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NATURE'S ECONOMY

A History of Ecological Ideas

Second Edition

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ture's ways and sympathy for human ambitions. Thus in the thirties, Clements' climax ecology came under the searching glare of practical experience and encountered its first significant criticism—from farmers, from scientists, from historians. But however this controversy affected the theory of the climax, the Dust Bowl would succeed dramatically in bringing the young science out of academe and into the public consciousness.

CHAPTER 12

Dust Follows the Plow

ON A TYPICAL AFTERNOON the average wind velocity on the Great Plains is about fifteen miles per hour. It is a constant, almost human presence, pressing down with unrelenting force the grasses and row crops, whistling with eerie persistence around the farmer's barn and fences. In the spring of 1934, however, the wind suddenly seemed to become a demon. On April 14 a vast black blizzard of earth came rolling out of the north toward Texas; it whirled and spun in a giant bowl, darkening the sun and covering the land with drifts up to twenty feet high. Less than a month later, on May 10, another great storm moved east toward Chicago, dumping twelve million tons of plains dirt on that city alone. Two days later the storm reached the eastern seaboard. Dust sifted into the White House and fell on ships standing out at sea.[1]

That the wind often carried dust along in its train was a fact familiar enough to settlers in the grassland. There had even been serious dust storms in 1932, in 1913, and farther back, in 1894 and 1886. But none of these was of more than local significance, nor came with such fierce turbulence. The storms of the thirties meant dust was everywhere, blanketing crops and wiping out fence lines, filtering through the cracks around the door—no matter how many wet rags were stuffed in them—and even mixing with the bread dough. And nothing in the past could match the sheer frequency and scale of these most recent storms: There

were 22 of regional extent in 1934, 40 in 1935, 68 in 1936, and 72 in 1937, before at last they began to drop off. It was inescapably clear to the entire nation that something was radically, desperately wrong on the western plains.[2]

The most obvious and frequently blamed villain, after the wind, was drought. On the plains, most of the year's rain falls during the spring and summer growing season, from April to July, and it oscillates wildly from year to year around a mean of twenty inches or less—a subhumid climate. In the summer of 1931 the rain did not come at all, or in the following spring, or in the next, and 1934 proved to be the driest year in the history of the region's weather records up till then. Even the more humid prairies suffered; by the end of July the Missouri River area in eastern Nebraska showed no water available for plant growth down to a depth of four feet. These conditions continued through 1940 across the entire grassland, and at times as far east as the Alleghenies. Frequent temperatures of over 100 degrees made this drought even more destructive to the native grasses, but especially to agricultural crops. In Thomas County, Kansas, no wheat at all was harvested in 1933, 1935, 1936, and 1940, and during the intervening years the average yield was at best only a third of pre-drought averages. By 1935 the United States, the vaunted breadbasket of the world, was forced to import wheat from other countries. Farther south, in Hall and Childress counties of Panhandle Texas—the very heart of the Dust Bowl—average cotton ginnings plummeted from 99,000 bales in the late 1920s to 12,500 in 1934 and 26,500 in 1936. "That drought," as one farmer said, "put the fixins to us."[3]

Soon Americans discovered another dramatic symbol of the times to go with blowing dust: the impoverished "Okie" and his wife and children heading out for California. They came in greatest numbers from the "OK state" of Oklahoma, but also from Kansas, Texas, and farther east. Along the highways of the southern plains one saw them at noon camped in the shade of a billboard, carrying on their truckbeds shabby, makeshift tents out of which dangled mattresses and a half-dozen red-brown children: sober, staring faces in faded overalls. Or one passed them chugging west in a battered old Hudson, flat bedsprings tied to the car roof along with odd pieces of lumber and a bucket or two, perhaps with a goat riding in a crate on the running board. And everywhere along the way one heard them telling of their misfortune:

"Come to the end of my row in Rockwell County, Texas."

"Nigh to nothin' as ever I see."

"That year spring came and found us blank."

"Yessir, we're starved, stalled, and stranded."

"Burned out, blowed out, eat out, tractored out."

In the second half of the thirties, they poured into California at the rate of 6,000 a month—a total of 300,000 "Dust Bowl refugees" from 1935 to 1939.[4]

But it was more than drought and dust that threw these people off their land and onto the factory farms of the west coast. Walter Stein has concluded that "most of the Okies came neither from the dust bowl nor from the areas of worst distress in the drought region. That Okies did come from the dust bowl was true; that the average Okie in California was a dust-bowl refugee was false." The typical migrant family had been living in the hills of eastern Oklahoma, on land that was once oak forest, not prairie or plains. Even the Joads of John Steinbeck's *The Grapes of Wrath* hailed from the town of Sallisaw, almost on the Arkansas border and hundreds of miles east of the dust center. Steinbeck, like most other Americans, assumed too simply that people like the Joads were the victims of a natural disaster that gave the banks and landlords an excuse to put them off the land, but in truth, their somber story was only peripherally connected with the drought on the plains. It was largely the outcome of purely social forces that within a decade or two had transformed rich, promising pioneer states into what Carey McWilliams called "a sump-hole of poverty."[5]

In the early 1870s, white families first began to settle in what had been designated the Indian Territory, a "region set aside for the perpetual home for the red man" which was later forcibly annexed as the eastern portion of Oklahoma.

For many years the whites lived here without laws or schools, either as tenants or as defiant intruders. They knew both styles intimately, coming as most of them did from the hill country of the rural South: a restless, violent, often resentful folk who had always lived by hard scrabbling. Few of these families could boast of more than the merest subsistence patch of twenty to forty acres, sometimes leased, sometimes taken from the Indians. A little farther west, during the famous "Sooner runs" of 1889 and 1893, the territory passed into the hands of other white settlers in equally scanty parcels, and soon thereafter into the amalgamating hands of a few wealthy landowners. When Oklahoma became a state in 1907, over half of its farms were small holdings operated by tenants; by 1935, over 60 percent. These tenants and sharecroppers had left behind them in the South a trail of bad farming and soil depletion, and they quickly overworked the land of Oklahoma, too. Their topsoil washed away, and with it any chance they might have had for self-sufficiency. In 1938 it was estimated that 275,000 people, or 28 percent of the farm population of the state, had moved to a new farm during the previous year—an aimless wandering that had begun as far back as the nineteenth century. "The roots of Oklahomans in the land are shallow," admitted Paul Taylor of the University of California, who followed with sympathy their exodus west. The drought and economic depression of the 1930s, it must be understood, only brought renewed desperation to this drifting mass of tenant farmers. Hard as it is to believe, within a single generation their last frontier had already become a rural slum.[6]

On the plains farther west, many of these impoverishing conditions were repeated. As in eastern Oklahoma, there were too many farmers for too few farms, and although in this drier grassland the individual holdings were usually much larger (the 160-acre homestead was typical), they still were not adequate to support a family. But here, where the land is more level, another force for instability came into play: the technological revolution in the form of the tractor. The development after World War One of the small, inexpensive "farmall" machine made it possible for one man to plow and harvest a much larger farm at lower cost per acre.

Given that during the 1920s the total net income from even a 640-acre wheat farm in western Kansas could amount to only $35 a year, the rush to tractors is not hard to understand. But maximum efficiency would never be realized until holdings were consolidated and the surplus population gotten rid of. Luckily for the already wealthy and enterprising few, almost 40 percent of the farmers throughout the entire Great Plains were tenants, and therefore easily sent packing. This process of consolidation was expedited when the Agricultural Adjustment Administration began making crop reduction payments to landowners only (though in fact there was often nothing to reduce); the money generally went not to their tenants but to tractor salesmen. During the first half of the dirty decade, about 150,000 persons emigrated from the plains. Not drought but the machine drove most of these farmers from the land, but perhaps it was easier on their pride to blame their misfortune on nature. In many ways resembling the English peasants uprooted by the eighteenth-century enclosure acts, these surplus tenants were the victims of America's judgment—perhaps justified—that agriculture must be made to pay a higher return. Although they may not have been precisely the Okies Steinbeck knew, these displaced tenants of the plains tumbled west with their more famous eastern cousins.[7]

But whatever "put the fixins" to these various rural folk and sent them fleeing down the road toward the Golden State, that a genuine human tragedy took place during the Dust Bowl years is undeniable. On the southern plains in particular—Texas, New Mexico, Oklahoma, Colorado, and Kansas—the blowing dust often went hand in hand with bankruptcy and welfare. By 1935 in some counties of the region as many as 80 percent of the families were living on relief, and from 1934 to 1936 about 5 million acres of land here were blowing severely. By 1938—the peak year for wind erosion, though not for the most sensational storms—this total had jumped to almost 9 million, scattered over an area of 51 million acres. Soil scientists for the Department of Agriculture estimated in this same year that half of the Great Plains—some 500,000 square miles—had been seriously damaged by erosion, a situation that was

bound to produce much economic hardship and misery. As a farmer rightly noted in the *Dallas Farm News* in 1939: "The prairie, once the home of the deer, buffalo and antelope, is now the home of the Dust Bowl and the WPA."[8]

As we have been reviewing here, the causes of the Dust Bowl were complex, more cultural than natural, and certainly not to be summed up in the fact of drought. The root cause of this most destructive episode in America's environmental history was described thus by Archibald MacLeish in the mid-thirties:

> The meaning of the dust storms was that grass was dead. The small tornadoes, spectral with earth, which sucked up out of the western wheat fields were the ghosts that said it. Erosion of the soil, whether by wind or water, results not from the sickness of the soil but from the sickness of the vegetation which once held the soil in place. On the Great Plains that vegetation is the grass.

It was man's destruction of the grassland that set the dirt free to blow. Through such ill-advised practices as plowing long straight furrows (often parallel to the wind), leaving large fields bare of all vegetation, replacing a more diverse plant life with a single cash crop, and—most importantly—destroying a native sod that was an indispensable buffer against wind and drought, the farmers themselves unwittingly brought about most of the poverty and discouragement they suffered.[9]

This destruction was not accomplished in a season or two: it was the product of the entire fifty-year period of settlement that preceded the 1934 storms. And in a real sense, the way of life of the Okies, eastern and western, was in large part what destroyed the grass: tenancy, the moving itch, violence toward nature as well as other men, disregard for the land as a permanent home. All of these traits had been long represented, sometimes even celebrated, in the pioneer mentality that still dominated the culture of the region. This mentality and its values were most succinctly wrapped up in the image of the "sodbuster"—an image that had long signified heroic qualities to the American imagination. In that image was also implied, indeed fairly shouted, an environmental ethic of conquest. The advance of the sodbuster across the plains most fundamentally ex-

plains both the blowing dirt and the relief rolls. The sodbuster made the Dust Bowl, and the "Dust Bowl refugees" were his children.

Sometime in the 1880s the sodbuster came to and began to conquer the Great Plains. His final victory, as Walter Prescott Webb has demonstrated, awaited the perfection of several technological innovations, including the railroad, plow, windmill, and barbed wire. Surely the most important of these, and invested with an almost sacred meaning by the homesteader, was the steel plow. This instrument had been devised to tear apart the dense sod of the tallgrass prairies of Iowa and Nebraska, to break up root masses that sometimes weighed four tons to the acre. It was confidently assumed that fertility would follow the plow; that the plains remained sterile and useless until cultivated. But beyond the 100th meridian, though the virgin sod here was far easier to penetrate and thus seemingly more inviting to the farmer, rainfall begins to drop off to a level that defies all agriculture. West of that longitude, rain averages less than twenty inches a year, not enough for intensive, traditional plowing and cropping. Nevertheless, in 1881 Charles Dana Wilber, a land speculator in Nebraska, succeeded in magnetizing a nation with the gloriously hopeful, go-ahead slogan: "Rain follows the plow." There was no reason for the sodbuster to hesitate before the Great Plains, he declared.

> To those who possess the divine faculty of hope—the optimists of our times—it will always be a source of pleasure to understand that the Creator never imposed a perpetual desert upon the earth, but, on the contrary, has so endowed it that man, by the plow, can transform it, in any country, into farm areas.

With such reassurance from Wilber and others, the sodbuster rushed out to the plains in unprecedented numbers. By 1890 there were almost 50,000 people in the westernmost counties of Kansas, four times the 1880 population. And during the same years the number of settlers in the Texas Panhandle jumped 600 percent.[10]

Then came the disastrous drought of 1894–95, bringing complete crop failures to thousands and intense dust storms to many areas. Along with the Panic of 1893, these conditions led to a vast retreat of the settlement line. In some plains counties, as many as 90 percent of the home-

steaders abandoned their farms, cursing nature and the banks as they went. And the simple but unsuspected truth in all this was that much of it was unnecessary. According to Edward Higbee, if the Spanish–Mexican system of land grants had been followed, rather than that of the Homestead Act of 1862, these consequences of drought on the plains would not have been nearly so ruinous. As early as 1825 the Mexican government, intent on establishing a grazing rather than a cropping economy in the region, offered 4,000 acres to every settler who agreed to become a rancher. In substantial agreement with this policy were John Wesley Powell and W. D. Johnson, both of the United States Geological Survey, who agreed that livestock ranching—requiring at least one or two thousand acres—was the only safe use of the shortgrass country. The American political establishment, however, would not tolerate such a "feudal," undemocratic policy that supposedly would set up great land-owning barons against the small yeoman homesteader. Not cattle but wheat, they were sure, was God's intention for the plains. But after the disasters of the 1890s they were forced to admit that "there is no god west of Salina."[11]

After 1900 the rains returned in unusual abundance, lasting, except for a few seasons, through World War One. Once again it was boom-time on the plains, stimulated not only by the plentiful moisture but by governmental confidence that new "dry-farming" techniques would yet make the plains blossom like the rose. By 1910 practically all of western Kansas was resettled, as well as eastern Colorado and the Panhandle. Then came the war and an even bigger drive to "plant more wheat for America." President Woodrow Wilson and his Secretary of Agriculture urged Kansas to plant one million more acres to win the war; Oklahoma and Texas had their suggested quotas, too. This pressure of patriotism along with the appeal of good prices took effect in short order: in 1918 the nation harvested 14 million more acres of wheat than in the previous year, a large portion of which was shipped to European allies. Few farmers, however, saved any of the money they made in these years of boom. With wheat selling at over two dollars a bushel and the future looking even rosier, they reinvested their earnings in more land and more machines with which to plant even bigger crops. Then suddenly, with the armistice, came the collapse of the boom markets. But, wrongheaded as it now seems, the conventional wisdom was that to survive the crunch of the postwar decade, investments had to be doubled to achieve greater economies of scale. Soon a truly formidable phalanx of tractors, combines, and trucks were clanking across the fields. By 1925 it was clear, according to Vance Johnson, that "mass production had reached the plains."[12]

In this desperate race against themselves and their creditors, the farmers of the southern plains alone, from 1925 to 1930, plowed up a fragile sod seven times as large as Rhode Island. If surplus was the problem, more surplus would solve it. In the eight principal plains states, the fifty-year record tells clearly the story of the big plow-up. In 1879 about 12 million acres of crops were harvested; in 1899, 54 million acres; in 1919, 88 million; in 1929, 103 million—in wheat and cotton chiefly. As a consequence, fewer and fewer acres were left in native grass and grazed, and these were soon overstocked and their forage value badly damaged. Yet there were also times during the twenties when crops had to be left standing in the fields because market prices were so low: wheat, in some years, dropped to less than a dollar a bushel. Sometimes land was broken only to be left bare and idle, exposed to the eroding wind—a not uncommon practice when the farmer was in fact living far off in a city; there were many such absentee owners, interested in the land only as a fast return on a financial investment. In 1936 the federally appointed Great Plains Committee noted this side of the history of the region's settlement:

> A strong speculative urge . . . has been one of the driving forces in the development of the Great Plains. The majority of settlers probably intended to establish homes and farms for themselves, but the purpose of many was speculative gain. This was promoted by public land policy which, under an expansionist settlement, gave little consideration to the long-run stability of the Region.

By the 1930s the western farmers had cut the ground from under their very feet. The committee concluded in the very

midst of the Dust Bowl years that at least 15 million acres, extending over 24,000 farms, should be immediately returned to native sod and never plowed again. All in all, 60 million acres of the plains had been badly abused and needed quick attention. After fifty years of being hailed for his heroic exploits, the sodbuster had become a menace to the nation.[13]

During the thirties the Department of Agriculture struggled to reverse within a very few years this half-century's heritage of land abuse. In part this was accomplished by paying farmers to stop producing and to retire their marginal land. It was also achieved by buying at public expense almost 6 million acres of those lands blowing most severely and trying to stabilize them as fast as possible. Eventually these lands were leased back to local residents for forage only. The Taylor Grazing Act of 1934 set aside for leasing to ranchers another 80 million acres in the public domain, all thereby withdrawn from homestead entry. In another part of the effort, chisels and listers were used to turn up heavy clods of earth that would hold the dust. Soils across the region were surveyed and classified according to their safest use. Sudan grass and sorghums were planted in contours and strips and terraces. Billions of trees were set out to provide a system of shelterbelts one mile apart. By 1941 about 75 soil conservation districts had been organized on the plains. No other period in the nation's history saw as much progress toward a full-scale conservation program for agriculture.[14]

One of the most important environmental documents of the decade was the report of the Great Plains Committee, "The Future of the Great Plains," submitted to President Franklin Roosevelt in December 1936. The committee's chairman was Morris Cooke, head of the Rural Electrification Administration, and the other members were Hugh Bennett of the Soil Conservation Service, Harry Hopkins of the Works Progress Administration, Rexford Tugwell of the Resettlement Administration, and Secretary Henry Wallace of the Department of Agriculture. Without a murmur of qualification, the committee concluded that the Dust Bowl was a wholly manmade disaster, produced by a history of misguided efforts to "impose upon the region a system of agriculture to which the Plains are not adapted." The essence of the tragedy, as they understood it, was a failure to heed the lessons of ecology. "Nature," they observed, "has established a balance in the Great Plains by what in human terms would be called the method of trial and error. The white man has disturbed this balance; he must restore it or devise a new one of his own." Unless this were done, Cooke and the others warned, the land would become a desert and the government would have on its hands a perennial, costly problem of relief and salvage.[15]

At the very root of the abuse of the plains lay not only an ignorance of natural science but more importantly a cluster of traditional American attitudes. According to the committee, these included the assumption that the corporate factory farm was more desirable than a smaller family operation, that markets would expand indefinitely, that the pursuit of self-interest and unregulated competition made for social harmony, that humid-land farming practices could be followed on the plains. There was also the pioneering view that America's vast natural resources could never be exhausted. Contrary to early confidence that it would take thousands of years to settle the region, the committee remarked that only a few decades had been required for the plains to become "economically congested." But at the very top of their list of fundamental causes for the Dust Bowl, they placed the misguided notion that man thrives by conquering nature:

> It is an inherent characteristic of pioneering settlement to assume that Nature is something of which to take advantage and to exploit; that Nature can be shaped at will to man's convenience. In a superficial sense this is true; felling of trees will clear land for cultivation, planting of seed will yield crops, and applications of water where natural precipitation is low will increase yields. However, in a deeper sense modern science has disclosed that fundamentally Nature is inflexible and demands conformity. . . . We know now, for instance, that it is essential to adjust agricultural economy on the Plains to periods of deficient rather than of abundant rainfall, and to the destructive influence of wind blowing over dry loose soil rather than primarily to a temporary high price for wheat or beef; that it is our ways, not Nature's, which can be changed.

What ultimately was needed for the grasslands, they were saying, was a radically new environmental outlook. The American farmer must learn to walk more humbly on the earth and to conform his economy to nature's, not vice versa. The dogged confidence of the sodbuster that nature can always be bent to human will had been decisively discredited.[16]

Up to this point, the conservation movement in America had been overwhelmingly dominated by a series of uncoordinated resource-management programs, most of them set up around the turn of the century. Forests, water, soils, wildlife were all connected only by the loosest of conceptual threads. The major reason for this single-mindedness was that conservation policies usually had been founded on purely economic grounds; at whatever points resource demand exceeded supply, there sprouted a management program. But in the 1930s, largely as a direct consequence of the Dust Bowl experience, conservation began to move toward a more inclusive, coordinated, ecological perspective. A concern for synthesis and for maintaining the whole community of life in stable equilibrium with its habitat emerged. Undoubtedly this shift of outlook is also partly accounted for by the mood of the nation after the collapse of the Wall Street markets and the entire economic system—a mood that had become more communal and less individualistic. Holistic values everywhere challenged private, atomistic ways of thinking, and the atmosphere of depression also encouraged an unwonted willingness to subordinate economic criteria to broader standards of value, including ecological integrity. One of the unanticipated consequences of the sudden fall of America's economic empire, in other words, was the birth in the public consciousness of a new conservation philosophy, one more responsive to principles of scientific ecology. This new approach was evident in the report of the Great Plains Committee; in the regional planning of the Tennessee Valley Authority headed by David Lilienthal; in the writings of the wildlife expert Aldo Leopold; and in the organismic environmental philosophy of Lewis Mumford. In the space of thirty years, the newly independent science of ecology had moved from the early works of Warming, Cowles, and Clements to a position of considerable influence over government policy and popular values.[17]

A circle of Midwestern scientists led this movement toward ecological conservation, for the grassland in particular. In 1932, for example, Roger Smith, president of the Kansas Academy of Science and entomologist at Kansas State Agricultural College, blamed the devastating outbreaks of insect pests and plant diseases in his state on the plowing of the sod and the concomitant disturbance of the natural community. "Man with his agriculture," Smith wrote, "has upset the age-old balance of nature in the great plains region, and a new balance has not been reached. It probably is a long way off, in fact, since man is constantly changing his agriculture." The result here was that chinch bugs, grasshoppers, and wireworms—all native to the area—had run wild when their natural checks were removed and they were given by unwitting farmers an abundance of attractive new food. By some means, Smith argued, Kansans must establish an artificial system of biological controls to restore order to their land. Then in 1935 the Oklahoma ecologist Paul Sears published a more comprehensive and widely influential critique of land-use practices entitled *Deserts on the March*. Though much of the book dealt with other continents, the consideration that most compelled Sears to produce it was unquestionably the dust storms that seemed to be turning the American West into a desolate, drifting Sahara. First with the destruction of the forests, then of the grasslands, he wrote, "the girdle of green about the inland deserts has been forced to give way and the desert itself literally allowed to expand." Sears advocated the appointment of a resident ecologist to supervise land use in each county with the aim of spreading the view that "all renewable natural resources are linked into a common pattern of relationship."[18]

Both Smith and Sears contended that the pioneers had brought down on their heads this host of Egyptian plagues because they had not appreciated the genius of the climax community of the plains—the unique grass–buffalo biome. Naturally enough, then, they took their lead largely from Frederic Clements, and indeed, Clements' writings on

dynamic ecology provided much of the scientific authority for the new ecological conservation movement. From the 1930s on, American environmentalists, lay as well as scientific, relied heavily on Clements' climax theory as a yardstick by which man's intrusions into nature could be measured. Their basic assumption was that the aim of land-use policy should be to leave the climax as undisturbed as possible—not on account of the intrinsic value of virgin wilderness, but more pragmatically because it had proved itself through millennial vicissitudes of climate to be stable, tenacious, and marvelously well adapted to its habitat. Whenever human interference was necessary—and most acknowledged that it was, unless the population dropped abruptly and mankind reverted to a hunting economy—they believed that the best course was to stick as tightly as you could to nature's model.

Two more of Clements' disciples were John Weaver and Evan Flory, both ecologists at the University of Nebraska; they too were among those scientists promoting a grassland conservation program founded on the ideal of the climax community. In 1934 they wrote:

> A thorough study of Nature's crops and Nature's way of making the most of a sometimes adverse environment is of scientific importance. It is also fundamental to an understanding of the effect of prairie upon stabilizing such factors as temperature and humidity, and its effect upon stabilizing the soil. It furnishes a basis for measuring the degree of departure of cultural environments from the one approved by Nature as best adapted to the climate and soil.

Man's crops, they believed, are inherently more unstable, more susceptible to disease and extremes of weather, than nature's: this is part of the price civilization must pay for its very existence. But there is no need to pay to the point of bankruptcy or dust bowls. At the very least, they supposed, it would be useful to understand more precisely the penalties for disturbing the ecological balance, and then to question whether Americans were "properly utilizing Nature's prairie garden or exploiting it." Such a comparative study, they warned, "should be made now, before the opportunity with the destruction of the natural vegetation has forever passed."[19]

Clements himself, in his several works on applied ecology written during the thirties, agreed wholeheartedly with these younger colleagues. As early as 1893, when he had been only twenty-three years old, it had been obvious to him that Nebraska homesteaders were committing a serious blunder in destroying the sod covering the sandhills of that state rather than preserving the natural grassland for grazing livestock. He recalled that Charles Bessey too, in the course of botanical surveys during the 1880s and 1890s, had come to understand that there were safer uses for those marginal lands than those he saw practiced. In the *Phytogeography*, published in 1898 by Clements and Pound, "all the essential features of the proper ecological system for the development of the Great Plains had been clearly discerned and set forth." And ignored. Clements and his associates had then been futile voices crying in the wilderness. Now, almost forty years later, he still maintained that the plains were in critical need of a broad regional plan of ecological land management faithful to the climax theory and the nurturing process of succession. It seemed to Clements that only an ecologist could see what special-interest land users such as the engineer, forester, farmer, and subdivider always overlooked: how man's actions in one place can ramify destructively through a whole biota, over thousands of square miles, across an entire nation. Such a program of management might well begin by searching out and protecting those relicts of the pre-settlement formation that still grew free and wild in neglected corners of country cemeteries and along the railroad tracks where farmers could not plow. From these forsaken byways might come regeneration: the healing grass that could cover a multitude of wounds.[20]

In dynamic ecology, it will be recalled, the climax or adult stage is the direct offspring of climate—and weather in the midcontinent is notoriously promiscuous. Ultimately, then, the ecologist must be as much a student of meteorology as of plants and animals. In the final analysis, "there is no basis for assuming either that the earth itself or the life upon it will ever reach final stability," Clements cautioned. But within the narrow span of human time-

consciousness, vast periods of relative climatic stasis could be plotted with the aid of fossil records. By the same means, the ecologist might also be able to predict the future climate, knowledge vital to the farmer seeking to achieve a sustainable economy on the plains. The thirties drought, Clements maintained, was neither a freak event nor an omen of abrupt climatic change that would damn the plains to an eternally arid future. At least as far back as 1850, records showed a series of severe droughts in the West. Clements wanted to correlate this pattern with the sunspot cycle: in essence, whenever the sunspots subside to a minimum level, drought occurs. He admitted that this theory rested on a scanty statistical base, and climatologists are debating it still. It does seem clear that a major drought occurs every twenty years or so, whether due to sunspots or other causes. Recurring dry spells are a fact of life in the grassland, Clements warned, and man must explore every avenue of science that might aid in predicting them. Without such knowledge, no permanent settlement was possible.[21]

Clearly, this shift of attention from preserving the biological community in favor of adjusting to the climate, which Clements' writings in the 1930s emphasized, did undercut some of the force of climax conservation. Adaptation to cycles of drought rather than to a mature biome became Clements' dominant theme. This was undoubtedly an easier, more practicable route for farmers to follow, and for all his criticism of them, Clements' sympathies were often on the side of those homesteaders who were still determined to wrest a living from this intractable land. Clements did not altogether abandon the idea of climax preservation; he recommended that the westernmost edge of the shortgrass country be given over to the ranching industry and that millions of the most fragile acres in the Southwest and Great Basin area be set aside wholly for recreation or as wilderness. In these instances the aim would be to maintain the natural climax as much as possible, given the absence of Indians, bison, wolves, and many other elements of the original community. But these were the exceptions in Clements' environmental recommendations. He assumed—indeed had to, in view of the plowman's resolve—

that farming would continue to be the central economic activity in the grasslands, and therefore that man would go on battling against ecological succession. Considered realistically, the function of the ecologist must be to show men how they might manipulate the sere to their advantage, by deflecting or retarding the successional process with greater care and expertise. In forest as well as prairie, Clements noted, "the climax dominants are not necessarily the most valuable to man." Inevitably then, to some extent and in some places, man's economy would always take precedence over nature's.[22]

Despite his more pragmatic admissions, Clements' doctrine of the climax as a natural ideal was by now firmly lodged in the national imagination. And Clements himself could not surrender his admiration for this long-enduring communal order, this complex super-organism nicely adjusted to the vagaries of climate. This feeling created a dilemma for both the man and the nation, not an easy one to resolve. There was that primeval state of nature representing a perfect marvel of adaptation, and yet one belonged to a civilization that, despite the blowing dust, continued to believe it needed the land for its own purposes and could somehow find a way to match nature's ingenuity. The confusion over which direction to turn, so apparent in the sum of Clements' own work, was at the very core of conservationist thought in the 1930s. Not since the coming of the Industrial Revolution to America in the early nineteenth century had there been so keen a debate between the claims of nature and culture. Reinforcing the first of these two sides was a new and profound suspicion of technology in the American mind, a wariness instilled by the collapse of the national economy and its industrial system. The tractor on the plains could become the focus of that suspicion as well as any assembly line in Detroit. Take the tractors and combines, the plows and harrows, out of the grassland and give it back to nature: this was in effect what a number of ecologists and other Americans were saying during the thirties, even those who, like Clements, were also struggling to be responsive to human needs in the region. Moreover, in

the theory of the climax community they had a formidable scientific defense for that back-to-nature mood.

But such a pessimistic reaction against technology cut hard against the grain of a society that for the most part retained its confidence in man's managerial skill. This was especially true, of course, among farmers on the High Plains. Substantial numbers of them fitted Archibald MacLeish's description of Tom Campbell, who in the twenties signed a lease with the federal government to plow up ten million acres of Indian reservations. "Wheat to him was the occasion, the excuse," wrote MacLeish. "A tractor was the reality, . . . Campbell ran his farm for the machines' sake." He owned no fewer than thirty-three tractors. Such enthusiasm for the machine was not likely to be tempered by a little dust. Another farmer expressed the unrecalcitrant pride and defensive resentment felt by many: "You can say what you want about the way we farm, but those dust storms ain't manmade." And despite the massive mechanization of agriculture, most of the nation still held firmly to the old Jeffersonian faith that the farmer is nature's ally, if not her benefactor. Even in the Dust Bowl era, the mythic ideal of the husbandman living in fruitful marriage with the land would not be obscured by dusty reality: not in the mind of President Roosevelt or in the mind of the suburban middle class or in the mind of the farmer himself. Hence it was most unlikely that the West would be returned to grass and bison. Most of the wheat farmers were there to stay, and to them in particular the climax theory must have seemed at best academic and at worst a threat to their livelihood and hegemony.[23]

There were a number of scientists, too, who found the anti-technology implications in the climax ideal hard to accept. From this objection, as much as from any purely scientific quarrel with Clements, there emerged in the thirties an "anti-climax" party. Earliest to join issue with Clements on this point was Henry Gleason of the University of Michigan. His essay "The Individualistic Concept of the Plant Association," published in 1926, announced by its very title that he did not at all like the organismic notion applied to the plant formation, not even as an occasional metaphor. Plants do form associations, Gleason argued, but these are mere accidental groupings, each the result of unique circumstances and too loosely related to be likened to an organized being. The drift of this reasoning, as it became clear, was toward a repudiation of the carefully orchestrated, precise succession to the climax state. Indeed, Gleason took exactly that step in the next year, warning against a too rigid idea of the sere and its outcome. Clements' weakness had always been his rigidity, and that was the charge Gleason effectively made now by calling for a less formal concept of ecological dynamics. More important, Gleason's "individualistic" view of nature suggested that the climax was a haphazard, imperfect, and shifting organization—one that man need not worry overly much about disturbing.[24]

Not far behind came A. G. Tansley of Oxford, who despite his recognition of the Nebraskan's leadership refused, as he declared, to drink the "pure milk of the Clementsian word." During the period from 1926 to 1935 he delivered a number of sharp rebuttals to the successional-climax school, especially to Clements' young South African disciple, John Phillips, as well as to the old master himself. Tansley was above all insistent that the "monoclimax" ideal would no longer wash. He claimed that in any single climatic region there may be many apparently permanent types of vegetation, all of which deserve to be called climaxes. Special soils may give rise to edaphic climaxes, for example; heavy grazing by animals to a biotic climax; recurrent fires sweeping over an area to a fire climax. But it was the isolation of modern man's activities from the climax ideal that most bothered Tansley—especially the assumption that he is always an intrusive, disruptive force in nature.

> It is obvious that modern civilized man upsets the "natural" ecosystems or "biotic communities" on a very large scale. But it would be difficult, not to say impossible, to draw a natural line between the activities of the human tribes which presumably fitted into and formed parts of "biotic communities" and the destructive human activities of the modern world. Is man part of "nature" or not? Can his existence be harmonized with the concept of the "complex organism"? Regarded as an exceptionally powerful biotic factor which increasingly upsets the equilibrium

of preexisting ecosystems and eventually destroys them, at the same time forming new ones of very different nature, human activity finds its proper place in ecology.

To these "new ones" Tansley gave the name "anthropogenic" climax, describing a biological system that is artificially created by humans but is as stable and balanced as Clements' primeval climax—a permanent agricultural system, for example. "We cannot confine ourselves to the so-called 'natural' entities," he maintained, "and ignore the processes and expressions of vegetation now so abundantly provided us by the activities of man." Earlier, Tansley had been willing to call this artificial environment a "disturbance climax" or "disclimax." But now he would no longer accept the inferiority implied in those terms; they seemed to reinforce the view that technological man is a corrupting influence.[25]

But the issue Tansley raised here was far more than a mere semantic quibble, a fear of the power of words. Fundamental discords in environmental values were sounding and would not easily be quieted. Basically, Clements' climax ecology looked to primitive nature as a pure state against which the degeneration wrought by civilization could be unfavorably contrasted. By the thirties, however, at the very peak of its popularity, serious weaknesses in this ecological paradigm were becoming apparent. It had to be granted, for instance, that Clements exaggerated the role of climate as the sole, sweeping determinant of the mature formation. It was also convincingly argued that he insisted too strenuously on his inflexible, monolithic system of sere order, a system that nature herself did not always follow. In these respects Clements' critics made a great deal of sense.

The merit of his science, on the other hand, was that it kept in sharp relief the dislocating and mutilating effect civilization has had on the biological community. The charge could indeed be made that Clements segregated modern man from nature and made him an alien in the natural realm, a bull thrashing around in a china shop. But in a more positive light, climax ecology held fresh the memory of a world by which civilization could be measured. As a boy on the frontier, Clements had seen that primeval climax order firsthand, and this experience was surely responsible for his powerful sense of disjunction between man's and nature's worlds. Of course, the distinction between nature and culture had always been emphasized in America. It had been dramatically understood, used over and again in literature and social thought, even made the basis of a national purpose—albeit an ambivalent one, designating nature by turns as a foe to be vanquished and a redeemer to be praised. But in any case, the image of a wild, untrammeled nature was deeply etched on the American consciousness, far more than could be true for Europeans. And the persistent appeal of this image helped make Clements' ecology persuasive and even valid for America.

Tansley, in contrast, could grant that civilization had profoundly altered the course of natural succession, but went on to discount the importance of this. For him, the distinction between nature and civilization had no clear relevance in a long-settled Britain. If nothing else, to insist on it would effectively deprive the ecologist of a subject to study, for virtually none of Clements' climaxes had existed intact on the other side of the Atlantic for several centuries. Tansley's defection from the climax school, however, was not simply aimed at guaranteeing work for himself and his colleagues in their more thoroughly manmade world. Behind his elevation of the anthropogenic climax to equal respectability lay the refusal of the Great Plains farmer to admit that nature's ways are best. Fundamentally, Tansley did not want to accept any climax achieved by purely natural processes as an ideal for man to respect and follow. His concern was not to reestablish man as a part of nature, but to put down the threat to the legitimacy of human empire posed by the natural climax theory. If Tansley was right and there were no meaningful differences between the balance achieved by nature and that contrived by man—if the two systems were at least equals in quality and performance—then what reasonable objection could there be to man's rule over the biological community, or to the further extension of his empire? The effect of Tansley's proposal, in other words, would be to remove ecology as a scientific check on man's aggrandizing growth. The Clements standard of the climatic climax must be replaced, he

was saying, by a kind of environmental relativism; there would then be no exterior model against which the artificial environment could be evaluated scientifically. The yardstick would be tossed away, and man would again be free to design his own world.

Some twenty years later, this clash of environmental values was defined more clearly than it had ever been in the thirties. In 1956 James Malin, an agricultural historian at the University of Kansas, made the most comprehensive and revealing argument to date for the "anti-climax" school. He was not a scientist, but his ideas gained a good deal of scientific acceptance. Malin had long been the foremost American scholar on the history of grassland agriculture, especially wheat farming, when he strayed into ecology in the mid-1940s. After a decade of research and writing he published *The Grassland of North America*, a collection of essays that represented the first effort by a historian to incorporate ecology into the study of a region and its culture since Walter Prescott Webb had tried it, though less explicitly, in his classic book *The Great Plains*. But while Webb had emphatically favored livestock ranching over farming as an economy more in harmony with the shortgrass environment, Malin came vigorously to the defense of the pioneering homesteader. The sodbuster, he maintained, had been a hero after all. Unfortunately for his side of the debate, Webb had published his work in 1931, shortly before the advent of the Dust Bowl years; therefore it lacked the most telling evidence against the agrarian empire and its failure to adapt to regional ecology. Malin, in contrast, could not avoid facing and explaining that experience. Indeed, he was truly possessed by it, so much so that it became his central purpose over several decades to justify the role of the farmers in the dust-storm years and to defend their battered reputation not only against Webb but also against the "evangelical conservationists" and ecologists. That revisionist aim required above all, as he soon became aware, a direct refutation of the theory of the climax community. Consequently, not Webb but Frederic Clements became his main target.[26]

Malin's interest in the ecological history of the grassland peaked from 1952 to 1956, coinciding precisely with the return of drought across the region. Even less rain fell in those years than during the thirties, and once again dust storms blotted out the noonday sun with dark, choking clouds, but now over a larger area. Federal observers attributed the renascent problem in large part to the fact that plains farmers had once again been encouraged by good prices and patriotic appeals during World War Two and the Korean War to go for "all-out production," even on fragile marginal lands. But apparently a *few* lessons had been learned since the dirty thirties; somehow the region narrowly averted a new dust-bowl disaster. From Professor Malin this fortunate turn of events evoked less a sigh of relief than a shout of triumph. This recent history, he claimed, showed that the climax conservationists had wildly exaggerated the tragedy of the 1930s and so had wrongly concluded that farming had no place on the High Plains. In particular he lambasted the documentary film *The Plow That Broke the Plains*, made in 1937 by Pare Lorentz for the Farm Security Administration, as sensationalizing propaganda that had left an indelible slur on the farmer's good name. "No more brazen falsehood was ever perpetrated upon a gullible public," wrote Malin, "than the allegation that the dust storms of the 1930s were caused by the 'plow that broke the Plains.' " On the contrary, he insisted, agricultural enterprise—especially large-scale mechanization—was "a constructive step" forward. The plains had benefited from it rather than being harmed. Nature needed plowing up, and even a little blowing dirt now and then, he argued, to remain vigorous and fertile.[27]

The notion of a superior climax state gave a scientific validation to the conservationist's case against the machine and the farmer; hence, in Malin's view, the influence of Frederic Clements was the ultimate source of this "hysterical" conspiracy against progress. To discredit the climax ideal was Malin's chief aim, expressed thus in 1953:

> The conventional or traditional concept of the state of nature must be abandoned—that mythical, idealized condition, in which natural forces, biological and physical, were supposed to exist in a state of virtual equilibrium, undisturbed by man.

Rather than the climatic formation extending unbroken over millions of acres, he believed there were only a handful of small "nuclear areas" that remained relatively stable. All the rest of the grassland had always been in wholesale flux, a chaos of permanent impermanence. When the white man first came upon the prairies, therefore, he discovered not a perfect balance but a world in tumult, awaiting a stabilizing hand. In this view, modern agriculture made possible for the first time a reign of order, peace, and harmony. Only to those primitivistic ecologists who had been blinded by the myth of a perfect, virginal state of nature before civilization corrupted it, was this fact not obvious.[28]

Just as the bison had disturbed the sod with their dusty wallows, and the prairie dogs with their sprawling cities, so the farmer had plowed the land—a civilized version of these other creatures' "natural tillage." In either case, the result was, in Malin's judgment, "the long-term vigor of the vegetation of the grassland." Dust storms too have always been among "the natural phenomena of the Great Plains. They are a part of the economy of nature and are not in themselves necessarily abnormal; at least, not in the sense in which the subject was exploited during the drought decade of the 1930s." As early as 1830, he went on, a missionary-surveyor named Isaac McCoy had reported from north-central Kansas a severe blowing of dust; dozens of other examples could be found in local papers—all before the breaking of the sod. Indeed, it was this very process of wind erosion, Malin claimed, that built a rich and fertile soil. On the plains the soil lacks the distinct layering or profile seen elsewhere; remove a foot or two of the topsoil, and no real damage was done. But sifted by the wind and deposited elsewhere, as in the fertile loess hills of Nebraska, that topsoil could be a useful gift. This incessant process of blowing the dirt to and fro was nature's chief way of improving the land over the million or so years of the Pleistocene epoch.[29]

Like Tansley in England, Malin was unhappy with what seemed in ecology to be a prejudice against civilization: a belief that "only civilized man was evil" and therefore had no moral right to alter the natural order. The preservationist's oft-repeated charge of "rape" for what modern man had done to the grassland especially enraged him, in part because it implied that nature is more than a mere thing, that it has personal character, that it is female and vulnerable. Nor would he accept any distinction between the environmental impact of the Indian and of the white man. Since Folsom Man killed his first bison, humans had been a disruptive force in the grassland ecology, he contended. With the re-introduction of the horse in the sixteenth century and its eventual incorporation into a new plains culture, primitive man became especially destructive, slaughtering the game on every hand. Moreover, from the Berkeley geographer Carl Sauer came support for Malin's belief that the grassland was the result not of low rainfall but of Indians setting fire to the grasses every year to improve hunting. Sauer, who grew up along the heavily forested banks of the Mississippi River, complained that primitive and modern man alike have hated the trees and destroyed them whenever they could. Nothing else, he was sure, could account for such "a great deformation of the vegetation" as the prairie showed: "an impoverished assemblage, not a fully developed organic household or community." Much earlier, Frederic Clements had admitted that fire, whether caused by lightning or Indians, could have been a decisive influence at least in the "ecotone," the narrow no-man's land between forest and grass. But Sauer—and here Malin followed him exactly, though he could not have liked the other's denigration of his homeland grasses—sought to make fire the master over a landscape a thousand miles wide. And, of course, such a man-made origin for the grassland would put the kibosh on all back-to-nature yearnings, all resistance to other kinds of human interference with the "climax order."[30]

This is not the place to answer all of Malin's arguments point by point; each has been refuted more or less successfully in several places, by scientists and others. But at least we can say here that it assuredly was not true, as Sauer and Malin asserted, that the idea of a climax community "assumes the end of change." No one since Darwin, and certainly not Clements, would think seriously that any part of nature is completely or permanently static. A final climax could endure, Clements pointed out, only in the absence of

major climatic shifts. But ultimately underlying Malin's objections to the climax theory was a personal motive that really had little to do with issues of fact or fantasy, with the degree of stability or flux in nature. Like the sodbusters he defended, Malin refused to be hedged in by ecological laws. To obey rather than conquer nature was a surrender, in his view, to the chains of determinism. Even if the grass–bison biome was, as Clements said, the mature stage of the sere, one was confronted merely with a fact, not a decree. It is man, not nature, Malin believed, who creates norms and values. If it suits his purposes, he can and should alter the grassland radically and create his own kind of world there. Of course, to urge that civilization, whether for reasons of self-interest or morality, adapt to its biotic environment was not really a deterministic stance. Walter Webb had been accused of a similar crime in writing *The Great Plains*, and he rightly denied the charge. He insisted, to be sure, that American agriculture and institutions must inevitably adapt somewhat to the western environment. More significant, however, was his view that the forage economy of the cowboy was more suited to the climax grassland conditions than that of the farmer, whose technology shattered that harmony and imposed on the land an alien existence. Webb's implied conclusion, like that of the climax conservationists, was that humans can make a choice which route they will follow. To adapt rather than transform need not be deterministic or fatalistic. Rather, it may be the exercise of a highly civilized, mature will and self-discipline.[31]

The ethic of environmental self-restraint had never been taken very seriously by the sodbuster. He generally had bound himself by a different set of chains, those of technological determinism, under the illusion that he was winning freedom from natural forces. Malin too depended on the machine to extricate him from nature. "The contriving brain and skillful hand," he fairly exulted, have refused to be bound by anxieties about a shrinking land heritage, or by propaganda on the Dust Bowl. Conservationists of all sorts, he decided, had become pessimists and critics because they had lost faith in technology. Their fears of the destruction of resources by human mismanagement were totally unfounded, according to Malin:

> The potentiality of man to solve problems has not yet been exhausted, and the potentiality of the resources latent in the earth to be brought into the horizon of usefulness is still beyond the power of man to conceive. The key to the situation is not the earth, but the minds of men determined to realize their own potential in act.

Thus Malin preached the familiar homily of cornucopian expansion: that neither nature nor American civilization is a finished product; that change is the law of each; that the machine is wholly legitimate under this law, if not its perfect expression; and that nature is an inexhaustible warehouse of riches for those enterprising enough to dig around.[32]

Hopeful though he was about the promise of technology on the plains, Malin could not preach his transformationist gospel without some qualification. Still a loyal child of the grassland, he resented as much as did Webb or Clements the persistent tendency of Americans from forested, humid areas to regard the prairies as a *deficient* environment, lacking in some element necessary for human welfare. Each region has its unique character, its strengths and weaknesses, he countered, and the newcomer must learn to appreciate that character before setting about to change it. And Malin, on at least one occasion, forgot himself so far as to write: "The degree of success in the occupation by man of any of these land regions could be measured in terms of his ability to fit his culture into conformity with the requirements of maintaining rather than disrupting environmental equilibrium." The grassland biome, he was now arguing, should suggest to its human invaders a set of restraints that would delimit the contours of a distinct regional culture, one that could make a special, unique contribution to the world. It would seem from this comment that nature, not the machine or man, must determine the shape of the region's culture, and that its peculiar and precarious balance must be respected after all.[33]

In such moments of apostasy Malin really gave his case away. For all his scattered pinpricking at the climax model, he could not effectively deflate its credibility, even in his own mind. There did seem to be empirical evidence of something one could call an equilibrium or climax in na-

ture, before the coming of the white man. That order was not perfectly stable; it had its ups and downs, its faults and slippages. Other natural forces were always at work trying to upset it, and sometimes succeeded temporarily. But despite all this, a few million years of evolution had produced on the plains a system that worked extraordinarily well—one that civilized man, for all his ingenuity, would always have trouble matching, and one that he interfered with at the risk of his own well-being. And no amount of quibbling over whether dust might have blown down the streets of Atchison or Amarillo before the 1930s could conceal the simple bleak truth that never in the history of the plains since their discovery by European man had anything approaching the devastation of the Dust Bowl years occurred. But then, never before that point had the natural-growing grass been so quickly and violently ripped apart, and so much of the earth left bare under the wind and sun. Though he might potshot at details, Malin could not really deny these elemental facts, for he himself had lived through them. Indeed, they had been written large enough for the entire nation to see and experience—in lurid skies, in the smell of dust and the taste of grit, in blinding blizzards of dirt, and in the hopeless, defeated faces of migrants on the road, or on relief.

All this is not to say, however, that Malin was easily dismissed. Despite their obvious weaknesses, his arguments presented a formidable challenge to the climax theory of ecology and its environmental message. Nobody before him had marshaled such an effective refutation of Clements and his school—a refutation based primarily on historical research, to be sure, but not without scientific credentials. Consequently, he had a discernible impact on both ecologists and conservationists. To take only one example, his writings were a chief source for the forest ecologist Hugh Raup, manager of the Harvard University forests in Massachusetts and New York. In a 1964 essay, "Ecological Theory and Conservation," Raup applied Malin's view of the primitive grassland to the eastern deciduous forest. His conclusions were pure Malin doctrine: the image of a pre-European virgin forest that was dense, mature, and fully productive is a myth; the stable climax ideal is exaggerated; and traditional environmentalists have been too frightened by scarcity, too cautious in their husbanding of resources. According to Raup:

> Ecological and conservation thought at the turn of the century was nearly all in what might be called closed systems of one kind or another. In all of them some kind of balance or near balance was to be achieved. The geologists had their peneplain; the ecologists visualized a self-perpetuating climax; the soil scientists proposed a thoroughly mature soil profile, which eventually would lose all trace of its geological origin and become a sort of balanced organism in itself. It seems to me that social Darwinism, and the entirely competitive models that were constructed for society by the economists of the nineteenth century, were all based upon a slow development towards some kind of social equilibrium. I believe there is evidence in all of these fields that the systems are open, not closed, and that probably there is no consistent trend towards balance. Rather, in the present state of our knowledge and ability to rationalize, we should think in terms of massive uncertainty, flexibility and adjustability.

There was much truth in this analysis, mixed with a great deal of tendentiousness and distortion. Raup was trying to establish that ecological conservationists would place too much restraint on harvesting and transforming the biological community—a policy that was, in his view, timid, unscientific, and even more important, uneconomic.[34]

Other critics besides Malin and Raup contributed to a certain loss of faith in Clements and the climax school, but it nonetheless remains an influential tradition in British and American ecological thought. Indeed, in many science texts of recent years the climax idea has not even been much modified. That observation, of course, does not necessarily make the climax theory true in some conveniently absolute way; there are many who assume too quickly that science can always give them the final, unambiguous word, and they can be satisfied with nothing less. But the succession–climax model, as we have been suggesting all along, is inextricably wrapped up in those muddled, subjective things called human values. Probably there is no final or compelling reply to the question of whether the climax ever existed or not, or at least no answer that sci-

ence alone can give for all time. The issue of the climax is an enduring conundrum.

Yet its tenacity as a model over so many years, despite stiff and searching criticism, must establish a certain degree of reliability—enough at least to give pause to unrestrained interference with nature. It can be taken as instructive if not conclusive that science keeps returning to some version of the climax. R. H. Whittaker, for instance, in what is basically another revisionist analysis of the theory, nevertheless agreed with Clements that "through succession the community develops from one of scattered pioneers utilizing only a fraction of environmental resources available, to a mature community with maximum utilization of resources on a sustained basis." Then, too, ecologists like Whittaker have not yet been convinced by the anti-climax critics that no practical distinction can be made between a natural prairie and a farmer's cornfield. All discriminations may appear arbitrary in some light, but a distinction need not be valid in every respect in order to be both true and valuable. The old idea that nature's economy is an astonishing success is not yet overthrown. The natural ideal is still there, basically as reliable as ever—for those who seek and are willing to accept guidance from the nonhuman world.[35]

Usually where the climax is ignored or discounted as an ideal, the only criterion left is the marketplace—the very standard that gave America the dirty thirties. But as the veteran grassland ecologist H. L. Shantz pointed out in 1950:

> The economic yardstick now used to determine the best use of land is by no means a safe one from an ecological or biological point of view. Economics has given us strip lands over coal beds and stone fields in rich narrow valleys over gold-bearing gravels. Much the same approach gives us barren moss and lichen-covered hills where redwood forests stood; bracken fields where Douglas-fir or cedar and hemlock were produced; great areas of downey chess where bluebunch wheat grass or Idaho fescue produced a dense cover; snakeweed and burrowweed where valuable gramas covered the soil, and nearly bare soil on our mountains once knee-deep in lush vegetation. The sustained high price of wheat has reduced much of the grass cover of the High Plains to nearly bare soil—a potential dust bowl.

At times himself a critic of Clements' dogma, Shantz still remained convinced that nature, in order to make the best possible use of the region's limited rainfall, evolved on the plains a system superior to man's. Though deviance may be unavoidable in some areas, he believed, in others man can protect the natural climax from all intrusion; it can serve as an oracle that speaks truths of which the human contrivers remain ignorant. That course seemed a safe one at least, and may have had the virtue of humility to recommend it too.[36]

There are other explanations for the persistence of the climax ideal in American thought. First, that James Malin himself could slip even momentarily into the Clements persuasion demonstrates its powerful appeal for cultural regionalists. Regionalism, even in Malin's case, has been essentially a rejection of the prospect of a vast homogenized industrial landscape stretching from coast to coast, from which all local and regional uniqueness of ecology and culture have been eliminated. So long as an allegiance to regional peculiarity endures in America, or in Britain for that matter, credence will surely be given to some version of the ecological climax. Regionalism swings on a double hinge: natural geography and cultural heritage. In the theory of the climax, regionalists such as Webb and Malin have a concrete and usable guide to local identity. Though the regionalist must grant more free choice to humans than the ecologist and plant geographer can ascribe to their subjects, both groups want to know how climate and conjoining species have influenced the development of a given community.[37]

The climax theory still appeals, too, because it serves as a model of succession to maturity. It suggests that the receptive student of nature may yet learn how to achieve a man–land harmony, a mature or climax stage in which man thrives, too. With that hope in mind, the North Dakota ecologist Herbert Hanson declared, in his 1939 presidential address to the Ecological Society of America, that it is impossible to secure the adaptation of the plains people to their environment chiefly "by the use of the plow and the wheat plant." Other modes of land use would have to be practiced, including ranching. "Instead of gradual development of the community towards stabilization," he con-

tinued, "the pioneers have often been making conditions less favorable, rather than more favorable, as should be the case, for the next generation." What Hanson envisioned was the achievement of an integrated man–nature equilibrium—a cultural as well as biological climax state—for the grassland.

> The United States is passing from its pioneering stage into more advanced stages. . . . The special contribution of ecology is to ferret out relationships with the environment so that man, using this knowledge in conjunction with that obtained from other fields, can strive intelligently to secure balance and stabilization, a goal essential for the "abundant life" and the building of a culture far beyond our present dreams.

On the success of this search for ecological harmony would rest all prospects for a vital, stable Great Plains region.[38]

Long after the black and red and yellow clouds had settled back to earth, and the sunflowers and thistles had begun to reclaim the barren dusty land, the controversy over climax conservation continued. For the grassland, as for any other environment, the issues were not to be easily resolved. Even today it is not unusual to see a dust-devil whirling over the naked dirt of a Panhandle suitcase-farmer who may be too busy totting up his ledgers in a city bank to care where his land is going.

But if all Americans did not learn from the Dust Bowl how to live with even simple prudence on the plains, many nonetheless absorbed from the climax ecologists one perception: that the blanketing, tough-rooted sod that the pioneers found so monotonous and useless knew its business pretty well. And still the larger question remains unanswered in our expanding technological culture: How far can and should man adapt himself to nature? Or how far can and should he go in altering its order for his own ends? Perhaps we are all unredeemably "edge" creatures, never wholly at home either in the dark humid forest or the big open-sky country of the grassland, always struggling to convert both into a Kentucky idyll of shady oak groves dappled across a pastoral meadow. But then we also know that we are animals of remarkable adaptability—when and where we have to be.

The Dust Bowl, the ecologists were arguing in the 1930s, was America's most serious failure to adapt to the natural economy. It was dark proof of a certain truth in Robert Frost's observation that "the land was ours before we were the land's." And they warned that it could happen again someday unless the nation heeded their advice. How much of their argument was true is not finally the main issue here. More germane to our purpose is that as a result of this environmental crisis of the dirty thirties, the most telling in our history, the new profession of ecologists found themselves for the first time serving as land-use advisers to an entire nation. That episode laid the groundwork for a more scientifically fueled conservation movement in America, one that would pick up steam in the decades ahead.