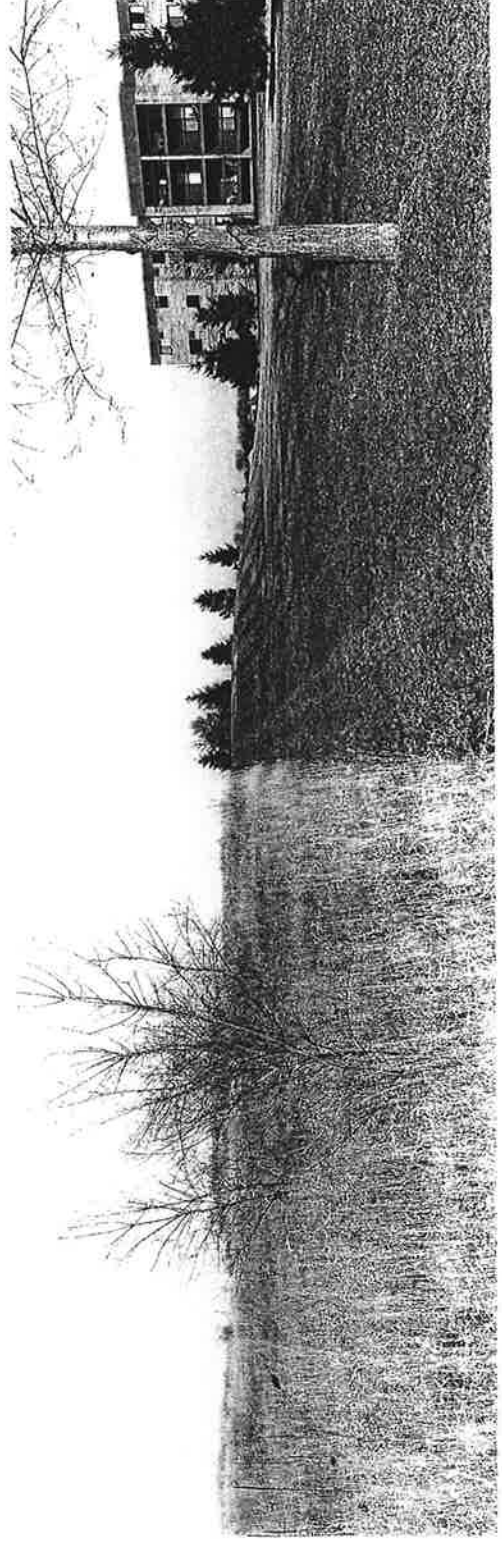


3 | Inherit the Grid

CURT MEINE



CURT MEINE is a conservation biologist and writer with the International Crane Foundation in Baraboo, Wisconsin, and a lecturer in the Institute for Environmental Studies at the University of Wisconsin-Madison. He has worked as a consultant to various scientific and conservation organizations, including the National Academy of Sciences, the American Museum of Natural History, and the U.S.-based Biodiversity Support Program. His publications include the award-winning biography *Aldo Leopold: His Life and Work*.

OVERLEAF:

Top: Lot Division Lines, Eagan, Minnesota (August 1991).

Bottom: The Edge, Eden Prairie, Minnesota (May 1990).

The culture of a nation, by general consent, would, I suppose, be regarded as its greatest heritage, but a heritage perhaps equally worthy of being cherished is the land surface which a nation occupies. The culture to a large extent must have been influenced by the character of the land surface, and in any event culture and land surface are interwoven, and interact in countless directions difficult to unravel.

—Reginald G. Stapledon, *The Land: Now and Tomorrow* (1935)

Ecological design is the careful meshing of human purposes with the larger patterns and flows of the natural world and the study of those flows and patterns to inform human purposes. . . . When human artifacts and systems are well designed, they are in harmony with the larger patterns in which they are embedded.

—David W. Orr, *Earth in Mind* (1995)

WE FACE A SHARP BEND in the road. Behind us lies the landscape we inherit, before us the landscape that, in due time, we will bequeath. Looking back, we see important flaws in the relationship between the human-dominated landscape and the natural world. Looking ahead, we see a need to reform that relationship but find it hard to know just how we might alter our direction, shift our momentum, adjust our speed. We seek a more careful “meshing” (to use David Orr’s word) of social and natural systems, but we have no sure map to guide us.

Lacking explicit directions, we peer ahead, advance with deliberation, and make forays. We ask, what kind of knowledge and experience do we need to blend in any given place to address issues of biodiversity conservation, environmental quality, landscape aesthetics, economic sustainability, social justice, and com-

munity cohesion? We begin to integrate perspectives, ideas, and data from diverse fields—ecology, restoration ecology, conservation biology, environmental history and economics, geography, landscape ecology, landscape architecture, land-use planning and design, and architecture and the allied arts.

History contributes a caution: exploration of the new requires assimilation of the past. In particular, we need to be aware of and avoid the flaws that have placed us in our current bind. Conservation biologist Gary Meffe, in defining his own field’s contribution, cites Albert Einstein on this point: “We cannot solve the problems that we have created with the same thinking that created them.”¹

Here we consider one of the key features of the thinking that created our problems: the perception of context. If, as Orr suggests, sound design requires that “human artifacts and systems” fit

well with "the larger patterns in which they are embedded," then a clear view of those patterns is essential to successful design. Yet, our artifacts and systems have tended to cloud the view. Architectural historian Vincent Scully writes:

The relationship of manmade structures to the natural world offers . . . the richest and most valuable physical and intellectual experience that architecture can show, [yet] it is the one that has been most neglected by Western architectural critics and historians. There are many reasons for this. Foremost among them, perhaps, is the blindness of the contemporary urban world to everything that is not itself, to nature most of all.²

Scully extends and responds to his own complaint:

At present, most human beings of the developed nations live in an environment that is almost entirely manmade, or think they do so. Hence the major contextual questions of modern architecture have come to be those having to do with the modification of existing manmade environments by new structures. But underneath all the complexity of those urban situations *the larger reality* still exists: the fact of nature, and of humanity's response to the challenge—the threat, the opportunity—that nature seems to offer in any given place. It follows, therefore, that the first fact of architecture is the topography of a place and the way human beings respond to it with their own constructed forms.³ (emphasis added)

In considering contextual questions of the past and future landscape, we need amend Scully's observation only slightly. Not only have our urban structures and situations been inattentive to "the larger reality," so too have patterns of settlement and land use throughout the human-dominated landscape. Subdivisions, suburbs, edge cities, towns, farms, ranches, managed forests, and semi-wild lands are also "manmade structures," though less compact or obvious than the skyscraper and city block. They too are constructed forms within the landscape. Recently, environmen-

tal historians and conservation biologists have even reexamined wilderness—or at least our received idea of wilderness—as a human construction.⁴ Meanwhile, our understanding of "the larger reality" of nature has continued to expand and change. In recent years, ecologists have stressed the dynamics of natural systems and the need to take ecological processes into account in conservation and resource-management strategies.⁵

Here, then, is a task. We must somehow achieve the capacity to step away from the artificial order in which our lives are embedded. We must appreciate the varied scales of time and space in which we exist. We must read well the character of the earth and know how culture has influenced the view from within.

The lenses through which we see landscapes, and ourselves within them, vary from place to place and from culture to culture. In much of North America, we perceive—and modify—the landscape through the superimposed system of rectangular land surveys, with its grid of township and range lines, that was instituted in the late 1700s. In those places where the grid system predominates, it has profound impacts on the landscape and the patterns of life within it. But our obligation to inherit wisely the grid holds broadly applicable lessons. As a metaphor, the grid illustrates starkly the difficulties that can ensue when our land distribution and tenure systems are constructed without appreciation of their natural contexts.

Yet, the very pervasiveness of land-survey systems can hinder our appreciation of them. As Hildegard Binder Johnson notes in her important study *Order upon the Land*, "most Americans accept the survey system that so strongly affects their lives and perception of the landscape in the same way that they accept a week of seven days, a decimal numerical system, or an alphabet of 26 letters—as natural, inevitable, or perhaps in some inscrutable way divinely ordained."⁶ In our present efforts to devise more sustainable land-management and landscape-design practices, we

need to grasp fully the historical impact of land-survey systems and to consider the constraints and opportunities they offer in light of conservation biology, landscape ecology, and other emerging fields.

AS WES JACKSON WRITES, "The grid and property lines and what they mean must be factored in, almost as immutable givens, as we begin our journey to become native to a place. Those lines are likely to last as long as there is a United States."⁷ To factor in the grid—what it signifies, the impact it has had—we need first to place it in perspective.

We are drawn to places where the larger reality of the earth can be sensed. Those who dwell among mountains have ready access to such panoramic views. This access now draws us as desperately to the modern American West as the halt are drawn to Lourdes (and with much the same hope for healing).⁸ Those who dwell near oceans and other wide waters are also blessed with built-in access to larger realities: the creatures of the deep, the visible arc of the horizon, the pull of the moon. Deep forest—even the threatened fragments that remain—can still lift us beyond the human scale and put us in our place.

For dwellers of flatlands and inlands, however, a sense of the enveloping order is harder to come by. No grand vistas, no swelling sea, no vaulting trunks and shafts of light to lift the eyes to greater proportions. Johnson writes that, in our most *extreme* Midwest of straight roads, furrows, and ditches, "all forms seem to be hardened into plane geometry. . . . Enthusiasm over nature's roundness can be stirred only by the spectacle of clouds under the dome of the sky."⁹ In flatlands, the hints of magnitude, the feeling of ultimate context, must come to us through filters of rectangular corn and soybeans fields, straight county roads that meet at precise 90-degree angles, and strip developments that cling to the grid lines like detritus to storm grate. Yet, even

within neatly stitched, buttoned-down landscapes, we find ourselves inevitably confronting the larger reality of wild nature.

Where to find it? From one of its odd corners, memory whispers a hint: seventh-grade English class, Miss Fitch presiding. Or trying to, anyway. The suburban adolescents under her care were none too attentive to begin with, and she had begun to lose access to our minds. One afternoon, in an effort to strike a spark of critical thinking within us, Miss Fitch pulled out the classic brainteaser. "Listen again. You're standing in the door of your house at Point A. You walk a mile due south to Point B. Then you turn right and walk another mile due west to Point C. But then, suddenly you see a WILD BEAR! So you turn right and race one mile due north, where you arrive safely back at your house." Dramatic pause. "What color was the bear?" The expected bewilderment all around. I recall trudging my triangular way through those imaginary stations and somehow arriving at the answer. Distraction, however, ruled. It was not the logic of the problem that held me but the daydream vision of the great bear wandering through arctic mists. We walk with wildness, and within wildness, even if unawares. Before I could raise my hand, a classmate screamed from the southern latitudes of my consciousness: "WHITE!"

The ostensible point of discussion that afternoon had more to do with methods of deductive reasoning than with finding our place in the world or the role of mystery in illuminating reality. Yet, however unintended, the latter lessons snagged. "Nature is not a place to visit," Gary Snyder writes, "it is *home*."¹⁰ Let the bear signify the presence of the wild in our home, and of our home in the yet larger wild place—the wild that we have banished to odd corners of our classrooms, our landscapes, our selves, the wild that provides guidance when we are ready for it. Aldo Leopold understood the fundamental cultural value of these wild presences and places. They "give definition and mean-

ing to the human enterprise." We return to them again and again, he wrote, "to organize yet another search for a durable scale of values."¹¹ And when we turn back to the cultural enterprise, to the more humanized portion of the landscape, we find ourselves, and our place, changed. With pragmatic consequences. "The lessons we learn from the wild," Snyder observes, "become the etiquette of freedom."¹² The better we know the larger reality, the better we might know how to act within it.

WITH THE EXCEPTION of the 13 original American states, plus Maine, West Virginia, Kentucky, Tennessee, and Texas, the continental land mass of the United States is delineated politically according to the land-survey system developed originally in the Ordinances of 1784 and 1785 and the Land Act of 1796, and modified through later acts and policies. (Canada's land survey followed much the same system.)¹³ Under the survey, all lands in the public domain were to be measured and divided according to a gridwork of survey lines whose coordinates would, in Johnson's words, "always run north-south and east-west with complete disregard of the terrain. This unconditional rule [made] it possible for the survey to be continuous not only in concept but in practice over thousands of square miles—the most extensive uninterrupted cadastral system in the world."¹⁴

Formalized under the influence of eighteenth-century rationalism and Enlightenment science, drawing upon (or at least resembling) diverse precursors, and applied and polished according to Thomas Jefferson's political vision, the survey system was well suited to its central task: the efficient distribution of lands, whose indigenous peoples had been dispossessed of their tenure, among newly arrived inhabitants for whom individual land possession was a bulwark against the inequities of European land tenure and a stabilizing keel for the embarking democracy. "It is not too soon," Jefferson wrote from France in 1785, "to provide by every

possible means that as few as possible shall be without a little portion of land. The small landholders are the most precious part of a state."¹⁵ Among the "possible means" would be the survey system.

The land ordinances established the principles and methods of the survey: adoption of the nonvarying gridwork of survey lines as the fundamental model; subdivision of the western territories into square townships, first envisioned to be 10 miles square, later amended to 7, and finally 6 square miles; further subdivision of the 6-square-mile blocks into 36 square sections; consecutive numbering of the sections; reservation of one section of each township for maintenance of a public school; appointment of surveyors and geographers to undertake and direct the survey; and auctioning off of the lands so defined. Following strict Euclidean geometry and Cartesian coordinates, Gunter's chains in hand, the government surveyors began their work in the wild lands of eastern Ohio. The work would continue to the Pacific. "Across the public lands," Wallace Stegner wrote, "the General Land Office imposed a grid of surveys upon which the small freeholds of the ideal agrarian democracy could be laid out like checkers on a board."¹⁶ "The result," John Hildebrand observes in *Mapping the Land*, a history of one of the millions of freehold farms to which the survey gave definition, "was the landscape as a work of political imagination."¹⁷

Not, that is, as a work of ecological or biogeographical realism, or as a foundation for socioeconomic and environmental sustainability. The scientific basis of the survey, after all, lay in mathematics and geometry, not in the natural sciences—much less in the *integrating* natural sciences of ecology, biogeography, and evolutionary biology, which were but faint premonitions in the Age of Enlightenment. The survey, in abstracting the earth, might indeed extend across the continent to the Pacific. There was nothing to stop it—not great rivers, or sweeping plains, or abrupt

plateaus, or vast mountain ranges, or high deserts, or thick forests. For that matter, not civil wars, or native uprisings, or land speculators, or corrupt officials, or land rushes, or railroad barons. All fell before, within, and under the grid. Although perfection could not and would not be attained in the laying on of lines, the illusion of perfectibility and control could be maintained.

Up to a point.

For there was an inherent flaw in the methodology of the original U.S. Land Survey. The survey aimed to render square townships on the landscape, with the eastern and western boundaries laid out along parallel north-south longitudinal meridians. But (as English teachers and polar bears can teach us) meridian lines are not parallel; they converge as one moves closer to the earth's poles, where they intersect. In reality, the survey squares are not squares at all, but curved trapezoids in three-dimensional space. If the survey were carried out to the poles, the trapezoids would become triangles. In short, on a round earth one simply cannot construct and stack identical square townships along a north-south axis.

The convergence of the meridians could not be disregarded in the ideal grid system. The grid might extend unencumbered by climate, geology, hydrology, slope, aspect, soil type, flora, and fauna; resurveying might be required when waves washed away sands, rivers gained and lost oxbows, landslides reshaped landforms, or volcanoes created new land; corners might be cut through the fatigue, error, or bribery of the surveyors. None of these called into question the attempt to fit an artificial order upon the natural order. But this one ultimate "natural feature"—the curvature of our earthly orb—could not finally be ignored.

At the beginning, nonetheless, it was. The Ordinances of 1784 and 1785 did not address the problem, nor did the Land Act of 1796. Not until 1804 did the Surveyor General begin to work out not exactly a *solution*, but a *technique* to mask the flaw. The

problem was addressed not through reconstruction of the survey or reconsideration of its principles, but through a series of expedient steps described in the surveyors' field manuals over the first half of the 1800s. The key innovation was the establishment of regular "correction lines" that allowed the grid to be shifted slightly to take into account the earth's curvature. The geodetic technique could not solve the unsolvable problem; all it could do was institute a shift in order to compensate for it.

Johnson notes that this "grid shift," though important to surveyors, is "rarely noticed in the field." But across the broad actual landscape of the American earth, one may find what she calls "this right-angled curiosity:" "Offsets through correction lines . . . can be seen from the air because of the sharp angles they produce on north-south running section roads. On the ground they make for awkward driving, even in the twentieth century. . . . On good modern roads, corners have often been replaced by a curve."¹⁸ We might wish to protect some of these anomalies. They might remind us of our own imperfectibility. They might show us that the earth remains, despite the order imposed upon it, whole, round, and essentially wild—beyond, in the end, the willing impulse of immodest human intentions.

BEFORE ME LIES a sharp bend in the road. I pull off on the wide grassy shoulder, 50 yards before the narrow road takes a 90-degree dogleg turn to the east. A driving wind from the northwest carries the first serious chill of the fall. High pressure has also brought bright coherent clouds, behind which the falling sun shines resplendently. Defying the gusts, strewn flocks of mallards plummet from on high into the field on the west side of the road, joining those already feasting on the dross of the just-harvested corn. At least a thousand ducks forage in this field alone, moving methodically among the gaunt remains of the summer's crop, vacuuming waste kernels.

Leaving the car, I turn up my collar to the wind and stride north past the traffic sign, its black arrow against a yellow background, pointing east. Take heed, motorists, or carom among the solid oaks in the woodlot straight ahead.

Turn east. In the adjacent field to the south, the farmer combines his corn, moving in concentric rectangles; now he approaches the far corner. The road continues east for a hundred yards, where another sign directs the traveler to take a 90-degree left turn, due north again.

Proceed 100 yards to the second corner. At the bend, there is activity amid the branches of scrawny Chinese elms. The mingrating juncos have arrived only recently. They have taken to this particular spot for food and shelter from the wind. A dozen of them flit from elm branch to ground, working just the thin strip of shoulder between the pavement and the roadside brambles. Like the mallards, they dine on waste corn. In this case, however, the corn has spilled over centrifugally from trucks negotiating the sharp curve. Closer inspection reveals that the laws of physics and ecology remain intact: the corn kernels, and hence the juncos, are predominantly in the shoulder of the outer, not the inner, curve of the road.

Pause. At the corner, off to the side of the road, a yellow stake is hidden amid the elms. A small sign mounted at its top reads:

WITNESS POST

Please do not
disturb nearby

S M
U A
R R
V K
E E
Y R

At the base of the post, a small aluminum shield marks the section corner.

Round the corner, face due north, and walk on a short way. The woodlot to the left is great with oaks. The brawniest, an expansive bur oak four feet wide at breast height, dates from a time before roads, corn, and survey markers arrived in the savannas, when the Sauk and Fox watched mallards fly to roost in interstitial wetlands.

Reverse course, and head back around the bend in the road.

Pass again the feasting mallards, one mass hopscootching another through the corn leavings.

Return to the initial point and, before moving on, face true north again.

THE FLAW IN THE SURVEY was obviously not fatal. For all practical purposes, the surveyor's makeshift correction lines sufficed. The grid triumphed. Where the grid was laid, we now see and live the world through it. It orders the streets of our cities and towns. It turns in on itself in our suburban subdivisions and cul-de-sacs. It dictates how we drive to work and walk to school. It guides ambulances, school buses, limousines, and hearses. It directs our backhoes, tractors, manure spreaders, plows, and combines. It drains water from some lands, spreads it out across others. It leads our cows to pasture, shows our neighbors where to stop, tells our politicians where to campaign. It fixes the borders of lands we deem sacred enough to include in national parks. It bounds our national forests and wildlife refuges. Ironically, even wilderness came to be defined by the grid: When in 1924 Aldo Leopold and his colleagues in the Forest Service traced the boundaries of the Gila Wilderness Area, the nation's first, they did so along survey lines.¹⁹

Although the grid's influence was and is ubiquitous, its triumph was not absolute. Johnson's *Order upon the Land* is an ex-

tended study of a region, the intricately dissected country along the Upper Mississippi River, where one may view "the tension between the efforts of surveyors to put a conceptual order upon the land and the country's natural configuration of hills and valleys."²⁰ Close examination of the grid's deviations in such areas might reveal precisely what angle of slope, what curve of river, what depth of wetland muck is required to give nature precedence.

One can observe other manifestations of such "tension": angled street corners where Chicago's diagonal thoroughfares, following ancient ridges and pre-European trails, meet the city's postsettlement latticework of streets; center-pivot irrigation systems on the high plains that, due to some wrinkle in the local topography, leave pie wedges of unwatered land during their circumambulations; the weird artificiality of the Four Corners of Arizona, New Mexico, Colorado, and Utah; the way Camelback Mountain blots out the otherwise uniform nighttime grid of streetlights in Phoenix.

Such places underscore the point. The triumph of the grid, and the tenacity with which the surveyors served the ideal, remains mind-boggling. The consequences, for biotic and human communities alike, are pervasive. In organizing the way Americans define, distribute, possess, and use land, the grid has profoundly modified the gene flows, populations, species, and communities of life in the landscape. No one has yet attempted to review the myriad ways in which the land survey has affected the continental biota. Even listing the mechanisms of influence would be exhaustive. The broader categories would include such factors as encouragement of urbanization; facilitation of habitat conversion and fragmentation; construction of roads, fences, and other barriers; segregation, concentration, and intensification of land uses; division of land jurisdictions and management plans; and hindrance of cooperative conservation efforts.

Examples of the grid's impact on biodiversity can be found at all levels of biological organization:

Genetic. Many of the structures that follow grid lines—roads, fences, ditches, hedges, shelterbelts—serve as corridors for (or, alternately, barriers to) the dispersal of organisms and the exchange of their genetic material. Roads in particular have been shown to have differential impacts on spiders, insects, and small and large mammals, depending on road width, type, and frequency of traffic. One multiyear study in a Kansas grassland, for example, found that cotton rats and prairie voles rarely crossed a three-meter-wide dirt road.²¹

Population. By directing construction of roads and other landscape features, the grid has encouraged the spread of some plant and animal populations and restricted others. In the forests of the upper Great Lakes, for example, the density of gray wolves has been found to be inversely proportional to the density of roads. In this region, wolves rarely occur in areas where the density of roads exceeds 0.9 linear miles per square mile.²²

Species. The grid has had lasting impacts on the distribution of many plants and animals. For example, during the decades following European settlement of the mixed grass prairie of Oklahoma, Kansas, and Nebraska, the osage orange was widely planted as a windbreak hedge plant (usually along field borders) beyond its original range. This in turn allowed the fox squirrel, which favors the osage orange's softball-sized fruits, to move beyond the wooded riparian zones where it originally occurred and into the uplands.²³

Community. The composition and function of plant and animal communities have also been altered by the grid's demands. Each day, my route to work takes me along County Road A, which follows the section line. The road neatly dissects a small, shallow,

circular pothole, less than an acre in size. To build the road around this tiny refuge for arrowheads and migrating buffleheads and grebes would have required a jog of 50 yards west or east. Now the road has become a lesson in disrupted hydrology. The compacted soils of the roadbed have altered the groundwater flow. The western half-moon of wetland drains a somewhat larger catchment than the eastern. The western half holds more water through the summer; the eastern half tends to dry up.

Landscape. The effects of the grid can be discerned in almost any landscape where it has influenced land use. For example, few factors have been so effective in galvanizing support for forestry reforms over the last two decades as published images of the stark borders between clear-cuts and wooded lands in the American West.²⁴ These borders often follow the survey lines dividing private and public forest lands and public-land jurisdictions (i.e., national parks and national forests). The impact of such habitat edges on the biodiversity of forest interiors has been a central focus of research in conservation biology since the early 1980s.

Biome. Entire biomes have been changed through the grid's influence. The tallgrass prairies and oak savannas of the North American interior are among the most extensively altered ecosystems on the continent, with the estimated losses exceeding 99 percent.²⁵ As William Cronon remarks in *Nature's Metropolis: Chicago and the Great West*, "Few other regions in the United States were better suited [to the survey system]. . . . By imposing the same abstract and homogeneous grid pattern on all land, no matter how ecologically diverse, government surveyors made it marketable. . . . The grid turned the prairie into a commodity, and became the foundation for all subsequent land use."²⁶

In addition to its direct impacts, the grid, through the patterns of land use it facilitates, affects biodiversity by altering biological, ecological, and even physical processes, including migration, col-

onization, seed and spore dispersal, herbivory, parasitism, predation, fire, and flooding. William Romme, for example, describes how the migration of elk in La Plata County, Colorado, "is becoming more difficult and dangerous for both elk and humans as their traditional movement corridors become obstructed by subdivisions and strip development along highways" (chapter 8, this volume).

The grid's pervasive impact on human communities and the character of civic life in North America deserves separate discussion. We can say, in general, that the continuing evolution of the social and political landscape cannot be understood apart from the grid upon which it quite literally rests. The farming economy and community grew out of the grid; the grid, too, has fed the economies of scale that promote farm consolidation and the depletion of those same rural economies and communities. Many a Main Street was laid out along the grid line; many a Main Street has, in turn, declined through grid-abetted sprawl and rational calculations of, for example, optimal Walmart placement. Only in the last few years have commentators begun to consider the connections between the grid, the political economy it has engendered, and the fraying strands of community life.²⁷

What can we say, in sum, of the enduring effects of the land survey and its consequent grid? The very pervasiveness of the survey trivializes any list of attributes. Let us consider, however, a few of the more far-reaching.

A tentative inventory would include many positive and long-celebrated features. The freeholding yeoman, keeping fertile the ground of American democracy, was, in Stegner's words, "a kind of Jeffersonian hope more than he was a Jeffersonian fact." Nonetheless, "the fact of free land had meant that a great many people acquired freeholds in the New World."²⁸ Concentration of land ownership, wealth, and political power might have been

worse without the survey. Land disputes might have been pandemic in the new land. Ignoring for the moment the unignorable—the alienation of the native inhabitants—Americans have generally been able to avoid conflicts over land possession through the survey's clear definition of property.²⁹ The education provisions instituted through the survey, including the eventual establishment of the land-grant colleges under the Morrill Act, provided Americans with unprecedented educational opportunities. Moreover, the process of surveying gave us reliable records of what the land was like at the time of European settlement and a convenient basis for subsequent mapping, quantitative analysis, and restoration measures.

On the other side of the ledger are the forces that the grid directed, and with which conservationists, architects, landscape architects, and planners (among others) must contend. The survey imposed a standard scale and method, and drew attention away from the particular features, constraints, and opportunities found in any given place. "Too much rectilinearity, tied to efficiency, in our daily environment has been an American misfortune," Johnson concludes.³⁰ The survey promoted land fraud and speculation on a continental scale. It encouraged the adoption of the hard utilitarian view of land as commodity rather than (in Johnson's words) "a common good under the stewardship of its owners" or (in Leopold's words) "a community to which we belong."³¹ The land survey by its very implementation emphasized and deepened the distinction between public and private land, and hence between public and private interest in the use of land. For our inability to bring into harmony these interests—not to mention those of the prior inhabitants, future generations, and other species—we continue to pay mightily. The grid, of course, did not breathe these forces into being. Economic doctrines, land policies, and traditions of faith, philosophy, and science have contributed as much, if not more. But the

grid did give these forces exceptional opportunities to express themselves.

We inherit a grid that is simultaneously real and metaphorical. It has dictated our system of land use and our way of thinking about land—the natural, the wild, the human, the civilized. Our daily activity and our planning take place within it. At the same time, it signifies our adherence to, and imposition of, an abstract construction of the human mind. We have looked to the lines first, not to the land upon which the lines have been laid. In this light, we can see that one of the functions of our evolving national land ethic is to help us to read in between the lines.

AN INHERITANCE is, almost by definition, inescapable. We can neither uncritically celebrate nor deny the fact that the grid has helped make us who we are. If we unconditionally embrace what it has made of us and our society, we become thoughtless patriots. If we unconditionally denounce what it has made of us, we fall into self-hate, availing little.

We cannot return, in any case, to a pre-grid world. Moreover, there is no evidence that places that humans have occupied outside the formal North American grid are any more ultimately "fitted" or conducive to a sustainable future. Other humanized landscapes throughout the world developed, too, before the integration of the natural sciences provided us with an alternative view of the land, its "membership," and its workings. Many landscapes lacking the extensive grid have nonetheless been more thoroughly converted than North America's, leaving only small patches of wildness. We have inherited the grid, but recently enough that residual wildness yet remains. For now.

The grid was designed to allow land tenure to be modified quickly and efficiently, and it will allow for ever more intense economic land use unless we actively comprehend it and build wildness into and through it.³² We are on a fast road to a wholly

domesticated, extremely mechanized, and not necessarily civilized landscape. There is, however, still time to turn aside.

Our remaining option, then, and our self-defined task, is to accept the inheritance with grace. How can conservation biology, landscape ecology, and landscape design aid in this task? Part of the answer lies in understanding previous efforts to reconcile the dictates of the grid with a more humane and naturalistic vision. The tradition of such efforts is as old, if not as prominent, as the land survey itself. Historian Vernon Carstensen notes, for example, that in 1785, "Washington and other farmers foresaw and complained about" the control that the straight lines of quarter sections would exercise over the shape and size of fields and thus over tillage methods.³³

In *Beyond the Hundredth Meridian*, his classic study of the life and career of John Wesley Powell, Stegner explores the most significant challenge that has been made to the primacy of the grid. During the latter half of the 1800s, as European settlement advanced into the arid lands west of the hundredth meridian, it became clear that the traditional 160-acre family homestead was poorly suited to such conditions. Stegner wrote:

[The] firmly fixed pattern of settlement, of which the rectangular surveys and the traditional quarter-section of land were only outward manifestations, though in some ways determining ones, began to meet on the Great Plains conditions that could not be stretched or lopped to meet Procrustes' bed. . . . The rectangular grid of the General Land Office could easily leave all the water for miles within a few quarter-sections, and the man who obtained title to those quarters could control thousands of surrounding acres. Instead of rectangular parcels, therefore, Powell proposed surveys based on the topography, letting farms be as irregular as they had to be to give everyone a water frontage and a patch of irrigable soil.³⁴

Through the 1870s and 1880s, Powell recommended a series of land reforms in the West based on the essential reality of arid-

ity. These included proposals for political organization of the arid lands along natural watershed divisions and for cooperative management of the region's range and water resources. Such ideas sought to encourage a system of land tenure based not on the polarity but on the complementarity of public and private interest in land. The momentum, however, of the "fixed pattern of settlement" proved all but irresistible. Powell's visionary proposals fell dormant.

Yet, within a few short years the impetus behind Powell's recommendations began to counter history's momentum. The efficiency with which the grid—in alliance with market forces, land policies, and new technologies—allowed land resources to be exploited gave rise to the Progressive-era conservation movement. In particular, the heedless depletion of the pines of the upper Great Lakes forests inspired the crusade to establish forestry as a profession in the United States and to organize national forests on the public domain. In this sense, one can argue that it was from within the grid itself that the seeds of its rejection as the *sine qua non* of land policy germinated. By fostering irresponsible land use on an epic scale, the grid made the conservation movement necessary.³⁵

Even as forestry advocates, national park supporters, and game protectors were pursuing conservation in the nation's hinterlands, others were attempting amendments of the grid in urban settings. As early as 1869, Frederick Law Olmsted and Calvert Vaux introduced curvilinearity into the plans for the Riverside community near Chicago. In the decades that followed, according to Johnson, "the opposition against rectangular planning was tied to a back-to-nature movement that produced two major 'substitutes for nature' on the American scene, landscape parks and suburbs."³⁶ Even larger-scale projects were undertaken. For example, civic leaders in Chicago in the early decades of the twentieth century instituted the system of forest preserves that still rings the city (and that, ironically, protects some of the Mid-

west's most important remnants of prairie and savannah ecosystems).

The fundamental importance of the watershed as a landscape unit—in contrast to the superimposed importance of the section or township—was reaffirmed during the 1930s as the national movement for soil conservation gained force. The manifestations were both topographical, as contour plowing, terracing, and strip cropping introduced curves into the grid, and sociopolitical, as landowners organized themselves in soil conservation districts. Interest in conservation at the watershed scale flourished. At Coon Valley in western Wisconsin, 92,000 acres were included within the Coon Creek Erosion Control Demonstration Project, advertised from the roadside as “The First Watershed Project of the Nation.”³⁷ Leopold, who supervised the wildlife-management component of the project, surmised from his experience there that “each of the various public interests in land is better off when all cooperate than when all compete with each other. . . . The crux of the land problem is to show that integrated use is possible on private farms, and that such integration is mutually advantageous to both the owner and the public.”³⁸

Leopold's own intellectual evolution can be interpreted, in part, through the grid. Through his training as a forester, he became accustomed to it. His early attempts to define the principles by which game populations could be managed were carried out in large part in a midwestern landscape where clean farming was monotonizing the biota of the typical farmstead. Leopold proposed to diversify the habitats of that landscape through what he called the “interspersions of types.” Such interspersions of land uses created additional “edges” that could support populations of bobwhite quail, cottontail rabbits, and other farm game animals. He even reduced the technique to a neat formula: “The potential density of game of low mobility requiring two or more types is, within ordinary limits, proportional to the sum of the type peripheries.”³⁹ By the late 1930s, Leopold's

faith in formulaic answers (though not in responsible science) was tempered by an increased appreciation of landscape-level ecological processes and the need for approaches to conservation that recognized land as more than a collection of isolated and independent “resources.” One result would be his definition, in 1947, of a land ethic that “enlarges the boundaries of the community to include soils, waters, plants, and animals” and that “changes the role of *Homo sapiens* from conqueror of the land community to plain member and citizen of it.”⁴⁰

Leopold's quiet call would be lost in the din of postwar development fervor, but it would also gain a growing audience and help to inspire a movement. Coincident with the advent of environmentalism, Johnson notes, planners began to adopt land-use regulations that aimed to “loosen the hold of the survey pattern on real estate development and lessen the powerful influence that the existing cadastral system had on urban planning.” She continues with an example:

An architect in Barrington, Illinois, observed that subdivision based on soil information could “minimize a variety of problems which application of a rigid arbitrary gridiron system of design ignores or accentuates.” At the time of these debates and observations much of the urban-rural fringe was already frozen into the survey pattern by streets, utility installations, and lots. As a countermeasure, town planners used soil maps, which follow the lay of the land, rather than the gridiron pattern.⁴¹

The same liberalization could be seen in the pioneering work of Ian McHarg, who in *Design with Nature* (1969) used overlay maps on soils, vegetation, and other biophysical features of the landscape in large-scale design and planning exercises.⁴²

Broadly speaking, these and other past efforts to respond to the grid aimed to correct its perceived aesthetic, social, political, environmental, and even spiritual deficiencies. They addressed only peripherally issues of the diversity and larger patterns of life within the grid. They could not have done otherwise. As inte-

grative as they often were, they still tended to address particular components of the landscape—soils, forests, parklands, rangelands, wildlife, suburban lots, urban neighborhoods—with only incidental attention to the total landscape mosaic or to the broad spectrum of living things and ecological processes implied in the term *biodiversity*. Even so welcome a concept as “greenspace” lacked a certain vitality, a sense of the evolutionary and ecological drama transpiring within and between those green spaces.

BY CONTRAST, new concepts in conservation biology, landscape ecology, restoration ecology, and other fields allow us to see these spaces differently. Built upon the premise that it is wiser to recognize, consult, and take direction from the order in the land than to impose an abstract order *upon* the land, these new concepts provide tools that we can apply in a selective and coordinated fashion to the management of urban space, suburb, farmstead, field, woodland, forest, stream, watershed, and wild land. They attempt to build connectivity, dynamism, and wildness back into a landscape where fragmentation and control were not merely collateral results but purposeful goals.⁴³ They evoke a new aesthetic, one that may help us to overcome the century-old division between utility and beauty in conservation.⁴⁴

Signs of progress toward these ends can be seen at various scales. At the scale of the building site, architects and designers are beginning to sketch the outlines of a “sustainable architecture.” Drawing on proven traditions, but responsive to environmental realities, these efforts build upon the architectural innovations of the past several decades. New, however, is a strengthened emphasis on context. In *Designing with Nature: The Ecological Basis for Architectural Design*, Ken Yeang describes the need to see the project site as “more than just a spatial zone”:

At present, many designers tend to wrongly conceive the environment and its state as simply a physical and spatial zone (i.e., as a site and geographical location) on which the designed system is

erected. They are not fully aware of (or some prefer to ignore) the existing ecological and biological systems inherent in their project sites. Many of the current design approaches that claim to be “green” do not show a thorough understanding of the earth’s ecosystems and their functioning. In an ecological design approach, the concept of the environment has to be regarded as much more inclusive, encompassing not only the physical (inorganic) milieu of the building but . . . the biological (organic) milieu as well. In most building projects, we find that the architect or the designer has completely omitted any consideration of the biological components of the project site’s ecosystem.⁴⁵

Recognition of this embeddedness is no small advance and calls for a new kind of genius. Even Frank Lloyd Wright’s masterworks, for all their indebtedness to midwestern tallgrass prairies and Appalachian falling waters, dealt little with the actual prairie and stream ecosystems themselves.

At the landscape scale, landscape ecology offers new opportunities to understand how the spatial arrangement of land types affects their composition and function.⁴⁶ Similarly, one of conservation biology’s central tasks since the early 1980s has been to investigate how biodiversity responds to the spatial arrangement and temporal dynamics of habitats. Increasingly this information is being used to devise conservation plans for both reserved and nonreserved lands. During this same period, the advent of geographic information systems (GIS) has extended McHarg’s basic approach to landscape-level planning. Innovative uses of this and other emerging technologies have allowed conservationists to synthesize more effectively relevant field data (involving, for example, levels of species richness, the distribution of rare and endemic species, and the siting of protected areas).

At the ecosystem scale, Powell’s call for greater attention to the native characteristics of geographic regions and his appreciation of the inherent need for social responsibility in devising ways to live with these characteristics remain essential more than a cen-

tury later. Among the latest incarnations of these themes is ecosystem management, which seeks, among other goals, to overcome the boundaries between disciplines, agencies, interest groups, and political jurisdictions in the stewardship of lands, waters, and life-forms.⁴⁷ As an attempt to address the causes of environmental problems and not deal merely with symptoms, ecosystem management is still unproven and subject to wide interpretation. Still, it holds the potential to reweave, in more enduring patterns, the fabric of thought and life with respect to place.

We see responses at even larger scales. The most audacious of these is undoubtedly The Wildlands Project, a long-term, continental-scale endeavor that has taken emerging principles of conservation biology to ultimate lengths. The mission of The Wildlands Project is "to help protect and restore the ecological richness and native biodiversity of North America through the establishment of a connected system of reserves."⁴⁸ If the magnitude of the project seems incredible, this may itself be taken as a measure of the degree to which the grid has helped to transform the continent.

These and other experimental efforts are still ill defined. They are responding, after all, to unprecedented demands, using rapidly emerging ideas, data, and techniques. Yet, in them we hear echoes of the older hopes and dreams that the grid was intended to serve. For even as we inherit the grid, its flaws, its benefits, and its consequences, so do we inherit the aims that its Enlightenment authors sought to ensure in conferring it upon us: democracy, opportunity, an equitable share of wealth, a stake in the land, a home place. The difference is that we can and must see this legacy in a different, and larger, context.

SO, HOW DO WE get around the bend in the road? How do we get from here to there? How do we fit ourselves realistically into what Snyder has called "the Big Watershed."⁴⁹ Nature has given

us ecological boundaries and systems that, all too late, we have come to appreciate. History has bestowed upon us political boundaries and systems that evolved before our understanding of the natural world revealed their limits. The natural and political systems operate at different scales of time and space. The pace of changes within and between them vary. Hence confusion and the sharp bend before us.

What if we cannot negotiate the turn? What sort of landscape will we pass on if we continue to follow past patterns of land use? Among other prospects: unsustainable patterns of resource use; repeated, intensified land-use conflicts at the local and national level; large, expensive, often ineffective resource management programs; a lengthening list of threatened species; inconsistent policies and shifting incentive structures; a greater degree of polarity in the landscape, with purely utilitarian ends served at one pole, and purely recreational or traditionally aesthetic ends served at the other, with less room anywhere for wild things and more integrated lives; and continued fragmentation of the body politic. The grid alone does not produce such trends, but they cannot be addressed apart from it.

Our work is to harmonize our natural and cultural legacies based on a realistic assessment of the situation. We require not a merely romantic rebellion against the aesthetics of the gridded landscape but well-grounded ways of dealing with the social, economic, aesthetic, and environmental costs that are now, because of the grid, inherent in the landscape. To negotiate the turn successfully, we will need to slow down, look around, and admit the world's nonlinearity and complexity.

We should not underestimate the task. There are major obstacles ahead: deeply ingrained land-use traditions, bolstered at every turn by economic and political incentives; extreme views of private property that have everything to say about rights and nothing to say about responsibilities; the drag of the already built; the fact that scientific information can never be complete

enough to provide unerring predictions of long-term impacts; the constant challenge of crafting interdisciplinary solutions in a disciplinary culture; ethical systems that have only begun to extend our notions of community beyond the human circle; and the progressive loss of native knowledge and traditions.

A sobering prognosis. We are led on—involuntarily, by the push of history; compellingly, by the pull of posterity. We go forward out of necessity and responsibility. On the journey to become native to this place, each generation takes its turn and prepares a path for those who follow.

Acknowledgments

My colleagues in the Landscape Ecology and Culture seminar provided constant stimulus, information, and insight during the preparation of this essay. In particular, I would like to thank Deborah Karasov and Joan Nassauer for inviting me to participate and for introducing me to Hildegard Binder Johnson's *Order upon the Land*. This essay also benefited from the critical reading and comments of Eville Gorham of the University of Minnesota, Richard Knight of Colorado State University, and Gary Meffe of the Savannah River Ecology Laboratory.

Notes

1. G. K. Meffe, "Sustainable Development: Conservation Panacea or Politically Correct Ecocide? Presented at the 9th Annual Meeting of the Society for Conservation Biology, June 1995, Fort Collins, Colorado.
2. V. Scully, *Architecture: The Natural and the Manmade* (New York: St. Martin's, 1991), p. xi.
3. Scully, *Architecture: The Natural and the Manmade*, p. 2.
4. See, for example, M. Oelschlaeger, *The Idea of Wilderness: From Prehistory to the Age of Ecology* (New Haven: Yale University Press, 1991); J. Baird Callicott, "The Wilderness Idea Revisited: The Sustainable De-

velopment Alternative," *The Environmental Professional* 13 (1991): 236-245; A. Gómez-Pompa and A. Kaus, "Taming the Wilderness Myth," *BioScience* 42, no. 4 (April 1992), 271-279; J. B. Callicott, "A Critique of and an Alternative to the Wilderness Idea," *Wild Earth* 4, no. 4 (winter 1994/95), 54-59; R. E. Noss, "Wilderness—Now More Than Ever," *Wild Earth* 4, no. 4 (winter 1994/95): 60-63; D. Foreman, "Wilderness Areas Are Vital: A Response to Callicott," *Wild Earth* 4, no. 4 (winter 1994/95), 64-68; J. Baird Callicott, "Deep Grammar," *Wild Earth* 5, no. 1 (spring 1995), 54-59; W. Cronon, "The Trouble with Wilderness: Or, Getting Back to the Wrong Nature," in *Uncommon Ground: Toward Reinventing Nature*, W. Cronon, ed. (New York and London: Norton, 1995), pp. 66-90. The winter 1996/97 issue of *Wild Earth* contains a series of responses to Cronon's original essay.

5. See D. B. Botkin, *Discordant Harmonies: A New Ecology for the Twenty-First Century* (New York and Oxford: Oxford University Press, 1990); S. T. A. Pickett, V. T. Parker, and P. L. Fiedler, "The New Paradigm in Ecology: Implications for Conservation Biology above the Species Level," in *Conservation Biology: The Theory and Practice of Nature Conservation, Preservation, and Management*, P. L. Fiedler and S. K. Jain, eds. (New York: Chapman and Hall, 1992), pp. 65-88; G. K. Meffe and C. R. Carroll, *Principles of Conservation Biology* (Sunderland, Mass.: Sinauer, 1994), pp. 16-18; W. S. Alverson, W. Kuhlmann, and D. M. Waller, *Wild Forests: Conservation Biology and Public Policy* (Washington, D.C., and Covelo, Calif.: Island Press, 1994), pp. 39-63; S. T. A. Pickett and R. S. Ostfeld, "The Shifting Paradigm in Ecology," in *A New Century for Natural Resources Management*, R. L. Knight and S. F. Bates, eds. (Washington, D.C. and Covelo, Calif.: Island Press, 1995), pp. 261-278; E. Gorham, "Human Impacts on Ecosystems and Landscapes," chapter 1, this volume.
6. H. B. Johnson, *Order upon the Land: The U.S. Rectangular Land Survey and the Upper Mississippi Country* (New York: Oxford University Press, 1976), p. i.
7. W. Jackson, *Becoming Native to This Place* (Lexington: University Press of Kentucky, 1994), pp. 17-18.
8. See W. H. Romme, "Creating Pseudo-Rural Landscapes in the Mountain West," chapter 8, this volume.
9. Johnson, *Order upon the Land*, p. 235.

10. G. Snyder, "The Etiquette of Freedom," in Max Oelschlaeger, ed., *The Wilderness Condition: Essays on Environment and Civilization* (San Francisco: Sierra Club Books, 1992), pp. 21-39; see p. 24.
11. A. Leopold, *A Sand County Almanac and Sketches Here and There* (New York and Oxford: Oxford University Press, 1949), pp. 200-201.
12. Snyder, "The Etiquette of Freedom," p. 38.
13. See H. W. Ottosen, ed., *Land Use Policy and Problems in the U.S.* (Lincoln: University of Nebraska Press, 1963); V. Carstensen, ed., *The Public Lands: Studies in the History of the Public Domain* (Madison: University of Wisconsin Press, 1968); M. J. Rohrbough, *The Land Office Business: The Settlement and Administration of American Public Lands, 1789-1837* (New York: Oxford University Press, 1968); D. W. Thompson, Men and Meridians: The History of Surveying and Mapping in Canada (Ottawa: Department of Mines and Technical Surveys, 1969); Johnson, *Order upon the Land*; W. Stegner, *Wolf Willow: A History, a Story, and a Memory of the Last Plains Frontier* (Lincoln and London: University of Nebraska Press, 1980), pp. 81-99.
14. Johnson, *Order upon the Land*, p. 30.
15. Quoted in Johnson, *Order upon the Land*, p. 39. For helpful discussions of Jefferson's views on land, nature, and democracy, see J. M. Brewster, "The Relevance of the Jeffersonian Dream Today," in Ottosen, *Land Use Policy and Problems in the U.S.*, pp. 86-136; C. Miller, *Jefferson and Nature: An Interpretation* (Baltimore: Johns Hopkins University Press, 1988); E. Hargrove, "Land Use Attitudes," ch. 2 in Foundations of Environmental Ethics (Englewood Cliffs, N.J.: Prentice-Hall, 1989); C. Merchant, ed., "Farm Ecology in the Early Republic," ch. 5 in *Major Problems in American Environmental History* (Lexington, Mass. and Toronto: Heath, 1993).
16. W. Stegner, *Beyond the Hundredth Meridian: John Wesley Powell and the Second Opening of the West* (New York: Penguin, 1992), p. 213. For a discussion of the "checkerboard" image in descriptions of the grid and its influence on land use, see Johnson, *Order upon the Land*, pp. 143-146.
17. J. Hildebrand, *Mapping the Farm: The Chronicle of a Family* (New York: Knopf, 1995), p. 16.
18. Johnson, *Order upon the Land*, p. 58.
19. C. Meine, *Aldo Leopold: His Life and Work* (Madison: University of Wisconsin Press, 1988), pp. 200-201, 224.
20. Johnson, *Order upon the Land*, p. 238.
21. R. K. Swihart and N. A. Slade, "Road Crossing in Sigmodon hispidus and *Microtus ochrogaster*," *Journal of Mammalogy* 65 (1984): 357-360. See also R. F. Noss and B. Csuti, "Habitat Fragmentation," in Meffe and Carroll, *Principles of Conservation Biology*, pp. 237-264; M. L. Hunter, *Fundamentals of Conservation Biology* (Cambridge: Blackwell Science, 1996), pp. 158-162.
22. R. P. Thiel, "Relationship between Road Densities and Wolf Habitat Suitability in Wisconsin," *American Midland Naturalist* 11 (1985): 404-407; L. D. Mech, S. H. Fritts, G. L. Radde, and W. J. Paul, "Wolf Distribution and Road Density in Minnesota," *Wildlife Society Bulletin* 16 (1988): pp. 85-87.
23. Originally reported in H. L. Whitaker, "Fox Squirrel Utilization of Osage Orange in Kansas," *Journal of Wildlife Management* 3 (1939): 117.
24. The most concerted example of the use of these images can be found in the anti-coffee-table book *Clearcut: The Tragedy of Industrial Forestry*, W. Devall, ed. (San Francisco: Sierra Club Books, 1994).
25. See R. F. Noss, E. T. LaRoe III, and J. M. Scott, *Endangered Ecosystems of the United States: A Preliminary Assessment of Loss and Degradation*, Biological Report 28 (Washington, D.C.: National Biological Service, U.S. Department of the Interior, 1995).
26. W. Cronon, *Nature's Metropolis: Chicago and the Great West* (New York and London: Norton, 1991), p. 102.
27. Recent treatments of these themes can be found in such diverse sources as Cronon, *Nature's Metropolis*; Jackson, *Becoming Native to This Place*; S. L. Yaffee, *The Wisdom of the Spotted Owl: Policy Lessons for a New Century* (Washington, D.C., and Covelo, Calif.: Island Press, 1994); Hildebrand, *Mapping the Farm*; and C. J. Herndl and S. C. Brown, eds., *Green Culture: Environmental Rhetoric in Contemporary America* (Madison: University of Wisconsin Press, 1996).
28. W. Stegner and R. Etulain, *Conversations with Wallace Stegner on Western History and Literature*, rev. ed. (Salt Lake City: University of Utah Press, 1990), p. 151.
29. On this point Carstensen writes: "Had a system of describing land by metes and bounds been employed, with the almost infinite possibility of odd-shaped parcels and hence overlapping and conflicting

- claims, lawsuits and neighborhood feuds would have been one certain harvest of [the] vast movement of land-seekers on to new land." Carstensen, *The Public Lands*, p. xvi.
30. Johnson, *Order upon the Land*, p. 233.
31. Johnson, *Order upon the Land*, p. 219; Leopold, *A Sand County Almanac*, p. viii.
32. In a 1996 address at the University of Iowa titled "A Complex Weave: Changing Prairie Landscapes," environmental historian Donald Worster suggested that the hold of the grid has begun, in some sense, to weaken. On the one hand, nature had begun to "chew on the section lines," as floods, river meanders, revegetation, and wildlife have reclaimed certain abandoned areas. From another angle, the infrastructure of rails, paved roads, oil development, and other expressions of the ever-increasing corporatization of especially the midcontinent's prairie and plains regions has brought forth an emerging asymmetrical web overlain upon the grid. Worster's address provides a very useful socioeconomic and political take on questions that in this essay are asked from a more strictly biogeographical angle.
33. Carstensen, *The Public Lands*, p. xvi.
34. W. Stegner, *Beyond the Hundredth Meridian*, pp. 214, 227. The foundational document is J.W. Powell, *Report on the Lands of the Arid Region of the United States, with a More Detailed Account of the Lands of Utah*, first published in 1878 as 45th Congress, 2nd Session, H. R. Exec. Doc. 73; republished in 1983 by The Harvard Common Press, Boston.
35. Johnson, *Order upon the Land*, p. 200. Johnson, in discussing the difficulty in organizing effective soil conservation districts in the 1930s and 1940s, cites M. Harris, "Private Interests in Private Lands: Intra- and Inter-Private," in Ottosen, ed., *Land Use Policy and Problems in the U.S.* pp. 307-335: "[The] laws against waste [of land] have been ineffectual in cases of gradual deterioration. The whole conservation movement might have been unnecessary if the laws of waste had been more effective and had applied to owners as well as holders of lesser estates [e.g., tenants]. In society's efforts to establish the freest tenure, the pendulum probably swung too far toward complete freedom" (p. 329).
36. Johnson, *Order upon the Land*, p. 178.
37. Johnson, *Order upon the Land*, pp. 193-194.
38. A. Leopold, "Coon Valley: An Adventure in Cooperative Conservation," in S. L. Flader and J. B. Callicott, eds., *The River of the Mother of God and Other Essays by Aldo Leopold* (Madison: University of Wisconsin Press, 1991), pp. 218-223; see p. 219.
39. A. Leopold, *Game Management* (New York: Scribner's, 1933), pp. 129-132. For biological and historical overviews of the role of "edge effects," see Meffe and Carroll, *Principles of Conservation Biology*, pp. 254-256, 310.
40. Leopold, *A Sand County Almanac*, p. 204.
41. Johnson, *Order upon the Land*, p. 223.
42. I. McHarg, *Design with Nature* (Garden City, N.Y.: Doubleday Natural History Press, 1969).
43. See, for example, W. Hudson, ed., *Landscape Linkages and Biodiversity* (Washington, D.C., and Covelo, Calif.: Island Press, 1991); D. A. Saunders and R. J. Hobbs, *Nature Conservation 2: The Role of Corridors* (Minneapolis: University of Minnesota Press, 1991); D. S. Smith and P. C. Hellmund, *Ecology of Greenways: Design and Function of Linear Conservation Areas* (Minneapolis: University of Minnesota Press, 1993).
44. See J. B. Callicott, "The Land Aesthetic," *Environmental Review 7* (winter 1983): 345-358; Curt Meine, "The Utility of Preservation and the Preservation of Utility: Leopold's Fine Line," in Oelschlaeger, ed., *The Wilderness Condition*, pp. 131-172; M. Eaton, "The Beauty That Requires Health," chapter 5, this volume; Joan Iverson Nassauer, "Cultural Sustainability: Aligning Aesthetics and Ecology," chapter 4, this volume.
45. K. Yeang, *Designing with Nature: The Ecological Basis for Architectural Design* (New York: McGraw-Hill, 1995), pp. 4-5.
46. See R. T. T. Forman and M. Godron, *Landscape Ecology* (New York: Wiley, 1986); R. T. T. Forman, "Designing Landscapes and Regions to Conserve Nature," in Meffe and Carroll, eds., *Principles of Conservation Biology*, pp. 292-293.
47. For a useful overview of ecosystem management, see R. E. Grumbine, "What Is Ecosystem Management?" *Conservation Biology* 8, no. 1 (1994): 27-38.
48. See "Mission Statement," *Wild Earth* 5, no. 4 (winter 1995-96); and "The Wildlands Project: Plotting a North American Wilderness Recovery Strategy," *Wild Earth* (special issue, 1993).
49. Snyder, "The Etiquette of Freedom," p. 38.