planting trees in Algeria might seem more applicable, but Wilson made no effort to document the French program and a careful reading of Marsh reveled extreme skepticism that Egyptian tree planting had appreciably altered rainfall.[31]

Wilson was not the only American official offering questionable advice on tree planting during the late 1860s. In his 1867 report to Congress, Wilson included a section from Ferdinand Hayden, director of the Geological and Geographical Survey of the Territories. Like Wilson, Hayden had concluded that trees could transform the West after reading George Perkins Marsh. Hayden brought practical as well as intellectual experience to

the Land Offices' Reports. He led several Western expeditions in the 1870s and was widely respected as a field geologist and explorer. It was Hayden who began the long and popular tradition of explaining the great differences between past epochs, and current conditions. During the Tertiary period, Nebraska had an almost tropical climate with abundant rainfall and was cloaked in "a luxuriant growth of forest." The ancient forest cover had worked in a sort of virtuous circle by helping to increase rainfall which in turn helped create the conditions for its own existence. Hayden argued that human settlement and tree planting would one day return the Plains to Tertiary like conditions, and that "settlement of the country and the increase of the timber has already changed for the better the climate of that portion of Nebraska lying along the Missouri."[32]

Hayden was so optimistic about tree planting on the Plains that he not only offered ideas about how to grow timber but also made claims about the future benefits of tree planting. He explained that the "planting of ten or fifteen acres of forest-trees on each quarter-section will have a most important effect on the climate, equalizing and increasing the moisture and adding greatly to the fertility of the soil." Tree planting would improve soil fertility and within a mere thirty to fifty years they would provide timber for commercial uses, thereby ending the region's dependence on outside sources for lumber.[33]

In the late 1860s, Joseph Henry, still directing the Smithsonian, added further scientific evidence that trees could alter climate. In 1869, 1870, and 1871, he had some of the work of French scientist M. Becquerel translated and published in the Smithsonian's annual report. Although modest in its claims and intended for European conditions, Becquerel's "Forests and Their Climatic Influence" agued that forest could have two significant effects on climate. First, large masses of trees would force air to rise and "if it encounters a colder

stratum of air, yields its vapor to precipitation, and a fall of rain ensues." Second, tree roots penetrated the soil and "fulfill an important part in the distribution of the waters of a country" by allowing water to move back and forth between subsoil and surface. In 1870, Henry also published a report by W. W. Johnson who made similar claims about forests in Idaho, Montana, and Washington, and suggested that most of the treeless parts of the United States could be transformed merely by seeding the ground.[34]

Henry and Hayden also used their positions to promote the work of railroad agricultural agent Richard Smith Elliott. Elliott—who once compared himself to Napoleon Bonaparte—was involved in a number of projects ranging, from mining to harbor design. During the 1860s, he turned his considerable enthusiasm to forestry and railroad promotion in Kansas. As the industrial agent for the Kansas Pacific, Elliott found himself in the enviable position of offering objective scientific advice while promoting settlement. Nowhere did it seem to occur to Elliott—or to Henry and Hayden—that such an arrangement might present a conflict of interest, probably because all three agreed that settlement was more important than concerns about climate.[35]

Although it is easy to question Elliott's objectivity through the graces of hindsight, in 1870 he appeared as a scientific and powerful proponent of settlement and forestry. The sciences, and particularly forestry, had not yet become carefully policed professions. Self-educated individuals with wide-ranging interests could make believable claims to expertise on a subject with less worry about peer review or criticism. Elliott operated in the tradition of a Benjamin Franklin rather than according to the standards of later forestry officials such as Raphael Zon. Elliott also did what he could to make sure his advice sounded as objective as possible. He conducted his experiments "along the line of the" railroad, and while careful

readers would have guessed that Elliott was in the employ of the Kansas Pacific, he never made his connection explicit. Elliott also presented his work as part of "experiments in cultivation" done at "stations" along the line, again making his work appear an integral part of both the *United States Geological Survey* and *Report of the Smithsonian.* Elliott also brought the one important element that previous scientific treatise on Plains forestry and climate lacked: real world experience.

Unlike other writers, Elliott enjoyed the rhetorical and practical advantage of having actually cultivated crops and trees on the Plains. Henry, Hayden, and Marsh were theorists when it came to Plains agriculture. Elliott invented himself as an "expert" by convincing the Kansas Pacific to set up three "little patches of a few acres each" at Wilson, Ellis, and Pond Creek, Kansas. Elliott then carefully exploited his position as a national "expert" and, by 1871, began referring to his experiments as "our *Agricultural College*" and pointing out to readers of the *Lawrence Journal* that "we are not acting out the suggestions of the learned world, taken as a whole; for many very learned people have decided, from *theory*, that nothing could be done, where, in *practice*, we now have grains and grasses and trees growing." Elliot offered very real—if suspect—evidence that crops and trees could be grown, and that settlement was already transforming the climate of the region. By constructing his three little "stations" and publishing his findings at the critical moment, Elliott had transformed himself into an expert on climate and cultivation on the Plains.[36]

While often condescending towards scientific expertise, Elliott was far less critical of theories he liked and never met a theory about positive climatic change that he did not like. He believed that cultivation, trees, railroad and telegraph lines, and seemingly just about everything else was already improving the climate. Fortunately, many of the potential climate

improving changes occurred alongside settlement as the railroads stretched lines into new areas and as settlers began cultivating the land. In his report to Hayden for 1870, Elliott listed the many factors that might verify "the popular notion of a climatic change [on the great plains]." He then explained that, while none of these could be verified, "it partakes more of sober reason than wild fancy to suppose that a permanent and beneficial change of climate may be experienced." In closing his discussion of the possible causes of climatic change, Elliott referred to Marsh for support.[37]

Like other proponents of Plains forestry, Elliott's favorite theory was that if deforestation reduced rainfall, then it would be increased by reforestation. Elliott put this syllogism in slightly different terms however, by speculating that "the appalling desolation of large portions of the earth's surface through the acts of man in destroying the forests [see Marsh's book, "Man and Nature"] justifies the trust that the cultivation of taller herbage and trees in a region heretofore covered mainly by short grasses, may have a converse effect." However twisted its logic, Elliott's version contained two useful modifications of previous thought on the issue. First, he replaced the necessity of reforestation with "cultivation of taller herbage and trees," a more appealing and nebulous change that, if true, meant settlement was the real key to climatic change and that tree planting was only incidental. Second, Elliott argued that cultivation would improve the climatic condition of a landscape "heretofore covered mainly by short grasses." Previously, authors had speculated that formerly fertile landscapes degraded by human activity could be gradually reclaimed through forest plantings. Elliott's theory applied to lands that were relatively untouched by humans and contained what later observers would call stable and climax vegetation. These two changes made Elliott's version of climatic modification much more appealing to boosters,

town builders, and the railroads, since it required very little sacrifice and applied directly to the conditions of the Plains.[38]

Ever the self-promoter, Elliott made sure his theories gained an audience by widely publicizing his work along the Kansas Pacific Railroad. In the summer of 1871, the Missouri State Board of Agriculture stopped by his stations and returned with the news "that grasses, grains and trees may surround the settler's house at a small outlay of labor, promises grand results in the future." Later that same summer an "excursion of agricultural editors and writers" from Midwestern and Eastern states visited the stations and brought back similar news. The agricultural writer for the *Chicago Tribune* declared "that trees may be grown on these plains without the aid of irrigation," while a correspondent for the *Albany Country Gentleman* called Elliott the "Tree Planter of the Prairies" who "possesses a vast amount of information on all subjects, and has proved to all the wisdom of his project, and no one who has seen his plantation can doubt the possibility of clothing these fertile prairies with forests of deciduous and evergreen trees." Other writers carried similar testimonies in the *Germantown Telegraph, Hearth and Home*, and *Kansas Farmer*.[39]

Elliott was not alone in recognizing the value of trees in advertising settlement, or in believing the climate was improving. Nebraskans Robert W. Furnas and J. Sterling Morton also promoted tree planting. Furnas was editor of the *Nebraska Advertiser* newspaper, as well as nursery owner, politician, and first president of the Nebraska State Board of Agriculture. By the late 1860s he had developed a deep interest in promoting settlement. Morton, the "father of Arbor Day," also owned a newspaper, the *Nebraska City News*, and had his own political ambitions. Despite disagreeing on most subjects—Furnas was a Republican, Morton

a Democrat—both promoted tree culture as a means of increasing settlement, and especially in Furnas' case, improving climate.

Of the two, Furnas more closely fit the mold of Elliott and other tree boosters. He was a vocal and enthusiastic proponent of tree-modified climate, and he used his position as editor and then governor to promote tree planting. In 1871 he published "The Effects of Trees on Climate" in the *Nebraska Advertiser*, arguing that the Plains had some of the richest and most productive soil in the world. Nebraska only needed a bit more moisture to become the center of America, and the key to that extra moisture lay in trees. As proof, Furnas cited the example of Egypt, where tree planting had supposedly increased rainfall from six to twenty-four inches, and similar changes were underway in Algeria. His examples suggested as liberal a reading of Land Commissioner Wilson's 1868 report as Wilson had made of Marsh's *Man and Nature*.[40]

Morton offered a slightly different perspective on tree planting. Like Furnas, Morton had dabbled in farming and fruit growing as well as politics and journalism. He also advocated tree planting as a way to increase settlement. Historian Ian Tyrrel illustrated how Californians and Australians after 1860 promoted garden landscapes to stabilize population and move from frontier to civilized society. Morton applied similar logic by arguing fruit and forest trees would civilize Nebraska and improve the social and moral health of its citizens. Of his peers, Morton most fully articulated a Marsh-like approach to forests that linked social progress to landscape, and that specific landscapes produced different societies. At a meeting of the Nebraska State Horticultural Society in 1871, Morton outlined the potential of Nebraska as a fruit growing state and then ended his discussion by explaining the many indirect benefits orchards would have:

> Orchards are missionaries of culture and refinement. They make the people among whom they grow a better and more thoughtful people. If every farmer in Nebraska will plant out and cultivate an orchard and flower garden, together with a few forest trees, this will become mentally and morally the best agricultural state, the grandest community of producers in the American union. Children reared among trees and flowers growing up with them will be better in mind and in heart, than children reared among hogs and cattle.[41]

At the 1872 meeting of the Nebraska State Board of Agriculture, Morton urged the board to create a special day for recognizing and encouraging tree planting in Nebraska. The board offered $100 to the county agricultural society that planted the largest number of trees and $25 worth of books to the individual that planted the most trees. The Board unanimously endorsed the proposal, and on 10 April 1872 thousands of Nebraskans entered the contest. Newspapers across the state took up the cause and bombarded the public with incitements to join the festivities. The individual winner—J. D. Smith—won the contest by planting 35,550 trees! Morton's own seedlings arrived late so he could not plant them until after the holiday, but he commemorated the event with a letter to the *Omaha Daily Tribune* in which he exclaimed: "the cultivation of flowers and trees is the cultivation of the good, the beautiful, and the ennobling in man, and for one, I wish to see this culture become universal in the State." While governor in 1874, Furnas issued a formal proclamation celebrating Arbor Day and calling upon Nebraskans to take up tree planting as a yearly duty. The holiday proved popular not only in Nebraska, where it became official in 1885, but in many other states after 1890, and eventually in many other countries around the world.[42]

The actual impact of Arbor Day on the landscape of the Plains went well beyond numbers of trees planted. The labor of planting often consumed only one day a year, but the trees left by that labor became community landmarks that united labor and landscape.

Participants in Arbor Day had the opportunity to see their labor modify the landscape. In doing so, they not only gained an appreciation of how labor could modify the landscape, but an understanding of the Plains recreated in their vision. Eventually, some planters also, had the opportunity to see how nature rejected their labor because of aridity, hard winters and disease.

Many Nebraskans already had a deep appreciation of labor in nature through their farm work, but the labor and results of Arbor Day elevated their labors to social cause. Arbor Day encouraged entire communities to engage in tree planting. Newspaper editors, schoolteachers, farmers, and merchants alike participated. Growing trees became visually dramatic symbols that the Plains had sustained an agrarian landscape over the course of years and then decades, not just a season or two. As residents and tree boosters were fond of saying, 'trees lend an air of permanence.' Perhaps most importantly, trees and forests sat on the other side of the divide between human nature and natural nature. Even though these woods had anthropogenic origins, residents insisted that the dividing line between human and natural landscapes was between field and forest. Planting trees to the end of fields or even on town lots, helped to define the landscape as natural in a way that cultivated fields alone simply could not.

Historian D. S. Olson has suggested that Arbor Day was an early expression of environmentalism, but the holiday defies easy classification. Olson explained that "Arbor Day was established out of concern for the environment and as a means of improving it." Morton was indeed concerned, but he was less interested in saving the grasslands than Western civilization and American democracy. His idea for improving the environment was to completely change it. Tree planting would increase rainfall and enhance social goals.

Morton's holiday did encourage a fundamental engagement with nature, one that was neither work nor play but instead a mixture of the two combined in a ceremony that was as much about societal interests as the environment.[43]

Richard White has suggested that one of the fundamental ways humans come to know nature is through labor. Environmentalists have tended to subordinate modern labor-based relationships in favor of knowledge gained through play or archaic labor. Clearly there were elements of play and recreation in the ritual of Arbor Day and its picnic-like atmosphere, but these rituals also stressed the actual labor of digging, planting, backfilling, and watering. Many participants in the first Arbor Day got up early and spent the entire day planting trees. Although largely unrecorded, the results of their labor, and how they came to judge its success was the first large-scale social "conversation" about trees and nature on the Plains. If the holiday encouraged some to see the Plains reconstructed as a forest, it probably convinced others that tree planting was hard work for slim results.[44]

Although the symbolic value of tree planting remained significant, boosters gradually undermined the climatic-modifying effects with enthusiasm for a variety of less intensive methods. Richard Elliott had originally claimed that tree planting would improve the climate, but by 1873, when he left the Plains to build jetties at the mouth of the Mississippi, tree planting had become only a small part of his prescription for climate change. Nebraska professor of botany Samuel Aughey followed a similar course. In 1873 he explained to the state legislature "as civilization extends westward the fall of rain increases from year to year" because of planting and preservation of trees. If such planting continued, Nebraska would soon re-enter Ferdinand Hayden's "Tertiary epoch" of semi-tropical climate, "magnificent forests," and lakes swept by "balmy breezes" similar to those of Mexico or Cuba. By the end

of the decade, however, Aughey had reversed himself when he realized that the improved climate could not have been solely due to tree planting. The recent increases in rainfall had actually begun before settlers had planted enough trees to replace those they had cut. Instead, Aughey theorized that cultivation was the true cause of increased rainfall. The resulting program of climate change, labeled "rain follows the plow" by Charles Wilber, soon replaced visions of timber culture among Plains boosters, railroads, and many residents. Doubts emerged about taking the trouble to plant huge numbers of trees if all one had to do was plow. If a settler needed trees for other reasons, they might be better off to wait until plowing had sufficiently improved the climate to make tree growing a simple task.[45]

Today we read such claims as transparent boosterism, but at the time they carried more than just the weight of American optimism. Nature itself seemed to confirm hopeful theories. Elliott, Aughey, and the many others were noticing a subtle rise in precipitation during the 1870s. Without the benefit of long-term climatic records from the region, they worked with the extant evidence and concluded that the increase was part of some larger, hoped-for pattern. Between arguments over measurement, equipment, and the recent nature of settlement, the climatic history of the Plains was almost exactly skin-deep in the 1870s. The longest nearby records were from Minneapolis since 1837, from Leavenworth starting in 1836, and from Manhattan, Kansas beginning in 1858. The early portions of all three record sets were somewhat unreliable because of equipment and methodology, but also because of the rough conditions of the Army camps. Nevertheless, all three locations indicated a gradual upswing in precipitation beginning between 1865-70. The two Kansas records peaked in 1880 before declining to lows around 1895.[46]

Climatic uncertainty did not prevent Congress from initiating its own tree-planting program, the Timber Culture Act of 1873. Congress had floated different plans for a modified homestead law to encourage tree planting since 1866. Although none of these early proposals became law, the object of the acts—tree planting to improve climate—went unchallenged. Instead, what prevented the passage of early bills were objections over specific measures that required all homestead claims to plant a portion in trees or to make reforestation a much broader goal that would promote forest growth on all public lands. Debates over deforestation and future timber famines were not unusual in Congress in the late-1860s and 1870s. These discussions would eventually lead to the first Forest Reserve Bill of 1876. In 1871, however, Congress was not ready to pass radical forest legislation. The overall mood was instead only supportive enough of forestry for a narrowly aimed bill. In December 1871, Iowa Senator George Wright submitted just such a resolution to the Committee on Public Lands that urged homesteaders to plant trees on their claims. The bill spent a year in Committee and was finally introduced on 20 February 1872 by Nebraska Senator Phineas Hitchcock as a bill: "To encourage the growth of timber on western prairies."[47]

The bill sailed through Congress. Debate in the Senate was the most significant and even here it revolved around the bill's details rather than its purpose. The original bill required 120 acres of 160 be planted to trees. The Committee had reported the bill out with that amended to forty acres, and some Senators found this too liberal. They also wanted to require the claimant to show ten years worth of timber cultivation, instead of the original five, before granting final title. Iowa Senator James Harlan worried that "those of us who were born on the frontier and understand how things are done and may be done, know very

well that five years' growth of timber on a western prairie, cultivated as it probably will be within the meaning that clause, will not amount to much." The only other attempt to amend the bill involved preventing preemption claims under the Homestead Act from also filing under the Timber Culture Act. Senator Hitchcock successfully defended the measure by explaining that planting forty acres to trees would require significant capital investment. Individuals without capital, and who had no previous land claim, would surely file under the Homesteading Act rather than go through the expense and labor of filing a Timber Culture claim. The House accepted the Senate's version, and President Grant signed the Act into law on 3 March 1873.[48]

The law underwent a series of changes for both environmental and political reasons before its repeal in 1891. Congress passed the original law with so little attention that the next year it had to revisit the act and clarify some details. As originally passed the act would have allowed anyone to file a timber claim. In 1874, Congress demanded that claimants meet the same age and citizenship requirements as pre-emption and homestead acts. Grasshopper plagues and dry conditions in Kansas and Nebraska led to further amendments in 1874, 1875, and 1876 that allowed settlers to maintain all land rights even if the trees were destroyed. In return, they added time to proving up equal to the number of years lost due to the destruction. In 1878, petitions, memorials, and general dissatisfaction with the operation of the law persuaded Congress to reduce the area of required tree planting from forty to ten acres and decreased the spacing between individual trees by half. In 1882, the Commissioner of the General Land Office alerted Congress to serious abuses of the law by fictitious entries later sold to speculators or real settlers. Such complaints plagued the law throughout the 1880s and led to several failed attempts at repeal by the House of Representatives. Finally in 1891,

the Senate agreed to repeal the law. A law that had begun as an attempt to alter the climate of the West ended as a widely ridiculed land giveaway.[49]

Initial indifference on the part of Congress, land offices, and forestry boosters to abuses and failures of the Timber Culture Act should not be interpreted as evidence that it arose from a cynical desire to give away land. Theories of forests and climate that permeated debates reveal a different impulse. By 1873 and the passage of the Act, many individuals subscribed to the same ideas and ideals as Elliott or Aughey. They believed that the climate of the Plains was already changing because of a variety of less intensive methods. With settlement being the key to unlocking the Garden, it made sense to ignore the law's limited success and get on with the business of transferring the public domain to the public. It was also no accident that Congress resisted repeal until 1891, when drought forced members to admit Joseph Wilson optimistic prophesy of three decades earlier that nature was willing to "second the operations of man in respect to climate" simply had not proven true.

Although the Timber Culture Act never cloaked the Plains with timber, its failure was almost as useful as success. Later investigations, programs, and theories all used the Act as a starting point to make claims about nature and the role of trees. More than one future Congressmen would work a tree claim or have first-hand knowledge of someone who did. They took these experiences with them to office and made it central to their understanding of whether trees would grow on the Plains. Many opponents of tree planting—either for the National Forests or Shelterbelt Project—used the Timber Culture Act as evidence that the Plains would not grow trees, yet tree supporters were just as eager to invoke the Act's examples of successful claims.

During the nineteenth century, the single greatest lesson of the Timber Culture Act was that it lacked the very qualities that progressive foresters would soon bring to federal forestry. The law lacked careful monitoring and bureaucratic support. The western states were more concerned with transferring public land into private hands than enforcing either the letter or the spirit of the law, and, above all, the individuals who carried out the actual work of planting lacked proper information. There were no specific planting instructions as to time of year, depth, method of planting, preferred species, spacing, or care after planting. Tree suppliers sold settlers unsuitable species from far-flung nurseries transported haphazardly. Even when settlers used hardy native species, they did not have adequate expertise to grade stock for disease, pests, or "sickliness." In the absence of sound scientific expertise, many foresters would later argue, it was a wonder that any tree claims succeeded.

Chapter One—Notes

[1] Henry Nash Smith, *Virgin Land: The American West as Symbol and Myth* (New York: Vintage Books, 1962); Leo Marx, *The Machine in the Garden* (New York: Oxford University Press, 1964); Roderick Nash, *Wilderness and the American Mind* (New Haven: Yale University Press, 1967).

[2] Edward O. Wilson, *Biophilia* (Cambridge: Harvard University Press, 1984).

[3] George Perkins Marsh, *Man and Nature: The Earth as Modified by Human Action* (Cambridge: Belknap Press, 1864 [1967]). The idea that trees attracted moisture and could change climate was not new, see Walter Kollmorgen and Johanna Kollmorgen, "Landscape Meteorology in the Plains Area," *Annual of the Association of American Geographers* Vol 63, No. 4 (December 1973): 424-41. For an introduction to current science on forests and climate see, Norman Myers ed., *Tropical Forests and Climate* (Boston: Kluwer Academic, 1991).

[4] Marsh, *Man and Nature*, 10.

[5] Zebulon Montgomery Pike, *Sources of the Mississippi and the Western Louisiana Territory* (Ann Arbor: University Microfilms, 1966), Appendix to part II, pg. 8; quoted in Roger L. Nichols and Patrick L. Halley, *Stephen Long and American Frontier Exploration* (Newark: University of Delaware Press, 1980), 167.

[6] Map of the United States and British Provinces. 1849. *Transportation and Communication* [online] Library of Congress, American Memory Collection, 2003 [cited 20 April 2003]. Available from world wide web: (http://memory.loc.gov/cgi-bin/query/D?gmd:39:./temp/~ammem_sHlt::)

[7] Martyn J. Bowden, "The Perception of the Western Interior of the United States, 1800-1900: A Problem in Historical Geography," *Proceedings of the Association of American Geographers* 1 (1961): 16-21; Martyn J. Bowden, "The Great American Desert in the American Mind, 1890-1972: The Historiography of a geographical notion," in *Geographies of the mind: Essays in historical geosophy in honor of John K. Wright*, edited by Martyn J. Bowden and David Lowenthal (New York: Oxford University Press, 1975); Bradley Baltensperger, "Plains Promoters and Plain Folk: Premigration and Post-Settlement Images of the Central Great Plains" Ph.D. diss., Department of Geography, Clark University, 1974; Bradley H. Baltensperger, "Plains Boomers and the Creation of the Great American Desert Myth," *Journal of Historical Geography* 18(1) (1992): 59-73; Merlin P. Lawson and Charles W. Stockton, "Desert Myth and Climate Reality," *Annals of the Association of American Geographers* 71(4) (1981): 527-535.

[8] John Wesley Powell, *Report on the Lands of the Arid Region of the United States, with a more detailed account of the lands of Utah* (Washington: Government Printing Office, 1879); Robert L. Snyder, *Pare Lorentz and the Documentary Film* (Norman: University of Oklahoma Press, 1968); Paul B. Sears, *Deserts on the March* (Norman: University of Oklahoma, 1935 [1959]); Deborah E. Popper and Frank J. Popper, *The Buffalo Commons thesis of land use in the Great Plains region* [sound recording], (Ames: Iowa State University Lecture Series, 1993).

[9] Bernard De Voto ed., *Original Journals of the Lewis and Clark Expedition*, (Boston: Houghton and Mifflin, 1953); Pike, *Sources of the Mississippi*; Nicholas and Halley, *Stephen Long*; Edmund Schulman, *Dendroclimatic Changes in semiarid America* (Tucson: University of Arizona, 1956); Harry Weakly, "A Tree-Ring Record of Precipitation in Western Nebraska," *Journal of Forestry*, 41 (November 1943): 816-19; Harold C. Fritts, Robert G. Lofgren, Geoffrey A. Gordon, "Past Climate Reconstructed from Tree Rings," *Journal of Interdisciplinary History* 10(4) (1980): 773-793; Lawson and Stockton, "Desert Myth."

[10] Merlin P. Lawson, "A Behavioristic Interpretation of Pike's Geographical Knowledge of the Interior of Louisiana," *Great Plains-Rocky Mountain Geographical Journal* 1(58) (1972): 58-64.

[11] Nicholas and Halley, *Stephen Long*; John Charles Fremont, *Report of the Exploring Expedition to the Rocky Mountains*, (Ann Arbor: University of Michigan Microfilms [1966]); David Roberts, *A Newer World: Kit Carson, John C. Fremont, and the claiming of the American West*, (New York: Simon and Schuster, 2000).

[12] Richard White, "Discovering Nature in North America," *Journal of American History* 79 (December 1992): 874-891.

[13] Donald R. Whitnah, *A History of the United States Weather Bureau* (University of Illinois: Urbana, 1961); Charles W. Stockton and David M. Meko, "A long-term History of Drought Occurrence in Western United States as Inferred from Tree Rings" *Weatherwise* XXVIII (1975): 244-249; James R. Fleming, "Meteorology at the Smithsonian Institution, 1847-1874: The Natural History Connection" *Archives of Natural History* 16(3) (1989): 275-284; Karen DeBres, "Plains Climate Conditions: An Early Interpretation by the Smithsonian Meteorological Project in Manhattan Kansas 1858-1873" *Prairie Forum* 25(1) (2000): 159-172; Gary Libecap, Hansen Libecap and Zeynap Kocabiyik, "'Rain Follows the Plow' and Dryfarming Doctrine: The Climate Information Problem and Homesteading Failure in the Upper Great Plains, 1890-1925" *Journal of Economic History* 62(1) (2002): 86-120.

[14] Lawson and Stockton, "Desert Myth," 531, 535. See also, John L. Allan, "New World Encounters: Exploring the Great Plains of North America," *Great Plains Quarterly* 13(2) (1993): 69-80.

[15] Walter P. Webb, *The Great Plains* (Boston: Ginn and Co., 1931), 9. The idea that irrigation would increase rainfall had remarkable staying power and continued to be widely popular as late as the 1960s. For more on rainmaking see, Jeanne Schinto, "Rainmakers," *American West* 14(4) (1977): 28-33.

[16] See David Emmons, *Garden in the Grasslands: Boomer Literature of the Central Great Plains* (Lincoln, Neb.: University of Nebraska Press, 1971), for a more detailed examination of the varied manifestations of Plains boosterism.

[17]Alexander von Humboldt, *Cosmos: A Sketch of a Physical description of the Universe* (London: G. Bell, 1891-1893) I. Joseph Henry, *Scientific Writings of Joseph Henry* (Washington: Smithsonian Institute, 1886) II, 10, 19; David M. Emmons, "Theories of Increased Rainfall and the Timber Culture Act of 1873," *Forest History* 15(3) (1971): 6-14.

[18] See Emmons, "Theories of Increased Rainfall," p. 8, 10.

[19] Marsh, *Man and Nature*, 155, 170.

[20] Ibid., 3.

[21] Ibid., 9.

[22] Ibid., 10, 11.

[23] Ibid., 46, 25, 280.

[24] Richard White, *'It's Your Misfortune and None of My Own': A History of the American West* (Norman: University of Oklahoma Press, 1991). The "safety-valve" theory is associated with Frederick Jackson Turner, *The Frontier in American History* (New York: H. Holt and Company, 1920).

[25] Discussions of the potential of artesian wells to transform the environment were not unusual. They seem to derive from a very fundamental misunderstanding of the amount of water such sources could provide. Most discussions of the idea speculated that humans might enlarge the number of wells and increase the flow and then spread the water to a variety of regions. Later assessments dismissed the notion because of the limited number of artesian sources.

[26] Perl W. Morgan ed. *History of Wyandotte County Kansas and its People* (Chicago: Lewis Publishing, 1911), Part two; quoted in Frank W. Blackmar, *Kansas: A Cyclopedia of State History* (Chicago: Standard Publishing, 1912). See also, Merlin P. Lawson, *Nebraska Droughts—A Study of Their Past Chronological and Spatial Extent with Implications for the Future* (Lincoln, University of Nebraska: Nebraska Water Center, 1971).

[27] Joseph S. Wilson, *Report of the Commissioner of General Land Office for the Year 1868* (Washington: GPO, 1868), 137.

[28] Ibid., 173.

[29] Ibid., 176.

[30] Ibid., 176.

[31] Ibid., 197; George Perkins Marsh, *Man and Nature*, 165n.

[32] F. V. Hayden, *Report of the Commissioner of the General Land Office for the Year 1867*, (Washington: GPO, 1867), 135-136, 159-160. Wilson included sections by Hayden in his reports for other years, but the 1867 report was representative of his opinions.

[33] Ibid., 135-136.

[34] M. Becquerel, "Forests and their Climatic Influence," in *Annual Report of the Board of Regents of the Smithsonian Institution, 1871* (Washington: GPO, 1871), 415. Henry had various pieces from Becquerel printed in the *Annual Report* for 1869, 1870, 1871, but they all made the same claims. M. M. Johnson in *Annual Report of the Regents, 1870*, 428.

[35] Richard Smith Elliott, *Notes Taken in Sixty Years* (St. Louis, MO: R. P. Studley and Co. 1883).

[36] Ibid., 313-315. Many of Elliott's writings have an anti-intellectual or anti-theory tone to them, which is especially entertaining in light of his frequent and wide ranging theorizing.

[37] Ibid., 309-10. See also, F. V. Hayden, *Preliminary Report of the U. S. Geological Survey of Wyoming and Portions of Contiguous Territories* (Washington: GPO, 1872); F. V. Hayden, *Preliminary Report of the U. S. Geological Survey of Montana and Portions of Adjacent Territories; 5th Annual Report of Progress*" (Washington: GPO, 1872).

[38] Elliott, *Notes Taken*, 309-310.

[39] Ibid., 315-319. See also, Richard Smith Elliott, *Letter Press Book*, Missouri Historical Society, St. Louis, Missouri.

[40] Burton J. Williams, "Trees But No Timber: The Nebraska Prelude to the Timber Culture Act," *Nebraska History* 53 (Spring 1972): 77-87; James C. Olson, "Arbor Day—A Pioneer Expression of Concern for Environment," *Nebraska History* 53 (Spring 1972): 1-13. James C. Olson and Ronald C. Naugle, *History of*

Nebraska (Lincoln: University of Nebraska Press, 1997), 336. The Nebraska State Legislature made Arbor Day a formal holiday in 1885.

[41] Ian Tyrrell, *True Garden of the Gods: Californian-Australian Environmental Reform, 1860-1930* (Berkeley: University of California Press, 1999); Nebraska Horticultural Society, *Transactions* (Omaha, 1871): 17-22.

[42] N. H. Egleston, *Arbor Day—Its History and Observance* (Washington: USDA, 1896); Quoted in James C. Olson, *J. Sterling Morton* (Lincoln, Nebraska: University of Nebraska Press, 1942), 166; Olson, *History of Nebraska.* See also Williams, "Trees But No Timber," 81; Wilmon H. Droze, "Changing the Plains Environment: The Afforestation of the Trans-Mississippi West" *Agricultural History* 51:4 (January 1977), 6-22.

[43] Olson, "Arbor Day." See also, Olson, *J. Sterling Morton.*

[44] Richard White," 'Are You an Environmentalist or Do You Work for a Living?': Work and Nature" in *Uncommon Ground: Rethinking the Human Place in Nature.* Edited by William Cronon, (New York: Norton, 1995).

[45] Elliott, *Notes Taken*; Samuel Aughey, *The Geology of Nebraska* (Lincoln, 1873), 14; Samuel Aughey, *Physical Geography and Geology of Nebraska* (Omaha: Daily Republican Book and Job Office, 1880), 41-47; Charles D. Wilber, *Great Valleys and Prairies of Nebraska and the Northwest* (Omaha: Daily Republican Printer, 1881).

[46] Elliott, *Notes Taken.* The Depression of 1873 ended Elliott's employment for the Kansas Pacific Railroad and care for the experimental stations he started. But even in 1873 while still working at the stations he recorded many instances of failed crops and dead trees. In every case he tried to emphasize the positive and downplay such failures. C. G. Bates, "Climatic Characteristics of the Plains Region" in *Possibilities of Shelterbelt Planting in the Plains Region* (Washington: GPO, 1935), 96; Cary J. Mock "Drought and Precipitation Fluctuations in the Great Plains During the Late Nineteenth Century" *Great Plains Research* 1(1) (1991).

[47] *Congressional Globe* 39th Congress, 1St Session (1866), 1588, 3427, 3782; *Congressional Globe* 40th Congress, 1st Session (1867), 292; *Congressional Globe* 40Th Congress, 3rd Session (1869), 814; *Congressional Globe* 41st Congress, 1St Session (1869), 29; *Congressional Globe* 41St Congress, 2nd Session (1870), 413, 1819; Benjamin Horace Hibbard, *A History of the Public Land Policies* (Madison: University of Wisconsin Press, 1924 [1965]). Although there are a number of articles dealing with the Timber Culture Act (see above), none explained why it succeeded in 1873 but not earlier. This is probably because none of the various proposals inspired much debate. The best explanation is still John Ise, *The United States Forest Policy* (New Haven: Yale University Press, 1920), 43.

[48] *Congressional Globe* 42nd Congress, 2nd Session (1872), 4464; *Report of the Commissioner of Agriculture* (Washington: GPO, 1869); James D. Richardson ed., *A Compilation of the Messages and Papers of the Presidents* (Washington: Bureau of National Literature and Art, 1910), 4158. The Act became law in March, well before the September financial meltdown that became the Depression of 1873. Grant's support was probably partially electoral—the law would be popular in the Western states but cost little—and genuine in that he seemed to believe in its underlying principal.

[49] Hibbard, *A History of Public Land Policies*, 414-21; William F. Raney, "The Timber Culture Acts" *The Mississippi Valley Historical Review* 10:2 (November 1920), 219-229. For a good overview of the Act's actual success see, C. Barron McIntosh, "Use and Abuse of the Timber Culture Act" *Annals of the Association of American Geographers* 65:3 (September 1975): 347-62.

Chapter Two—Formalizing Science: forest reserves on the Great Plains

Plains forestry underwent fundamental shifts in methods and structure at the turn of the twentieth century. Formally trained scientists—increasingly specializing in forestry—replaced the ad hoc and self-appointed tree apostles, and began to develop a professionalized science and discourse of Plains forestry. Most of these experts worked for federal or state government, and sought to replace private management with public control. They succeeded at building a scientific base for Plains forestry and drawing the federal government into tree culture, but their success was as much the result of natural fluctuations as the strength of their convictions. Likewise, the variations in Plains nature that helped initiate the profession limited the growth of Plains forestry and insured it remained on the margins of the national forestry movement during the Progressive Era.

The brightest goal of professional foresters was direct federal involvement in constructing a series of national forests on the Great Plains. These foresters believed that forests would gradually modify the climate and serve as demonstrations of tree growth under difficult conditions. While foresters might be accused of over optimism, they understood the need to develop both a theoretical explanation for afforestation and a scientific program for planting. The unarticulated, but obvious dilemma they faced was that to develop scientific evidence about climatic change, they first needed to grow large numbers of trees. As a result, foresters could only speak in theoretical terms about the "potential" effects of forestry on climate. More successful was their rapid development of a practical and concrete science of tree culture. While foresters remained unable to test climatic theories, they were able to study and promote a host of other benefits that planting trees might bring. In part this was simply a

way of rationalizing their own actions so they could successfully compete for public funds. But through laboring in nature on the Plains reserves, foresters also developed new ideas about how forestry and federal land control could assist residents.

Foresters advocated federal land control to help eliminate many of the weaknesses of earlier afforestation programs, but when they controlled substantial sections of land, they became involved in actions only loosely related to forestry. The Forest Service wanted control to apply the latest scientific ideas and to protect the plantations. However, to obtain local support they also needed to allow access to traditional users. The landscape of the reserves became a hybrid that combined public and private goals. Better off ranchers used the fenced and managed range to improve their livestock. Foresters used the reserves as giant working laboratories to develop nursery and planting techniques.

It was in the actual work of growing trees on the Sandhills of Nebraska that many foresters came to terms with the Great Plains landscape, the potential role of trees, and the future of the Forest Service on the Plains. Initially, many foresters believed that they would convert millions of acres of grassland to forest, but as they interacted with Plains nature they realized the impracticality of massive plans. Although early disappointments discouraged the most exuberant, occasional modest successes led foresters to appreciate forestry's potential. They found that constructing a forest was exceedingly difficult work. They needed to build nursery facilities and get seedlings growing under the trying climatic and soil conditions. Once they had seedlings to plant they had difficulty getting them to grow in the Sandhills. Partially solving some challenges of propagation still left them under constant threats from stray livestock, drought, disease, and fire. The tenuous plantations also required constant human labor to insure reproduction. Despite these trials, foresters remained surprisingly

enthusiastic especially when they realized that even a small forest served as a refuge for animals and humans. Foresters also learned that the nurseries and nursery techniques they developed were a valuable commodity on the Plains.

Before foresters could test their theories against the reality of Plains nature, they had to construct a series of forest reserves where there were no forests. The first hesitant step in appreciating the difficulties of afforesting the Great Plains began in 1891 as a part public, part private, experimental plantation in central Nebraska named the Bruner Plantation after its owners. The justification of an expanded program ultimately hinged on this experiment. Beginning in 1902, President Theodore Roosevelt undertook that expansion by establishing four forest reserves on the Plains: the Dismal (1902), Niobrara (1902), and North Platte (1906) Reserves in Nebraska, and the Garden City (1905) Reserve in Kansas. President William Howard Taft added the Dakota National Forest (1908) in North Dakota to the list. Like the Bruner Plantation, these Forest Service efforts met mixed success. Congress opened the North Platte reserve to homesteading in 1913 after planting trees on only a few dozen acres. The Garden City reserve struggled with drought, fire, and the Forest Service's lack of experience in Plains forestry before President Woodrow Wilson terminated it in 1915. The demise of the first Dakota National Forest followed two years later, and the Forest Service combined the Dismal and Niobrara River reserves as the Nebraska National Forest in 1908. Only this last forest still exists today. Though begun with grand intentions, the eventual importance of Plains forestry lay in helping to create a science and profession, not in modifying climate.[1]

The call to put Plains forestry on a sounder scientific basis began almost as soon as the idea gained official recognition. The successful passage of the Timber Culture Act in 1874 led the American Association for the Advancement of Science (AAAS) to urge creation of an Office of Commissioner of Forestry. Franklin Hough, a prominent member of the Association, and eventually the first Commissioner of Forestry, was the most active voice in arguing for tree planting on the Plains. Hough's explanations sounded similar to his contemporaries: he argued that deforestation led to desertification and loss of soil. Hough offered examples from Europe where tree planting seemed to increase rainfall, and he even included data from Utah that indicated settlement increased rainfall.[2]

The AAAS and its call to professionalize forestry research were part of larger changes within America that led to the Progressive movement. Historian Samuel Hays saw the building demand for a "program of scientific management" originating in worries over waste by the timber industry. Hough and others sought scientific methods for managing efficiently a variety of economic activities, but they were equally concerned with modernizing government to keep pace with industry. The application of steam power to logging, the rapid spread of railroads, the consolidation of forest-to-market activities, and the increasing scale of operations had by the 1870s far outstripped the ability of private individuals or even elected officials, to influence forest policy. Professional scientists like Hough desired some federal oversight over industry. They assumed that science, professionally applied, would rationalize the timber industry and create nonpartisan public policy.[3]

Although substantial federal intervention in timber management remained decades away, Hough succeeded in creating a forestry office entrusted with studying the potential

effects of trees on climate and other aspects of the nation's timber resources. The Committee on Public Lands did not act on the Association's recommendations in 1874, but the following year it provided funds for "studying" American timber resources and in 1876 created a forest commission within the Department of Agriculture. The Division remained essentially a one-man job during its first decade, and both Hough and his successor, Nathaniel Egleston, began compiling and publishing on a variety of forestry activities.

During his tenure as Division head from 1876 to 1883, Hough built a scientific case for Plains forestry. One of his tasks was to bring together much of the available information on forestry within the United States. He published this as *The Elements of Forestry.* Although wide-ranging in subject matter, *Elements* dwelt on the potential humidifying effects of forests on rainfall. Instead of quoting George Perkins Marsh and other earlier authors, Hough developed his own theoretical foundation for how forests might increase humidity and rainfall. Without concrete, long-term data on rainfall and tree growth, he had to rely on explaining evaporation rates and the influence of temperature. He reasoned that trees created a cooling effect that reduced evaporation and added moisture to the air, and that these factors encouraged the formation of clouds and precipitation. Hough then used his theory as lens into the North American past and adapted traditional Old-World narratives linking deforestation and social collapse to New-World conditions. He speculated that the collapse of some American Indian cliff dwelling societies might be attributed to deforestation.[4]

Hough also developed a long list of potential benefits for Plains forestry and specific advice on planting. In his discussion of shelterbelts, he submitted the traditional explanations of humidity and temperature but also emphasized their wind-reducing benefits. The latter would help orchards, improve pasture and crop yield, and make yards and gardens more

pleasant. He also suggested that tree planting increased the habitat for insectivorous birds and thereby helped control grasshoppers—a theory obviously designed to appeal to the many farmers that faced grasshopper plagues during the mid-1870s. Finally, he offered hope that many plantings might eventually be harvested for lumber. Although Hough did not elaborate on these arguments, foresters would increasingly emphasize alternative influences and decrease climatic claims.[5]

Hough's successor at the Forestry Division, Nathaniel Egleston, continued in much the same vein. He argued that forests drew clouds and created a cooling effect that increased precipitation, and he also revised downward Land Commissioner Joseph Wilson's suggestion that "one-third the surface" of the Plains should be covered with forests to "one-quarter." Egleston also remarked that forests might reduce the incidence of droughts, floods, tornadoes, and destructive rainfall. Tellingly, he admitted that there was not enough evidence to know whether trees had any effect on climate, but theory, reason, and available data from Europe seemed to indicate they should. He was certain that trees could be grown on the Plains and that this fact alone made the region much more attractive for settlement.[6]

Underlying both Hough's and Egleston's discussions of Plains forestry was the amazing flood of settlers during the late 1870s and 1880s. Despite the panic of 1873 and grasshopper plagues and localized droughts throughout the mid-1870s, the population of Kansas and Nebraska increased by 173 and 268 percent respectively during the 1870s. The rush slowed during the 1880s, but population still increased by 43 and 134 percent respectively. In the 1870s, much of the increase had moved into the eastern counties, but by the 1880s the legislatures in Kansas, Nebraska, and the Dakotas were creating new counties,

towns and villages in the central and western parts of the states. Even eastern Colorado joined the boom as optimistic settlers flooded in by the tens of thousands. [7]

Adequate rainfall in most years helped support these waves of settlers. Kansas experienced good crop years in 1878 and from 1884 to 1887. The success of the 1878 crop started a rush for the central and western counties of the state, and although the subsequent years were often marginal for crop production, they were not bad enough to break the optimism. When rainfall improved in 1884, settlement accelerated in the western quarter, of the state. Nebraska also benefited from improved rainfall in 1878, and unlike Kansas, mostly good conditions continued until 1890. The Dakotas followed a similar path. Good rainfall during and after 1878 triggered heavy settlement until droughts in 1886 and steep declines in the price for wheat brought the Dakota boom to a close. Meanwhile, good rainfall in eastern Colorado in 1886 seemed to demonstrate for some Coloradoans the existence of a human induced rain belt. The *Elbert County Democrat* told its readers their county was "an extension of the beautiful lands of Western Kansas, and is productive beyond computation ... the quantity of moisture is no longer a speculation, but it is an assured fact ... all that is needed is to plow, plant and attend to the crops properly; the rains are abundant." The rapid return to dry conditions in 1889 brought the Colorado boom to a halt.[8]

During the early 1880s, Hough and Egleston's theories about trees, rainfall, and the need to reserve one-quarter the surface of the Plains for trees seemed out of step. Americans continued to trumpet the benefits of tree planting, but there was little sustained enthusiasm for any plan that cost money or stood in the way of settlement. Even enforcing the full provisions of the Timber Culture Act seemed unnecessary when the goal of the act—settlement and climatic improvement—was happening anyway. Settlers and boosters were

more in tune with the pronouncements of Samuel Aughey and other proponents of rain follows-the-plow. Most had little interest in making the sacrifices that massive tree planting required.[9]

In the late 1880s and early 1890s, however, the boom in Plains settlement ground to a painful halt. Half the population of western Kansas exited between 1888 and 1892, driven by failing rainfall, inflated land values, and high temperatures. By 1891 tens of thousands of settlers a year were heading back across the Missouri River. Between 1887 and 1897, crops failed in the central and western regions of Kansas and Nebraska in at least five of ten years, and production remained low in all but two years. A professor in Lawrence, Kansas, reported to the Weather Bureau that at the peak of the drought in September 1894, "the fierce dry heat burned the foliage of the trees so that they crumbled to powder at the touch of the hand."[10]

The low rainfall and hot winds that crushed settlers' dreams coincided with the appointment of a new and vigorous head to the Department of Forestry. On 15 March 1886, President Grover Cleveland appointed Bernhard Fernow to replace Nathaniel Egleston as Division chief. That summer Fernow went into the field to study tree planting in the West. He traveled through Kansas, Nebraska, and Colorado, and in September attended the American Forestry Congress in Denver. Returning from the trip, Fernow compiled his first *Report of the Division of Forestry*. Fernow made a strong case for the role of forestry on the Plains, arguing that government could play a crucial role. He believed the work of "a forest department might be properly extended to the creation of new forests, so as to produce beneficial results upon the agricultural conditions of the arid and semi-arid regions of the Western States." Planting in small tracts would not suffice because the "unfavorable climatic conditions" would not soon change "unless large tracts be covered with forest growth."[11]

Fernow's assertion that the government would have to plant large areas to achieve any lasting benefit was a direct challenge to the agrarian and frontier ethos of many Plains residents. The implication was that individual initiative as embodied by Arbor Day and the Timber Culture Act, was inadequate to the task. Fernow did not take the logic of this failure as far as later critics of Plains settlement who equated pioneering with reckless destruction. Instead, Fernow felt individual effort was simply insufficient to the task at hand. He saw Arbor Day and the Timber Culture Act as steps in the right direction, but as needing more scientific and financial support from government. A key aspect of this science was Fernow's theory—which became central to Plains forestry advocates—that forests created their own conditions for existence. If enough trees could be started in a dense stand, and protected from early threats, then gradually the forest would create ideal soil and moisture conditions for its continued propagation. As a forester, Fernow understood how and wanted to build forests. He had an authentic desire to assist settlers, but his primary training and interests lay in creating managed forests. Ideally, along the lines of the single species, regimented forests of his German homeland. It was not immediately obvious to him that the two goals, assisting settlers and building forests, could be in conflict.

Theories about settlement and forestry were never based on a close examination of nature. Fernow and many later authors viewed the failure of the Timber Culture Act and the economic distress and farm abandonment of the 1890s as economic and political problems that could be addressed with scientific or political solutions. In both cases, nature—in the form of drought—probably played a far larger role. Likewise, many agricultural experts and later historians argued that the improvement in conditions after the mid-1890s was the result

of improved methods and crops when a large share of the success was simply the result of increased rainfall.[12]

The vast government plantations that Fernow imagined would have spatial consequences as well. The ideal of carving the land into private parcels would be replaced by consolidating huge tracts under bureaucratic responsibility. Farmers and ranchers would, at least in part, become government tenants leasing rights to use government lands. Even on farms surrounding the reserves, where older patterns of ownership prevailed, a putatively egalitarian social structure would collide with distant, powerful bureaucratic controls on a scale to make even the railroads seem local. Fernow had not made the step to advocating public maintenance of private lands. He still imagined a Plains separated into public and private spheres with the public being managed to improve the private and it would not be until the ecological and economic disasters of the 1930s that foresters and other conservationists would willingly cross that threshold. In the 1890s, Fernow and his peers still harbored deep reservations about spending public funds to improve private lands. They understood that consequences could flow between spatial divisions because the premise of the reserves was that massive tree planting would improve the climatic conditions of neighboring farms.[13]

Fernow had difficulty articulating the reverse formula in which bad behavior on the part of some landowners created negative consequences for other users, but another attendee at the American Forestry Congress in Denver, Charles Bessey offered a partial solution. Bessey, an influential author and botany teacher at the University of Nebraska was in Denver to describe the results of his botanical survey of Nebraska. His studies suggested that the Nebraska Sandhills had been partially forested. The remains of fossilized yellow pine

suggested that scattered groves had once grown throughout the northern, central, and western portions of Nebraska. Another clue was the frequent presence of Bearberry or "kinniknick," a prostrate, vine-like plant that normally favored open wooded hillsides. Bessey hypothesized that unfavorable climate alone did not explain the treeless character of the Plains. Instead, he suggested, that lightning fires had gradually destroyed the forests, and bison trampling and repeated Indian burning had prevented natural reforestation. If Bessey was right, then excluding fire and grazing from portions of the landscape would be an essential first step in afforestation. The best way to accomplish both goals would be through some form of public ownership.[14]

Neither Fernow nor Bessey had yet begun to advocate federal controls, but Fernow remained interested in the subject and promoted forestry to state agencies and farmers. Although Fernow's thinking had clear implications about the limits of individual enterprise, he continued to advocate private involvement and to use agrarian rhetoric. He argued that farmers would be the best forest owners since they were the "most stable class of our population, and can devote the most care and attention to the management of their wood lots." This agrarian perspective infused Division of Forestry reports until he left in 1897. Fernow's concern for agriculture was not limited to eastern farmers. He consistently advocated forestry for the Great Plains, and as Congress expanded the Division's budget, Fernow made planting experiments on the Plains one of the Division's three research goals.[15]

By 1891, Fernow was ready to explain why the region lacked forests and how to remedy the deficit. On 20 January 1891, Fernow delivered an early version of his 1891 *Report on Forestry* to the annual meeting of the Nebraska State Board of Agriculture. Combing Bessey's work with his own theories, Fernow argued that "the entire earth is a

potential forest," and "it is a noticeable fact that the forest to some extent creates its own conditions of existence." He admitted that "unfavorable rainfall conditions in parts of the region" made forest extension difficult, but even here he insisted that foresters could have prospered if "the fire of man with the tramp and browsing of buffaloes had not prevented it." Fernow proposed that "forest planting is one of the necessary requisites to permanently reclaiming this vast domain . . . [and] success can be forced only by co-operation . . . systematically carried out by commanding knowledge, means, and power, such as alone a government—be it state or general government—can command."[16]

In the face of the environmental and economic disruption of the early 1890s, Fernow was taking the final steps from reliance on private initiative to advocating a statist approach to Plains landscape management. With Bessey's data in mind, Fernow was able to make an effective argument that the Plains could be returned to its formerly forested condition. Doing so would require an effort on a scale completely beyond the individual farmer, and only science and government could create such landscape. A stable controlled environment would serve as the backbone of the "independent" farmer, even if that independence would be increasingly dependent on outside intervention.

Although Fernow remained silent about the growing political challenge of Populism, the timing and essence of his proposals seemed heavily influenced by them. Fernow's understanding of Populism was similar to historian John Hicks who argued the movement was "the inevitable attempts of a bewildered people to find relief from a state of economic distress made certain by the unprecedented size and suddenness of their assault upon the West." Later historians have questioned whether economics was a sufficient motivation for Populism, but in the early 1890s it was the second part of Hicks' thesis that was particularly

compelling: "their assault upon the West." Fernow theorized that trees would help create a more stable farm population, and foresters all the way back to George Perkins Marsh had argued that mixed landscapes created the best class of farmer. Not only was tree planting linked to long-term social and environmental stability, but the trees would be valuable commodities that could help farmers through trying times. Most of this theorizing about landscapes and people was based more on foresters' visceral distaste for farming practices that resulted in deforestation, soil erosion, and then abandonment, rather than a clearly articulated argument about how trees created prosperity. For Fernow, however, the exact mechanism was less important than the immediate goal of stabilizing land and society by getting more trees on the Plains.[17]

While Fernow and Bessey may have dreamed of an expansive, government funded effort to afforest the Great Plains, the political will and bureaucratic organization for such an effort was severely lacking. This did not stop them from taking small steps. As early as 1891, Fernow organized a trial planting. He asked Bessey to find a man who owned property in the Sandhill region and was "responsible and fit to do the work of planting, who would place his ground and superintendence at our disposal under some arrangement by which he retains possession of his land and ultimately of the forest growth." Fernow urged Bessey to find someone as soon as possible so that they could begin planting next spring. Bessey tapped Lawrence Bruner, an enthusiastic fellow professor at the University of Nebraska, who owned land near Swan Lake in Holt County, Nebraska (Figure 2.1).[18]

The scale of their experiment was small compared to the vastness of their plans, but even a little experiment could help identify future problems. One was that the desire for scientific controls exposed tensions between public funds and private lands. Fernow and

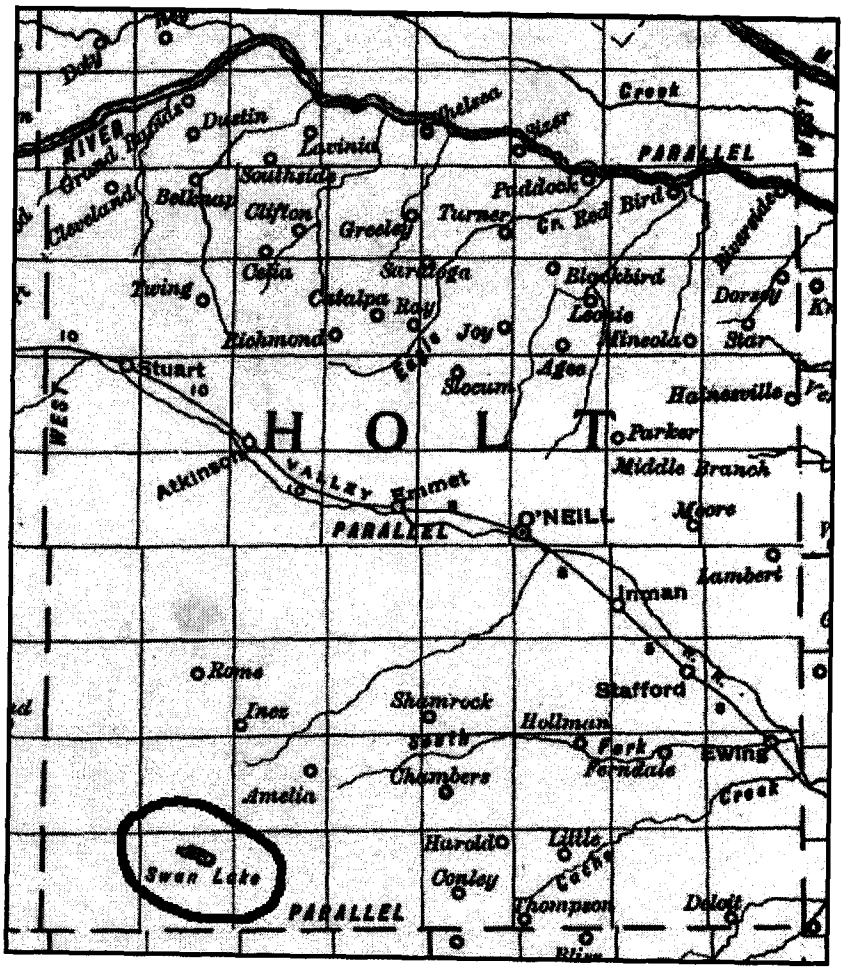

Figure 2.1—Holt County, Nebraska from an 1889 map showing Swan Lake.[19]

Bruner became locked in a legal dispute over the exact status of trees and land. The Division of Forestry asked for a contract that secured control of the experiment for five years. Fernow hoped this would prevent premature cutting of trees, undesired replanting, or, worse, plowing under of failed plantings. The Division's difficulties were compounded by problems in locating the right numbers of seedlings and delivering them to the Bruner brothers. At the end of March, Fernow took personal control of the project to expedite matters. He agreed that there would be no formal contract and that "a simple distribution of plant material under

special conditions" would suffice. Dispensing with a formal contract reduced legal and departmental red tape, and perhaps relieved the Bruner's worry that they would be locked into a relationship that might prove difficult to fulfill. Fernow hoped that the 1891 plantings would be "a beginning which may lead to more, [and] if experience warrants then we may enter more formal arrangements."[20]

The Bruner's choice of plantation site made success difficult. Their land lay on the eastern edge of the Sandhills of north-central Nebraska. The Sandhills are, as the name implies, wind created sand dunes most of which are stabilized by a mixture of perennial short and tall grass prairie. The region lies between the 24 and 16-inch isohyets but rainfall is often distributed in a patchy fashion making local droughts frequent. The porous, sandy soil absorbs most runoff, and valleys between dune formations are often covered with seasonal marshes or lakes. The lush grass and open water encouraged early settlers, but the sandy soil, high winds, and frequent droughts made crop production difficult. Adding to the inherent difficulties of Sandhills cultivation, Nebraska suffered from serious drought in 1890, and while conditions temporarily improved in 1891, droughty conditions returned the following year and cumulated with the severe drought of 1894.[21]

Despite the difficult conditions the Bruners began planting in late spring 1891. Delays over the status of the land and late arrival of planting material forced the brothers to begin work in May when the weather had already grown hot and dry. They followed Fernow's guidelines and planted their seedlings in four separate half-acre plats. They located the rectangular plats end to end in a rough line on the high Sandhills, about five miles southwest of Swan Lake. They surrounded each one hundred yards long by twenty-four yards wide plat with a plowed firebreak, and intended to install a temporary windbreak of willow cuttings on

the northwest and southwest sides. The willow cuttings arrived in insufficient numbers and poor condition, however, so the plats remained largely unprotected from the drying winds. The brothers tried a number of conifer species, including Austrian pine, jack pine, Douglas spruce, ponderosa pine, red pine, and Scotch pine. In some plats they also intermixed rows of deciduous trees such as box elder, cherry, oak, and locust. The sources for the seedlings were almost as varied, with material coming from private nurseries in Franklin and Fairbury, Nebraska, Snowflake, Michigan, Dundee, Illinois, and Grantsburgh, Wisconsin. In all, the brothers planted 16,434 seedlings in the spring of 1891.[22]

The first year's plantings were successful enough to warrant more the next spring. In October 1891, Bruner wrote Fernow a detailed report on the conditions of the plantation from the previous spring. He indicated that 43.6 percent of the seedlings survived. Of those, the black locust, "although reported to be received in poor condition, and the Banksian pine, dug from the forest in Wisconsin," were the most successful. In April 1892 the brothers once again planted seedlings and counted survivors, and throughout that summer Fernow kept close track of the plantations. In February 1893, however, he informed Bruner that because of a lack of funds "we might for the present consider our tree planting experiment at an end."[23]

In most accounts of the Nebraska National Forest, the Division of Forestry forgot the Bruner plantation until 1901, but this was an oversimplification. Fernow maintained personal correspondence with Hudson Bruner concerning the condition of the plantation at least until November 1894, and that year Charles A. Keffer, Assistant Chief of the Division of Forestry, also visited the plantation and published his observations in the Division of Forestry *Bulletin 18*. Keffer explained that the Division had abandoned the plantation because its location,

twenty-five miles from the nearest railroad, made inspections difficult. Keffer indicated that of the four plats planted in 1891 and 1892, only plat number one survived, and only the jack pine seemed adapted to the locality. Keffer returned in 1896, and reported that 87 percent of the jack pine, and 45 percent of the yellow pine survived. The Division of Forestry had by this time a number of experiments underway at the State Agricultural colleges of South Dakota (Brookings), Nebraska (Lincoln), Kansas (Manhattan), and Colorado (Fort Collins). By the middle of the 1890s in other words, the Division of Forestry was, if anything, suffering from an overload of information on Plains forestry.[24]

During the 1890s, the Division of Forestry faced greatly expanded responsibilities with limited staff and budget. In 1891, the Forest Reserve Act authorized the president to create forest reserves from the public domain. Between them, Presidents Benjamin Harrison and Grover Cleveland created 18 million acres of forest reserves. These reserves remained under the control of the Department of Interior, but the Division of Forestry, within the Department of Agriculture, provided technical assistance. Congress did not expand the Division's budget as rapidly because its duties and activities remained largely advisory, not managerial. Thus, just as Fernow began his first experiment in Plains forestry, he was suddenly overwhelmed by potential activity on the nation's forest reserves. Fernow had linked the agency to direct planting experiments on the Plains and, through the Bruner plantation, even had evidence that trees could grow. Given the Division's limited staff and funding, however, the Bruner plantation was not so much forgotten as ignored because it did not mesh with Division goals.[25]

Fernow's goals for the Division reflected the many ideas and reforms that became Progressivism. At a practical level this meant an expanded responsibility assisting the

Interior Department in managing forest reserves, and an expanded research program lodged in the nation's land grant colleges. But the ideas of the 1890s and early 1900s were also at work on the agency. Historian Daniel Rodgers used the term "idea clusters" to refer to sets of rhetorical concepts that groups began using. Rodgers argued that the central Progressive viewpoint that such groups shared was discontent with arbitrary, unregulated individual power. Foresters such as Fernow, and later Gifford Pinchot, represented one idea cluster in the Progressive Era. Yet within that cluster Progressive foresters could vary considerably in how they wanted to respond to the abuses of the Gilded Age. Historian Samuel Hays suggested that Fernow "believed that the Division of Forestry should merely dispense information and technical advice," but Pinchot desired to improve forest management through federal intervention. Although the two men may have had different views about the potential for scientific management of American forests, they shared similar ideas about the need to apply science to Plains afforestation. They also worried about the failure of previous private efforts. The politics of afforestation for both men echoed themes that Progressives sounded in many spheres. They sought a more centralized, efficient, and scientific model for resource management. The movement to rationalize resource management gained momentum during the 1890s, and by the end of the decade the final pieces were in place.[26]

With the 1898 appointment of Gifford Pinchot to replace Fernow as head of the Division of Forestry, a new era began in American forestry. What Pinchot lacked in technical skills, he more than compensated for with political acumen. This allowed him to continue Fernow's expansion of the Division of Forestry, and he rapidly made the Division a powerful and far-reaching bureaucracy. Pinchot worked to increase the role of the Division in managing the Department of Interior's forest reserves. In 1901 he had the Division of

Forestry upgraded to the Bureau of Forestry, and in 1905 responsibility for the reserves transferred to the Bureau of Forestry, which was renamed the Forest Service. Pinchot also greatly increased the budget of his office through timber sales and Congressional funding.[27]

Although Pinchot did not share Fernow's deep interest in Plains forestry, in the summer of 1899 he began to consider the opportunities it presented. The Division's budget for the year—double that of only two years before—included language authorizing afforestation experiments. Pinchot had read some of Bessey's papers on the Sandhills, and hired Bessey as a "Collaborator" for $300 a year to "take up the subject of the causes which produce treeless prairies of large or small extent in regions from which forest trees are not wholly absent." The request to explain the treeless nature of the Sandhills was for Bessey, at least, a familiar request, and he quickly agreed to help with the understanding that the Division was finally going to take up the cause of Plains forestry in earnest.[28]

Pinchot's other motive for involving the Service, while less clear, appears to have been political. First, Pinchot wanted to transfer responsibilities for all of the nation's forest reserves to his department. He disagreed with the Interior Department's management of the reserves as preserves that were off limits to many uses, and he distrusted the Department as corrupt. Gaining control of several reserves on the Great Plains would be a first step in showcasing the Forest Service's management abilities. Pinchot viewed forests as something akin to agricultural crops that could be planted, grown, and harvested. He also wanted to open forests to grazing. With this management scheme in mind, it made both political and institutional sense for the Forest Service to embrace projects closely connected with agriculture. The reserves on the Plains were the perfect example of a forest that would be managed like a crop and whose very existence benefited agriculture. On reserves consisting

mainly of grasslands, it would also be logically difficult to exclude grazing interests except where trees grew. [29]

The move onto the Plains would also increase political support from a region that was well-disposed to government tree planting but skeptical of federal regulation. Pinchot needed Western support to have the nation's forest reserves transferred to his department and to increase its budget to manage the new lands. Creating Plains reserves and opening them to managed grazing signaled the Forest Service's contribution to Western development. Although the idea was of fading importance, the reserves' theorized effect on climate also appealed to western agricultural interests and, perhaps, served as a model for even drier areas.

Finally, Theodore Roosevelt's sudden assumption of the Presidency in September 1901, upon the assassination of President William McKinley, signaled to his close friend Pinchot that the Division would have staunch support from the executive branch for any expansion efforts. Both Pinchot and the President believed that scientific management of the nation's resources was a legitimate goal of government. The duo would greatly expand federal control and activities on public lands. Within this broader agenda, the reserves were scientific testbeds for afforestation and could act as a model for managed grazing on public and private lands. They were also politically less sensitive first steps to increased Forest Service involvement in conservation.

Pinchot had a talent for attracting dedicated personnel to his new agency, and these young, college educated, and mostly male, foresters spread out across the nation at the turn of the twentieth century. Foresters such as Henry Graves and Eugene Bruce that Pinchot brought along became the core of the growing profession. Pinchot also established the

Society of American Foresters in 1901 and began to transform the American Forestry Association into an advocate of scientific forestry. Between Pinchot's ability to inspire his subordinates, and the larger social stirrings of Progressivism and conservationism, the personnel that he hired brought with them an unusual level of dedication and commitment.[30]

On the Great Plains, the cutting edge of Pinchot's expansion was a small party of seven young foresters, and several mules that set out from the Mid-way Hotel in Kearney, Nebraska on a hot July day in 1901. All were recent university graduates, and only two, the party's chief, Royal Kellogg and the second in command, Louis Miller, had been with the Division of Forestry for more than a few months. William Hall, the Assistant Superintendent of Tree Planting of the Bureau of Forestry, had organized the group to travel through western Nebraska with a view to establishing government forest reserves in the Sandhills. Their mission was to conduct a survey of the Nebraska Sandhills to determine if trees grew, or could be made to grow, in the wind-swept and dry vastness beyond the ninety-eighth meridian. To that end, they brought along a large, sharp cross-cut saw and several axes for felling any trees they might find. From a cut tree they would carefully saw a six-inch section of stem. The trophies could then be used to calculate growth rates. Hall hoped to use this information to locate and justify several large reserves. As if in penance for this initial destruction, Charles Scott, the party's cook and mule driver, would spend subsequent years in the Sandhills trying to grow trees rather than cut them down.[31]

Fortunately for Plains forestry, 1901 was a wet year in Nebraska. Spring and summer rains were especially forgiving, and the Sandhills were damp and green when the party began its survey. They moved up the Platte River and then the North Platte towards the Wyoming state line (Figure 2.2). Upon reaching Collins, Nebraska, they traveled north to Harrison,

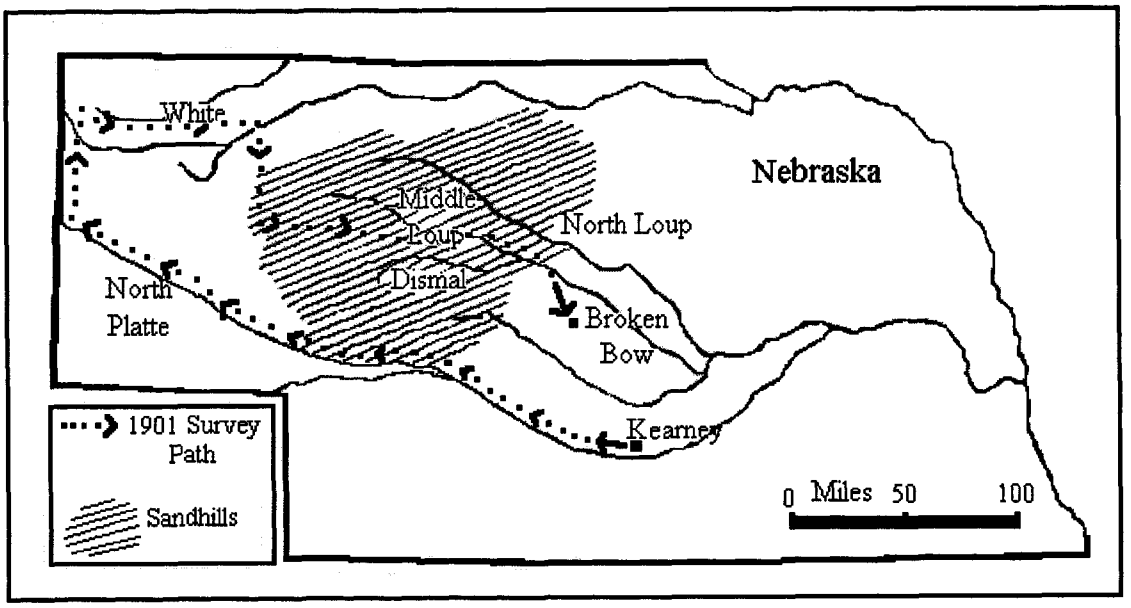

Figure 2.2—Path of the 1901 survey.[32]

and then along the White River to Crawford. In these far western reaches of Nebraska they entered the Pine Ridge region. Here they found large numbers of red cedar and ponderosa pines, some quite large. On several occasions they counted annual growth rings of large ponderosas that indicated trees had been there for three hundred years. From Crawford the party moved east towards Rushville. The broken edges of the Pine Ridge landscape gave way to undulating hills, the grama and buffalo grass common transitioned to distinctive Sandhill bunch grass. Occasionally the party came across "blow-outs," or holes of loose sand. In areas of especially loose sand, or on south slopes, they found long-leafed reed grass reaching their horses' bellies. Interspersed throughout the Sandhills, the dry but rich bottom lands supported thick growths of switch grass that local farmers cut for hay. The party rode right through the center of the Sandhills roughly paralleling the Burlington Railway to Broken Bow.[33]

Unlike areas farther west, the party encountered little evidence of tree growth in the Sandhills. Along the river courses they found some green ash, hackberry, cottonwood, and aspen. In a few locations they found clumps of young trees growing in the Sandhills proper, but they could not find any trees of significant age. It appeared that Bessey was correct, that fire or poor soil prevented tree growth, but the foresters reasoned that if trees grew to the west in soils containing similar materials, then the same trees might grow in the Sandhills if protected from fire.[34]

Word that the Bureau of Forestry was interested in creating a forest reserve on the Sandhills spread. Fernow, by then the dean of the New York College of Forestry at Cornell University, heard of the plan and asked Bessey about the condition of the old Bruner plantation in Holt County. Fernow encouraged Bessey to use the plantation to promote an enlarged program of tree planting. This would eventually lead to a survey of the plantation by Charles Scott, but not until after President Roosevelt created the reserves. In the meantime, Bessey, at the urging of William Hall, lobbied President Roosevelt to back the plan. Bessey also convinced the Nebraska Academy of Sciences to pass a resolution in favor of such a plan.[35]

Efforts to create the forest reserves ran into strong opposition from railroads. George W. Holdrege, the general manger of the Burlington and Missouri (B&M) Railroad organized the resistance. Holdrege saw Sandhills forestry as a threat to the railroad's prospects. He feared that locking up large parts of the region would prevent continued settlement, and he pressured Nebraskan Senator Joseph Millard to oppose it and traveled to Washington in March of 1902 to organize opposition. Holdrege had been instrumental in getting the railroad to run a spur line from Grand Island through the Sandhills to Sheridan. He had also pushed

the B&M to help settle the region by funding experimental farms, irrigation, and even a dry land farming expert.[36]

The Bureau of Forestry tried to appease Holdrege in February 1902, by indicating that the plan would not harm the economic welfare of the region. James Wilson explained that the farms of the region greatly needed "growing timber to check the wind, retain soil moisture, and provide fuel, posts, and other supplies." The plan would not sacrifice the whole region to timber, and it would not unduly interfere with livestock interests. Grazing only needed to be excluded "on such limited portions as are actually planted to timber, an area which for many years would be less than 10 percent of the reserves." The Bureau and the Department of Agriculture assured Holdrege that "to the region as a whole the outcome of such a action could be only advantageous."[37]

But Holdrege stood fast. He learned that many Sandhills locals, especially smaller ranchers, also opposed the plan. Some ranchers were already infuriated at the government for forcing them to dismantle fences on the public domain. One of the more prominent citizens of Hyannis, Nebraska, let out "a prodigious roar about the disaster it would be to Grant County." Other cattlemen encouraged their congressmen to oppose the plan. Benjamin Irwin, clerk of the Broken Bow Land Office and an important local supporter of the proposed reserves observed that "the cattlemen . . . and of course the banks and railroads would rather mortgage and haul cattle than raise trees."[38]

Afforestation goals were coming into conflict with tacit uses of the Sandhills. Foresters wanted to reserve a portion of the public domain, ostensibly for improving surrounding lands but also as living laboratories. Livestock owners, railroads, and farmers, were less convinced that the goals of the Forest Bureau and their own coincided. Most local

interests remained deeply suspicious of outside control of the landscape, even when that control promised to improve their own conditions. Foresters were discovering that constructing a forest required more than just planting trees. Despite their seeming emptiness, the Sandhills where already a thoroughly occupied place. Foresters would have to incorporate existing usages with their own penchant for the scientific management of nature.

The Bureau of Forestry eventually reached a compromise. It had originally hoped to establish three reserves in Nebraska, but in return for dropping the third, most western reserve from the plan, Holdrege agreed to end his opposition. The Bureau also drastically scaled back the size of earlier reserve proposals and worked hard to assuage local fears by persuading ranchers that the reserves would improve grazing and favor local landholders in grazing permits. Unlike its timber policy that demanded competitive bids, the Bureau sold range permits based upon a "reasonable fee." In practice this meant granting grazing permits that were considerably cheaper than private lands. Pinchot had instituted this policy as a way to favor small nearby stockowners that might otherwise have been outbid by large corporations, although the policy also often reflected the varying quality of public and private lands and sometimes simply corruption. The compromise allowed President Roosevelt to establish two forest reserves without antagonizing the Nebraska congressmen. The Dismal River Reserve located in central Nebraska, and lying between the Middle Loup River and Dismal River in Thomas County, stretched over 96,000 acres of Sandhills. The Niobrara River Reserve, which lay between the Niobrara and Snake Rivers in Cherry County of north-central Nebraska, encompassed 110,000 acres. In the end, the actual size of the reserves was 206,000 acres instead of the hoped-for 1,200,000 acres. [39]

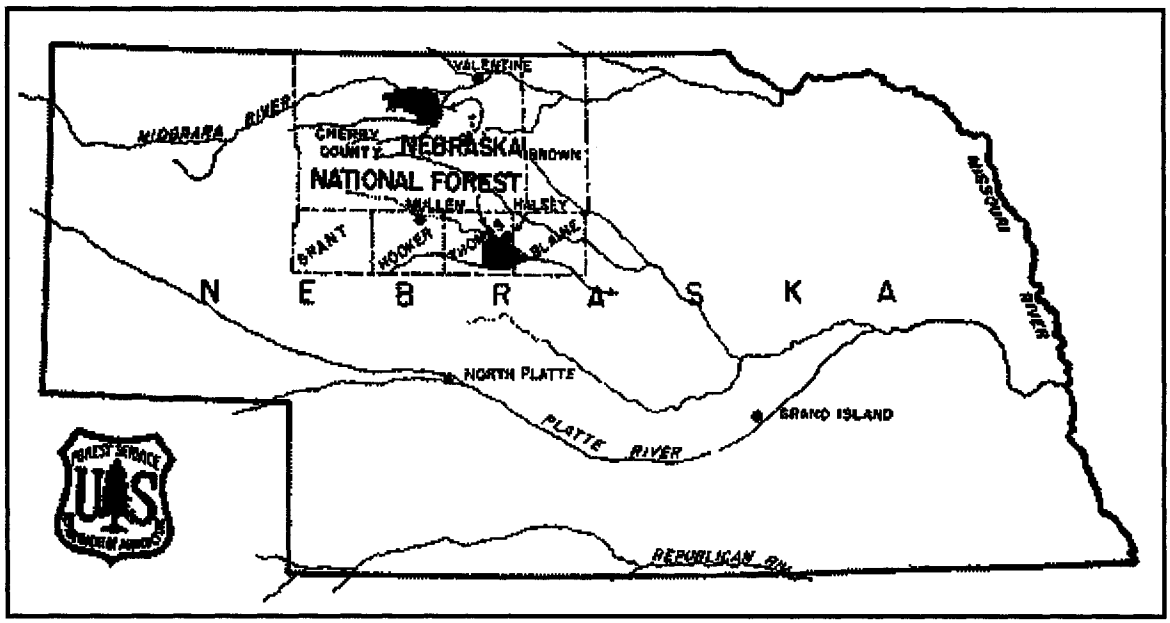

Figure 2.3—The Niobrara and Dismal River Forest Reserves.[40]

Establishing the reserves was only the beginning. The Bureau of Forestry still had to mark reserve boundaries, locate a nursery site, persuade trees to grow in sand, and hope the weather cooperated. Louis Miller and Charles Scott returned to the Plains in spring 1902. When the two, along with a new cook and teamster, reached Broken Bow, they recovered the equipment, mules, and horses from the previous survey, and ventured back into the Sandhills. With the help of local homesteaders, they traveled to the Dismal River Reserve and began to locate section corners. More personnel began to arrive while the party was working at the Dismal River Reserve, and on 12 July the group divided. One gang led by Miller continued to survey the boundaries of the reserves, while another led by Scott established a nursery west of Halsey. On 18 August President Roosevelt added the 80 acres of the nursery to the Dismal River reserve.[41]

Planting operations began the next spring at the Halsey nursery. A party of seed collectors visited the Pine Ridge region and returned with a large supply of red cedar and ponderosa pinecones. After a visit to the reserve in late September 1902, William Hall put Scott in charge of the program and returned Miller to Washington. Scott then left for the Black Hills of South Dakota to acquire more seeds and seedlings. The nursery also received ponderosa seed from New Mexico, jack pine seed from Minnesota and Michigan, and assorted pine seeds from California. They experimented with planting stock from different locations under the assumption that the growing conditions of seeds collected at high elevation might approximate the adverse Sandhill climate. Despite all the work of getting the nursery into shape, Scott was able to begin planting in the late fall of 1902.[42]

While Bureau of Forestry personnel may have been up to the task of locating reserves and preparing the nursery, they had less success with getting trees to grow. Foresters tried broadcast seeding red cedar and ponderosa pine collected from Pine Ridge, but none even sprouted. The following spring Scott and his crew tried planted seedlings pulled from the Black Hills, but these showed almost immediate signs of failure. Scott estimated that fewer than 100 out of 30,000 specimens survived. They had somewhat better success with Jack Pine seedlings dug from the forests of Minnesota, as these had an average survival rate of 15 to 20 percent after three years. The nursery's one apparent success in spring 1903 was the rapid sprouting of seeds planted in the newly created nursery-beds, but these too failed when hit by a "damping-off." In 1903, a particularly wet year, the many difficulties could have been a warning about what would happen during dry years. However, Plains climatology was still a new subject and foresters had difficulty knowing wet from dry years.[43]

The initial disappointments of the nursery were partially offset by Scott's success in convincing ranchers to support the program. Although he did not explain it that way, Forest Service policies proved especially favorable to middle and large sized ranchers, and once Scott convinced these users, the rest were "gradually falling in line." The more powerful ranchers were angry over Department of Justice prosecutions for maintaining illegal fences on the public domain. Many saw the reserves as another effort to drive them from the range. Convincing them otherwise required many small meetings to explain the advantages that the reserve would bring. One important incentive was that each permit holder would have their own range and could supply salt and water to their stock. The reserve permit would also eliminate the need for annual community roundups that caused stock to lose valuable weight. Most importantly, controlling the range allowed a rancher's stock to breed true. This allowed ranchers that could afford the cost to invest in expensive bulls to improve the quality of their herd. Rancher Bob Fadis, who had been instrumental in introducing Scott to other locals, told Scott three years later that "he had branded a crop of 95% white-faced calves, due to the fact his fences on the Reserve had kept his neighbor's bulls out of his heard." Another well-off rancher, Ed Myers, told Scott that his cattle averaged 100 pounds per animal heavier as a result of having their own range, water, and salt. As historian Claire Strom pointed out in her study of tick eradication in the South, government cattle improvement plans often contained a class bias. Forest Service controls on the Nebraska Reserves mostly benefited those who could afford to take advantage of them.[44]

In addition to the social and political control of the range, the Forest Service introduced animal pest eradication as a small, but visible element of natural control. Historian Thomas Dunlap attributed the drive for federal involvement in "pest" control on

the Great Plains to "Western Congressmen [who] saw federal predator control as a cheap way to serve their constituents." At the time, this was easy political capital since it was one proposal to which no one objected. By the time the Forest Service took control of its reserves in Nebraska there were few large animals left as market hunters and local settlers had eliminated the antelope and deer populations, but foresters did poison smaller competitors. In later years, one of the primary values of the forests would be to encourage wildlife. Despite the many advantages, Scott could not convince everyone that the reserves were desirable. Sometimes squabbles broke out over divisions between ranges—especially when the new North Platte reserve was created—but gradually local ranchers went from opposing the plan to support.[45]

Although neither the stockmen nor Scott realized it at the time, they were spearheading the future of the reserves. Foresters had come to the Plains to grow trees, but as most of their reserves remained covered with grass, they quickly had to learn grassland management. The records of the forests were especially revealing in this respect. The majority of the material related to range management, many of the forester's working hours revolved around grazing issues, and the only "profit" the reserve could generate came from grazing fees. Stockmen also gradually came to appreciate the reserves once they realized that most of the land would remain covered by grass for the foreseeable future and that federal control was not inimical to local profits.[46]

The other important future activity on the forests, nursery operations, gradually improved as foresters developed more effective methods. They learned to defeat the "damping-off" problem by chemically treating seedbed soil using a program devised by Carl Hartley of the Bureau of Plant Industry. Hartley and the Bureau of Plant Industry were

another part of the rapid expansion of government during the Progressive Era. Hartley's use of a sulphuric acid to treat seedbeds was only one of their many innovations. They worked on plant genetics, pest control, agricultural inspection, aspects of mechanization, and became a valuable source of plant expertise for other federal agencies. With seedlings increasingly safe while at the nursery, foresters next had to improve field survival. A time-consuming but effective method was to move seedlings from the seedbeds to a transplant-bed in the third year. Seedlings did not grow materially taller in the transplant-beds, but they did increase their root system, thus improving the ability to withstand final transplanting in the fourth year.[47]

In the field, planting crews gradually understood the Plains' microenvironments and developed viable practices. They categorized the Sandhill environment into types based on slope and vegetation. They then adapted their selection of species to location. Planters placed yellow pine on windy "ridge type" soils, where exposed trees would receive less water. Jack pine found favor on warmer and wetter south slopes. On the heavier soil of the bottom lands, most species would grow if they could out-compete native grasses, but planters chose yellow pine because it could make best use of the fertile soil. On the cooler north-slopes, planters eventually settled on Scotch pine, which was better suited to the wetter, cooler micro-climate. Planters were literally constructing a forest out of sand and grass by conceptualizing Plains nature as a series of environments. In doing so, however, they favored a forest system that resembled conditions in wetter natural forests, and did not at first try to replicate the mixed forest growth of cottonwood and red cedar that was indigenous to Plains river valleys. Only in later years, once nursery personal under the direction of Carlos Bates learned to

successfully germinate and transplant red cedar, did the red cedar become an important part of afforestation efforts.[48]

The actual method of putting seedlings into the ground also varied as planters developed methods that maximized survival rates by mimicking natural conditions. Initially, planting crews tried the "slit" method. A planter inserted a shovel into the ground, moved it back and forth to create a narrow hole, and then inserted the seedling. They then closed the hole by inserting the shovel off to one side and pushing the earth towards the seedling. This method was fast and required little labor, but the narrow plane of the planting limited the seedling roots' access to moisture. If the seedling's roots were unnaturally cramped by the slit method, then perhaps they could be spread along three dimensions. This led to the "square-hole" method. One planter moved ahead and dug a square hole in the soil. Another planter put a seedling in the hole and backfilled with one hand while trying to keep the seedling centered. The square-hole method was slow, however, and the roots were often as cramped as with the slit method. These observations led planters to try the "cone" method, in which one planter dug a square hole, with a cone shaped mound pointing upwards in the center. The next planter then spread the seedlings' roots around the cone and carefully backfilled. In assessing these methods, economic considerations were as important as agronomic findings. The cone method was very successful at first, but after the first year the survival rate for all methods equalized. Thus, the slit method was judged most desirable because the higher initial death rate for seedlings was more than compensated by its lower labor costs.[49]

The slit method also allowed the eventual application of mechanical power. Planters initially used a breaking plow to turn a shallow furrow. They then ran a trencher plow down

the furrow to make a deep, but narrow, "V-shaped" trench. Into this narrow trench planters placed seedlings at regular intervals and pressed the hole closed with a shovel. While this method required the greatest human artifice, it proved the most economical since it was rapid and inexpensive.[50]

Bessey and Fernow had argued that trees could be grown because they had once been a natural part of the environment, but when foresters tried to recreate those forests, they found themselves instead creating a new hybrid nature. At the nursery site they had to chemically treat seedlings, cover them with shade cloth, and move them between beds. When they plotted planting sites, their paper forests had more in common with a home architect's vision than a natural mimesis. Their planting methods mixed economics, human labor, and machine labor in an effort to emulate natural conditions. But their interventions would never end. Once they succeeded in getting trees to grow, they had to exclude cattle and fires from plantations. As forests matured, they became infested with a variety of plant diseases and parasites that kept foresters busy spraying, fumigating, and praying. All along the single most important factor, rainfall, remained the one element they could neither control nor predict, and however much they modified other aspects of the landscape, their efforts remained dependent on nature. The eventual forests were not Frankenstein monsters—they never turned on their creators, or ran amuck—but then neither could they be considered natural. Instead a novel, hybridized landscape had emerged that was in perfect symmetry with the hybrid society around it.

The rhetoric of restoring natural conditions would become a common theme in Great Plains conservation, but from the start it was in dissonance with the actual hybrid landscape. Farmers substituted native grasses with domesticates: corn and wheat replaced native

perennials. Ranchers replaced bison with "purebred" cattle. The human landscape also hybridized as the federal government confined American Indians to reservations and "native" Americans and immigrants from northern and eastern Europe resettled the land. Claims about nature were tied to social and political goals and were disconnected from the actual hybrid nature. Efforts to return areas to antediluvian forest would only add another hybrid layer to the landscape.

While foresters began constructing a new landscape, the political context of conservation underwent a series of changes. When President Roosevelt established the Nebraska reserves in 1902, conservation was beginning to gain popular appeal. Between 1904 and 1908 both Democrats and Republicans competed to display their conservation credentials. This had concrete consequences for Nebraska. On 10 March 1906, President Roosevelt created the North Platte Reserve, comprising 347,170 acres, north of the North Platte River in Grant and Arthur Counties, Nebraska. The following year Pinchot relabeled the nation's "forest reserves" as "national forests" to better indicate their purpose as utilitarian forests rather than preserves. Suddenly and with little opposition, the Forest Service had three forests in Nebraska.[51]

By 1910, however, political and public support for the Forest Service had ebbed. Pinchot's aggressive promotion of his agency and conservation in general produced a backlash. Much of this opposition came from westerners who feared that eastern conservationists were interfering with their plans for development. The 1907 act establishing national forests also ended Presidential authority to create new national forests in six western states. President Roosevelt's successor, William Taft, also curbed the conservation movement further by appointing Richard Ballinger to head the Department of Interior. When

Pinchot, a bureau chief, and Secretary Ballinger, clashed over Alaskan coal claims in 1910, Taft replaced Pinchot with acting chief Albert Potter. Later that year, Henry Graves became the official chief of the Forest Service, and during his tenure from 1910 to 1920 the watchwords were retrenchment and economy, not expansion. On the Plains, the Forest Service continued its reserve program, but it lost interest in other experimental programs run through the state experiment stations. The Office of Dry Land Agriculture within the Bureau of Plant Industry largely assumed these activities (See Chapter 3).[52]

Congressional hostility to the Nebraska National Forests also erupted in 1910. The initial attack was directed at the Forest Service in general. Many members of Congress believed that the Service spent far too much money, and the Nebraska forests were easy targets. James Latta of Nebraska explained, "in my state . . . you appropriate $18,000 for the maintenance of a national reserve. You can buy all the timber on that reserve for less than $5000." Latta did not see how the forests could both be used for grazing and growing trees since the cows and sheep would destroy them. Forest Service supporters argued that "the purpose of the reservation . . . [was] to determine whether or not it might be possible to reforest land in that region." Latta responded rhetorically, "is it not cheaper and better if you want to grow timber to put it on land that will produce timber in a reasonable time? That land is so poor it will not grow a merchantable saw log in five hundred years. [Laughter.]"[53]

The Kansas National Forest also generated criticism. This was particularly acute at hearings before a congressional subcommittee in June 1911. Part of this criticism was the familiar refrain that operation costs far outweighed potential benefits, but the committee also received evidence suggesting that the Forest Service wasted seeds and planted at the wrong time of the year. Although Congressmen had occasionally offered unsolicited advice about

tree planting, this was the first time they challenged the expertise of the Forest Service over Plains forestry. Unprepared for the criticism, acting Assistant Forester, Earle Clapp denied the allegations but promised to look into the matter further. The result of his inquiry undermined the evidence put before the committee, but was not particularly satisfying. The Kansas Forest had cost much less to plant per acre than what had been alleged at the committee hearings, but it still ran over $10 an acre with just labor and seedlings counted as a cost. To claims that the foresters planted at the wrong time of year, the State Forester from Kansas informed Clapp that they had "every reason to believe that spring or summer sowing will prove the most satisfactory." Neither the cost nor the scientific uncertainty should have been a surprise in such a new and difficult endeavor, but these were weak and uncomfortable responses before a skeptical Congress.[54]

The Forest Service did retain supporters in Congress. Nebraska representative George Norris defended the forests as experimental but treaded on treacherous ice by suggesting that "in my judgment . . . good timber could be raised if water could be supplied." Such a hope was not only unrealistic, since water supplies were limited in the Sandhills and the sandy soil made irrigation problematic, but it was also illogical since the effort would hardly be justified for the limited profit. Norris was using an end to justify the means. He wanted to see the forest and state prosper, and he willfully disregarded the fact that the land would be far more valuable in crops than in timber, even if water were available.[55]

Perhaps sensing the vulnerability of this argument, Norris also argued that trees would improve the conditions for agriculture. He gave Congress a personal example from his own district, where he was "shown a mountain of white sand as high as the ceiling of this room, and there was a man living close by who was cultivating land worth $75 an acre

growing as good alfalfa as ever grew upon ground. They had planted these scrub trees, which held the sand, and made good soil where there was nothing but barren area." This, Norris believed, was what the Forest Service was trying to do with its forests. "If scrub trees would grow, it would gradually redeem a country now almost worthless." Edmond Madison of Kansas, whose district included a part of the sandhill forests of that state, added his support for the Nebraska forests by explaining that "people out on those treeless Plains want to be told and have demonstrated to them what trees will grow there, and the influence in this forest is becoming to be [sic] felt all over the south-western portion of Kansas." Madison died in office the next year, but the 7th District he represented would be at the heart of the Dust Bowl.[56]

Some senior representatives were even more direct in their belief that trees had modified the environment of the Plains. William Reeder of Kansas explained that farmers in western Kansas had quit irrigating "because our cultivation and tree planting have produced such an atmospheric condition that the rains come more frequently." He argued that if pines and cedars were planted in the sandhills, and the land then cultivated, it would render the country as fertile as eastern sections of the state. Reeder had made his fortune in Kansas by buying cheap land during the troubles of the early 1890s and then creating one of the largest irrigated tracts in Kansas. It undoubtedly bolstered his perception that rainfall had been particularly heavy in 1909.[57]

Perhaps what was most surprising about these assertions was not that politicians believed trees might influence climate, but that they believed afforestation on the Plains had already improved conditions. Just as optimistic boomers in the 1870s and 1880s had believed that tree planting and plowing improved climate, members of the most powerful law making

body in the nation argued in 1910 that tree planting was improving climate even though few trees had actually been planted. Every member of the body had lived through the excessive optimism of the 1880s and the droughts of the 1890s, but the return of relatively good rainfall quickly revived dreams that humans could change the climate for good.

A few observers remained more discriminating. The representative of the district that encompassed all three of the forests in Nebraska, Moses Kinkaid, was only partial in his praise. Kinkaid visited the Dismal River Forest in 1907 and, according to Charles Scott, came away impressed. Kinkaid believed that trees would grow on the Sandhills, and he brought up the example of the old Bruner plantation as proof. He pointed out that the plantation trees had quickly reached a mature size despite the poor soil of the Sandhills, yet he was not as happy with the creation of the North Platte Forest. The Bureau of Forestry had submitted the request for the forest before he could object, and now land that seemed suitable for settlement had been locked up. Kinkaid argued that the Forest Service had overreached itself with the creation of the North Platte Forest, and he was receiving "many requests" to open the forest to homesteading.[58]

Congressman Kinkaid had staked his name on homesteading in western Nebraska, and support for the North Platte Forest quickly withered under his influence. The Kinkaid Act of 1904 allowed settlers in western Nebraska to take up 640 acre enlarged homesteads. Although in later years a 640-acre homestead would seem too small to support a family, in the 1900s this appeared generous and new settlers rapidly took up much of western Nebraska. By the 1910s the North Platte Forest had become an undeveloped island in a sea of hungry settlers, and the Forest Service seemed to have plenty of land in the Dismal and Niobrara Forests to practice forestry for the foreseeable future. In the face of this pressure,

Congress opened the North Platte Forest to homesteading on 1 March 1913. At a stroke, the total area of the reservations in Nebraska fell by well over half. In some ways though, the loss of the North Platte Forest was an advantage because the Forest Service could no longer afford to administer so much territory since the budget for the forests had also declined precipitously, from $18,000 in 1910 to $2,919.[59]

Concern over the path and success of the forests also grew within the Forest Service. The difficulty of planting meant that trees would never be as widespread or significant as hoped. The most optimistic congressmen might believe that the forests were already modifying the climate, but that enthusiasm was difficult to maintain among foresters who measured plantings in hundreds of acres. In 1909 the most successful forest, the Dismal River, had about 300,000 living trees spread over 865 acres, but in 1910 a prairie fire burned several hundred acres of the forest. At Niobrara and North Platte results were even slimmer with acres counted in the dozens. The Kansas Forest had several hundred acres planted, but by 1911 these were in extremely poor condition, and a drought that year killed almost all the broad leaf species, which had been the forest's primary species. It seemed that trees were the clear losers in the battle to transform the Great Plains. Their dead trunks marked the field of battle like headstones. Though it does not appear in the records, it must have crossed the mind of some foresters that money spent in Nebraska or Kansas, building forests against difficult odds, might have put far more trees into the ground if spent on a region where trees grew naturally.[60]

The least known of the Plains forests, the Dakota National Forests, also failed to meet Forest Service expectations. At 13,930 acres, the forest was the smallest and least publicized of the Plains reserves. In part this was because 3,762 acres of it were already covered with

pine trees. This made it a more "logical" forest than the others, and its isolated location in the badlands of Slope County, North Dakota also helped by limiting pressure from outside forces. Although on a much smaller scale, operations preceded there much as in Nebraska. Foresters set up a small nursery at Deep Creek to supply seedlings and received additional seedlings from other locations. Most supplies came by mule until 1913, when the station obtained a Model T Ford. Forester Francis Cobb relates that "trees were planted in plowed furrows in the sod, on contours where hilly" using a planting crew similar to Nebraska. Despite the presence of natural growth, the Forest Service had little success in growing seedlings and discontinued operations and relinquished the land to the state in 1917.[61]

The Forest Service was concerned enough about the future of the national forests on the Plains, and the internal criticism they generated, that in 1909 it sent Raphael Zon to survey the Nebraska forests. The Service could simply have requested a progress update from personnel on the ground, but there was enough concern over the forest's future that they needed someone with a strong theoretical and research background. Zon had risen rapidly within the Bureau of Forestry since his appointment as a "student assistant" in 1901. Not only had he become a close friend and confidant of Pinchot, he had also turned his small office into "the first cradle and treasure house of forest research in America." His interest and abilities led to his appointment as chief of the Office of Silvics in 1907, from which he continued to advocate an increased role for research within the Forest Service. In the spring 1909, Zon took up the challenge of the Plains forests, and found himself in a line of research that would periodically consume him for the rest of his career.[62]

Zon was never short on criticism or advice, and his report stood out for its honesty about forest conditions. He realized that one of the primary problems facing Plains forestry

was imagery. National forests needed to look successful. Previous reports had always justified the plantings as an attempt to show that tree culture was possible, but forests that looked barren and patchy could easily discourage tree culture. Zon remarked: "what impressed me most sadly is the unconscious attempt of emphasizing our failure to enormous proportions by planting every year new areas (this year about 125 acres) regardless of the fact that plantations of the previous years were almost in every case a complete failure." Zon was shocked to see miles of plowed Sandhills with very few trees growing in the furrows. His solution was to use all available stock and labor for replanting. Zon expressed many other concerns about the quality of the planting stock and methods of planting. He argued that the Halsey nursery was a mistake that should be abandoned, but his chief explanation was nature: the "lack of success in plantings on the sand hills is deficient moisture and strong desiccating winds."[63]

Although Zon did not realize it, he had charted the essential future of the national forests on the Plains. Until the crisis of the Dust Bowl in the 1930s, there would be no more grand plans to cover wide areas with trees. Foresters would concentrate instead on improving methods, reforming failures, ending controversial forests, and gradually expanding remaining forests. The forests and nurseries would serve as important training and research centers, but they would never regain significant institutional support from within the Forest Service or Congress. The North Platte Forest had been the first to go in 1913. The Kansas National Forest suffered a similar fate from President Woodrow Wilson in 1915, and the Dakota National Forest followed two years later. The Forest Service debated adding the Niobrara Forest to the list of failed reserves, but decided not to push the issue either way. The

establishment of a nursery there in 1914, its proximity to the Dismal River Forest, and the lack of any public outcry helped insure its survival.[64]

Despite the setbacks, foresters did not stand still on the two remaining reserves in Nebraska. Their efforts to develop satisfactory nursery and planting techniques began to pay dividends, and at the silver anniversary held in Halsey in 1927, the forest's supervisor could proudly point to "nearly 12,000 acres of this area successfully planted, and the work is being continued at the rate of 1000 acres per year." Foresters could also point to new nursery techniques they had helped pioneer that had produced enough seedlings to continue both planting on the Sandhills and distribute to local farmers under the Kinkaid Act of 1911 (See Chapter 3). Clearly, much of the success foresters had in increasing their survival rates came from improved techniques and seedlings, but to that list should also have been added improved natural conditions. After the drought year of 1910 and with the exception of 1916, Nebraska enjoyed relatively wet weather until 1931. Rainfall was particularly heavy in 1915 and even the 1916 crop year benefited from reasonably good summer conditions. The role of nature would not become obvious, however, until foresters applied their improved methods without the support of natural conditions. [65]

Acres planted were not the only way to measure a forest's success. The paper that John Hatton presented at the silver anniversary illustrated the point. For Hatton, it was the ritual and camaraderie of the anniversary—outdoors under the very trees it came to celebrate—that mattered. He argued that the question of profits was "not the only consideration in our country's reforestation or afforestation needs." Instead, he offered a more personal sense of valuation: "I can see groves and shelters when all that come to me are

the joyous caroling of birds, the chirp of squirrels, the scurrying of rabbits, the contentment of farm animals, and the sweet voices of children enjoying their friendliness and shade." In tones reminiscent of George Perkins Marsh or J. Sterling Morton, Hatton told the audience "we must not overlook the contentment, the contributions to spiritual good, to character and citizenship building, for these are wealth, the richest of all possessions." Hatton had found his own reasons to advocate forestry on the Plains, but these were a significant departure from strictly economic arguments.[66]

The grand design of converting one-third or one-quarter of the Plains into forests faded rapidly when confronted with the reality of social and natural constraints. The return of settlers to the Plains after economic and natural conditions improved in the later half of the 1890s made the reservation of large areas for forestry, let alone forestry experiments, politically unpopular. The four reserves created by President Theodore Roosevelt were the high point of the Plains forest reserve movement, not its beginning. The failure cannot be entirely blamed on a lack of public support. The reserves themselves were difficult and expensive, so much so that even the Forest Service began to question their future. Barring another natural disaster, institutional, public, and governmental will for big forestry simply withered during the 1910s and 1920s.

The reserves may not have succeeded in some of their wildest goals, but they created an institutional and financial framework for federal Plains forestry. Forest Service experts working at the reserves developed their own techniques and perspectives on Plains forestry. Some, like Raphael Zon, never abandoned their belief in climatic change or the role that forestry could play in transforming the Great Plains. Zon would continue to build his case about forests and climate while increasing the role of the Forest Service in research on Plains

forestry, but most others eventually abandoned claims about climate, and developed a more constrained, agronomic perspective.

Chapter Two—Notes

[1] The reserves were often referred to as Divisions. Today they are usually referred to as the Nebraska National Forest. In 1915, the Forest Service changed the name of the Dismal River Division to the Bessey Division and also changed the name of the nursery there from the Halsey Nursery to the Bessey Nursery. President Nixon changed the name of the Niobrara Division to the Samuel R. McKelvie National Forest in 1971. This paper will use the commonly used names of the time. See Chapter 3 and 4 for the second Dakota National Forest, although technically it was the North Dakota National Forest.

[2] Proceedings of the American Association for the Advancement of Science, 23rd Meeting, August 1875, (Salem, 1875): 37-45; *Reports of the Committees of the House of Representatives*, 43rd Congress, 1st Session, 1874. For an examination of public perceptions about climatic change see, Paul D. Travis, "Changing Climate in Kansas: A Late 19th-Century Myth" *Kansas History* 1(1): 48-58. See also David M. Emmons, *Garden in the Grasslands: Boomer Literature of the Central Great Plains* (Lincoln: University of Nebraska Press, 1971).

[3] Hays, *Conservations and the Gospel: The Progressive Conservation Movement, 1890-1920* (Pittsburgh: University of Pittsburgh, 1999), 27.

[4] Franklin B. Hough, *The Elements of Forestry* (Cincinnati: Robert Clarke, 1882); House Executive Document 267, 48th Congress, 2nd Session, 1885, 130-31.

[5] Hough, *Elements*, 10-28, 132-134.

[6] *Report of the Commissioner of Agriculture* (Washington: GPO, 1883): 453-55, 457; *Report of the Commissioner of Agriculture* (Washington: GPO, 1884): 157-58; *Report of the Commissioner of Agriculture* (Washington: GPO, 1885): 184, 186, 192-93.

[7] U. S. Census Bureau, *Twelfth Census of the United States, 1900, Population*, Volume 1, Part 1 (Washington: GPO, 1902), 2-4.

[8] Gilbert C. Fite, *The Farmers' Frontier 1865-1900* (New York: Holt, 1966); John D. Hicks, *The Populist Revolt: A History of the Farmers' Alliance and the People's Party* (Lincoln, Nebraska: University of Nebraska, 1961); Alvin T. Steinel, *History of Agriculture in Colorado* (Ft. Collins, Colorado: State Agricultural College, 1926); Fred A. Shannon, *The Farmer's Last Frontier: Agriculture, 1860-1897* (New York: Rinehart, 1945). *Elbert County Democrat* 15 August 1887, quoted in Fite, *The Farmers' Frontier*, 124. There seems to be a consensus among historians that increased rainfall supported the boom, but there has been very little detailed examination of actual rainfall. See also, United States Department of Agriculture: Weather Bureau, *Climatology of the United States* (Washington, DC: GPO, 1906); United States Department of Commerce: Weather Bureau, *Maps of Seasonal Precipitation Percentage of Normal by State, 1886-1938* (Washington, DC: GPO, 1942); John P. Finley, *Certain Climatic Features of the Two Dakotas* (Washington, DC: GPO, 1893).

[9] Emmons, *Garden in the Grasslands*, is still the best discussion of the boosterism that drove settlement, but see also Emmons, "Theories of Increased Rainfall;" Charles R. Kutzleb, "American Myth: Can Forests Bring Rain to the Plains?" *Forest History* 15(3) (October 1971): 14-21; Travis, "Changing Climate;" Kollmorgen and Kollmorgan, and "Landscape Meteorology." Although localized to Kansas, James C. Malin, *Winter Wheat in the Golden Belt of Kansas: A Study in Adaptation to Subhumid Geographical Environment* (New York: Octagon, 1973) suggests that many observers were far from convinced of a changing climate.

[10] Fite, *Farmers' Frontier*; Hicks, *The Populist*; Steinel, *History of Agriculture*; Finley, *Certain Climatic Features*; Weather Bureau, *Climatology*, 57.

[11] Harold K. Steen, *The U. S. Forest Service: A History* (Seattle: University of Washington Press, 1976); *Report of the Division of Forestry for 1886* (Washington: GPO, 1887), 165. Fernow gradually backed away from claims of direct climate change in his later writings, but his reports consistently expressed an interest in Plains forestry and its benefits to agriculture.

[12] Walter Prescott Webb, *The Great Plains* (Lincoln: University of Nebraska Press, 1931), began the tradition of explaining the failure of settlement as an unwillingness to adapt humid agricultural methods to the Great Plains. The problem became one of adapting or adjusting of the agricultural system to the environment. In doing so he underemphasized the role of natural variation. Under the dry conditions of the Dust Bowl the post-1890 adaptations failed. Likewise, the reemergence of the mini-dust bowl of the 1950s suggested that the success of many 1930s adjustments was the result of improved rainfall.

[13] The Forest Service would begin reforestation efforts on private lands under the leadership of Gifford Pinchot after 1905, but doing so remained controversial and even more so when the beneficiaries were small farmers.

[14] *Charles Edwin Bessey Papers* on microfilm repository, hereafter *Bessey Papers*. See also, Andrew Denny Rodgers, *Bernhard Eduard Fernow; A Story of North American Forestry* (Princeton: University Press, 1951), 84; Bernard Edward Fernow to Charles Edwin Bessey, 3 November 1890, *Bessey Papers*.

[15] *Report of the Chief of the Division of Forestry, Annual Report 1886* (Washington: Government Printing Office, 1886); 166. Report of the Chief of the Division of Forestry, Annual Report 1892 (Washington: Government Printing Office, 1892); *Report of the Chief of the Division of Forestry, Annual Report 1897* (Washington: Government Printing Office, 1897); see William Robbins, "Federal Forestry Cooperation: The Fernow-Pinchot Years," *Journal of Forest History* 28 (October 1984): 164-73.

[16] Nebraska State Board of Agriculture, *Annual Report, 1890* (Lincoln: State Journal Co., 1891), 140-42.

[17] Hicks, *The Populist*. See, Brian Bogue, *Money at Interest: The Farm Mortgage on the Middle Border* (Lincoln: University of Nebraska, 1955); John Dibben, "Who Were the Populist: A Study of Grass-Roots Alliance Men in South Dakota," *Agricultural History* 54 (October 1982): 677-91, for arguments that Populism could not be explained by economic troubles. See, Peter Argersinger, *Populism and Politics: William Alfred Peffer and the People's Party* (Lexington: University of Kentucky Press, 1974) for a more current view that economics was important. For more on the role of environment see, David S. Trask, "Nebraska Populism as a Response to Environmental and Political Problems," in Brian W. Blouet and Frederick C. Luebke eds., *The Great Plains: Environment and Culture* (Lincoln: University of Nebraska, 1979): 61-81.

[18] Fernow to Bessey, 12 February 1891, *Bessey Papers*.

[19] State Board of Transportation. 1889. *Transportation and Communication* [online] Library of Congress, American Memory Collection, 2003 [cited 3 April 2003]. Available from world wide web: (http://memory.loc.gov/cgi-bin/query/D?gmd:9:./temp/~ammem_66Pb::)

[20] N. H. Eglestron to Lawrence E. Bruner, 9 March 1891, *Bruner Family Papers*, Nebraska State Historical Society, Lincoln, Nebraska. Hereafter *Bruner Papers*. Fernow to L. Bruner, 24 March 1891, *Bruner Papers*; *Nebraska State Horticultural Society, Annual Report 1893* (Lincoln: State Publisher, 1893). Ideally, they would have begun planting in April.

[21] Sam S. Kepfield, "The Nebraska Drought of 1890," *Journal of the West* 36(1): 47-53.

[22] *Nebraska State Horticultural, 1893*; *Report of the Secretary of Agriculture, 1891* (Washington: Government Printing Office, 1891). Many early forestry records do not contain Latin nomenclature for all the species they refer to. Rather than simply guess the Latin name of the species under discussion this author has simply decided to use the common names as they appear.

[23] *Report of the Secretary, 1891*; Fernow to Hudson Bruner, 20 February 1893, *Bruner Papers*.

[24] Fernow to H. Bruner, 7 November 1894, *Bruner Papers*; USDA, Forest Service, *Bulletin 121* (Washington: Government Printing Office, 1913), 20; USDA, Division of Forestry, *Bulletin 18* (Washington: Government Printing Office, 1898).

[25] Steen, *The U.S. Forest Service*, 26-27; Robbins, "Federal Forestry Cooperation."

[26] Daniel T. Rodgers, "In Search of Progressivism," in Stanley I. Kutler and Stanley N. Katz, eds *The Promise of American History* 10(4) of *Reviews in American History* (Baltimore, 1982): 113-32. Hays, *Conservation and the Gospel*, 29. See also, Char Miller, *Gifford Pinchot and the Making of Modern Environmentalism* (Washington: Island Press, 2001) for more about Fernow and Pinchot's strained relationship.

[27] Steen, *The U.S. Forest Service*.

[28] *United States Statutes at Large* (Washington: GPO, 1899): 30, 952; Gifford Pinchot to Bessey, 26 August 1899, *Bessey Papers*.

[29] The threat of transfer to the Department of Interior was a long running fear of the Forest Service that arose from several sources. Pinchot felt the Department of Interior was corrupt and mostly interested with putting its lands into private hands. From a practical aspect, the Forest Service was also probably reluctant to lose its close working relationship with the Department of Agriculture and its agencies, such as experiment stations and the Bureau of Plant Industry; See Steen, *U. S. Forest Service*, 148-152. Samuel P. Hays, *Conservation and the Gospel of Efficiency* (Pittsburgh: University of Pittsburgh Press, 1999 [1959]), 39-48.

[30] Hays, *Conservation and the Gospel*, 30; Stephen J. Pyne, *Year of the Fires: The Story of the Great Fires of 1910* (New York: Viking, 2001), 14, 30-31, 46-47.

[31] Charles A. Scott, "My Story of the Development of the Tree Planting Project in the Nebraska Sand Hills," Unpublished typescript, 8 May 1951, Iowa State University Library. Scott's work can also be found under the title "The Early Days: The Dismal River and Niobrara Forest Reserves." Scott's actual diary of the trip is held at the Denver Public Library, Denver Colorado. Most of the actual tree felling took place on the eastern extreme of Nebraska in the Pine Ridge region.

[32] Created by author.

[33] USDA:WB, *Climatology*, 582. The account of the party's travels was taken from, Scott "My Story," and US Forest Service *Bulletin 121*.

[34] Ibid.

[35] Fernow to Bessey, 30 September 1901, *Bessey Papers*; William L. Hall to Bessey, 13 January 1902, *Bessey Papers*; Gifford Pinchot to Bessey, 28 January 1902, *Bessey Papers*.

[36] Hall to Benjamin Irwin, 3 March 1902, Regional National Archives, Denver, Colorado (RG 95), hereafter Denver Archives. See also *George Ward Holdrege Papers*, Nebraska State Historical Society, Lincoln Nebraska.

[37] James Wilson to G. W. Holdrege, 14 February 1902, Denver Archives (RG 95).

[38] Irwin to T. C. Jackson, 3 April 1902, Denver Archives (RG 95); Irwin to Jackson, 8 April 1902, Denver Archives (RG 95).

[39] William L. Hall to Jackson, 17 March 1902, Denver Archives (RG 95); Hall to Bessey, 13 January 1902, *Bessey Papers*; US Forest Service, *Use Book: Grazing* (Washington: Government Printing Office, 1910), 41; US Forest Service, *Nebraska National Forest* (Washington: Government Printing Office, 1952), 4-5. President Roosevelt created the reserves on 16 April 1902.

[40] US Forest Service, *Nebraska National Forests*, 1954.

[41] Charles A. Scott, "The Development of the Bessey Nursery," unpublished typescript, 8 May 1951, in author's collection.

[42] Ibid., 6; Scott to Bessey, 9 December 1902, *Bessey Papers*.

[43] Scott, "The Development," 5-6. A "damping-off" disease is a fungal infection causes the young seedlings to wilt and eventually many will die. USDA:WB, *Climatology,* 582.

[44] Scott, "The Development," 8; Fred R. Johnson to District Forester Denver, Colorado, 19 December 1914, Denver Archives (RG 95); Fred R. Johnson to District Forester Denver, Colorado 27 July 1915, Denver Archives (RG 95); Claire Strom, "Texas Fever and the Dispossession of the Southern Yeoman Farmer," *Journal of Southern History* 66(1): 49-74. "White-faced claves" is a term used to describe Hereford cattle, thus the statement indicates Fadis' pleasure that his animals have bred true.

[45] Thomas R. Dunlap, *Saving America's Wildlife: Ecology and the American Mind, 1850-1990* (Princeton: Princeton University Press, 1988), 39; Scott, "The Development," 8; Fred R. Johnson to District Forester, 19 December 1914, Denver Archives (RG 95). Johnson had an early interest in seeing the forest as a game reserve, but he despaired because state officials were unwilling or unable to enforce game laws. Deer that walked off the reserve were liable to be killed.

[46] The best example of this are the federal records held at the Regional National Archives, Kansas City, Missouri (RG 95), but the holdings of the National Archives, College Park, Maryland (RG 95), also reflect the early importance of grazing.

[47] Raymond J. Pool, "Fifty Years on the Nebraska National Forest," *Nebraska History* 34 (Septemeber 1953): 156; USDA, Forest Service, *Bulletin 121*, 34-35.

[48] USDA, Forest Service, *Bulletin 121*, 36-37. See also, Carlos G. Bates, "Experiments In Sandhill Planting," *Proceedings of the Society of American Foresters* 5 (1910): 59-83.

[49] Ibid., 40-42.

[50] Ibid., 42-3.

[51] Steen, *The U.S. Forest Service*, 74, 96.

[52] Ibid., 100-01.

[53] *Congressional Record*, 61st Congress, 2nd Session (1910), 1345-46.

[54] House Committee on Expenditures in the Department of Agriculture, *Agricultural Department Appropriations Bill 1911*, 61st Congress, 3rd Session (1911); E. H. Clapp to District Forester, 1 July 1911, National Archives, College Park, Maryland (RG 95), hereafter National Archives; District Forester (A. Riley) to the Forester, 11 July 1911, National Archives (RG 95).

[55] *Congressional Record*, 61st Congress, 2nd Session (1910), 1346.

[56] Ibid., 1347.

[57] Ibid., 1349.

[58] Ibid., 1348.

[59] *Congressional Record*, 61st Congress, 3rd Session (1911), 1962; Benjamin Horace Hibbard, A *History of the Public Land Policies* (Madison: The University of Wisconsin Press, 1965), 392.

[60] U.S. Forest Service, *Bulletin 121*; U.S. Forest Service, "History of the Nebraska National Forest," unpublished typescript, (1927), Denver Archives (RG 95).

[61] M. H. Wolff to Francis E. Cobb, 14 December 1940, State Historical Society of North Dakota, Bismarck. This information is taken from K. D. Swan who was a forest assistant at the forest. The Little Missouri National Grassland covers the area today.

[62] Norman J. Schmaltz, "Forest Researcher Raphael Zon," *Journal of Forest History* 24:1 (1980): 25-97

[63] Raphael Zon to E. E. Carter, 11 May 1909, National Archives (RG 95).

[64] The Forest Service abandoned the Niobrara or Morton Nursery in 1925 citing its poor soil as the primary reason. It is not entirely clear why the Niobrara forest continued, but the best explanation is perhaps that no one opposed it. Without public or political pressure to dismember the forest, the Service was able to continue its work there, and as the town of Valentine grew the forest became an important recreational outlet.

[65] U. S. Forest Service: Department of Agriculture, *The Bulletin, Rocky Mountain District, Nebraska Forest Silver Anniversary Issue* (July 1927); Addison E. Sheldon, *The Lincoln Sunday Star*, 19 June 1927, Section D, pg. 1.

[66] John H. Hatton, "Nebraska National Forest Celebrates Its Silver Anniversary," no date, Denver Archives (RG 95).

Chapter Three—Science Professionalized: the early science and politics of Plains forestry

In the decades following 1890, scientific forestry on the Plains emerged as the concern of a wider audience than just the Forest Service. State experiment stations, agricultural colleges, and a growing bureaucracy of agricultural scientists sought to stabilize and standardize farm methods. By the mid-1890s they had added farm forestry to their list of solutions to the "farm problem." For these researchers, trees were simply one of many tools to improve farm life, whether that was by slowing winds around farm houses or providing firewood and fence posts. At the same time they remained skeptical of sweeping claims about the value of afforestation. In part, they wanted to distance their discipline from the wild claims about trees and climate of the 1870s and 1880s, but their skepticism also reflected fundamentally different goals. Agricultural scientists wanted to improve the economic and social conditions of farming, and to modernize what they perceived as archaic practices and habits. Growing trees would always only be a small part of that agenda.[1]

Institutional conflicts were also part of a growing trend towards professionalization of the sciences. Political scientist Stephen Skowronek explained that the burgeoning influence of professionals corresponded with the increasing popularity of governmental reform, and was a partnership between professionals and politicians. Professionals ran and staffed the growing bureaucracies, which made it possible to control the increasingly complex state and economy. However, as professionals divided into various bureaucratic institutions, each with its separate agenda, they lost their ability to speak with a unified voice. Foresters' disagreements over theoretical and practical issues were complicated by struggles for

political recognition for the profession and, eventually, battles with soil scientists for control of trees, money, and objectives.[2]

While deeply entangled in its myriad duties on the nation's forests, the Forest Service continued to support some Plains forestry research and planting. Most Forest Service researchers, like their agricultural scientist peers, began to doubt earlier theories of climatic change, yet they did not abandon trees as a tool for modifying Plains landscape. Like agricultural scientists, they looked to the wind-slowing effect of trees as a potential tool, but their plans showed a bias toward forests creation rather than wind reduction. The Forest Service was institutionally a forestry agency, and it had difficulty adapting as an agricultural service agency. Foresters also believed they had good reasons for their preferences: trees created the conditions for their own existence, farmers often lacked the interest and skills to make forestry work, only forests could provide merchantable timber to help relieve the nation's "timber famine," and tree distribution programs seemed designed more to please politicians and their constituents than to transform the Great Plains. Thus, foresters' institutional perspective and scientific leanings divided them from researchers with a more agronomic perspective and from the farmer clientele they both sought to serve.[3]

A few Forest Service researchers harbored even more radical differences with agricultural scientists as well as other foresters. Although they were every bit as dedicated to scientific precision as their peers, a small group of foresters remained theoretically wedded to the late-nineteenth-century social forestry theories about trees and climate that had spawned the Timber Culture Act and Plains forest reserves. These foresters favored massive projects that would transform the very nature of the Plains. Planting sporadic windbreaks and encouraging municipalities to plant trees, while good for public relations, could never

fundamentally alter the landscape. The cooperative plantings embodied in the Kinkaid and Clarke-McNary Acts were a poor solution because they lacked bureaucratic control and depended on private initiatives. Only an ambitious forestry program, run centrally by a government agency could alter the landscape sufficiently to test climatic theories. Although on the Great Plains big projects and direct federal control fit with climatic views, such plans also reflected the conservation agenda put forward by Gifford Pinchot and others who promoted aggressive regulatory policies during the 1920s.

President Taft had ousted Pinchot as head of the Forest Service in 1910, but Pinchot continued to be an influential political force and advocate of federal regulation. Historian Harold Steen agued that Pinchot saw his dismissal as an opportunity to promote conservation to the public "unencumbered by government regulations." By the 1920s he was once again in government, first on the Pennsylvania Forest Commission and then as a two-term governor of Pennsylvania. Pinchot also maintained contact with his allies within the Forest Service. Historian Char Miller explained, "Pinchot's veiled authority had been immediately reflected in what the press believed to be Taft's fortuitous selection of Henry S. Graves, then dean of the School of Forestry at Yale, to be the second chief of the Forest Service. Actually, there was nothing fortuitous about his choice of one of Pinchot's oldest friends and closest colleagues—the disgraced chief had helped arrange it." Pinchot and Graves grew apart during the 1920s because of Pinchot's meddling in Forest Service politics, and what Pinchot perceived as Graves' lack of support for federal regulation. Graves' replacement, William Greeley, had even less interest in promoting regulation. He instead developed a cooperative model of forest management that mirrored Republican Party platforms of the era. However,

even on the outside, Pinchot continued to maintain close ties with other Forest Service personnel, including Raphael Zon, with whom he felt a shared sense of purpose.[4]

Of Pinchot's supporters within the Service, Zon was the most outspoken and visible advocate of climatic influences and federal control. In the 1920s he led Forest Service opposition to Greeley's cooperative forestry agenda. Politically sidelined by Greeley because of his opposition, Zon reemerged instead as one of the Forest Service's top scientists and, as late as the 1930s, continued to argue that trees could influence climate. While clearly in the minority of opinion, Zon remained an influential voice within the Service from both a bureaucratic and scientific standpoint. Drawing inspiration from him, other researchers working on Plains forestry also argued variations of the trees-and-climate theme, as well as alternative schemes, that would result in planting enough trees to ameliorate the Plains climate.

Of all the scientific agendas that Plains foresters promoted, the most problematic was the connection of trees to climate. Initially the drought and economic crisis of the early 1890s seemed a fatal discredit to climatic theories. The idea that links between trees and climate ended with the crisis of the early 1890s has dominated the historiography of Plains afforestation. Geographer Michael Williams recently perpetuated this historiographical misconception by claiming that "the exceptionally dry years of 1889-90 showed that planting in this part of the country did nothing to ameliorate the climate," but views on trees and climate remained considerably more complex than this.[5]

Although the early 1890s did crush the most facile theories of climate change, trees-and-climate had much greater staying power than ideas such as rain-follows-the-plow. The

public and some foresters believed that Plains forestry had never been given a fair chance, and they argued, accurately enough, that the crisis of the 1890s could not be blamed on the failure of trees to modify the climate because far too few trees had been planted to test the theory. Bernhard Fernow and then Raphael Zon continued to support versions of this link well into the twentieth century, despite their recognition that the idea had lost most professional support. Perhaps even more significant was that the general public never completely lost its belief in the link either, and as late as the 1930s many Americans, still thought that trees could influence climate.

Adding to the confusion, the exact meaning of "climate change" underwent its own modifications. Originally many Americans had hoped that forests would increase rainfall. By the 1890s most supporters, and all who valued their credentials as scientific experts, grew far more cautious in their pronouncements. In his 1891 report on forestry, Fernow largely avoided the question of whether forestry could directly affect climate. He instead vaguely noted that "there is a very peculiar and intimate connection between vegetation (especially forest vegetation) and climatic conditions ... [T]there is also a reaction of vegetation upon climatic conditions, and this truth is strikingly expressed by the poet, who speaks of 'Africa's arid sands, where nothing grows because it does not rain, and where it does not rain because there nothing grows.'"[6]

Two years later Fernow articulated more clearly the current state of science on trees and climate. His remarks bore the hallmarks of the continuing ambivalence about trees-and-climate. On the one hand he admitted that the possibility of large-scale climatic changes, or "cosmic" effects, were unlikely and speculative, and he attributed most such claims to "popular writers on forestry, friends of forestry reform, and the public mind." On the other

hand, Fernow advocated a more balanced and scientific study of the potential effects of forests on climate because "there are as trustworthy and careful observers who maintain the existence of such influences." Having left the issue unsettled, Fernow went on to describe the known effects of forests on "the local modification of climate conditions."[7]

The more Fernow tried to clarify the subject, the murkier it became. The phrase "local modifications" was less than transparent, and in the hands of some pundits it was becoming code for wider ranging effects. The continuing premise was that a sufficient percentage of afforested land could produce cumulative "local modifications" that would have a result similar to "cosmic" changes. For Fernow the question was "whether we can alter these [temperature and moisture] conditions on a larger scale by such means as alternating forest areas and fields or by large bodies of forest." This was not a simple appeal to trees increasing rainfall, but the basis for a controlled scientific experiment in landscape change:

> We are not so much concerned as to whether the total rainfall over the continent is increased, but whether the distribution of precipitation in time and quantity over and near a forest area is influenced by its existence; whether we or our crops feel its absence or presence in our immediate neighborhood; whether the protection it seems to afford and the changes it seems to produce in the meteorological phenomena are or are not real and of sufficient magnitude to influence our forest policy.

Fernow cautioned that these deductions were far from proven, yet he insisted that there were enticing "results obtained in the forest station at Lintzel, which seem to show that forest-planting did, under the conditions there prevailing, produce a considerable change in meteorological conditions."[8]

Although Fernow was guardedly optimistic, most scientists remained unpersuaded. M. W. Harrington, chief of the Weather Bureau, and meteorologists Cleveland Abbe and George Curtis also contributed to the 1893 forest influences report. Their arguments varied in

subtle ways, but they all agreed that it was unlikely trees influenced climate or that, if they did, it was only by a very small amount. And this was Fernow's friendly audience. Researchers at the US Geological Survey and Massachusetts Institute of Technology (MIT) had already come out with much stronger rebukes. The Geological Survey studied data from twenty-four weather stations and concluded there was no evidence of any increase in rainfall from tree planting. An MIT study reexamined George Perkins Marsh's *Man and Nature* and concluded there were no scientifically verifiable cases of forests increasing rainfall.[9]

Despite the many critics, however, some foresters continued to suspect trees might influence climate, whether through a slight "cosmic" effect or, more probably, local effects writ large. An 1898 Division of Forestry publication on Plains forestry revealed that the issue was far from dead. *Bulletin 18* was a sober analysis of the difficulties faced by Plains tree culture, but Fernow displayed a continued interest in trees and climate. He opened by arguing that "forests subserve [sic] two purposes: supply of most necessary raw material, and amelioration of the conditions of climate and water flow." On the Plains "protection, then, amelioration of climate, is the principal object of forest planting in these regions." Fernow's introduction formed a brief part of the bulletin, and he was probably already more concerned with his upcoming move to lead the new Forestry Department at Cornell University, but his salvo cast a lasting, if ambiguous, illumination on the subject.[10]

Fernow's usage of "amelioration" caused considerable misunderstanding. Those who doubted claims that trees influenced climate took such words as a code for outdated theories that trees increased rainfall. Fernow almost surely meant something different, and was instead expanding on his "localized modification" theory of 1893. By the later half of the decade, Fernow and Division of Forestry scientists were piecing together how localized

effects might have wide-ranging results without resorting to easily discredited claims about increasing rainfall. First there would be localized changes such as the wind slowing effect of a grove or windbreak. Farmers who had successfully planted windbreaks around farmsteads could testify that indeed windbreaks had "ameliorated" the climate around their home. Thus Fernow had carefully chosen the word to suggest, at least potentially, the role forests might play in other aspects of the hydrological cycle, but lacking a simple sentence clarifying that "ameliorate" meant only the localized wind slowing effect, confusing misinterpretations persisted.[11]

A clue to what Fernow might have had in mind by wider ameliorative effects was in another section of *Bulletin 18*, written by assistant chief forester Charles Keffer. Discussing the value of afforestation to Western agriculture, Keffer explained that "tree tops will protect the surface of the soil, which ... will become much more absorptive than when protected only by the slight covering of grasses which nature has placed there." The additional absorptive capacity of the soil tree groves would act like a giant sponge, and the moisture would be "available to the surrounding fields." Keffer's sponge theory was typical of forester's conception of how Plains forestry could benefit farmers. He was harkening back to Land Commissioner Wilson's plea to cover one third of the Plains with trees, but instead of arguing that tree planting would increase rainfall, Keffer envisioned forests as reservoirs. This was perfectly in keeping with more credible theories about the value of forests to watersheds in other parts of the nation, where reserving areas to protect water supplies was common and popular.[12]

Division of Forestry personnel avoided public discussion of the trees-and-climate issue following Fernow's departure, but Raphael Zon, who had been a student of Fernow's at

Cornell in the early 1900s, reasserted the forests-and-climate theory as he established himself in the new Forest Service. At the 1911 meeting of the Society of American Foresters, Zon presented a paper titled: "The Relation of Forests in the Atlantic Plain to the Humidity of the Central States and Prairie Region." Zon began by arguing that deforestation of the Atlantic seaboard could have a significant influence on the circulation of water vapor. His contention was that much of the atmospheric moisture derived from continental sources, and he believed that while the eastern United States received most of its moisture from evaporation from the Gulf of Mexico and the Atlantic Ocean, as the air moved inland and lost moisture to precipitation, continental evaporation became more important to areas further inland. Forests absorbed and expired precipitation, and like exhaust steam that moisture reentered continental circulation. If water were allowed to run-off and enter streams or soak into the aquifer, then areas further inland would receive proportionately less rain. At the time, there was little precise knowledge about global circulation patterns, and while many scientists were beginning to suspect that oceans played the primary role in adding water vapor to global circulation, the exact relation between continental and oceanic sources remained unknown. There was also imperfect knowledge about the total amount of water in circulation, so Zon's argument that oceanic evaporation "ran out" as it moved inland remained plausible. Additionally, there was little unequivocal evidence that forests reduced run-off more than tilled or pasture lands. Proving forests could influence run-off became a major Forest Service goal, but it was highly contested territory in the 1920s and 1930s. The exact effect of vegetation on rainfall remains contested. Roger A. Pielke Sr., an atmospheric scientist, has recently suggested that forested landscapes influence the formation of thunderstorms and therefore rainfall. Zon's greatest error was of proportion. He

underestimated the amount of water vapor in circulation and therefore the ability of small changes in continental evaporation to have a perceptible effect on the entire hydrological cycle.[13]

While cooperating with the National Waterway Commission the following year, Zon began to work on *Forests and Water in the Light of Scientific Investigation*, in which he reviewed much of the available literature and found that most reports "demonstrate beyond doubt that the amount of precipitation over forests is greater." Zon noted that "this excess of precipitation over forested areas varies from a fraction of 1 percent to 25 percent." Although much of Zon's discussion was aimed at preventing deforestation, he found that the best proof "of the effects of forest in increasing local precipitation is afforded by observations following forest planting in the steppes of southern Russia." In this he not only made an explicit claim that forests influenced climate, but his choice of "most direct proof" focused on how afforestation of a dry plains had increased precipitation. Unfortunately for Zon, the increased precipitation over forested areas found in many of the studies he examined was indeed a common occurrence, but it also reflected an error in measurement. Small forest clearings created air currents that did draw slightly more precipitation into waiting rain gauges. Not until the 1930s was this phenomena widely recognized and weather researchers compensated with more accurate experimental methods. Thus in the nineteenth and early twentieth-century Zon's theories remained supportable.[14]

Zon understood that his conclusions were controversial, but that did not restrain him from presenting his views to a wide audience. *Forests and Water* entered the *Congressional Record* in 1912, and Doubleday books published the popular science reader *Science Remaking the World*, which included a chapter by Zon setting out his theories on the

importance of forests to rainfall in the central United States in 1922. Then in 1927, while Zon was the director of the Lake States Forest Experiment Station, the Forest Service published a revised edition of *Forests and Water*. In every case Zon was careful to qualify his findings with the caveat that science had not reached conclusive findings on the issue, and his persistence revealed that the issue of trees-and-climate was far from settled after 1890, even within scientific circles.[15]

In formal settings Zon carefully qualified his claims as theories, but privately he expressed little doubt that forests increased rainfall. In 1913 he undertook for the Forest Service a survey of forest conditions and the conservation movement in Kansas and Nebraska, but the resulting report seemed mostly aimed at his close friend, Gifford Pinchot, whose signature it bears. Zon argued that the "forests of the Appalachians and Coastal Plain exert a most marked influence upon the humidity of Kansas and Nebraska. Being in the pathway of the prevailing moist winds from the Gulf of Mexico and the Atlantic Ocean they help to carry the moisture farther into the land, and in this way increase the precipitation over the prairie region." This was a simplified and more positively stated version of his "The Relations of Forests" paper. Addressing the question of the afforestation of the Plains more directly, he claimed that "forests are needed, especially in the sandhills, to check the wind locally for preventing the further encroachment of the sand on the fertile land to the east, and ameliorating the dryness of the atmosphere so that the agricultural land to the east may receive a greater amount of precipitation." As Zon shifted from a scientific to a political discourse, he also moved from cautious speculation to forceful advocacy. In his mind the issue seemed settled: forests increased rainfall in other areas, and they could do the same for the Great Plains.[16]

For these reasons Zon's thinking appealed to and paralleled popular opinion. In 1914, A. K. Westervelt addressed a letter to the Secretary of Agriculture calling on the federal government to plant trees along the Missouri River as a giant windbreak and moisture reservoir. As the resident expert on forest influences, Zon eventually received the letter. Zon replied by sending to Westervelt a copy of *Forests and Water* and an encouraging note that he had "little doubt that if the prevailing winds during the summer passed over large bodies of timber south of Nebraska and the Dakotas and absorbed the moisture given off by the trees through evaporation, large quantities of moisture would be carried farther north and deposited in the form of rain." Little separated such a claim from tree booster Richard Elliott except forty years and Zon's substantial credentials as one of America's premier forest researchers.[17]

Although Zon was the best known and most forceful advocate of forest influences on climate in the twentieth century, other foresters made similar claims. One of the Forest Service's leading researchers on Plains forestry, Carlos Bates argued:

> When the prairie regions of the Middle West were first developed the lack of trees was felt severely. The clear sweep of the winds across the flat plains was a great hindrance to agriculture, for the soil was dried out quickly by evaporation, and grain was lodged and orchards injured by the mechanical forces of the wind. Windbreaks were the only remedy, and thousands of miles of them were planted along roads and farm division lines. The effect of this planting, though only gradually felt, was very distinct; farming and living conditions became more favorable throughout the whole region.

Perhaps he was only referring to aesthetic conditions, or perhaps simply local effects, but without greater elaboration the statement led some readers to conclude that Bates hoped for regional climatic changes from windbreak planting. Ten years later Bates would revisit the issue when the Shelterbelt Project came under criticism, and his opinion was still unclear.[18]

Bates' ambiguity was not unusual, and other sources displayed similar uncertainty. In 1910, *Scientific America* published an editorial that categorically refuted any claims that trees influenced climate. The editorial relied on the work of Willis L. Moore, chief of the US Weather Bureau, who had found no evidence in the climatic record of the United States that deforestation had in any way reduced precipitation, let alone the ability of afforestation to increase it. Moore also doubted that forest cover was superior to cultivated land in its water retention capabilities, and stream flow measurements seemed to bear out this conclusion. Four years later, however, *Scientific America* carried an article by L. A. Foshey claiming that deforestation had a profound influence upon climate. Foshey was more ambiguous about the potential benefits of afforestation, but his findings kept the debate open.[19]

The persistence of the trees-and-climate theme was a mixture of scientific and bureaucratic pressures. One the one hand, Fernow and Zon were making honest interpretations of the available scientific evidence. Extant measurements from Europe did indicate that trees might influence climate. The incomplete knowledge of such things as atmospheric circulation and albedo limited discussions of their influence to speculations. One the other hand, by arguing for some link—whether it be "cosmic" or local—Fernow and Zon were also arguing for an increased Forest Service role in managing the national landscape. When Fernow argued that only government could mobilize the resources necessary for a vast program of Plains forestry, he clearly understood that the Division of Forestry would likely oversee any project. Likewise, if Zon's analysis of the role of trees in the moisture cycle was correct, then forest preservation would have to become a national project; a project perfectly suited for the Forest Service.

Forest Service employees were not the only ones working on forestry, and researchers working in different institutional settings tended to come up with different explanations for the value of afforestation. They concentrated on versions of what Fernow called "local effects," with less emphasis on the potential for local effects to be anything but local. Working out of state agricultural colleges, state experiment stations, and the Office of Dry Land Agriculture, foresters C. B. Waldron and Francis Cobb developed an array of opinions on the needs and potential of forestry. Their solutions often sought to solve concrete problems of farm life. This meant a greater interest in proving that windbreaks were a paying investment, or on farmstead plantings protecting buildings and gardens. They de-emphasized timber production and experimented with narrow windbreaks that occupied little land. They were also more supportive of cooperative programs that offered seedlings and advice but depended on farmers to do the work. The increased acceptance of cooperative programs by agricultural scientists was partly a reflection of the conservative political goal of keeping government small, but it also reflected their desire to remain independent of Washington DC, and their dependence on state funds. Forest Service researchers, however, remained skeptical of agricultural scientist's forestry projects and viewed their cooperative programs and emphasis on local goals with suspicion.

Many potential criticisms of both agricultural and Forest Service scientists could be traced back to their institutional and political perspectives. It was the job of the Forest Service to promote forest growth and to insure the nation's timber supply. Many in the Service regarded giving away seedlings as part of a long tradition of questionable congressional practices more akin to franking privileges than serious forestry. Experiment station and Office of Dry Land Agriculture programs also had their faults. Researchers at

state experiment stations could rarely devote themselves to forestry full time because of the wide range of agricultural experiments underway at most stations, and the limited number of personal and funds to carry them out. Not only did this result in haphazard experiments, but they could rarely publicize forest issues. The shifting and unstable nature of their funding undermined studies that were, by their very nature, long-term. The cooperative farmstead windbreak plantings, undertaken by the Office of Dry Land Agriculture, also tended to invest most public money to increase the comfort of a select few farmers. Farmstead planting had few broad public benefits, either for future timber needs or for erosion control.

While agricultural scientists had difficulty explaining the public benefits of windbreak planting, they were clear about the benefits of windbreaks to individual farmers. Under the leadership of Fernow, the Division of Forestry helped plan and fund a series of forest experiment stations after 1896. Working from land grant colleges under the auspices of the Hatch Act, researchers developed subtly different goals and procedures than Division personnel. One of these differences was a greater emphasis on the crop production benefits of windbreaks. In 1897, Fred Card at the University of Nebraska explained that "the great problem upon the Plains is that of conserving, to the utmost extent, the available moisture supply during the growing season." Windbreaks helped by slowing the winds, and he insisted that "this is their chief though never their only, use upon the Plains." Card also surveyed members of several state horticultural societies on their opinions about windbreaks in a self-conscious effort to make windbreaks immediately relevant to the personal needs of farmers. A long decade later C. B. Waldron of the North Dakota Agricultural College also argued that windbreaks had multiple uses, but "the primary object of tree-planting in North Dakota has been and should be for protection." Windbreaks were a way to protect homes and crops at the

individual level, while erosion control, climatic change, and timber production were secondary or incidental benefits.[20]

Forest Service plans were by their very nature less amenable to this type of thinking. If the only benefit of trees on the Plains was to slow the wind for a short distance, then large forest reserves were clearly a poor solution. Likewise, trees in windbreaks made timber production problematic. Trees would have to be harvested and replaced from within the windbreak if it was to retain its aerodynamic properties. Most researchers advocated windbreaks with a variety of species, including shrubs, but this made harvesting and replanting an entire windbreak even less efficient. Finally, the Forest Service personnel responsible for Plains forestry would have to become customer-oriented and learn to work with farmers on solutions to farm problems, not simply advocate wholesale afforestation. This would include educating farmers about planting and care but also convincing them to convert valuable land to trees. These challenges were essentially cultural and institutional, but the Forest Service personnel could never quite imagine themselves as agricultural scientists. Even within the realm of forestry, Plains forestry ran a poor second to working on the nation's "real" forests.[21]

The institutional perspective of the Forest Service was particularly apparent in its preference for timber production. This continued long after evidence mounted that growing profitable timber on the Plains would be a difficult task. Carlos Bates, a graduate of the forestry program at the University of Nebraska, had become one of the Forest Services' lead afforestation researchers in the 1910s through his work at the Nebraska and Kansas National Forests. Both reserves experienced serious difficulties in 1912, when Bates published *Bulletin 86.* Despite the growing evidence that building forests on the Plains was expensive

and difficult, he devoted nearly one-third of the publication to theories on generating profits through timber sales. Card, Waldron, and other agricultural scientists always included at least a paragraph suggesting that windbreaks might provide a source of fence posts and firewood, but Bates went much further. He calculated hypothetical sales numbers as part of a windbreak's value. He also recommended planting high value species such as white and ponderosa pine. Bates conceptualized windbreaks as miniature planned forests that would slowly migrate across a field as farmers harvested the mature side as they replanted the other side. Neither goal was realistic. Most researchers, including Bates, found conifers difficult to establish and required interplanting with deciduous trees. Ironically, a properly located and successfully established conifer windbreak was in fact far too valuable to cut.[22]

Foresters and agricultural scientists had institutionally different approaches to controlling erosion as well. Congress created many of the nation's national forests to protect water supplies and to prevent flooding. As with timber production, the Forest Service regarded windbreaks as another means of erosion control that might also act as water reservoirs—Keffer's "sponge" theory. Agricultural scientists had from time to time noted that windbreaks prevented erosion, but they did not boost this specifically except in extreme cases, such as the blow sand areas of Wisconsin. In some cases they even denied its significance. In a 1910 bulletin on the control of blowing soil, soil scientists E. E. Free and J. M. Westgate commented that "the moving of soil by wind and water, and even its final removal into the sea, is not in general harmful. Much good results from this process." When instability became a problem, there were numerous methods for controlling soil, including planting a cover crop or stubble mulching which left of crop residue on top of the soil to act as protection. Windbreaks were only a distant choice because "their cost is relatively high

and the percentage of idle land is considerable." Such costs would only be justified for protecting valuable crops "regardless of the existence or nonexistence of danger of wind damage to the soil." For Free, Westgate, and other agronomists, trees were often only a last resort.[23]

While not all foresters agreed on the goals of windbreak planting, they did tend to favor certain solutions. One was a search for a superior tree species that would grow vigorously, resist disease, and survive drought. During the nineteenth and early twentieth centuries, many researchers designed their windbreaks as single species stands. Sometimes they suggested adding shrubs or quick growing deciduous trees to protect slower growing conifers, but generally their idealized windbreak would be a nearly pure stand of superior specimens. In support of this during the 1890s, the Department of Agriculture searched the world for exotic species and imported the most promising for trial planting. During the 1920s and especially in the 1930s, foresters shifted to favoring communities of trees. They began to design windbreaks with numerous species that complemented each other's growth patterns and created a total that was greater than the sum of its parts. By the 1930s many researchers grew skeptical of exotic species and favored the use of natives.[24]

Single species plantings only gradually gave way to mixed plantings. In 1897, Card encouraged farmers to identify a species that was rapid growing and vigorous enough to survive the Plains. By 1910, Waldron noticed that "it is impossible to get all of these qualities in perfect degree in any one species, it is usually advisable to use a combination of two or three different kinds to get best results." Experimentation continued over the next decade, and by 1921 some researchers recommended planting as many as nine distinct species within one windbreak. Under the theory that "mutual protection is afforded where large numbers are

put out." Fred Johnson and Francis Cobb commented that "most older plantation in the Great Plains have been made with but a single species," but in their opinion "the ideal shelter belt will contain a mixture of species." This was not yet a consensus view. Some such as Carlos G. Bates continued to recommend single species windbreaks—mostly it seems for timber production—but even he eventually became an advocate of mixed plantings.[25]

Inspiring the search for how trees might act as a community was a hope that observations of the natural world would guide human activities. The natural tree growth on the Plains was a mixture of cottonwood and red cedar strewn together by time and chance. Somehow such combinations created the conditions for their own survival and reproduction. An article for *Successful Farming* in 1920 suggested that nature had planted trees to make havens of calm for other species and that "we must think about these things and adjust our screens as Nature suggests." Writing for the South Dakota Agricultural College, N. E. Hansen believed that "nature has provided trees for almost all conditions ... in our plantings we should work with, rather than against, nature." Popularized appeals to follow nature ran back at least to ancient Greece, but turning to nature for Plains foresters was not so much a search for ultimate truths as an incorporation of ecological theories.[26]

Nebraska was an early center of ecological education. Frederic Clements developed his ideas of "plant associations," or the grouping of plants according to climate, while a student at the University of Nebraska in the 1890s. Clements and Roscoe Pound had explored the Sandhills and were apparently encouraged by Charles Bessey to examine the Bruner plantation in 1892 and 1893. While a professor at Lincoln in 1904, Clements published *The Developmental Structure of Vegetation*, in which he argued that vegetation must be understood in its entirety as a complex organism. The next year he published his influential

Research Methods in Ecology that outlined a program of study for ecology as a discipline. Eventually Clements described collections of species as starting, growing, maturing, reproducing, and dying together as a "superorganism." The mature phase of the process was popularized as the "climax" stage, and he theorized that plant communities within specific climates tended to reach a stable "climax" growth.[27]

Critics would accuse Plains forestry of disregarding ecological knowledge, but Plains foresters in fact had an early exposure to ecology. Ecology was not a widely recognized scientific discipline in the 1900s, and foresters at Yale and Cornell had no compulsory exposure to the new discipline. Clements had only recently introduced it to the regular botanical curriculum at Lincoln. While a student at Lincoln, Bates studied with Clements, and later when Clements worked at the University of Minnesota he also introduced Cobb. Bates, of course, went on to work for the Forest Service and Cobb in Dry-Land Arboriculture for the Bureau of Plant Industry. Through these well-placed foresters Clements' theories began subtly to influence Plains forestry, but the full expression of that influence—the enormous wide and mixed species shelterbelts—would not flourish until the 1930s. This was the very moment when critics would accuse Plains foresters of not understanding Plains ecology. Yet many Plains foresters had already been thinking about ecology, forestry, and the Great Plains for several decades. They had come to a different conclusion than their critics, not because they lacked an ecological understanding, but because they viewed ecology as another forestry tool.[28]

The difference in perspective between foresters and agricultural scientists was not universal. As with the growing emphasis on ecology, their work was often indistinguishable. At other times differences that appeared institutional actually reflected idiosyncratic

approaches. The Forest Service also became less involved with Plains forestry as the Bureau of Plant Industry and its Office of Dry Land Agriculture became more involved. Although Bates continued to publish on windbreaks after 1909, he spent much more of his time on the controversial Wagon Wheel Gap forest cover and stream flow experiment. This study would offer clues about the ability of forested land to reduce run-off—and theoretically support Zon's climatic theories—but it also reduced Bates' interaction with agricultural scientists and their work on afforestation. The growing differences between institutional approaches would not be revealed until the Forest Service returned to the Plains during the 1930s, however, and by then agricultural scientists had assumed the lead in afforestation. The Forest Service thus had to rebuild or borrow expertise from state laboratories and the Office of Dry Land Agriculture.

Although the Forest Service grew less interested in Plains forestry, it still possessed two national forests in Nebraska and one of the earliest experiments with cooperative planting: the Kinkaid Act. In 1904, congressman Moses Kinkaid secured passage of an act allowing settlers in Western Nebraska to claim 640-acre extended homesteads. The act was a success, and within ten years settlers had taken up all but a quarter of a million acres out of seven million subject to entry. The land boom in Western Nebraska helped spell the end of the North Platte forest reserve, yet at the same time created thousands of potential "customers" for trees. In this way the Forest Service nursery at Halsey became an attractive and valuable institution in western Nebraska, where trees were a rarity. Kinkaid himself recognized that potential, and in 1910 secured an amendment to the Kinkaid Act authorizing the Forest Service to distribute "extra" seedlings not needed for its forestry program to surrounding farmers.[29]

When they started to distribute seedlings under the act's provisions, foresters quickly realized that there was no such thing as an extra tree. Nursery workers had carefully coordinated their plantings with planned work on the Sandhills. Some stock was deemed "cull" every year because of unsuitable growth habits, disease, or other factors, but unloading culls on unsuspecting farmers was an invitation to disaster. Fred Johnson, the forest supervisor at Halsey, considered it a "waste of money to wrap up trees of this kind, and a discouragement to tree planters who may be interested." Johnson warned that during the first year of distribution "if the present plans are to be carried out there is no stock available for distribution." Rather than disappoint local farmers, the Halsey nursery decided to distribute a small amount of stock. This was great for publicity, but without funding it was also a burden and, worse, toying with negative publicity.[30]

Whatever problems the act created for the Forest Service, it was an opportunity for Congressman Kinkaid. He began to pass personal requests on to the Forest Service. Not only did this link him to trees in his constituents' minds, but it made it very difficult for the Forest Service to turn down requests. Kinkaid also made requests on the behalf of towns, schools, and other local property owners. The demand for seedlings was so strong that Kinkaid began questioning why the Forest Service had so few seedlings available and why they could not rapidly increase production so there would be sufficient seedlings the next year. Chief Forester Henry Graves had to explain that "it has been found by past experience that successful plantations of suitable species can not be started in the sandhills with trees less than three years of age. In other words, they must be grown in the nursery for three years from the time of sowing the seed before they are large enough to plant, under the arid conditions." Thus, even under ideal conditions, it would take several years to increase

production. Kinkaid responded by trying to secure a larger appropriation for the program, but Congress was less enthusiastic about funding a tree giveaway for western Nebraska. The Forest Service would have to carry the burden until Clarke-McNary Act funds became available in the mid-1920s.[31]

The open-ended nature of the Kincaid Act, which according to its wording allowed distribution to any "resident," also irritated the Forest Service. When a 14-year-old boy applied for trees in 1915 to plant on town lots in Thedford, Nebraska, the Service tried to reject the request. The understanding of nursery personnel was that, while the act technically allowed distribution to anyone, trees should only be furnished to "heads of families or single persons who either own land or hold it under homestead entry." The District Forester in Denver was no more certain than the nursery personnel how to handle the request, but he thought it seemed "logical to suppose that the object of the Act ... was to furnish trees to homesteaders ... or occupy[ed] lands within the District ... for the purpose of developing the farms and creating an interest among the agricultural residents in the growing of trees." The Denver office doubted that Congress intended to apply the act to towns or ornamental planting. If trees were distributed too loosely, they might end up subsidizing a burgeoning resale industry. Washington's eventual conclusion was that the lack of clear wording of the act meant that the Service had to interpret it liberally and distribute seedlings to any resident. If trees were to be planted in a town, however, "town officials or responsible associations" would have to make the request. There is no record whether the boy from Thedford ever received his trees.[32]

Although historians have concluded that the act was a successful addition to Forest Service activities in Nebraska, at the time it caused considerable disarray. In 1913, Johnson

complained to the Assistant Forester "the Kinkaid distribution has reached the point where it constitutes a distinct drain upon our appropriation and may readily prevent doing as much reforestation work on the Halsey National Forest as otherwise would be desirable." It was not just the drain of valuable seedlings that concerned Johnson. The large volume of correspondence created havoc with office routines. Johnson asked for an extra appropriation from Washington to cover the costs of the seedlings, a partial covering of facilities, and a full time clerk to handle shipping and receiving. The act in effect siphoned already razor thin resources to a haphazard planting program for local farmers. Washington remained unsympathetic, and it instructed Johnson to segregate his funds and stock to support planting and distribution under the Kinkaid Act.[33]

Foresters were also disappointed by the motivations of farmers. In 1915, Johnson cut back the number of trees sent to individual applicants from 350 to 150 on the grounds that "many applicants were attracted simply by the possibility of acquiring something for nothing." He was upset that only about half the recipients sent in the required follow-up reports. Johnson hoped that by limiting the number of trees, farmers would be forced to reevaluate and rededicate themselves. These frustrations were likely exacerbated when Johnson had to report that "the amount of stock on hand was not sufficient to plant the area required by the reforestation plan." Farmers seemed to waste valuable Forest Service trees that should have been contributing to their afforestation plans.[34]

Bowing to the inevitable in 1915, Johnson developed a policy to meet both forest planting needs and distribution needs. He made permanent the policy of sending reduced numbers of seedlings. In his eyes, the Kinkaid program "should be conducted to stimulate interest of settlers in tree growing and not to supply sufficient to raise large woodlots."

Sensing what would become a conflict between federal and private nurseries, Johnson hoped that farmers would instead purchase additional trees from commercial nurseries. If the Forest Service distribution program served simply to interest farmers in tree planting and then encouraged them to buy substantial stock from private sources, not only would the burden on the Halsey nursery be reduced but local commercial nurseries would be less likely to criticize the Forest Service for unfair competition. Johnson also expanded the Halsey nursery to provide 200,000 "extra" trees a year by 1917, and he wanted to establish a permanent inspection process. He wanted one of his foresters to visit participating farms and determine the success of plantations. This would help to eliminate the need for planting reports from farmers, who tended not to complete reports, and to provide valuable information on tree culture.[35]

The wrench in the works, however, was the constant need for greater funding. The Kinkaid Act was the Forest Service's first foray into cooperative planting on the Plains, and many of its early troubles seemed predictable. Foresters came to Nebraska to build a forest, not to run themselves ragged helping farmers. The design of the act and its lack of funding ensured, at least at first, that the two goals would conflict. Although the program eventually became popular with everyone concerned, and was widely regarded as a success, its early trials were particularly troubling in light of the distribution program begun by the Office of Dry Land Agriculture in North Dakota.

The Bureau of Plant Industry established the Office of Dry Land Agriculture in 1905 to tackle agricultural problems on the Great Plains. The Office of Dry Land Agriculture divided the Plains into three regions and established major experiment stations within each, along with substations in adjoining areas. The Northern Great Plains division, based at

Mandan, North Dakota, began cooperative tree planting programs with area farmers in 1915. The Southern Great Plains station at Woodward, Oklahoma, followed one year later. Both stations provided trees under a cooperative agreement that required farmers to prepare the land, do the planting, and care for the trees according to instructions provided by the stations. Both stations used the program to gather experimental data about planting sites, soil types, species selection, row requirements, and windbreak effects. Although the program was small and labor intensive, by 1937 the Office of Dry Land Agriculture could boast of more than 4,000 cooperative plantings, representing over 6,000,000 trees on the Great Plains.[36]

The experiment stations also conducted their own nursery work and experimental plantings, but these tasks complemented rather than complicated their cooperative programs. From the start the stations designed their nursery operations to distribute stock to local farmers. Station experiments were modest and only required a small portion of the output of the nursery. Likewise, managing and reporting on cooperative plantings was seen as part of the daily tasks of researchers, along with nursery labors and experimental activities. Designed as a farm service program with the funds and bureaucratic infrastructure to handle that task, the Office of Dry Land Agriculture project became an example of how to implement cooperative tree planting.

The North Dakota Agricultural Experiment Station epitomized this pragmatic farmer-oriented policy. The station encouraged a vigorous role for its scientists in solving North Dakota's farm troubles. Historian David Danbom argued that this was because North Dakota had few scientists and, by necessity, researchers were drawn to a wide variety of fields. This suited the early staff at the station, which had trained broadly and felt compelled to assist in North Dakota's immediate problems. Waldron was a good example of this thinking. He had

trained as a horticulturalist-entomologist but published on forestry and other farm issues, and he became a local leader in the Country Life Movement, which emphasized the need to beautify the farm home to make healthier and happier farm families. Predictably, Waldron began investigating how trees could be used to further his goals and then advocating an active role for the station in beautifying North Dakota.[37]

The successes of the Mandan program caught the attention of Forest Service researchers. By 1915, Johnson had modified Forest Service procedures at Halsey to imitate Office of Dry Land Agriculture procedures at Mandan. He would have modified them further to include hiring an inspector, as did Mandan, but the Forest Service lacked the necessary funds. Foresters continued to watch with anxiety as the Mandan program expanded, and in 1921, John Hatton wrote the Chief Forester that:

> It occurs to me that the Service has no idea of the extent to which the shelterbelt planting at the Mandan Station is growing. To some extent it is a duplication of work which has been done by the Forest Service and it threatens to crowd out a true function of the Forest Service on the plains region. It has been the experience of several men in this office who have come in contact with the officials at the Mandan Station, that they are somewhat jealous of the Service work.

Hatton had been a member of the original survey party that established the Nebraska National Forest, but by 1921 he had moved into range management at the Denver office of the Forest Service. Although such concerns were immediate and real for Hatton, observers in Washington cared little whether the Mandan Station crowded out their work on the Plains. The Plains had ceased to be a critical area in Forest Service planning.[38]

In retrospect, Hatton need not have worried that Mandan would take over tree planting. Beginning in 1913, the station underwent its own gradual realignment toward basic science rather than farm politics. The Office of Dry Land Agriculture grew more concerned

with conducting plantings as experiments rather than as farm assistance, although its emphasis on useful science persisted. Cobb typified the trend by promoting windbreak plantings as "cooperative demonstrations" which were at once field laboratories, farmer assistance, and demonstrations to encourage farmers to plant their own windbreaks. After 1915 the Mandan station's funding also stagnated. These developments undermined the possibility of further station expansion and afforestation seemed to settle in as a minor activity for both agricultural science and forestry.[39]

The first change in that attitude began with Congressional maneuvering over the passage of a new forest protection law that would eventually be called the Clarke-McNary Act. The Forest Service began work on a new forest management plan in 1919 to improve timber company practices, reforest cutover lands, and reduce forest fires. The framing of the new law soon pitted Pinchot and his conservationist friends against the timber industry, with foresters such as Henry Graves and William Greeley caught in the crossfire. Pinchot and his advocates—including Raphael Zon—argued for federal regulation of all timberlands. They believed that timber companies had proved that they could not harvest timber in a sustainable manner. Industry representatives predictably argued otherwise, and Graves and Greeley had the unenviable task of creating a compromise that would satisfy timber interests, the states, and federal agencies. Cooperative fire protection soon emerged as something that most could agree upon, but fire protection by itself did not add up to a national forest policy.

A bill that would form a national forest policy finally emerged in the summer of 1924. As expected the bill offered a cooperative program of fire prevention between federal and state government. The act also called for cooperative procurement and distribution of forest seedlings and seeds for reforesting cutover or under productive forestlands. In the same

vein, the Act called for a cooperative program of "assisting and advising" farmers in establishing woodlots, windbreaks, shelterbelts, and a program to establish and fund state nurseries that would meet the needs of the program. The bill earmarked $100,000 to provide technical advice to farmers and another $100,000 to fund nursery operations. It also included provisions for acquisition of cutover lands and other measures. The bill was truly national in that the section on farm forestry and nursery establishment allowed states with little or no forestlands to participate. This was important to Forest Service goals of increasing the national timber supply, but it also made the bill more politically palatable to key Senators such as Nebraska's George Norris, chair of the Agricultural Committee, which controlled the bill.[40]

Such support was critical because Clarke-McNary began to displease a number of foresters. Pinchot had already declared his opposition to any bill that did not give the Forest Service regulatory control of timberlands. When he realized that Greeley would support the existing cooperative measure, he encouraged allies within the Service and Department of Agriculture to oppose the plan. Zon led the challenge from within the Service. He was concerned that Greeley was too eager to compliment industry practices, and he insisted that the interests of the Service required that it be critical of all bad management techniques, even if this alienated industry support. Zon was not opposed to cooperative measures in principle, but he doubted the sincerity of industrial users, and therefore their suitability as partners in any cooperative venture. The criticisms that Pinchot and Zon raised were not central to Plains forestry, since under Clarke-McNary timber companies would have no role, but their distrust of private motives remained a potent force in future programs. By 1925, Zon's advocacy for

federal regulation and his confrontations with Greeley led to a "voluntary" transfer to head the Lake States Forest Experiment Station in St. Paul, Minnesota.[41]

The broad nature of the Clarke-McNary act, which seemed to assure something for every state, succeeded in drawing wide support, but the proposal to advise and assist farmers in tree planting highlighted a problem for the growing effort to lend federal science and support to farmers. Representative Martin Madden of Illinois lamented: "what are we getting at? Have we reached that stage in the Nation's progress where everything that anybody ought to do for himself is to be turned to the Government?" There was a general unease that America's most cherished icon—the independent yeoman farmer—was becoming a ward of the state. The conflict had roots well outside forestry, but foresters would have to learn how to overcome such fears if they ever hoped for legislation more aggressive than Clarke-McNary. In the short term, though, the Clarke-McNary Act's cooperative features negated most such criticism.[42]

The cooperative principles of the act created their own problems. Some congressional representatives believed that farmers needed advice but not their work done for them; others felt that farmers already had too much advice and not enough help. The debate came to a head over a proposed committee amendment removing the word "advised" from Section 4 of the bill, which authorized the Department of Agriculture to "advise and assist" farmers on planting windbreaks, shelterbelts, and woodlots. The amendment would have made the section more active, requiring the Department of Agriculture to offer assistance as well as advice. In dismay, representative James McLaughlin remarked: "Congress is going out and doing common, ordinary physical work for the people of the country." He was strongly in support of "the scientific, experimental, investigational, and educational work," but he

wanted to "emphasize my disapproval of laws and appropriations for the purpose of having officials and employees of the department perform ordinary physical labor."[43]

McLaughlin's objections ran completely counter to Representative Gilbert Haugen, chair of the Agricultural Committee and author of the amendment, who tried to convince his colleagues that the act should promote assistance but not advice. Haugen worried that farmers would be swamped by an "army of people traveling over the country giving advice, and no assistance would be rendered except advice." Coming from Iowa, a state hard struck by the post-World War I agricultural depression, he complained that farmers "have too much advice as it is." It was not simply that Haugen sought more assistance for farmers; he was also worried that without the amendment the act would "provide for a few soft berths in the public crib for people to hold down swivel chairs." Scientific agriculture had made great strides in the United States since its acceptance as official policy under the Hatch Act of 1887, but many Americans remained skeptical of its value. This was especially apparent on issues such as forestry, which could show little quantitative or concrete assistance for problems of oversupply and low prices.[44]

Clarke-McNary passed with its advise and assist language intact. Congressional opponents realized that the real power over Department of Agriculture activities lay in budgetary appropriations. Having voiced their opinions on the role of science and government in agriculture, they supported the bill. The larger question of how scientific forestry could assist agriculture remained unanswered. The bill's language authorized almost any tree planting action by the Agricultural Department so long as it could display some evidence of farmer cooperation. Likewise, the exact role of research remained unsettled. Foresters such as Zon and Bates remained frustrated that the public and Congress did not

adequately understand the difficulty of tree growth on the Plains or the need for scientific study. This created an obvious incentive to show how research could be relevant. Zon and Bates might have disagreed with the principle of only undertaking practical science, but they understood the need to make their projects politically meaningful.

The cooperative principle of the act also harbored conflicts that would return to plague future farm forestry projects. By their very nature cooperative plans divided complex actions into distinct duties assigned to different actors. In theory this spread the burden and ensured that all participants had an interest in a successful outcome. The difficulty was that every interest depended on all the others to complete any task. The failure of the process at any one stage could render other actions moot. In the Clarke-McNary Act this meant that government agencies and farmers had to wait until individual state legislatures funded their portion of the bill. The Forest Service, Office of Dry Land Agriculture, and agricultural colleges that handled seedlings and offered advice depended on the goodwill of individual farmers to get trees into the ground. If farmers chose to destroy those trees after a year or two, or to resell them, then governments had little recourse. Even legal restrictions about the future care and use of distributed stock were problematic since the whole plan depended on farmer volunteerism.

In light of the many pitfalls, then, it was notable that the results of Clarke-McNary were mostly successful across the Plains. Individual states could only receive a maximum of $2,000 a year in federal funds under the law, and although that appropriation was helpful, state support was critical to establish nurseries and to assemble the required technical personnel. Some states such as North Dakota rapidly qualified for federal funds and were able to funnel these through their existing infrastructure at Mandan and Bottineau. Other

states such as South Dakota were much slower to take advantage of Clarke-McNary funds because they lacked state nurseries. Nebraska was one of the most enthusiastic beneficiaries of the act. The governor and state legislature quickly cooperated, the Forest Service already had the Bessey Nursery at Halsey, and farmers were already demanding more trees than the state could provide. The first Clarke-McNary plantings in Nebraska began in 1926 with 33,900 trees and 96 cooperators in 44 counties. In 1927 the program distributed 186,000 trees and 700,000 the following year. The extension service hired Clayton Watkins to oversee the distribution and educational functions, leaving the Forest Service to concentrate on its nursery and afforestation duties. While the federal nursery servicing the Kansas National Forest had long closed, Kansas had an aggressive state program that included a nursery at Hays and a division of forestry at the state agricultural college in Manhattan. As with North Dakota and Nebraska, this infrastructure allowed Kansas to take advantage of Clarke-McNary funds. Oklahoma had the Office of Dry Land Agriculture experiment station at Woodward that was engaged in work parallel to Mandan, again providing infrastructure to take advantage of federal funds.[45]

Cooperative planning was not without dissenters, in particular Pinchot, Zon, and their allies. At the national level, the resignation of Greeley and his replacement by Robert Stuart caused big forestry proponents to renew their calls for federal control and big projects. Their efforts quickly focused on watershed protection, flood abatement, and regulation of timber companies. It was not immediately apparent, even to foresters like Zon, that the Great Plains would support an expansion of federal forest control. That would wait until economic depression and natural catastrophes rearranged the conservation calculus. In the meantime,

Zon initiated one final program that embodied big forestry principles, if not their scope, by proposing the creation of another national forest on the Plains.

In 1929, Zon and North Dakota Senator Gerald Nye, suggested establishing a satellite of the Lake States Forest Experiment Station on the sandhills near Denbigh, North Dakota. Senator Nye persuaded Congress to appropriate $15,000 for the substation and experiments on windbreaks and erosion control. The citizens of Towner provided the land for the station and its experimental plantings by turning over an unused section of the North Dakota School of Forestry. Congress and the Forest Service then set up two purchase units, the Sounis in McHenry County, and the Sheyenne in Ransom and Richland Counties. The proposal was consciously modeled after the Nebraska National Forest. Zon and his supporters hoped that several years of substation experiments would create the foundation for the afforestation of the sandhills. According to historian Wilmon Droze, they intended to cover "the entire sand hills area," but their plans unraveled. First was a growing realization that this land was worth more for grazing than trees, then the start of World War II ended Civilian Conservation Corp labor and finally the Forest Service was unwilling to purchase the land.[46]

Despite a hopeful beginning, Zon's latest scheme fizzled for reasons far beyond his ability to control. The failure of the Denbigh project was even more instructive because of its broad support. The creation of the Forest Service substation was not seen as an attempt to compete with the Office of Dry Land Agriculture at Mandan. In fact, Cobb drummed up local support for the plan, helped Zon during a visit to the state, and was enthusiastic about having more foresters nearby. In concept the two stations would have complemented each other. The North Dakota Experiment Station, and later the Office of Dry Land Agriculture, had always promoted windbreak planting "to stimulate interest in the improvement of farm

homes" and to increase crop yields. The Forest Service substation only enhanced these efforts by afforesting the marginal sandhill land with block plantings. Cobb saw little to worry about and many advantages in having two agencies working on forestry in North Dakota. The growing number of agencies engaged in afforestation would not necessarily overlap as long as their activities remained distinct. Thus the eventual battles for funding and scientific legitimacy were even more telling in how they led both agencies to compete for leadership and the prosecution of their distinct goals for Plains forestry.[47]

Much of the disagreement between the professions and the bureaucracies arose from defining spheres of influence. The Forest Service's influence increased through its ability to wrest control of the nation's forest reserves from the Department of the Interior. One of the first steps had been convincing Congress to allow the Service to manage the Plains forest reserves. In the following decades, the Forest Service was deeply entangled with national forest activities and only belatedly realized the potential of bureaucratic expansion through agricultural assistance. The Office of Dry Land Agriculture was positioned to provide agricultural assistance, but defined itself as a scientific institution, albeit one whose work benefited farmers. By working on farm forestry through cooperative measures they defined a separate role for themselves on the Plains. The state experiment stations were also heavily involved in providing agricultural assistance, but lacking an effective national bureaucratic structure, they saw their role more narrowly as only providing assistance not management.

Bureaucratization was also about the control of landscapes and sciences. Raphael Zon saw his trees-and-climate theories as a method of improving human welfare, but also as a way of promoting his own research and the Forest Service. It was not a stretch to argue that if

deforestation along the Atlantic states decreased rainfall in the Midwest, then the federal government should promote reforestation. Likewise, Office of Dry Land Agriculture researchers erected a farmer-centered approach that reduced forestry to one of many agronomic tools for increasing crop yields. In doing so, they reduced the claim of forestry to solve the nation's agricultural problems, and increased the profile of scientific agriculture. By promoting themselves as providers of agricultural science and increased production to be carried out by farmers, however, they limited their bureaucratic reach. Farmers should be taught to properly apply new scientific methods, and then there would be little need for a federal bureaucracy to manage private farmlands along the lines of what the Forest Service was doing for the national forests. An emphasis on increased production was also problematic. It had obvious appeal to farmers, but it was a difficult sell to a Congress that, during the 1920s, was primarily concerned with the problems of low prices and oversupply.

With so many voices speaking for Plains forestry, perhaps it was not surprising that legislative backing remained parsimonious. Plains foresters had difficulty articulating what problem they were solving other than pleasing institutions, farmers, or politicians. Farmers in western Nebraska enjoyed the "extra" trees that the Kinkaid Act provided, but this was not the goal that foresters had in mind when they established their plantations and nurseries. Clarke-McNary expanded the level of generosity by offering trees to all the Plains states. As a farmer assistance program it was a useful if small addition; as a forestry and conservation policy, however, it was severely lacking. Even when Plains foresters thought they had developed a legitimate forestry use, they often found that other institutions offered contradictory advice. The Forest Service promoted windbreak planting as timber production, while the Office of Dry Land Agriculture wanted to protect farm homes and increase crop

yields. All of these concerns would come to a head in the early 1930s when agricultural depression and wind based soil erosion suddenly combined to make the "farm problem" and Plains forestry front-page news.

Chapter Three—Notes

[1] The "farm problem" was a growing recognition that farming in America had become an increasingly risky and technologically "backwards" endeavor. The Hatch Act of 1887, which established the nation's agricultural experiment stations, was one attempt to solve the issue, but private writers and publishers also continued to offer farmers advice. See Alan I. Marcus, *Agricultural Science and the Quest for Legitimacy: Farmers, Agricultural Colleges, and Experiment Stations, 1870-1890* (Ames: Iowa State University Press, 1985) and R. Douglas Hurt, *American Agriculture: A Brief History* (Ames: Iowa State University Press, 1994).

[2] Stephen Skowronek. *Building a New American State: The Expansion of National Administrative Capacities, 1877-1920* (Cambridge University Press: Cambridge, 1982).

[3] Claims of a "timber famine" were legion in the early twentieth century. The theory was that the United States devoured its timber resources so rapidly that in the very near future the prices of timber would begin to skyrocket and cause serious economic harm. Often such claims were used to justify government intervention in either conservation or replanting. See, Harold K. Steen, *The US Forest Service a History* (Seattle: University of Washington Press, 1976), 89, 177-78; or "For Wider Public Forest Ownership," *New York Times*, 20 April 1924, p. 18 for an example.

[4] Steen, *The US Forest Service*, 102; Char Miller, *Gifford Pinchot and the Making of Modern Environmentalism* (Washington: Island Press, 2001), 218-20.

[5] Michael Williams, "Afforestation: the United States," in *Afforestation: Policies, Planning and Progress*, Alexander Mather, ed. (London: Belhaven Press, 1993), 194. Most historians of the subject tend to avoid the issue when covering the post-1890 period and, perhaps, overemphasize it in the pre-1890 period. Walter Kollmorgen and Johanna Kollmorgan, "Landscape Meteorology in the Plains Area," *Annals of the Association of American Geographers* 63(4) (December 1973): 424-441 is the exception and accurately depicts, if with little detail, the persistence of the claimed link between forest and climate well after 1890.

[6] F. E. Fernow, "What is Forestry," United States Department of Agriculture: Forestry Division, *Bulletin No. 5* (Washington: GPO, 1891), 32.

[7] F. E. Fernow, "Forest Influences," United States Department of Agriculture: Forestry Division, *Bulletin No. 7* (Washington: GPO, 1893), 9-11, 125-26.

[8] Ibid.

[9] F. E. Fernow, "Forest Influences." See, Charles R. Kutzleb, "American Myth: Can Forests Bring Rain to the Plains?" *Forest History* 15(3) (October 1971): 20, for a more detailed analysis.

[10] Charles E. Keffer, "Experimental Tree Planting on the Plains," United States Department of Agriculture: Forestry Division, *Bulletin 18* (Washington: GPO, 1898), 2.

[11] Keffer, "Experimental Tree Planting," 2.

[12] Keffer, "Experimental Tree Planting," 18-19. Although forest histories tend to focus on the role of timber protection, for obvious reasons, forestry and the reserve system was also directed at preserving water supplies. See, Ashley L. Schiff, *Fire and Water: Scientific Heresy in the Forest Service* (Cambridge: Harvard University Press, 1962); Steen, *The US Forest Service*, 30; Ronald F. Lockmann, *Guarding the Forests of Southern California: Evolving Attitudes towards Conservation of Watershed, Woodlands, and Wilderness*

(Glendale, CA: Clark, 1981). Schiff is particularly useful on the subject and argues that the Forest Service promoted the role of forests in preventing floods for political reasons.

[13] Rapheal Zon, "The Relation of Forests in the Atlantic Plain to the Humidity of the Central States and Prairie Region," *Proceedings of the Society of American Foresters* 8 (July 1913): 139-53; William R. Cotton and Roger A. Pielke, *Human Impact on Weather and Climate* (New York: Cambridge University Press, 1995), see also Anil Ananthaswamy, "Rising clouds leave forests high and dry," *New Scientist* (March 22, 2003): 18.

[14] Raphael Zon, *Forests and Water in the Light of Scientific Investigation* (Washington: GPO, 1927), 9, 13. This is a reprinted and revised versions of Appendix V from the final report of the National Waterways Commission of 1912 included as Senate Document No. 469, 62nd Congress, 2nd Session.

[15] Ibid; Raphael Zon, "How the Forests Feed the Clouds," in Otis W. Caldwell and Edwin E. Slosson, eds. *Science Remaking the World* (New York: Doubleday, 1923).

[16] Raphael Zon, "Notes on Forest Conditions and the Conservation Movement in Kansas and Nebraska," 17 June 1913, National Archives and Records Administration, College Park, Maryland (RG 95), 1, 9, (hereafter National Archives). This document has Gifford Pinchot's signature and the date he received it. Pinchot had resigned from the Forest Service in 1910, but was working actively to promote conservation and the report was probably sent to him with this in mind.

[17] A. K. Westervelt to Secretary of Agriculture, 28 July 1914, National Archives (RG 92); Raphael Zon to A. K. Westervelt, 6 August 1914, National Archives (RG 92). Letters like Westervelt's seem to have been fairly common. It was more unusual for the letters and employee responses to survive.

[18] Carlos G. Bates, "The Windbreak as a Farm Asset," United States Department of Agriculture: Forestry Division, *Farmers' Bulletin No. 1405* (Washington: GPO, 1924), 3. In fairness to Bates, the confusion might have resulted from deference to Zon who was his superior at the Forest Service. In private by the 1930s, Bates had become extremely skeptical of climatic effects. See Chapter 4.

[19] "Forests in Relation to Climate and Floods," *Scientific American* 103:334 (29 October 1910): 334; L. A. Fosbery, "Climatic Influences of Forests: Results of the Destruction of Timber on Climate and Soil," *Scientific American Supplement No. 2024* (17 October 1914): 246-47.

[20] Fred W. Card, "Windbreaks," University of Nebraska, U. S. Agricultural Experiment Station, *Bulletin 48* (Lincoln, 1897), 91; C. B. Waldron, "Windbreaks and Hedges," North Dakota Agricultural College, Government Agricultural Experiment Station, *Bulletin 88* (Fargo, 1910), 3. Some Plains states, such as Kansas also employed state foresters who cooperated in research and the promotion of tree planting within the state.

[21] Charles A. Scott to Charles E. Bessey, 25 April 1903, *Charles E. Bessey Papers*, Microfilm edition, Iowa State Library. Scott, the supervisor of the Nebraska National Forest, notes that "forest establishment" did not receive the attention it should at Yale. See Richard A. Overfield, "Trees for the Great Plains: Charles E. Bessey and Forestry," *Journal of Forest History* 23(1) (1979), for the experience of some of Bessey's students from the University of Nebraska in the Forest Service.

[22] Carlos G. Bates, "Windbreaks for the Great Plains," United States Forest Service, *Bulletin 86* (1911). See Bates, "The Windbreak as a Farm Asset" for changes in Bates emphasis. Fred R. Johnson and F. E. Cobb, "Tree Planting in the Great Plains Region," United States Department of Agriculture, *Farmers' Bulletin No 1312* (1923), provides another interesting contrast. Johnson worked for the Forest Service and Cobb for the Bureau of Plant Industry.

[23] E. E. Free and J. M. Westgate, "The Control of Blowing Soils," United States Department of Agriculture, *Farmers' Bulletin 421* (1910), 4, 11. Free was a physicist working for the Bureau of Soils and Westgate an agronomist working for the Bureau of Plant Industry.

[24] Bernhard E. Fernow, "Report Upon Forestry Investigations of the Department of Agriculture, 1877-1878," *House Document 181*, 55th Congress, 3rd Session (1899).

[25] Card, "Windbreaks," 94; Waldron, "Windbreaks and Hedges," 2-3; A. F. Yeager, "Shelterbelts for North Dakota," North Dakota Agricultural College *Circular 43* (1921), 2-3; Johnson and Cobb, "Tree Planting in the Great Plains Region," 5, 19; Bates, "Windbreaks as a Farm Asset," 11.

[26] Anonymous, "A Shelter From the Storm," *Successful Farming* 19(2) (1920): 52; N. E. Hansen, "The Shade, Windbreak, and Timber Trees of South Dakota," South Dakota State College, *Bulletin No. 246* (1930), 1. See, Clarence J. Glacken, *Traces on the Rhodian Shore; Nature and Culture in Western Thought from Ancient Times to the end of the Eighteenth Century* (Berkeley: University of California Press, 1967); Neil Evernden, *The Social Creation of Nature* (Baltimore: John Hopkins Press, 1992) for a discussion of nature as norm. See, Daniel B. Botkin, *Discordant Harmonies: A New Ecology for the Twenty-First Century* (New York: Oxford Press, 1990) for organic views on nature.

[27] The description of Clements trip to the Bruner plantation is from F. E. Clements to Paul H. Roberts, 26 May 1941, Regional National Archives, Kansas City, Missouri (RG 95), (hereafter Kansas City Archives); F. E. Clements, *The Development and Structure of Vegetation* (Lincoln: University of Nebraska, 1904); F. E. Clements, *Research Methods in Ecology* (Lincoln: University of Nebraska, 1905); Ronald C. Tobey, *Saving the Prairies: The Life Cycle of the Founding School of American Plant Ecology, 1895-1955* (Berkeley: University of California Press, 1981). Although Clements was best known for his work with grasslands, during his early career he actually studied the association of forest trees in the Eastern United States.

[28] Clements to Roberts, 26 May 1941, Kansas City Archives (RG 95). Clements claimed to have had several other foresters among his students, but it is not clear from the letter who exactly he was refereeing to besides Bates and Cobb. Unfortunately, Richard S. Sartz, "Carlos G. Bates: Maverick Forest Service Scientist," *Journal of Forest History* 21(1) (1977): 31-39, does not cover Bates' education.

[29] Benjamin Horace Hibbard, *A History of the Public Land Policies* (Madison: University of Wisconsin Press, 1965), 392-393.

[30] Fred R. Johnson to District Forester, Denver Colorado, 12 October 1915, p. 3, National Archives (RG 95); T. S. Woolsey to W. T. Cox, 27 March 1911, National Archives (RG 95).

[31] M. P. Kinkaid to Supervisor Forest Service, Halsey, Nebraska, 21 December 1911, National Archives (RG 95); Henry Graves to M. P. Kinkaid, 4 January 1912, National Archives (RG 95). There are a great number of assorted letters from Kinkaid and his constituents asking for trees.

[32] Fred R Johnson to District Forester, 13 December 1915, College Park (RG 95); District Forester to Forester, 17 December 1915, National Archives (RG 95); Forester to District Forester, 27 December 1915, National Archives (RG 95).

[33] Memo for the Forester, 15 August 1913, National Archives (RG 95); B. L. Moore to District Forester, 3 January 1912, National Archives (RG 95).

[34] Johnson to District Forester, 21 December 1911, National Archives (RG 95).

[35] Ibid., 1-3.

[36] R. Wilson and F. E. Cobb, "Development of Cooperative Shelter-belt Demonstrations on the Northern Great Plains," US Department of Agriculture, *Bulletin 1113* (1923); House Committee on Appropriations, *Agricultural Appropriation Bill*, 75th Congress, 1st Session (1937).

[37] David B. Danbom, *Our Purpose is to Serve: The First Century of the North Dakota Agricultural Experiment Station* (Fargo: North Dakota Institute for Regional Studies, 1990).

[38] Johnson to District Forester, 13 December 1915, National Archives (RG 95); John H. Hatton to the Forester, 19 November 1921, National Archives (RG 95).

[39] Danbom, *Our Purpose is to Serve*; Wilson and Cobb, "Development of Cooperative Shelter-belt Demonstrations."

[40] Steen, *The US Forest Service*, 176-95; Gerald R. Ogden, "Forestry for a Nation: The Making of the National Forest Policy Under the Weeks and Clarke-McNary Acts, 1900-1924" (PhD dissertation, University of New Mexico, Albuquerque, 1980), 262-355; Williams G. Robbins, *American Forestry: A History of National, State, and Private Cooperation* (Lincoln: University of Nebraska, 1985), 96-104. Senator McNary actually tried to avoid sending the bill to the Agricultural Committee, but when Norris blocked this move he acquiesced and sent it through normal channels.

[41] *Minutes of the Service Committee* 4 January 1923, National Archives II, College Park (RG 95); Char Miller, *Gifford Pinchot and the Making of Modern Environmentalism* (Washington: Island Press, 2001), 285. Zon and Pinchot kept up a lively correspondence on conservation goals, internal politics, and their individual projects. See, *Raphael Zon Papers*, Minnesota State Historical Society, St. Paul, Minnesota especially Box 6.

[42] *Congressional Record*, 68th Congress, 1st Session (1924), 6993. Madden was suspicious of government inference in most spheres, but the context of his remark suggested such interference was particularly troubling when directed at small farmers.

[43] *Congressional Record*, 68th Congress, 1st Session (1924), 6982.

[44] Ibid. A valid argument can be made that scientific agriculture has increased the problems of oversupply and low prices, but a full debate of agricultural science and agricultural depression in America is outside the scope of this paper. See, Thomas H. Johnson, *Agricultural Depression in the 1920s: Economic Fact or Statistical Artifact?* (New York: Garland, 1985); Bruce L Gardner, *American Agriculture in the Twentieth Century: How it Flourished and What it Cost* (Cambridge: Harvard University Press, 2002); R. Douglas Hurt, *Problems of Plenty: The American Farmer in the Twentieth Century* (Chicago: Ivan R. Dee, 2002); Deborah Fitzgerald, *Every Farm a Factory: The Industrial Ideal in American Agriculture* (New Haven: Yale University Press, 2003).

[45] John H. Hatton, "A Review of Early Tree-Planting Activities in the Plains Region," in *Possibilities of Shelterbelt Planting in the Plains Region* (Washington: GPO, 1935); E. G. Maxwell, "Twenty-five Years of Clarke-McNary Tree Distribution," *Extension Circular No. 1728* (Lincoln: University of Nebraska, Agricultural Extension Service, 1951). Farmers bought the seedlings "at cost," which was actually less than the full cost, but helped stretch federal and state appropriations.

[46] Francis Cobb, Untitled typescript, *Francis Cobb Papers*, Historical Society of North Dakota, Bismarck, (hereafter *Cobb Papers*); Wilmon Droze, *Trees, Prairies, and People: A History of Tree Planting in the Plains States* (Denton: Texas Women's University, 1977). It may be that Droze also took his account from Cobb's typescript, as some of the facts are similar. Cobb was the state forester and a supporter of the plan, although he seems to have had slightly less grand plans in mind.

[47] Francis E. Cobb to John Taylor, 6 December 1929, *Cobb Papers*; Cobb to Taylor, 14 November 1929, *Cobb Papers*; Wilson and Cobb, "Development of Cooperative Shelterbelt Demonstrations," 1.

Chapter Four—The Rhetoric of Nature: science, politics and the Shelterbelt Project

Plains forestry became front-page news in the summer of 1934 when the Department of Agriculture and Forest Service announced to the nation the enormous Shelterbelt Project. The *New York Times* and *Herald-Tribune* explained to a puzzled public that President Franklin Roosevelt had issued an executive order allocating $15 million in drought relief funds for a tree-planting project on the Great Plains. And that was only the beginning. Over the next ten years, Roosevelt would request $75 million for the project, which was a huge sum of money in 1930s America. The project was equally large. The plan called for constructing a one hundred mile wide zone of shelterbelts, spread one mile apart, and running continuously from the Canadian border to the Texas Panhandle. The 1200-mile long parallel forests would be America's Great Wall, holding back the dust, drought, and despair of the Dust Bowl.[1]

Although public reaction was a mixture of ridicule, adulation, and sheer disbelief, the plan was everything that some foresters had long dreamed of for the Plains. They believed that the Timber Culture Act had failed, not because trees had failed, but because farmers had lacked the necessary knowledge and skills. Likewise, the reserve movement had been a good, but under-funded, idea in need of more systematic planning. Plans for cooperative tree distribution were by their very nature, too limited and too prone to some of the same failures as the Timber Culture Act. Foresters hoped that the Shelterbelt Project would correct previous errors by bringing the full scientific, budgetary, and bureaucratic might of the federal government to bear on the problem.

Despite these positive developments, the plan posed both opportunities and risks. Foresters such as Raphael Zon thought it would finally fulfill their quest for big forestry on the Plains. The program would make the Forest Service relevant to two of the nation's great problems: unemployment and natural disaster. The former would be ameliorated by the massive need for labor, and the later by altering or stabilizing nature. The great risk, however, was not simply that it could fail, but also that its dramatic claims would reignite arguments over the direction of the profession, the relationship between trees and climate, and the future of the Great Plains.

The plan instantly divided the already politicized forestry community over leadership of the profession. The drought and depression of the 1890s had no more killed the debate about the effects of trees on climate than it had killed the popular desire to settle the Plains. In the 1930s the pro-climate faction, led by Raphael Zon, struggled again to articulate an acceptable version of their theories or, failing that, to convince the profession to close ranks in order to secure support from Congress. Opponents charged that the plan was bringing unwanted publicity to old, discredited ideas, and that it threatened to undermine their scientific credentials. What the profession thought mattered because without unanimity, or at least its facade, the plan would lack the sheen of scientific objectivity.

Outside the profession, the Shelterbelt helped focus a debate on the future of the Plains. Chief Forester Ferdinand Silcox, Zon, and their allies portrayed shelterbelts as a way to assist farmers. To their surprise, many Americans questioned whether they should be helping farmers, and whether planting trees was really the right type of help. In many ways the debate repeated older arguments about the true nature of the Plains as Desert or Garden. Despite low agricultural prices during the previous decade, many Americans still viewed the

region as a moral, economic, and cultural center, yet others assembled a different combination of moral, economic, and ecological arguments in favor of federal programs that would restore it to natural grassland. Both claims had merit. For many residents the land had been a garden and would be so again, but critics rightly wondered at what cost. The downside was that the Desert and Garden narratives reduced the debate to scripted positions and oversimplified the role of nature.[2]

The role of nature mattered, even if most opinions about it were based on little observation. Bureaucracy building, professional recognition, and social welfare were each bound to specific definitions of Plains nature. The Forest Service supported a view of the Plains as Garden as much because it would increase their profile and professional standing as because they thought their plan would benefit people. Foresters and the Forest Service were not the only ones with a stake in the outcome, however. The state agricultural colleges, the Office of Dry Land Agriculture, the Agricultural Adjustment Administration, the Erosion Control Service (Soil Conservation Service), political parties, and more, had their own views, all of which were based more on myth and self-interest than on careful ecological study. Thus when researchers did begin to examine the Plains, they quickly realized it was an enormously large and complicated landscape, and that their initial plans and hopes were often unrealistic. Gradually institutions and researchers circumscribed their claims to ever-smaller spaces. Grand plans to belt the middle of the nation with trees morphed into concentrated plantings in ever-smaller zones, and finally transformed into individual farm blueprints.

Beginning in 1931 the Great Plains underwent almost a decade of low rainfall and high temperatures. The summer of 1934 was the hottest on record, and rainfall in the Dakotas

and Nebraska averaged about half of what was called "normal" in this typically volatile area. During the peak of the drought in 1936, an area from Oklahoma to North Dakota received only one-third of normal rainfall. Hot, dry conditions combined with poor cultivation practices and high winds to spawn dust storms that, at their peaks in the spring of 1934 and 1935, blanketed areas as far east as shipping lanes in the Atlantic Ocean with a fine layer of soil.[3]

Compounding the adverse natural conditions was a massive economic depression. Indebted from heavy investment and rapid expansion during World War I, some Plains farmers had only managed to forestall insolvency during the 1920s through high production. Much of this increased production came from newly opened lands on the western reaches of the Great Plains. The plentiful rains of the first two decades of the century did not last, however, and a precarious balancing act collapsed in 1931 when bumper crops led to record deflation. Prices stayed low for the rest of the decade.

The Forest Service was aware of the brewing farm crisis and looking for ways to make their expertise relevant. At first it was not obvious that this would be through anything as grand as the Shelterbelt. Raphael Zon hoped the North Dakota National Forest would assist the national problem by providing useful employment and, eventually, assisting agriculture. Gifford Pinchot and Zon also discussed the potential for forest work to take up large numbers of the nation's unemployed, but Zon doubted that forestry could absorb vast sums of money or untrained individuals. Another ambitious plan floated at a Service meeting in late January 1929 was "to give agricultural relief through putting larger acreage of marginal and sub marginal lands in forests." Composed of the Forester and most Washington

department heads, the committee agreed that while it wanted to be relevant to the crisis, the true goal should be forestry, not solving farm problems.[4]

There were also plans to increase forestry work for flood and erosion control. In April 1930, Zon and George Pratt the President of the American Forestry Association began directing "a steady pressure of public opinion to secure increased federal appropriations for carrying out the provisions of the several fundamental forestry and conservations laws." They hoped to insure a share in any job creation or economic recovery programs for forestry. A year later Earle Clapp, chief of research for the Forest Service, directed Zon to lobby for the McSweeny-McNary Act which would provide funds for erosion and stream flow studies. Zon and Carlos Bates gave presentations to the Mississippi Valley Association, the Izaak Walton League, drainage and flood control conventions, and other forums advocating an increased role for forestry in national plans. Taking his lead from Gifford Pinchot, Zon expressed dissatisfaction with farm relief and unemployment programs in which "erosion was merely incidental to the bigger problem." He remained pessimistic that Congress would enact aggressive legislation because "the progressive legislature place farm and unemployment relief above everything else and the conservatives think of nothing but economy in government expenditure." Zon believed that the real problem was recognizing a need for greater government intervention in a variety of spheres. He argued that only the federal government had the resources and knowledge to revive the economy, enforce conservation goals, and counter the negative influences of private capital. Although Zon sensed the beginnings of a change in political sentiments, he worried that new proposals would become entangled in political infighting and compromise. He wrote to Clapp: "we will gain much more by waiting for the opportune psychological moment."[5]

The first hint of that moment began in the summer of 1933, when newly elected President Roosevelt canvassed his department heads for solutions to the troubles afflicting the Great Plains. Roosevelt had pushed reforestation efforts while governor of New York State, and he took a personal interest in tree planting on his estate at Hyde Park. He also admired the conservation credentials of his distant cousin, Theodore Roosevelt. In August, Roosevelt asked Chief Forester Robert Stuart: "What can be done to reforest the Great American Desert?" His question caused confusion at the Forest Service, because nobody was sure what Roosevelt meant by "the Great American Desert." Edward Munns drew the task of decoding Roosevelt's query and made a visit to the Library of Congress to search old geography texts. Once they had an answer, Stuart and Munns encouraged Roosevelt to sponsor shelterbelt planting along highway and section lines throughout the Plains and Prairie regions of the Midwest.[6]

Roosevelt was unhappy with the Forest Service's plan. He had in mind something far more ambitious, far more systematic. Roosevelt wanted to form a wall between the expanding 'deserts' on the western Plains and the more productive regions to the east. He imagined a single belt of trees, three or more miles wide, running slightly west of the 100th meridian. The earliest plans called for a wall of trees to stretch from the northern border of Nebraska to the end of the Texas panhandle near Childress. This soon extended into a single wall running from Canada to southern Texas. Roosevelt's ideas fit the tradition of nineteenth century forestry, with its emphasis on climatic and "cosmic" effects. The idea might seem anachronistic for 1930s America, but the eventual public debate over the plan revealed a different conclusion. Coming from an eastern perspective, Roosevelt had little familiarity with the use of windbreaks and shelterbelts on the Plains, and he seemed inclined to think

that existing plantings were insubstantial and haphazard. Bates later wrote that it was "quite apparent that President Roosevelt's proposal in 1933 for a belt of tree plantings several miles wide from Canada to the Gulf of Mexico did not have in mind local protection of soils or crops, but a widespread effect from the presence of trees." Roosevelt's plan reflected the tradition of Joseph Wilson, Charles Bessey, Bernhard Fernow, Zon, and others who had argued for over half a century that tree planting on the Plains would increase rainfall and have far reaching effects.[7]

A central problem for Roosevelt's enthusiasms was that most foresters no longer subscribed to theories about trees and rainfall. The Forest Service resisted Roosevelt's plan of a single wall of trees. Munn's plan for planting along highway and section lines, while less dramatic, was thought to do far more to assist the region. Evaporation studies conducted by the Forest Service and Bureau of Dry Land Agriculture suggested that windbreaks only protected an area of approximately ten times their height. Thus shelterbelts should be narrow, tall, and planted around fields. In the face of Roosevelt's insistence, however, the Forest Service tried to develop a compromise calling for one central forest belt several miles wide and one-hundred-foot wide belts spaced one mile apart running parallel to the western side of the central belt along its full length. This plan still did not please Roosevelt's department heads or Roosevelt, but he finally agreed to let the Forest Service handle the planning and placement of the belts. However, he always maintained his vision of the project as a dramatic wall across the Plains.[8]

The final report was closer to Roosevelt's original plan than to Munn's. Although the exact internal process by which the Forest Service developed the proposal is unclear, the content of the report strongly suggests that Raphael Zon wrote it. Presented to Roosevelt in

late August of 1933, "Forest Planting Possibilities in the Prairie Region" began by explaining that wind-slowing effects of a shelterbelt would reduce evaporation over an area five to ten times the height of the barrier. It described shelterbelts as "a form of insurance against the evil effects of drouth," and it discussed Russian studies that demonstrated an increase in annual precipitation on plains protected by systematic forest plantings. The report closed "it is possible that their [shelterbelts] beneficial effects as to climate would spread far beyond their immediate vicinity." These arguments paralleled the theories and evidence Zon had presented in *Forests and Water* and that the Forest Service had republished only six years before. Although the justifications were fully formed, in other ways the plan was still clearly preliminary. It specified little about the exact type and location for plantings, and it continued to present arguments both for and against planting in a three-mile wide wall versus planting along highways and section lines, as though these decisions had not been finalized. Munns and other foresters in Washington had already made clear their preference for diffuse plantings; only Zon was still advocating block plantings as useful to agriculture (as for example in his plans for the North Dakota National Forest). Therefore it seems likely that any author other than Zon would have omitted the information about potential climatic effects and argued strenuously against block plantings.[9]

Federal interest in the project waned during the winter of 1933-34, but as dry weather and high winds descended again in the spring and summer of 1934, soil conservation regained urgency. With dust from the Plains falling on Washington, D. C., and with refugees fleeing the area, Roosevelt needed some stabilization plan to keep the political troubles from spreading. This was the psychological moment that Zon had been looking for: the nation, its

president, and the Forest Service were yearning for a dramatic solution, and the plans from the previous summer provided one.

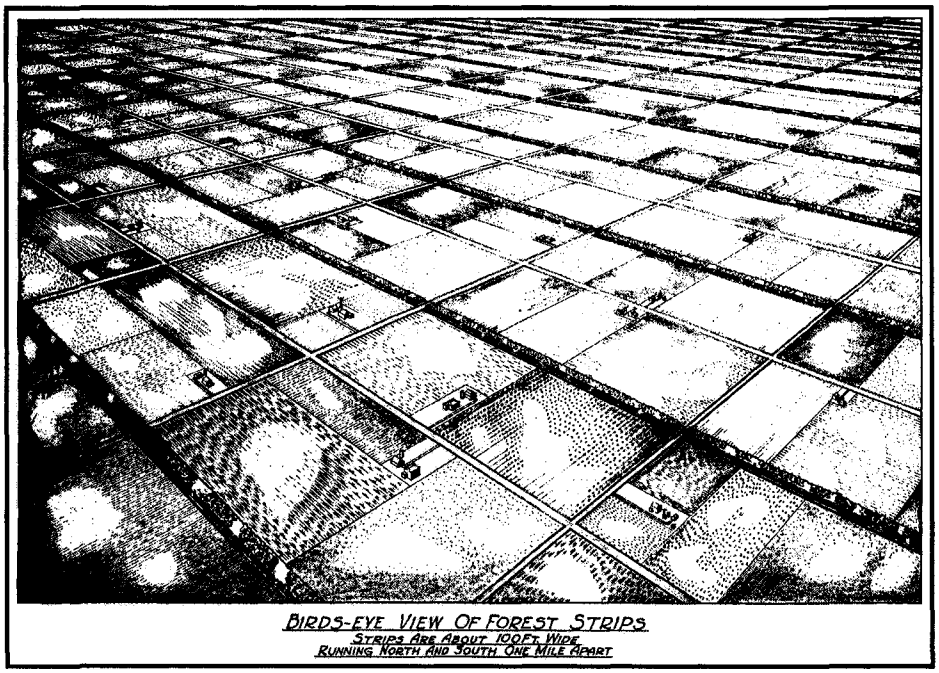

Figure 4.1—1934 Forest Service artist's rendering of Shelterbelts. [10]

Given the controversial nature of Zon and Roosevelt's ideas, it should not have surprised either of them that the plan that hit the front page of newspapers in July 1934 drew as much ridicule as support. The *New York Times* quoted the somewhat ambiguous statement made in Executive Order 6793 authorizing the project, that is was "a means of ameliorating drought conditions," and described it as nothing less than "an experiment in climate control to combat the ravages of drought." Ferdinand Silcox, the new chief of the Forest Service after Stuart's death, was less ambivalent. Silcox explained that "man cannot change all the forces of weather, but he can modify his own surroundings." He did not limit this to climatic

modifications in the immediate vicinity of tree planting because he went on to state that man "can ameliorate the effects of weather on a large scale, just as he can around his own home." Like Fernow three decades earlier, Silcox was supporting the theory that mass localized effects might have cosmic effects.[11]

At least part of the explanation for Silcox's claims was the need to define the public benefit of the project. The Forest Service had seen in earlier debates over forestry proposals that many Americans were skeptical about federal actions on private lands, especially when the beneficiary was only the landowner. Bearing this in mind, Silcox presented the Shelterbelt in its widest possible impact as addressing the "general public interest in ameliorating the climatic conditions over broad areas." Silcox elaborated on this at the end of July by outlining Forest Service assumptions about the nature of the crisis on the Plains and impact of the Shelterbelt. He argued that severe climatic conditions and heavy agricultural use had turned the Plains into "an incipient desert" that threatened both the Plains and "a much larger area to the east." Westerly summer winds blew dry, overgrazed, and over-plowed soils eastward. President Roosevelt's preferred solution was not "scattered plantings here and there, but ... continuous, practically unbroken forest strips." The proposal combined George Perkins Marsh's theories about forestry and civilization with Fernow and Zon's ideas about climate to argue the nation had an interest in afforesting the Plains.[12]

Not all public discussions focused solely on large-scale effects, and most evinced a confused mixture of large-scale hopes and practical suggestions. A speech written for President Roosevelt in early August 1934 had as its second paragraph the suggestive sentence that "we must learn how to overcome the effects of recurring drouths, locust plagues, dust storms, and the economic hazards that go with single crop farming, if we are to

build for the future." Someone had crossed out the section about single crop farming, but it nevertheless suggests the President's desire to modify climate. Echoing Silcox, Roosevelt admitted that "man, of course, cannot change the climate over a wide region, but he can and does improve his immediate surroundings." He then described how plantings in the Nebraska Sandhills had improved the "physical conditions of living" in the immediate vicinity. When discussing the form the plantings would take, Roosevelt called for a "systematic manner" on large scale because "planting forest strips against the prevailing wind within a wide belt should have a more general beneficial effect over a larger territory than could be attained by scattered windbreaks on small areas." Roosevelt cautioned that shelterbelt planting would not solve all the region's problems and that its immediate benefit would be employment for local farmers. The outlined program and effects were for the most part supported by the experience of both foresters and farmers, but in the already politicized context created by the first public announcements, critics could interpret such statements as resurrecting discredited theories about forests and climate.[13]

In the fall and winter of 1934, Roosevelt's "tree belt" materialized into a project that began to plant trees in spring 1935. Before the Forest Service could begin, however, it had to reclaim its funding. Executive Order 6793 had allocated $15 million in July 1934 to execute the project, but Comptroller General John McCarl had ruled that the plan was not an immediate relief measure, and therefore could not use relief funds to purchase land. More ominously, McCarl believed that the project should receive Congressional approval since it was in essence a new federal agency. During August 1934, Secretary of Agriculture Henry Wallace negotiated a deal with McCarl to spend $1 million in relief funds for the first year. McCarl agreed to the initial allocation with the understanding it served, literally, as seed

money so the Service could establish nurseries and devise a program of action, but this was a temporary measure until Congress passed judgment.[14]

While the Service worked to release the funds Roosevelt had committed, it assembled an infrastructure for directing operations. In August 1934 personnel began arriving in Lincoln, Nebraska, to set up administrative headquarters. Initially Fred Morrell led the effort, with Paul Roberts as Associate Director. In late September Roberts took over as acting Director, and Morrell returned to Washington to work with the Civilian Conservation Corps. The administrative branch directed shelterbelt planting, nursery operations, seed collection, acquisition of land, and other activities. They did not do the actual planting or nursery work, but instead managed seasonal labor crews hired from local relief rolles. Although this was an awkward process that involved considerable paperwork and training, the plan had always been considered both a work relief and tree-planting program.[15]

One task of setting up a new program was the creation of technical guidelines to guide fieldwork and provide a scientific foundation to defend the project from its critics. Silcox gave the technical branch control over developing guidelines and standards, and Zon directed it from the Lake States Forest Experiment Station. This included determining the "zone," or area of operations. While the location of the zone changed several times, it was generally an area one hundred miles wide from the Canadian border to the Texas Panhandle. The research branch also determined the orientation that belts should follow, and this too varied. Finally, Silcox and Zon commenced a study of tree planting on the Plains and developed plans for belt design. During this phase their primary goal was to determine the ideal shape, species selection, and soil types for shelterbelt planting. In late 1935 the Forest

Service published its study and technical standards as *Possibilities of Shelterbelt Planting in the Plains Region.* It would form the scientific and public face of the Shelterbelt.[16]

The program's rapid creation locked the Forest Service into promoting a controversial plan. It had committed its name, scientific reputation, and many personnel with the belief that Roosevelt's support, and a general public outcry for action in attacking the Depression, had created the right psychological moment for big forestry. Unfortunately, the scientific community of professional foresters mostly operated outside either concern. Even foresters who normally supported any Service plan worried about dissipating its efforts on projects only loosely related to forestry. They also still worried that unsupportable claims might undermine their scientific authority, and, by extension, their ability to promote other goals. The project's relation to the Depression and Dust Bowl was also problematic since many Americans questioned whether the Great Plains were naturally suited to agriculture and trees. It was hard to convince many Americans that trees could even be grown in an area wrenched by drought and dust, let alone solve these vexing problems.

The unexpected announcement of a massive new forestry program on the Great Plains shocked many within the community of professional foresters and led to accusations that the old climate-and-forests issue would discredit forestry's status as a science. The opposition leader was Herman Chapman, president of the American Forestry Association. In an article for the November 1934 issue of *Journal of Forestry*, Chapman explained that "foresters have been and still are regarded by many engineers and scientists as falling short of professional status. This attitude has been due largely to many unscientific statements regarding the effects of forests on climate and rainfall." Chapman worried that, just as the profession was

overcoming doubts about its scientific objectivity, along "comes this sudden front page publicity, reviving all the old misguided notions of forests and climate."[17]

Although Chapman offered sound criticisms, Zon believed that Chapman had acted out of political motivations. Chapman and Zon had been feuding over leadership of the Society of American Forests since 1932. Zon saw himself in the Pinchot tradition, representing scientific management and federal regulatory power at a time when industry and private capital lacked strong conservation credentials. The Dust Bowl, the giant Mississippi floods, and denuded tax-delinquent timberlands had cast considerable doubt on the Hooverian ideal of cooperative-based conservation, and the time had come for more active federal involvement. In Zon's mind, Chapman's wrongheaded support for industry miscalculated the changed climate of the country. He was a throwback to failed policies. Zon viewed the Forest Service as the logical lead agency for the science of forestry and that the rest of the profession ought to respect its expertise; Chapman wanted to make the Society into an alternative voice for the profession, and he was willing to undermine Forest Service projects to do so.[18]

This pre-existing antagonism between Zon and Chapman was recast by the announcement of the Shelterbelt Project. In January 1935, Zon circulated a letter among the *Journal of Forestry* members attacking Chapman for using the *Journal* to criticize the Shelterbelt. In Zon's opinion, Chapman was misusing his position and publishing the opinions of foresters with "little knowledge" of Plains forestry or who disliked the Forest Service and were of "doubtful" scientific standing. Zon had not confronted Chapman in November 1934 because he was still a useful ally in the fight to keep the Forest Service

within the United States Department of Agriculture. Thus Zon's desire to maintain a unified voice for the profession impaired his ability to strike back against Chapman.[19]

Ironically, the article to which Zon objected, "Digest of Opinions," presented a less critical view than Zon had suggested. In preparation for the article, Chapman had mailed a form letter to forty-four foresters. Of the thirty-one who replied, over half were from the Plains or immediately to the east and several were experts on Plains forestry. Chapman divided the responses into twenty categories. Although no responses offered "unqualified approval of the project as originally announced by the U. S. Forest Service," most favored the plan with modifications. Chapman also admitted that some foresters were unhappy with the publication of the article, and printed the names and positions of the protesters, along with their telegrams of protest. Perhaps more importantly, of the eighteen individual letters actually printed, eight supported the plan given some technical modification. Among these where long letters offering conditional support from F. E. Cobb, Fred Johnson, and Clayton Watkins.[20]

A letter to Zon from Arthur Pack, a private forester, illustrated the misgivings many had about the plan. Zon had written Pack asking him publicly to support the proposal. Pack instead expressed concern that the project, while presenting opportunities, also entailed significant risks. "To my mind," he wrote, "our own organization has not been sufficiently careful in editing our statements. We don't know. We may guess wishfully. Who has the courage to come forward honestly and admit the uncertainty of our collection of facts? Who has the courage to admit there will be a tremendous wastage of money in such a large-scale experiment?" Zon's effort to present a unified voice of scientific support for the Shelterbelt conflicted with the disparate reality of forestry science's "collection of facts" and voices. Zon

wanted the profession to speak with authority, but well-trained scientists could and did come to widely different opinions.[21]

In response to Zon's request that he help put together a scientific plan, Pack explained that while he was willing to help, he doubted that Zon and others at the Forest Service would be happy to hear what he had to say. "The trouble is," explained Pack, "that what I might finally conclude would be at variance with some of the flag-wavers. Will it really help forestry to have the gift horse's teeth examined? Does anybody want them looked at right now?" Pack feared that helping the Forest Service might force him to abandon his scientific opinions and become a Pollyanna.[22]

As Pack's letter suggested, the calculus surrounding the Shelterbelt was never solely scientific. Letters in the "Digest of Opinion" were not the hatchet job that Zon had claimed. Many of the concerns and suggestions turned out to be valid, but the ideal of peer review suffered in the face of both the political need to present a united opinion and the politically-borne caution of some critics. "For myself," wrote Pack, "I have already half turned conservative. I'm frightened for the ability of forestry to fulfill the promises made in its behalf." Consensus could only be achieved outside the normal avenues of scientific praxis. Zon and his allies within the Forest Service and in Washington were a powerful group. They would have preferred keeping disagreements private, but, when that was no longer possible, they had to settle for using the *Journal of Forestry* as a debating forum.[23]

The November 1934 issue of the *Journal of Forestry* carried an article by Carlos Bates defending the Shelterbelt and its relation to climatic change. He had been heavily involved in Plains forestry early in his career, but during the 1910s and 1920s he had devoted much of his time to erosion, growth rate, and flood control studies. Then in 1927 he

transferred to the Lake States Experiment Station under Zon. Bates still carried a considerable reputation for his work on Plains forestry, but his efforts to clarify the issue resulted in a weak nod to both positions. He began by explaining that the early announcements were misunderstood, and that the Forest Service based their claim of ameliorating climate strictly on the local, or "micro-climatic" effects of windbreaks, but then he described the possibilities for increasing rainfall by preventing run-off and making more water available for evaporation and re-precipitation. Like others before him, Bates' attempt to settle the climate issue left it open to interpretation. Opponents were unsatisfied because he seemed to cling to outdated ideas about the importance of re-precipitation, while supporters argued that enough trees, over enough area, could add enough vapor to the air to indeed increase rainfall.[24]

Bates' article had little impact on the project's critics, so in spring 1935 Zon also addressed the issue. In an article for *Science* magazine he attributed all claims of climatic modification to "popular imagination" and "newspaper publicity" which dramatized the project as "a grandiose plan of changing the climate of the entire plains region, and droughts and dust storms through the planting of trees." While Zon denied ever having promised the plan would increase rainfall, he did not completely abandon the idea of regional climatic modifications. His temporizing insured that climatic effects would again become an issue after the publication of *Possibilities of Shelterbelt Planting* and during Congressional debate.[25]

For all the politicking, the ongoing debate revealed the still unsettled scientific opinion on trees and climate. Both Zon's and Bates' claims represented honest, educated guesses. Bates' arguments that shelterbelts would reduce run-off and evaporation were well

documented. His major error was in assuming that most precipitation came from continental evaporation and re-precipitation rather than ocean-borne currents. Zon, being the more enthusiastic proponent of the idea that afforestation might influence climate, had repeatedly published his ideas on the theory and during the early 1930s became embroiled in a controversy with Russian forester G. N. Vissotsky over who had originated the idea of "forest influences" and the "transmissive role of forests"—two phrases used to signify the effects of tree planting on climate, although forest influences also referred to flood control and other tasks. In a private letter to the editor of the *Journal of Forestry*, Zon admitted borrowing some of Vissotsky's ideas and added that "there is no denying that the idea that forests have an effect upon climate over wide continents, is largely a Russian idea." A trademark of Zon's work on forests and climates was using evidence from European studies, and usually he was "inclined to think that the school of thought which believes in the influences of forests on climate has an edge on the opposing forces."[26]

Although Zon's writings did little to silence his loudest critics, his *Science* article did outline a plan that many professional foresters could support. G. A. Pearson, the Director of the Forest Service's Southwestern Forest and Range Experiment Station, wrote to Zon after reading the *Science* article to complement the changed plans and offer his support. Pearson was cautious and wanted verification from Zon that the article represented "the official announcement of a change in the shelterbelt program." He was sure that "the shelterbelt would have received the support of most of the foresters who have opposed it, and of the larger number within the Forest Service who have disapproved in silence" if it had been presented in the form Zon now advocated. Pearson was not entirely clear about all the changes, but he hoped that "under the new program, as I understand it, you will plant only on

suitable sites and I read between the lines that the plantations will not necessarily be in the form of long narrow strips." Pearson then suggested "it would be impracticable to plant enough shelterbelts to have any appreciable effect on the climate in the plains country." The debate within the profession over the scientific merits of the project had a healthy political effect on the project. Supporters were learning to edit climatic claims from their public announcements, if not their private thoughts, while opponents were learning to overlook early dramatic proposals and look at the latest plans for the project.[27]

In part the debate over climatic change and project standards was the extension of political debate within the forestry profession, but it was also rooted in different visions of what the Plains should or should not be. Many Americans still believed that the Plains were unsuited to tree growth and that the Shelterbelt was not only likely to fail, but a poor solution to agricultural distress. Thus instead of finding clear sailing once the scientific debates eroded, the Forest Service was drawn into a much wider and more troubling debate about the future of the region.

Many critics believed that the Great Plains were naturally suited only for grass and stockraising. Echoing the sentiments of John Wesley Powell and other critics, they often argued that the region required a fundamentally different approach to settlement and that traditional agricultural methods were completely unsuited to the semi-arid climate. Some had also incorporated into their criticisms ecological theories about climax vegetation developed by Frederick Clements. They argued that ecology proved the region was naturally suited to grass. Trees were not a survival type of vegetation and thus doomed to die. Other opponents argued that God had already determined what was natural for the Plains, and it was not trees.

Critics had not misunderstood the region's troubles; they simply believed the best response was to return the landscape to a more natural state.

Much popular sentiment regarding what was a natural, and thus logical, use for the Plains rested on a view more mythical than scientific. The Great Plains were still the land of Indians and buffalo, a grand Wild West only marginally suited for civilization. This was the Plains as Desert—forever outside the pale of civilized humans. Those who believed the region a wild Desert favored a stock raising economy based on grass and cattle. Although the landscape they described was a hybrid of ancient and modern, they believed that "returning" the land to grass and cattle was still more natural. The converse view was an extension of the American East, of the landscape as Garden only waiting for the plow and human will. Booster's theories of rain following the plow had failed, but many Americans still hoped that some scientific approach—such as systematic trees planting—would effect the necessary changes to precipitation and aridity. Despite their plans, the Garden and the Great American Desert still informed public opinions. Those who saw a Garden understood that the Plains was, at best, an uncertain producer, but they hoped new tools, hard work, and daring would reduce uncertainties and guarantee agriculture a permanent place in the Heartland.

The Shelterbelt Project became entangled in the Garden verses Desert debate as the first trees were going into the ground in spring 1935. Opponents condemned the plan for challenging the desert. One writer commented that Roosevelt had flouted "the traditionally impossible of nature and economics! ... the sort of planting the cattle country needs to preserve its usefulness and keep its soil from blowing away is that of grass ... What this region pre-eminently demands is restoration of its natural cover—grass—and of its appropriate use—grazing instead of tillage." The land was "good cattle country, for nutritious

grasses grow there admirably," but poor farming country. An article published in *Nature Magazine* reached a similar conclusion. According to its author, "Nature herself" would decide where trees will or will not grow. "Regardless of all this, how often we find ourselves arguing with Nature over the matter, even going so far as to work contrary to her wishes and purposes." By working "contrary to the established rules of Nature" the Shelterbelt Project was destined to suffer defeat. Clementsian ecology had combined with resurgent Desert myths to condemn tree-planting as unnatural. Opponents in effect rejected the entire ethos of wholesale manipulation of the landscape. The obvious solution was to return the Plains to a more natural order—a desert-like landscape whose climax state was grass—yet project opponents seemed unaware that their own preferred uses—grassland and cattle—were no more or less natural than trees and farms.[28]

The same mythic reasoning sometimes shaped supporters of the project. Some claimed that the Desert myth was born from a lack of first-hand knowledge of Plains conditions and forestry, yet this claim also faltered as criticism arrived from foresters with direct Plains forestry experience. In a 1934 letter to the editor of the *New York Times*, C. E. Brinkman explained his long familiarity with Plains conditions while living there in the "middle Eighties." He argued that "the full absurdity of the plan to plant arbitrarily where Nature failed can be understood only by a man who has actually broken the tough sod which was the natural protection of the soil and water under that soil." William Hall, Chief of the Section of Tree Planting for the Forest Service during the 1910s, explained that "the area is upland where nature with great fixity of purpose has determined upon grasses as permanent cover. To shift to trees as permanent crop means a fight with nature every step of the way." Royal Kellogg, another forester with practical experience on the Plains, but who by the 1930s

was living in New York State, argued that "the end form of vegetation for the plains area in the present geological epoch is grass sod." Kellogg maintained that it was foolhardy to go against nature's plan. "Nature clothed the plains with buffalo grass and other hardy species, just as she covered the northeastern states with pine and spruce and hardwoods. We might conceivably cover the High Plains with trees and we might carpet the state of Maine with buffalo grass—but if we are sensible we shall try to do neither."[29]

For all the emphasis on natural order, however, critics also had to answer a much more tangled political question. In defining the Great Plains as primarily grassland unsuited to trees and conventional agriculture, critics had to explain what to do with the people already living there. Ellsworth Huntington, a Yale University geographer, historicized the agricultural and ecological breakdown as just the latest in a long series of crises all caused because Americans had not recognized the true nature of the land and its unsuitability for permanent crop-production. Instead of altering the fundamental base of their economy, Plains residents repeatedly called on Washington for help. "With the normal perversity of human beings the farmers blamed the government at Washington for troubles due to nature." To Huntington, the Shelterbelt Project was an attempt to save "sub-marginal" land, ground not even marginally suited for cultivation. The *New York Times* built on this theme in an editorial that characterized Plains farmers as stubbornly dim. They had "emphatically declined to fall in with Washington's belated discovery that those regions never should have been brought under the plow, being primarily adapted for grazing." Plains farmers were "peasants on the slopes of a volcano" who lacked the sense to flee. Framed this way, people who actually lived and worked on the Great Plains were the least informed actors in the debate.[30]

Arguments that the Shelterbelt Project contravened nature, that the area would be better off returned to grassland, created a problematic narrative. Critics that embraced the Desert myth had constrained both their position and that of supporters. To embrace the Desert myth was to declare it no longer myth but history, and to accept its narrative as an explanation of events, conditions, and outcomes. The Desert myth cast residents as at best ignorant. The only solution was to return to a cowboy-and-cattle past. The myth also positioned Easterners as "outsiders" locked in inevitable conflict with residents. Outsiders were objective observers who dispassionately perceived the Plains' true nature. They were simply presenting unpalatable truths to childlike, recalcitrant residents. Residents would by definition regard outsiders as critics and unnecessary meddlers. Likewise, the Desert narrative simplified nature and transformed it into a staged backdrop. Nature was not the cause of the current crisis because it had always really been a desert. The real problem was rather that humans had ignored reality. Market agriculture's simplification of human and natural influences reduced the ability of either to solve the crisis. The more critics leaned on the Desert myth, however, the more inevitable seemed the return of its opposite, the Garden myth.

To counter critics and place the Shelterbelt Project on firm scientific footing, the Forest Service published *Possibilities of Shelterbelt Planting* in 1935. The technical branch of the project, led by Zon, assembled the book not so much as a guide for fieldwork as a reference for the science of Plains forestry. It was also quite clearly a refutation of the Desert narrative. Both were important because Roosevelt's plans to bypass Congress with relief funds had failed to materialize. By late-summer 1934 it was clear the project would have to

go through Congress. Thus Zon and his fellow authors issued *Possibilities* to answer critics and provide a tool for future struggles over funding and recognition.

In the book, Assistant Secretary of Agriculture M. L. Wilson offered the most direct refutation of the Desert myth. Wilson offered an economic and social history of agriculture on the Plains that seemed to discredit completely the idea of a "Great American Desert." Settlers and pioneers had overcome "eastern suspicion of the prairie country" to create the nation's "greatest wheat-producing section." The Garden narrative could never contain the Desert except as fallacy. To do otherwise would have undermined its own claims. Inverting the logic of the Desert narrative, residents were pioneers and settlers who knew their land best. They were hardly the "peasants on the slopes of a volcano" that critics suggested. Residents had built unique rural communities before the drought and depression, and they had been "well satisfied with the farm as home and as a mode of living." Ecological reality prevented Wilson from adhering to script, however. The region's climatic variability was too much in evidence, too much at odds with facile stories of a Garden. Recognizing the need to explain the current crisis, Wilson argued that the lack of rain was only a temporary burden. He claimed that the "farmer, over a period of years, can expect a few bumper crops, several fair-to-good crops, a number of crops that pay little more than the cost of harvest, and some seasons in which crops do not grow at all." It was the last instance that caused wind erosion and erased the profits of good years. An unstable nature was the primary culprit, and the government's role was to stabilize nature. In the new Garden narrative, the state would deploy science to ensure nature as provider.[31]

Most of the rest of *Possibilities of Shelterbelt Planting* was written to answer the project's scientific critics, but doing so also helped refute the Desert myth. Zon took the lead

in summarizing the project's technical aspects. He explained that the western limit of the planting zone was "generally within the precipitation boundary marked by 16 inches of precipitation annually in the north and 22 inches, to allow for greater evaporation, in the south." Within this zone, belts would run not in continuous north to south strips but along an east-west axis on favorable soils. All these changes were suggested by early criticism within the profession, but rather than admit that critics had made inroads, Zon claimed that early newspaper accounts had exaggerated the plan and that the Forest Service never intended to create rigid belts. This was pure politics. Zon, Silcox, and Munns had created the early plans and sent them to the press, and in later testimony Zon would lament the project's loss of its original rigid pattern.[32]

Zon once again tried to clarify the meaning of climate modification, and once again he offered mixed messages. He carefully qualified earlier statements about the effects of trees on climate by explaining that shelterbelts were only intended to have local climatic effect, but then he noted that "European data, based not on occasional windbreaks but on a succession of them at regular intervals, indicate that cumulative protection can be obtained if the belts are established at every one-third mile." The results of such a cumulative change would be an overall climatic modification that would protect areas to the east. The same study referred to Danish afforestation experiments in the Heath Districts of Jutland that showed an increase in rainfall due to forest plantings. Local effects had once again become a vessel for potentially larger regional changes. Zon's disclaimers about the relation of forests to climate were more likely a recognition that the majority of foresters did not share his opinion than evidence of a personal change of mind. As late as August 1936, Forest Service

documents called farm forestry "one of the principal permanent remedial measures to ameliorate the effects of recurring droughts."[33]

Another section of the report addressed afforestation data from countries such as Canada, Denmark, Hungary, and Russia. Of the four, the Russian information was most abundant and the writers believed conditions there were closest to the United States. Russian silviculturalists had successfully planted shelterbelts on the steppes since the early nineteenth century, and the government had promoted shelterbelt planting since the 1890s. The survival of many early plantings stood "as a monument to the practical ideal of bringing forests benefits to a treeless region." The report suggested that extensive plantings might have increased the rainfall of the Kamennaya Steppe by nearly 15 percent. As further, if problematic, evidence of success, in 1932 the Soviet Union launched a new shelterbelt program calling for planting 865,000 acres (compared to the 1,282,000 proposed for the Shelterbelt Project). The report did not claim the studies were conclusive proof that afforestation could modify climate, but given Zon's history of relying on such work, the section was yet another red flag for critics.[34]

The issue of climatic changes was important to Zon, but because opposition had always been broadly based, *Possibilities of Shelterbelt Planting* presented an extensive historical case for tree growth. The argument consisted of a survey of past plantings, a review of earlier tree planting programs, an overview of studies done in other countries, and a refutation of the Great American Desert. Predictably, the Service found that trees did indeed grow on the Plains, and that while past plantings showed the strain of severe drought and indifferent care, they nevertheless survived. A quick survey conducted in fall 1934 estimated

that "some 230,000 acres appear to have been more or less successfully planted in the shelterbelt zone in the past 50 years."[35]

A section on previous tree-planting efforts by John Hatton showed that the region had never been a forest, but that at one time it had contained many more trees than at present. Native Americans had used fire to reduce underbrush and to encourage fresh grass, but in the process they also destroyed native timber and prevented its spread. European Americans greatly increased the use of native timber, and by the late 1860s they had completely destroyed certain areas. More optimistically, the reports noted that "where destructive factors were eliminated, native timber reclaimed sections where it had been destroyed and, according to some opinion, even extended into other districts where it had not grown for centuries." This section of the report focused on anthropomorphic causes of timber destruction, creating the impression that humans largely controlled the landscape. This supported the Forest Service's case, and the authors hoped that it would convince skeptics who believed trees would not grow on the Plains. It did little, however, for those who questioned whether humans should meddle with nature.[36]

Hatton also reviewed various federal and state programs that had promoted tree cultivation, and once again he stressed human failure over natural difficulties. For example, although the Timber Culture Act was not "generally successful, it did have the effect of further directing popular thought to tree culture." Hatton noted the establishment of the Nebraska and Kansas National Forests as other examples that trees could be grown. As for the failure of the Kansas Forest, he cryptically explained that it was discontinued "for a number of reasons." He also assured readers that the Office of Dry Land Agriculture plantings would "make the largest single contribution to the shelterbelt project because of the

authentic records that have been kept on the behavior and success of different species." This proved misleading since some foresters would later feel the project had not sufficiently consulted the Office of Dry Land Agriculture. Hatton concluded the section on federal planting efforts with what had become a clichéd explanation that farmers wanted to grow trees but lacked proper cultivation knowledge and the right species.[37]

Despite the contribution of *Possibilities* to the field of Plains forestry, opinions remained divided over the true nature of the Great Plains. Beliefs about nature were not purely subjective judgments; science itself was fragmented and contradictory. In the face of such incomplete evidence people could passionately disagree. The Forest Service made a scientific case that trees were natural to at least part of the Great Plains, even as critics made an equally scientific claim that trees were unnatural. Ironically, while both sides viewed nature as separated from human intervention, and accorded direction and purpose to nature, they also supported particular human interactions with nature. Project critics believed the proper, undisturbed nature was grassland, yet in reality they wanted to replace one hybrid landscape with another, exchanging farmers for cattle ranchers. The Forest Service argued that without human intervention the Plains would have had more trees, and that their proposals would complement natural re-growth. All along, however, they knew they were advocating planting in many areas that had not seen trees for millennia. The convoluted logic of both sides reflected a desire to use nature as a normative tool to support deductive arguments. By removing humans from nature, each side could claim a direction to the natural system based on their preferred scientific observations. Science, in this case, was as much a matter of rhetoric and power as hypotheses and findings.

While *Possibilities of Shelterbelt Planting* may not have succeeded in establishing the true nature of the Great Plains, it was well received by foresters and conservation professionals. The publication met "with a wide demand from agricultural workers, foresters, and other land-use technicians, and the small edition was soon exhausted." For the personnel who worked on the project, "the bulletin has remained in effect the 'Bible,'" although actual operating procedures varied. Most foresters seemed to find the book altogether "a very fine piece of work." Even critics found it a "competent technical document" that corrected many errors in the earlier plan. Paul Sears, another graduate of Bessey and Clement's botany program at Lincoln, who was highly critical of the Shelterbelt, declared the publication "a remarkable example of applied ecology."[38]

The contradictory opinions—by foresters that they had solved the essential problems and by critics that the Forest Service was not addressing the larger issue—left fertile ground for future misunderstandings and conflict. Zon was correct when he wrote a friend and fellow Shelterbelt supporter that the center of gravity in the debate had changed and "most of our opponents (and that includes not only scientists but many lumbermen) grant now that trees can be grown within the belt selected." The new objection was "whether it was a worthwhile use of public funds." This was a question that the early plans had not clearly addressed, especially if claims of climatic change were omitted. Although Zon argued that the residents would ultimately have to make that decision, he did offer an opinion:

> Are you willing to give up an investment of close to two billion dollars in farm lands and improvements, aside from several hundred million in cattle, and move, some million and a quarter strong, into regions soon to be opened by irrigation? ... This region was and probably will continue to be the granary of the United States. We glibly talk about the Federal government providing long term credit to the lumber men, running into tens of millions of dollars to pay the tax on their timber land. We do not hesitate to provide CCC labor to

> improve private forest land and yet there are some who protest the expenditures of a few million dollars for the farmers in the plains region.

Proving that trees could grow on the Plains was only a first step. Zon and the Forest Service still had to show why trees should be grown, and why the federal government should foot the bill.[39]

Drawing funds from Congress for the Shelterbelt Project proved problematic. Most members objected to the expenditure of public funds to improve private lands. Many argued that if farmers were the ultimate beneficiaries, then they should plant the trees. To modern readers, the deficit spending of the 1930s seems mild, but at the time it concerned many in Congress and they made every effort to curtail spending. Some conservative leaders objected simply because they saw it as Roosevelt's pet project. Others noted that the program seemed to have done fine with relief funds and saw little reason to give it permanent status. Many members also adhered to the mythical visions of the Plains as desert or garden, which in turn shaped their responses to the project's practicality.

The Shelterbelt Project began operations in 1934 with $ 1 million in relief funds. In 1935 it again operated on relief funds since its field operations had only just begun, and *Possibilities of Shelterbelt Planting* was not ready by the July 1 deadline for regular appropriations. The 1935 allocation of $1,990,958 appeared generous compared to the 1934 allocation, but for a project that once envisioned spending $75 million in ten years this was small indeed.

Using relief funding was also less than ideal because of restrictions placed on expenditure. While the exact guidelines became stricter over time, the Works Progress Administration (WPA), which administered relief funds, was first and foremost an

employment measure. Its interest in creating new employment opportunities meant that 90 percent of WPA funds went for relief worker's wages. This left 10 percent for the salaries of permanent employees, the purchase of material, and any other miscellaneous expenses. A further restriction placed on relief funds—that they be divided between states to meet varied planting needs, and the strict guidelines governing the ratio of supervisory to labor personnel made it difficult to achieve the level of control the Forest Service would have liked given the untested nature of planting. If the Shelterbelt was to proceed on the scale, and with the control that Roosevelt and the Forest Service desired, becoming part of the regular Agricultural Department budget was a necessity.[40]

In January 1936, the Forest Service presented its case to the House Subcommittee on Agriculture of the Committee on Appropriations. Under the heading "Forest Influences" the Forest Service justified the project as providing immediate relief to drought stricken farmers and the unemployed. It would also "improve the physical conditions of living, aid in stabilizing rural population, conserve soil moisture, develop needed recreation areas, establish a protective cover for upland game and other wildlife, and make an area of over 70,000,000 acres, a better place to live."[41]

By 1936 the scientific community largely rejected any claim that tree planting could modify climate, but the political pressure to show a general public benefit from shelterbelt planting kept climatic issues in debate. Chief Forester Silcox found himself caught by this dilemma when he testified before the Committee. On the one hand, Silcox explained that the project did not intend to alter the climate of the region. He blamed "newspaper reporters and others" who jumped on the idea the project intended to change the weather. On the other hand, Silcox had to respond to congressional critics such as Georgia's Malcolm Tarver who

demanded to know "whether there is any general improvement by reason of the planting of this shelterbelt, or whether the benefits will be confined chiefly to the area in which they are being planted?" Silcox responded vaguely that "there has been consistent legislation recognizing the public benefits of planting some of that area," and that one such legislation, the Kinkaid Act, had resulted in "a change of temperature, wind velocities, and moisture."[42]

Well aware of the controversial nature of climatic claims, the Forest Service tried to deflect criticism during congressional testimony by subtly modifying the form of such claims. For example, foresters denied that the project would increase rainfall, yet they also argued shelterbelt effects would extend well beyond the immediate vicinity. Zon explained to congress that "the shelterbelt project, as an ameliorative measure, if it is to be of national benefit, should, in my opinion, follow the original plan and objective." This meant planting in continuous parallel strips, "systematically carried out through the entire length of the plains States." Zon told the congressmen that "if you plant only one shelterbelt, it will not, modify the conditions very much except a short distance from the shelterbelt, but if you plant them at certain intervals, then there is a great accumulative effect, and that effect will be of a regional character." The effect would not be limited simply to the area between belts, but "the aggregate effect of these 100 strips will extend beyond the 100-mile width of the belt." The program would be of "a national significance, climatically and biologically." In Zon's opinion, such widespread effects satisfied the congressional demand for public benefit.[43]

Besides the issue of public versus private good, the Committee also had reservations about the plan's financial and economic advisability. Several members questioned the logic of spending more per acre planting trees than the ground was worth. Even if the trees made the neighboring land more valuable by increasing its production, they felt that "we are adding

to the problems of the American farmer in disposing of his already top-heavy surplus of farm products." The Forest Service had no effective way of answering either criticism except to note that one day the land might be worth more and the crop surplus disappear.[44]

In the face of open congressional hostility, the best hope was a rapid revision of the plan to make it more palatable. A week after its initial hearing the Forest Service returned with a new cooperative plan that would operate under the structure of the Clarke-McNary Act. The Service hoped that the cooperative nature of the Clarke-McNary Act, combined with the fact that it was already popular in many states, would reduce criticism of the Shelterbelt and allow the Service to receive legislative recognition. The Forest Service dutifully presented the revised plan, but the Committee was no more impressed with the new version than the original. Assistant Chief Forester C. M. Granger promised that under the cooperative plan the Forest Service would "require, just as fast as we could, at least 50 percent cooperation by the states and all landowners." This unspecific ideal of moving towards a fifty-fifty participation between the federal government and the states and farmers was not what the Committee had in mind. They wanted specific and substantial contributions by farmers in carrying out and paying for site preparation, fencing, and cultivation. One Committee member complained that "there is no greater degree of cooperation under this plan ... than has been required before." There was still the chance that an amendment could be added to the Agricultural Bill on the floor of the House, or the plan could get re-approved in the Senate, but loosing the support of the Agricultural Committee would be a major blow.[45]

The Forest Service believed that acquiescing completely to the Committee's view of making the Shelterbelt simply another public tree distribution program would be worse than

failure. Withdrawing key elements of federal control from the Shelterbelt would endanger the whole undertaking and potentially discredit the idea of federal Plains forestry. In a long and impassioned memo, D. S. Olson lamented the budget restrictions the project labored under and warned against relaxing federal control. He pointed out that:

> when the common question arose as to why the Government should undertake this project rather than the individual, and why success could be expected in this undertaking as a federal project, when individual efforts had failed, we replied that ... the Government would protect the planted areas from livestock by fencing ... would prepare the ground sufficiently in advance to conserve adequate moisture ... would carefully select seed of a suitable sources ... [and] would control such enemies as rodents. All of these important points seem to be wiped out by the restriction set up in our present authorization, and with them goes any assurance of success.

The Forest Service was not just maintaining federal control to increase its importance. Foresters believed that Service control was essential to success.[46]

It was no surprise then that the Forest Service was not pleased with the Agricultural Bill the committee reported. It contained no funds for the project, and contained only a paltry $99,152 for "forest investigations." The committee also inserted an amendment to the Agricultural Department Appropriations Bill specifically prohibiting the use of any part of it to continue or establish a shelterbelt program. Not only had the committee failed to support the project, they were squarely opposed to any continuation. With the program rejected by the committee, the Forest Service's next hope for funding was by amendment to the Agricultural Department Bill when it came up for debate on the floor of the House.[47]

Relying on amendments from the floor of the House to revitalize the Shelterbelt was a risky proposition. In committee hearings the Forest Service had been able to provide expert advice that eliminated most challenges of the project's scientific credentials, and confined debate to issues of economics and bureaucratic politics, but on the floor the plan was open to

attack from every direction, and its only defenders would be the Service's congressional allies. On the floor, members could without restraint claim that trees would not grow on the Plains, or do any real good if they did, without any fear of being contradicted by Forest Service experts. Similarly, members could freely lament that the "tree giveaway" did not include their own districts. Without Forest Service experts there to explain the reasons for confining the plan to a zone, the project was open to traditional pork barrel politics.

Representatives were particularly swayed by the view of the Plains as a desert and that planting trees would go against "nature." Just as the Forest Service had feared, the early negative publicity surrounding the project had colored public opinion, and led members to embrace the Desert Myth. Louis Ludlow of Indiana ridiculed the Forest Service for thinking "they could construct a luxuriant forest belt across a part of the country where the Almighty will hardly permit a cactus to grow." He went on to explain that even were they allowed to spend huge sums of money and managed to do "what the Almighty has not done ... it would not have affected climate or temperature, and the only benefit would have been to local people in the belt zone who would have profited by the Government's largess." Earl C. Michner of Michigan ridiculed the science of the project as "blueprints, formulas and theories" by those without any practical experience. The Forest Service simply did not understand "that trees will not grow in a desert country."[48]

Jed Johnson and William Lambertson combined desert mythology with pork barrel politics to condemn the project for not running through their districts. Johnson, whose district sat just to the east of the planned Shelterbelt zone, argued against spending money "that might be wasted in the future in an unsuccessful effort to grow trees in an arid region and in many instances many miles from water." Lambertson, who like Johnson found his district in

Eastern Kansas excluded by early plans, was "convinced from the first ... that the project would fail, because I have seen too much of these trees trying to grow under existing circumstances." The claims for the project were so "fantastic" that they "brought ridicule on the idea of planting trees."[49]

Possibilities of Shelterbelt Planting, the document that the Forest Service hoped would overcome such objections met with almost as much ridicule on the House floor as did the project. Ludlow condemned it as an extravagant waste of paper. He charged that "even a pamphlet that was issued to advertise it was prepared in such an expensive way and with such artistic embellishment that it cost the taxpayers of this country $4,011.64." Rather than see the book as presenting a scientific viewpoint, Ludlow considered it simply another example of extravagance typical of the whole scheme. According to forester Edward Munns, Republicans raised a "hullaboo" over the publication, calling it a "political document and the project a Demo affair" because it had a picture of President Roosevelt along with other important personalities in Plains forestry. Its partisan attributions were overstated, however, because Democrats had been just as ready as Republicans to oppose it. Rather, *Possibilities* stripped of its physical supporters in the form of Forest Service experts, transmuted from scientific plan to political document.[50]

The defeat in the House illustrated the need on the part of the Forest Service to create a public voice in favor of the project before the Senate took up the bill. Zon blamed the Administrative Branch for not having organized greater public support before the House hearings. Now he promised to take more aggressive action himself to insure approval by the Senate. This consisted of getting "regional interest in this item to manifest itself in full measure to the respective Senators." These "regional interests" were the forest experiment

stations, state planning boards, and anyone else with an intellectual or fiscal interest in the project. For his part, Silcox had "secured the definite interest of the President" and promised to go "to the mat in the Senate with a competent presentation of the Shelterbelt, bringing in the scientific basis and the social values of the project."[51]

To maintain an aura of scientific objectivity, however, Zon and his staff sought to mask their hand in generating political support. They instructed backers to keep "yourself and staff out of the picture." Zon proved a master of double-speak. When writing to Senator Gerald Nye of North Dakota to sound out his opinion, Zon indicated that "when it comes to dealing with Congress, I, as a scientific worker, must necessarily remain 'deaf, dumb, and blind.' If the people in the region are vitally interested in this Government activity, they will have to look to their Senators and not to us for any help." This tactic seemed to work. Nye was impressed enough by the program, and what it might bring to North Dakota, that he promised to lend his support.[52]

Zon's and Silcox's efforts resulted in an impressive showing before the Senate Committee on Agriculture Hearing. Secretary of Agriculture Henry Wallace made a personal appeal, and the Forest Service brought large pictures showing windbreaks already growing in the proposed area. Various "regional interests" also did their part. Letters of support came in from James Anthony, State Forester of North Dakota, Raymond McLees, President of the School of Forestry, W. R. Ronald, Chairman of the South Dakota State Planning Board, and a host of other figures.[53]

Having learned from his experience with the House, Silcox began by showing senators that trees would grow on the Plains. He hoped that his efforts would prevent the attitude of the House that "God did not make trees grow in that plains country, and they

could not grow." Presenting the senators with photographs of twenty-year-old shelterbelts on a Nebraska farm made it clear that trees did grow. While the senators were dutifully impressed, Silcox had not explained the more crucial question of why trees should be grown. Fortunately, the senators provided their own reasons.[54]

It turned out that Silcox was preaching to the converted. Senator Charles McNary of Oregon called himself "a dreamer when it comes to planting trees, and I love the forests." Charles Copeland of New York, the Committee chair, was a long-time Forest Service supporter, and Senators Nye of North Dakota and Peter Norbeck of South Dakota were strong supporters of a project that promised to pump federal dollars into their states. The Senate was in general more supportive of spending measures. Often because they knew the House would do the unpopular job of curtailing spending while they could make constituents happy by supporting pet programs. True to form the Senate Committee restored the $1,000,000 for the Shelterbelt Project and recommended the deletion of the House amendment that prohibited the use of Agricultural Appropriation Bill funds.[55]

The restored project moved through the Senate without significant opposition, which brought the issue to a joint conference committee. The House had no intention of allowing the project to go ahead, and succeeded in again killing funding. As a measure of compromise, however, House conferees did agree to add an amendment originally proposed by Representative Philip Ferguson of Oklahoma providing $170,000 to distribute the trees already growing in project nurseries. The conferees also agreed to remove the restriction on using Agricultural Department Appropriations funds. With no source of funding it appeared termination was imminent.

Fear of termination threw the administrative branch into disarray. Zon explained to Assistant Chief Forester Earle Clapp that two of the "strongest men" in Paul Roberts' organization, Alva Simpson and David Olsen, had already left or would shortly. Both Simpson and Olsen were senior foresters working in Lincoln. Zon believed their loss would mean "the death of the Shelterbelt Project, not in a physical but a spiritual sense." Zon blamed Roberts for giving up too early when Roosevelt had made clear in a recent press conference that he was going to find a way to continue the project despite the disapproval of Congress. Zon informed Clapp, "the fact is that the Shelterbelt organization is 'all washed up' with Roberts."[56]

Zon was correct in his assessment the project would continue. Roosevelt released $1,605,521 in WPA funds under the justification that it was part of the "long-range drought relief program." While WPA funds came with some restrictions, the Forest Service found these "quite liberal" during early years and had "little difficulty living up to them." The Service also renamed the project the Prairie States Forestry Project to "increase emphasis on the Project's relationship to the WPA, and suggest a change in program." The change also helped distance the project from the controversial linkage of shelterbelts to climatic change.[57]

In order to shore up failing morale and make clear the reasons for the name change, Acting Chief Forester L. F. Kneipp circulated a memorandum spelling out Forest Service plans for the Shelterbelt in August 1936. He reassured the branch stations that "our purpose is to try to salvage and hence to continue the Shelterbelt plan." The name change was simply to increase the likelihood of obtaining Congressional support. He also made it clear that the Service intended to use the $170, 000 in regular funds of Ferguson's termination amendment to continue the day-to-day operations and not as intended to end the project. Although he was

optimistic Congress would at some later date fund the plan, he assured the stations that WPA funds would be forthcoming to continue the work. There was also the possibility in the near future of having the Agricultural Adjustment Agency provide funds to the Service as part of its land management plans.[58]

While the project continued to rely on WPA funds, its most important supporter, President Roosevelt was unsatisfied with the state of affairs. In particular he was troubled that his "wall" of shelterbelts was little in evidence across the Plains. Roosevelt had visited shelterbelt plantings during his 1936 reelection campaign and left dismayed that most appeared more ornamental than soil conserving. Also he argued that the total acreage planted so far was "negligible from the point of view of soil conservation and water retention." He urged Secretary of Agriculture Wallace to submit a new study "from a large acreage point of view."[59]

With the continued support of President Roosevelt, the Forest Service turned again to Congress. This time they promoted the Norris-Doxey Cooperative Forestry Act. Senator George Norris of Nebraska and representative Walt Doxey of Mississippi proposed a national program of farm forestry. Under it the Forest Service would cooperate with farmers in every state and territory to "bring about a more scientific and effective control" of farm woodlands. This included reforestation, management of existing farm woodlands, and conducting research. The wording of the act avoided mention of the Shelterbelt Project, but the Service drew the act broadly enough to cover any afforestation work on the Great Plains. As passed, it called for spending $2,500,000 a year spread between all the states but with the lion's share earmarked for the Plains. However, success eluded the project when the House Deficiencies

Committee refused to fund Norris-Doxey under the suspicion they were being tricked into supporting the old Shelterbelt.[60]

The Forest Service renewed its struggle with Congress in 1938, but success proved as elusive as before and for similar reasons. In 1938 they placed their request in the regular Department of Agriculture Appropriation Bill, and requested $1,000,000 for the Prairie States Forestry Project. The House Appropriations Committee reacted with irritation to what they believed was a complete subversion of the spirit of the Cooperative Farm Forestry Act. The original act had a national farm forestry program as its nominal goal, but the request before the committee made a mockery of this intent by allocating the vast majority of funds to the six Plains states of the Shelterbelt. Even the project's stalwart supporter, Senator Norris, felt that the proposal directed far too much of the appropriation towards the Plains. It also upset several committee members that the Forest Service was forcing through a proposal Congress had already, repeatedly, declined to fund.[61]

Only on the surface did the Forest Service's intransigence seem surprising. Olsen had earlier warned that spreading Forest Service efforts too thin, and placing too much dependence on farmers, would imperil the whole project. The Service also had to consider President Roosevelt's original intentions and continued interest. The President had made it clear on several occasions that he expected the Shelterbelt to be an intensive program that would make a bold statement and significantly impact the entire Plains region. The proposals put before Congress had never been intended to replace WPA funding but merely to supplement it and add greater flexibility. Failure to secure congressional funding was a hindrance, but after 1935 the President had made certain the project would not lapse for lack of funding. The Service's logic seemed to be borne out as the WPA continued to fund the

program until 1942, when it for the first time received a regular appropriation from Congress for $218,000.[62]

Relying of WPA funding had drawbacks, however. The guidelines governing use became stricter over the years, and the amount of funds eligible for supervisory personnel declined. This encouraged the employment of as much relief labor as possible, regardless of its relevance to the project, so that critical supervisory personnel could continue in employment. After 1940 the WPA no longer recognized Civil Service status and stripped project field personnel of their titles and salary schedules. Originally, money had shuffled between the six states where planting took place, allowing some leeway in meeting personnel and material needs. This too changed in 1942 when WPA guidelines locked up funds within each state. Despite these restrictions the project continued and actually increased the number of plantings each year until World War II mobilization began to drain labor. The Forest Service's plan was mostly a success, even if the project continued in a greatly scaled back imitation of its 1936 form.[63]

The Shelterbelt Project, planned as a dramatic solution to dust and depression, became embroiled in controversy that it seemed unable to shake. Encouraged by President Roosevelt, Zon and Silcox had formed a plan to grid the Plains with a Great Wall of Trees, and perhaps modify the climate. The wildest features of the earliest plans quickly faded when exposed to the light of scientific debate, but the project never recovered from its initial misstep. Trumpeted as a plan to stop a desert, the public took it at face value and argued its practicality. Congress had many reasons for opposing the plan, but none more compelling than its lack of widespread public support and scientific uncertainty.

For their part, foresters tried to blame the initial missteps on newspaper publicity and public ignorance, but their own actions had assured both. Some wanted the Shelterbelt to be a dramatic solution, and they seized the opportunity to make forestry central to national recovery. When other foresters and the public questioned elements of their plan, they tried to play politics and enforce scientific comity instead of swiftly modifying their proposals. When the project went before Congress, the Forest Service decided it would rather be assured of WPA funding and presidential support rather than risk spreading itself too thin and risking failure. When foresters began planning for the project they hoped that they had left behind politics for the calmer atmosphere of scientific planning, however, they quickly found that their technical decisions were also contested, and that even the seemingly most mundane silvicultural choices harbored multiple goals.

Chapter Four—Notes

[1] "Tree Belt in West to Fight Droughts," *New York Times*, 22 July 1934, p. 1; Earnest Lindley, "Roosevelt Puts Tree Belt Plan in Operation," *New York Herald-Tribune*, 22 July 1934, p. 1.

[2] A very legitimate criticism may be made that the Shelterbelt had little to do with the Dust Bowl since most planting was to the east of the worst hit counties, see Chapter 6. At least initially, however, this did not figure prominently in debate.

[3] USDA, Weather Bureau, *Report of the Chief of the Weather Bureau, 1934-35* (Washington: GPO, 1936), 5; USDA, Weather Bureau, *U. S. Meteorological Yearbook 1936* (Washington: GPO, 1938), 7. Use of the term "normal" is problematic when referring to climate on the Great Plains given the frequent fluctuations. The term is used here more to indicate perceptions at the time than to make any claim about what constitutes normal rainfall.

[4] "Can the Forests Help in the Agricultural Situation?" *1338th Meeting of Service Committee*, 29 January 1931, National Archives II, College Park, Maryland (RG 95) (hereafter National Archives).

[5] President George D. Pratt to Raphael Zon, 10 April 1930, *Raphael Zon Papers*, Minnesota State Historical Society, St. Paul (hereafter *Zon Papers*); E. H. C. to Zon, 7 April 1931, *Zon Papers*; Zon to E. H. Clapp, 8 February 1932, *Zon Papers*; E. H. C. to Zon, 29 February 1932, *Zon Papers*.

[6] Edward N. Munns to Paul H. Roberts, 21 February 1966, *Paul H. Roberts Papers*, Nebraska State Historical Society, Lincoln (hereafter *Roberts Papers*); The first extant plans are described in Edgar B. Nixon ed., *Franklin D. Roosevelt and Conservation* (New York: Franklin D. Roosevelt Library, 1957), 199-00. A search of the Roosevelt Library at Hyde Park, New York and the National Archives II, College Park, Maryland reveled little additional information.

[7] Nixon, *Franklin*, 198-99, 205; The earliest map is found at the Franklin D. Roosevelt Library in Hyde Park; Carlos G. Bates, "Technical Considerations Which Should Govern the Shelterbelt Project," quoted in Paul H. Roberts, "The Prairie States Forestry Project," 8, unpublished typescript in *Roberts Papers*.

[8] Earle H. Clapp to Paul H. Roberts, 1 February 1964, *Roberts Papers*; Roosevelt to Robert Y. Stuart, 19 August 1933, in Nixon, *Franklin*, 198; Roosevelt's continued vision for the plan was seen in Claude R. Wickard to Roosevelt, 4 November 1940, in Nixon, *Franklin*, 481-83.

[9] "Forest Planting Possibilities in the Plains Region," 15 August 1933, in Nixon, *Franklin*, 200-203. Nixon and Wilmon Droze, *Trees, Prairies, and People: A History of Tree Planting in the Plains States* (Denton, Texas: Texas Women's University, 1977), both attributed the plan to Zon. Another possible conclusion is that Zon, Munns, or perhaps even several other foresters jointly wrote the report. In either case, Zon's influence on the issue of climate seems apparent.

[10] Prairie States Forestry Project, National Agroforestry Center, Lincoln (hereafter National Agroforestry Center). Picture carries the subtitle "Bird's-Eye View of Forest Strips. Strips are about 100 feet wide, running north and south, one mile apart."

[11] "Tree Belt," *New York Times*.

[12] F. A. Silcox, "To Insure Against Drought, A Vast Plan Takes Shape," *New York Times*, 29 July 1934, sec. 8, p. 3.

[13] "Shelterbelt Project," typescript speech prepared for the use of the President in his speech at Devils Lake, North Dakota, 7 August 1934, National Archives (RG 95). No author is given for the speech and it is unclear who penned in the changes.

[14] "McCarl Halts Roosevelt Shelter Belt Money Grants Only One Million of the 15 Allotted," *Forestry News Digest* (November 1934): 1; "Roosevelt Forest Belt Plan Halted as McCarl Bars Drought Fund Use," *New York Times*, 22 September 1934, sec. 4, p. 6. The controversy between Roosevelt and McCarl became public in late September. Henry A. Wallace to Roosevelt, 17 August 1934, in Nixon, *Franklin*, 324.

[15] Droze, *Trees*, 110, explains that Roberts and Morrell were close friends and when the project was vastly reduced in scope by McCarl's ruling, Morrell recommended Roberts take charge; Copies of Roberts promotions and salary changes are in his papers; E. L. Perry, "History of the Prairie States Forestry Project," unpublished history (United States Forest Service, 1942), in *Roberts Papers*; Americans frequently believe that Civilian Conservation Corps workers did the planting, but in fact they were only involved in a few, and the great majority of plantings used relief labor hired from either local rolls or the Works Progress Administration.

[16] "Morrell and Zon Head Shelterbelt Project," *American Forests*, 40(9) (September 1934): 415; Forest Service, Lake States Forest Experiment Station, *Possibilities of Shelterbelt Planting in the Plains Region* (Washington, D. C.: GPO, 1935).

[17] H. H. Chapman, "The Shelterbelt Tree Planting Project," *Journal of Forestry*, 32 (November 1934): 801-03.

[18] Chapman continued to be a thorn in the side of the Forest Service, or at least the parts of it that supported greater federal regulation. See, for example, his use of the *Journal of Forestry* to oppose the Cooperative Forest Restoration Plan of the late 1930s because it involved federal control of private lands. H. H. Chapman, "Why the Cooperative Forest Restoration Bill Should Not Pass," *Journal of Forestry*, 38 (March 1940): 231-34; Zon to H. H. Chapman, 26 December 1932, *Zon Papers*. Pinchot had used the *Journal of Forestry* to oppose Forest Service policy under Graves and Greeley. It could be argued that Chapman was simply trying to return independence to the *Journal*.

[19] Zon to Robert Marshall, 14 November 1934, *Zon Papers*. Beginning in the early 1930's some members of Congress proposed moving the Forest Service to the Department of the Interior and renaming the Department of the interior the Department of Conservation. These efforts increased as the decade passed. See A. L. Riesch Owen, *Conservation Under F. D. R.* (New York: Praeger Publishers, 1983), 176, for a review of this movement; H. H. Chapman, "Digest of Opinions Received on the Shelterbelt Project," *Journal of Forestry* 32 (December 1934): 952-72; Raphael Zon, "Some Instances of Censorship and Bias on the Part of the Editors of the Journal," 26 January 1935, *Zon Papers*.

[20] Chapman, "Digest," 952.

[21] Arthur N. Pack to Zon, 6 August 1934, *Zon Papers*. Arthur N. Pack was the son of Charles Lathrop Pack the President of the American Tree Association. Arthur N. Pack corresponded frequently with Zon, mostly about candidates for the Pack Fellowship, but occasionally on forest policy.

[22] Ibid.

[23] Zon, E. E. Clapp (then vice-president of the Forest Service), George Marshall, George Ahern, Ned Richards, Edward N. Munns, and other foresters actually made plans to start their own magazine. See Zon to Gifford Pinchot, 19 June 1934, *Zon Papers*.

[24] Carlos G. Bates, "The Great Plains Shelterbelt Project," *Journal of Forestry*, 32 (November 1934): 978-91. Once again it was possible that Bates was simply deferring to his superior Zon's judgment. However, by all accounts, Bates never learned to defer in his scientific opinions. Bates had also been in consideration to take over the Lake States Forest Experiment Station in 1923, but because of his opinionated nature, and the need to get Zon out of Washington, Greeley passed him over.

[25] Raphael Zon, "Shelterbelts—Futile Dream or Workable Plan," *Science*, 81 (April 1935): 391-93.

[26] "Morrel and Zon Head Shelterbelt," *American Forests*, 415; Hubert A. Smith to Zon, 5 July 1935, *Zon Papers*; Zon to W. R. Ronald, 21 February 1935, National Agroforestry Center, Lincoln (hereafter National Agroforestry Center).

[27] G. A. Pearson to Raphael Zon, 18 June 1935, National Agroforestry Center.

[28] Wilson Compton, "Government Versus Desert: The Fallacy of the Shelter Belt," *Forum and Century*, 93(4) (April 1935): 237-39; Ellsworth Huntington, "Marginal Land and the Shelter Belt," *Journal of Forestry*, 32(8) (November 1934): 804-12; Floyd A. Johnson, "Covering Nature's Nakedness—A Sacred Duty," *Nature Magazine*, 26(5) (November 1935): 302-03. Although a grazing economy was closer to the region's aboriginal economy, the cattle ranching disasters of the mid-1880s showed that such an economy was not without its own risks.

[29] C. E. Brinkman, "The Midwest Tree Belt; Feasibility of Project Doubted by One who Knows Country," *New York Times*, 13 September 1934, p. 22; William L. Hall, "The Grand Shelterbelt Project," *Journal of Forestry*, 32(9) (December 1934): 973-74; Royal S. Kellogg published extensively on different areas of forestry. On Plains forestry see, USDA Forest Service Bulletin No. 66 (Washington: GPO, 1905); Royal S. Kellogg, "Forest Planting in Western Kansas" (Washington, D. C.: GPO, 1909). Kellogg opposed the Shelterbelt well before his contribution to the *Journal of Forestry*. In September 1934, shortly after the official announcement, the *New York Times* published an editorial by Kellogg. The major claim of the editorial was that the plan was impractical "where trees are not nature's survival form of vegetation and where they cannot be made into that form." Royal S. Kellogg, "Proposed Tree Belt Regarded as Futile," *New York Times*, 16 September 1934, sec. 4, p. 5; Royal S. Kellogg, "The Shelterbelt Scheme," *Journal of Forestry*, 32 (December 1934): 977.

[30] Huntington, "Marginal Land," 804; The *New York Times* reprinted part of Huntington's analysis in "Tree Belt Project Hit by Huntington," *New York Times*, 11 November 1934, p. 2; "Trees for Air Dikes," *New York Times*, 25 July 1934, p. 16.

[31] "Section 10.—Economic and Social Aspects of Agriculture in the Plains Region," in Forest Service, *Possibilities*, 77-82.

[32] Raphael Zon, "Section 2—What this Study Discloses (a summery of findings and recommendations)," in Forest Service, *Possibilities*, 3-10. See Chapter 5 for Zon's testimony before Congress.

[33] Raphael Zon, "Section 6—Prospective Effects of the Tree-Planting Program," in Forest Servcie, *Possibilities*, 35; "A Farm Forestry Program," 15 August 1936, p. 4, *Roberts Papers.*

[34] "Section 9.—Shelterbelt Experience in Other Lands," in Forest Service, *Possibilities*, 59-76.

[35] "Section 7.—A Survey of Past Plantings," in Forest Service, *Possibilities*, 39-47.

[36] "Section 8.—A Review of Early Tree-Planting Activities in the Plains Region," in Forest Service, *Possibilities*, 51-57.

[37] Ibid.

[38] Perry, "History," 46; George W. Hood to John D. Jones, und., Box 421 (RG 114) Regional National Archives, Kansas City, Missouri (RG 95) (hereafter Kansas City Archives); Paul B. Sears, "The Great American Shelter-Belt," *Ecology*, 17(4) (October 1936): 682-89.

[39] Zon to W. R. Ronald, 21 February 1935, National Agroforestry Center.

[40] Perrry, "History," 57.

[41] "Forest influences" was not the most astute choice of titles given the ridicule that claims of climatic modification met. House Subcommittee on Agriculture of the Committee on Appropriations, Hearings, *Agricultural Department Appropriations Bill 1937* (1936), 74th Congress, 2nd Session, 410. This committee was in charge each session of putting together a budget bill for the Department of Agriculture. Part of this duty was to rule on the merit of new spending proposals by the Department of Agriculture. Once the committee finished with the bill it "reported it out" to the full House for debate. Although debate here was limited by the Rules Committee, representatives could add amendments to the bill reported by the Committee. The next step was to send the bill to the Senate where the whole process was repeated. When the Senate had finished with the bill it was usually considerably changed and a conference committee with representatives from both House and Senate would create a compromise bill. Assuming the compromise bill was satisfactory to both House and Senate, it could then go on the President's desk where he could sign or veto. If legislation was made during a session of Congress that had not received funding in a regular Departmental appropriation (as was the Cooperative Farm Forestry Act). The legislation had to go before a deficiencies committee. The deficiencies committee would then decide whether to include the legislation in a deficiencies bill. The $1,000,000 figure asked for in 1937 was considerably less than Shelterbelt personnel hoped for. Paul H. Roberts approached the Budget with a request for two and one-half million dollars. The Administration's Budget Office reduced this to one million before sending on the request to the Committee. See, Edward E. Munns to Raphael Zon, 19 December 1935, *Zon Papers*.

[42] Subcommittee Hearings, *Agriculture Department 1937*, 412, 414-15; R. E. Marsh to Zon, 4 December 1935, *Zon Papers*.

[43] Ibid., 784, 790-91. The different scales implied by "region," area," and vicinity" are vague. Neither Zon, nor any other forester, clearly laid out just what space they meant when talking about "widespread" or "regional" effects. Foresters did indicate that the influence of individual windbreaks was about ten to twenty times height, but they never quantified the scale of any larger effect.

[44] Ibid., 791.

[45] Ibid., 791, 790.

[46] D. S. Olson to Paul H. Roberts, 5 July 1935, Kansas City Archives (RG 95).

[47] House Committee on Appropriations, *Agricultural Department and Farm Credit Administration Appropriation Bill, Fiscal Year 1937*, 74th Congress, 2nd Session, Report 2061 to accompany H. R. 11418.

[48] *Congressional Record*, 74th Congress, 2nd Session (1936), 2716.

[49] Ibid., 2882, 8340, 2873.

[50] Ibid., 8339; Munns to Roberts, 21 February 1966, 2, *Roberts Papers*. Democratic support, in a heavily Democratic congress, was too weak to get the project out of committee or amend it to the Agricultural Bill.

[51] Zon to Silcox, 26 February 1936, *Zon Papers*; R. E. M. to Zon, 4 March 1936, *Zon Papers*; Silcox to Zon, 1 March 1936, *Zon Papers*.

[52] R. E. M. to Zon, 4 March 1936, *Zon Papers*; Zon to Senator Nye, 27 February 1936, *Zon Papers*; Gerald P. Nye to Zon, 4 March 1936, *Zon Papers*.

[53] Subcommittee of the Committee on Appropriations, Senate, *Agricultural Department Appropriation Bill 1937* (1936), 74th Congress, 2nd Session.

[54] Ibid., 111.

[55] Ibid.

[56] Zon to Earle Clapp, 18 July 1936, *Zon Papers*. Zon was referring to a press conference given on 11 July 1936.

[57] The $1,605,521 figure combined left over funds from fiscal year 1936 and 1,255,736 in new funds given during 1937; *New York Times*, 4 August 1936, p. 11; Perry, "History," 55; Droze, *Trees*, 209.

[58] L. F. Kneipp to Paul Roberts, 10 August 1936, National Agroforestry Center, Lincoln, Nebreska.

[59] Roosevelt to Henry A. Wallace, 23 January 1937, in Nixon, *Franklin*, vol. 2, 7.

[60] *Congressional Record*, 75th Congress, 1st Session (1937), 3622; Perry, "History," 55. Norris had introduced a similar act in the previous session of Congress, but it failed to gain sufficient support in the House.

[61] House Subcommittee on Agriculture of the Committee on Appropriations, *Agricultural Department Appropriation Bill 1939* (1938), 75th Congress, 3rd Session. See also, House Committee on Appropriations, *Department of Agriculture and Farm Credit Administration Appropriation Bill, 1939* (1938). Report 2130 to accompany H. R. 10238, 75th Congress, 3rd Session; Droze, *Trees*, 213, attributes the inequality of funds to a mistake by the Budget Bureau. This seems strange as the Forest Service defends the unequal allocation as just by explaining that the Plains states were in the most need, and that previous forest spending had been confined mostly to Eastern states.

[62] Perry, "History," 56, 57.

[63] Ibid., 57, 58.

Chapter Five—The Politics of Planning: technical decision-making, politics, and nature in constructing a plan

When foresters began preparations for the Shelterbelt Project they hoped to leave behind political and professional battles in favor of pure technical planning. Surely science and planning could provide solutions that would be above criticism by outsiders, and scientific forestry could assume a central role in securing Plains landscapes. This, at least, was their theory, but foresters' grand plans gradually eroded before them as environmental, economic, and governmental pressures proved far more complex and resistant than expected. The landscape foresters constructed became a hybrid monster of technical, burecratic, and social decisions, all of which were shaped by forces beyond their control.

Part of the difficulty foresters faced was that the plan they pursued epitomized what political scientist James Scott calls "high-modernist ideology." As Scott explains, this reflected a belief "about scientific and technical progress, the expansion of production, the growing satisfaction of human needs, the mastery of nature (including human nature), and above all, the rational design of social order commensurate with the scientific understandings of natural laws." Foresters Carlos Bates, Edward Munns, and particularly the European-trained Raphael Zon, attempted a radical simplification of natural and social spaces to accommodate their vision of proper planning. At its peak they contemplated literally dividing the United States in half with evenly spaced shelterbelts, running like unbroken corn rows from the Canadian border to the Gulf of Mexico. This grand reorganization would tame nature and stabilize the economy and society. When it became clear that political, social, and natural conditions militated against the scheme, planners attempted to enforce their notions of order and nature on ever-smaller landscapes.[1]

Three interrelated aspects of planning caused foresters the most trouble. The first was the zone of planting, or the region in which foresters expected to plant. At the outset this region seemed to reflect natural barriers as defined by the latest science, but in practice the borders, and even the entire region itself, shifted repeatedly in response to scientific, political, and natural forces. The second issue was the direction and continuity of shelterbelt plantings. Foresters wanted shelterbelts to enforce a rectilinear order across the center of the nation, thereby blocking the eastward spread of the Dust Bowl. When this proved unrealistic, foresters clung to the hope that they could create such structures within smaller areas. Finally, the vast reorganization of space collided with property. Foresters wanted some form of state protection for their shelterbelts, but financial insecurity and existing ownership patterns made this unworkable. As restrictions on shelterbelt plantings waned, farmer support seemed to increase, but there was no guarantee that farmers would maintain acreage in trees. When foresters modified plans for the zone, direction, and ownership to accommodate farmers, politicians, and nature, they increased the support and practicality of the project, yet ultimately changed it into something that had lost most of its vision and uniqueness.

Foresters' earliest plans did not lack for vision. They were ambitious on a scale seldom seen in United States history. The idea that perhaps most clearly illustrated foresters' penchant for overarching, systematic planning was the selection of a zone or region for planting. Confining the shelterbelt to a zone was supposed to be a technical adaptation to natural conditions, a geographic area within which planners would conduct successful planting operations. Thus the Forest Service called for a zone based on a natural boundary "as far west as trees will grow." The resulting belt of trees would be "100 miles wide

extending for 1300 miles from Canada to the Gulf of Mexico." The "western border of this belt [would] follow approximately the line of 18 inches average rainfall." The earliest newspaper announcements echoed this logic by placing the "western boundary of the forest protective zone ... as far west as trees can be made to grow with assurance of success," while *Possibilities of Shelterbelt Planting*, the Forest Service's "bible" for the plan, located the zone along the ninety-ninth meridian with some wavering from the Turtle Mountains of North Dakota to Lubbock, Texas.[2]

Planners were essentially constructing a new environmental space on the Plains, one that thoroughly blurred the social with the natural. The zone was defined as a natural region where tree planting was difficult but possible. Concrete natural limits such as "average" rainfall, soil type, and climate were supposedly the primary determinants of where tree planting was possible, and plans could never account for the full complexity or capriciousness of nature, let alone humans. Planners found themselves once again locked in what historian Richard White described as a "conversation" with nature that built on and modified previous understandings of the natural world. During the dry years of the 1930s, the conversation returned to the old debate about whether the Great Plains was a desert. The shelterbelt zone became the potential demarcation between wasteland and permanent agriculture. The exact location of this divide was hotly contested territory, however, and planners had to adjust it several times to account for natural and political concerns. Although foresters prided themselves on their unprecedented knowledge of Plains nature, they were no less engaged in a process of discovery than Zebulon Pike.[3]

The zone concept at first seemed to harbor several advantages. Centralizing control and limiting the planting program to a finite region fit well with the main tenets of

progressive government and resource conservation, which stressed efficiency and scientific management. By spatially limiting plantings, the project paralleled efforts such as the Tennessee Valley Authority and the abortive Columbia Valley Authority, which stressed "comprehensive, expert designs for vast sections of the country." The economic crisis of the 1930s had discredited the market-oriented policies of the 1920s. Greater government intervention had gained much political support. Centralized planning unified these interventions, and the PSFP was portrayed as another way to apply "rational and scientific method" to managing natural resources over a large area of the country. With greater freedom to intervene in economic and natural problems of the 1930s, experts developed plans to reorganize space in ways that they believed were ecologically and socially rational. In the case of the Shelterbelt zone, this meant identifying an area where trees would grow and where agriculture needed trees. The borders of the region, at least in an idealized sense, could ignore political boundaries.[4]

From the start, however, plans for the zone also had to incorporate bureaucratic concerns. For administrative and field personnel creating a zone offered significant advantages. The zone facilitated standardization of planting and training, since procedures could be worked out on paper and then adapted to specific geographic locations. Concentrating plantings had the happy coincidence of offering political centralization as well, or in PSFP director Paul Roberts' words, it "enabled location of field unit headquarters inside or nearby the major work areas." This not only increased Roberts' control of field work, but it also brought PSFP employees into contact with other Federal relief agencies such as the Works Progress Administration, Resettlement Authority, and Agriculture Adjustment Administration. Although true coordination eluded relief agencies, the close

proximity of administrative and field personnel at least assisted in joint planning. In addition, Roberts wanted to ensure his access to local relief organizations, regional planning groups, and other groups and individuals that might be encouraged to promote planting. In these ways the zone concept, initially construed as a sort of bioregional construct, also helped planners to control the institutional workings of the project and enhance bureaucratic connections to the other agencies and people which shared the space.[5]

Not everyone took such a positive view of Roberts' dedication to planting within a zone. Carlos Bates argued that Roberts wanted the zone primarily so "that their [administrative's] job is purely mechanical and that Research can give such information that no brain work on their part is essential." Although Bates was not opposed to the idea of a zone, he worried that the administrative branch was using the concept to rush forward with plans that were still tentative and prone to spectacular failure. If the administrative branch did not adopt the attitude that all jobs were technical, then the project might be "one awful flop." According to Bates, Roberts had become so enamored with the zone concept, and his ability to specify uniform planting procedures, that he was "perhaps the worst enemy that this consideration has to face, because he is so absolutely bland and immune to any worry about technique." Bates was too harsh, for like Roberts, he too believed that confining planting to a zone based on natural boundaries was the best method to minimize field errors, especially on a grand scale.[6]

Political tensions also intruded in planning the putatively natural boundaries. President Roosevelt had originally wanted to create a "wall" of trees across the Plains, and Chief Forester R. Y. Stuart had responded in October 1933 with a proposal approximating the President's wishes. The belt would be 25-miles wide and extend from Valentine in

northern Nebraska to Childress in the Texas panhandle (Figure 6.1). More than later plans, Stuart's proposal was directed at walling off a region that soon became notorious as the Dust Bowl. This received very little circulation outside of the Department of Agriculture, however, and it is unclear how FDR himself felt about it. What we do know is that the plan sat poorly with professional foresters.[7]

People who made their living planting trees wanted a broader, more nuanced approach. As work began on the conservative 25-mile plan, Raphael Zon and his staff grew even more ambitious, devising a plan that called for a 100-mile wide zone extending from the Canadian border to Brownsville, Texas (Figure 6.2). The western border of the zone would roughly parallel the 20-inch rainfall line along the middle and southern Plains but move significantly to the west in the northern tier states to account for lower temperatures. This massive belt would test Zon's theory that forest planting, systematically carried out on a broad scale, could transform the region climatically and economically. Paradoxically, Roosevelt's narrower wall of trees was too confined to accomplish the large-scale changes Zon desired, yet too ambitious for a temporary relief measure. Thus the long and narrow form of the 100-mile plan was a deliberate effort to maintain some part of President Roosevelt's original idea and thereby maintain his interest.[8]

By the time the public saw the first plans in the summer of 1934, the zone had moved again. A July 1934 map in the *New York Times* shifted the zone slightly east throughout most of its length, yet it omitted most of the Texas section (Figure 6.3). This map was attributed to the Forest Service, and it seems to have been part of a concerted publicity drive that summer to drum up support and to reassure the public that the administration was actively pursuing solutions to the dust storms. The map itself was not particularly detailed, however, nor was it

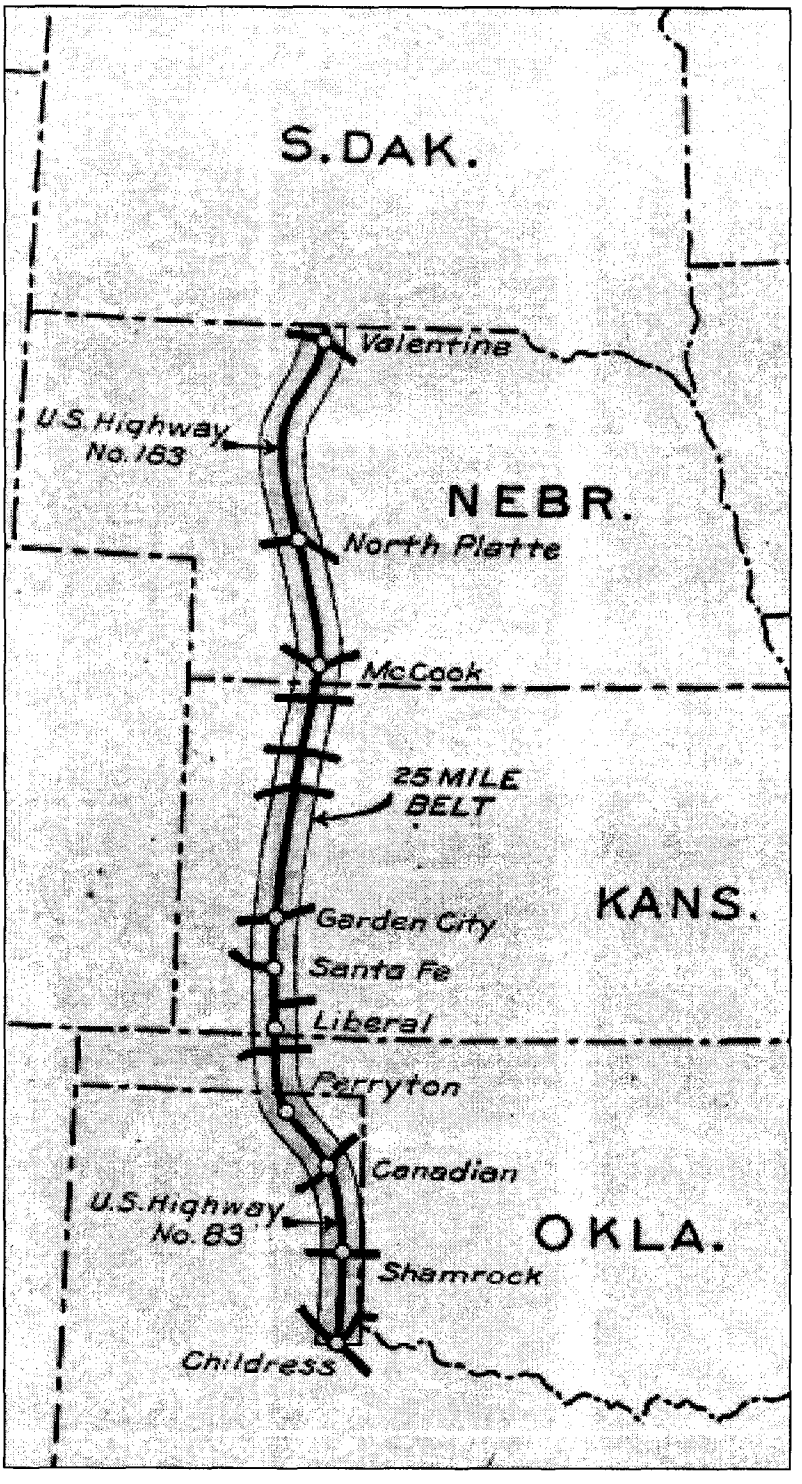

Figure 6.1—Earliest Plan for a 25-mile wide belt.[9]

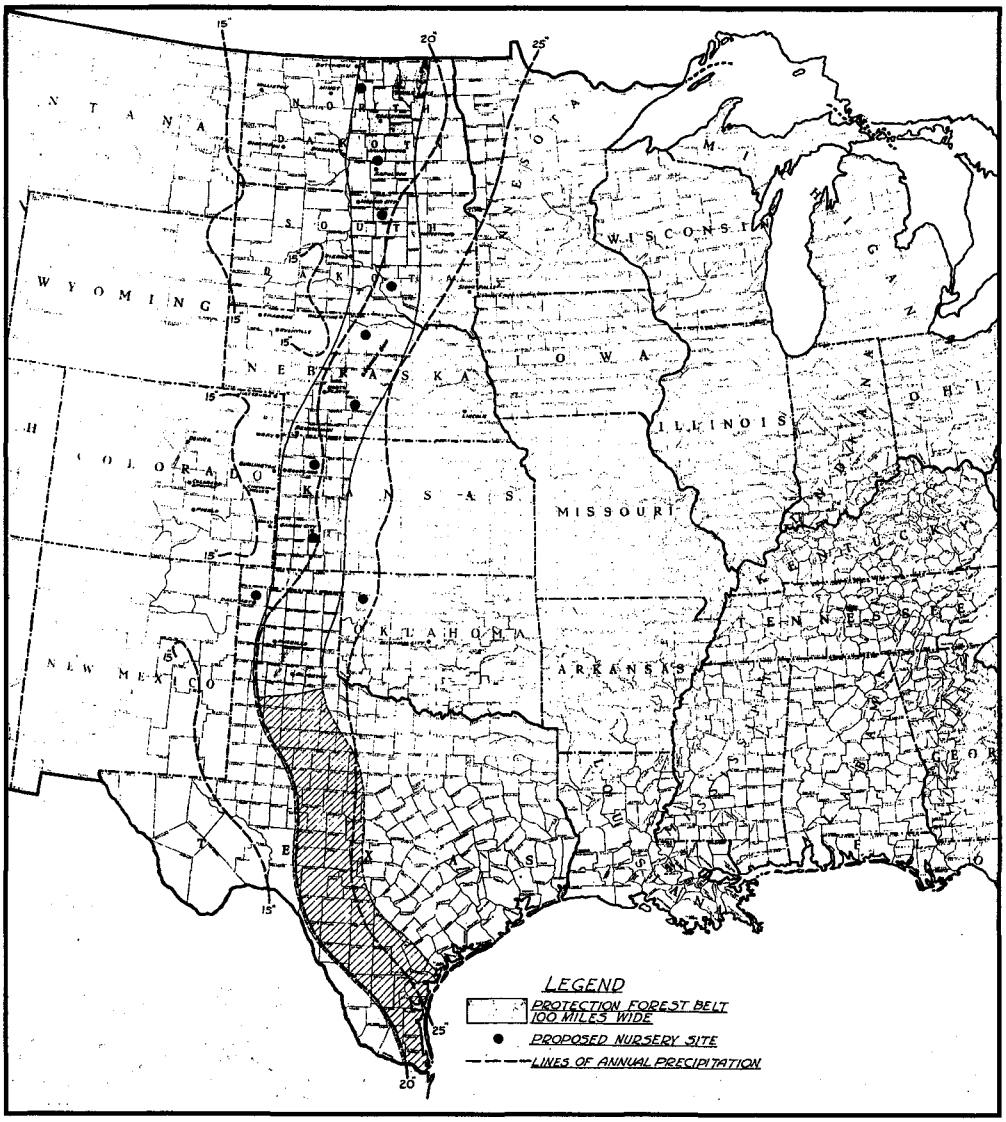

Figure 6.2—Early plan for a belt running from Canada to Brownsville, Texas[10]

intended as much more than a representation of the final boundary. For the many Americans eager for information, it remained the best available source. [11]

During late 1934 and January 1935, yet another map began to circulate (Figure 6.4). By then the center portion of the zone had moved dramatically to the west and dropped the

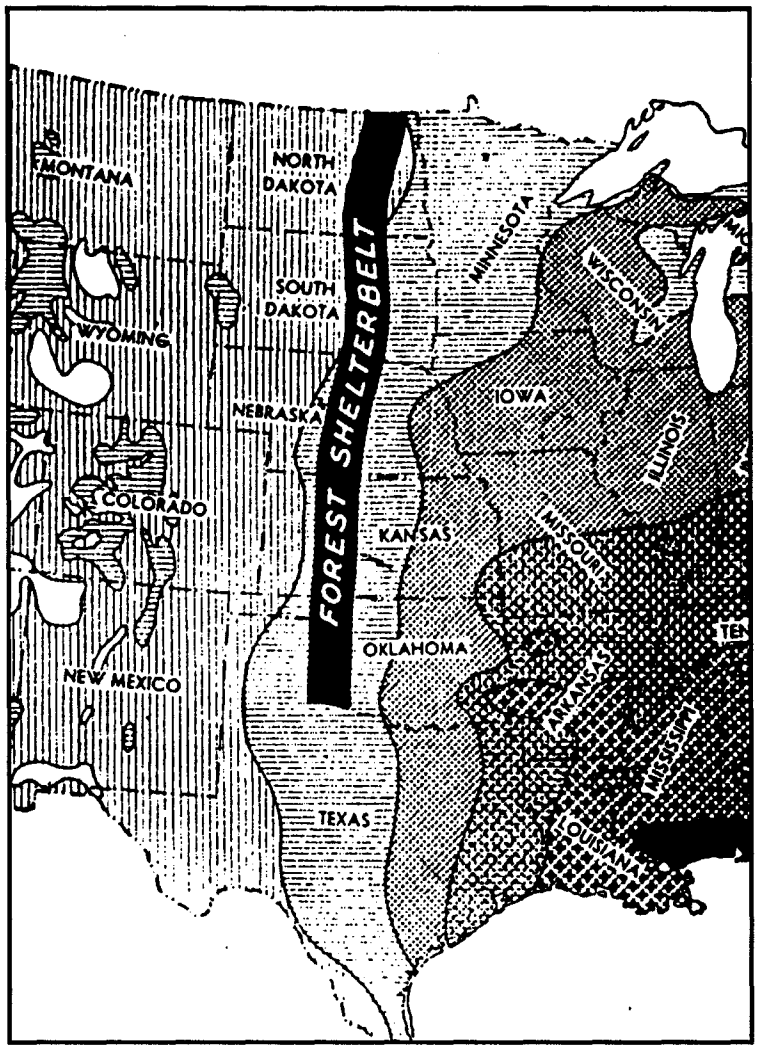

Figure 6.3—Zone from the *New York Times* in summer of 1934.[12]

rigid borders of earlier maps. Although the map's exact authorship is unclear, it was apparently created as a work-map for the various state directors who were organizing field operations. It was never intended for public distribution, yet it began to circulate and "received considerable public distribution." The map had a large divot out of its center portion to exclude the Nebraska Sandhills, presumably under the assumption that these were primarily non-agricultural lands. The deep westward bow in the zone's center allowed

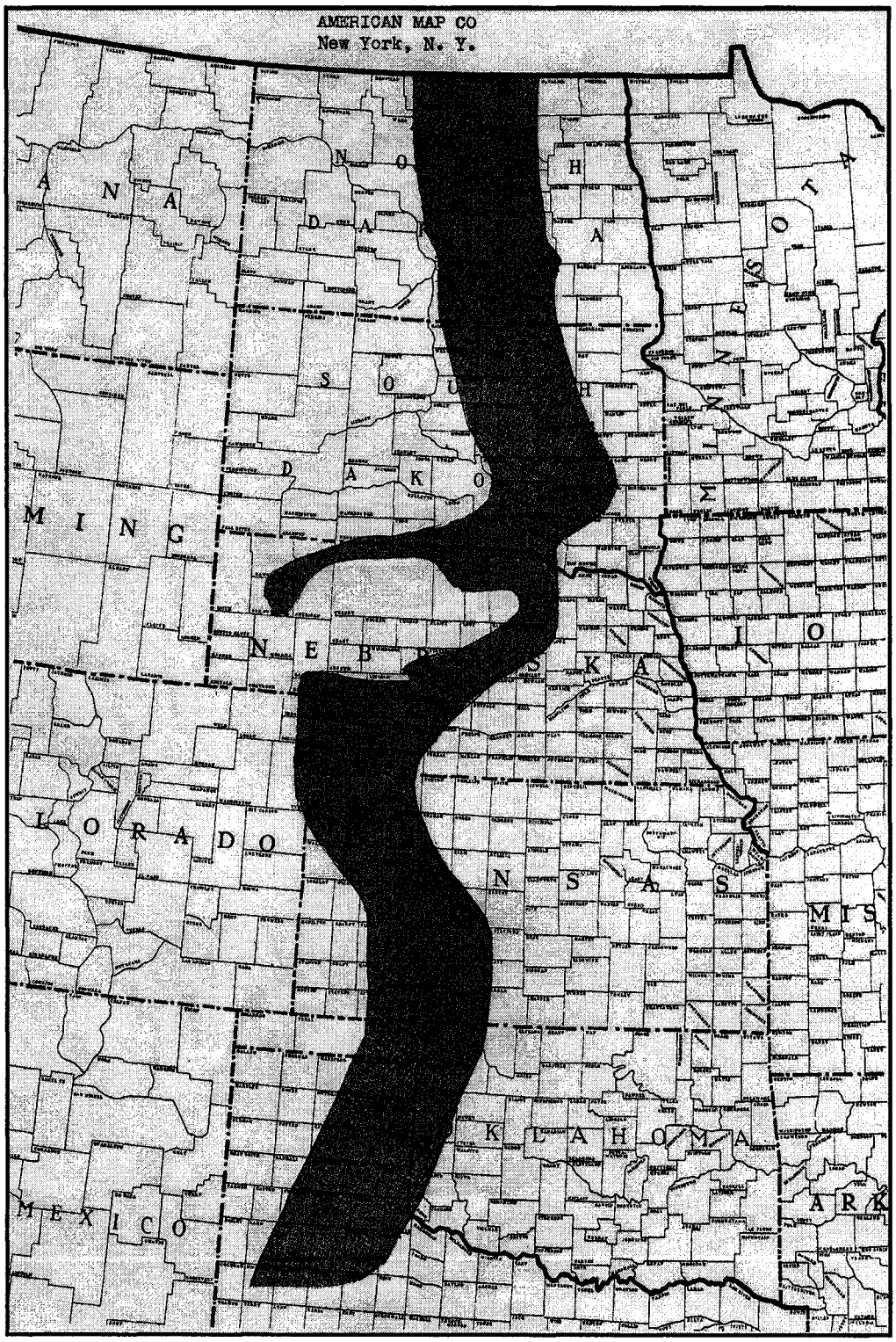

Figure 6.4—Zone from fall of 1934.[13]

foresters to include a portion of the Platte River Valley that extended all the way into Colorado, both areas of which were demanding inclusion. Increasingly, the Shelterbelt's zone was morphing for political as well as ecological reasons. The long protrusion above the sandhills extended planting activities along the Niobrara River Valley into the Pine Ridge region of Northwestern Nebraska. Over the years these areas had proven their potential for tree growth despite being west of the previously announced boundary. The same applied to the Platte River Valley in Southern Nebraska, where tree growth had long preceded Euro-American settlement. Yet the inclusion of the eastern counties of Colorado was almost certainly purely political, as this was far west of any previously successful tree planting effort. The new map's uneven borders and westward push only exacerbated calls for further changes, and on Chief Forester Ferdinand Silcox's order in late January 1935, Roberts discontinued its use, instructing his personnel to do likewise.[14]

Towards the end of 1934 zone planning developed another wrinkle when foresters contemplated creating a second "grass belt" to the west of the Shelterbelt. According to a press release, this "new belt 100 miles wide will be added on the west of the original shelterbelt zone extending in some places like Colorado almost to the foothills of the Rocky Mountains." The release described the various methods of restoring the zone, including afforestation and water conservation, to restore "its natural grass cover." The idea for a second grass belt was the result of "insistent demands from several of the Plains States that the protective zone be pushed farther west." Silcox explained that the combination of grass, trees, and water conservation would have "the effect of increasing the productiveness of the lands in the eastern half of the belt where farming has a definite and permanent place." The

grass belt never evolved beyond the speculation stage, and the Forest Service quickly found that creating one belt was difficult enough.[15]

While moving the zone west might please some potential constituents, foresters were extremely cautious in this regard, and their impulse was often to move the zone farther east into higher rainfall regions. Word that the administration was interested in a vast tree planting project on the Plains had leaked out as early as 1933, and although little public attention focused on the plan before the *New York Times* and other newspapers began to carry stories, foresters were aware that the plan faced significant opposition. In particular, many foresters questioned whether trees would even grow on the drought stricken Plains. Although the project's defenders claimed that these were foresters with little knowledge of the region, in fact even foresters with long experience were cautious. The impulse to shift planting to an area of higher rainfall might thus reassure some doubters. As it turned out, though, many critics still regarded the zone as too far west even after the politically-motivated eastward shift, and a storm of criticism met the plan's release in the summer of 1934 (see Chapter 4). The relocation actually exacerbated political tensions because it placed the zone squarely atop relatively more populated sections of the Plains states. These sections had higher land values and produced a greater agricultural surplus, thus making it easier to justify extensive federal spending, but it also made farmers more reluctant to donate land for tree planting.

At internal meetings in December 1934, foresters aired many of these concerns and tried to push the zone of planting farther eastward. The Oklahoma representative wanted to shift the border "15 to 20 miles east of the present approved eastern boundary." Kansas foresters, led by the former Nebraska National Forest director Charles Scott, wanted the

"eastern boundary considerably farther east." With the exception of areas along the Platte River, the Nebraska foresters also wanted the boundary moved farther east. But the Dakota representatives wanted a slight westward shift at the extreme north of the zone. Everyone agreed that there was sufficient land in the eastern region of the already established zone for existing planting programs, and that an immediate revision was not necessary. Roberts endorsed these findings and informed the research arm of the Shelterbelt, directed by Raphael Zon out of the Lake States Experiment Station, that "the zone should be located far enough east so that it will have public support, so that it will involve primarily agricultural land, and so that the plantings themselves will be successful."[16]

At such moments it became impossible to hide political dimensions of the Shelterbelt Project, yet the move eastward was too little for most critics and the resulting protests pushed the zone even farther eastward. The final version of the zone began to circulate as early as February 1935, although not widely outside the Forest Service until the publication *Possibilities of Shelterbelt Planting* (Figure 6.5 and 6.6). More than the first shift east, the move between summer 1934 plans and February 1935 was clearly designed to ameliorate political criticisms and to increase public support. The project had operated on relief funds in 1934 and 1935, and foresters were intensely aware of the need to increase public and political support to ensure long-term survival. However, the shift was not solely the work of politics. Foresters had been studying Plains climate and soils for a number of years. As their knowledge had increased, so had their caution about planting too far west.[17]

Foresters had intended the zone to define the region within which planting would take place, but in practice both the eastern and western boundary were porous. A survey of

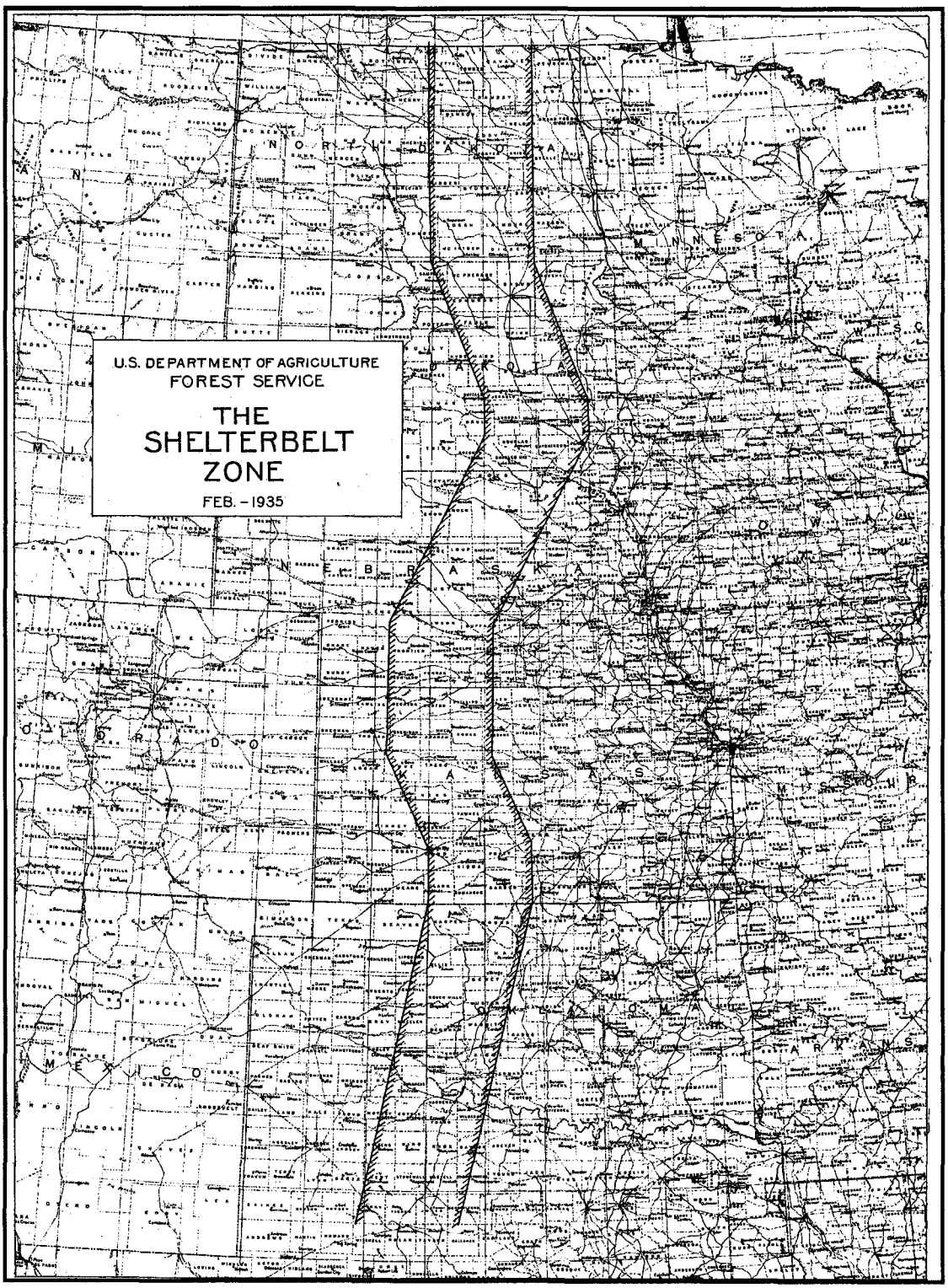

Figure 6.5—Zone in February 1935.[18]

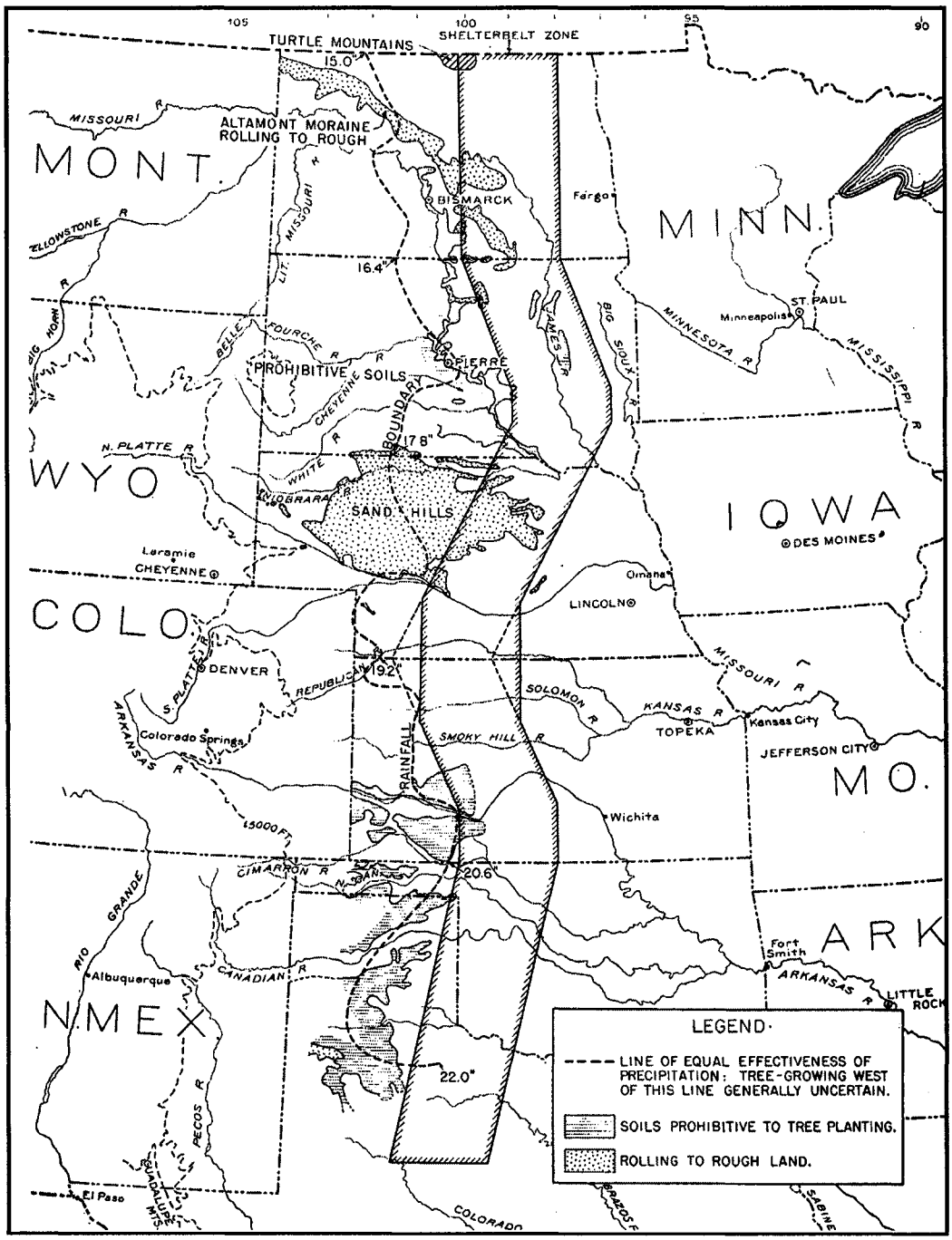

Figure 6.6—Zone from *Possibilities of Shelterbelt Planting*.[19]

plantings done by Ralph Reed in 1954 found considerable planting had been done east of the zone shown in *Possibilities*, and in some areas plantings had also extended farther west (Figure 6.7). Thus by 1936 the Forest Service was regarding the zone's borders as essentially elastic, but in 1934 and 1935 it was not at all clear that the zone would be a flexible creation. To many Plains residents, it appeared that "blueprints, formulas, and theories" might triumph over "practical experience."[20]

The logic of limiting planting to a zone was never as convincing to Plains residents as it had been to foresters. The high-modernist affection of some foresters, or at least the zone that such thinking facilitated, left many residents outside the planning process. The borders became highly contested territory, with each county and state lobbying for their own section to be included. Sometimes they argued that the zone should be shifted east or west to incorporate their favored space; other times they asked for exceptions. Some clever residents in South Dakota argued that the borders of the zone should be used to indicate what counties would be included, thus farms falling outside the zone, but inside a county adjacent to or partially within the zone, would also qualify. More even than inclusion, though, residents wanted the Forest Service to acknowledge their opinions and experiences.

The potential for relief work and federal dollars that the Shelterbelt program represented was a significant draw for regional politicians, and many lobbied the Forest Service on behalf of their preferred location. When Oklahoma congressman Jed Johnson discovered in the newspaper that the zone would run to the west of his district, he immediately opposed the project because "every farmer in every area or section of the United States is as much entitled to these free Government trees as are people who live in the so-called shelterbelt." Senator W. J. Bulow of South Dakota took a less aggressive tack, asking

for "careful consideration" to expand the program into Potter County, which stood just west of the proposed zone. Representative Francis Case, also of South Dakota, lobbied the

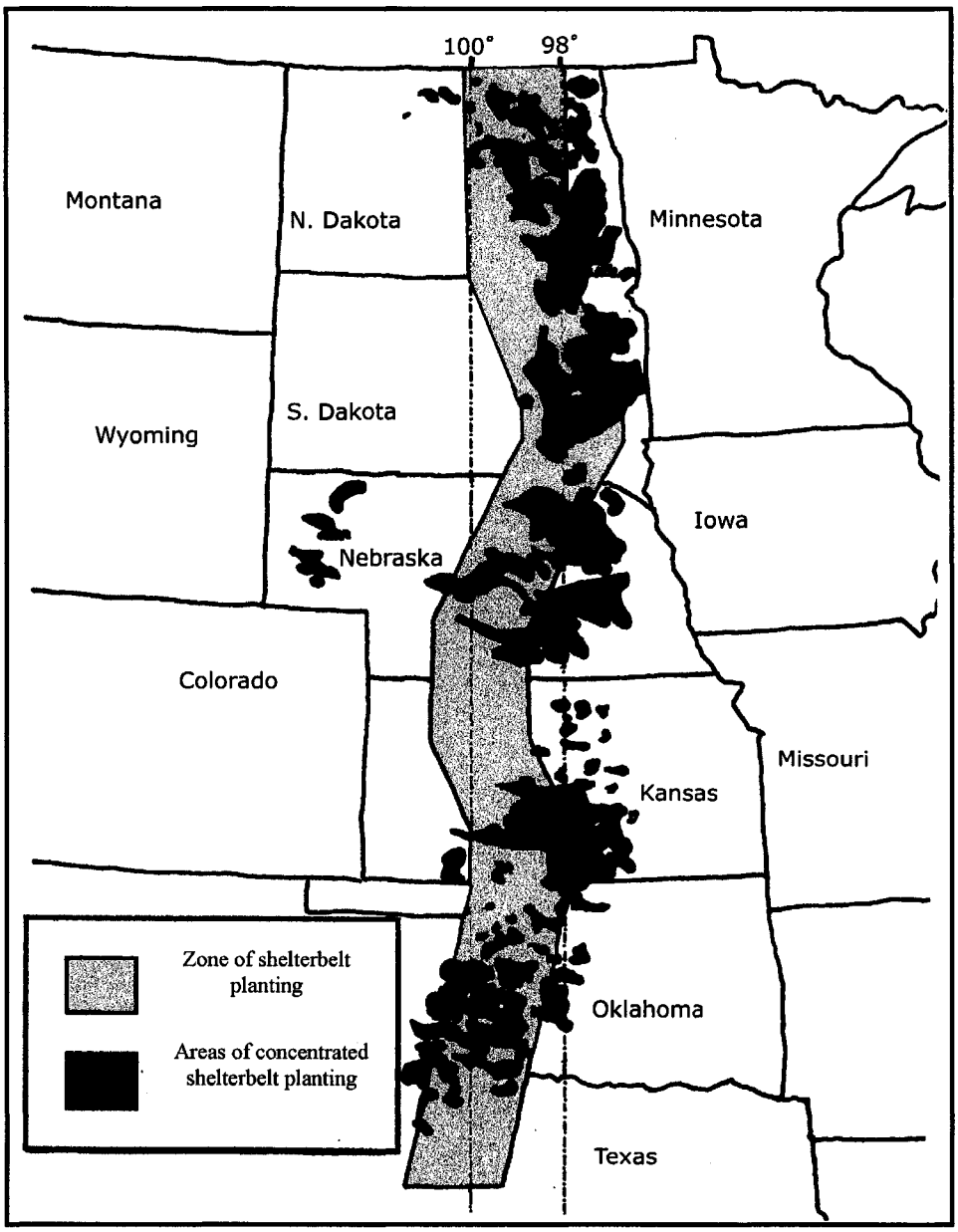

Figure 6.7—Actual areas of heavy planting compared to Zone.[21]

PSFP to make at least some plantings in the West River counties. The Colorado State legislature petitioned the U. S. Congress to create a second shelterbelt zone "supplementing the proposed national shelter belt, to relieve dire need and distress in eastern Colorado." In each instance the primary attraction seemed to be less the presence of trees than the infusion of federal work relief funds.[22]

The location of the zone also spurred demand by Plains residents that resembled a community tug-of-war. By March 1935, at least 2050 residents living to the east of the proposed zone in South Dakota had signed a petition asking the Forest Service either to expand the boundaries or to shift the zone eastward. Meanwhile, 1601 residents to the west signed another petition asking the Forest Service to leave the line as originally announced, thus including Campbell and Walworth Counties. The Colorado Forestry Association adopted a resolution calling for extension of the project west into Colorado, while the *Business Farmer* asked that the belt extend deep into the Platte Valley. An ad hoc organization in eastern Colorado, western Kansas, and western Nebraska, which called itself "the Western Great Plains Shelterbelt Association," petitioned for the establishment of another shelterbelt zone on the western Plains. The demands for a second shelterbelt zone in turn encouraged additional states, including Wyoming and Montana, to ask for inclusion as well.[23]

The placement of the zone for areas to its west was particularly critical. For western residents the implication of remaining west of the planting zone meant not only that they were excluded from the project but that their very status as agricultural pioneers was threatened. In both a material and cultural sense, they were beyond the agrarian pale. Many had moved to the high Plains during better times and struggled for years to carve out a

meager existence against great odds. In so doing they thought they had earned their right to remain. Given their lack of other services, the government had an obligation to help them through the current difficulties. In her study of western South Dakota, historian Paula M. Nelson observed that "the symbolic implications of the plan ... were well understood in western South Dakota, located as it was on the windy and sunny side of the shelterbelt. Those on the east side would be protected from hot winds, blowing dust, and blizzards, and perhaps as well from the sight of failure to the west. West river residents, outside of the shelterbelt by a decision of their own government, would stand unprotected." Bradford Knapp, president of the Texas Technical College in Lubbock, warned the Forest Service that "to run the belt in Texas as suggested is a very serious matter, because it is the equivalent of condemning all of the land west of the belt as unfit for development."[24]

It was the limiting of the shelterbelt planting to a zone, not the project itself, which threatened residents farther west. The zone was a visible demarcation of which land, and by implication people, the government decreed worth saving. Having previously encouraged settlement and dry farming on the western Plains, the government was now implicitly telling settlers that their lands were unsuited for crop production. The zone was a marker in the ever-shifting construction of nature on the Plains. As this marker shifted to the east in the 1930s, some settlers were redefined as "not builders, as they saw themselves, but destroyers; not the final chapter in manifest destiny, but manifest failure; not heroic pioneers, but foolish hanger-ons."[25]

Almost instinctively, residents living to the west challenged the decision to exclude their areas. Many, such as I. E. Shirk of Colorado, assured the Forest Service that their county had "very fertile ground and produces fine crops." On the surface these requests

sought to have the Forest Service reexamine the boundaries of the zone, but their requests also revealed a quest for legitimacy. They were defending their decision to farm the ground as much as requesting assistance. George Frye of North Dakota explained that "I know this country is subject to droughts but there were times when we had an abundance of everything." Flora Kicken of Nebraska (Jules Sandoz's daughter) reminded foresters that "we have no good roads, no good schools, no good churches here but this is one thing that we could have and need." When the Forest Service responded that the "the shelterbelt as it is set up now applies only to agricultural lands," she fired off a second letter reminding the foresters that "this may be a grazing region, primarily, but the government considers it an agricultural region also … many of the families around here make their living entirely by farming as do most of my own people." O. B. Helmer of North Dakota noted that she had "lived in North Dakota sixteen years and have planted quite a good many trees. They have nearly all lived, and are doing fine."[26]

Although the zone was less threatening to residents living to the East, they too sought to influence the location of planting. H. C. Halvorson of South Dakota warned the Forest Service that people in the eastern portion of the state had advocated shelterbelt planting for years with little hope of systematic success, and now, when the government had finally initiated a program, it seemed like it would completely miss them. In response to an Associated Press article that indicated the Forest Service was considering moving the zone west in North Dakota, E. J. Gurski adopted the Forest Services' own technical arguments to warn foresters that "the original location was ideal, particularly from the standpoint of rainfall, and we feel that serious consideration should be given to this feature." Echoing the worries of the foresters who were even then trying to finalize the zone's location, Gurski

warned that "it would be an awful blunder if the shelter belt were moved westward, and then it were found later that there was not enough rainfall for the trees to survive."[27]

Project personnel had admitted the eastern boundary was "somewhat arbitrary," but they defended their verdict on the grounds that tree growth east did not necessitate government expenditure. They were also concerned that high land values might discourage farmers from participating, and that they did not want to "lose" land to trees. While the first reason contained some logical consistency, the widespread demand of residents to the east that the zone include their lands had already demolished the second. Instead, the eastern boundary represented two interrelated desires on the part of planners. First, they wanted to maintain a wall like zone with fixed borders and a 100-mile width. Second, they wanted to create what they called a concentrated effect. This could only be accomplished by planting in a relatively confined region.[28]

The Forest Service adopted a different argument for the western boundary, defending it as the "natural limit for any tree plantings," but this too was somewhat arbitrary. The supposed natural limits of the zone had in fact blurred because of foresters previous efforts. The western border of the Shelterbelt zone ignored the earlier testing by field experiment stations on the Plains, some of which seemed to indicate that with proper planning and management trees could be grown in areas far to the west of the zone. The western border also seemed increasingly arbitrary as the project progressed. Foresters began to encounter complicated problems with soil types, water tables, and species selections, all of which proved every bit as important as an arbitrary "natural limit" line. They also realized that their assumptions about average rainfall were problematic, since not only did rainfall on the Plains vary considerably between years, but the exact timing, the soil type, and the age of the trees

were also critical factors. Increasingly, any hard line on a map seemed difficult to determine, and one survey even suggested delineating "four nearly parallel but somewhat variable western boundaries."[29]

In the end any ecological rationale for constructing the western boundary was intrinsically founded on the political economy of market agriculture. As a Forest Service memo noted, shelterbelt planting "aims to make land more valuable for agriculture, less subject to the effects of the elements—in short, to develop its more intensive use under the artificial conditions set up by human activities." It was thus a priori senseless to enhance a grazing or predominantly grass landscape. Not only must the land support tree growth, but it must also be worth growing trees. Therefore, "should an economic survey of the same territory show that agriculture as far west as this is too much of a risk, then it would be only fair" to move the boundary until it contained lands of "fairly uniform prospects along the entire western boundary." The more planners tried to pin down the zone's location, the more they realized that the "final determination of the shelterbelt limit will give us protection from political considerations to place the boundary here or there, [but] this entire process might be considered merely as a rather expensive means of "rationalizing" what, in the end will be just a good, well-balanced estimate of the best location for the western boundary." As if that were not enough, the plan also needed to fit "the President's original conception of the shelterbelt project," which "was to create a barrier against the desiccating winds of the western plains—the western boundary of which was to be approximately in the longitude of the Missouri River and Bismarck."[30]

More than any other factor, the creation and maintenance of a zone of planting—long after it had become a political liability—reflected foresters' wish to "concentrate" plantings. This was part of the long running effort to alter the nature of the Plains through tree planting. During the nineteenth-century this goal had reflected a pastoral vision of groves and forests interspersed with farms. The twentieth-century version was a combination of scientific forestry and high-modernist planning. As James Scott's has noted, this high-modernist plan was more systematic, more uniform, and imagined a program of shelterbelt planting carried out over a wide area. One forester explained there was a need for "some cumulative mass effect which would necessitate a systematic arrangement of large numbers of individual shelterbelts, together with other miscellaneous plantings." Concentrating shelterbelts would also offer overlapping protection. In a completely developed community, each farm would only need belts on one or two sides. The other sides would be protected by neighboring farms likewise throughout the entire zone. Conversely, if every farm were an island then the job of foresters and the amount of land each farm would dedicate to trees would be much larger. Planners, operating on a Plains constructed of paper, numbers, and theory, had imagined a way of rearranging the landscape to accommodate a new conservation feature, trees. [31]

During the early New Deal political discourse took a radical departure towards comprehensive, statist plans, and progressive politicians contemplated drastic rearrangements of formerly state and private spaces. Briefly high-modernist approaches seemed possible in a variety of places: from the Tennessee Valley to the Great Plains. However, the window of opportunity closed rapidly and regional interests and Congress began to reassert their traditional authority. The most obvious example of this was the Supreme Court's declaration that the National Recovery Act (NRA) was unconstitutional in May 1935. But there were

also increased rumblings from a restless public that saw the NRA and other early programs as a failure of the dream that disinterested experts could effectively manage the economy or nature. The Shelterbelt Project, with its suggestions of climate change, was an easy target since criticism made few enemies outside the Forest Service. Silcox and Zon understood that the political momentum had shifted against them, and they avoided making the types of dramatic claims that had seemed possible in 1934. After that year high-modernist planning became more difficult to discuss in public, but foresters continued promoting a systematic concentration policy even if they did not always clearly articulate the reasons.[32]

Instead of dramatic claims, Zon relied on scientific and bureaucratic rationale to determining the outline of the Shelterbelt zone. In response to a letter from Roberts requesting advice on expanding plantings west of the line in South Dakota, Zon noted in 1935 that farmers outside the zone should be reassured of their eventual inclusion. Otherwise no immediate action should be taken until the Forester decided that helping areas outside the zone was "more important to the country than the systematic development of the zone itself." This was in some senses pure politics, Zon was the Forester's principle advisor on such issues, so he in practice had immense influence in regard to answering such questions. Shifting the decision to Washington was in this instance an effort to deflect requests. In other cases, though, he defended adamantly the concentration of work. In his testimony before the House Subcommittee on Agriculture in 1936, he argued that without a definite zone forestry work would be so spread out as to be just another program to assist individual farmers, with no "larger" public benefit. Although Zon was the strongest proponent of this idea, it was not uncommon to see other foresters, such as South Dakota State Director A. L. Ford, warn that

"our present scattered plantings serve very well to sell local people on the proposition but I question its selling value from a national standpoint."[33]

Nevertheless, after 1936 the zone gradually broke down. Zon became less involved with planning for the PSFP and the administrative staff had greater control over locations and methods. As the Director of the Lake States Forest Experiment Station, the Shelterbelt and then PSFP were only a small part of his duties. He also seemed to lose personal interest as the project lost its more transformative aspects and became "simply" a plan to assist farmers in tree planting. At first the field personnel tried to sustain Zon's policy, but this was primarily for labor reasons. Concentrating planting work helped reduce transportation and equipment expenses. It also allowed the relatively few skilled field personnel to supervise a large number of plantings and thereby avoid the WPA employment ratio cap.[34]

In the face of continued pressure to expand operations, the zone became a largely theoretical construction that had only a general influence on plantings. Despite the labor advantages of concentration, Olson began to argue in favor of dispersion on the grounds that "it would be to our advantage from the public relations standpoint to have in each state a vastly greater number of community developments ... wherever we have gone the program has gained the wholehearted support of the community." From this he concluded that not only should planting extend beyond the zone, but work should "extend into Colorado, Wyoming, and Montana." John Emerson made the same argument for inclusion of western Minnesota and Iowa. For the 1939 and 1940 planting seasons, Robert asked Washington for permission to expand plantings to some of these states, but the final ruling was that "in view of the present emergency status of the Project, and the relatively limited amount of work you are now able to carry on each year with funds available, it appears unadvisable to attempt

extension of activities." While this quashed plans, the PSFP continued to expand its operations within the Plains states.[35]

A strange thing happened as Roberts pushed for expansion within the Plains states: the natural barrier to tree growth moved west. In response to "rather urgent requests to push further west in several of the states" in 1941, Roberts began planting west of the old shelterbelt zone in the northern states. In part the expansion was based on obvious political advantages, but Roberts also hoped that "we are going into a rainfall cycle when we can expect to get some successful results." This was still a bit optimist in 1941 when, with the exception of South Dakota, rainfall remained below average, but the following year did mark the end of drought and the beginning of higher rainfall. After almost a decade of bad news, the Weather Bureau finally reported in 1942 that production was increasing on the Plains and that "the phenomenal increase over drought years is due primarily to the difference in the weather." Nature had changed the line of "as far west as trees will grow."[36]

It was not only the zone of planting but the orientation of belts that displayed the limits of high-modernists planning. The earliest plans called for trees to run continuously north to south in belts one mile apart. Such an orientation fit eastern desires for a green wall against western aridity. When President Roosevelt had first suggested a tree wall to hold back dust storms, forester Edward Munns had proposed planting belts along section lines and highways. Munns did this to control costs, since more of the land under such a plan would be publicly owned. He also wanted to form a grid pattern that would protect fields from the prevailing winds. By the summer of 1934, however, the plan called for "about 100 parallel windbreaks one mile apart" running north-south. Chief Forester Silcox reinforced this rigid

pattern in his early announcements by calling for "windbreaks to run north and south; each to be seven rods wide, making about 100 parallel windbreaks, one mile apart and 1,000 miles long." The Forest Service had multiplied FDR's tree wall idea several fold into a series of tree-walls that, at least on paper, buffered the East from dust storms like those of 1934 (Figure 6.8). Running continuous, rigid shelterbelts along a north-south axis would materially and symbolically protect the East.[37]

Politics made the north-south orientation of trees seem like second nature, but the Plains subverted such common sense dreams. To begin with, not all soils were suitable for tree growth. Thus regardless of whether plans called for north-south belts, they would not and could not be continuous. In addition, the hot winds of summer generally blew from the south or southwest, while winter winds descended from the north and northwest. In neither season was a north-south orientation particularly protective. Politics and nature collided before planner's eyes, and given the choice of either north-south plantings or west-east plantings—the only choices possible given the township survey system—the west-east orientation emerged as the stronger choice. For *Possibilities of Shelterbelt Planting*, the authors assembled the best available evidence about soil types and wind direction on the Plains (Figure 6.9, 6.10, 6.11, 6.12, and 6.13), to clearly demonstrate the impracticality of continuous, north-south belts. To diagram their findings foresters used "wind roses," a small circle with wedge-like petals, the width of which indicated the frequency of winds from that direction. Most winds struck the southern two-thirds of the shelterbelt zone from the south during summer months. However, switching to an east-west orientation was also less than ideal because enough variation existed—especially in the critical months of spring—occasionally to render east-west belts useless as well. Even displaying the average sweep of

the wind was deceptive in terms of crop health. Some years it only took a few days of hot dry winds—usually from the southwest—to ruin a crop. Such short blows might barely register on the wind rose, but they would be the most important to the farmer. The best plan would be

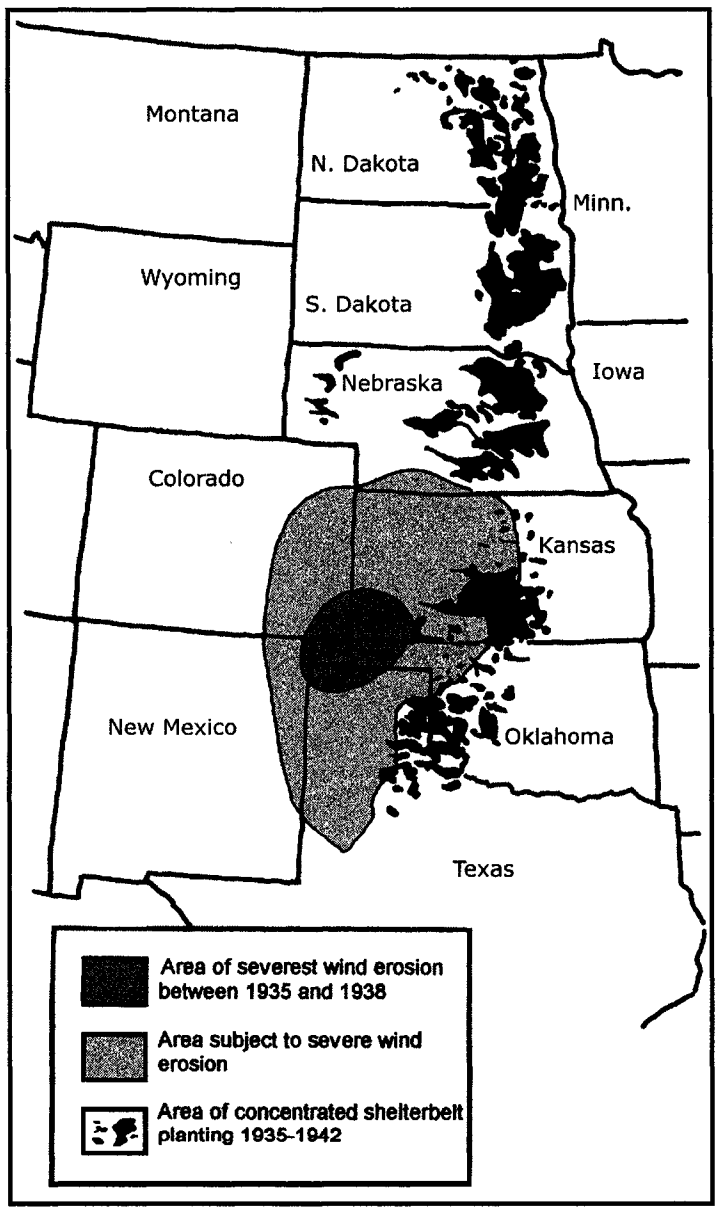

Figure 6.8—Areas of concentrated planting compared to Dust Bowl region.[38]

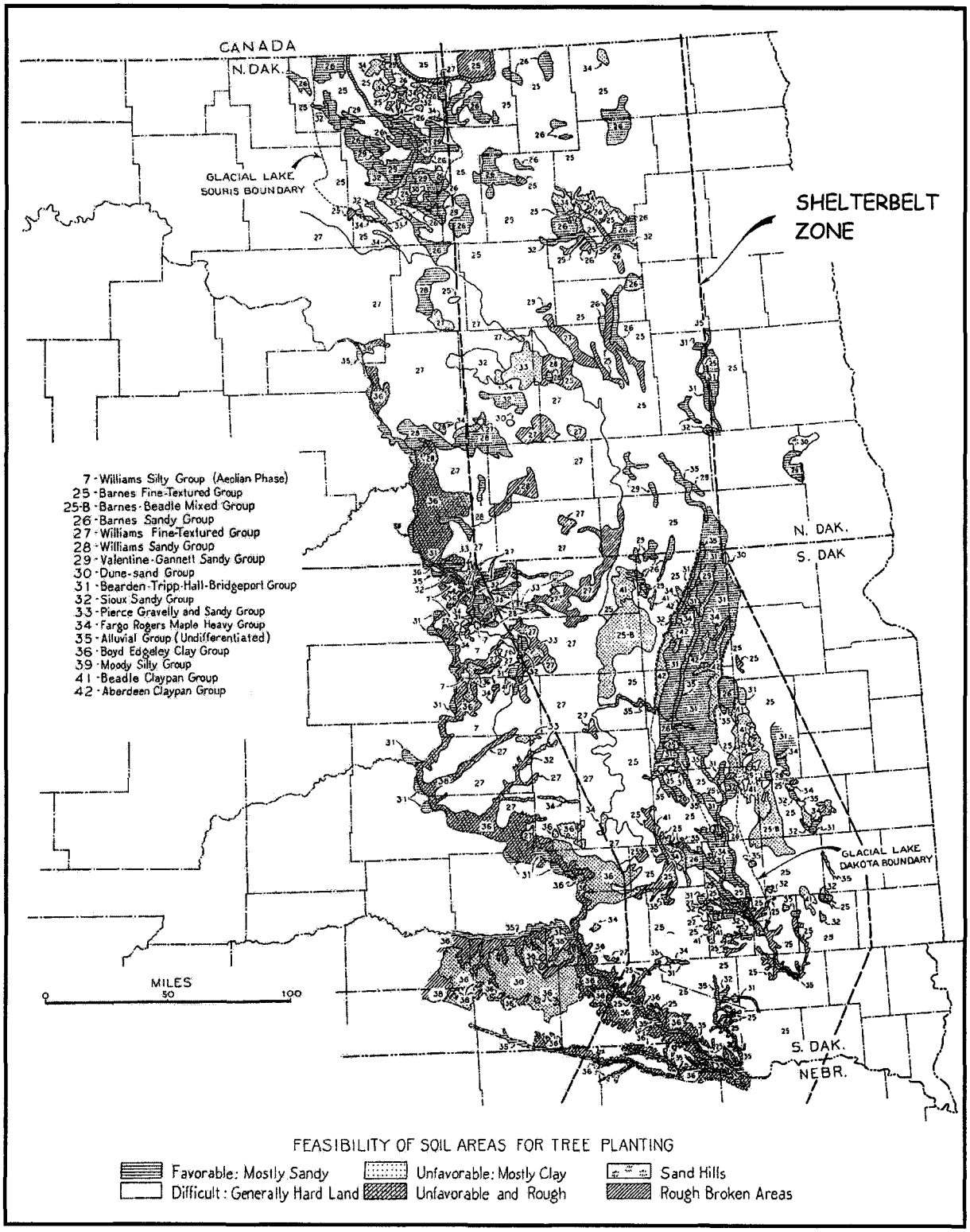

Figure 6.9—Soil types of Northern Plains and tree growth.[39]

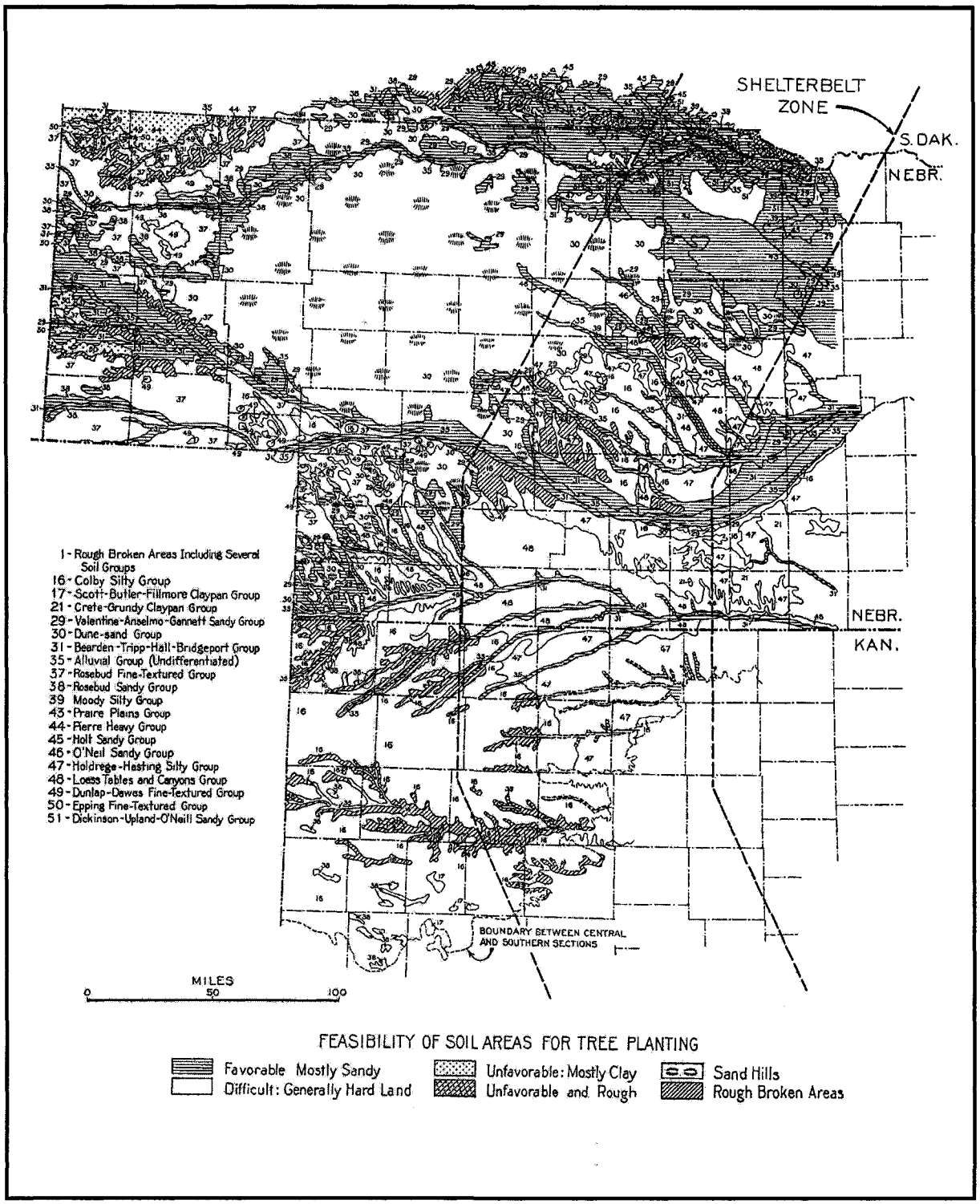

Figure 6.10—Soil types of Central Plains and tree growth.[40]

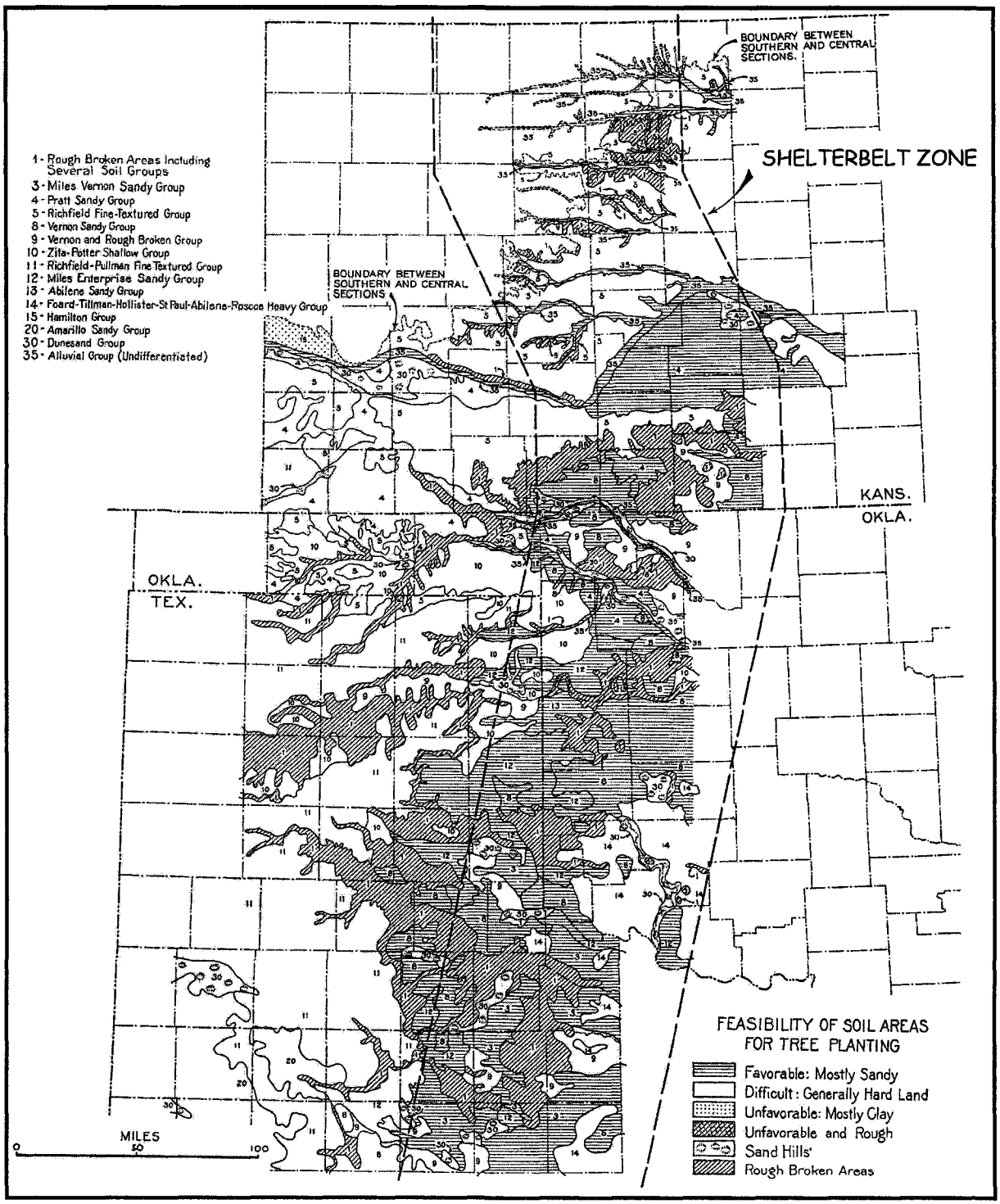

Figure 6.11—Soil types of Southern Plains and tree growth.[41]

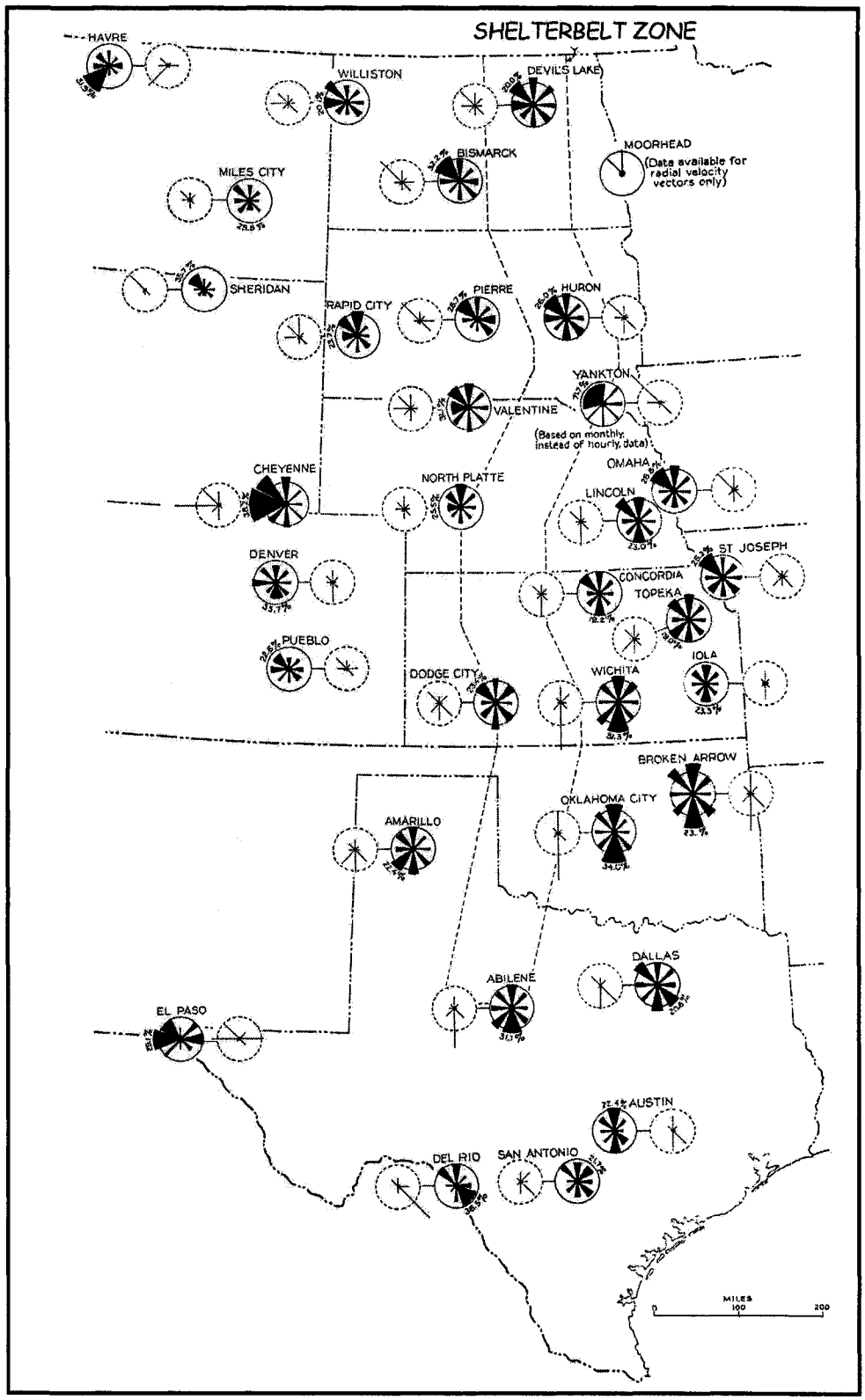

Figure 6.12—Summer wind patterns on the Great Plains.[42]

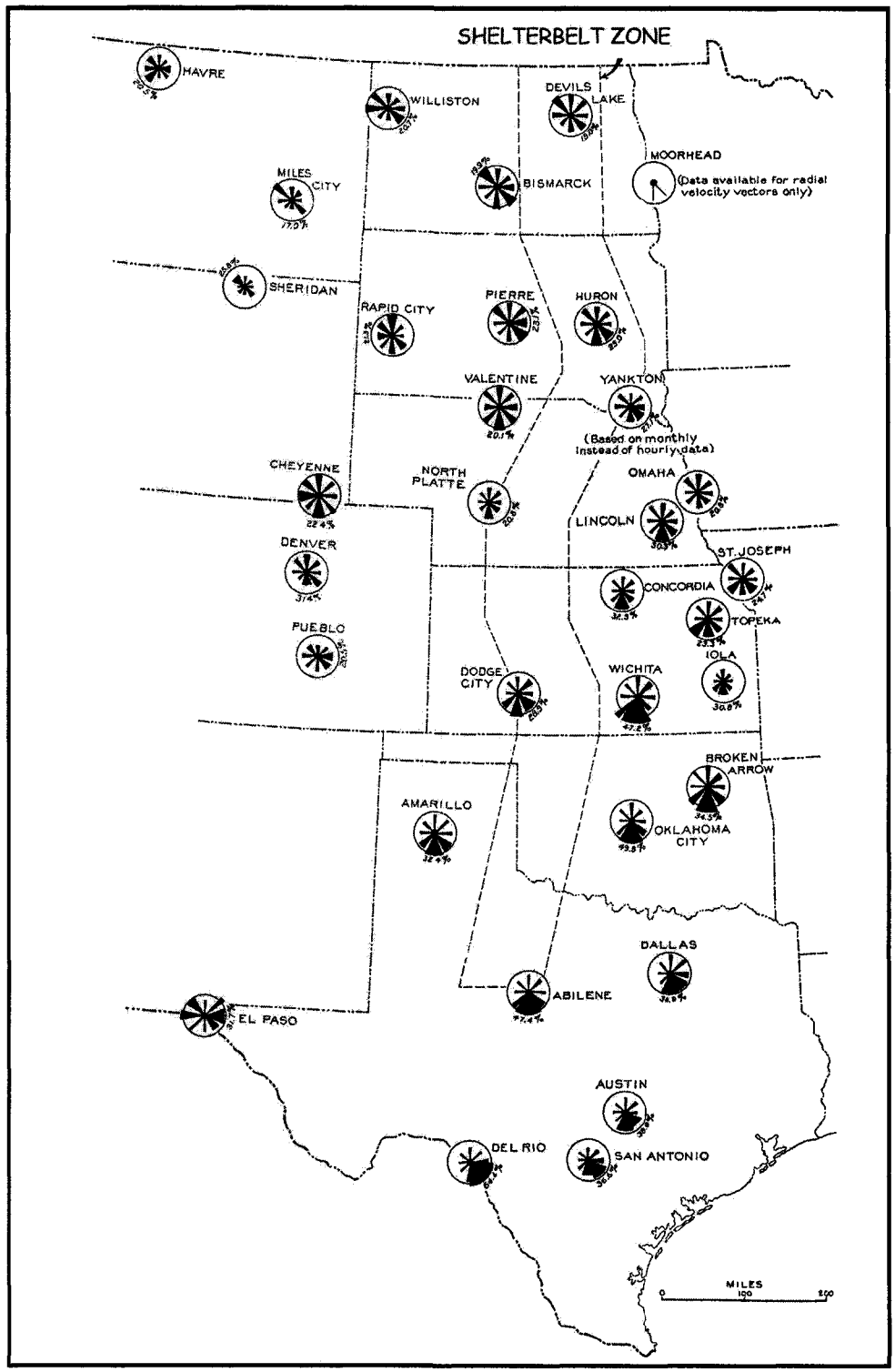

Figure 6.13—Wind pattern on the Great Plains for non-summer months.[43]

to enclose each section or farm on two, or better yet, three sides, yet such tactics instantly doubled or trebled the amount of plantings.[44]

Although not as immediately obvious as orientation, the complexity of soil types also influenced location and orientation. Both the Bureau of Chemistry and Soils and the Soil Erosion Service had conducted soil-reconnaissance surveys over a large part of the proposed zone. The agencies had developed an extensive, even intimate knowledge of Plains soils, but knowing the soil in a specific area did not mean knowing whether it would support trees. After all, much of the point of the project was to plant trees where they had not grown. Therefore foresters had to find examples of tree growth in each soil type and then make assumptions about the suitability of the soil. The life histories of some trees might be well recorded, but in many cases foresters had to make educated guesses about the relationship between soil and tree condition. The surveyors could not always know that the poor condition of a grove was the exclusive work of unsuitable soil types. It was possible that certain varieties of trees were unsuited to the vicinity, that previous treatment such as cultivation or thinning had been less than ideal, or that any number of other factors had influenced events. Despite these hurdles, foresters reduced the huge variety of Plains soils to three categories: favorable, difficult, and unfavorable. Even keeping in mind the above difficulties of categorizing tree growth and soil types, the approximations were further complicated by geographic features, water table levels, and precipitation.[45]

But it was not only natural conditions complicating the simplifying pressures of planning. Human patterns of use, ownership, and perception also contributed to the conflict. Unless the government was going to buy land for the belts, there was little incentive for farmers to cooperate if belts ran north-south. Having lived on the Plains, many farmers were

skeptical that north-south belts would offer protection from anything but cold winter winds. A former wheat-grower from central Kansas warned the Forest Service that "your proposed plan of building 'Wind-breaks' of trees running from the North to the South is like trying to dam a river by building a dam parallel to the running water in the stream" and only a "'greener', just out of college, would plow ground or plant crops in rows North and South." Belts that did not protect crops, homes, or fields, but took up valuable farmland, were not going to be popular. Making matters worse, continuous belts would require the government to exercise its eminent domain powers to seize the land of non-cooperators. The Forest Service never considered doing this, but it was increasingly obvious that maintaining the original orientation of nearly continuous strips would require drastic interventions by the state. Given these difficulties, Bates informed Zon in January 1935 that "within the territory covered by the Zone, there will be so many omissions for various reasons that the solid 'belt' idea, implying uniform distribution, cannot be carried out."[46]

Most foresters viewed these changes as an entirely positive development. The idea of systematic, continuous belts had always seemed more a science fiction hoax—an agrarian analog of Fritz Lang's *Metropolis*. Many foresters who submitted opinions to the *Journal of Forestry* in 1934 cited the continuous north-south belts as a primary objection. More telling, even supportive foresters questioned this aspect. It was not until April 1935, when Zon published "Shelterbelts—Futile Dream or Workable Plan," that Zon publicly abandoned the goal, but even then the issue remained clouded. G. A. Pearson, Director of the Southwest Forest and Range Experiment Station, wrote to Zon to congratulate him on the "new program" because, as he understood it, "you will plant only suitable sites and I read between the lines that the plantations will not necessarily be in the form of long narrow strips."

Although Pearson was ultimately correct that the project would abandon the idea of long continuous strips, the change was not yet a forgone conclusion.[47]

Zon and Olson attempted to maintain some aspects of the plan's early emphasis on continuous north-south strips. Zon tried to sustain elements because it was only through such systematic planting that a large-scale climatic effect could be attained. Zon made this point explicitly in his testimony before the House Subcommittee on Agriculture in 1936. He tried to convince the committee that the project should retain its commitment to continuous north-south plantings. Only in this way could the project justify itself as for the general public welfare rather than just for individual farmers. According to Zon, Chief Forester Silcox also supported retaining aspects of the original plan, although it is not clear whether Silcox was doing this to support Zon or because he truly believed in the plan.[48]

As the Chief of Timber Management, Olson had a central role in determining the actual location of belts, and initially he tried to maintain some continuity and a north-south orientation. Like Zon, Olson seemed to believe that systematic plantings might have wider effects, but Olson remained concerned about the effects shelterbelt work would have on the Forest Service and Plains forestry. He argued that the "work should have some semblance of forestry," or at least the "general public concepts of forestry," rather than simply a scattered project of planting hedgerows on individual farms. Olson firmly believed farmers could do the latter for themselves. Maintaining the original plan of wide, relatively continuous belts running on a north-south axis would unequivocally place foresters and the Service at the center of the undertaking.[49]

Olson was no neophyte when it came to Plains forestry. He understood the natural and social barriers to such an arrangement, and the plantings he directed were always

something of a compromise. There was little chance to create continuous, north-south belts from the Canadian border to Texas, but he hoped for something similar on a smaller scale. Within concentrated areas he wanted belts to run "practically continuous" except for roads. If the PSFP could maintain continuous belts at half-mile intervals on this reduced scale, then the plantings would create an interlocking system of protection. On an isolated farm, foresters would have to plant on at least two sides, ideally in an "L" shaped pattern. However, with long continuous strips running across multiple farms each would give up only one side to a shelterbelt. Farms would be bracketed on two sides by a belt, one their own and the other their neighbor. In addition the continuation of the belt on their other neighbor's land to the north and south would help protect against glancing winds from the north or south.[50]

By 1937 Olson had realized that even this compromise was not having the desired effect. In some cases shelterbelts were not stopping sand and soil from blowing. The southwest corners of farms in the three southern Plains states were particularly vulnerable, and north-south belts seemed unable to stop such erosion. Under pressure from the state directors of Kansas, Oklahoma, and Texas, Olson agreed that "it should not only be permissible but is highly desirable that your organization plan the location of the shelterbelts where they will do the farm the most immediate good, whether such locations be on the north, south, or west edge." Olson admitted that when "we look back at our 1935 and 1936 strips, we realize that some of them cannot justify their present locations." In the future most field shelterbelts would run "east and west and preferably on the south edge or mid-field." The southern Plains states had been the strongest in their criticism, but plantings all along the zone tended to follow an east-west axis after 1937. Unlike the early plans for continuous north-south plantings, the reorientation was never rigid and Olson gave the rather vague

advice that "this office believes that exceptions to the rule should all be given their due consideration, and wishes to leave with you [the state directors] the responsibility of meeting or rejecting those exceptions."[51]

Much as many foresters suspected, land ownership became another factor determining belt direction and continuity. One hundred continuous belts running from Canada to Texas, spaced one mile apart within a 100-mile zone, would have given the Forest Service 1,820,000 acres of forestland to administer. Some foresters hoped that farmers could be convinced to donate all or most of this land, but this faded rapidly when most farmers balked at participating under such conditions. Foresters' preferred solutions were either direct government ownership or a protective lease. The first choice would have guaranteed long-term protection for the belts, vastly expanded the bureaucratic reach of the Forest Service, and put the entire project in terms very similar to the National Forests. If direct ownership could not be achieved, however, the Service might at least gain partial control over planted belts through a protective lease or other legal agreement that prevented farmers from removing trees and allowed the Service to maintain the belts.

Predictably, Zon was the most vocal advocate for direct ownership. Zon was closely connected to a cadre of radical fosters that were pushing for greater government ownership in the early 1930s, including George Ahern, Earle Clapp, Robert Marshall, Edward Munns, and Gifford Pinchot. Marshall's book, *The People's Forests*, was one of the most influential statements of their goals. In 1932, Pinchot presented Roosevelt a white paper created by Marshall and Zon that summarized many of the points from *The People's Forest*. As Zon began work on the Shelterbelt the following year, he brought the group's ideas to the plan. To those who argued for cooperative agreements or land donation, he replied that the

government policy as seen by the Clarke-McNary Act "has been that private altruism, plus government subsidy" would protect forestland. Time and again this assumption had fallen short because "voluntary private forestry has failed the world over. There is absolutely no reason to assume that it will succeed in the U. S." The condition of private forests appalled Zon. Private land owners consistently over-cut without replanting. Government purchase and planting of forestlands was the only way to assure success and protection. Zon even, wanted to "reverse gears" on public land policy and have the government buy land to *increase* public ownership. Placing shelterbelts under direct federal control would thus ensure that investments in planting and maintenance would not be wasted through ignorance or exploited for greed.[52]

There were other reasons for foresters to support public ownership. Assistant Forester L. F. Kneipp wanted some "definite certainty of tenure" because it "seems to be somewhat of futility in starting a 100-year program" with a protective lease that only ran for 10 years. A donation policy was clearly out of the question on such lands, and even a short-term lease agreement faced serious bureaucratic and legal hurdles since it would have to go through a variety of insurance and loan companies, banks, federal and state agencies, the Federal Farm Loan Bank, Rural Credit Agencies, State Land Agencies, and individual owners. Thus Kneipp favored "establishing fee-simple ownership" to guarantee the shelterbelt's long-term survival. Chief of Lands, Alva Simpson, also argued for direct purchase, noting that "a large percentage of the farms within the shelterbelt zone are mortgaged." Buying of foreclosed farmland would give the Forest Service direct control of the land and it would simplify immensely the legal landscape of the Plains. It would also have guaranteed the public welfare over individual greed.[53]

The bureaucratic advantages to the Forest Service were also substantial. As planning for the project began in the summer of 1934, the Service contemplated that "the organization created for the handling of this project may eventually grow into a new regional office." Taking into account the unique character of Plains forestry and the need to integrate various Forest Service activities, Roberts hoped to create a "new Forest Service region" which would have "all Forest Service functions having to do with afforestation, and articulation and integration of forestry and agriculture transferred to it." For the foresters planning the project, land ownership was both a means of protecting shelterbelts and a way to make tree planting "someone's business." Giving the Forest Service almost two million acres to manage as a massive, interconnected forest would certainly have made the Plains its business.[54]

But one after another, plans for landownership fell through. Forced to rely on WPA funds for its budget, the project barely met administrative expenses. With each failure to obtain a permanent budget from Congress, and with no change in House opinion in sight, foresters drastically trimmed their hopes for transforming the Plains, forced instead to rely on whatever resources were available to get trees in the ground. The Forest Service initially signed lease contracts that used a land valuation system borrowed from the Agricultural Adjustment Administration (AAA) to determine rental payments. These ten-year leases guaranteed the Forest Service a measure of control over the early life of trees, and they contained a clause allowing the Forest Service to purchase the land outright. This was, however, an expensive policy with considerable red tape. Surveying the belts and establishing the exact outlines of leased land was a burden. In 1936, the PSFP secured a deal to use AAA funds to pay for shelterbelt land as part of its crop reduction program, but the deal fell through when the Supreme Court ruled the AAA's processor tax unconstitutional.

The PSFP next negotiated an arrangement with farmers to donate a perpetual easement, and after 1936 the PSFP conducted plantings under cooperative agreements that carried no government interest in the land or trees planted. The final agreements eliminated the need for three complete divisions in the regional office (Land, Engineering, and Law), reduced costs, and streamlined the application process, but it also left in question the long-term future of plantings. Just as Zon had feared, many farmers later removed their shelterbelts to increase acreage or make room for center-pivot irrigation systems.[55]

When foresters began planning for the Shelterbelt, they undertook a sweeping reorganization of the natural, political, and social spaces of the Great Plains. They did so primarily under the assumption that they could use science to find a more efficient and rational arrangement. But the plans they created always contained a mixture of contradictory goals that science was ill-equipped to reconcile. In his study of the Wilderness Society in the 1930s, historian Paul Sutter unearthed similar complications with planning. Wilderness Society members such as Aldo Leopold, Robert Sterling Yard, Benton MacKaye and Robert Marshall became increasingly skeptical that federal planning efforts could make nature accessible to the majority of Americans and still protect it. All four developed an ambivalent relation to high-modernist planning. On the one hand they worried that the state would destroy the very resource it was trying to save; on the other, they advocated a new round of state intervention and management through a system of planned wilderness. Complex political and environmental landscapes subverted many of the New Deal's high-modernist interventions.

Difficult compromises also faced the Shelterbelt when it entered the political arena. Certainly Raphael Zon and Carlos Bates were aware that the science of Plains forestry could not at that time determine the absolute boundaries for tree growth, but when confronted with resistance to their plan on one side and calls for massive expansion on the other, they understandably turned to the one source that seemed above such considerations: science. It would have taken considerable courage to tell President Roosevelt that the nature of the Great Plains was incredibly complex and that the science was uncertain. Speaking truth to power threatened to disrupt plans for the Shelterbelt, and other programs that foresters hoped Roosevelt would support. Bates acknowledged the pitfalls of simplistic thinking in a letter to Roberts:

> The writer [Bates] is perfectly willing to admit that he has made a mistake; that his sympathy for the drought-sufferers of the Plains region, and the striking "simplicity" of the original scheme "carried him away", as it did a great many other persons, by its magnificent sweep. It is well, indeed that we have all had opportunity to realize that a project so magnificent in its conception cannot possibly be "simple" in execution, and that wish alone does not make fulfillment possible. This should not make us any less ardent for that which is good in the proposal, or for anything else which may be <u>better than</u> the original proposal.[56]

Foresters' high-modernist impulses had come into conflict with the complex natural and cultural environment of the Great Plains. In the struggle to reconcile statist, professional, and local visions, foresters found the discourse of high-modernism had far less appeal than American populism. Historian Alan Brinkley described the populist discourse as "one of the most powerful impulses of the Great Depression, and of many decades of American life before it: the urge to defend the autonomy of the individual and the independence of the community against encroachments from the modern industrial state." Farmers, local

politicians, and townsfolk on the Great Plains welcomed government money, but they fiercely resisted letting that assistance undermine their independence. From the perspective of planners this resistance threatened both efficiency and effectiveness, and it was only through a long process of discovery that they learned to modify their plans enough to make them palatable to local opinion. By the time they had succeeded in this goal, their plans had lost most of their high-modernist ideals.[57]

The difficulty that early plans had of integrating political, social, and natural factors made latter changes difficult to recognize. President Roosevelt continued to believe that the Forest Service was creating a giant tree-wall across the Plains, and he was poorly prepared to understand why his hopes had gone unrealized. This was partly the Forest Service's fault for being less than candid at critical moments, but it also had a simpler explanation: Roosevelt had neither the time nor the inclination to follow the nuanced history of his own plan. Explaining why the Shelterbelt Project had become the PSFP, why it could not plant a solid wall, and why it planted in different directions was a complicated story. To this technical discussion foresters would also have had to add an explanation of why Plains residents and politicians had reacted in shock to what they perceived as "blueprints, formulas and theories." The compromise program that foresters carried out was not only difficult to explain but could never capture the President's or the public's imagination with the same power as had the early, dramatic plans and maps. Nuance did not sell in public forums.

Although it was easy to criticize foresters' plans, they nevertheless contained a number of valuable ideas. Roberts, Olson, and Zon had been correct in arguing that systematic planting in concentrated areas was the most efficient way to utilize labor and to minimize the amount of land that any one farmer needed to devote to trees. Likewise,

foresters' preference for landownership policies would have given much better long-term protection to the land and public investments in shelterbelts, and community planning represented a more efficient approach to regional problems than individual initiative. Each of these agendas required compromises, however, that most Americans were unwilling to accept. Foresters' large-scale plans never resolved these tensions, but that did not discourage them from focusing their planning on ever-smaller landscapes.

Chapter Five—Notes

[1] James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998), 4.

[2] F. A. Silcox, "To Insure Against Drought, A Vast Plan Takes Shape," *New York Times*, 29 July 1934, sec. 8 p.3; E. L. Perry, "History of the Prairie States Forestry Project," unpublished typescript (United States Forest Service, 1942), 34; "A Plan for immediate Drought Relief and for the Permanent Benefit and Protection of the Great Plains Belt through Extensive Windbreak Planting," 6 June 1934, *Raphael Zon Papers*, Minnesota State Historical Society, Minneapolis, Minnesota (hereafter *Zon Papers*); F. A. Hayes, "Section 3 The Shelterbelt Zone: A Brief Geographic Description," in US Forest Service, Lakes States Experiment Station, *Possibilities of Shelterbelt Planting in the Plains Region* (Washington: GPO, 1935).

[3] Richard White, "Discovering Nature in North America," *Journal of American History* 79 (December 1992): 874-891.

[4] Clayton R. Koppes, "Efficiency/Equity/Esthetics: Towards a Reinterpretation of American Conservation," *Environmental History Review* 11(2) (Summer 1997): 134; Samuel P. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920* (Pittsburg, University of Pittsburg, 1999 [1959]), 69.

[5] Paul H. Roberts, "The Prairie States Forestry Project," unpublished typescript, 66, *Paul H. Robert Papers*, Nebraska State Historical Society, Lincoln, Nebraska (hereafter *Roberts Papers*).

[6] Carlos Bates to Joseph Stoeckeler, 17 November 1934, National Agroforestry Center, Lincoln, Nebraska (hereafter Agroforestry Center).

[7] R. Y. Stuart to Dr. Tugwell, 18 October 1933, Agroforestry Center. The actual map of the plan is found only in *Personal Papers of Franklin D. Roosevelt*; Franklin D. Roosevelt Library, Hyde Park, New York (hereafter *Roosevelt Papers*). The author of the first map and plan is unclear, but it was probably members of the Forest Service's Washington office.

[8] Shelterbelt Map, Agroforestry Center, 1933.

[9] Shelterbelt Map, *Roosevelt Papers*.

[10] Shelterbelt Zone, Agroforestry Center, 1935.

[11] Ibid.

[12] Silcox, "To Insure."

[13] Untitled Map, no date, Regional National Archives, Kansas City, Missouri (RG 95) (hereafter Kansas City Archives). This copy of the map is attached to "Memo. For State Directors," 23 January 1935, Kansas City Archives (RG 95).

[14] Ibid.

[15] "New Release," 17 September 1934, Agroforestry Center. Although at other times Zon had been a supporter of expanding Forest Service conservation programs on the Plains, he argued against the grass belt

idea on the grounds that it would "reduce shelterbelts to a very unimportant activity." More than any other factor, foresters were probably concerned about taking on too many tasks at once.

[16] "Memorandum," 21 December 1934, Kansas City Archives (RG 95); Paul Roberts to Bates, 2 January 1935, Kansas City Archives (RG 95).

[17] "The Shelterbelt Zone," February 1935, Kansas City Archives (RG 95). This is the earliest copy of the zone map that follows the map released in Forest Service, *Possibilities*.

[18] "The Shelterbelt Zone."

[19] Forest Service, *Possibilities*, 11.

[20] Great Plains Agricultural Council Publication No. 16, "The Great Plains Shelterbelt in 1954" (Lincoln, Nebraska: University of Nebraska Experiment Station, 1958), 11; *Congressional Record*, 74th Congress, 2nd Session (1936), 2882.

[21] Created by author.

[22] W. J. Bulow to Roberts, 22 August 1935, Agroforestry Center; *Congressional Record*, 74th Congress, 2nd Session, (1936), 2943; Francis Case to Roberts, 29 July 1941, Kansas City Archives (RG 95); "Shelterbelts in Eastern Colorado," 15 April 1935, Kansas City Archives (RG 95).

[23] Roberts to Raphael Zon, 22 March 1935, Kansas City Archives (RG 95); "Colorado Seeks Shelterbelt," *American Forests*, 41 (April 1935): 186; "Federal Shelterbelt Should Extend to the North Platte Valley Region," *Business Farmer*, 6 December 1934, 1; Perry, "History," 25, *Roberts Papers*; J. A. Hill to Fred Morrell, 9 August 1934, Kansas City Archives (RG 95). There is some disagreement between the figures Paul Roberts gives for the South Dakota petitions and those of Wilmon Droze, *Trees Prairies and People: A History of the Tree Planting in the Plains States* (Denton: Texas Women's University, 1977), 125. Because the various records have moved between archives repeatedly, there is no way to determine Droze's exact source. This author has decided to use Roberts' numbers.

[24] Paula M. Nelson, *The Prairie Winnows out its own: the West River Country of South Dakota in the Years of Depression and Dust* (Iowa City: University of Iowa, 1996), 191; Bradford Knapp to E. A. Sherman, 31 July 1934, Kansas City Archives (RG 95).

[25] Nelson, *The Prairie Winnows*, 191.

[26] I. E. Shirk to F. A. Silcox, 24 July 1934, Kansas City Archives (RG 95); George Frye to R. E. Cobb, 31 December 1934, Kansas City Archives (RG 95); B. A. Kicken to Nebraska Forest Service, 2 January 1935, Kansas City Archives (RG 95), as was typical of the time, Flora's letters are signed Mrs. Boris Kicken after her husband's name. The Forest Service was aware of her recently deceased father's reputation for farming and tree growing on the sandhills and were solicitous; B. A. Kicken to Clayton Watkins, 30 January 1935, Kansas City Archives (RG 95); O. B. Helmer to William Lemke, 20 August 1934, Kansas City Archives (RG 95). The records contain dozens of letters expressing similar wishes.

[27] H. C. Halvorson to F. A. Silcox, 4 April 1934, Kansas City Archives (RG 95); E. J. Gurski to Zon, 10 September 1934, Kansas City Archives (RG 95).

[28] Bates to Zon, 9 January 1935, Zon Papers. "Reasons for the Proposed Location of the Shelterbelt Zone," 31 August 1934, Kansas City Archives (RG 95). The 100-mile width is something of a puzzle. Nowhere has this author found an explanation for it other than that it would allow enough room for 100 strips one mile apart.

[29] Bates to Zon, 9 January 1935, Zon Papers; USDA, *Circular No. 421* (GPO, 1932); "General Shelterbelt Project Research," 15 August 1934, Kansas City Archives (RG 95).

[30] "Reasons for the Proposed Location of the Shelterbelt Zone," 31 August 1934, Kansas City Archives (RG 95); "General Shelterbelt Project Research," 15 August 1934, Kansas City Archives (RG 95).

[31] Alva Simpson, 13 May 1935, Kansas City Archives (RG 95). Simpson's letter is very revealing of all of these arguments. See also Zon, Memorandum, 13 June 1934, *Zon Papers*.

[32] David Kennedy, *Freedom From Fear: The American People in Depression and War, 1929-1945* (New York: Oxford University Press, 1999).

[33] Zon to Roberts, 28 March 1935, Kansas City Archives (RG 95); House Subcommittee of the Committee on Appropriations, Hearings, *Agricultural Department Appropriations Bill, 1937* (1937), 74th Congress, 2nd Session, 784, 790; A. L. Ford to Roberts, 18 May 1937, Kansas City Archives (RG 95).

[34] D. S. Olson, "Memorandum," 14 June 1938, Kansas City Archives (RG 95).

[35] Ibid.; John Emerson to Acting Director, 13 May 1938, Kansas City Archives (RG 95); Roberts to Chief, Forest Service, 8 March 1939, Kansas City Archives (RG 95); George Phillips to Director, 13 April 1939, Kansas City Archives (RG 95).

[36] Roberts to Francis Case, 1 August 1941, Kansas City Archives (RG 95); Roberts to State Director, 1 August 1941, Kansas City Archives (RG 95); USDC, Weather Bureau, *US Meteorological Yearbook* (GPO, 1949), 1.

[37] Edward Munns to Roberts, 22 March 1968, *Roberts Papers*; "A Plan For Immediate Drought Relief," 6 June 1934, Zon Papers; Silcox, "To Insure."

[38] Created by author.

[39] Forest Service, *Possibilities*, 113.

[40] Ibid., 114.

[41] Ibid., 115.

[42] Ibid., 84.

[43] Ibid., 85.

[44] "Section 11—Climatic Characteristics of the Plains Region," Forest Service, *Possibilities*, 83-110.

[45] "Section 12—Soil And Forest Relationships of the Shelter Beltzone," in Forest Service, *Possibilities*, 111-154.

[46] J. H. Howard to F. A. Silcox, 23 July 1934, Kansas City Archives (RG 95). Although Howard's letter was the most humorous, his complaint was common.

[47] H. H. Chapman, "The Shelterbelt Tree Planting Project," *Journal of Forestry*, 32 (November 1934): 801-803; H. H. Chapman, "Digest of Opinions Received on the Shelterbelt Project," *Journal of Forestry*, 32 (December 1934): 952-72; Roberts to State Directors, 23 April 1935, Kansas City Archives (RG 95); Raphael

Zon, "Shelterbelts—Futile Dream or Workable Plan," *Science*, 81 (April 1935): 391-393; G. A. Pearson to Zon, 18 June 1935, Agroforestry Center. See, "Pros and Cons of the Shelterbelt," *American Forests*, 40(11) (November 1934): 528-46, for similar opinions.

[48] House Subcommittee of the Committee on Appropriations, Hearings, *Agricultural Department Appropriations Bill, 1937* (1936), 74th Congress, 2nd Session, 784, 790; Zon to Project Director, 30 January 1935, Kansas City Archives (RG 95).

[49] D. S. Olson to Zon, 28 November 1936, Agroforestry Center.

[50] Ibid. Continuous belts "replaced" the horizontal leg of the ideal "L" shape with the assumption that a long single line would catch most quartering winds. Of course, wind blowing nearly parallel to the belts would be unaffected.

[51] Olson to State Directors, 9 February 1937, Kansas City Archives (RG 95); Olson to State Directors, 25 January 1937, Kansas City Archives (RG 95).

[52] Robert Marshall, *The People's Forests* (Iowa City: University of Iowa, 2003), originally published in 1933, Marshall and Zon worked from Marshall's manuscripts to create the white paper. Zon to Franklin Roosevelt, 20 January 1933, *Zon Papers*; Zon to Gifford Pinchot, 26 January 1933, *Zon Papers*.

[53] L. F. Kniepp to Acting Director, 12 February 1935, Kansas City Archives (RG95); Alva Simpson, "Memorandum for the Acting Director," 13 May 1935, Kansas City Archives (RG 95).

[54] "Protective Forest Belt Planting Project," 13 June 1934, Roberts Papers; "Memorandum for the Forester," 23 May 1935, *Roberts Papers*; Carlos Bates, "Confidential: Memorandum for the Acting Chief, Division of Research," 25 September 1936, Agroforestry Center. Representative John Taber of New York accused the Forest Service of creating the project solely to increase its bureaucratic stature, a charge Earle Clapp strongly denied. See, House Subcommittee on Deficiencies, Committee on Appropriations, Hearings, *Third Deficiencies Appropriation Bill, 1937* (1937), 75th Congress, 1st Session, 451.

[55] Alva Simpson, "Memorandum for the Acting Director," 13 May 1935, Kansas City Archives (RG 95); Perry, "History," 36, 37.

[56] Paul Sutter, *Driven Wild: How the Fight Against Automobiles Launched the Modern Wilderness Movement* (Seattle: University of Washington Press, 2002); Bates to Roberts, 16 January 1935, Kansas City Archives (RG 95).

[57] Alan Brinkley, *Voices of Protest: Huey Long, Father Coughlin and the Great Depression* (New York: Vintage, 1983), ix-xi.

Chapter Six—Forests in Miniature: PSFP technical standards

As foresters began the work of translating plans into trees they confronted a host of technical troubles. Removed from the politics of zone boundaries, belt orientation, and landownership, foresters hoped to apply their scientific expertise on a smaller scale. Just as with large-scale plans, they constructed these as technical problems to be solved through expertise and experiment, but the many difficulties their plans encountered revealed that, even on a miniature scale, science operated within a milieu of competing political, social, and natural forces. Even the most tightly focused silvicultural decisions harbored multiple influences and goals.

Foresters made a series of design compromises to account for this changing milieu. They planned their original belts as wide, "forest-like" structures that mimicked natural conditions. They theorized this would increase the chances of long-term survival and serve a broad range of forestry goals, but replacing farmland with forests was less popular with farmers than foresters. Thus foresters gradually narrowed tree belts. Within the belts foresters had to make further decisions about tree spacing. Foresters viewed this as another compromise between technical ideals and farmer needs, and again they ultimately accommodated farmers. But there also existed considerable scientific and natural uncertainty within these decisions. Foresters could not agree on an ideal spacing, and what seemed ideal in dry years was different from wet years. Foresters also hoped to choose tree species for belts based on technical suitability. For longevity and superior wind deflection, they preferred conifers, but politics and economics forced them instead to rely on cottonwoods. In the long term, the over-reliance on cottonwoods and underutilization of conifers meant less

effective shelterbelts, but in the short term their choices helped get more trees in the ground and increase popular support.

More than farmer resistance changed PSFP technical standards. State extension agents formed a vocal and experienced pool of scientific knowledge on Plains forestry. PSFP personnel repeatedly found extension challenging their judgments on issues such as belt width, row spacing, and species selection. The conflict had both bureaucratic and technical roots. Most extension agents wanted the PSFP to work through their offices, or at least to present them with detailed plans. This would prevent interference between extension and PSFP projects, but it would also give extension greater control over PSFP actions. PSFP work potentially challenged extension's position as the principal supplier of scientific farming knowledge, at least on the subject of tree cultivation, and some extension agents thought that their longer experience with Plains forestry and residents gave them a certain scientific authority. They were therefore frustrated when PSFP planners ignored their advice and research. This was not only a case of hurt feelings. Extension foresters fretted that, by not following their standards, PSFP planners would repeat old mistakes and reduce the effectiveness of plantings. The conflict between extension and PSFP in this case prefigured a much larger struggle between the PSFP and SCS.

When foresters began planning for the Shelterbelt, they had to make choices about belt width and form. Setting aside President Roosevelt's idea of a multi-mile wide belt, the initial plans called for shelterbelts of about 100 feet in width. In the face of extreme skepticism about foresters' ability to grow trees on the Plains, and foresters' own growing realization that this might be no simple task, belts paradoxically grew wider. The theory

behind wide belts was that they would create "forest-like" conditions, or microclimates that facilitated tree growth. This silvicultural ideal neatly merged with other agricultural programs, such as the Agricultural Adjustment Administration, that limited farm production. Thus foresters replaced 100-foot belts with 165-foot belts (Figure 6.1), but creating miniature forests and limiting production was never a popular goal with farmers.

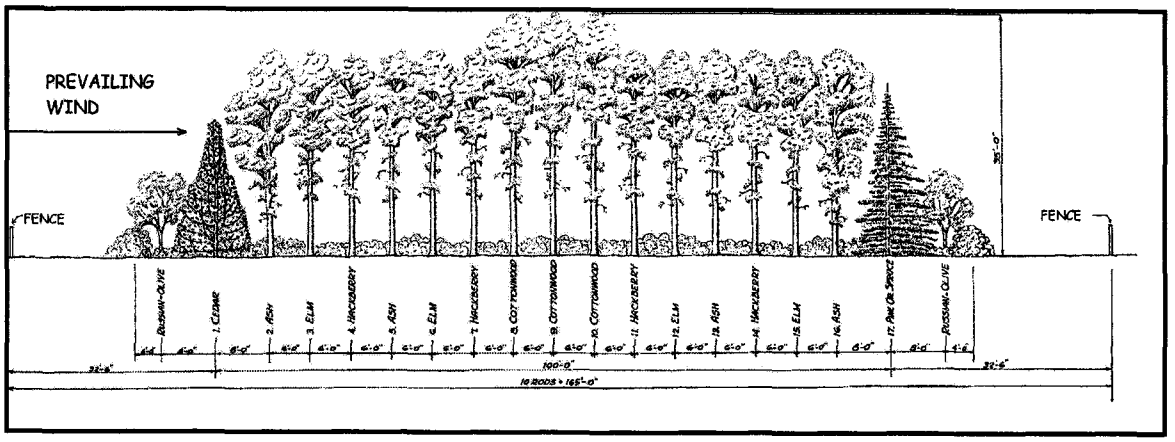

Figure 6.1—A 165-foot wide belt from 1936 creating forest-like conditions.[1]

Creating forest-like conditions within individual belts promised to bring eastern forestry conditions several hundred miles farther west. The underlying theory was that in the first years of a belt's life, it depended like any other row crop on available water. A large amount of this came in the form of showers that were too light to be effective, but these problems might not be permanent. As trees grew, a litter of fallen leaves and twigs formed a spongy duff that absorbed moisture and retarded run-off. When this mulch covered the ground, a canopy of foliage closed protectively overhead, and the sides of the belt grew to shut out wind and light. Forest conditions resulted. In areas only marginally supportive of tree growth, these conditions created an interior climate that was significantly moister. The

closure of the canopy also shaded out weed growth, leaving more of the moisture that entered the belt for trees. D. S. Olson argued that in areas with an annual precipitation of twenty-four inches, 82 percent of the total was lost under open field conditions. Forest-like conditions reduced this loss significantly, and in his estimation made another twelve inches available for tree growth.[2]

For 1935 the Forest Service planted these wide, forest-like belts, but this proved atypical. Initially, foresters were able to choose the most enthusiastic tree farmers to participate. Every county in the Great Plains seemed to have at least one farmer, or more often several, who were supportive of tree planting. They had often worked for years, with relatively little recognition, to grow trees on their property, sometimes making use of Clarke-McNary trees and other times buying them from local nurseries. Letters from such farmers trickled into program headquarters in 1934 and 1935, and while many were from outside the zone, enough were from nearby farmers to give the foresters a pool of zealous candidates for the first year's very wide belts. Unfortunately, these farmers were always a small minority, and given their limited geographical reach, foresters quickly exhausted such farms.[3]

The first year foresters also had the luxury of offering payments for the land. The severe economic and natural conditions of the Dust Bowl and Great Depression made giving up a small portion of one's land in return for even a small, but steady, payment appealing. The Department of Agriculture justified this policy on the grounds that it would help protect the belts and act as a form of assistance. However, such a plan had serious drawbacks. First, the funds were coming from the President's emergency relief money, and the Budget Office raised serious objections about using relief funds to make lease payments. As it became clear that the project would continue to operate on relief funds for the foreseeable future, further

lease payments were impossible. In their search for funding foresters also began to realize that Congress wanted farmers contributing to the program in some substantial manner. One of the most obvious ways farmers could was to provide the land for shelterbelts. After all, the belts were nominally designed to assist the farmer and improve conditions. Therefore, as the Shelterbelt became the PSFP and began promoting its cooperative nature, it was difficult for foresters to maintain even a minimal leasing policy.

By 1936 the wide belt policy was running into significant opposition because many farmers objected to sacrificing large portions of their land to tree production. Farmer pressure was sufficient in states such as Kansas that field workers began to "favor hedge rows and narrow shelterbelts as a substitute for the wide belts as originally conceived and planted up to the present time." Workers made these compromises in a deliberate effort to encourage greater participation. Farther north in Nebraska, field workers tried to maintain the wide belt policy, but under the new working conditions of 1936 they had abandoned the Broken Bow headquarters because of a lack of farmer demand. Clayton Watkins, the state director, explained that the lack of interest was "due to the fact that last year we leased land and fenced it at Government expense, and this year we were able to do neither." To keep the project going, Clayton had moved work to the Stapleton area where several landowners had petitioned for belts. Field administrators were still finding land to plant in 1936, but not without difficulty and one of the simplest inexpensive steps to increase farmer participation was narrower belts.[4]

Foresters initially advocated wide belts as a technical adaptation to Plains conditions, but upon closer examination some began to question the wisdom of wide belts. The ever-opinionated Carlos Bates outlined the many technical failings in September 1936. Bates

explained that "elaborate plans which have been made for wide, self-protecting shelterbelts ... have had in view the most difficult conditions for tree growth." Wide belts increased the cost of planting "without furnishing protection to any large proportion of the land, it being admitted that at least four belts per mile would be necessary to give even the minimum of protection to all the land." Bates suggested planting much narrower areas on favorable locations. From the standpoint of protecting adjacent fields, belts that were two- to five-rows deep were every bit as effective as a much wider belt. If narrower belts jeopardized the chances of successful growth, then plantings should be concentrated on more favorable soils and in the eastern portion of the zone. Although Bates, was still struggling with the dilemma of whether such narrow plantings represented true "forestry," or simply soil conservation, he could no longer justify wide belts as technically necessary.[5]

The breakdown in technical agreement allowed Roberts to urge a new policy of narrower plantings. The primary advantage of wide belts had been their ability to create forest-like conditions, but this seemed unnecessary on higher value, higher rainfall lands on the eastern edge of the zone. As the architect of the forest-like conditions theory and the project's chief field technical advisor, Olson was the most significant target for Robert's campaign to change the standards. Roberts began by explaining to Olson that "at least consideration should be given to the question of whether it is desirable on the more valuable lands to take as much as a 10-rod strip per section out of commodity crop production, and devote it to tree growth unless we are in a position to show definitely that the benefits gained thereby are economically justifiable." Roberts was well aware that Olson could not provide any such direct economic justification. Lest Olson misunderstand what was at stake, Roberts reminded him that "as a matter of fact the 10-rod standard width of shelterbelts is one of the

primary things which is in the way of getting good concentration of planting in many areas at the present time, because many farmers object to the wide belts." Roberts offered Olson the carrot of "concentrated plantings" with the stick of farmer objections.[6]

Roberts also had to convince Zon to accept a narrower belt policy, or at least persuade him not to object strenuously if field personnel displayed flexibility. Roberts began by pointing out the many difficulties that field personnel were having obtaining farmer cooperation under the new donation policy. He then explained that from a field protective standpoint one-to-three row belts worked fine. Accurately judging Zon's attitude, however, Roberts then explained that the PSFP would be "justified in planting belts at least five rods wide through their combined value as field protective belts, wood supply, bird sanctuaries, and recreational areas." Thus, despite being the one arguing for narrower belts, Roberts had put himself in favor of a "compromise" solution that would "in part [meet] the wishes of the farmers and yet maintain sufficient width to bear some resemblance to a forest—and forestry." Roberts' arguments proved persuasive to Zon, who by that time had already moved to other projects. Zon even sent his own letter to Olson urging a reduction in widths and a more flexible approach to "the encouragement of more numerous narrow belts."[7]

A strange thing happened when Olson defended his wide belt policy: instead of justifying wide belts as necessary technical adaptations, he explained them as bureaucratic and social decisions. Zon had suggested that Olson show more flexibility in planning options, including using narrow 3-row belts. Olson countered that "if the program is to be handled by the Forest Service, the work should have some semblance of forestry. ... I doubt if planting hedge rows can be accepted by the public or profession as forestry." In Olson's estimation, three-row belts were really "hedge rows" and should be planted by farmers. Foresters planted

forests, not hedges. Instead, Olson "suggested five to seven-rod belts because I felt that it was administratively necessary to plant as near like a forest on each farm as was economically justified." He admitted that wide planting could not be "justified on the major point of protection against wind erosion, but it is possibly justified because of its additional benefits in supplying wood products and increased social values." Following the thinking of foresters for generations, Olson also alluded to the long-debated climatic effects of trees, suggesting that "the wider belts are also justified for the benefits that wide belts may give which cannot now be recognized because of lack of factual data, but which we hope will come later into the picture." He admitted that it was "inadvisable to give these possibilities any place in our publicized objectives," but social and climatic impacts were intrinsic to his justifications.[8]

According to Olson, one of the most important functions of the belts was to "demonstrate the value of trees to the farm economy and the social security of the region." Olson hoped that wide belts would appeal to farmers as woodlots, even if they were skeptical about reducing wind erosion. The forest-like conditions within the wide belts would also create new wildlife sanctuaries. Habitat once limited to riparian corridors would spread over the uplands, offering shelter to songbirds, deer, pheasants, and other animals. Most importantly of all, project officials wanted to demonstrate that trees would grow. Wide belts abetted this goal by hiding, or making irrelevant, planting failures. It was not uncommon to have one or two rows within a belt partially or completely fail. According to Olson, "had the farmers planted hedge rows or two-to three-row belts at this stage of the Project and encountered these row losses, there would have been much disappointment, and skepticism toward our ability to establish successful shelterbelts." Wide belts, except under extreme conditions, presented a full and successful appearance even while containing failures.[9]

Despite all of Olson's arguments, the pressure to narrow belt width was irresistible. Most of the 1935 and 1936 plantings were 165 feet wide with many narrowly spaced rows. By 1937 the standard width was 7-rods, or closer to 110 feet, and about 10-rows wide. However, the retreat from the original standard opened the door to further revisions, and state directors and field personnel often followed a flexible approach. They would start negotiations by encouraging farmers to plant at least a full 7-rod belt, but would then consider reducing the width if conditions warranted. Under this approach plantings often had seven, or even five, rows. In some cases the 10-row standard belt was only a 9-row belt "so that one could start cultivating on one buffer strip and go around each row and the last buffer strip and wind up at the same end of the belt where he started." Although Roberts had been a forceful advocate of narrowing belt width, he was also a staunch supporter of centralized control and maintaining standards, and he found field personnel's display of flexibility disturbing.[10]

To restore order, Roberts and Olson ordered field workers to follow the 7-rod standard. In a shrill memorandum to state directors in 1938, Roberts scolded them for their "violation and disregard of standards." What field personnel viewed as a flexible approach, Roberts saw as "a more or less passive attitude on the part of the State Offices in following up the standards in the field." In Roberts' opinion this indicated "taking the course of least resistance and [an] inability of administrative personnel to handle their assignment." If "these standards do not agree with the wishes of the cooperators," he admonished "it is your job to sell him on our standards, rather than the other way around." Olson also worried about the gradual drift from standards, and warned the state directors "it is human nature to meet any rule or standard with a claim for exception. If we can hold our ground at the start, as I believe

we can, only the first few days will be difficult." Foresters were not planting belts to make farmers happy, but rather "for the very definite purpose of protecting fields from wind erosion." Olson saw no contradiction between enticing farmers with wide belts' multiple benefits and then insisting that shelterbelts were solely for wind erosion.[11]

Olson understood that farmer resistance was driving the project towards accepting narrower belts, and he continued to resist such a move. When Roberts returned from an inspection tour of Kansas in the summer of 1938, he warned Olson that the Kansas foresters and farmers were still unhappy with the width standards. In response Olson prepared a new policy statement on belt width that allowed for significant width reductions on intermediate and "small farm" belts. He held firm at 7-rods for most belts however. Olson defended the wide standard on the grounds that "Timber Management's [Olson's office] main concern has been in developing simple standards that would be more or less fool-proof to the relief roller type of men and inexperienced foresters." He also suggested that "the claim of Kansas that the land is too valuable for crop production to release four to five percent for trees" was unreasonable. Olson noted that a "great percent of Kansas wheat land is speculatively grown in wheat by business men of the towns," and he agued that wide shelterbelts were really a form of "crop acreage retirement." None of these insights were entirely new, nor for that matter were they particularly persuasive to Kansas farmers. They did illustrate how far Olson had come from supporting wide belts as a technical necessity. Wide belts increasingly reflected Olson's social goals, not a technical adaptation to harsh conditions.[12]

All of Olson's arguments could not make wide belts popular with farmers. To limit some criticism Roberts adopted a policy of speaking of belts in row numbers, not rods. Accordingly, the "standard basic belt will be comprised of 10 rows in all States," but field

personnel would be allowed to adopt either 10 or 8 foot spacing between rows. In theory this would reduce the focus on belt width, and allow field personnel to slim belts using narrower spacing. In announcing the policy, Roberts reminded field workers that, "from an administrative point of view, we are still in the demonstrational stage and must play safe. It is far better to find years hence that we planted more trees than were necessary than too few to make work effective." While logical from Roberts' perspective, the counter argument—that planting too many trees would make the work less effective—was also a distinct possibility.[13]

The logic of reducing belt width to meet farmer demands eventually proved stronger than administrative standards or silvicultural ideals. John Emerson, the Nebraska State Director, later explained that the width of early belts was "extreme" and "took too much land out of production." During his time as state director he faced "considerable resistance to our seven rod wide belts because farmers are reluctant to divert so much land to trees." In many planting districts Emerson saw little "social" justification for shelterbelt plantings since "a great many farms have some waste land along a creek or other drainage in natural timber. Wild plums and some other fruits are abundant and the fire wood supply will normally be available from a sources aside from the field shelterbelt." If wide shelterbelts offered few social advantages, and neither grew better nor protected more soil than narrow ones, then Emerson saw little reason to plant them. He was "beginning to wonder if we are justified in demanding strict adherence to our seven rod wide standard." Finally, he warned Roberts that "I am confident the Pierce District has potentialities for planting 300 to 400 miles of five rod wide shelterbelts in 1939, but I am not prepared to estimate what may be the result if we adhere to our present requirements for seven rod wide belts."[14]

Emerson was not alone in his desire to see belt widths narrow. In 1940, the Kansas State office of the PSFP conducted a survey that asked field crews to outline the reasons for local resistance to shelterbelts. Donald Duncan from the Meade area explained that farmers there "cannot give up that much land for trees." Robert Dellberg of Kingman clarified that farmers objected to wide belts and that "this is particularly true on the eastern half of the district, although all the owners of the better farm land object to the wide belt." Carl Hawkes of Pratt, added that farmers in his section believed that "fourteen acres of land still seems like a lot of land to be out of production." When the state office tabulated the results, they found that the loss of land topped the list of farmer concerns, beating out absentee ownership, unwillingness to fence, and lack of moisture—the other top complaints—by a considerable margin. With such overpowering evidence in hand, the Kansas State Director argued for a further narrowing, to perhaps as low as one or three rows at more frequent intervals.[15]

Although it was not a common occurrence during the 1930s—at least according to the existing records—there was the potential that farmers might carry out the desired narrowing themselves. Once the PSFP adopted a cooperative model it lost control over the trees, and there was nothing to stop farmers from plowing under "extra" rows. In Kearney County, Nebraska the PSFP planted a 14-row belt with 10 foot spacing on the land of Julius Hansen. He kept the rows cultivated through the first summer, and "it was considered as one of the best plantings in Kearney County, in growth and survival." When the local PSFP representative next visited Hansen's farm, however, he found that the 14-row belt had become a 6-row belt. Hanson had plowed up eight rows of trees, and made it clear to the forester that he wanted the belt left that way. Hansen's experience was likely not unique, and

many belts that were recorded as "failures" or "partial failures" in the PSFP files were probably the victims of farmer modification.[16]

The logic of planting wide forest-like shelterbelts was always open to more interpretations than foresters had initially imagined. Olson planned for wide forest-like belts to help increase interior moisture conditions, but in defending the decision he relied on social goals, even if he cautioned against too heavy a reliance on them. Roberts always saw belt width as primarily a political consideration. If belts were too wide, then farmers would never voluntarily cooperate; if belts were too narrow, then the PSFP would lose its connection to forestry. The more their plans for shelterbelt width incorporated social, political, and technical considerations, the less attention foresters paid to nature. Foresters were involved in fundamental manipulations of nature on the Plains, yet their plans assumed a static nature which even the most cursory examination belied. When foresters planned their wide, moisture saving belts, they assumed the belts would shelter farms facing the same natural conditions. However, as rainfall began to increase in the 1940s, soil erosion declined, land values swelled, and many farmers found themselves the owners of what, by almost any standard, appeared excessively wide belts. Foresters, of course, defended wide belts as necessary for the eventual return of drier conditions, but such a claim continued to be problematic on several levels. On areas of favorable soil and ground water, the trees, once established, could fend for themselves even during dry years. On less favorable soils, the trees would gradually use the subsurface moisture and begin to die from competition and a lack of soil moisture, irrespective of forest-like conditions. Besides, farming was a business that rewarded those who took advantage of the good times, not those who waited for the bad. A slight increase in production when prices were low was worth far less than a substantial

increase in production when prices were high. For all of these reasons, wide belts proved one of the PSFP's most problematic legacies.

Row spacing, another significant element of belt design, also harbored both long and short-term problems. Row spacing was the distance between rows of trees within a belt. Like belt width, it began as a silvicultural ideal but soon became a hybrid of technical and social needs. Leaning on research done at the Mandan, North Dakota experiment station by Ernest George, Edward Munns and Olson promoted a "hip-roofed" belt design that featured low shrubs on the outsides and progressively taller trees towards the middle. Ideally this created an arboreal A-frame. Foresters theorized that belts with this shape would act as a sort of wind-wedge, gradually pushing low-lying winds upwards.

Although the aerodynamic advantages of the "hip-roofed" design were doubtful, the design was attractive from a silvicultural perspective. The dense belts would capture blowing snow and thereby increase springtime moisture. Belts composed of diverse species would also provide home and food for wildlife. The low growing, dense shrubs on the outside prevented light from reaching the interior and encouraging weed growth. Most important, the trees growing in the center would receive the greatest protection and achieve the greatest possible height. However, the taller, larger trees towards the center needed to be spaced farther apart to allow more growing room, while the shrubs and smaller trees were spaced closer to encourage a closure of the canopy and forest-like conditions. From a silvicultural perspective the ideal belt had many rows with variable spacing.[17]

Unfortunately, these laboratory ideals ran into immediate problems in the field. Farmers liked the idea of a closed canopy, thereby ending their cultivation duties, but they

opposed close or variable spacing. As a part of their cooperation with the project, farmers harrowed or plowed between the rows several times each year to eliminate weed growth, but farmers could not cultivate narrow rows with their regular equipment, and they did not want to make special alterations to accommodate foresters. Recognizing the gravity of the situation, Roberts began lobbying Zon to change standards. Roberts warned Zon that "spacing between the rows has caused more controversy from the field than any other point." Roberts agreed that the six to eight foot spacing used in 1935 and 1936 was close to ideal, but "as long as we cannot definitely plan that the Forest Service will do the cultivation, but on the contrary must depend upon the farmer's help, we will have to meet his demands to some extent." Further confusing the matter, different states had different types of equipment. Thus "Kansas wants to go to twelve-foot spacing because it is claimed 'practically all' tillage machinery on the farms we are planting is ten-foot width." Zon, Olson, and Bates resisted widening row spacing on the grounds that this would make creating "forest-like" conditions difficult. Instead they hoped for a compromise whereby farmers would modify or buy the right equipment and foresters would avoid narrow spacing.[18]

Asking farmers to buy new equipment in the midst of the Great Depression to cultivate trees was doomed from the start. The only real alternative for Roberts was to create a compromise standard. A. L. Ford, the South Dakota State Director, warned Roberts that "under the present depressed financial conditions, it would be decidedly unwise, we think, to require the cooperators to purchase special tools to fit Lake States spacing." As a practical matter Ford wanted "to space the trees to fit the tools," even if it meant facing down "rather stubborn opposition on the part of the research people." Other state directors and county extension agents also put Roberts "under terrific pressure ... to increase the spacing." In

consultation with Olson, Roberts agreed to adopt ten foot spacing between all rows as the new standard. John Emerson in later years lamented that this was "a little wider than we probably would recommend if only technical considerations were involved, but cultivation of the trees devolves upon the farmer and spacing must accommodate common farm cultivation machinery." Although social considerations were the immediate issue, in later years environmental contingencies also exposed problems with spacing. In some cases ten foot spacing was too narrow because of increased competition between trees as they matured. The tall, water-loving cottonwoods, most commonly planted in the center rows, would in drier soils die out as a result of competition from nearby rows. Ten-foot spacing was thus a "compromise" between what some foresters thought were the "safe limits of good forestry practice" and "the wishes of the farmers," but this was in fact only one of several critical factors.[19]

Row spacing was not the only compromise foresters would have to make. Like other facets of the project, technical guidelines developed for the selection of tree types contained multiple goals. Foresters chose between types based on silvicultural principles such as hardiness, habitat, and longevity, but they also made compromises based on availability and "flashiness." Foresters used this term to describe fast growing trees, such as cottonwoods, which impressed farmers and generated early community interest in tree planting by rapidly creating an image of success. Foresters also preferred cottonwoods because they were one of tallest species available and could be collected free from riverbeds. Conifers were another popular choice because of their long-lived nature and year-around protection. Unlike cottonwoods, however, conifers were slow growing, difficult to cultivate, and not available in

large numbers. For all these reasons foresters tended to over-use cottonwoods and under-use conifers despite the admitted silvicultural advantages of the latter. Foresters also experimented with exotic species, some of which seemed to promise a proverbial "silver bullet" solution for Plains tree planting. Foresters reasoned that if the available choices, such as cottonwood and conifers, offered unpleasant compromises, then perhaps an exotic would offer the traits they sought. With tight planting deadlines, however, foresters did their experimentation with exotics in the field and often produced unexpected results.

Of the native species, cottonwood was the most popular because it was available as a seedling from North Dakota to Texas. Pulled cottonwood species had been the basis of Plains forestry efforts since the period when farmers had tried to fulfill the requirements of the Timber Culture Act. This long history reassured foresters that they could grow cottonwoods in a variety of locations and soils. Cottonwood seedlings grew wild on the sandbanks of most Midwestern rivers, and foresters hired crews of relief workers to pull these "wildings." In late winter or early spring, foresters searched local rivers for natural cottonwood nurseries. These were usually large, newly formed sandbars covered with thousands of similar age trees. Relief workers used steel hoops from old wagon wheels to pull the "wildlings" by holding the top of the seedling firmly clamped to the wheel and gently rolling it until the seedling was pulled from its roots. With little effort foresters could transform first nature into bundles of seedlings ready to create second nature. For the 1935 plantings this was a critical advantage because there were not enough seedlings available through other sources for extensive plantings.[20]

Cottonwoods also had the distinct advantage of being flashy, and this trait was particularly important to early planting efforts. A common criticism of the Shelterbelt Project

was that trees would not grow in the proposed zone (Chapter Four), and the leafy shade of a fast growing cottonwood was one of the quickest ways to dispel such criticism. By 1937 cottonwoods planted in 1935 were already taller than a man. Newspapers emphasized this point by showing pictures of smiling farmers amidst their cottonwood-dominated shelterbelts. An article from the *Christian Science Monitor* in November 1937, had three photographs running down the center. The top showed three men standing silhouetted against a dust filled sky, surrounded by blow-sand and weeds. The next photo was from the same site, seventeen months later showing a farmer standing between leafy rows of cottonwood trees that reached well above his head. The final picture featured a crew of relief workers planting another shelterbelt. Variations on this theme appeared in other papers. The flashy cottonwood had done its work with spectacular results, proving that trees would grow on the Great Plains.[21]

The next question that foresters faced was how long those trees would grow. Foresters had overused cottonwood. In 1936, Harold Engstrom had begun warning his fellow foresters about over-reliance on cottonwood. He admitted that "during the early life of a shelterbelt it [cottonwood] stimulates interest in the plantation because of its habit of rapid and vigorous growth." But he cautioned that "the slower growing and less showy species may ultimately be of greater value." The cottonwood was fast-growing, but it was also short-lived. On deep sandy soil, or in areas with a shallow water table, the cottonwood's longevity was comparable to other broadleaf species, but on less favorable sites it was often the first to die. According to Engstrom, "therein lies the danger in its indiscriminate planting," for "nothing lowers a farmer's interest in a plantation more than having even part of the trees of which it is composed die at an early age." Choices about trees had to consider both short- and

long-term goals. The heavy use of cottonwoods had resulted in a media victory for the PSFP, but what foresters began to call the "cottonwood problem" also threatened eventually to reinforce the very claim it was intended to refute.[22]

As with so many other compromises, deciding on whether to continue planting cottonwoods presented unpalatable choices. Not only were cottonwoods flashy, but they were also cheap to harvest as seedlings and tall, when they survived. Foresters had no ideal replacement for the troublesome cottonwood, so they continued to use it but compensate by developing new planting guidelines. The problem with developing new guidelines, however, was that there was no real agreement about what represented safe conditions. Olson suggested limiting cottonwoods to bottomlands or sites where the water table or runoff increased the moisture supply. John Emerson continued to recommend cottonwoods for Nebraska but left open the option of using Chinese elms instead. Farther south, Engstrom wanted to use cottonwood only on sandy soils, reserving American elms for heavy bottomland soils. In the Dakotas, foresters also tried to limit cottonwood planting to bottomland or sandy soils, but they continued to rely on it widely because of the ease of gathering seedlings.[23]

By developing cottonwood guidelines while still planting, foresters had in effect created the largest cottonwood experiment in history. Although they would spend years arguing over the final results, it was clear by 1940 that cottonwood guidelines had mixed success. In Oklahoma, Texas, and, to a lesser extent, Kansas, foresters concluded that the 1936, 1937 and 1938 plantings had "erred in early judgment of what constituted a cottonwood site." But hope sprang eternal, and for "1939 this situation was largely corrected, and this year [1940] cottonwood planting will be even more rigidly limited." This proved a

bit premature since cottonwoods often looked splendid after the first couple years. It was actually during the next few years that problems appeared.[24]

At its root, the cottonwood problem required a technical solution. Foresters had recommended, and continued to use, cottonwoods primarily for political and economic reasons, but they still needed to develop technical guidelines to support their choices. Foresters argued about what exactly constituted a "cottonwood site," one group "contending that a high water table is essential, the other maintaining that a deep, sandy soil without a high water table will support cottonwood." The high-water-table supporters pointed out that cottonwoods were typically planted in the center of a shelterbelt and thus were "locked in" on both sides and faced competition from more drought-hardy species. They contended that using cottonwoods required a change in site selection guidelines and probably a modification in belt design. The sandy-soil supporters based their arguments on the historic success of cottonwoods in sandy soils since at least the Timber Culture Act. There was no absolute answer available to either group, however. The experiments continued, and in the meantime failed seedlings "created an enormous repair job in those plantings, one which will require our best efforts to solve." Deciding upon cottonwood guidelines for the Great Plains was like trying to hit a moving target: the zone of sufficient moisture kept shifting, and foresters would only learn years later whether they had hit or missed.[25]

The results of cottonwood die-off could be dramatic, and correcting the problem time-consuming. Cottonwood had formed the center of the wide belt policy because of its availability and growth characteristics. Foresters had often planted several rows of the species, but when most cottonwoods in one of these belts died they left "a 58-foot space through the middle of the strip." The plantings might otherwise be in "excellent care, all rows

except the cottonwood having been clean cultivated this last season," but down the center ran rows of broken skeletons. Such a failure created particular concerns when they were close to local highways. Foresters were left wondering whether to "clean out all the cottonwood including the few trees that are alive and plow up and replant the gap or should we merely go in and underplant, leaving the dead trees stand?" If foresters decided to replant, they still had to decide whether to cover the gap quickly with rapid growing species, such as Chinese elm and black locust, or to try slower growing but more "ideal" species such as cedar. Or, if one of the remaining sides was in acceptable condition, foresters might remove the other half and leave a much narrower shelterbelt. The cottonwood problem was revealing that there was much more to planting shelterbelts than getting a high initial survival rate. Shelterbelts could involve considerable maintenance.[26]

The purported political and social advantages of cottonwood had turned from a blessing to a curse, and Roberts—ever conscious of political repercussions—recognized the change. Although earlier a supporter of cottonwoods, by 1940 he warned Olson that he was "opposed to the use of cottonwood on anything except sites where we can reasonably expect cottonwood to reach a satisfactory state of development and have a life of probably a minimum of 30 years." This seemed a reasonable conclusion, one which Olson would fully approve, but Roberts added that he did "not believe we should compromise sound, technical practices to administrative exigencies where we can avoid doing so, and on this basis I am opposed to the use of cottonwood as a so-called 'propaganda' tree to encourage interest and care by farmers." Coming from Roberts, this was quite a leap. In 1936 he had argued that "the cottonwood's rapid growth generates just the sort of interest we need if we are ever to

refute the doubters." He, like the rest of the PSFP, had benefited enormously from the positive publicity that cottonwood created.[27]

As the project's chief silviculturalist, Olson made the final decisions about how to deal with the cottonwood problem. He chose to defend the species, and continue recommending its use "because the species is so highly desirable for our program where it can be successfully grown." Instead of blaming the cottonwood, Olson argued that the failures were an "early indicator of the difficult conditions under which all tress are attempting to maintain themselves." He believed that the "unusually dry spell" explained "why we have been unable to establish cottonwood where evidence on the ground shows this species thrived before." The question for Olson then became whether he "should accept the present situation as the new normal or recognize it as an extreme condition not likely to reappear in the comparatively short rotation of shelterbelt plantations." Answering this question had implications for more than just cottonwood planting. If the weather was taken as the "new normal," then Olson foresaw "the reclassification of the old zone into submarginal farm land and the question of feasibility of shelterbelt protection for such submarginal crop land." However, Olson's explanation failed to account for the thousands of other trees that had thrived under "new normal" conditions. The simplest answer was still the best: "due to the popularity of the cottonwood for its quick showing, to some extent because of shortages in other species, and for other reasons, its use has in a good many cases been extended far beyond the feasible classification for this species."[28]

Foresters also had to struggle with complex choices over whether to use conifers in their plantings. Unlike cottonwood, conifers were long-lived and maintained foliage

throughout the year, an important consideration for a windbreak. Foresters commonly used blue spruce, red cedar, ponderosa pine, and Austrian pine in their shelterbelts. Even after belts narrowed to 10-rows, they still called for one or two rows of conifers on the windward side. Despite their substantial advantages, conifers were difficult to use. In the 1935 plantings, a large number of the red cedar was "wilding" stock. This had such a poor survival rate that foresters abandoned the practice almost immediately, relying instead on nursery-raised seedlings. These proved more reliable but required more labor and more time in the nursery than deciduous trees. The greatest barrier to increased conifers use, however, was that they did not provide the rapid visible growth of deciduous trees such as cottonwood. Red cedar seedlings looked like little more than a weed after a year—not a bold statement of trees conquering the Plains. Thus, even though in the long term conifers were a better choice for most shelterbelts, politics and economics dictated a reliance on faster growing shorter living species.[29]

The political and economic liabilities of conifers also made it difficult to experiment with very narrow belts. Ultimately, they resulted in helping sustain the wide-belt, many-row theory of planting. The dense structure and year-around foliage of conifers made them ideal for one- or two-row shelterbelts. Most foresters doubted that narrow deciduous belts would be as effective since wind poured through gaps making the belt almost useless once trees lost their leaves. But instead of favoring narrow conifer plantings, foresters reasoned that "two rows of conifers are needed to get a dense year-long wind protective barrier, and these become the permanent part of the planting for wind erosion protection." These two rows needed a row of shrubs to protect them until established. "But because these necessary rows of conifers are so slow growing that it would be years before they became effective and made

an encouraging showing to the farmer, the faster growing hardwoods must be planted." Foresters also wanted "at least two rows of high trees" and "sufficient rows of intermediates to give wind resistance during all seasons of the year until the conifers have become established." They hesitated to rely solely on conifers, so they added yet another row or two to resolve the permanence and permeability issues of pure deciduous windbreaks. Foresters' institutional and political goals had once again shaped their shelterbelt plans.[30]

Olson was the only forester to raise a sustained and significant objection to what he called "over-reliance" on deciduous trees. Beginning in 1936 he berated Zon for "moving away from their [conifer] heavy use." Olson wanted standards that required several rows of conifers in all belts. He argued that only conifers would achieve the goal of "permanency in farm plantings," and only conifers would provide much needed winter protection. This was not an idle concern in the winter of 1936 because "right now the soil is blowing at a terrific pace from Nebraska north, and the leafless hardwood belts do not seem adequate protection." He also worried that it would be difficult to justify the large expense of planting and maintaining a shelterbelt if it only offered protection for a few decades. In theory, conifers would last several times as long as a deciduous belt, and the initial cost could be spread over more years.[31]

In what was a common pattern for the PSFP, events in the field made Olson's theories moot, and conifers always formed only a small portion of plantings. Work at the Bessey Nursery on the Nebraska National Forest had increased foresters' ability to raise conifer seedlings—especially the difficult red cedar—but the process remained slow and difficult to replicate at other nurseries with untrained relief labor (Chapter Two). D. S. Gross, on an inspection of plantings in 1936, explained that in many early plantings "practically all the

conifer rows were left blank for future planting" because of insufficient seedlings. The premium on conifer seedlings meant that the hoped-for replacement plantings rarely took place. Gross warned that in "many cases these blank rows are now being filled with hardwoods since the conifers of planting size are still not available." In the Northern Plains states the problem was slightly different. Foresters had to experiment with a variety of species and methods just to establish conifers as a part of their belts. Pine, the fastest growing conifer, did poorly during the cold winters, so foresters tried protective cover such as sorghum or other crops which they grew around the conifers late in the season. Eventually, both F. E. Cobb and Olson came to favor spruce in North Dakota to the exclusion of most other conifer species. This was one of the slowest growing varieties, however, and foresters relied heavily on deciduous trees to make up for spruce's failings.[32]

It was doubtful that foresters could have initiated the Shelterbelt on such a grand scale if they had insisted on using conifers, but from a purely technical standpoint, such a decision would have resulted in narrower and more permanent belts. Given that these two issues—longevity and width—would be the program's most frequent post-mortem criticisms, depending on deciduous trees became a liability. This was not simply a failing of foresters; it also represented a failure in the way Americans approached conservation decisions. Everyone from farmers to news editors, foresters, and President Roosevelt desired immediate, visible results, and they were impatient with solutions that required careful explanation and years of preparation. Foresters made choices in favor of flashy trees because they were under pressure from Congress, the President, and the public to show immediate results. The pressure to show immediate results was a powerful goad when combined with

foresters' own enthusiasm and sense of technical mastery. It caused continual difficulties with species selection.

The Shelterbelt's early plans called for the use of hardy native species such as cottonwood and red cedar, but foresters attempted to improve upon nature and experimented with exotic, non-native species as well. Foresters used fast-growing caragana, Russian olive, and Chinese elm extensively, but the caragana and Russian olive, while "flashy in early life," did not endure the vicissitudes of the Plains as well as native species. The caragana, also called the Siberian pea-tree, produced a multitude of pea-shaped pods filled with edible pea-like seeds. Unfortunately, few animals or humans on the Plains had adapted to take advantage of this yearly windfall, and the tree's weeping form made it vulnerable to heavy snow and ice. The tree eventually found favor in urban gardens, where its form, nitrogen fixing qualities, and small size were more appreciated. Americans had experimented with Russian olive since at least the 1830s, but even a century later there had been little systematic study of the tree. Foresters with the PSFP chose to experiment with Russian olive because of its reputation for drought hardiness, ability to grow on poor soils (like caragana it was also a nitrogen fixer), and promise as a compact, fruit-producing shrub. To their surprise they found that Russian olive was really more of a tree and would quickly overshadow and suppress nearby rows. Its large and sharp thorns made trimming painful work. If it did not succeed in suppressing its neighbors, the Russian olive frequently died. Despite these setbacks, the Russian olive survived well enough to spread from many PSFP shelterbelts and across the Plains, where it is now considered an invasive weed.[33]

Of all the exotics foresters experimented with, the Chinese elm seemed closest to providing a "silver-bullet." The tree was easy to cultivate and grew quickly and vigorously,

giving the cottonwood competition. It was also drought resistant, dense, and relatively tall. According to Engstrom, "the success of this species has done much to spread the shelterbelt gospel among the great plains farmers." Foresters widely recommend the tree and it became a favorite of both farmers and foresters in the Central and Southern Plains states. Not until 1940 did Chinese elm's fatal flaw reveal itself. A cold front hit the Southern Plains on November 13-14, with temperatures hovering at 0° F. This was the first cold snap of the winter, and the trees had yet to harden. The extreme cold killed most of the Chinese elm in Kansas in what Olson described as the "Chinese elm freeze." The damage was less severe to the south, but as with the cottonwood problem, fixing the damage presented an enormous task.[34]

Although the Chinese elm freeze surprised foresters, there was ample evidence available in Kansas that the tree was near its climatic limit. The Fort Hays branch of the state experiment station had planted the first Chinese elm in the state in 1913. The tree was one of two obtained from China, and its rapid growth made it popular with the experiment station, which propagated thousands of seedlings from this one parent and planted them throughout the state. On March 26, 1931, however, a severe blizzard struck Kansas, killing thousands of Chinese elms and leaving the rest severely damaged. The November 1940 freeze finished off "practically all Station Chinese elm over 16 inches in diameter," damaged most other young trees, and killed the old 1913 tree "except for one branch on the north side." The Fort Hays experiment station had a wealth of information on Plains tree culture, not only about Chinese elm, but the Forest Service rarely made full use of extension. The freeze of 1931 and forester's surprise at the results of the 1940 freeze served as an example of this compartmentalization.[35]

The 1940 freeze served as a synecdoche of broader bureaucratic divisions. Foresters believed they did a relatively good job of working with other agencies concerned with forestry on the Plains, but the relationship was never trouble free. Forest Service personnel tended to view their expertise as superior, and they rarely paid more than lip service to outsiders. One of the largest sources of forestry knowledge outside the Forest Service, extension foresters, had been prominent among the Shelterbelt's early critics. They generally supported a federal tree-planting program on the Plains, but they regarded early proposals as unrealistic, even dangerous, to the status of forestry as a profession. As the Shelterbelt lost its wilder elements and evolved into the PSFP, extension foresters gradually changed their views and became supporters. But even then they continued to harbor serious differences over such matters as belt width, row spacing, and species selection. At one level these were simply scientific disagreements about technical aspects of tree growth, but they also reflected different approaches to farmer assistance, and different opinions about what organization was better positioned to provide that assistance.

The Forest Service's initial act of coordination was to send a representative through the Plains states late in 1934 to discuss the program with various agencies. H. D. Cochran, the forester charged with the task, was surprised at the skepticism he found. Most officials he met were "skeptical of the possibility of accomplishing much ... except in the way of social benefits." Foresters of the Bureau of Plant Industry experiment station at Woodward were particularly critical. Director E. F. Chilcott warned Cochran that the effect of shelterbelts "on crops will be negligible," and that because of root sapping the net effect would be negative. Instead of focusing on field protection, Chilcott suggested that the Forest Service concentrate on "protection for livestock and farm buildings." If the Service really wanted to expand its

program on the Southern Plains, then it should "do some planting around lakes that are being developed especially in Kansas by the C. C. C." Cochran did find individuals who were more supportive, but even the most enthusiastic proponents urged the program to "adapt the planting to local conditions."[36]

Chilcott might have had a more positive view of the Shelterbelt had its planters made more effort to study the station's work, and if his own circumstances had not been so precarious. Chilcott had directed the station since its founding in 1913, and while he focused on crop and livestock studies, he also experimented with trees and shrubs. This had given him fairly fixed opinions about what would grow in the region, what purposes trees might serve, and how they should be planted. Until Cochran's visit, Chilcott had received little attention from the Service, and despite an occasional visitor thereafter, the PSFP never expressed a sustained interest in his findings. Adding to Chilcott's annoyance were New Deal bureaucratic reorganizations. For a time in 1934 it appeared that the Woodward Station, and several other Great Plains stations, would not be funded for 1935. Popular support eventually forced Congress to restore Woodward's budget, but the scare had done nothing to endear the Shelterbelt and other New Deal recovery schemes to Chilcott.[37]

The Forest Service also faced serious difficulties with extension in Nebraska. At first it counted itself lucky for having convinced Clayton Watkins, a state forester, to assume the role of PSFP state director, but Watkins became an opinionated and troublesome director. Although not part of the Forest Service's research branch and without an advanced degree in forestry, he believed that his "eight years of farm tree planting work in Nebraska" gave him the right "to make some comments as a result of observation and study." The most damning of these observations was that shelterbelt planting could not be justified from an economic

perspective. He could not rationalize a program which spent "$99.50 per acre or nearly twice the actual value of the land involved." To those who thought the initial high cost might be justified partially as a research measure, he replied that "a lot of our experimental work parallels or overlaps similar research activities being conducted by Experiment Stations." He also did not see how the program could be defended as a labor measure since "it is costing $950.00 per year to pay each laborer $550.00 an overhead which is grossly out of proportion." He thought there might be some justification for making plantings around homes and livestock pens, but the economics of planting did not seem to warrant using shelterbelts to protect fields. Watkins never made his complaints public, but he was never comfortable working for the Forest Service and left in 1937 when replaced by John Emerson as state director.[38]

Having worked with farmers and local farm organizations for years, state agents such as Watkins had considerable sway with farmers, so their views mattered for more than bureaucratic reasons. When John Emerson assumed control in Nebraska, he became "concerned relative to the attitudes of farm organizations in Nebraska towards our Project." The Farm Bureau, Grange, State College, and extension service all doubted the project's practicality and questioned the value of shelterbelts for field protection. Watkins attributed the resistance to negative publicity, but the existing records also suggest that he did little while state director to change opinions. Blaming poor newspaper coverage was also unconvincing, because by 1937 and 1938 newspapers were almost unrelenting in their praise. Emerson hoped to correct the situation in Nebraska through "more aggressive action toward bringing to their attention the value of shelterbelts in general land use plans," but by the time he made this proposal in 1938 the window for this opportunity had already passed. The PSFP

had needed vocal support from the Farm Bureau and extension in 1935 and 1936, when its legislative status had been under consideration by Congress.[39]

Roberts was also concerned with the relationship between the PSFP and extension in Nebraska and other states. By the summer of 1937, he was under "considerable criticism" from other agencies for not being in "full cooperation with the states." Roberts admitted that some of this was "well founded" and called upon his state directors to increase their cooperation. He instructed the state directors to draw up memorandums outlining their current activities and to send these to the heads of various agencies before following up with personal meetings. The policy seemed limited in its effect. By late in 1937, he was warning his state directors that "there is still a question in my mind whether we are yet working in as close cooperation [as we should] with the Extension Service, State Foresters, and Agricultural Colleges in the various States." W. H. Brokaw, the director of extension for Nebraska, had been placing particular pressure on Roberts to provide more information about ongoing work in the state. Roberts was also under instructions from the Department of Agriculture to coordinate his agency's work.[40]

Despite Roberts' attempt, the PSFP continued to enjoy poor relations with extension in Nebraska. An inspection report in 1941 once again put Roberts on the defensive. He explained to the Chief Forester that the PSFP had "experienced considerable difficulty with the Nebraska Extension Forester's office from the very beginning of this Project." In Roberts' opinion extension had "often capitalized on opportunities given them by Region 2 to carry on this criticism more or less publicly." Extension was using the inspection report to unfairly criticize PSFP work. Roberts' primary complaint was that Nebraska extension was bypassing his office and going directly to the Region 2 office in Denver, but there was more

at stake than disagreements over bureaucratic lines of command. Extension foresters disagreed with many of the PSFP's technical decisions.[41]

A simple three-row shelterbelt planted at a state hospital in Hastings, Nebraska came to represent these divergent views. The PSFP had planted the short belt in Chinese elm, green ash, and American elm with 6 by 12 foot spacing in 1936. When the belt was reexamined in 1940, PSFP foresters thought the belt was in "very vigorous condition" and should be left alone. However, Higgins in the Denver Regional Office "made the recommendation that the two outside rows be cut out completely to give the center row 'adequate' space to grow in," and the Cheyenne experiment station suggested "taking out every other tree in each row." The PSFP foresters were surprised at these criticisms since they went against everything that had been desired: dense wind blocking stands and forest-like conditions.[42]

PSFP research assistant Joseph Stoeckeler had documented the disagreement "to show the apparent confusion and division of opinion that still exists in various agencies engaged in demonstration tree planting in the Great Plains." He explained that on the one hand there was the "orchardist" approach that recommended very wide spacing "on the theory that since good orchard practice in subhumid regions consists of giving each tree a maximum of rooting space and area for crown and fruit development, such practices can be given blanket endorsement for shelterbelts." On the other hand the "silvicultural" approach "favors relatively close spacing, formation of a closed canopy and a forest floor early in the life of the belt." As Stoeckeler explained, the silvicultural approach was "the foundation of the Prairie States Forestry Project's concept of prairie tree planting." He favored the silvicultural approach and recommended that the Forest Service impose some discipline on the issue since the PSFP and its silviculturalists were the "dominant" federal agency.[43]

Stoeckeler's opinions aside, the evidence was not as clearly in his favor as his report suggested. Crowding was a real concern in tightly packed shelterbelts, and although the cottonwood problem had many causes, the situation was made worse by narrow spacing that forced trees to compete for moisture. The silvicultural approach held that close spacing was needed to quickly shade out weeds and create forest like conditions. The orchardist solved this problem by requiring more frequent and longer-term cultivation. The orchardist approach was a higher energy solution, but it increased the amount of moisture available to individual trees and held the promise of supporting greater ultimate growth. Contrary to Stoeckeler's claim that orchardist techniques were devised for subhumid regions, they were actually a careful adaptation to Plains aridity. It was the silviculturalist's affection for forest-like conditions that was a holdover from humid conditions.

Although not described using the same terms, the orchardist v. silviculturalist dilemma was also a feature of relations between PSFP and extension on the southern Great Plains. The Woodward Station favored a much wider spacing than the PSFP for western Oklahoma and Texas panhandle. PSFP foresters tried to reassure themselves with the knowledge that the Woodward Station was generally planting farther west than the PSFP, and that therefore its standards might differ, but given that the "drought has resulted in bringing the dryer western climate farther east," some foresters began to worry if they were too hastily dismissing Woodward's findings. One PSFP visitor commented that he "could not help but feel that they [Woodward] confidently expect us to sooner or later recognize their spacing recommendations." Disagreement over row spacing was not unique to Woodward. The Kansas extension service also wanted wide spacing, although for somewhat different reasons. Kansas opposed the PSFP standard ten-foot spacing between rows because "the

wide tillage equipment used in that state for wheat farming" and, like Woodward, because it followed an orchardist approach to spacing.[44]

The Woodward Station also had different standards for belt width. The Station followed the policy that if "the farmer can only take care of one row, that is all they plant since one row is better than none at all." If the Station thought the farmer was able and motivated to cultivate more rows it would supply the trees—sometimes enough for even five rows. The director told Engstrom in 1940 that "in a few cases, if the farmer is so 'gullible' as to want more than five rows for his windbreak, they will even supply those." Engstrom surmised from the director's choice of the word "gullible" to describe farmers who accepted 10-row belts that "the Station has a definite opinion that our 10-row belts contained more rows than necessary when considered from a purely windbreak standpoint." The orchardist approach to shelterbelt planting not only allowed, but encouraged, narrower belts because of the greater cultivation required.[45]

Woodward had also developed its own methods for handling tree types. The station had largely abandoned cottonwoods except for locations "under irrigation or depressions where run-off accumulated or where high water table afforded an opportunity for supplemental moisture." The Station thought it lunacy to plant cottonwoods at sites that depended solely on rainfall. The Station had also developed a unique method of growing conifers that produced better initial survival—a problem that constantly plagued PSFP conifer plantings. The Woodward Station removed the conifer seedlings from the nursery using a special puller, similar to a post-hole digger, that removed the root ball with the seedling. The root ball was then wrapped in burlap and sent to the planting site. The method showed exceptional results compared to the bare-rooted method used by the PSFP. The

problem was that it used up the nursery's topsoil and made for a very heavy seedling. The PSFP would have had to move thousands of the eight pound balled stock from nursery to planting location, a logistical task they were unwilling or unable to undertake.[46]

The conflict between PSFP and other agencies was never particularly open or fierce, but it displayed the potential for disagreement when multiple organizations assumed overlapping control for a conservation measure. Each group contained foresters with peculiar views and experiences, and each was reluctant to adopt other perspectives. Roberts had admitted that "in the early days of the Shelterbelt it practically ignored the pioneer work of the early Land Stations at Mandan, Cheyenne, and Woodward." This statement was formulaic, though. It was a staple of PSFP inspection reports for the life of the project to recommend more visits to stations, yet each time a PSFP forester visited a station they thought they were the first, and never failed to recommend the experience to peers. Such visits and recommendations did little to transfer knowledge, however. The cottonwood problem, the Chinese elm freeze, and disagreements over spacing would all have been assisted by greater cooperation that never really emerged.[47]

Even the minutia of technical planning involved sweeping social, political, and natural implications. In moving from grand to tightly focused plans, foresters had not escaped this dilemma. Belt and row widths combined technical adaptations, land use policy, and more than a small part of nineteenth-century "social forestry." Species selection became a race for short-term acceptance, even with many of the participants knowing they were racing towards a double-edged end. In the case of belt and row width, foresters seemed intent on deceiving themselves about their methods to continue advocating wide forest-like belts.

The theory and techniques that went into creating these belts gave foresters more professional and personnel satisfaction. They thought of themselves as foresters and not agronomist and were reluctant to make the switch. However, as long as landownership remained with farmers, forestry goals would always be second to farm ones, and foresters would have to learn to be agronomists if they wanted to continue planting trees.

This realization had long since dawned on most state foresters on the Great Plains. For years they had learned to work with farmers, and their limited budgets and cooperative tree planting programs had made promoting forestry goals off of the experiment station difficult. Extension foresters experienced more than a little frustration when the Forest Service repeated many of their experiments and ignored their advice. They already intimately understood that when farmers lost interest in trees, or decided that the land was more valuable used for other purposes, the trees' days were numbered. In contrast, Forest Service personnel were annoyed that extension did not embrace forestry's potential to transform Plains society and environment. The two groups often argued about technical decisions, but the arguments reflected underlying institutional cultures and goals. The disagreement between the two would seem minor when compared to the graver struggle between Soil Conservation Service and PSFP.

Chapter Six—Notes

[1] US Forest Service, Lake States Experiment Station, *Possibilities of Shelterbelt Planting in the Plains Region* (Washington: GPO, 1935), 23.

[2] "Forest Planting Possibilities in the Prairie Region," in Edgar B. Nixon, *Franklin D. Roosevelt and Conservation, Vol. 1, 2* (New York: Franklin D. Roosevelt Library, 1957), 203. For the Shelterbelt and Agricultural Adjustment Administration see "Rented Acres for Shelterbelt," *American Forests*, 41(8) (August 1935): 388; D. S. Olson and Joseph Stoeckeler, "Section 4—The Proposed Tree Plantation," in *Possibilities*; D. S. Olson, "Forest Conditions in Shelterbelts," *Plains Forester* 5(4) (1940): 1-2.

[3] The Regional National Archives (RG 95), Kansas City, Missouri (hereafter Kansas City Archives), and the National Agroforestry Center, Lincoln, Nebraska (hereafter Agroforestry Center) houses a wide variety of correspondence relating to the project.

[4] Olson to Paul Roberts, 2 September 1936, Kansas City Archives (RG 95); Clayton Watkins to M. L. Gould, 31 December 1935, Kansas City Archives (RG 95). Some of the initial unpopularity could also be attributed to skepticism that trees would grow (see Chapter Four) and the availability of other planting programs such as the SCS or Clarke-McNary.

[5] Carlos Bates to Roberts, 16 January 1936, Kansas City Archives (RG 95), underline in original.

[6] Roberts to Olson, 10 September 1936, Kansas City Archives (RG 95); The rod is a standard unit for measuring land. One rod equals 16.5 feet. Although this chapter avoids using as many of these terms as possible, the following is a brief introduction. A "rod," "pole," or "perch" are the same length. Four rods equal a chain and 40 rods equal a furlong. One hundred sixty square rods equal an acre.

[7] Roberts to Raphael Zon, 13 November 1936, Kansas City Archives (RG 95); F. H. Eryre to Olson, 25 November 1936, Kansas City Archives (RG 95). Erye was Zon's acting director. By late 1936 Zon seemed to have adopted a pragmatic policy of letting Roberts and the field personnel sort out most of their own technical difficulties.

[8] Olson to Zon, 28 November 1936, Kansas City Archives (RG 95), underline in original.

[9] D. S. Olson, "Why 7-Rod Shelterbelts?" *Plains Forester*, 2(12) (1937): 7-10; "Report on Forestry on the Plains," no author or date, National Archives and Records Administration, Washington DC (RG 95); Olson to Zon, 28 November 1936, Kansas City Archives (RG 95).

[10] E. L. Perry, "History of the Prairie States Forestry Project," US Forest Service, unpublished typescript (1942), 48; Paul Roberts, "The Prairie States Forestry Project," unpublished typescript, undated, 69-70; Roberts to John Emerson, 17 June 1968, *Paul Roberts Papers*, Nebraska State Historical Society, Lincoln, Nebraska (hereafter *Roberts Papers*). It is unclear what percent of belts were actually planted to an odd number of rows. While seemingly an obvious improvement from the farmers' standpoint, field personnel continued to lobby for this change as late as 1940 with no apparent success. See, Harold Engstrom, "Inspection, Planting," 13 February 1940, Kansas City Archives (RG 95), 18.

[11] Roberts to State Directors, 17 March 1938, Kansas City Archives (RG 95); Olson to State Directors, 25 January 1937, Kansas City Archives (RG 95).

[12] Olson to Roberts, 16 July 1938, Kansas City Archives (RG 95), 2.

[13] E. L. Perry, Memorandum, 15 August 1938, Agroforestry Center. Perry was Roberts' administrative assistant. Underline in original.

[14] John Emerson to Acting Director, 14 June 1938, Kansas City Archives (RG 95).

[15] Donald Duncan to Ralph Johnston, 11 January 1940, Kansas City Archives (RG 95); Robert Dellberg to State Director, 15 January 1940, Kansas City Archives (RG 95); Carl Hawkes, "Reasons Given by Farmers Who Refuse to Sign Up," 15 January 1940, Kansas City Archives (RG 95); John Hall to Director, 13 January 1940, Kansas City Archives (RG 95); "An Appraisal of the Shelterbelt in Nebraska," no author, undated, Agroforestry Center.

[16] Victor Nutter to Lawrence Joris, 25 May 1938, Kansas City Archives (RG 95). The best evidence to support this was the frequently heard complaint by foresters in later years that farmers had a tendency to remove belts because they were too wide or that they needed to make room for irrigation. It seems unlikely that at least some farmers would not have come to similar conclusions about belt width while the plantings were still young. Even restrictive agreements were an uncertain remedy. Hanson indicated that some of the trees had died and that this was part of his reason for plowing them under. The forester found this unlikely, but with its dependence on volunteers and public support, the PSFP could hardly afford to criticize farmers too heavily, let alone bring them to court. Farmers who wanted to plow under trees were also clever enough to do so while the Forest Service was not watching.

[17] "Forest Planting Possibilities in the Prairie Region," in Edgar B. Nixon, *Franklin D. Roosevelt and Conservation, Vol. 1, 2* (New York: Franklin D. Roosevelt Library, 1957), 202; Roberts to Edward Munns, 16 April 1968, *Roberts Papers*; E. J. George to Roberts, 11 April 1968, *Roberts Papers*.

[18] Roberts to Zon, 13 November 1936, Agroforestry Center; Zon to Roberts, 25 November 1936, *Raphael Zon Papers*, Minnesota State Historical Society, St. Paul, Minnesota (hereafter *Zon Papers*).

[19] A. L. Ford to Roberts, 18 May 1937, Kansas City Archives (RG 95); John Emerson to Roberts, July 1965, *Roberts Papers*.

[20] Harold Engstrom, "The Cottonwood," *Plains Forester*, 3(3) (1936): 12.

[21] Z. C. Rechel, "Streamlining America's Plains," *Christian Science Monitor Magazine*, 3 November 1937, sec.6, p. 14. For other examples see, John Lienhard, "Last Laugh Goes to Zon's Trees," *St. Paul Sunday Pioneer Press*, 16 October 1938, p. 1-2; Wyman Smith, "Trees Stop Drifting Dollars," *Successful Farming*, 35(4) (April 1937): 26, 98-99; "Winning against the Wind," *Denver Post*, 19 September 1937, magazine section; "Dalhart Home Before ... and ... After the Trees Grow," *Ft. Worth Star Telegram*, 12 December 1937; Lauren D. Lyman, "Great Tree Belt Aids Plains Area," *New York Times*, 1 August 1937, sec. 4, p. 7; R. G. Miller, "Gosh! Those Trees are Growing," *The Daily Oklahoman*, 12 June 1938, p. 11.

[22] Harold E. Engstrom, "The Cottonwood," *Plains Forester*, 3(3) (1936): 12.

[23] "State Directors," 24 February 1941, Kansas City Archives (RG 95); John Emerson to Acting Director, 13 June 1938, Kansas City Archives (RG 95); Paul Roberts, "Memorandum for Olson," 3 February 1938, Kansas City Archives (RG 95).

[24] Harold Engstrom, "Inspection, Planting," 13 February 1940, Kansas City Archives (RG 95).

[25] Ibid., 10.

[26] Ibid., 14.

[27] Roberts to Olson, 30 October 1940, Kansas City Archives (RG 95); Roberts to Olson, 14 November 1936, Kansas City Archives (RG 95).

[28] D. S. Olson, "Planting, General," 24 February 1941, Kansas City Archives (RG 95), 1-3.

[29] United States Department of Agriculture, Forest Service, *Forestry for the Great Plains* (Lincoln, Nebraska: Prairie States Forestry Project, 30 June 1937), 10; Perry, "History," 42; H. E. Engstrom, "Shelterbelts of the Future," *Plains Forester* 5(12) (1940): 2-3.

[30] United States Department of Agriculture, Forest Service, "Report on Forestry on Plains," no date, 11, National Archives and Records Administration, Archives II, College Park, Maryland (RG 95) (hereafter National Archives). Windbreak aerodynamic theories were in their infancy, and many foresters believed that complete closure was the most effective. More resent evidence suggests that a more porous structure may be ideal for greater protection. See, Jon S. Wilson, *Windbreak Design* (Lincoln, Nebraska: University of Nebraska, 1996).

[31] Olson to Zon, 28 November 1936, Agroforestry Center. It was not uncommon for other foresters to recommend conifers, but these were typically passing comments buried in inspection reports.

[32] L. S. Gross, "Inspection Report Shelterbelt Project," 28 December 1936, National Archives (RG 95); Paul Roberts, "Memorandum of Inspection," 1 July 1939, Kansas City Archives (RG 95).

[33] Engstrom, "Shelterbelt of the Future," 2-3; H. E. Engstrom, "Field Survey," no date, *Roberts Papers*. PSFP documentation only rarely used the scientific name when describing a tree. Therefore this paper uses common names. For a summary of exotic introductions see, H. A. Stephens, *Woody Plants of the North Central Plains* (Lawrence: University of Kansas, 1973).

[34] Harold Engstrom, "Field Survey," undated, *Roberts Papers*; Olson, "Planting, General," 1. Although undated, this survey appears to have been conducted in the late 1930s shortly before the freeze. Chinese elm was sometimes called Siberian elm, although the two trees are distinct, with the Chinese elm having smoother bark. The Chinese elm was so vigorous on some sites that it overwhelmed nearby cottonwood rows and eventually, through competition for moisture and light, killed them.

[35] Fort Hays Experiment Station, *Kansas Bulletin 453* (Fort Hays: Kansas State University, 1947).

[36] E. D. Cochran, "Memorandum," 23 November 1934, Kansas City Archives (RG 95).

[37] John Hatton, "Shelterbelt Inspection," 13 April 1935, Kansas City Archives (RG 95); Louise Boyd James, "Jujubes, Grapes, & Grass: The USDA Research Station at Woodward, 1913-1987," *Chronicles of Oklahoma* (Winter 1987).

[38] Clayton Watkins to The Director, 30 December 1935, Kansas City Archives (RG 95). The full circumstances of Watkins replacement are unclear.

[39] John Emerson to Acting Director, 12 February 1938, Kansas City Archives (RG 95). Foresters continued to hope for Congressional recognition, but the House Committee on Agriculture had made it clear they were unwilling to fund the project and even resented attempts to continue it (Chapter Four).

[40] Roberts to State Directors, 25 August 1937, Kansas City Archives (RG 95); Roberts to State Directors, 3 December 1937, Kansas City Archives (RG 95).

[41] Roberts to Chief, Forest Service, 8 December 1941, Kansas City Archives (RG 95).

[42] J. H. Stoeckeler to Zon, 30 October 1940, Kansas City Archives (RG 95), 7-8.

[43] Ibid., 8.

[44] Harold Engstrom, "Inspection, Planting," 13 February 1940, Kansas City Archives (RG 95); Olson to Roberts, 25 January 1937, Kansas City Archives (RG 95).

[45] Engstrom, "Inspection, Planting," 3.

[46] Ibid., 3-4.

[47] John L. Emerson to Roberts, 12 June 1966, *Roberts Papers*; Cochran, "Memorandum;" Hatton, "Shelterbelt Inspection;" Engstrom, "Inspection, Planting;" and Stoeckeler to Zon, 30 October 1940, all display this theme.

Chapter Seven—Constructing a Bureaucratic Landscape: the SCS and PSFP

Foresters hoped that the Shelterbelt would make forestry relevant to the nation's natural and economic crises, and, equally important, assure the Forest Service as a national leader in agricultural conservation. The Service would apply the same scientific measures and concern for public welfare to the nation's farmlands that it had lavished on forests. This was always a two-sided goal. On the one hand, this giant expansion in activities would greatly increase the bureaucratic stature and financial clout of the Service. Even partially increasing its involvement in agricultural conservation would increase the Service's stature within the Department of Agriculture and help insure that it remained part of that Department. On the other hand, most foresters genuinely believed that the Service could improve the condition of farmland and farmers. Bureaucratic calculations aside, we should not completely dismiss the altruistic dimensions of the Shelterbelt Project.

Early optimism about an increased Forest Service role in conservation faded after 1934 as the Shelterbelt became a controversial and difficult project, and as a new conservation agency, the Soil Conservation Service (originally the Soil Erosion Service), took the lead. However, many Shelterbelt personnel such as Paul Roberts and Raphael Zon continued to argue that the program could wedge the Forest Service into farm conservation. They reasoned that the problems of drought and wind erosion on the Plains required a long-term solution. The best, if not the only, of these was tree planting. Since the Forest Service had the greatest technical proficiency in growing trees on the Plains, and since Soil Conservation Service (SCS) tree planting efforts appeared relatively unsuccessful, the Forest Service might still emerge as overseer of long-term conservation efforts on the Plains. Thus

while Forest Service attitudes were generally friendly toward the SCS, their desire to promote Forest Service successes by emphasizing SCS failures grated at bureaucratic relationships within the Department of Agriculture.

The growing antagonism of the Forest Service in large part reflected the growing status of the SCS. The SCS understood that some of its activities overlapped with the Forest Service, but it had framed the problem of soil erosion in a way that favored SCS plans. The agency was greatly assisted in this by the relative newness of soil conservation science and by the stature of Hugh Bennett as the nation's premier soil conservationist. As SCS director, Bennett envisioned a national farm conservation agency that attacked soil erosion on all fronts with all methods. Although he had initially focused on the water-based erosion that afflicted his native South, by 1935 Bennett also addressed wind erosion. His multi-front attack on soil erosion was not only effective but offered solutions to erosion on most landscapes, something that the exclusively tree-planting approach of the Forest Service could not offer. As a result, the SCS gained permanent funding and legislative status as the nation's soil conservation agency and then used this status to assume control of most Prairie States Forestry Project (PSFP) activities.

A more stable funding base gave the SCS significant advantages over the PSFP. Foresters' preference that shelterbelts be a long-term erosion control measure, and their reliance of Works Progress Administration (WPA) funding, encouraged them to establish their own nurseries and to constrain their plantings. The PSFP needed its own nurseries to "soak up" excess WPA labor and to maintain the exacting standards foresters believed necessary. Foresters also argued that the PSFP should only plant field shelterbelts, preferably in close proximity and systematic form, to end wind erosion. Planting around recreation

areas, farm homes, or feedlots was not really an erosion measure, so it was not part of the Shelterbelt's mandate. Unfortunately for the Forest Service, such projects were the most popular with Plains' residents. A long shelterbelt beside a field might or might not improve a farmer's crop or reduce erosion, but every farmer understood that well designed windbreaks would make the home more comfortable and that animals protected by windbreaks put on more weight than those left in the open. Likewise, a well-placed grove around a recreation area could dramatically improve local perceptions of Plains forestry, although it might do little to stop erosion. The SCS quickly stepped into these lacunae to offer communities and farmers desired trees.

By the end of the 1930s, the relative success of the SCS and the budgetary difficulties of the PSFP made a merger increasingly irresistible. This was a contest that the Forest Service could not win. President Roosevelt, Secretary of Agriculture Henry Wallace, and Budget Director Harold Smith pushed the Forest Service to turn over the project to the SCS. Forest Service personnel resisted the transfer until 1942, but the demands of World War II, returning rainfall, and a changing bureaucratic calculus made tree planting seem at least temporarily irrelevant to the Forest Service's central mission.

The exact role and extent of the Shelterbelt Project had remained unclear during its early planning stages. Forest Service planners led by Raphael Zon developed several proposals that would fit with President Roosevelt's idea of a wall of trees, but they were uncertain how far such a program could extend and which agency should take charge of conservation work beyond the project's boundaries. As early as 1934, Zon questioned Chief Silcox whether the plan was designed primarily as land retirement or revegetation and water

conservation. In Zon's view the Shelterbelt could only be a small portion of any land retirement scheme on the Plains, and the President would have to give another agency overarching control. If the primary goal was revegetation and water conservation, however, then the Forest Service should be given control. He proposed dividing the Plains into two regions, "in the eastern half tree planting will be the dominant feature while in the western half revegetation with grass will be the prevalent method of controlling wind erosion." The methods varied, but the objective stayed the same.[1]

Although the conservation zone that Zon proposed would be at least half composed of grassland, he hoped to give the Forest Service overall control. Up to that time, the Forest Service had been the primary agency charged with national conservation measures, and Zon believed that the Service could easily acquire the expertise to expand its mandate on the Plains. The only other agency with a large interest in grassland conservation, the new Soil Erosion Service, was still a part of the Department of Interior. Only a small amount of public land on the Plains remained under Interior control, however, and the vast majority was privately held and therefore more appropriately managed by the Department of Agriculture and the Forest Service. Zon argued that at the very least, the Soil Erosion Service's involvement should be under the "guidance and direction of the Forest Service."[2]

Zon's conservation plan envisioned the Forest Service as the lead agency, but the actual outline closely resembled the future mission of the Soil Conservation Service. He wanted to treat the protective zone as an "integrated unit" in which shelterbelts, grass cover, water impounding, and other conservation measures would be applied in unison. All of these activities would be organized in "close cooperation with local government and land planning agencies" to secure support and integrate federal plans with state and regional views.

Ironically, integrated conservation management and local conservation districts became hallmarks of Bennett's SCS, in almost direct opposition to Zon's early plans for sweeping walls of trees. Zon did not dwell on the contradictions between the two visions, but he probably wanted the Shelterbelt to remain as the flagship of Forest Service conservation work on the Plains, while other activities extended conservation work west of the zone in which trees could be safely grown.[3]

Paul Roberts, the Shelterbelt's Director, most fully thought through the implications of expanding the Shelterbelt into a wider farm conservation program. In the spring of 1935, as dry conditions and high winds once again stirred dust storms on the Plains, Roberts argued that "listing and plowing" were merely temporary measures and "totally ineffective on certain types of soils." He envisioned a "system in which, probably, shelterbelts might form the primary bulwark against the wind, supplemented by strip farming or other tillage methods." Like Zon, Roberts advocated returning some land to grasses, but he was more optimistic about pushing shelterbelt planting "considerably west of the Shelterbelt zone." There was little scientific data to support such a program, but Roberts argued that "since there is practically no agency which has devoted a great deal of effort to this subject," the Forest Service was as logical a leader as any government organization.[4]

Underneath Zon's and Roberts' proposals was a belief that systematic, large-scale tree planting would also have regional effects. Under such a strategy it was logical to establish and then expand areas of concentrated tree planting. As these areas grew they would gradually improve the conditions of surrounding lands and make further expansion easier. In its most extreme expression, systematic shelterbelt planting would gradually stabilize most of the Plains and render other conservation techniques irrelevant. Under such a

system Forest Service expertise would reign supreme and other conservation agencies would be marginalized. In 1934 and 1935 foresters were already learning to edit climatic claims from their public announcements, but internal discussions about the role and extent of the Shelterbelt still frequently expressed climatic beliefs.

The connection between climatic change and soil conservation goals meant that Forest Service plans were necessarily long term. Writing to Roberts in the winter of 1935, assistant forester L. F. Kneipp explained that the project might be viewed mostly as a relief measure during the next few years, but if the Shelterbelt were "viewed as a measure to permanently modify the ecology of the middle western States, as foresters naturally would view such a project, then we are working ... for the next century, or possibly several centuries." Chief of Lands, Alva Simpson reinforced Kniepp's view when he pointed out that not only would plantings be for the long haul but, because only systematic plantings were likely to have significant climatic effects, planting would "have to be continued until completed." Simpson argued that "each individual shelterbelt will have its own immediate local effect, but it is also expected that there may be some cumulative mass effect which would necessitate a systematic arrangement of large numbers of individual shelterbelts."[5]

Although the discrediting of climatic claims and lack of congressional support quickly eclipsed grand plans, Roberts continued to seek a central role for the Forest Service in Plains conservation. In 1937, Zon advised Roberts to concentrate on shelterbelt planting within the zone because any major expansion of Forest Service activities on the Plains seemed unlikely. Roberts responded that shelterbelt planting would always be a major part of their work, but "the success of this work will draw us into new phases of forestry activity in the Plains States." Roberts hoped that new conservation activities would serve as "the basis

for additional future financial support." He then chastised Zon for giving up too soon on a more expansive agenda. As he described some of the "new phases" of forestry activity, the pair reversed their roles from only two years earlier, when Zon had refused to believe that the program was "all washed up." Now Zon had gone conservative and Roberts was the ceaseless promoter.[6]

Roberts' list of expanded objectives read like a wish list for Plains forestry. There was something for everyone but little to unify the disparate elements other than an emphasis on tree planting. On the sandhills of Nebraska, Roberts wanted to plant windbreaks for livestock protection. To please various state governments, he advocated roadside and "beautification" plantings. In the more northern states, roadside plantings could serve as living snow fences and potentially save the states thousands of dollars in snow removal costs. Rounding out the list, he encouraged "community recreational planting." Roberts hoped that such an expanded system would not only increase the profile of the Forest Service as a Plains conservation agency, but it would also result in an outpouring of state assistance.[7]

Despite the budgetary uncertainties surrounding the project, Roberts never lost interest and continued to clarify his reasoning for an expanded mandate. By 1940, when the Forest Service had clearly been overshadowed by the SCS, he was still advocating expanded Forest Service responsibilities along lines similar to his 1937 proposals. He argued that "rehabilitation and stabilization" would require the "consideration of a wide range of problems dealing not only with the techniques of using the land, but the spiritual wellbeing and morale of the people." Roberts then described eight different ideas for improving social and ecological relations on the Plains. The first three involved soil and water conservation goals traditionally attributed to shelterbelt planting. Points four-through-eight outlined an

expanded program of planting for community and individual interests. Although Roberts did not list "spiritual wellbeing and moral health" as one of his eight goals, the memo dwelt at length on the subject. Roberts apparently realized that the only way to shift from strict erosion control goals to communal and individual goals would require a new, non-economic calculus. For example, Point Five contemplated increased farmstead plantings to "contribute tremendously to the comfort and contentment of the farm family." Although such a conclusion seemed valid, Roberts could not explain why the government should subsidize the personal comfort of farm families. Selling erosion control to a skeptical Congress had been difficult enough; expanding that mandate required more than arguments to include the farm home or livestock pens. By 1940, Roberts needed not only to make a concrete case for the advantages of tree planting but to explain why tree planting was superior to other techniques of erosion control and farm improvement.[8]

Lacking any concrete economic calculus, Roberts fell back on the social forestry ideas of George Perkins Marsh. According to Roberts, humans has a "sentimental attachment to trees." They were not merely a sign of good land use but "part of a way of life, a part of the culture of the people, and as such their full function in the Plains encompasses but also transcends their function as an implement of land use." Tree planting was thus a conservation goal and a moral crusade in which, for obvious reasons, Roberts and the PSFP could play a pivotal role. This was Roberts' justification for going "a long way beyond the job of shelterbelt planting" and launching a renewed "attack on the whole field of forestry effort in the Plains." Under the weight of moral and social arguments, the economic and political calculus of tree planting would gradually be directed towards wider goals. While this was an appealing formulation to Roberts, and perhaps other forestry advocates, Marsh-like ideas of

social benefits through tree planting carried little weight politically and were unconvincing in scientific debate. By 1940, it was also probably too late for the Forest Service to assume control of Plains conservation. The SCS had already largely assumed that role, and Roberts and his fellow PSFP staffers were about the only Forest Service employees still seriously considering the possibility.[9]

Early in the 1930s when the contest between the two agencies was still unsettled, the Forest Service has been under considerable pressure to show concrete evidence about the usefulness of trees as an erosion control measure. The SCS promoted a much broader agenda of soil conservation in which tree planting was only a small part. By relegating trees to a secondary status, the agronomic approach of the SCS undermined Forest Service claims of dominance in Plains conservation. Returning tree planting to a dominant position in the Plains conservation hierarchy required reasserting Marsh's moral and social claims and then providing concrete evidence. The first of these requirements was largely checkmated by the SCS's appropriation of moralistic and crusading rhetoric. The second was also problematic. Not only was evidence hard to come by, but more often than not it ended up supporting the SCS position at least as much as the Forest Service.[10]

The SCS's founder and chief, Hugh Bennett, had been making a name for himself as the "father" of soil conservation since the 1920s. Bennett built on the work of Marsh and Nathaniel Shaler to argue that soil erosion was a fundamental threat to the future welfare of the country. Like Marsh and Shaler, he attributed the decline of ancient civilizations in the Mediterranean and China to soil erosion. If the United States did not halt erosion, it would follow a similar path. Also like Marsh, Bennett attributed the lack of soil conservation in the

United States to a frontier mentality that used and then abandoned land. For Bennett, America had been a "virgin land" before "eager colonists" began their "march of occupation." The major differences between Bennett's description of the problem and his predecessor's was his greater use of figures to define the extent and cost of soil erosion, and his focus on sheet and gully erosion of cultivated fields.[11]

Bennett had begun his campaign against erosion in 1928 with a lecture at the Department of Agriculture that contrasted geological and accelerated erosion. According to Bennett, natural erosion occurred at a slower rate than soil formation. He admitted that under some circumstances, such as spring floods, soil might erode even in a state of nature, but under normal conditions nature achieved equilibrium. European settlers' arrival in the Americas had upset this delicate equilibrium and begun a process of accelerated erosion. Under accelerated erosion, soil was removed from the land faster than it could be replaced, and the removed soil was lost to future cultivation. Later ecologists would question the idea that nature left undisturbed assumed equilibrium, but Bennett's explanation was attractive at the time because it explained the decadent condition of much of the nation's farmland and offered an immediate solution. Humans had made the problem, and therefore humans could fix it.[12]

To address the "national menace" of soil erosion, Bennett urged Congress to pass legislation funding a series of erosion stations in 1929. At the urging of James P. Buchanan of Texas, the ranking Democrat on the House Subcommittee on Agricultural Appropriations, Bennett addressed the committee and outlined the major points of his "national menace" speech. Like foresters in the late 1920s, Bennett pitched his discussion towards flood control. He argued that, with proper soil conservation measures on the upper Mississippi Basin,

floods like those of 1928 might be significantly reduced. He also commented that farmers would never address soil conservation on their own and that it was therefore in the public interest to teach them how to farm properly. Although Bennett was skeptical of framer's conservation credentials, he was careful to present his program as assistance and education, thus avoiding criticism that he was simply doing things farmers should do for themselves.[13]

Congress was impressed enough to grant Bennett most of his wishes, but it did so in a way that made eventual leadership in the field unclear. The Department of Agriculture received an additional $160,000 to establish four or five experiment stations to study erosion control. The money was spread between Bennett's Bureau of Chemistry and Soils, the Bureau of Agricultural Engineering, and the Forest Service. Of the other two agencies, the Bureau of Agricultural Engineering seemed the most threatening at the time because there was no common agreement about what separated agronomy (Bennett's purview) from agricultural engineering. Thus in any competition for leadership, it was unclear which organization would triumph. Not only was this bureaucratically threatening, but Bennett was skeptical of what he viewed as the Bureau of Agricultural Engineering's over-reliance on terracing. Bennett found the Forest Service less threatening in 1929 because its mandate seemed only to apply to forestlands, and he saw little immediate risk that it would move into farm conservation.[14]

Like forestry several decades earlier, in 1930 soil conservation was not clearly understood as a separate field of study and the voices that dominated it were few. This allowed Bennett and fellow scientists within the Bureau of Chemistry and Soils, and later the Soil Erosion Service and Soil Conservation Service, enormous control over the discourse. In the introduction to a soil conservation bibliography compiled in 1935 and 1936, Bennett

lamented that "inasmuch as the subject of erosion was not studied systematically until recent years, much of the material is of an empiric nature. It is unfortunate that more of the literature on erosion is not founded on actual experimental data or accurate surveys." The greatest potential source of opposition resided in the state extension services, where some erosion studies had begun in the 1920s. But no one from the extension service had anything like the extensive publication record or national reputation of Bennett. The extension service did not begin to challenge Bennett's ideas until after Congress granted the Soil Conservation Service a permanent mandate in April 1935. The other possible source of scientific opinion was from professional foresters, who had always thought of themselves as soil conservationists, but Bennett was careful to construct erosion as a farm problem. The creation of the Shelterbelt Project suggested that foresters had their own ideas about how to control soil erosion, but they where not ready to challenge Bennett publicly in 1935, and at first they saw little reason to do so.[15]

During 1933 two possible solutions to dust storms on the Great Plains emerged in Washington. The first of these was the Soil Erosion Service under Bennett. The creation of the Service had caught Bennett napping, and much of the justification for its creation appears to have been as a make-work project rather than erosion control. Interior Secretary Ickes clearly wanted to increase his Department's role in conservation. His decision proved opportune because later that year dust storms began on the Plains, and with them the prospect of making the Soil Erosion Service a permanent agency. The second solution was, of course, the Shelterbelt Project (Chapter 4).[16]

The huge increase in government spending during the early 1930s left room for both projects, but their pasts decisively influenced how each would progress. The SCS saw fewer

challenges raised to its methods and reasoning when it sought permanent funding from Congress. This was not so much because its methods were superior or because it was a national program as because Bennett and his agency were better able to control the scientific discourse on soil conservation. First, the field of soil conservation was relatively new, and there were few recognized authorities within it and none who could challenge Bennett's stature. Second, by its nature the SCS's approach was more insulated to criticism. By advocating multiple methods towards erosion control, it was much easier to emphasize or deemphasize specific practices as needs dictated. If farmers in Kansas wanted trees, then the SCS could offer them trees. If farmers in Georgia wanted terracing and gully damming, then the SCS would offer that too.[17]

Probably the greatest contrast between the SCS and the Forest Service was that the creation of the SCS was untroubled by scientific debate. Members of Congress accepted at face value the SCS's claims and voted millions of dollars to the new agency. The only serious debate arose over bureaucratic questions about whether to place the new agency in the Department of Interior or Department of Agriculture. The desirability and practicality of the SCS's program was not an issue. Unlike the reception that the Forest Service faced in Congress, when Bennett testified before the House and Senate he was free to define both the problem of soil erosion and its solutions. In retrospect his scientific, economic, and historical statements were open to criticism, but no one in Congress had the background to contest him.[18]

Besides being able to control the scientific discourse on erosion, Bennett also benefited from natural events. The story that has been handed down within the soil conservation community is that Bennett stalled his presentation before the Senate Committee

on Agriculture and Forestry in early April 1935 so that a dust storm darkened the windows of the chamber as he introduced his plan. In the actual Senate hearings, there was no indication of such an event, but Washington DC had been subject to a series of dust storms that March and the Committee was primed for a solution to the problem.[19]

Bennett's presentation emphasized the long-term damage that accelerated erosion cost the nation, but he also offered a solution to the current troubles. He told Congress that his studies "have reached the definite conclusion that it [erosion] is the most serious problem relating to the permanency of our agricultural lands." According to a recently completed survey of the United States, "we have destroyed, practically destroyed, approximately a hundred million acres of formerly cultivated land." In addition to the millions of acres lost to cultivation, another 125,000,000 acres had "lost all or the greater part of the topsoil" and impoverished the thousands of farmers working the land. The perception that soil erosion was destroying the Plains was not unique to Bennett. By the mid-1930s, the idea received wide circulation in books such as Paul Sears, *Deserts on the March*. Sears, an ecologist, and other populizers of the theory that agricultural misuse was turning the Great Plains into a desert simply reinforced Bennett's claims.[20]

Trying to put a cost on such destruction was a standard part of Bennett's presentation. His usual figure was "at least $400,000,000 annually, to say nothing of the enormous damage to highways and railways and the costly silting of reservoirs, streams, and ditches." Despite the enormity of these figures, neither Congress nor the public challenged Bennett until well after his program was underway. Instead, congressmen such as Samuel Massingale told his colleagues that "in the discussion of this bill on the floor of the House some startling figures have been submitted which show conclusively the importance of immediate enactment of

legislation to put an end to the ravages of water and wind erosion." On occasion Bennett bandied even more outlandish numbers, as in December 1934 when he issued a press release that claimed the $5 million spent that year by the Soil Erosion Service had saved the nation $5 billion. There was no indication in Bennett's records how he arrived at this figure. In his testimony before Congress, he attributed it to studies done by the Soil Erosion Service, but similar numbers had appeared in his "National Menace" bulletin of 1928, created well before the Soil Erosion Service. It was not surprising that Bennett would make such claims to support his new organization and to promote a cause in which he believed deeply. What seems significant is that the numbers went undisputed.[21]

By the end of April 1935, the bill had made it through Congress and received President Roosevelt's signature to become Public Law 46. The law transferred the Soil Erosion Service from the Department of Interior to the Department of Agriculture, renamed it the Soil Conservation Service, and gave it permanent status as a regular bureau. The program was also greatly expanded by the transfer of 150 Civilian Conservation Corps camps from the Forest Service to the SCS that spring, with a further 300 camps shifted during the ensuing summer. Also that year the SCS began 147 demonstration projects and started 48 nurseries.[22]

As the above developments suggest, the SCS's gains were Shelterbelt Project's losses. By the early 1930s, forestry science had many organizations, many experts, and many voices. Not only was it difficult to achieve agreement between them, but they could and did frequently work against each other's purposes. The scientific uncertainty and professional bickering that surrounded the Shelterbelt Project gave critics of all types ample opportunity to contest it. Likewise, the Shelterbelt's reliance on one remedy weakened its overall appeal and made it downright unworkable in some areas. Partially as a result of this, the Shelterbelt

only survived on the sufferance of Roosevelt and as work relief. Both the Forest Service and SCS argued that they had sound science on their side, but the debate was never just about the best science. It also reflected the ability to control scientific debate.

Bennett and the SCS did not go unchallenged for long. As political scientists Robert Morgan and historian Donald Worster both describe, the SCS soon found itself in conflict with county agricultural extension agents. Extension hoped that new federal conservation efforts would go through their offices, while the SCS wanted the freedom to deal directly with farmers and dictate its conservation methods. Worster describes a further conflict between the two over whether their assistance would be aimed at increasing crop production or conserving soil. Many SCS personnel, including Bennett, advocated returning large areas of the Plains to grasslands as a permanent conservation measure, something that was anathema to state college agronomists. The SCS also continued to struggle with the Bureau of Agricultural Engineering, particularly in the South, over the use of terracing. When criticism coming from several sides, the SCS began to modify its plans to increase support. Public Law 46 had contemplated using coercion if necessary to achieve compliance. In the heady atmosphere of 1935, with Washington DC being blanketed by dust, this had seemed a reasonable, if last resort, provision, but Bennett quickly and completely renounced any such intention to gain farmer support in his struggle with local extension agents.[23]

The SCS's relation to the Forest Service was also problematic. For the most part Bennett seemed more concerned with extension and the Bureau of Agricultural Engineering than with the Forest Service, but he wanted Congress to define more clearly the relationship. In 1935 the Soil Erosion Service was engaged in a large number of forestry projects around the nation as a part of their larger soil conservation goals. They had signed agreements to

convert over twenty-two thousand acres of farmland to forest. They had also planted over eight thousand acres of forest and set up 129 demonstration plots for forest management. When Bennett testified before the House Committee on Public Lands, he noted that "the energies of all services, Federal, State and private, may be made to work in harmony and for the accomplishment of the desired end." If the committee did not use the opportunity created by the current crisis to rationalize conservation programs, "there may follow a haphazard effort of erosion control, with conflicting ambitions and purposes and with the bidding of Government agencies for the support of various interests." In the name of "efficiency and economy," Bennett wanted a method of coordinating the various agencies. This did not mean giving one complete control. Bennett argued for a policy of "assigning of responsibility of major problems of distinct differences, such as erosion control on farm lands, and on forest lands, to different agencies."[24]

Maintaining distinct differences between agencies by charging them with control of specific landscapes was an appealing idea because it granted the SCS dominance on farmland, while the Forest Service retained control of the National Forests. This arrangement was less clear on the Great Plains, however, where the nature of the soil conservation problem, and thus the responsibilities, were most confused. If strictly followed, such a plan would force the Forest Service to terminate the PSFP or transfer control to the SCS. Even if such an arrangement had bureaucratic appeal, there remained problems of scientific expertise. Up to 1935, Bennett had focused on hydraulic erosion, but the primary problem on the Great Plains was wind erosion. The Forest Service, through its longer involvement in Plains afforestation and through the Shelterbelt, was better positioned to manage wind erosion. Thus for the SCS to challenge the Forest Service's control, they either had to build

up their own expertise in forestry or to develop alternative strategies. Bennett pursued both tactics.[25]

The SCS began by advocating a host of wind erosion control strategies, including shelterbelts. Bennett spelled out his pragmatic program in a series of speeches during the summer of 1935. As with his earlier emphasis on erosion by water, he claimed that "several million acres of formerly good land already have been seriously impaired or ruined," and that the SCS had a duty to prevent this destruction. For wind erosion he recommended "preservation of crop residues or stubble to anchor the soil; (2) Strip plantings of adaptable grasses and other plants; (3) Permanent windbreaks of trees and shrubs, and other measures for establishment and maintenance of protective plantings." Building on this combined approach, Bennett began to describe the SCS's work as "parts of a broader plan that differs from any heretofore undertaken in this country in that it does not contemplate the employment of any single, unsupported method of control." Although Bennett did not criticize the Shelterbelt by name, his emphasis on a "closely coordinated, properly balanced, adaptable and integrated system" contrasted sharply with reliance on the singular, tree-bound methods of the Forest Service.[26]

The SCS program on the Great Plains followed Bennett's "integrated system" approach, and tree and windbreak planting always remained a small part. On the most erodible soils, the SCS promoted land retirement and grassland restoration. On the vast rangelands of the Western Plains, the SCS became primarily a range management specialist, demonstrating conservation techniques to ranchers and encouraging wheat farmers to diversify. In regions suited to permanent tillage, the SCS advocated a variety of agronomic methods to reduce erosion, including trees. Although windbreaks, shelterbelts, and erosion

control plantings were a small part of their program, the SCS's farm forestry program represented a significant presence on the Plains. Nowhere was this more evident than their tree and shrub nurseries. Nationally in 1935, the SCS controlled 20 Bureau of Plant Industry nurseries, 18 emergency conservation work nurseries, 17 SCS nurseries, and they had cooperative agreements at 5 PSFP and 19 state nurseries. They also put out contracts with private nursery operators. The vast majority of the trees and shrubs from these nurseries were destined for mass planting on heavily eroded lands, but the SCS also planted several thousands acres of windbreaks and shelterbelts, a number that would continue to grow during the decade.[27]

With the initiation of Bennett's integrated approach, the SCS largely "captured" the soil conservation business on the Plains and ended foresters' hope of expanding the Shelterbelt—with the noted exception of Roberts. The congressional recognition and funds that the SCS now controlled made it almost impossible for the Shelterbelt to pursue a more diverse approach. Deviations from shelterbelt planting would be viewed, both by Congress and the SCS, as clear cases of overlap. Even if the Service had tried to expand their program, they would have had to do so with emergency funds since Congress would clearly not contemplate funding two overlapping agencies on the Plains. The presence of two federal agencies offering farmers trees on the Plains already created sufficient groundwork for future competition, without the Service compounding the problem by trying to expand into the SCS's "work."

At first, the two agencies tried to work together. The Great Plains was a vast region in dire need of assistance, and both the SCS and PSFP faced daunting tasks. The rapid acceleration of forestry activities in 1934 and 1935 quickly exhausted the available supply of

seed stock. The SCS in particular was left with only a limited supply with which to start its nursery program. The Forest Service agreed to share some of their recently accumulated stock, and for its part the SCS agreed to purchase five million seedlings grown at PSFP nurseries. The Forest Service charged the SCS an average of three dollars and fifty cents per thousand seedlings. This figure included a discount for a portion of the cost if the SCS had contributed seed stock to the nursery. The cost was far less than what private nurseries charged, and it was just enough to meet costs.[28]

The two agencies also worked together to protect the image of tree planting programs on the Plains. When in 1937 an SCS employee circulated a letter criticizing over-reliance on windbreaks as an erosion control measure, the SCS rapidly clamped down on the debate and demanded that its branch offices recall the letter. The reaction was spurred by fears that the letter "might be interpreted as a criticism not only of the SCS but of the much more extensive tree planting program of the Forest Service." Scientists from the two agencies also tried to cooperate in their research. Carlos Bates suggested bringing aboard SCS scientists for his crop influence studies. He believed that having SCS agronomists assist in the experiments would "supplement the natural enthusiasm of the foresters." He hoped "that this intimate working together may be continued, at least long enough to satisfy your bureau thoroughly that the results obtained and the methods employed are thoroughly reliable and free from taint of prejudice." Bates' response was probably partly a defensive strategy to allay fears rather than foster camaraderie, but at least the agencies were making some effort to coordinate their research.[29]

In 1938 the Washington office of the SCS circulated a letter to its regional offices on the Plains asking whether they saw any reason why the SCS should not cooperate with the

Forest Service in obtaining congressional funding for the PSFP. The SCS employees "agreed that the shelterbelt program of the Forest Service could not be harmful to a general soil conservation program." The only significant objection was a concern that a farmer might be satisfied with only a windbreak, and "therefore the SCS could not inaugurate other measures it felt were equally essential." Although the last criticism was put in carefully qualified and polite terms, it betrayed the growing institutional rift. They could cooperate, but ultimately they were two different agencies with two different programs competing for the same space.[30]

As soon as the dust had begun to fly on the Plains, foresters started to worry about the Soil Erosion Service and its plans. Writing from Lincoln, Nebraska, in March 1935, and enveloped by a "thick pall of dust," Paul Roberts warned his superiors in Washington that the "Soil Erosion Service is unable to cope with the situation." Roberts noted that the SCS's efforts "have been directed towards preventing water erosion" and that the only way to prevent continued blowing was revegetation. The problem with revegetation was that "it would unquestionably not be possible to re-establish grass" without first establishing "some form of tree and shrub growth as a start, and later establish grass growth." Roberts' letter never elaborated on what exactly he had in mind, but it was a good example of the natural tendency to put trees before everything else. In this case, Roberts was reasoning that even grass needed trees to grow. At almost the same moment Roberts was warning his peers in Washington, Raphael Zon also telegrammed to warn the Forest Service it needed to act quickly to tackle the soil blowing problem and that only the Service had the necessary expertise with "revegetation with grass and trees." Although, not quite as biased towards trees as Roberts, Zon too saw a central role for forestry in solving the dust storms. Had they

known that Bennett was using the very same storms to lobby for the SCS program of erosion control, both Roberts and Zon would have been doubly distressed.[31]

As March rolled into April, Roberts became increasingly concerned that the SCS would take over the field. He advised Zon that the States disliked the Soil Erosion Service because it "worked too independently of the States." He told Zon that "it is incumbent upon both of us to watch the going pretty closely for a while, to see that we are not swallowed up in some general scheme; that we retain our identity; and, if possible, that we have a leading part in the coordination of the entire program." In Roberts' opinion this was not an unrealistic goal, since public sentiment on the Plains favored the Forest Service over the SCS. Most alarmingly, Roberts had heard from a local SCS employee that the SCS would soon be taking over the Shelterbelt Project. With the legislation still moving through Congress, all this was still speculation, but not paranoid speculation.[32]

Later in 1935 the Forest Service began to come to terms with Public Law 46 and the SCS's emergence as the new giant of soil conservation. The Forest Service hoped to establish a new Great Plains Forest Experiment Station, however the Budget Bureau began resisting the Forest Service request on the grounds that it would overlap "the work already planned by the Soil Conservation Service in the Plains region." Congress had granted the SCS both regular and emergency funds and authority for conservation work on the Plains. In the Budget Bureau's opinion, "a lot of work, research and otherwise, is programmed by the SCS directly tied in with the Shelterbelt, including establishment of nurseries, [and] tree shrubbery plantings." The Forest Service tried to counter that the SCS's claim that it already had a mandate for soil erosion control by appeals that the Shelterbelt was "the President's project" and it needed a large amount of research to insure success. The Forest Service might be able

to resist absorption by the SCS, but it could not avoid the increasingly obvious redundancies and conflicting agendas.[33]

The conflicting agendas became particularly apparent when both agencies went to work on the same ground. By early 1937 the SCS began to pressure the Forest Service to pay more attention to their terracing and contour practices when planting. The SCS complained that the PSFP had "cut through their contour areas with straight-line shelterbelts." From its inception the Shelterbelt had advocated rigid plantings running across the Plains irrespective of local human and natural geography. Although it had abandoned this goal as impractical even before the Shelterbelt morphed into the PSFP, the PSFP continued to plant shelterbelts on the grid pattern of property boundaries. There were very few examples in the PSFP files of shelterbelts planted along a contour. Roberts defended PSFP efforts at some length by arguing that they followed sound conservation practices. Others pointed out that SCS methods were not immune to the same criticism. In response to a circular that questioned SCS practices by asking state directors to comment on the differences between the two programs, John Emerson responded that "in many [farmers] the urge to plant, work with and live among trees is bred right in their bones." The SCS "practices, on the other hand, of contour farming, constructing terraces, farming around the hills with crooked rows and odd-shaped fields is directly opposed to every habit a good farmer has been taught from father to son down through the ages." Emerson argued that the PSFP was "encouraging something which nearly everyone wants or likes to do."[34]

In reality, the issue was not whether either agency followed established practices, or even what farmers preferred (a question that was open to more debate than Emerson's letter suggested), but whether different methods and different programs could co-exist in space and

time. In 1935 and 1936 there was no unified cooperative structure between the two agencies. Sometimes one agency only belatedly discovered that the other agency was working in the same area. The Forest Service tried to hold informational sessions across the Plains, but Roberts admitted that he was unsure if SCS personnel had attended more than a couple meetings.[35]

In the Woolsey-Shue Creek Demonstration area of South Dakota, the two agencies found themselves in direct competition. The SCS had set up a demonstration area in several townships located within a PSFP concentration area. The local PSFP supervisor understood that a field agreement had been arranged in which the SCS would avoid planting in areas the PSFP had already entered, but the SCS carried out plantings anyway. Not only did both agencies work the same townships, but in one high profile incident they even established shelterbelts "on opposite sides and adjacent to the same highway." In response the PSFP project manager tried to interest the SCS in allowing the PSFP to establish all shelterbelts within the demonstration area, but found the SCS unwilling even to consider the idea. The SCS argued that it had primacy through Public Law 46, which had given the agency a mandate to conserve the nation's soil. The PSFP foresters replied that their seniority in the area and their superior expertise in tree culture justified their primacy. Both agencies reluctantly agreed on the need for some coordinating policy.[36]

Initially, coordination meant meetings between the field personnel of both agencies to create "memorandum of understanding." Typically at these meetings both agencies tried to stake a claim to preeminence. SCS agronomists pointed out that they had been given a mandate to manage soil conservation on the Plains, and that windbreak and shelterbelt planting was but one type of soil conservation. Therefore the SCS should exercise overriding

control. PSFP foresters took the view that there were more benefits to tree planting than soil conservation. If the SCS was worried about overlap, then "that could be solved by having the Forest Service direct all tree planting work, including that on soil erosion projects." In part, this was bureaucratic bargaining with each agency attempting to maintain its own budget and mandate, but for the PSFP there was the added threat that haphazard SCS plantings might undermine public perceptions of Plains forestry.[37]

The early public controversy and stiff congressional opposition that the Shelterbelt faced made it imperative that plantings have a high success rate. Forest Service personnel were trying to convince a skeptical Congress that trees could be grown on the Great Plains. The last thing they needed was dead, dying, and mishandled SCS plantings providing ammunition for critics. Roberts made this very argument in his early reports on cooperative agreements between the SCS and Shelterbelt. In his opinion the SCS was unequipped and lacked the "technique necessary in this region of adverse climatic conditions." The Forest Service could, and would, go to great lengths to ensure that its plantings achieved a high success rate. For Roberts the solution was, predictably, to give the Forest Service control of tree planting on the Plains or, at the very least, to establish cooperative agreements that required the SCS to use Forest Service technical advice.[38]

The overlapping jurisdiction that the two agencies faced in the early 1930s was common among the tangle of agencies created by Roosevelt's New Deal. Similar conflicts emerged among the Agricultural Adjustment Administration, the Works Progress Administration, extension, and other agencies. In an attempt to impose some order on the growing chaos, the Department of Agriculture created regional advisory committees composed of members from the various agencies. The regional committees in turn referred

decisions and derived guidance from a Departmental Committee located in Washington. In the case of the Great Plains, the new regional coordinating committee created a formal chain of command within which to address complaints. The Board also offered personnel in both agencies a clearer idea of who to contact about concerns. As a result there were fewer obvious (or at least reported) incidents of overlap. The notable exception was in the area of nurseries, where accusations of overlap persisted because no coordinating committee could ever remove the fundamental redundancy of two agencies offering similar services across the same landscape.[39]

In the early 1930s both agencies had scrambled to establish nurseries, and gradually this became a public relations problem. The two agencies also began to compete for planting sites and public acceptance. In this struggle the Forest Service was handicapped by its limited budget and restrictive rules. The SCS capitalized on the Forest Service's difficulties by conducting a variety of popular planting activities. By the early 1940s the two agencies were also mired in the previously unimaginable: a struggle for labor and farmland. Finally, and most problematically, bureaucratic reorganization eventually transferred the PSFP to the SCS.

The problem of overlapping nurseries seemed minor in the early 1930s when seedling demand far outstripped supply, but by the late 1930s both agencies were producing excess stock. In an embarrassing case, the agencies had even located nurseries across the street from one another. The two agencies worked to remedy these situations by closing, moving, or sharing nursery space. They also tried to defend the overlap that did exist as necessary, but these arrangements never completely removed criticism. In the summer of 1939 both agencies once again found themselves in hot water over nursery duplication. This time

"outside sources" informed President Roosevelt that "considerable duplication still exists," so he ordered the Secretary of Agriculture to examine the matter.[40]

The resulting investigation uncovered significant redundancies in South Carolina, Indiana, and the Great Plains. Both the SCS and PSFP had nurseries at Mandan, North Dakota and in Manhattan, Kansas. The PSFP vacated their Manhattan lease and moved to Abilene to distance themselves from the SCS nursery, but the two nurseries were still uncomfortably close from an organizational standpoint. In South Dakota several PSFP nurseries were included within the zone of distribution of the SCS's Vermillion nursery. The Biological Survey had a nursery at Valentine, Nebraska near the PSFP's Halsey nursery and there were also several state-run nurseries in the region. The Secretary of Agriculture instructed the two agencies to consolidate their production. If a case arose in which there were good reasons for overlap, then "the nurseries should be considered as one cooperative nursery and appropriately posted on the ground and maps," but the actual process was left to regional directors.[41]

Consolidation was not as easy on the Great Plains as the administration wished. The existence of nearby nurseries did not necessarily equate with excess capacity. To reduce overlap, the PSFP canvassed the SCS nurseries with requests to use any idle acreage, but the SCS had very little to offer. The forester assigned to handle the PSFP's nursery consolidation, D. S. Olson, argued that despite their efforts, cooperative agreements had possibly "resulted in the saving of [only] one small lease in South Dakota." Olson blamed the SCS, which in his opinion "should release more of their acreage." Although Olson sincerely desired greater SCS cooperation, his primary goal was to get the SCS out of the nursery business so the PSFP could become the primary provider in the territory. He argued that "the

crux of this whole situation lies in whether or not the SCS is willing as yet to declare themselves going out of the tree production business in our territory." It seemed to him that the "logical adjustment would be that we grow the comparatively small amount of stock the SCS needs in this region in our nurseries, and that the present SCS tree nurseries be either abandoned or turned over to us." Olsen then offered a number of reasons why existing PSFP nurseries were necessary, including their superior locations, their more developed facilities, and their connection to local work areas.[42]

In the late summer of 1939 the Department of Agriculture called in representatives from the PSFP and SCS, including Olsen, to Washington D. C. The meetings consisted of both agencies justifying their activities while requesting that the other agency transfer its nursery operations. They also discussed the political logic of moving nurseries such as the recent PSFP migration from Manhattan to Abilene, Kansas. Although all sides agreed that nursery duplication was undesirable, they were also uncomfortable with the idea of shuffling nursery leases for such callous political reasons. As a result they agreed that "the Department [of Agriculture] would fully support us on matters of this kind as long as conditions justified the selections we had made." In other words, nurseries would no longer be shuffled to avoid the appearance of overlap, but any new plans to acquire, expand, or abandon nurseries would be cleared through the Department's Coordinator Office.[43]

Although un-discussed in the records of the meeting, PSFP resistance to nursery consolidation was rooted in bureaucratic and funding imperatives. As J. A. Fitzwater told Paul Roberts in July 1939, the "fact that the Prairie States Forestry Project is operating strictly on emergency funds may to a considerable degree preclude adjustments which might otherwise be very desirable." With only ten percent of WPA funds slated for management

and materials, the PSFP used its nursery programs to absorb some of the labor paid for by the other ninety percent of WPA funds. Even more problematic, the PSFP lacked the fiscal flexibility to contract with other agencies to grow its seedlings. Given the restrictions on WPA funding, the PSFP found it more efficient to grow as much of its own seedling stock as possible using WPA labor. Thus an infrastructure of nurseries had to be the foundation for any expanded conservation mandate, a goal that Roberts and many on his staff still sought. It also almost certainly mattered that many PSFP personnel saw nursery duty as one of their primary responsibilities. Foresters such as Olson and Bates spent a great deal of time and invested a significant portion of their careers tackling nursery-related problems. Giving this responsibility to the SCS and becoming "simple" tree planters was neither politically nor personally appealing to most professionally trained PSFP employees.[44]

The PSFP was also dedicated to the idea of planting only conservation shelterbelts and avoiding windbreak plantings around public facilities, farm homes, and livestock pens. From its initiation the Shelterbelt had been designed to halt wind erosion. As the project morphed into the PSFP, it never lost its focus on this primary goal. Zon explained that "only planting around fields in the form of shelterbelts is the thing worth while doing." Other activities "fall short of accomplishing the real objective of plains planting." When the project faced intense criticism over such issues as providing "free" trees to farmers, its directors had countered by suggesting that field shelterbelts provided local, regional, and national benefits. Their precarious financial standing also encouraged foresters to stay within well-defined policies. During the early 1930s this narrow focus on field shelterbelts had been politically savvy, but by the end of the decade the PSFP came under criticism for being unwilling to expand its program.[45]

The criticism came out most forcefully in a study conducted in late 1939 at the request of Milton Eisenhower, the Land Use Coordinator for the Department of Agriculture. Eisenhower directed the various regional land use coordinators to solicit opinions on the value of the PSFP "from the standpoint of its worthwileness [sic] to farmers and agriculture generally." The regional directors mailed surveys to farmers, extension workers, agronomists, businessmen, newspaper publishers, and others. They then assembled reports and summarized findings for Eisenhower. For the most part the reports revealed unrelenting praise of the PSFP. The exceptions were recurring requests that shelterbelt plantings be expanded geographically and extended to community and farm plantings. W. E. Grimes, the head of the Kansas State College Economics and Sociology Department, responded that "in many cases a good farmstead planting is more important than a shelterbelt planted along a field." L. E. Call the Director of the Agricultural Experiment Station at Manhattan, Kansas offered the similar opinion that "shelterbelts are of the greatest value in protecting livestock and the farm home, in beautifying the farm home and the countryside, and in furnishing protection for plantings and wildlife." Call wanted a change in the regulations to allow these types of plantings.[46]

If the PSFP did not make these plantings, then there was always the risk that the SCS might step in. This was the case in Emporia, Kansas, when in 1938 the city asked the PSFP to furnish nursery stock for a new reservoir. Harold Reitz, the PSFP state director, visited the reservoir and discussed the city's plan, but he left without making promises. There was no farmland near the lake, and plantings could not be considered soil conservation plantings under the Farm Forestry Act. Furthermore, the PSFP recommended cultivating land at least one year before planting to reduce weeds and build soil moisture, so even if the PSFP could

bend its rules, any planting would have to be done the following year. Reitz was careful to inform the mayor and local representatives of these restrictions before returning to the work of planting shelterbelts on farmland.[47]

It came as a shock six weeks later when Reitz read in his morning paper that the SCS had announced it was planting 79,900 trees on the site in the next few days. With its wider mandate and less restricted funding, the SCS had rapidly put together a large planting program. Perhaps even more disturbing, there were many other newly built or planned reservoirs around the state. The PSFP had missed a major opportunity to make itself relevant in the state of Kansas. Reitz fumed that the PSFP's narrow mandate had "elevated the S.C.S. to leadership in forestry matters." In the future, the new status of the SCS threatened to crowd the PSFP out of the tree planting field altogether. As Reitz surmised, why should Kansans work through the rule-bound and geographically limited PSFP when they could go to the SCS and get substantial and immediate assistance? Reitz concluded that the PSFP needed to pursue such plantings more aggressively and to lobby in Washington for overall control for Plains forestry, but this contained a circular problem. Without regular funding and a wider mandate, the PSFP could not expand its program; yet without an expanded program and the popular support such a program might generate, the PSFP lacked the political support to secure more funding and a broader mandate.[48]

Despite some efforts at coordination, the two agencies continued to compete for planting locations and, by the early 1940s, labor. Because of conflicts over land and technique, the SCS petitioned the Forest Service to end its planting programs in Bridgeport and Broken Bow, Nebraska. Roberts argued that if carried out, this halt in PSFP operations would devastate the future of Nebraska planting. Bridgeport was at the western edge of PSFP

operations in Nebraska but contained a large area of plantings. Roberts wanted to maintain a program there so the PSFP could follow up on the success of older plantings, but to do so he needed "a new program of reasonable size each year to provide an economical operation and maintain the organization." The case was even worse in Broken Bow, which had been the center of operations for a large area and the greatest supply of WPA labor. Shutting the PSFP out of Broken Bow would "require long hauls of labor and result in reduced output" in neighboring areas. To make matters worse, the SCS move to assume control in these areas was part of a "progressive elimination of areas of this kind within the operating territory of the PSFP" that "would soon break up the area to the point where it would seriously interfere with the whole Project."[49]

Adding to Robert's worries, it also appeared that the SCS and PSFP were in competition for WPA labor. The start of World War II in Europe had raised farm prices and reduced the attractiveness of WPA work on the Plains. Rearmament was also beginning to lower urban unemployment rates and even draw unemployed workers from smaller towns to larger cities, where the new jobs were emerging. By 1941, Roberts feared that there was insufficient labor in many districts to accommodate both SCS and PSFP programs. Since the agreements had already been signed, this could leave the PSFP in the unenviable position of failing to live up to its commitments and having a large excess of unplanted nursery stock on its hands. The situation for 1942 looked even worse.[50]

The nature of WPA funding, and the PSFP's reliance on it, made the labor problem particularly thorny. The PSFP needed to hire enough WPA labor each year to insure that the 10 percent allowance for administrative costs was sufficient to cover fulltime employees. Reducing the level of plantings to accommodate reduced labor availability thus left the PSFP

with insufficient funds to pay staff and nursery costs. Likewise, more labor-efficient planting methods, such as the mechanical planters that the PSFP was experimenting with, could not solve the problem since it could not replace the lost administrative funding. The SCS, with its permanent funding, was better positioned to deal with such changes. It could use whatever WPA labor was available without imperiling its permanent structure. The SCS also employed mechanical planters to help maintain its overall acreage goals in a tightening labor market.[51]

Although the war forced a consolidation that both agencies had conceded, the groundwork had been laid over many years. A part of that reorganization effort was transferring control of the nation's farm agencies to the Department of Agriculture and control of the nation's public lands agencies to the Department of Interior. The first of these was successfully achieved in 1935 when the Soil Erosion Service became the Soil Conservation Service and moved to the Department of Agriculture, but transferring the far more powerful Forest Service to Interior proved impossible. Roosevelt had discussed transferring the Forest Service since his election, but Gifford Pinchot and other conservationists had dissuaded him by painting Interior as corrupt and poorly managed. With the passage of the Reorganization Act (1939), Roosevelt once again began to support the Brownlow Committee recommendations for reorganizing the executive branch, including proposals to relocate the Forest Service. He justified this move in part on grounds of efficiency, but it was also an attempt to trim the power of the hugely influential Department of Agriculture, which had grown by leaps and bounds during the New Deal.[52]

Forest Service resistance in what became known as the "transfer fight" angered President Roosevelt and soured him on any efforts to expand the Forest Service. Opposition to the transfer was widespread both within the Department of Agriculture and the

conservation community, but it was particularly fierce in the Forest Service itself. Assistant Forester Earle Clapp led the resistance and, as a consequence, never became Chief Forester. In explaining the affair to Paul Roberts, Clapp warned that "the whole transfer business, I am sorry to say, left F. D. R. with a very bad opinion of the Forest Service." Clapp explained that Roosevelt had transferred most of the forestry activities enabled under the 1936 Cooperative Forestry Act to the SCS. This was a deep wound to Forest Service plans to become a major player in farm conservation. It left them controlling only the PSFP on the Plains, while the SCS assumed control not only of farm conservation but most tree planting activities. Roberts, for his part, felt that Roosevelt would have preferred Clapp's "head on a platter" after the transfer fight.[53]

As part of a policy of resistance, Secretary of Agriculture Henry Wallace tried to shuffle responsibilities between agencies within the department. There were many theories but little clear direction. The Forest Service was left guessing exactly what Wallace intended. In an attempt to reassure various departmental directors within the Service, including Roberts, who were anxiously awaiting the outcome of the struggle, the Washington office issued a memorandum outlining two theories. The first was that Wallace was "diffusing some of the work in forestry through other bureaus" in order to "so inextricably relate forestry to the Department as a whole that it would be impossible on a logical basis to transfer the Forest Service from the Department of Agriculture." The second theory was that Wallace was removing most of the farm forestry, erosion, and flood control programs of the Forest Service to push it "more to the edge or corner of the agriculture field where we could be picked off with very little if any dislocation."[54]

The first theory proved the most accurate. A memo on 15 October 1938, marked "read and destroy," indicated that Wallace's principle purpose was "to integrate the Forest Service so fully with the Department that it could not be transferred." Farm forestry functions moved to the SCS, but the Forest Service maintained control of the research for such programs and for the PSFP. Thus Wallace had tried to locate forestry functions within so many different bureaus of the Department of Agriculture that Roosevelt could transfer no single bureau. Although such tactics may have helped prevent the transfer of the Forest Service to Interior, they did not endear the Department or Service to Roosevelt.[55]

Trying to prevent transfer, however, did not mean allowing obvious and politically sensitive examples of overlap to continue. In 1937, Secretary Wallace began warning PSFP officials that, if they did not correlate their program with that of the SCS, he would do it for them. Instead of resigning itself to some form of shared responsibility, though, the Forest Service became increasingly protective and even paranoid. During the summer of 1938, Roberts sent a series of letter to Silcox warning him to resist any transfer of farm forestry functions to the SCS. According to Roberts, the SCS "has awakened just during the past few months to the full possibilities of shelterbelt work as a conservation measure in the Plains States, and that they want the work and they want it badly." In his view, the two agencies were waging a "battle" for control of forestry in the Plains states, and he calculated that the Forest Service was popular enough in Oklahoma, Kansas, and Nebraska to get those states to support the Forest Service. Conversely, if they lost farm forestry on the Plains, he feared they would lose it elsewhere around the country.[56]

Later that year, the Department of Agriculture seemed to confirm Roberts by fulfilling Wallace's threat to reorganize Forest Service and SCS activities on the Plains. In

October, Wallace authorized the SCS to administer the Cooperative Farm Forestry Act programs undertaken by the Department. As part of this Wallace instructed the Forest Service to transfer employees engaged in this work to the SCS. In January 1939, Wallace qualified his earlier plan by specifically excluding the PSFP and its personnel from transfer. For Roberts this was the foot in the door that he dreaded. It seemed only a matter of time before the SCS consolidated its gains and took full control of the PSFP.[57]

The one potential barrier to the absorption of the PSFP was President Roosevelt, who had all along been the project's most important supporter. Roosevelt had wanted the project to form a wall between the Dust Bowl and more productive farmland to the East. For a variety of technical and political reasons the project as it actually developed was a more diffuse undertaking than the "wall" President Roosevelt had imagined across the middle of the nation. After swinging through the area briefly in his reelection bid, Roosevelt had been disappointed to find little evidence of "his" program. He expressed his dissatisfaction to Secretary Wallace and to Wallace's replacement, Claude Wickard, and instructed them to make the plantings conform more to his original suggestion. Roosevelt wanted to create a "very vivid effect" that would immediately announce to travelers that they were passing the Shelterbelt. Rather than just a soil conservation measure, he wanted one giant "Shelterbelt" that would "create an extensive national monument of trees in a treeless country."[58]

Secretary Wickard tried to explain to Roosevelt why the project was not "monumental." Since the plantings varied in intensity, they did not present a clear contrast between land inside and outside the zone of planting. Most of the belts ran parallel to the main roads rather than across them, which reduced the impact of driving past. The original plan of having belts running north-south proved impractical because of wind direction which

tended to come from the southwest or northwest. The Forest Service could not make the belts continuous because they needed to meet community needs, and because soil types made such plantings nearly impossible. Although Wickard's explanation was correct, the program he described was not what Roosevelt had wanted, and there was little to differentiate it from the broader SCS program.[59]

Roosevelt's vision for the Shelterbelt was not simply a matter of personnel egotism or monument building. Just as had past generations, he saw the Great Plains as a landscape that could be remolded through human intervention. The Shelterbelt was Roosevelt's way of reducing the troubles of the region to a manageable level. The problem became one of systematically planting trees to halt wind erosion. Of course, this was a vast oversimplification of both the troubles of the region and forestry's role as a solution. Roosevelt was, in the words of political scientist James C. Scott, "seeing like a state." He had narrowed his vision to focus on one solution, a tree wall. This process of simplification made the region seem more legible and easier to manipulate. Roosevelt did not have the time, or the inclination, to learn the nuances of soil science, settlement and wind patterns, or dozens of other variables. Although Roosevelt's plan was perhaps the grandest simplification of all, he was not the only one with a vision for the Plains. Each federal agency involved in erosion control had their own plans, and each plan involved a process of simplification.[60]

When Roosevelt realized that the Forest Service could not complete his vision, he began supporting a reorganization of Plains soil conservation agencies. Roosevelt started by urging the Department of Agriculture to transfer the PSFP to the SCS in 1940. Bureau of the Budget Director Harold Smith pressed Roosevelt to make the transfer because the SCS could legally spend regular appropriations on the PSFP. He also pointed out that, in the six states

where the program worked, the SCS had already established Soil Conservation Districts which could take over maintenance and operation of the project. With all of these arguments in hand, Roosevelt exacted his revenge on Clapp by informing Wallace that the SCS was now in a position to take over responsibility for PSFP operations.[61]

However, Roberts had not yet relinquished his policy of resistance, and in December he asked his state directors to assemble a report on SCS plantings. The next month Roberts presented his report to Acting Chief Forester Clapp. It painted a largely negative view of SCS efforts. John Emerson, the Nebraska State Director, claimed that 99 percent of the SCS's demonstration plantings from 1935 to 1937 had died by 1940—some 2.5 million trees. He observed that "the farmers in the area were pretty disgusted with the SCS and after an indignant meeting the SCS asked us to take over the job of replanting and fixing up the plantings they had originally started." Earle Thomas of the North Dakota state office complained that the SCS plantings ignored the needs of farmers and planted too close to roads. Personnel from other states echoed these complaints. Although Roberts hoped the report would help the Forest Service resist Departmental reorganization, there was no evidence that Roosevelt, Smith, or even Wallace ever read his reports. Furthermore, Roberts' logic—that the SCS lacked proper techniques and knowledge—was undermined by bureaucratic reorganization efforts aimed at transferring the PSFP to the SCS, thereby providing the SCS with many former PSFP personnel.[62]

Stalling and internal resistance continued for much of 1941, but by the end of the year Smith could report to Roosevelt that Wickard had finally agreed to the transfer. Smith had continued to promote the transfer, despite Forest Service resistance during 1941, on three grounds: that the SCS already had authorization for such a program, that the SCS received

funding for the Cooperative Farm Forestry Act for fiscal year 1942, and that the presence of two such organizations on the Plains led to "duplication and overlapping." Smith acknowledged that the PSFP had made the program a success when no one else wanted it and when most believed it would not work, but that was as far as Smith or the administration would go. Wickard's decision to finalize the transfer was based primarily on a financial checkmate. With relief funds drying up in the face of renewed prosperity and wartime mobilization, the PSFP needed regular funds. In 1941, Congress finally seemed to recognize this by including funds for the PSFP under the Cooperative Farm Forestry Act (also often called Norris-Doxey) for fiscal year 1942, but Smith and Roosevelt warned Wickard that they would reduce Forest Service funding under the Act unless Wickard made the transfer.[63]

This left Wickard and the Forest Service with an operose choice. The SCS was still trying to establish conservation districts in many Plains states. Since the SCS would only carry out work within established conservation districts, this meant that transferring the PSFP to the SCS would result in abandonment of roughly 80 percent of the shelterbelt zone, at least until the SCS expanded. The other alternative was even less pleasant to contemplate. The Forest Service could retain the PSFP and lose all of its Cooperative Farm Forestry Act funding, some $700,000. Not only would the Forest Service then lose funding for a number of other programs, but it would have to locate funds to continue the PSFP. Given these unpleasant alternatives, Wickard and the Forest Service agreed to the transfer.[64]

In functional terms, however, transferring the PSFP to the SCS effectively signaled the end of the Shelterbelt Project. Under the SCS, Cooperative Farm Forestry Act work on the Plains would be realigned from "shelterbelt farm forestry work" as "rapidly as possible" to a program of "forestry assistance to farmers through local soil conservation districts."

Funds would increasingly be used for technical guidance at a national level rather than be channeled into the PSFP zone. Thus transferring the PSFP to the SCS did not constitute a true continuation. The SCS would reassign personnel and funds according to its needs, and it was under no obligation to sustain shelterbelt planting or research, although it did continue some of both.[65]

For the foresters of the PSFP, this was a deathblow. E. L. Perry, a forester who wrote an unpublished official history of the PSFP in 1942, explained that the SCS was "largely dominated by agronomists who, by and large, have a tendency to believe that any conservation end that can be achieved with trees can be better and more cheaply done by agronomic methods." Roberts noted that the "project lost its identity and character when turned over the SCS in 1942 and became an incidental and very minor phase of the activities of the SCS." Clapp mourned the loss, and could never "understand why FDR, after sponsoring the project as he did, approved a recommendation which could have only one result." What their disappointed appraisals ignored was an ongoing legacy. The PSFP foresters who did go to work for the SCS found that, while their work had a broader focus than previously, they never stopped planting trees on the Plains. Most continued to advocate afforestation as a superior long-term erosion control measure.[66]

The SCS and the PSFP were as much engaged in constructing bureaucratic strongholds as conservation landscapes. Foresters wanted to make shelterbelts the primary conservation device for the Great Plains, partly because they hoped shelterbelts would solve some of the region's troubles but also with an eye towards bureaucratic survival and expansion. The PSFP depended on a farm landscape divided by shelterbelts to justify its

existence and sustain the flow of federal dollars to the Great Plains. Foresters argued in favor of tree planting by claiming that it was the only true long-term solution. In their arguments for an expanded conservation program with multiple approaches, however, foresters undermined their rationales for bureaucratic dominance. If soil conservation really did involve more than just trees, then why should the Forest Service and tree planting be given primary billing? This was a question that foresters could not answer, but that the SCS was poised to explain.

The SCS promoted a more agronomic approach that made tree planting a small part of a larger program of soil conservation, but, like the PSFP, its ideas about the conservation landscape also harbored bureaucratic favoritism. SCS agronomists argued that a number of agronomic approaches could largely eliminate the need for field shelterbelts. To some degree they were correct, but reducing the importance of tree planting and adopting a variety of conservation methods was also an effective way to check PSFP influence on the Plains and to increase the stature of the SCS. Replacing an idealized landscape of tree-shrouded squares with a landscape of contoured, stubble mulched, and terraced squares was thus also a process of exchanging one bureaucracy for another.

Chapter Seven—Notes

[1] Raphael Zon to F. A. Silcox, 12 September 1934, Regional National Archives, Kansas City, Missouri (RG 95) (hereafter Kansas City Archives).

[2] Ibid., 3.

[3] Ibid., 3.

[4] Paul Roberts to Zon, 6 April 1935, Kansas City Archives (RG 95).

[5] L. F. Kneipp to Roberts, 12 February 1935, Kansas City Archives (RG 95); Alva Simpson to Acting Director, 13 May 1935, Kansas City Archives (RG 95).

[6] Roberts to Zon, 22 November 1937, Kansas City Archives (RG 95); see Chapter 4.

[7] Ibid., 2.

[8] Roberts to Richard Metcalfe, 22 March 1940, Kansas City Archives (RG 95), 2.

[9] Ibid., 3, 8.

[10] Carlos Bates began a series of crop influence studies during the 1930s to determine what effect shelterbelts had on productivity. Although his research was badly interrupted by the Second World War and the transfer of the PSFP to the SCS, his results proved inconclusive. See Carlos Bates, *The Windbreak as a Farm Asset* (U. S. Department of Agriculture: Farmers' Bulletin 1405), and Bates' assistant during some of these studies J. H. Stoeckeler, "Shelterbelts and Their Effects on Crop Yields in the Great Plains," *Journal of Soil and Water Conservation* 18 (1963): 139-44. The effect of shelterbelts on crop yields is a complex problem and remains contested even today.

[11] George Perkins Marsh, *Man and Nature: The Earth as Modified by Human Action* (New York: Charles Scribner, 1907), viii; N. S. Shaler, *Nature and Man in America* (New York: 1891); N. S. Shaler, "The Economic Aspects of Soil Erosion" *National Geographic Magazine* 7(1896): 328-338, 368-377; United States Department of Agriculture, *Circular 33* (Washington: GPO, 1928); See also, Hugh Bennett, *Soil Conservation* (New York: McGraw-Hill, 1939).

[12] Hugh H. Bennett and W. R. Chapline, *Soil Erosion: A National Menace* (USDA: GPO, 1928); Daniel B. Botkin, *Discordant Harmonies: A New Ecology for the Twenty-First Century* (Oxford Press, New York, 1990); Neil Evernden, *The Social Creation of Nature* (The John Hopkins University Press: Baltimore, 1992).

[13] House Subcommittee on Agriculture of the Committee on Appropriations, Hearings, *Department of Agriculture Appropriation Bill for 1930*, (1929) 70th Congress, 2nd Session, 310-30. A similar bill had been introduced in the previous Congress but died in the House Committee on Agriculture. Robert Morgan, *Governing Soil Conservation: Thirty Years of the New Decentralization* (John Hopkins: Baltimore, 1965), attributed that failure the House Committee's belief that existing research within Extension was sufficient to deal with soil erosion.

[14] Morgan, *Governing Soil*, 7.

[15] Lillian H. Wieland, *Bibliography on Soil Conservation* (USDA, Soil Conservation Service: GPO 1936).

[16] Morgan, *Governing Soil*, 7.

[17] The Congressional debate in March and April of 1935 over making the Erosion Control Service a permanent agency is surprising in its overwhelming approval and the scarcity of objection. The objections that are made are about questions of budget and bureaucratic authority, not on the ability of the Service to prevent the "dust storms that are starting their yearly progress over the western plains." See, *Congressional Record*, 74th Congress, 1st Session (1935), 2573, 3550, 5644, 5645. The contrast between committee hearings was equally sharp, for debate on the SCS see *US Congress Senate Committee Hearings Vol 481*, 74th Congress, 1st Session (1935). For debate on the Shelterbelt see Chapter 4.

[18] Ibid.

[19] Senate Committee on Agriculture and Forestry, *Protection of Land Resources Against Soil Erosion, Hearings*, 74th Congress, 1st Session (1935), 1-78; Douglas Helms, "Conserving the Plains: The Soil Conservation Service in the Great Plains," *Agricultural History* 64 (Spring 1990): 58-73. Helms is the National Historian for the SCS and has examined this issue. While he could not establish its veracity he found no reason to doubt it, and suggested that it might very well have been true.

[20] Helms; Paul B. Sears, *Deserts on the March* (University of Oklahoma: Norman, 1935).

[21] Senate Hearings, *Protection of the Land*, 7, 71; James C. Malin challenges Bennett's claims. See, James C. Malin, *The Grasslands of North America: Prolegomena to its History with Addenda* (Lawrence, Kansas; James C. Malin, 1961), 131; Bennett, *A National Menace*, copy of press release on file as typescript in Iowa State Library Special Collections, Bennett Papers, Ames, Iowa (Hereafter Bennett Papers).

[22] United States Department of Agriculture: Soil Conservation Service, *Report of the Chief of the Soil Conservation Service, 1935* (GPO, 1935).

[23] Morgan; Donald Worster, *Dust Bowl: The Southern Plains in the 1930s* (New York: Oxford Press, 1979).

[24] Hugh Bennett, "Statement presented by Bennett to Subcommittee of House Committee on Public Lands," 20 March 1935, Bennett Papers.

[25] Congress also transferred the SCS to the Department of Agriculture and, theoretically, unified all soil erosion activities under the SCS in March 1935. This included the Bureau of Plant Industry, Bureau of Agricultural Engineering, and various erosion control nurseries and work camps. See, US Department of Agriculture, Soil Conservation Service, *Report of the Chief of the Soil Conservation Service, 1935* (GPO, 1935); see Morgan, *Governing Soil*, for the many difficulties integration posed.

[26] Hugh Bennett, "Attacking Soil Erosion on a Nation-Wide Front," 19 June 1935, Bennett Papers; Hugh Bennett, "Program of the Soil Conservation Service," 8 July 1935, Bennett Papers.

[27] US Department of Agriculture, Soil Conservation Service, *Report of the Chief of the Soil Conservation Service, 1935* (GPO, 1935); Helms.

[28] "Memorandum of Understanding Between Forest Service and Soil Conservation Service," Signed by F. A. Silcox and Hugh Bennett, 17 October 1935, Kansas City Archives, (RG 95).

[29] Wilkie Collins to Dick Lewallen, 22 Novermber 1937, Kansas City Archives (RG 114); Memorandum for the Director, und., Kansas City Archives (RG 95). This letter is filed beside, and refers to Carlos Bates to A. E. Jones, 5 October 1938, Kansas City Archives (RG 95). Bates had a reputation as a loner and maverick within the Forest Service, and it was doubtful that he wanted anyone, least of all SCS personnel, interfering with his experiments. It was possible, however, that Bates hoped to use SCS expertise to support his findings. Bates was critical that the crop influences studies would show positive results, and he may have hoped SCS would support his side (see Chapter 8).

[30] John F. Preston to C. B. Manifold, 1 September 1938, Kansas City Archives (RG 95).

[31] Roberts to the Forester, 20 March 1935, Kansas City Archives (RG 95); Zon to the Forester, 22 March 1935, Kansas City Archives (RG 95).

[32] Roberts to Zon, 4 April 1935, Kansas City Archives (RG 95); Roberts to Zon, 8 April 1935, Kansas City Archives (RG 95).

[33] Memorandum for Silcox, 20 April 1935, Kansas City Archives (RG 95).

[34] Roberts to Chief Forester, 27 February 1937, National Agroforestry Center, Lincoln Nebraska, Shed Records (Copies of this letter are held in a shed at the Agroforestry Center). This complaint was not uncommon in areas where the two agencies overlapped. However, overlap was still by far the exception. There may have been shelterbelts planted along the contour particularly in later years, but this author has never seen such a shelterbelt in any of the plans. The Regional National Archives, Kansas City (RG 95) and National Agroforestry Center, Lincoln, Nebraska hold thousands of individual shelterbelt plans.

[35] John Emerson to Roberts, 3 February 1940, Kansas City Archives (RG 95).

[36] R. E. Marsh, "Comments on PSFP in Connection with General R-9 Inspection," 10 December 1937, 6-7.

[37] D. S. Olson to Roberts, 9 October 1935, Kansas City Archives (RG 95).

[38] Roberts to Forester, 18 October 1935, Kansas City Archives (RG 95).

[39] F. A. Silcox to Roberts, 20 April 1938, Kansas City Archives (RG 95).

[40] J. A. Fitzwater to Roberts, 24 July 1939, Kansas City Archives (RG 95).

[41] Ibid., 2.

[42] Olson to Roberts, 28 July 1939, Kansas City Archives (RG 95), 1,2.

[43] Olson to Roberts, 12 September 1939, Kansas City Archives (RG 95), 1-2.

[44] Fitzwater to Roberts, 24 July 1939, Kansas City Archives (RG 95), 1.

[45] Zon to Acting Assistant Chief Forester, 13 July 1936, Agroforestry Center.

[46] Edwin Henson to Milton Eisenhower, 15 December 1939, Kansas City Archives (RG 95). This is a rather extensive report and contains both Henson's conclusions and excerpts from various letters he received, however, all of these have been edited. Henson does not comment on the issue of expanding the range of plantings, but his choice of including these ideas suggests he, at least passively supported such a policy change. The conclusions that Henson drew were not uncommon and could be seen as far back as late 1934 when

Shelterbelt planners and local extension agents had argued over the value of different types of planting. See, H. D. Cochran, "Memorandum," 23 November 1934, Kansas City Archives (RG 95).

[47] Russell Reitz to Roberts, 30 March 1938, Kansas City Archives (RG 95).

[48] Ibid., 2. A similar incident had taken place in the Republican River Valley of Nebraska in 1935-36 when the SCS had jumped in to provide concerted erosion control to valley residents while the Forest Service dithered and argued over jurisdiction and plans. See, E. W. Tinker to Roberts, 16 March 1936, Kansas City Archives (RG 95).

[49] Roberts, "Memorandum for the Regional Coordinator," 8 August 1941, Kansas City Archives (RG 95).

[50] Ibid.

[51] Ibid.

[52] A. L. Riesh Owen, *Conservation Under FDR* (New York: Praeger Publishers, 1983), 179-180.

[53] Earle Clapp to Roberts, 4 April 1963, *Paul H. Roberts Papers*, Nebraska State Historical Society, Lincoln, Nebraska (Hereafter *Roberts Papers*); Roberts to Amerlia Fry, 28 July 1965, *Roberts Papers*. See Harold K. Steen, *The U. S. Forest Service: A History* (Seattle: University of Washington Press, 1976), 237-245 for more info. See Chapter 4 for Cooperative Farm Forestry Act.

[54] CLF, Memorandum for Directors, 11 October 1938, *Roberts Papers*.

[55] "Read and Destroy," 15 October 1938, *Raphael Zon Papers*, Minnesota Historical Society, Minneapolis, Minnesota. Fortunately Zon disobeyed the instructions.

[56] Roberts to C. B. Manifold, 1 September 1938, Kansas City Archives (RG 95); Roberts to F. A. Silcox, 22 July 1938, *Roberts Papers*.

[57] Henry Wallace, United States Department of Agriculture, "Memorandum No. 785," 6 October 1938, *Zon Papers*; E. L. Perry, "History of the Prairie States Forestry Project." United States Department of Agriculture: Forest Service, unpublished typescript (1942).

[58] Claude Wickard, Secretary of Agriculture, to Franklin Roosevelt, 4 November 1940, Edgar B. Nixon, *Franklin D. Roosevelt and Conservation, Vol. 1, 2* (Franklin D. Roosevelt: New York, 1957), 481-483. In this letter Wickard refers to an earlier conversation between Roosevelt and Wallace and then explains his plan to meet Roosevelt's vision.

[59] Claude Wickard, to Franklin Roosevelt, 4 November 1940, Nixon, 481-83.

[60] James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (Yale University Press: New Heaven, 1999). For a more sustained discussion of the Forest Service's vision see Chapter 6.

[61] Franklin Roosevelt to Henry Wallace, 6 May 1940, Nixon, 448-49.

[62] John Emerson to Roberts, 30 December 1940, *Roberts Papers*; A. L. Ford to Roberts, 30 December 1940, *Roberts Papers*; Earle Thomas to Roberts, 19 December 1940, *Roberts Papers*.

[63] Harold Smith to Franklin Roosevelt, 6 November 1941, Nixon, *Franklin*, 535-38; Claude Wickard to Harold Smith, 31 October 1941, Kansas City Archives (RG 95). Roosevelt cancelled the WPA in 1942, and while this ultimate decision was still uncertain, it was quite clear in 1941 that relief money would no longer suffice.

[64] Claude Wickard to Harold Smith, 31 October 1941, Kansas City Archives (RG 95).

[65] Ibid.

[66] Perry, "History," 71; Paul Roberts, personal notebook, *Roberts Papers*; Earle Clapp to Roberts, 27 July 1946, *Roberts Papers*.

Chapter Eight—The Conservation Landscape

In the past two centuries Americans have altered the Great Plains. Farmers, politicians, scientists, and the state constructed and reconstructed the Plains to support their peculiar visions of a sustainable society. In the process, they transformed the region from a natural ecosystem or bioregion into a social and ecological space inextricably linked to the beliefs, agendas, and polices that had reshaped it. Americans' efforts to tweak, improve, and conserve the Great Plains created a new landscape. They so thoroughly blurred the social and the natural that these categories can no longer be separated, and their greatest task now is to recognize this hybrid space for what it is: a socially-constructed landscape, a *conservation landscape*.

Although Americans initially believed that nature was infinitely malleable, such illusions faded rapidly with resurgent drought conditions. In some sense their greatest miscalculation was not in misreading nature, but in their inability to view the Plains as a humanized place. Each new intervention assumed that previous efforts had failed because of miscalculation, and that better science, technology, and funding would inevitably lead to a clearer understanding of the true nature of the Plains. In James Scott's words, they were "seeing like a state," and in the process vastly oversimplifying both nature and society. Again and again Americans thought that measuring and categorizing would result in knowing, but the Plains was never so tractable. Its past did not simply repeat, and each intervention changed the Plains both materially and culturally in ways that essentially made it a perpetually novel place. The Great Plains had become an evolving landscape of human

artifice and natural fluctuations. Thus seeing like a state was not enough. One also had to see like a historian.[1]

In this way the Great Plains, or any other conservation landscape, underscores the significance of the historical perspective. Dry and wet cycles molded opinions about the land, pushed and pulled settlement and politics, and influenced people's assumptions about future climatic events. Viewing nature as a steady state, or natural events as singular rather than ongoing processes, led Americans again and again to misread the Plains. The same can be said about the institutional history of conservation landscapes. Americans formed organizations to undertake particular projects, but once they set an agency in motion, it developed an internal logic, an institutional view and goals that shaped its policies and work in ways that founders rarely foresaw. Scientific careers became wedded to the bureaucratic framework in ways that made it increasingly difficult for scientists to detach questions about how to shape the land, or judgments about previous programs, from the views of the institutions they served. In the end, understanding the environment, economy, politics, and institutions of the Great Plains requires understanding how each evolved over time.

What emerges most strikingly from this complicated narrative about Plains forestry is the tangled relationships among science, politics, and nature. Science was portrayed as an objective tool to modify Plains landscapes, but in ways that pleased other interest groups. Politicians played an obvious role in promoting afforestation during dry cycles and ignoring these programs when the rains returned, but they also shaped, managed, and judged scientists' solutions, just as science shaped, judged, and managed political policies. Neither scientists nor politicians attained their dreams, and both were frequently unhappy with the ensuing compromises because nature also played a critical role in this history. Politicians and

scientists could propose, but wishful thinking did not grow trees. Ultimately nature facilitated or frustrated their attempts according to forces that have bedeviled humans for millennia. Nature provided its own historical context, and its contingencies were often the only bottom line that mattered. As a result, this is necessarily an unfinished and unending tale.

When Americans first settled the Great Plains in the second half of the nineteenth century, they began a process of discovery. Boosters and theorists cast aside descriptions of the region as a Great American Desert and searched for a new title. They tried calling it a Garden, and they hoped that tree planting and other actions would eventually secure this image. Building on the work of George Perkins Marsh, tree boosters such as Richard Elliott, Robert Furnas, and J. Sterling Morton told Americans that trees would increase rainfall, and they stressed the many social advantages of forestry. This strain of thought, called social forestry, became the *raison détat* of later claims about the transformative potential of forestry. In the process of promoting social forestry, though, Elliott, Furnas, and Morton also promoted their own careers, but as with later foresters, this was never a simple matter of self-promotion. Neither "altruism" nor self-interest adequately captures their actions. The social and the personal instead blurred and reinforced one another.[2]

During this first era of transforming the Great Plains, Americans depended primarily on private initiative and public subsidies, and they were surprised when these failed. They had viewed afforestation as a relatively simple task. Speculators, boosters, and many farmers saw tree planting as a straightforward way to improve the image of the region or an inexpensive way to acquire land, but it was far easier to talk about trees than to plant and grow them. Although rarely acknowledged, nature, not humans, ultimately determined

success and failure. Had trees grown easily on the Plains, even the half-hearted efforts of farmers and boosters would have succeeded. Success would not have changed the climate or social structure, but it might have discredited the more outlandish claims about the transformative potential of social forestry.

In the late nineteenth century, the feedback loops between science and politics seemed perfectly symmetrical. It was only nature that fouled things. Early foresters invoked their scientific and bureaucratic authority when encouraging Americans to adopt afforestation. In return, Franklin Hough and Nathaniel Egleston believed that their solutions to national problems would secure for forestry a lasting place in the public's eye and purse. Scientific foresters urged Americans to set aside vast portions of the Great Plains for tree planting to ameliorate problems with the American Desert and the new federal forests. In the equation foresters served politicians, and politicians served foresters. Nature had its own say, however, when the rains returned. Americans rushed onto the Plains again and resisted all efforts to keep any land off limits because trees seemed irrelevant during the wet years.

But because history does not repeat itself, the next cycle of dry years sent foresters and politicians in a new direction. When drought struck the Great Plains in the 1890s, it undermined the facile theories of climate change. Trees and plows had not ensured the rains, so foresters and their allies argued that what was needed was better science and greater federal support. They scrutinized earlier failures for signs that private initiative and unscientific techniques had led to failure rather than that the Plains were unsuited to afforestation. Once they had established the argument, Bernhard Fernow and Charles Bessey laid the scientific groundwork for an expanded effort at Plains forestry, and Gifford Pinchot and the Forest Service created a series of forest reserves on the Great Plains. The Forest

Service in effect institutionalized Hough's and Egleston's dreams of transforming these treeless spaces into forests. Now the state would improve the condition of surrounding lands, and in return the Forest Service would secure its own future, and that of forestry as a profession. The future of the Plains and foresters were bound together by the success of the federal forests in Kansas, Nebraska, and the Dakotas.

Yet tree planting on the reserves proved much more difficult than foresters had anticipated. Instead of marking the start of a new era of authority, Plains forestry became mired in a fairly typical story of the times as one of many sciences competing for public recognition. Like other sciences, forestry grew increasingly diverse, and practitioners spent more and more time and energy contesting a variety of approaches to tree planting. The Forest Service tried to expand its institutional vision by promoting Plains forestry as an extension of forestry as practiced in other areas. They designed windbreaks and shelterbelts as miniature forests that would replicate the climates of other places. During this era Raphael Zon picked up where Fernow had left off, adding further scientific weight to social forestry ideas and continuing to argue for public control of forest resources. As forestry science matured, though, Zon could no longer control the debate as had Fernow and Hough. A growing number of foresters from outside the Forest Service also worked on Plains forestry, and their ideas were often at odds with the Forest Service. Their science and their experiences made them skeptical about social forestry, and they feared that continued reliance on social forestry would discredit their status as professionals.

Plains forestry seemed to recede during the 1920s into relatively uninteresting debates between experts, but then nature intervened again. The Great Plains descended into another drought. Suddenly old and new ideas about how to solve the problem of aridity were again

front-page news, and foresters once again argued that they had the best answers. For the Forest Service this was another opportunistic development, and with encouragement from President Franklin Roosevelt, Zon, Edward Munns, and Ferdinand Silcox developed a plan that mixed social forestry with ecology and land management to create a new vision of the conservation landscape. The more outlandish aspects of the plan did not stand up to scientific scrutiny, but they did inspire Americans to reexamine their understanding of the Great Plains. Foresters still believed that they could transform the region into a garden through scientific expertise and federal assistance, but many Americans were increasingly skeptical of foresters' claims and even the Great Plains.

The resulting political contests revealed the centrality of institutions in forestry and conservation history. Several historians have come to similar conclusions about conservation, forestry, science, and fisheries. When foresters planned for the Shelterbelt Project, their proposals were about more than growing trees. They sought nothing less than a dramatic reorganization of natural, political, and social spaces. Systematic tree planting carried out on rigid lines by federal experts would underpin this project. Foresters earnestly wanted to break the boom and bust cycles of Plains settlement. From their perspective they identified some of the large scale problems that farming faced on the Plains, including the struggle to find the limits of lands suitable for intensive cultivation and beginning of lands suitable for grazing. They hoped that by reducing the complexity of the region to manageable calculations, they could reengineer the mistakes of history and culture into a brighter future. It did not harm their enthusiasm however that such a program would also vastly expand the bureaucratic and budgetary importance of the Forest Service. The machinations of Zon and Paul Roberts, and

the hesitancy of Congress, suggests that bureaucratic concerns were an intrinsic factor of all forestry policies.[3]

These plans encountered a host of technical, social, and political problems as foresters began their work. The zone of planting, designed as a diagnostic of where tree planting was difficult but possible, became instead a political and ecological marker that was relocated repeatedly to accommodate conflicting values and interests that extended far beyond technical questions of how to grow trees. Foresters also explored land ownership and belt orientation as technical solutions, but these too contained a mixture of goals that included foresters' social views, President Roosevelt's statist ambitions, and bureaucratic imperatives. The resulting plans for the Shelterbelt Project represented the apogee of high-modernists plans in federal forestry, but that vision eroded rapidly under the pressure of competing public, scientific, and natural interests. Administrators grudgingly altered their approach to accommodate a more diffuse and populist approach in the PSFP. This was a defeat for planners such as Zon, Bates, and D. S. Olson, who fervently sought a particularly statist conservation landscape, but they continued to seek similar goals, if over a much more modest landscape.

Even on a minute scale, however, science continued to operate within a competing milieu of political, social, and natural forces. Planning shelterbelts as miniature forests appealed both technically and professionally to foresters, but the proposed massive, complicated belts were less appealing to farmers. Foresters worried that decisions concerning spacing within belts had compromised technical standards for farmer convenience, but it was unclear whether foresters' spacing preferences were technically any sounder than farmers' preferences. The search for appropriate species only underscored the blending of science and

politics in conservation landscapes. Foresters tried to identify the most robust, most appropriate trees for planting on the Plains, only to reverse themselves by favoring the technically suspect but flashy cottonwood over slower growing conifers for the sake of political expediency. Caught between political and economic pressures, foresters ultimately compromised their technical standards. In previous decades foresters had been able to justify their changes as technical necessities, but by the 1930s their decisions, even about specific technical considerations such as row spacing, were questioned by experts in other agencies. Such moments open a window, not onto the decline of expertise, but its evolution from a position of singular authority to heterodox contestation.[4]

The emerging culture of contest encompassed not only scientists but their constituent bureaucracies. One example was the Prairie States Forestry Project. The more the PSFP compromised on the high-modernists' ideals of social forestry, the more it was just another alphabet agency of the New Deal competing with other agencies such as the SCS agronomists for control of a conservation landscape. The leaders and personnel of both agencies believed that the United States needed a new approach to soil conservation, but they pursued substantially different institutional approaches. The tree-bound Forest Service put forests and shelterbelts at the center of their conservation landscape. They acknowledged a role for other techniques such as grassland restoration, but they always viewed trees as the first and most important step to recovery. Less ideologically wed to any single technique, the SCS proffered a broader array of conservation methods and employed them more explicitly according to political popularity and effectiveness. Although both agencies downplayed bureaucratic competition, it was increasingly obvious that two federal organizations, offering farmers two rival conservation measures, created untenable overlap and conflict. In 1942 the

Department of Agriculture and Congress ended this contest by transferring the PSFP to the SCS.

By the post-war period, shelterbelts were but one of many conservation techniques, and trees never regained their once-favored status. This was partly because the SCS was institutionally disinclined to elevate tree planting above its other techniques. Even during the Filthy-Fifties and the environmental-seventies, tree planting remained a relatively minor part of SCS programs, but shelterbelts' new status was not solely a matter of institutional inertia. Nature continued to influence events. Tree planting had always been a difficult and slow job that often frustrated even the most accomplished foresters. In regions where tree planting showed better results and greater stability, such as North Dakota, shelterbelt planting continued as an important conservation practice. As with every period in this history, this was a complicated tale.

Transfer of the Prairie States Forestry Project's (PSFP) to the SCS and the outbreak of World War II effectively ended the PSFP, if not shelterbelt planting. Instead, like other conservation programs tree planting entered a new era in which it became secondary to the immediate goals of winning the war. With few dollars and fewer personnel, the SCS was constrained in the assistance it could provide, so it tried to convince farmers to undertake conservation practices. Getting farmers to plant, let alone maintain, shelterbelts during a time of agricultural expansion meant emphasizing crop production benefits. A conservation measure that had once been part of a crop reduction scheme became, at least in theory, a yield booster, but this too was temporary.

The return of dry, dusty conditions during the "Filthy-Fifties" reawakened national attention to Great Plains conservation. Energized by crisis and bolstered by Great Plains

Conservation Program (GPCP) funding, the SCS again encouraged farmers to adopt conservation measures on a cost-sharing basis. Although in some ways cost-sharing was similar to the PSFP cooperative approach, shelterbelt planting remained a small part of SCS activities. Despite attempts to promote the PSFP as having ameliorated the Dust Bowl, there was little effort to revive the program. Stripped of most of its social forestry ideology, missing executive interest, and lacking bureaucratic promotion, afforestation could not recapture the public's imagination.[5]

Not until the 1970s did the environmental movement ignite new interest in shelterbelts as a conservation measure. Hoping to capitalize on public concerns over the environment, SCS foresters melded older social forestry ideas with newer environmental concerns. Trees once again became a way to influence climate, but this time by improving air quality and reducing global warming. While the goals were noble, the renewed interest underscored the paradox of shelterbelt planting in a bureaucratic landscape. Soil conservationists were exploiting pubic interest to promote a bureaucratic agenda. They were protecting soil the only way they could given the prevailing cost-sharing models of cooperation between private and public interests.

After 1942 the SCS became the primary federal agency charged with promoting shelterbelt planting on the Great Plains. During the 1940s the two main justifications for the PSFP—that it would provide employment and halt blowing soil—declined in importance. An expanding war economy put Americans to work, and increased rainfall held the soil. Just as Edwin Henson, land use coordinator for the Southern Great Plains, had predicted in 1939, "a good many of the Department of Agriculture's plow shares are going to be beaten into

swords; and it is more than likely that the Prairie States Forestry Project will be one of the first to feel the blow." The transfer of the PSFP to the SCS in 1942 was that blow, and with it came a different approach to tree planting.[6]

Under the SCS shelterbelt planting lost its distinctiveness, becoming but one of many farm conservation policies. Many PSFP foresters accompanied the transfer to SCS and carried on some of their work and traditions, but under wartime conditions there was neither funding nor labor to sustain former practices. At best the SCS offered technical assistance in species selection and arrangement, site preparation, planting methods, and a limited supply of nursery stock. Bureaucratic consolidation and war resolved nursery overlap. Most farmers now bought their seedlings instead from state nurseries, which still provided them at cost. Farmers carried out planting and maintenance themselves. The most direct help the SCS could offer was to loan tree-planting machines. Without more state support, farmers rarely planted field shelterbelts and most plantings done during and after the war were for farm and feedlot windbreaks. The heavy dependence on farmer labor forced the SCS to develop a new model to encourage field shelterbelt planting. During the 1930s the PSFP and SCS could rely on extreme unemployment and government subsidies, but during the 1940s conservationists had to reemphasize old claims about the benefits of shelterbelts on crop production.[7]

The relationship between shelterbelts and crop yields had fascinated and frustrated foresters. Early Forest Service plans partially viewed shelterbelts as a crop retirement scheme, and wide belts reinforced that impression. However, there was also the possibility that shelterbelts' wind-reducing properties might increase crop yields. Carlos Bates had begun a series of experiments in 1936 to establish a scientific test of such claims. The start of the war and end of the PSFP intervened before he could finish his work, and he never

published a complete accounting. Bates' biographer, Richard Sartz, suggested that Bates continued some research on shelterbelts until his death in 1949. If true, then Bates kept his own council, but in 1949 Joseph Stoeckeler, Bates' assistant during his field experiments, indicated that "the variability of production within fields" had made calculations so difficult that "the entire mass of data" collected between 1935 and 1941 had to be "restudied."[8]

Although the record is unclear, there were reasons to suspect that the study's results were negative or inconclusive. Bates had been extremely skeptical that shelterbelts produced a positive effect on crop yields, and nothing he said in the following years suggested a change of mind. In a confidential memorandum to Zon in 1936, he laid out a careful case against positive results. Bates argued that "wind protection as is reasonably attainable only slightly delays evaporation and loss of soil moisture and after any extended period without rain such temporary gains are entirely lost." He could not see how a slight reduction in the rate of evaporation would be effective in aiding growth or preventing drought damage except in very mild cases. "The percentage of cases in which this occurs does not seem to justify putting down moisture conservation as a 'certain benefit.'" Lest Zon miss his point, Bates reminded him that even "the most adequate shelterbelts scarcely delay the searing of crops and do not save them," because heat was the main cause of evaporation and shelterbelts did not reduce this. Bates then confidently predicted that reports of crop benefits from shelterbelts were the result of snow drifts, not wind reduction.[9]

Justifying shelterbelts as a yield booster was even a more difficult task. Bates' experiments to determine if shelterbelts increased crop yield were only a start. Even if he had found a modest increase in yield under ideal conditions, it would not then follow that shelterbelts boosted total yield. The increased yield behind a shelterbelt would have to be

sufficient to make up for the amount of land lost to the belt, for the root sapping effect on nearby crops, for the years of relatively little effect while the belt grew, and for the cost of installation and maintenance (Figure 8.1). Foresters would eventually prove that shelterbelts had a positive effect on crops, but proving that the benefit paid for the full costs was more difficult during a period when foresters had little hard data. It was clear, however, that wide shelterbelts had trouble "paying for" the land they occupied because their effects were no greater than a narrow belt, and they took a significant amount of land out of production. PSFP foresters had viewed shelterbelts as part of a sweeping overall plan to modify the Great Plains, and they envisioned increased crop yield as one of many positive improvements. Foresters might still value shelterbelts as soil conservation measures, wildlife habitats, wood

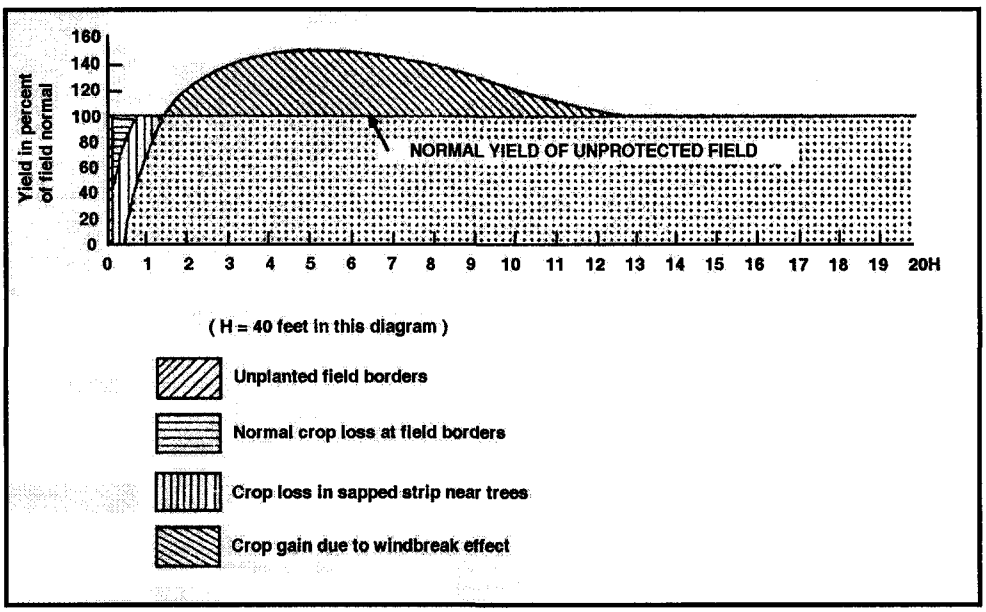

Figure 8.1—Idealized diagram of Shelterbelt effects on crop yield.[10]

producers, and aesthetic improvements, but the SCS thought few farmers would be willing to plant for these reasons alone. Thus in the postwar conservation calculus, SCS foresters pushed crop yield to the front of the list of potential benefits to encourage farmer participation.[11]

To sell this idea, though, SCS foresters depended on farmer testimonials. These folksy tributes became a regular feature of SCS literature on shelterbelt planting. R. J. Tucker of Paducah, Texas, explained that he would "rather have 100 acres behind shelterbelts than 150 acres outside of them." He was particularly pleased with the way the belts prevented spring winds from blowing out young cotton plants. Ernest Fuhrman of Norfolk, Nebraska, attributed his victory in a 1947 corn-yield contest to shelterbelts. "I had 90 acres of corn north of the shelterbelt, including the 10-acre contest plot, and it was evident that the protection the trees gave the field made a lot of difference. The best corn was near the shelterbelt. The yield tapered off as the distance from the trees increased." Such stories might have reassured farmers who already owned shelterbelts, but they offered little to tempt new participants.[12]

Even Joseph Stoeckeler could do little better than this when he published a study of shelterbelts on the Southern Great Plains in 1945. After the transfer of the PSFP to the SCS, Stoeckeler continued to work for the Forest Service from the Lake States Experiment Station. From this position he emerged as the Forest Services' principal Plains forestry technician, and he worked with the SCS to promote shelterbelt planting and research. In a 1945 study Stoeckeler examined PSFP shelterbelts planted during the 1930s. The results, published in *Soil Conservation*, indicated that shelterbelts increased crop yield, but like previous articles, Stoeckeler relied primarily on farmer testimonials to make the point. Rube Bittner of Vernon,

Texas, claimed that he had made as much money from nine acres of watermelon grown behind a shelterbelt as a neighbor on twenty unprotected acres. Ira Tucker of Cottle County, Texas, claimed she would "sooner have 100 acres of farm with shelterbelts than 150 acres without." Despite being partially responsible for one of the largest crop influences studies conducted, the only scientific evidence that Stoeckeler could offer was a rather cryptic statement that "unpublished data by the Lake States Forest Experiment Station, shows increased cotton yields" on fields protected by shelterbelts. In his defense, Stoeckeler was primarily interested in describing the soil conservation advantages of shelterbelts rather than yield improvements, but his terseness spoke volumes about the problems foresters faced trying to persuade farmers to plant their own shelterbelts.[13]

Suasion was not the only challenge foresters faced during the 1940s. The SCS was institutionally disinclined to plant more shelterbelts. As head of the SCS, Hugh Bennett continued to favor soil conservation, but he was astute enough to adapt his agency's goals to wartime interests. He instructed his staff to emphasize conservation techniques that maintained or increased yields and that required little labor, equipment, or technical assistance. Shelterbelt planting required all of these, though, and even the most uncritical boosters had to admit that they reduced crop yields in the short-term. In Bennett's *Elements of Soil Conservation*, published after the war, he briefly endorsed shelterbelts for "making farm homes more livable and comfortable for both men and animals in times of climatic extremes." He also suggested that shelterbelts could "help check soil blowing that would otherwise sweep topsoil from parts of fields near windbreaks." But between the demands of war and Bennett's less than ringing endorsement, the SCS's lack of emphasis on shelterbelt planting was unsurprising.[14]

As Bennett expected, high profits and wet years led farmers to expand their operations during the 1940s. The plow-up that accompanied the war was not as great as during and after World War I. Farmers did continue some conservation techniques, but agriculture nevertheless expanded into submarginal lands that had only recently been stabilized after the disaster of the 1930s. Moreover, demand remained high. Between 1941 and 1950 farmers opened approximately 5 million new acres to cultivation. About three-fifths of that total was on lands poorly suited for crop production, and a portion had never before been farmed. Under a "normal" rainfall regime, the plow-up represented little but profits for farmers, and despite occasional expressions of concern from soil conservationists, there was no strong effort to restrain the expansion.[15]

Of course, normal conditions were rarely normal on the Great Plains, and in 1950 dry conditions returned. The drought began in the Southwest, and by 1953 it had spread to Kansas, Nebraska, and Oklahoma. The next year the drought continued to stretch over a ten-state area from the Midwest to New Mexico. The most severe conditions struck the old Dust Bowl areas of the Texas panhandle, central and eastern Colorado, western Kansas and central Nebraska. As with the drought of the 1930s, the 1950s saw very high temperatures. In the summer of 1953 temperatures in Dallas exceeded 100 degrees F for fifty-two days. The drought peaked in 1956, and then relief came in 1957 when spring rains finally fell to hold the soil in place.[16]

Although the drought was shorter and not accompanied by the economic dislocations of the 1930s, its effects were severe. High temperatures and low rainfall cut crop yields by as much as 50 percent and seared grasslands for grazing. With its protective cover removed or in poor condition, the soil blew once again. By the winter of 1954 some observers remarked

that the dust storms were worse than in the 1930s. H. H. Finnell, head of the SCS Dust Bowl experiment and later head of SCS Region VI, remarked that the "catastrophe to the land has already exceeded that of the 1930s, but due to the absence of financial straits and hysteria which existed in the 1930s, farm abandonment has been much slower." Newspapers and magazines soon informed the nation that a new Dust Bowl had formed on the Great Plains. According to popular accounts there was little to separate these storms from the 1930s, but historian Douglas Helms has pointed out some significant differences. The area affected was much larger, and while it included all of the areas of the old Dust Bowl, conservation measures seemed to help limit the severity of the crisis within the old Dust Bowl area.[17]

Predictably, the drought and dust storms sparked a renewed federal commitment to Great Plains conservation. In 1956 Congress passed a new land protection scheme, the Great Plains Conservation Program (GPCP), that set out a system of farmer-government cooperation. GPCP authorized the Secretary of Agriculture to enter into ten-year contracts with farmers and ranchers who dedicated land to soil conservation practices. Recognizing that farmers had little incentive to pursue measures on their own, GPCP provided incentives in form of federal payments. The SCS was charged with helping farmers convert land and determining what constituted a conservation measure. As usual, the SCS promoted what it considered permanent techniques, such as strip-cropping, terracing, windbreaks, diversions, irrigation systems, and other techniques, but its preferred solution was to convert cropland back to grassland. An emphasis on grassland restoration was bureaucratically popular during the 1950s: in 1954 the Forest Service assumed responsibilities for managing the National Grasslands, a system created by the Bankhead-Jones Farm Tenant Act and the Resettlement

Authority in 1937, and the Bureau of Land Management continued to administer the much larger system of federal grazing lands established by the Taylor Grazing Act of 1934.[18]

GPCP legislation made clear the diminished status of afforestation as a conservation measure. Most supporters of GPCP, along with the SCS, hoped the program would "provide a great deal of incentive to landowners and operators to restore to grass hundreds of thousands of acres which probably should never have been plowed up in the first place." The best that trees could do under the program would be to allow "farmers a new opportunity to plant" around homes and livestock. In the middle of droughts and dust storms the previously unthinkable had occurred: afforestation had disappeared as all but a very minor aspect of any recovery scheme.[19]

While the GPCP abandoned trees as a tool of environmental modification, it did adopt organizational methods similar to the PSFP. Political and public pressures had forced foresters to modify extensively their early plans for the Shelterbelt Project. As it lost most of its high-modernist aspects, the reformulated PSFP pursued conservation as a cooperative program that mixed public and private funds to implement individual farm plans. Similarly, "the heart of the program [GPCP] is a long-time conservation plan for individual farms and ranches through which conservation and land-use adjustments can be worked out with producers in accordance with the capabilities of their land." The key to achieving cooperation would be government cost-sharing that, for example, paid roughly 50 percent of the cost of reestablishing grasslands in return for a contract that prevented farmers from plowing those lands for at least five years. As with the PSFP, farmers could plow under conservation measures after the agreement period. As a tool for temporary acreage reduction and

conservation, the GPCP was a significant step, but it was not the long-term solution that foresters had originally sought.[20]

Despite the meager recognition GPCP gave shelterbelt planting, plantings did increase except in the Southern Plains. Shelterbelts increased most rapidly in North Dakota, where they jumped from 591 miles a year in 1956 to 2,000 to 3,000 miles a year during the 1960s. Although less dramatic, South Dakota and Nebraska also experienced appreciable increases. Kansas, Oklahoma, and Texas displayed the opposite trend. Kansas planted 118 miles in 1956, and then declined to about a dozen miles a year in the 1960s. Oklahoma peaked with 29 miles in 1956 and Texas managed only 8 miles the same year.[21]

The reasons for the variation were unclear, but foresters recognized the difference and suggested several theories. Harold Engstrom blamed the difference on SCS personnel. In the North they had maintained a greater interest in field shelterbelt planting than in the South. Others suggested that field shelterbelts were more useful in the North because they held blowing snow in winter, and crops received extra water when it melted in spring. Another possibility was that the SCS had rapidly developed methods for harvesting wild grass seed, and Southern farmers had accepted grass planting as a quick and efficient alternative to shelterbelts. If true, these theories seemed to bear out Carlos Bates old adage that tree planting would never prosper unless it became "somebody's business." In North Dakota the SCS made shelterbelt planting an important part of its farm conservation plan, but on the Southern Plains it remained indifferent at best towards trees.[22]

Environmental and economic conditions on the Northern Plains were also more favorable to shelterbelt planting. The initial survival rate and longevity of trees were higher on the Northern Plains. The cooler summers were a great asset for newly planted seedlings

with underdeveloped root systems, and low temperatures kept evaporation rates modest and allowed trees to make the most of available moisture. The Northern Plains also received more snow, often piled in thick drifts around shelterbelts. Most years drifts would partially, or even completely, melt in spring only to be rebuilt by the next storm. The result was more water for tree belts than for the surrounding fields or for more southerly shelterbelts. Land values and farm size, both of which tended to be higher in the south, may also have discouraged farmers from planting shelterbelts. What clearly was not at stake was the role of shelterbelts in reducing soil erosion, since this problem was an order of magnitude larger in the Southern Plains. Farmers' preference for shelterbelts in the Northern Plains thus seemed both bureaucratically and environmentally influenced.[23]

Shelterbelt planting continued during the 1960s as a small part of general soil conservation plans. The Forest Service, SCS, and extension service each provided some technical advice, funding, and research, but shelterbelt planting and research during the decade went largely unnoticed by the public and Congress. Without specific advocacy trees remained just another agronomic method.

That changed in the late 1960s and 1970s as environmentalism became a popular movement worldwide and foresters realized that shelterbelts might once again garner public interest. Thus in 1969 the chief administrator of the SCS, Kenneth Grant, announced "'Windbreaks for People' [as] part of the enlarging 'Trees for People' movement that recognizes trees serve man in many ways before they mature for harvest as wood products." Capitalizing on the popularity of Earth Day and new environmental awareness, the SCS soon rediscovered older social forestry ideas, warning farmers that "trees are essential to life on our planet." In this new formulation trees did not modify climate directly; rather "they

moderate temperature and affect pollution, noise, wind, and water." Trees were also boosted as a partial solution to the "greenhouse" effect through their ability to absorb polluted air and emit oxygen. According to one SCS promoter, "the worth of the tree goes far beyond the concept of economics. Chlorophyll-bearing plants make life possible for other organism on earth."[24]

The SCS increased its promotion of shelterbelts after 1970 because, on the surface at least, they seemed to satisfy so many environmental goals. As historian Samuel Hays argues, conservationists often found that their goals conflicted with those of environmentalists because the former sought to rationally manage resources for sustained use, while the latter often stressed preservation of resources in an unused state. Shelterbelts seemed an ideal mediation of this rift. They protected soil and increased production while fixing carbon, reducing noise, and beautifying landscapes. Trees blurred the line between conservation and environmentalism. They seemed to offer the best of both worlds. Other soil conservation activities such as channelization and reservoirs, by contrast, conflicted with environmental attitudes. In areas where urban and rural interests competed, shelterbelts offered common ground between environmentalists and conservationists.[25]

Along with an increasing interest in shelterbelts came fears that trees might be disappearing faster than they were planted. The major concern was that farmers were removing shelterbelts to install center-pivot irrigation. Circular watering systems did not mesh well with existing, rectilinear belts, and at least some conservationists complained that farmers were choosing irrigation over shelterbelts. Some farmers were also removing windbreaks because of old age, disease, or production. The Comptroller General explained all of these fears to conservationists and to Congress in 1975. His report indicated significant

shelterbelt removal was occurring in Kansas, Nebraska, and Oklahoma (Table 8.1). Although the statistics came from a small sampling of counties in each state, the report concluded that shelterbelts were being removed throughout the region at a much greater rate than they were being planted. In the near future they would virtually disappear from some counties.[26]

County	Number Standing	Number Removed	Percent Removed	Miles Removed	Approximate Time Frame
Kansas					
Clay	18	-	-	-	1957-71
Pratt	687	11	1.6	2.3	1963-70
Reno	743	7	1	1.6	1963-71
Sedgwick	284	13	4.6	4.9	1963-70
Stafford	996	22	2.2	6	1963-70
Nebraska					
Holt	2117	165	7.8	35.4	1967-74
Madison	1240	41	3.3	19.7	1970-74
Merrick	560	20	3.6	4.1	1969-73
Seward	143	19	13.3	5.9	1965-70
Oklahoma					
Alfalfa	104	3	2.9	0.6	1961-73
Caddo	413	84	20.3	40.5	1935-72
Garfield	104	9	8.7	4	1961-73
Grant	107	-	-	-	1954-73
Greer	663	140	21.2	73	1935-72
Kingfisher	263	10	3.8	26 acres	1964-70
Washita	866	301	34.8	139.8	1935-74

Table 8.1—Windbreak Removal rates from the 1975 GAO report.[27]

The report offered a number of theories to explain the removals. Soil conservationists in Nebraska explained that "other conservation practices to prevent wind erosion are being emphasized because farmers are reluctant to give up productive land for trees." In Oklahoma, which had the lowest rate of new plantings, conservation officials had "deleted" cost-sharing "for field windbreaks" in 1974 "because of a lack of interest in using this practice." Farmers

offered additional reasons. Some believed "the windbreaks planted under the Prairie States Forestry Project are a nuisance because they occupy too much land and because certain tree species sap so much moisture that crops will not grow next to the windbreak." They also doubted whether the belts could produce sufficient benefits to pay their way, and they argued that "the high land values and prices of commodities raised on the land offset any benefits received from the windbreaks." One farmer in Oklahoma explained that "a mile-long windbreak he removed had added about 16 acres to his production" when he included both the land freed from under the shelterbelt and the adjoining land "on which crops would not grow." Some farmers also cited age, disease, crop sprays, and poor maintenance.[28]

The greatest reason for removal though, was to make room for center pivot irrigation systems. Frank Zybach, a Nebraska farmer, patented the first center-pivot device in 1952. Using a long rotating pipe equipped with sprinklers at regular intervals, and wheeled towers for support, these systems were expensive investments and farmers had to maximize their effectiveness by ensuring that booms traveled 360 degrees without hindrance from trees, fences, or other obstructions. Although the device occupied a full 160 acres, the circular sweep left four corners of each section unwatered. Thus the typical center-pivot irrigated closer to 133 acres. There were special attachments to allow farmers to irrigate these corner sections, but the corners were often covered with grass, shrubs, or, in a few cases, trees. Many farmers saw little reason to preserve shelterbelts once they had mechanical irrigation systems. Removed from dependence on rainfall, they no longer needed to worry about failed crops and vulnerable soil. If farmers wanted to take a field out of production, it was relatively easy to seed grass. Either way shelterbelts were unnecessary.[29]

The Comptroller General's report led to a Great Plain Windbreak Symposium in April 1976 that addressed the pressing question: "what can be done to halt the removal of tree windbreaks on the Great Plains and why are they being removed?" Larry Goldsmith of the General Accounting Office, who had helped write the original study warned the audience that "unless action is taken to encourage farmers to renovate and preserve the existing windbreaks rather than remove them, an important resource which has taken years to develop could be lost." Symposium attendees including representatives from the SCS, extension, Forest Service, and state agencies, agreed that they needed "an effective information and education program to urge landowners to reevaluate windbreaks." They also advocated increased research and "accelerated technical and financial assistance." SCS administrator R. M. Davis reasoned that farmers were removing shelterbelts for what they *thought* were right reasons, but the right reason was to replace ineffective ones. Simple removal to put more land in production was repeating bad decisions from the past.[30]

Davis objected to removing shelterbelts to increase production, but many farmers in the early 1970s heard a different message from the Department of Agriculture. President Richard Nixon viewed agricultural exports as one of two potential areas (technology was the other) in which the United States still enjoyed a competitive advantage, and he encouraged Secretary of Agriculture Earl Butz to expand production. American farmers began planting "fence row to fence row." The agricultural expansion was abetted by the sale of grain to the Soviet Union and a growing global food crisis. Grain prices spiraled upward and American farmers maximized production and then collected their profits. At the same time Butz tried to reduce agricultural support programs and disband the Department of Agriculture. The Democratic Party resisted Nixon's reorganization efforts, and when the boom turned to bust

during the Ford Administration, Democrats positioned themselves as friends of the farmer and supported a variety of assistance measures.[31]

Then drought descended again on the Great Plains, and brought home the risks of agricultural production on submarginal lands. The cyclical nature of drought was no longer a surprise, and farmers had been warned that the 1970s were likely to bring another dry period similar to the 1930s and 1950s. Most hoped that conservation and irrigation had freed them from natural cycles, but "in central Oklahoma on February 23, 1977, the worst dust storm in more than 20 years" transported soil particles far to the east. Satellite data also revealed a disturbing pattern to the blowing. The photography showed that the most severe storms originated in the heavily cultivated regions of West Texas and Oklahoma and "a sharp western limit to the wind-raised dust—this limit in Colorado corresponds to the western boundary of extensive cultivated lands in the eastern part of the that state [Colorado]." The cultivated lands were blowing, while grazing lands were stable. While it was unclear how much worse the blowing might have been without conservation and irrigation, it was clear that neither intervention had precluded the problems of drought and dust storm.[32]

The mid-1970s fear over shelterbelt removal was exacerbated by drought and politics. Democrats advocated stricter conservation legislation and greater government intervention, and a few even called for renewed shelterbelt plantings. The most substantial step in this direction was an order to the Agricultural Stabilization and Conservation Service (ASCS) to offer 50 to 75 percent cost-sharing for new shelterbelts. The resonance with the 1930s did not end there because the ASCS, heir of the New Deal's Agricultural Adjustment Administration, oversaw the Department of Agriculture's commodity price, income support, and conservation cost-sharing programs. Representative Larry Pressler of South Dakota even

introduced legislation to create a new shelterbelt program. Pressler's bill did not leave committee, but he continued offering variations of this legislation. By 1977 he was gaining support among Congressmen from other states.[33]

Pressler's call for a new shelterbelt program rested on two assumptions. The first was that the PSFP of the 1930s had helped fix the Dust Bowl. He explained that "the same inexpensive and effective conservation measures which helped to end the Dust Bowl years can be used today to prevent a recurrence of disastrous wind erosion." One of Pressler's more influential supporters, Hubert Humphrey of Minnesota explained that those who lived through the dust storms remembered and that "the shelterbelt would make things better, and that they would help stop the wind and dust storms." Of course, the PSFP had never stopped the dust storms, let alone the Dust Bowl. The single most important factor in checking the dust storms had been increased rainfall and the natural re-growth of grass and weeds. Shelterbelts were a short-term solution only to political problems, and even under ideal conditions trees could take a decade to reach heights at which they could prevent soil blowing over any considerable distance. However, shelterbelts had been more effective in the northern tier states that Pressler and Humphrey represented. The Plains were not all alike, and environmental contingencies created variations in political support for tree planting. Pressler and Humphrey mixed myth and experience promoting shelterbelts, and they probably realized this. Future versions of the legislation dropped the Dust Bowl claims.[34]

Both politicians probably did believe their second reason for renewed planting: the General Accounting Office's report that existing conservation programs were inadequate and farmers were removing more shelterbelts than they planted. Citing the GAO report and recommendations, Humphrey explained that "the deterioration of the shelterbelts cannot

continue without an adverse effect." In a letter to Butz, Humphrey warned that "in recent years trees planted as shelterbelts in the Great Plains during the 1930-1940's have been threatened with destruction. The shelterbelts stretching from the Dakotas to the Texas Panhandle, are being removed to increase the amount of available cropland." Pressler made similar claims, but in 1975 they could be excused for reaching such conclusions, the same concerns were motivating soil conservationists.[35]

Upon closer examination, however, this conclusion fell apart. Farmers were not removing shelterbelts faster than they were planting them. One result of the GAO report had been to push the SCS in 1977 to initiate a more substantial survey of shelterbelt planting. In 1980 the SCS published the study results. Using aerial photography to measure installation and removal in 126 randomly selected counties in five Plains states, it concluded that the number of field shelterbelts had increased between 1970 and 1975 at a rate of 2.5 percent per year overall. North Dakota led all other states in plantings (Table 8.2). The total area of field windbreaks had decreased by 5,500 square acres, but linear mileage had increased by almost 700 miles. Only Oklahoma showed a net decline in both acreage and linear mileage. The results revealed that even at the height of Nixon's and Butz's plow-up, Plains farmers were still planting field shelterbelts.[36]

Although the report undermined the narrative of decline that the GAO, Pressler, and Humphrey had presented, it did disclose a number of important trends in shelterbelt construction. The five state totals revealed that farmers abandoned wide belts (over 50 feet) at a net rate of 3.6 percent by number and 2.4 percent by length during the five-year period. In the same sample, medium shelterbelts (26-50 feet) showed only minor changes. However, the number of narrow field shelterbelts (less than 26 feet) had increased by 8.5 percent by

number and 8.8 percent by length in the same sample. Farmers were removing wide shelterbelts and replacing them with much narrower installations. In a crude sampling such a process could give the impression that shelterbelts were indeed endangered because the total area occupied was declining. But since the measure of a field shelterbelt was not how

State	Number		Acres		Miles	
	1970	1975	1970	1975	1970	1975
North Dakota	53437	55887	101635	101573	21569	22546
% of total	45.6	46.5	35.8	36.6	56.8	58.3
South Dakota	13546	13463	48513	47789	3808	3778
% of total	11.6	11.2	17.1	17.2	10	9.8
Nebraska	32630	32908	84159	79484	7661	7455
% of total	27.8	27.4	29.7	28.6	20.2	19.3
Kansas	12975	13397	34677	34948	3521	3521
% of total	11.1	11.2	12.2	12.6	9.3	9.1
Oklahoma	4594	4414	14722	14155	1443	1384
% of total	3.9	3.7	5.2	5.1	3.8	3.6
Total	117182	120069	283706	277949	38002	38684
Change		2887		-4747		682
% Change from 1970		2.5		-2.1		1.8

Table 8.2—Summary of field windbreak statistics from 1980 SCS report.[37]

how much land it occupied, but how much it protected, more and narrower shelterbelts meant more land protected.[38]

In one important respect the report supported earlier narratives. Farmers were indeed removing shelterbelts to make room for irrigation (Figure 8.2, 8.3, 8.4, 8.5, 8.6, 8.7). The report suggested that the leading cause was unknown, but it ranked irrigation second. The numbers also hinted at an explanation for the relatively greater acceptance of shelterbelts in the Northern than the Southern Plains. In North Dakota irrigation played no role in removals,

Five-State Summary

	Age	Irrigation	Farm reorganization	Unknown	Total
Number	138	526	335	1961	2960
% of total	4.7	17.8	11.3	66.3	
Acres	489	2938	636	9410	13473
% of total	3.6	21.8	4.7	59.8	
Miles	49	194	82	828	1153
% of total	4.2	16.8	7.1	71.8	

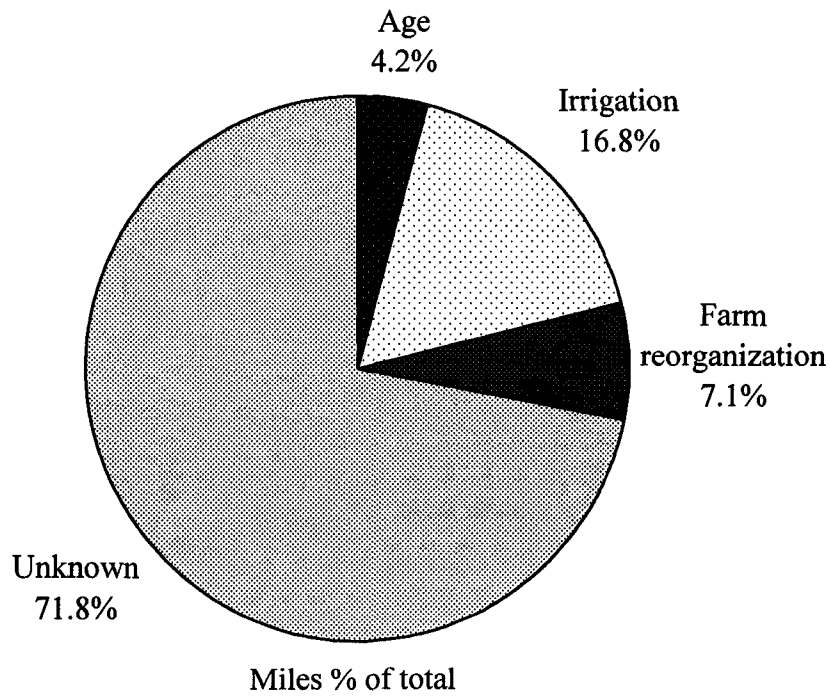

Figure 8.2—Five-state summary of reasons for windbreak removal.[39]

while in Kansas it was the major reason. Because of the unevenness of the data, firm conclusions were not possible, but the numbers seemed to support the theory that farmers preferred center-pivot irrigation to shelterbelts. Where irrigation was possible, it provided far more security than shelterbelts, and while conservationists might want farmers to choose both measures, the two did not easily coexist.[40]

North Dakota Summary

	Age	Irrigation	Farm reorganization	Unknown	Total
Number	0	0	97	829	926
% of total	0	0	10.5	89.5	
Acres	0	0	163	2859	3022
% of total	0	0	5.4	94.6	
Miles	0	0	25	368	393
% of total	0	0	6.4	93.6	

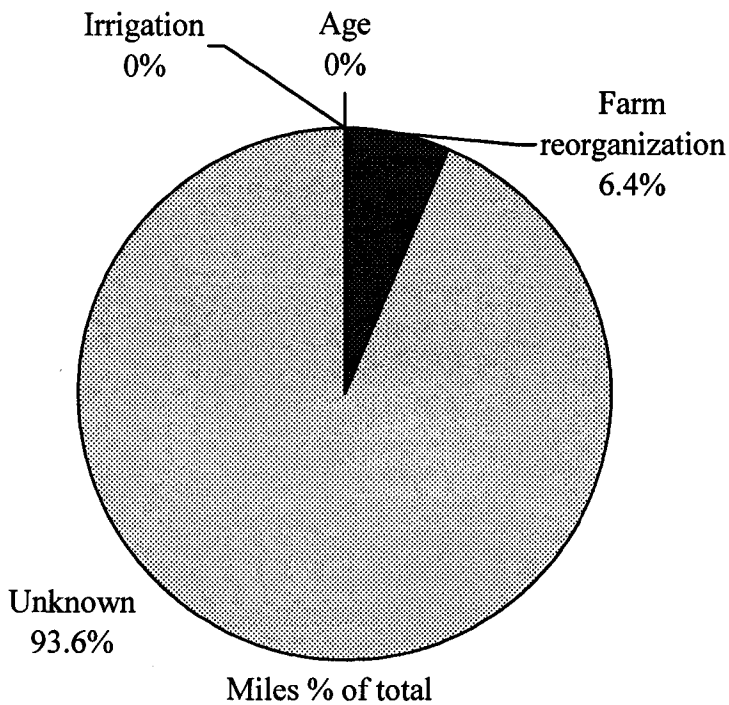

Figure 8.3—North Dakota summary of reasons for windbreak removal.[41]

The expansion of irrigated agriculture since 1950 seemed to offer farmers the long sought panacea. They could increase production and prevent soil erosion, and they could also farm right through dry years, as a few did in the 1950s, many did in the 1970s, and many more did in the late 1980s. Where and while ground water was available, irrigation seemed to solve the problem of aridity and free humans from dependence on the Great Plains' natural

South Dakota Summary

	Age	Irrigation	Farm reorganization	Unknown	Total
Number	0	123	87	0	210
% of total	0	58.6	41.4	0	
Acres	0	676	146	39	861
% of total	0	78.5	17	4.5	
Miles	0	28	9	3	40
% of total	0	70	22.5	7.5	

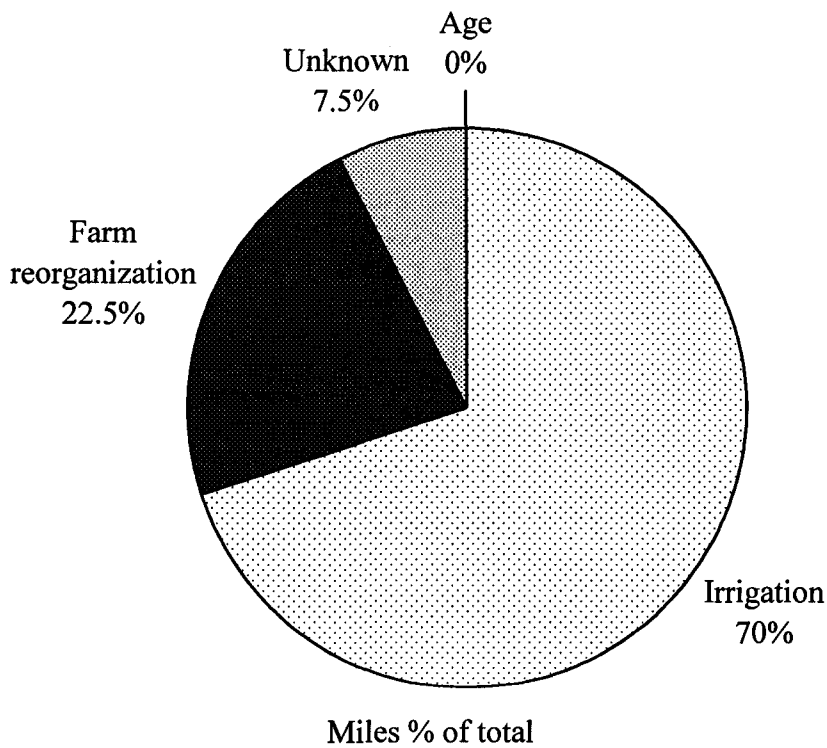

Figure 8.4—South Dakota summary of reasons for windbreak removal.[42]

cycles. As historian John Opie has noted, however, in the longer term dependence on groundwater was unsustainable. Like waking from a dream too good to be true, farmers will eventually have to reexamine the entire basis of intensive cultivation on the Plains.[43]

Nebraska Summary

	Age	Irrigation	Farm reorganization	Unknown	Total
Number	87	284	0	1047	1418
% of total	6.1	20	0	73.8	
Acres	219	1278	40	5291	6828
% of total	3.2	18.7	0.6	77.5	
Miles	25	107	2	369	503
% of total	5	21.3	0.4	73.4	

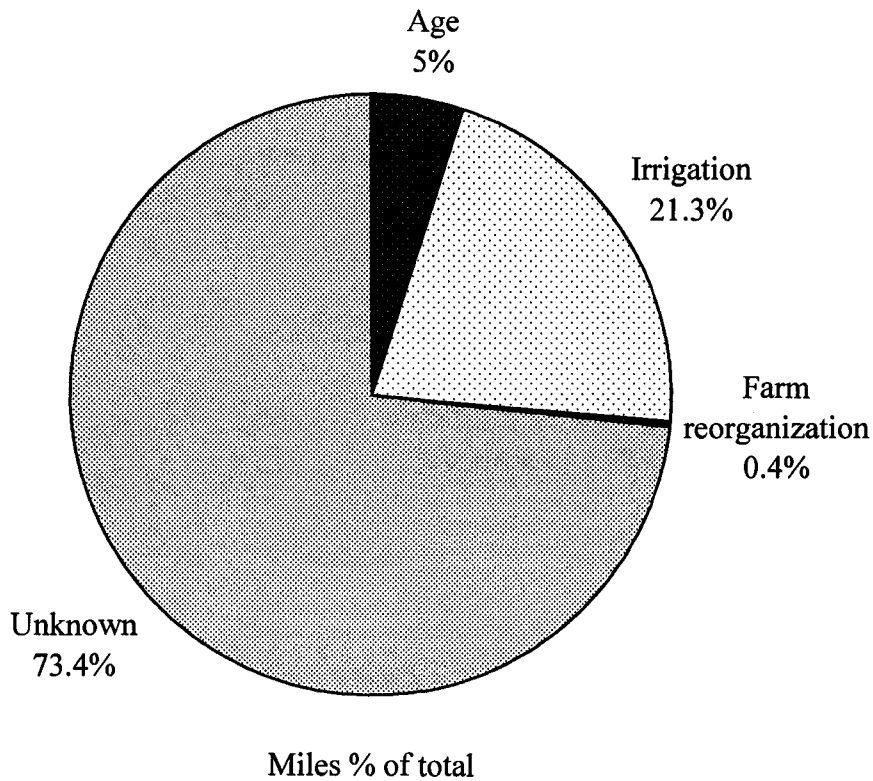

Figure 8.5—Nebraska summary of reasons for windbreak removal.[44]

Kansas Summary

	Age	Irrigation	Farm reorganization	Unknown	Total
Number	0	119	0	0	119
% of total	0	100	0	0	
Acres	0	984	0	1145	2129
% of total	0	46.2	0	53.8	
Miles	0	59	0	65	124
% of total	0	47.6	0	52.4	

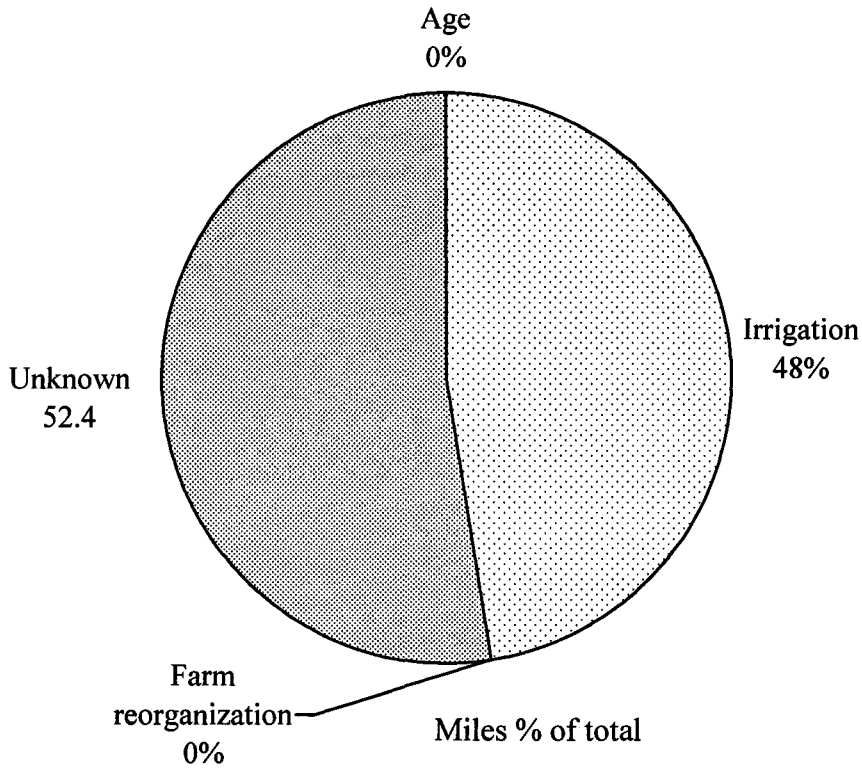

Figure 8.6—Kansas summary of reasons for windbreak removal.[45]

Although it is tempting to believe that farmers will inevitably rediscover shelterbelts, the history of afforestation on the Plains suggests that growing trees was always a difficult, and usually an unsatisfactory, affair. The slight decrease in evaporation rates downwind from shelterbelts might increase crop yields in some dry years, but these small changes have never

Oklahoma Summary

	Age	Irrigation	Farm reorganization	Unknown	Total
Number	51	0	151	85	287
% of total	17.8	0	52.6	29.6	
Acres	270	0	287	76	633
% of total	42.7	0	45.3	12	
Miles	24	0	46	23	93
% of total	25.8	0	49.5	24.7	

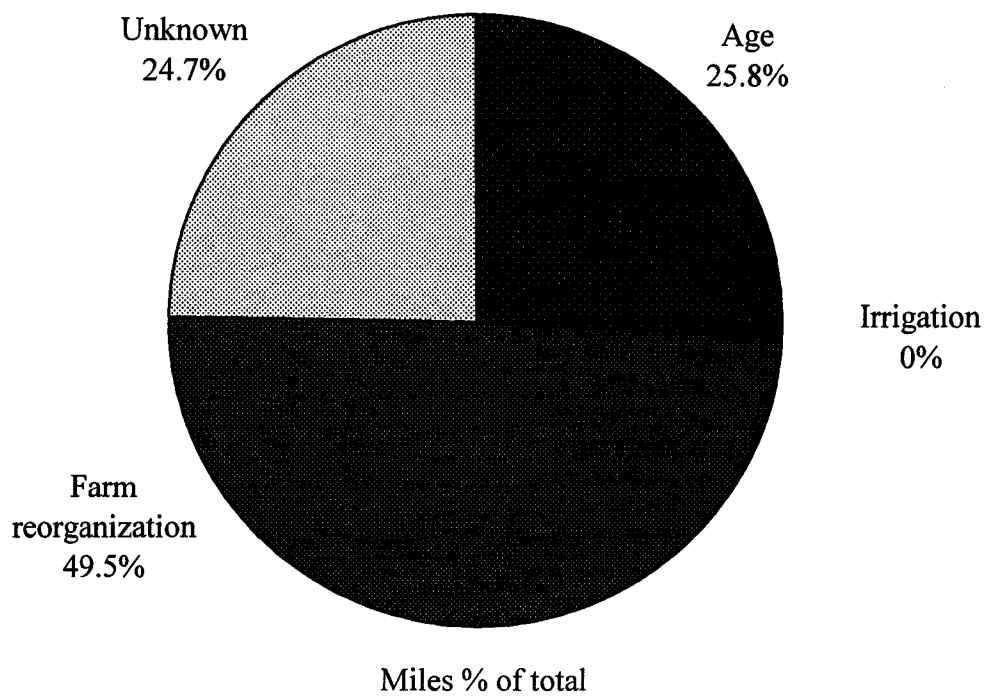

Figure 8.7—Oklahoma summary of reasons for windbreak removal.[46]

conserved enough water to free farmers from natural drought cycles. Plains farmers have learned to farm quite successfully during wet years, but shelterbelts have never compensated sufficiently for the dry years that spawned severe dust storm and economic disaster.

Nature has always played a central role in creating the Great Plains landscape. Humans have tried to impose labels, values, and management techniques upon the region, but

their "success" or "failure" always depended as much on nature as human effort. Even when Americans thought they were adapting their methods and perceptions to the region, recurring wet and dry cycles shattered their expectations. The forest reserve movement failed in part because foresters found it exceedingly difficult and slow to grow trees on the Great Plains. The erasure of federal forests is not then just a story of waning congressional support, insufficient land bases, or losses of faith in the principles of social forestry. When economic and natural cycles inflicted a devastating one-two blow during the 1930s, some foresters renewed their efforts to stabilize the natural and social conditions of the region, but their project remained at the mercy of the natural conditions that shaped its form, methods, and outcome. When the 1930s were done it was Plains forestry that seemed to have stabilized as a minor part of SCS conservation programs, not nature. After the Second World War farmers embraced irrigated agriculture to control natural cycles, but this solution will last only as long as another form of nature facilitates it: the Ogallala aquifer.

The Great Plains is also obviously a bureaucratic landscape, constructed by a variety of federal and state agencies. Shelterbelts, windbreaks, terraces, conservation reserves, and grasslands are second nature across the region, but each has its own history closely tied to the relative status of the scientists and bureaucracies that promoted these measure. This is not meant to condemn but to acknowledge the consequences of deeply entangled personal, public, and scientific ambitions across time and space. As Americans contemplate future changes to the conservation landscape, they will have to contend with the complex historical forces now embedded in the existing conservation landscape.[47]

The conservation landscape is also revealing for what it does not contain. In particular, the current formulation of the Great Plains is almost entirely based on the

principle of cost-sharing. To protect the nation from soil erosion and depletion caused by farming practices, the government entered into a compromise with landowners and agreed to pay for conservation measures on private lands. During the 1980s and 1990s demands increased for some form of "sod-buster" legislation to prevent farmers from destroying public investments in conservation, but federal policy remains wedded to the cost-sharing principle. For Plains foresters this was never a satisfactory solution. Partially this had been a function of bureaucratic expansionism and mistrust of private motives, but it also expressed a fundamentally different way of viewing the conservation landscape. Fernow and Zon imagined conservation as sustaining social values. Public spaces open to the community for recreation and relaxation would be managed to protect nearby private land. Their vision was easy to dismiss when scientific debate contradicted Zon's claims about climate change, but the idea of mixing public and private landownership into a hybrid conservation landscape that supports social values, not just individual profits, has continued to be an attractive alternative.[48]

The epilogue of Plains forestry is not a story of either gradual disappearance or faddish resurgence. Instead it is a narrative of a movement that is alive and well but different in many parts of the Great Plains where conditions—both environmental and institutional—continue to support it. Tree planting has gone through several phases of expansion and decline, much like the region itself. As in the past these vacillations are likely to continue to correspond with fears over drought or diminishing groundwater supplies, but new ideas, such as block planting cottonwood for pulp paper mills in the heart of Nebraska, will also shape this future in ways that make it something other than a simple repetition of the past.[49]

Beyond the stories of failure and success, beyond the tangled relationships of nature and the state and individuals and bureaucracies and science and politics, there is, finally and most importantly, a clear and hopeful insight. Foresters' concern for public and environmental welfare mixed as it was with bureaucratic and scientific calculations, suggests not simply that humans can improve the conditions of their existence but that social and environmental health are not inimical goals. Anne Whiston Spirn has urged Americans to embrace restoring the land within the city through the use of parks, green spaces, and waterways. An agrarian corollary to this might be to encourage American farmers to establish permanent conservation easements that serve human recreation and wild nature alike. Restoration ecologists, land use planners, and others stand ready to make such a transformation, but it will only happen if Americans gather the political will to challenge the centuries-old tradition of regarding private property owner's rights as sacrosanct, even when individual actions taken on those lands have negative externalities for society as a whole. Human and natural history are deeply entangled in the conservation landscape, but acknowledging this complexity is the first step to improvement.[50]

Chapter Eight—Notes

[1] James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998).

[2] Richard White, "Discovering Nature in North America," *Journal of American History* 3(79) (December 1992): 874-891.

[3] Samuel P. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920* (Pittsburgh: University of Pittsburgh, 1999); Nancy Langston, *Forest Dreams, Forest Nightmares: The Paradox of Old Growth in the Inland West* (Seattle: University of Washington Press, 1995); Charles Rosenberg, *No Other Gods: On Science and American Social Thought* (Baltimore: John Hopkins University Press, 1997); Joseph E. Taylor III, *Making Salmon: An Environmental History of the Northwest Fisheries Crisis* (Seattle: University of Washington, 1999).

[4] Brian Balogh, *Chain Reaction: Expert Debates and Public Participation in Americans Commercial Nuclear Power, 1945-1975* (New York: Cambridge University Press, 1991); Anthony Barker and B. Guy Peters, eds., *The Politics of Expert Advice: Creating, Using and Manipulating Scientific Knowledge for Public Policy* (Pittsburgh: University of Pittsburgh Press, 1993); Hamilton Cravens, ed., *The Social Sciences Go to Washington: The Politics of Knowledge in the Postmodern Age* (New Brunswick: Rutgers University Press, 2004).

[5] R. Douglas Hurt, "Return of the Dust Bowl: The Filthy Fifties," *Journal of the West* 28 (1979): 85-93; Douglas Helms, "Great Plains Conservation Program: 25 Years of Accomplishment," *Soil Conservation Service Bulletin No. 300*-2-7 (24 November 1981).

[6] Edwin Henson to Milton Eisenhower, 15 December 1939, Regional National Archives (RG 95), Kansas City, Missouri (hereafter Regional National Archives).

[7] Richard Pfister, "A History and Evaluation of the Shelterbelt Project," (MA thesis, University of Kansas, 1948), 69. Pfister quotes SCS figures indicating that it assisted farmers in planting 26,000 acres of shelterbelts. This is misleading, however, because it is a national figure and includes all types of shelterbelt planting.

[8] Richard Sartz, "Carlos G. Bates: Maverick Forest Service Scientist," *Journal of Forest History* 21(1): 31-39; Joseph Stoeckeler and Ross Williams, "Windbreaks and Shelterbelts," in *Trees, The Yearbook of Agriculture 1949* (Washington: GPO, 1949), 194.

[9] Carlos Bates, "Memorandum for the Acting Chief, Division of Research," 25 September 1936, National Agroforestry Center, Lincoln, Nebraska (hereafter Agroforestry Center).

[10] Comptroller General of the United States, "Action Needed to Discourage Removal of Trees That Shelter Cropland in The Great Plains," 20 June 1975, 9.

[11] Scientific opinion seems to have reached some agreement that shelterbelts have a positive effect on crop yields, but the much more difficult question of whether they are justified solely on this basis remains contested. See, Joseph Stoeckeler, "The United States of America," in R. N. Kaul ed., *Afforestation in Arid Zones* (The Hague: W. Junk N.V. Publishers, 1970) for Stoeckeler's opinion in favor of very narrow belts.

[12] "Shelterbelts Increase Production," *Soil Conservation* 10(2) (August 1944): 25; "Shelterbelt Boosts Yield," *Soil Conservation* 13(12) (July 1948): 267; "Trees Took a Hand," *Soil Conservation* 14(2) (September 1948): 44-5. *Soil Conservation* was the SCS's official publication that it sent to soil conservation district members and other participating farmers. The publication contains technical advice, conservation news, policy statements, and no private advertising.

[13] Joseph H. Stoeckeler, "Narrow Shelterbelts for the Southern Great Plains," *Soil Conservation* 11(1) (July 1945): 16-20.

[14] Helms, "Great Plains Conservation;" Hugh Bennett, *The Elements of Soil Conservation* (New York: McGraw-Hill, 1955 [1947]), 307.

[15] Hurt, "Return of the Dust Bowl," 85.

[16] United States Department of Commerce, Weather Bureau, *Climatic Summery of the United States—Supplement for 1931 through 1952* (Washington: GPO, 1953); United States Department of Commerce, Weather Bureau, *Climatic Summery of the United States. Supplement for 1951 through 1960* (Washington: GPO, 1961).

[17] Quoted in Helms, "Great Plains Conservation," 5. See also, Douglas Helms, "Conserving the Plains: The Soil Conservation Service in the Great Plains," *Agricultural History* 64(2) (1990): 58-73; Hurt takes a similar view.

[18] Helms, "Conserving the Plains." 65; Dan Flores, "A Long Love Affair with an Uncommon Country: Environmental History and the Great Plains," in Fred Samson and Fritz Knopf, eds., *Prairie Conservation* (Washington: Island Press, 1996): 14-15; R. Douglas Hurt, "Federal Land Reclamation in the Dust Bowl," *Great Plains Quarterly* 6 (1986): 94-106.

[19] *Congressional Record*, 84th Congress, 2nd Session (1956), 14693, 14113.

[20] *Congressional Record*, 84th Congress, 2nd Session (1956), 14112. The SCS had also pioneered these methods, and they too had struggled over whether their program was largely one of demonstration and assistance or direct management. The most frequent criticism of the GPCP was that large farmers used up most of the funds to subsidize the installation of center-pivot irrigation.

[21] James B. Lang, "The Shelterbelt Project in the Southern Great Plains—1934-1970—A Geographic Appraisal" (MA thesis, University of Oklahoma, 1970), 89.

[22] Ibid., 95-96; Bates, "Memorandum for Acting Chief," 5.

[23] Ralph Read, "The Great Plains Shelterbelt in 1954" *Publication No. 16* (Lincoln, Nebraska: Great Plains Agricultural Council, 1958); Susan Pommering Reynolds, "Shelterbelts in the Red River Valley of the North: Patterns in the Landscape" (PhD diss., University of Oregon, 1983).

[24] Kenneth Grant, "Windbreaks and Conservation," *Soil Conservation* 35(3) (October 1969): 71; Jacques Pinkerd, "Trees Regulators of the Environment," *Soil Conservation* 36(3) (October 1970): 56.

[25] Samuel P. Hays, *Beauty, Health, and Permanence: Environmental Politics in the United States: 1955-1985* (New York: Cambridge Press, 1987), 86.

[26] Comptroller General of the United States, "Action Needed to Discourage Removal of Trees That Shelter Cropland in The Great Plains," 20 June 1975.

[27] Ibid., 12. Kingfisher, Oklahoma data on miles removed was available in acres only.

[28] Ibid., 13.

[29] Ibid., 13-14. Rudi Volti, "Center-Pivot Irrigation," *Facts On File Encyclopedia of Science, Technology, and Society* (New York: Facts on File, 1999).

[30] Lee Egerstrom and Gil Gailey, "Roots of a New Dust Bowl," *The Des Moines Tribune*, 15 March 1977; John M. Cross, "Need for a New Approach Stressed at Great Plains Windbreak Symposium," *Soil Conservation* 41(11) (June 1976): 21-23; R. M. Davis, "Windbreaks: Fact or Fancy," *Soil Conservation* 41(11) (June 1976): 2.

[31] Allan Matusow, *Nixon's Economy: Booms, Busts, Dollars, and Votes* (Lawrence: University of Kansas, 1998); Joel Solkoff, *The Politics of Food* (San Francisco: Sierra Club Books, 1985); Mohammad Mohabbat Khan, "The Politics of Administrative Reorganization: Presidents Nixon's Departmental Reorganization Program," *Political Science Review* 19(2) (1980): 170-180; Leslie Gelb and Anthony Lake, *Less Food, More Politics* (17) (1974-75): 176-189.

[32] John Borchert, "The Dust Bowl in the 1970s," *Annals of the Association of American Geographers* 61 (March 1971): 1-22; Edwin Kessler, et al., "Duststorms from the U. S. High Plains in Late Winter 1977: Search for Causes and Implications," *Proceeding of the Oklahoma Academy of Sciences* 58 (1978): 1.

[33] The ASCS was folded into the Farm Service Agency in 1994; *Congressional Record*, 94th Congress, 1st Session (1975), 2105; See also (H. Con. Res. 35), (H.R. 9183), (H.R. 6602), and (H. R. 8888) in the 95th Congress, 1st Session (1977); *Congressional Record*, 95th Congress, 1st Session (1977), 12134.

[34] *Congressional Record*, 94th Congress, 1st Session (1975), 41065, 33544. As a South Dakota native Humphrey probably did have first-hand experience with shelterbelts while growing up.

[35] *Congressional Record*, 94th Congress, 1st Session (1975), 33544.

[36] United States Department of Agriculture, Soil Conservation Service, "Field Windbreak Removals in Five Great Plains States 1970 to 1975," 29 July 1980.

[37] Ibid., 9.

[38] Ibid., 8.

[39] Ibid., 14.

[40] Ibid.,14, 15. The numbers for Oklahoma undermine this theory since no local farmers listed irrigation as a reason for removal, but the great number that listed reorganization suggests that farmers may have been removing shelterbelts to make more room for irrigation works. This is one of the liabilities of the report. Aerial photography could determine the total acreage lost or gained with some precision, but it could not determine the motivations for changes. This relied on the cooperation and candor of landowners.

[41] Ibid., 14.

[42] Ibid., 14.

[43] John Opie, *Ogallala, Water for a Dry Land* (Lincoln: University of Nebraska, 2000); John Opie, "The Drought of 1988, the Global Warming Experiment, and its Challenge to Irrigation in the Old Dust Bowl Region," *Agricultural History* 66(2) (Spring 1992): 279-306.

[44] Soil Conservation Service, "Field Windbreak Removals," 14.

[45] Ibid., 14.

[46] Ibid., 14.

[47] Richard White, *The Organic Machine: The Remaking of the Columbia River* (New York: Hill and Wang, 1995), 108-13.

[48] Joseph E. Taylor III, "'Well-Thinking Men and Women:' The Battle for the White Act and the Meaning of Conservation in the 1920s," *Pacific Historical Review* 71(3)(2002): 356-387; Paul S. Sutter, *Driven Wild: How the Fight Against Automobiles Launched the Modern Wilderness Movement* (Seattle: Weyerhauser Environmental Books, 2002), 239-48.

[49] Walter Bagley and R. Monahan, "Cottonwood a Potentially Profitable Crop for Nebraska," *Nebraska University College of Agricultural and Home Economics Quarterly* 16(3) (Fall 1969): 18-19.

[50] Anne Whiston Spirn, "Designing with the Land," *Journal of Soil and Water Conservation* (January-February 1992): 35-38. The current Conservation Reserve Program (CRP), with its emphasis on cost-sharing for conservation measures on highly erodible soils, does not provide this model. It reinforces traditional private ownership patterns by allowing farmers to opt out and return land to cultivation at a future date. It is also scaled to farmer's goals, not community interests. Its emphasis on conservation ecology, however, has helped create the science and personnel to support a larger and more diverse program. See, Philip Gersmehl, "Bonanza for the Land Miners: A Contemporary Western Saga," *European Contributions to American Studies* 16 (1989): 81-98.

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