

# Indicators of Wildness: Using Attributes of the Land to Assess the Context of Wilderness

Gregory Aplet  
Janice Thomson  
Mark Wilbert

---

**Abstract**—Land can be described in a space defined by two fundamental qualities: naturalness and freedom. The axis of naturalness describes the wholeness of the ecosystem relative to a historical norm, while the axis of freedom describes the degree to which land remains outside of human control. Some land can be natural but not free, and vice versa, but the most natural and free are the most wild — they are the lands we recognize as wilderness. These concepts are illustrated through the mapping of indicators of wildness, derived from readily available data in a Geographic Information System.

---

The past few years have witnessed considerable attention to conceptions of wilderness. Generally, this attention has taken the form of a “debate” between critics of wilderness as *idea* on one side and defenders of wilderness as *place* on the other (see for example, Callicott and Nelson 1998). Critics contend that white, male, American minds have produced a concept that separates humans from nature, denigrates native peoples, and freezes ecosystems in time. Defenders point out all the myriad values, including wildlife habitat, watershed protection and spiritual healing, provided by the places we call wilderness and conclude that wilderness therefore must be good. Both sides assume they understand what they mean by wilderness; neither states it clearly.

Robert Marshall begins his classic 1930 essay, *The Problem of the Wilderness*, “It is appalling to reflect how much useless energy has been expended in arguments which would have been inconceivable had the terminology been defined.” Seventy years after Marshall offered his observations, it appears we are still suffering from the same misunderstandings. The debate over the value of wilderness is being conducted without a common understanding of its meaning. Before any more “useless energy” is expended, it is worthwhile to stop and consider what exactly we mean by wilderness.

One of the first places to look, of course, is the Wilderness Act itself. The Act (Public Law 88-577) defines wilderness straightforwardly enough as:

---

In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O’Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 2: Wilderness within the context of larger systems; 1999 May 23–27; Missoula, MT. Proceedings RMRS-P-15-VOL-2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

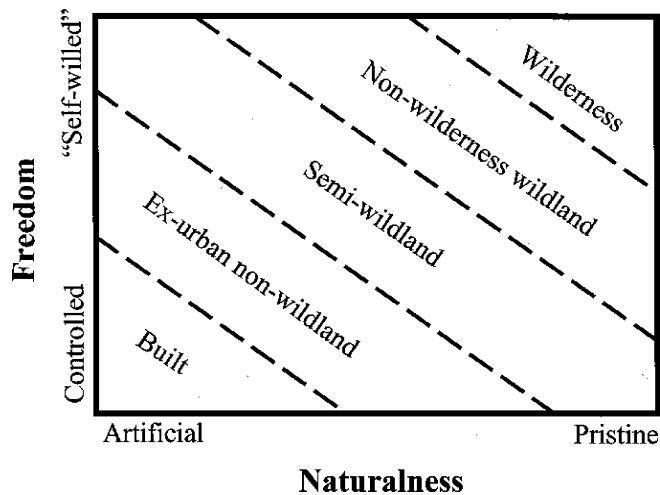
Gregory Aplet is Forest Ecologist and Director, Center for Landscape Analysis, The Wilderness Society, 7475 Dakin Street, Suite 410, Denver, CO, 80221 U.S.A. Janice Thomson is Remote Sensing Coordinator and Mark Wilbert is GIS Analyst, Center for Landscape Analysis, The Wilderness Society, 1424 Fourth Ave., Suite 816, Seattle, WA, 98101 U.S.A.

...an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

But this is a carefully crafted legal definition resulting from years of debate and compromise. Surely, we are not to believe that all the places wild enough to count as wilderness are limited to federal land. And why 5,000 acres? These are legal constraints necessary for the implementation of the Wilderness Act. A general definition of wilderness remains elusive.

In his exploration of the legislative direction provided by the Wilderness Act, ecologist David Cole (1996) notes that wilderness is expected to be both “untrammeled,” or uncontrolled and free, and “pristine,” or “what would have existed in the absence of post-aboriginal humans.” Cole concludes that these two goals provide conflicting direction for managers, as manipulation is often needed to repair damage caused by overuse, exotic species invasions, fire exclusion and other processes that have altered ecosystems away from natural conditions. Cole argues that these goals are “to some extent mutually exclusive” and suggests that we must choose one or the other of these goals to emphasize when managing wilderness.

Alternatively, Aplet (1999) suggests that these two outcomes, freedom and naturalness, rather than providing conflicting direction, actually describe two independent qualities of wilderness. Wilderness is that portion of the land that is most wild, and wildness is a function of both naturalness and freedom from human control. This dualistic nature of wildness can be illustrated with a simple figure (fig. 1) that represents landscapes in the two-dimensional space created by freedom and naturalness. In this conception, wildness increases in two directions: from the controlled to the “self-willed” along a gradient of freedom, and from the artificial to the pristine along a gradient of naturalness. At the most controlled and artificial ends of the continuum are the least wild lands – the built environment of the city. Where freedom and naturalness are highest is the wilderness, regardless of size or ownership. In between, lands can possess any combination of freedom and naturalness, and an intermediate



**Figure 1**—The “continuum of wildness.” Wildness increases as a function of both its naturalness and its freedom from human control.

degree of wildness. All lands fall somewhere within this two-dimensional continuum of wildness.

If wilderness is that portion of the landscape that is most natural and free, it follows that the wilderness manager’s job is to maximize *simultaneously* both of these characteristics. This is where the job becomes difficult, and tradeoffs arise. Maintaining freedom may compromise naturalness — for example, where exotic species are allowed to invade from the outside. Likewise, restoring natural conditions often requires bringing the land under tighter control. Just like the parent who simultaneously struggles to instill discipline and independent thought, the key for managers is to strive always toward both goals. When intervention is required, heed Wilderness Watch president Bill Worf’s good advice: “Manipulation should generally be limited to those minimum actions that will establish conditions that will allow natural processes to hold sway once again” (Worf 1997).

These qualities of freedom and naturalness help clarify what we mean by wildness, but they themselves are rather vague descriptors that cry out for further explanation. Managers need to know what exactly to pay attention to in order to achieve these twin goals. The remainder of this paper is devoted to exploring the attributes of the land that contribute to its naturalness and freedom from control. Ultimately, we would like to be able to measure these qualities to ensure that we are protecting and sustaining the wildness of wilderness. The measurement of wildness raises the possibility of mapping the wildness of the land, and this paper presents the results of some recent progress toward this goal and discusses how this method differs from other approaches to mapping our precious wild places.

## Indicators of Wildness

Throughout the history of the idea, wilderness has been thought of both as a place *that* is free and as a place *in which* to be free. In other words, wilderness has been thought of both as a real place and as an experience. For example, Nash (1982) notes the value of wilderness to the Romantics of the

19<sup>th</sup> century as a place to escape the stranglehold of civilization. In contrast, The Wilderness Act speaks of wilderness as “an area where the earth and its community of life are untrammelled by man,” suggesting that it is the land itself that is free in wilderness. While wilderness will likely always be highly valued for the experience it provides, it is this second sense, the character of wild land itself, that is the focus of the following discussion.

Though perceptions of wildness vary with each individual, there appears to be a limited set of characteristics that contribute to the freedom and naturalness of a place. Generally, the literature exploring wild land characteristics suggests that the attributes of the land that contribute to its freedom are 1) the degree to which land provides opportunities for solitude, 2) the remoteness of the land from mechanical devices and 3) the degree to which ecological processes remain uncontrolled by human agency. The attributes that contribute to the naturalness of the land are 1) the degree to which it maintains natural composition, 2) the degree to which it remains unaltered by artificial human structure and 3) the degree to which it is unpolluted. Each of these attributes need not exist at an absolute maximum in wilderness, but, collectively, they define the qualities of freedom and naturalness and therefore facilitate the measurement of wildness.

## Solitude

Solitude has been described as “the opportunity to meet the wilderness, or its maker, personally, quietly, on terms only you prescribe” (Whitney 1997). The “outstanding opportunities for solitude” afforded by wilderness have long been recognized as a key part of the “wilderness experience.” Thoreau (1862) enjoyed his opportunity to “walk ten, fifteen, twenty, any number of miles, commencing at my own door, without going by any house, without crossing a road except where the fox and mink do.” Robert Marshall (1933) required that wilderness have “no permanent inhabitants,” and Sigurd Olson (1938) exalted in “the ordinary phenomena of life in the open.” Though solitude is clearly an experience of the wild, the ability to provide it is a measurable attribute of the land. That the most wild land must be the least inhabited follows naturally from the notion that, at some population density, people necessarily bring land under control to serve their purposes (such as occupancy, transportation, recreation and hygiene). The degree of human-to-human contact is one of the defining measures of the freedom of the land.

The requirement that wilderness be uninhabited has been interpreted by some as ignoring or even subjugating indigenous people, who occupied (or occupy) the land even as it was (or is) considered wilderness (see Bayet 1994; Birch 1990; Denevan 1992; Gomez-Pompa and Kaus 1992; Nabhan 1995; Plumwood 1998). But it need not be. As the poet Gary Snyder (1990) has pointed out, every landscape has its “fire in the kitchen” and its “place less traveled.” Where population density is high, whether in the pre-Columbian or modern era, the ability of the land to afford solitude is diminished. In the “kitchen,” the land may still be “natural” (see below), but it will not be as free.

In practice, we may gauge opportunity for solitude by measuring population density. Over large areas, such as states or continents, we are usually limited to looking at

where people reside, but how people use the land is also a factor. Over smaller landscapes, we may be able to gauge the opportunity for solitude by examining recreation use patterns. In any case, we look to represent some measure of the probability of encountering others.

## Remoteness

Roadlessness is also widely recognized as a defining characteristic of wilderness. Aldo Leopold (1921) insisted that wilderness be “devoid of roads,” while his son Starker’s Commission on Wildlife Management in the National Parks considered the roadgrader to be “the most dangerous tool of all” (Leopold and others 1963). Marshall’s (1933) definition required wilderness to “possess no means of mechanical conveyance” in order that wilderness remain “free from mechanical sights and sounds and smells.” Environmental historian Michael Cohen (1984) believes road construction is the first act of “trammeling” the wilderness. He writes, “I am troubled by the term ‘untrammelled’. At what point have we caught and trapped the wilderness? I would presume that a process of capturing or trapping begins when men try to ‘open out routes’ among the mountains.” Thus, the very presence of a road diminishes the freedom of the land, and distance from roads is clearly a time-honored measure of wildness.

The measurement of remoteness is fairly straightforward where we know the location of the road system. Land may be assigned a value depending on the distance from roads of various types, assuming that roads vary in their impact on remoteness. For example, an interstate highway is louder and will bring more people near an area than will a dirt road. Of course, measuring remoteness requires an accurate description of an area’s road system, which often is not available for the most remote lands.

## Uncontrolled Processes

The most free land is the least controlled land. With the invasion of new technologies that attended the recent settlement of North America, ancient ecological processes were radically altered in many parts of the country. Where once fires (whether lightning-caused or anthropogenic), floods and migrations marked the passage of the seasons, fire suppression, dams and extermination replaced them. If wilderness is to live up to one of its definitions, “self-willed land” (Turner 1996), its historical ecological processes must be maintained.

The importance of uncontrolled processes to wilderness is amply noted in the literature. Wilderness has been described as a place where “a diversity of beings [flourish] according to their own sorts of order” (Turner 1996) and “where nature prevails or might prevail given the passage of time...so long as active ecological succession, structural diversity, and naturalness are permitted” (Frome 1997). Wilderness pioneer Arthur Carhart (1961) asserts, “[L]ands called ‘wild’ have retained the attribute of freedom. They have their own integrity intact. They have not been skinned, scraped, dug up, regimented and pounded into shapes and services desired and demanded by ‘civilized’ man.” Even the Wilderness Act itself insists that wilderness “retain its primeval character and *influence*” (emphasis added).

The equation of uncontrolled processes with presettlement influences again raises the question of the role of indigenous people in landscape dynamics. Clearly, indigenous people have had tremendous influence on the character of the land in localized instances and may have altered the nature of ecosystems over broad areas through the use of fire and hunting practices (see, for example, Denevan 1992). Where this influence was intensive, we must view the land as under tight control and not free. However, where influence was extensive, aboriginal fire and hunting joined other sources of ignition and mortality, making it very difficult to distinguish between aboriginal control and “the will of the land.” In this case, if only for practical purposes, we should consider extensive aboriginal influences to be part of the processes altered by the invasion of modern technological society.

Alteration of processes is probably the most difficult to measure of the six attributes that contribute to wildness. The science of historical ecology is just beginning to reveal the degree to which disturbance, hydrology, nutrient cycling, long-range migration and other ecological processes have been changed over the past few centuries. And even when we know something about rates of change, it is difficult to ascribe that information to the broader landscape. Nevertheless, progress has been made in mapping altered fire regimes, indices of watershed integrity and other metrics that may allow us to quantify land’s freedom from control of ecological processes.

## Natural Composition

Composition, the relative abundance of genes, species, communities and other components of ecosystems, is one of the defining characteristics of ecosystems. An ecosystem that has lost its native species or has been invaded by non-natives has been altered in a fundamental way. In general, we recognize as most natural those ecosystems that have retained their full complement of native species and harbor no exotics.

The protection of intact native ecosystems has long been recognized as a goal of wilderness designation. The Wilderness Act specifically intended to protect “the earth and its community of life...” The protection of species that are easily harmed by, or are harmful to, human contact is a role often relegated to wilderness. Eliminated from much of their historical range, native predators, especially, are considered by many to be a vital part of the wilderness experience. As Turner (1996) says, “Predators are perhaps our most accessible experience of the wild.”

The invasion of non-native species also can decrease the naturalness and therefore the wildness of an area. Severe invasions can even alter the structure and function of ecosystems. As wilderness manager Andy Kulla (1998) has said about invasive exotic plants, “Weeds take the wild out of the wilderness.” Growing realization of the damage to native ecosystems done by exotic species has led many managers to implement weed control programs, halt stocking of fish, especially non-natives, and to insist on the use of weed-free hay and revegetation mixes.

The measure of natural composition is reasonably straightforward, to a point. Most species are understood to be either native or the result of recent artificial introduction. The species composition of any area, therefore, can be quantified

in terms of proportion of native species. Determining the degree to which native species composition has changed as a result of human agency is more difficult. Recent developments in historical ecology and (recent) paleobotany are shedding light on changes in species composition.

## Unaltered Structure

Ecosystem structure refers to the spatial arrangement of the components of ecosystems. This can refer to the gross-scale features of geomorphology, the arrangement of vegetation patches or the arrangement and spacing of trees in a forest stand. The degree to which ecosystem components retain their historical arrangement contributes to the naturalness of the system.

The maintenance of unaltered structure has long been a litmus test of wilderness character and is the most familiar criterion for designation. The Wilderness Act requires wilderness to be “without permanent improvements or human habitation...with the imprint of man’s work substantially unnoticeable.” Bob Marshall’s (1933) definition stressed that “all roads, settlements, and power transportation are barred.”

Again, the standard against which alteration is to be judged is the condition of the ecosystem prior to the invasion by modern technological society, begun in North America 300-400 years ago. As has been noted, pre-Columbian North America was a network of trails and settlements (Denevan 1992; Snyder 1990). Some structures, such as the earthworks of the Southeast, were large by any standard. These structures were part of the historical ecosystem and should be considered natural. Interestingly, Marshall (1933) recognized historical structures as entirely consistent with his view of wilderness: “Trails and temporary shelters, features such as were common long before the advent of the white race, are entirely permissible.”

As with composition, the measurement of alteration of structure is fairly straightforward. Roads, dams, airstrips, mines, stockponds and other built structures diminish naturalness. Also, the substitution of square blocks of perfectly spaced plantations for natural forest, even if they comprise native species, alters ecosystem structure and diminishes naturalness. The science of landscape ecology has developed rapidly in the past few decades and has yielded a number of metrics that can be applied to land to measure its departure from historical structure.

## Pollution

Wilderness carries with it an expectation of purity: clean water, fresh air, clean soil, darkness. When air, streams and the night sky are dirtied with coal exhaust, road dust, bovine feces and distant industrial light, it diminishes the naturalness of the land and the experience it provides. The poet Mark Strand (1996) makes clear the relationship between pollution and wilderness when he writes, “First we pollute the wilderness, then we pollute our minds with the belief that we’ve done the right thing. Then we pollute the wilderness more because we’ve lost our ability to see it. Soon the wilderness ceases to exist.” Some forms of pollution have direct effects on the ecosystem, such as ozone and nitrogen

deposition; others, such as the influence of city lights, affect mostly the quality of the visitor experience. Even where the effect is only on experience, pollution remains a measurable attribute of the land that affects its wildness.

Because of national laws like the Clean Air Act and the Clean Water Act, pollution is one of the best studied and best documented of the indicators of wildness. Depending on the part of the country, good maps are available for a number of air pollutants and for the quality of surface waters. The Environmental Protection Agency monitors sources of pollution across the country and maintains data in a Geographic Information System. In addition, NASA has used remote sensing to measure from space the light emitted to the night sky. It should be possible to quantify the degree to which any piece of land remains free from pollution.

Each of these attributes contributes to the freedom or the naturalness of a place and therefore to its wildness. But just because they contribute does not mean there will not be cases when they conflict. For example, the maintenance of highly anthropogenic vegetation types (such as indigenous agricultural fields), which would be natural by the above definition, would require such intensive manipulation that it would diminish freedom. Nevertheless, these attributes, when considered in aggregate, should indicate much about the wildness of any given area.

## Mapping Wildness

---

In this section, we present results of an application of the attributes discussed above to the measurement of relative wildness at one scale – that of the contiguous United States. Though there are no hard and fast rules guiding how to apply these concepts, their application does require the selection of a consistent approach. In this case, our approach was to locate the best spatial data we could find to represent each attribute in a GIS data layer, assign each raster cell of the data layer a value for each attribute and, finally, sum the values to derive the “wildness index” for each cell. To accommodate work at a continental scale, we represented the United States as a matrix of just less than 8 million one-square-kilometer cells for analysis. The analysis was conducted with the GRID module of Arc/Info GIS software. Each attribute was represented with a value ranging between one and five. Some attributes (for example, solitude) were derived from a single data set; others resulted from a combination of several data sets (see below). Although our wildness index suffers from many of the same shortcomings attending other indices (such as the addition of unlike units as though they were commensurate), we feel it represents much of what contributes to the wildness of a place.

## Solitude

Ideally, the spatial representation of opportunity for solitude would display the probability distribution of encountering another person over a landscape. It would account not only for the presence of occupants of the land, but for visitors to popular locations like national parks. Unfortunately, there are no such data sets available for the entire continental United States. However, the U.S. Bureau of the Census keeps track of the distribution of the resident population

across the country. Map 1 shows the distribution of census block groups assigned to five classes, where the value 1 (lightest) was assigned to cells with a 1990 population density greater than 1,000 persons/km<sup>2</sup>, the value 2 was assigned to cells with a population density between 100 and 1,000 persons/km<sup>2</sup> and so on to the value 5 (darkest), which was assigned to census block groups with a population density of less than one person/km<sup>2</sup>. Not surprisingly, the results show high population densities along the Eastern seaboard and very few residents in vast parts of the West. This map represents only where people live; it does not consider the accessibility of the land to visitors. Future renditions of the data may take accessibility into account by representing distance from population centers as well as their location.

## Remoteness

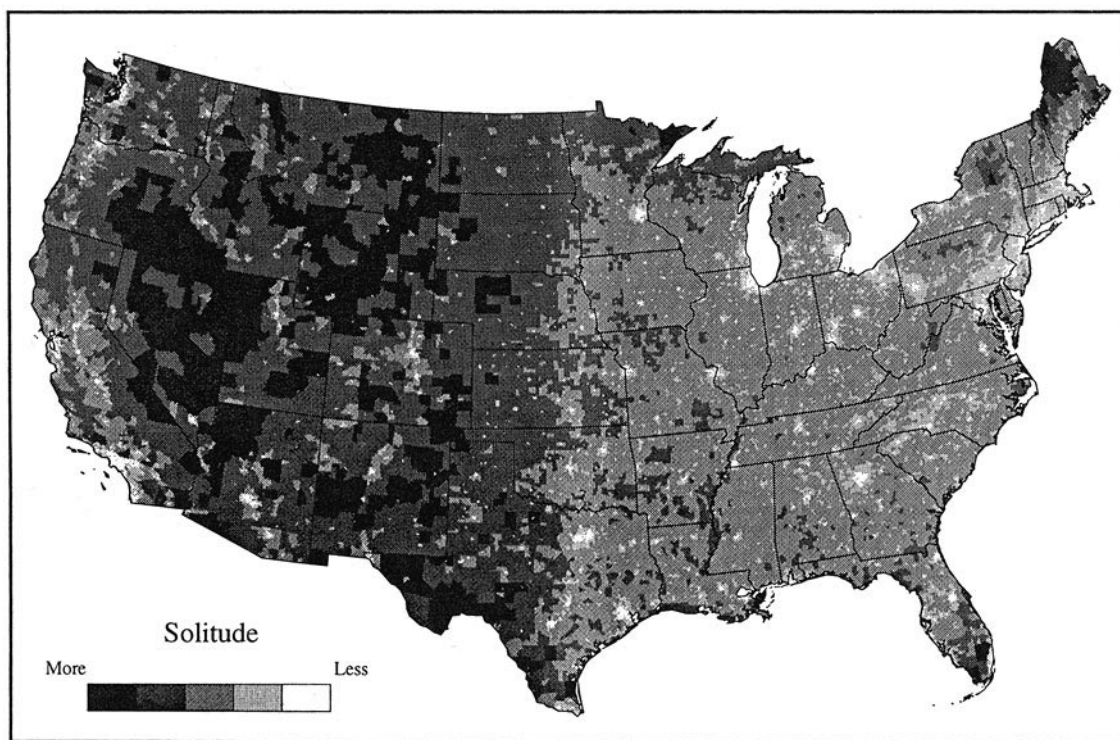
An ideal road data set would include all roads from interstate highways to natural surfaces and include all of the attributes needed to assess their relative influence on remoteness. Unfortunately, such a data set does not exist for the continental United States. Instead, we used a “major highways” (essentially paved intercity routes) data set compiled by the U.S. Geological Survey (USGS). To assign a remoteness value to each cell, we “buffered” the road system at five different distances. Cells within 2 km of a road were assigned a value of 1; between 2 and 5 km a value of 2; 5-10 km a value of 3; 10-25 km a value of 4; and greater than 25 km a value of 5. The results are displayed in map 2. Future

versions may dissolve the five distance classes into one continuous distance “surface.”

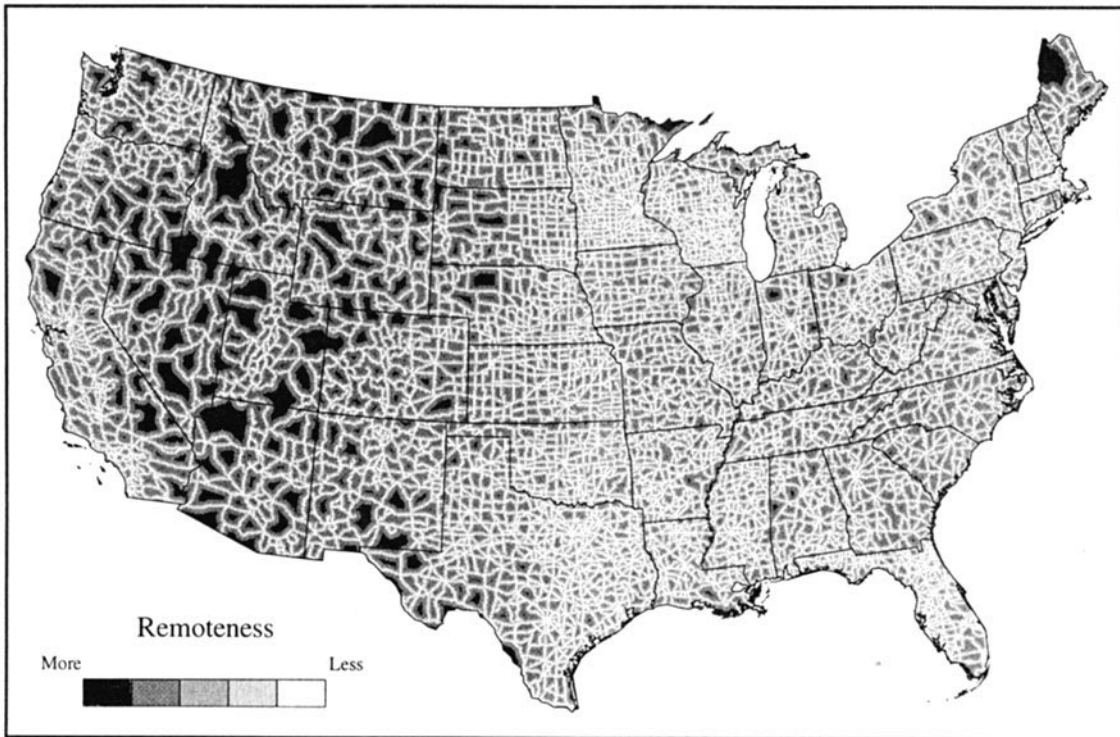
## Uncontrolled Processes

Ecological processes are inherently difficult to measure, since we rarely are able to measure rates directly; instead, we generally measure states at different times and infer rates. Mapping processes is even more difficult, as it requires tying process measurements to particular places. Such data with national coverage are extremely difficult to obtain. One of the few data sets that suggests process impacts is the national inventory of dams available from the USGS. To account for changes in hydrologic function, we evaluated the number of dams in major hydrologic units (watersheds) and divided the nation into five classes. We assigned a value of 5 to cells within watersheds with no dams; a value of 4 to watersheds with 1-6 dams; a value of 3 to watersheds with 7-20 dams; a value of 2 to watersheds with 21-50 dams; and a value of 1 to watersheds with more than 50 dams per watershed.

In future renditions, we plan to build on concepts developed by The Nature Conservancy (1998) to develop a surrogate for terrestrial processes based on patch metrics (area, distance to edge, major axis) for polygons of natural vegetation (see below) delimited by major highways, agricultural lands and urban areas. The approach assumes that ecological processes in larger, well-connected patches are under less human control than in smaller, disconnected patches.



**Map 1**—Opportunity for solitude. Population density by census block group.



Map 2—Remoteness. Distance from major highways.

## Natural Composition

There are a number of ways in which ecosystem composition can be measured. Conceptually, one of the most straightforward is species composition. Data sets should provide information on the degree to which ecosystems retain the species typical of the area and the degree to which exotic species have displaced natives. One of the few data sets available with coast-to-coast coverage of species composition is the North American Land Cover Characteristics satellite image classification conducted by the USGS, which assigns surface vegetation to over 200 different classes of natural and anthropogenic vegetation. We combined this data set with the urban classes from a separate USGS Land Use and Land Cover data set. To conduct our analysis, we assigned each one-square-kilometer cell to one of five classes, from unnatural (urban and cropland) to natural vegetation types. Cells exhibiting a mixture of use/cover fell in between. Map 3 illustrates the distribution of natural (darkest) and unnatural (lightest) vegetation across the United States.

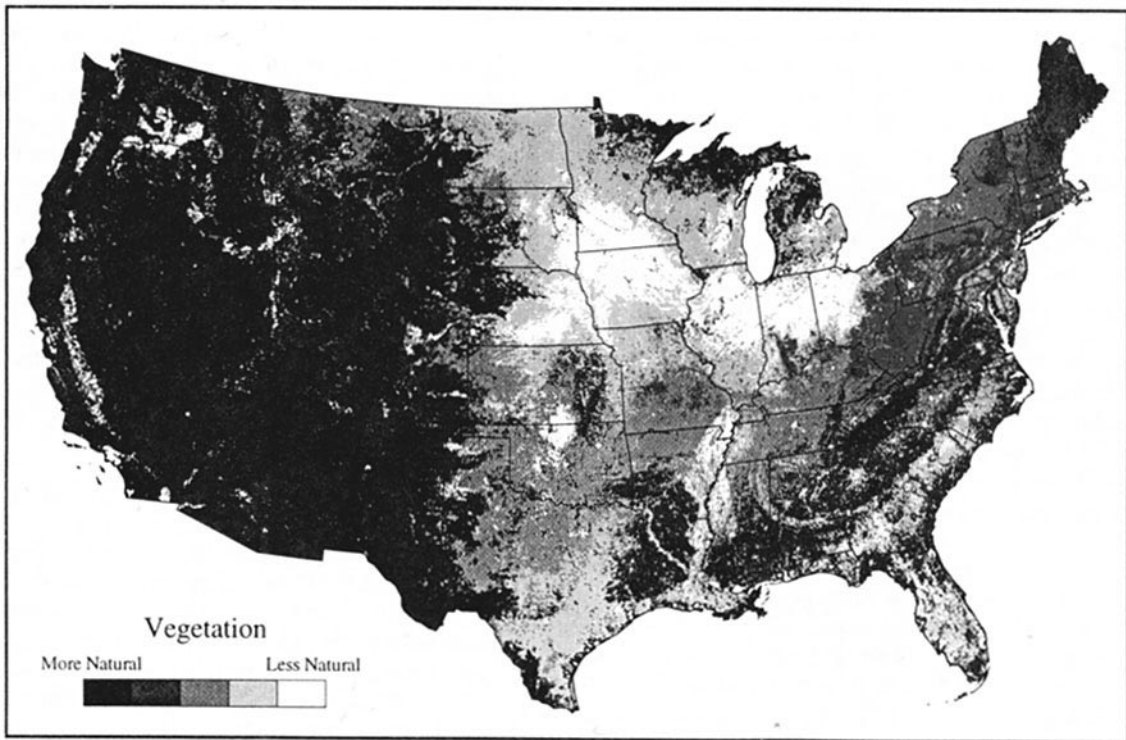
## Unaltered Structure

Humans alter ecosystem structure in a number of ways, from the construction of buildings, dams and roads to the leveling of agricultural fields and the clearcutting of forests. An ideal data set would account for all these effects. Unfortunately, available data for the nation as a whole are limited to “built structures.” We mapped the location of cities, towns, highways, dams and airstrips across the country. Cells that included built structures were assigned a value of one; all others were assigned a value of five.

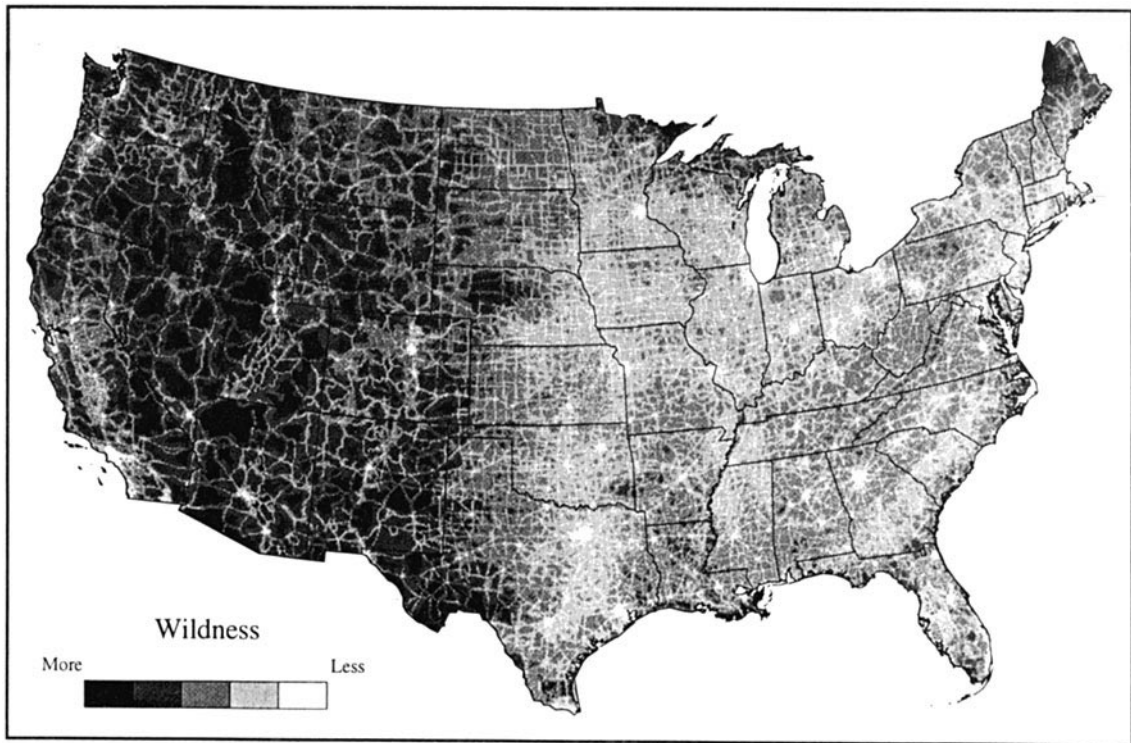
## Pollution

Despite the abundance of data on pollution compiled for various locations, there exist very little data describing the distribution of pollution across the entire country in a GIS format. The EPA maintains a “national priority list” in GIS format, recording the locations of all sites they regulate as sources of pollution. In order to assess the influence of light pollution, we evaluated NASA’s image of “lights at night” for the U.S. Again, cells were assigned a value from one to five based on a combination of these data sets. As we further refine the map, we intend to bring in data that reflect actual air and water quality, not simply sources.

To construct the map of wildness (map 4), we summed the values of the six attributes into an overall “wildness index” and displayed that index spatially. Beyond the trivial result showing that the West is notably more wild than the East, some results were somewhat surprising. Because the map was generated without regard for ownership or physiography, it bears little resemblance to maps of the distribution of wilderness areas, federal lands, mountain ranges or river basins. Instead, the map exhibits “features,” such as the swaths of wild land running from southwestern Arizona to eastern Utah and from Death Valley to southwest Idaho, that have nothing in common but their wildness. Other places, like eastern New Mexico and central Nebraska, jump out as particularly wild, though they are traditionally unheralded. The map also confirms what we already knew about places like the Boundary Waters, northern Maine, Okefenokee and the Everglades: These are very special wild places in an otherwise highly developed landscape.



**Map 3**—Natural composition. Natural and artificial land cover.



**Map 4**—Wildness.

As interesting as this map is, it is important to remember that it is simply one analysis at one scale. Wild land exists in all landscapes at all scales. Aldo Leopold said it best when he wrote, “[W]ilderness exists in all degrees, from the little accidental wild spot at the head of a ravine in a Corn Belt woodlot to vast expanses of virgin country.... Wilderness is a relative condition” (Leopold 1925). Figure 2 illustrates this sentiment by showing that the wild land continuum does not exist only at the scale of large landscapes from city to wilderness. Within the portion of the land that we call rural are land uses ranging from agribusiness to ranch. We may determine that tilled or developed land is not wild, but that a large ranch is. Even on the nonwild farm landscape, land can range from developed homesites to uncultivated pasture and forest. Within this landscape, these uncultivated areas provide a glimpse of the natural and free and are highly prized for their wildness.

The next step in our process will be to repeat this type of analysis at the scale of a region (a state) and a subregion to show that patterns of wildness emerge at all scales. At these scales, new (and hopefully better) data sets will be applied to show that relatively wild land exists all around us. For example, though it appears as a highly developed patch at the scale of the nation, the city of Chicago is home to hundreds of thousands of acres of precious wild places whose protection is being sought by a coalition known as “Chicago Wilderness.” The next stage of our analysis will demonstrate that the wildness of places like these can be illustrated through the application of the very same approach to smaller landscapes.

At the same time that we are moving forward with these other analyses, we will be working to improve our analytical approach. Currently, the analysis is plagued by a number of problems. For example, by displaying the data in a one-square-kilometer grid, we have implied a level of precision to the data that is inappropriate for an index based on data collected at a number of scales, some of them quite coarse. We are currently working to identify an appropriate level of precision for display. Also, the current approach has the potential to overemphasize the influence of some factors. For example, roads factor in the estimation of remoteness, uncontrolled processes and unaltered structure. We are working toward a more sophisticated way to combine data sets to account for all six attributes without unduly emphasizing any particular factor.

## Relationship to Other Efforts \_\_\_\_\_

The approach to mapping wildness described above is based on an understanding that wildness inheres in varying degrees in all lands as a function of the relative freedom and naturalness of the place. This allows the mapping of all lands as possessing some degree of wildness and the production of a continuous surface describing the wildness of any landscape. Such an approach allows us to discern connections across wild landscapes that are not readily apparent in maps based on any one of the attributes (for example, land use/land cover) or on land ownership. As a result, our method represents a new approach to the study of wild lands, complementary to other existing efforts.

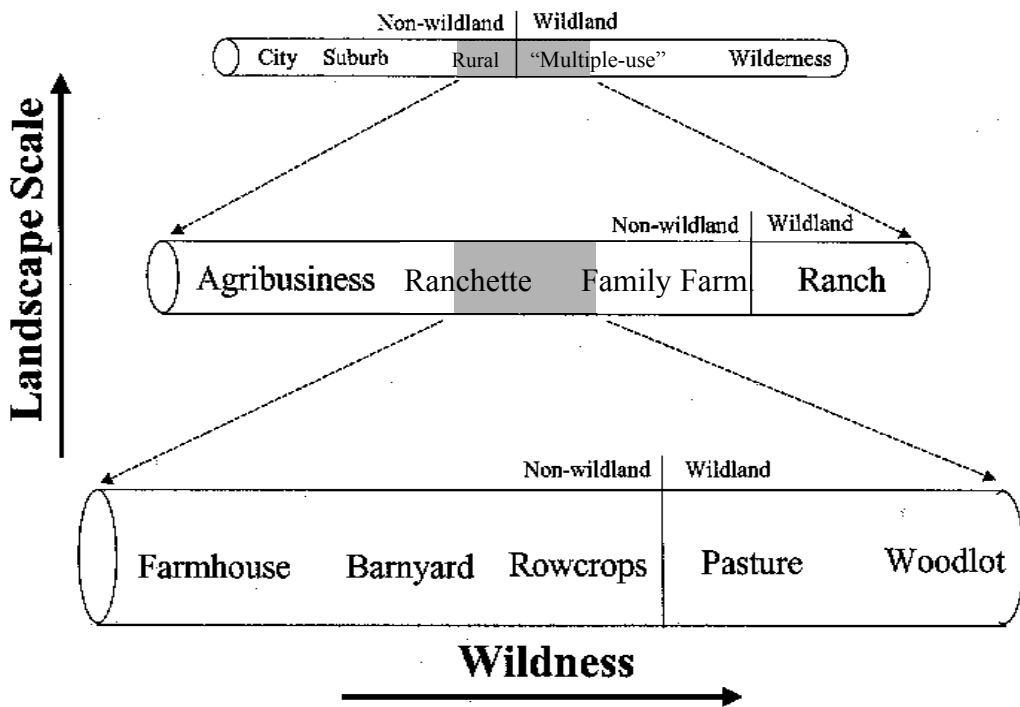


Figure 2—Wild lands can be found in any landscape at any scale.



Generally, efforts to map wild places have been of two sorts: those that focus on biological diversity and those that identify special wild places. Traditionally, mapping efforts have identified special wild places such as nature sanctuaries (Kendeigh and others 1950-51) and wilderness areas (The Wilderness Society 1989), with the implication that lands not identified in the map are not wild. Similarly, a 1997 report by the World Resources Institute characterized the world's forests as either "frontier" or "non-frontier," based on their ability to support a full complement of native species and ecological processes (Bryant and others 1997). Our method allows us to identify lands of particularly high value, while acknowledging the wildness inherent in all lands.

One of the most sophisticated wildland mapping efforts is the National Wilderness Inventory of Australia (Lesslie and Maslen 1995). This effort represents a significant advance over previous efforts because it provides an objective protocol for evaluating the wildness ("Total Wilderness Quality Index") of any particular place based on four indicators: "remoteness from settlement, remoteness from access, apparent naturalness, and biophysical naturalness." The approach described in the Australian National Wilderness Inventory Handbook (Lesslie and Maslen 1995) shares much in common with ours but still must be considered in the traditional mode, as it evaluates the wilderness quality of distinct land units identified as "natural."

The past decade or so has witnessed great progress in the mapping of areas critical to biological diversity. Efforts like the Gap Analysis Project of the USGS Biological Resources Division (Caicco and others 1995, Edwards and others 1995) and similar initiatives, such as that undertaken by the Florida Game and Freshwater Fish Commission (Cox and others 1994), have sought to identify lands of particular conservation value for protecting wildlife in each state. Studies like these improve on traditional conservation mapping initiatives because they acknowledge a continuum or gradient in wildland quality, irrespective of ownership. By including natural composition and uncontrolled processes in our analysis, we, too, recognize biodiversity as critical to wildland quality (although we do not pretend to achieve the level of detail of these other approaches). However, by also recognizing factors like solitude and unaltered structure, we assert that biodiversity is a necessary, but not a sufficient component of wildness.

One particularly noteworthy biodiversity-oriented mapping effort is The Wildlands Project, whose founders believe that "wilderness is absolutely essential to the comprehensive maintenance of biodiversity" (The Wildlands Project 1992). Such a philosophy turns the liabilities of other biodiversity mapping approaches into assets for the mapping of wild places. Because wilderness is essential to biodiversity, protecting biodiversity necessarily must result in the protection of nonbiological wilderness values.

Mapping under The Wildlands Project begins with the identification of "core reserves" essential to the conservation of wildlife – often large predators that have been exploited to extinction elsewhere. To these core reserves are added nonwilderness "buffer zones" and "corridors" to connect the core reserves. Core reserves are usually national parks and existing wilderness areas, augmented with roadless areas and places of particular conservation concern. By adding

buffer zones, The Wildlands Project begins to address some of the shortcomings of traditional wild land mapping, but because mapping generally begins with existing designated areas and builds out, it is a very "bottom-up" approach in the traditional mode of wild land identification. Our approach, in contrast, is very "top down," representing wildness unanchored by existing land designations. We believe our approach complements the "bottom-up" approach and will bring a new perspective to understanding the context of wilderness.

## Wild Land Mapping: Toward a Blueprint for Wilderness

---

The identification of quantifiable attributes of wildness makes possible the representation of wildness and the mapping of wildness across the landscape. The mapping of wildness is important for a number of reasons. First, it allows us to point to specific places, places that are important because they are wild, whether those places occur at the scale of a region, as they do in southern Utah, or at the scale of open space in such urban gems as L.A.'s Santa Monica Mountains or Washington, D.C.'s Rock Creek Park. Maps help make places tangible and the subject of action. They can help educate about wilderness, and they can help conservationists visualize the scope of their work. Maps can also serve as a graphic record of our success.

Second, a map of where the wild places are can help us, as conservationists, set priorities for our limited resources. The wildest places are not necessarily the highest priorities for attention, but we should understand the context of the places that we do work to protect. Also, maps that show the relative importance of various wild land tracts can provide convincing arguments for wild land protection. Maps that show a tract or subregion (for example, Okefenokee or the Grand Staircase-Escalante National Monument) to be the "wildest in the land" contribute to the argument for protection.

Third, maps of wild places can be powerful tools of inclusion. Wild land maps can help direct people who wish to contribute to wilderness protection toward high-priority lands. They can also help recruit new voices for wild land protection by showing people who otherwise think of wild lands only in the abstract just how close these places are.

Finally, maps can help illuminate possibility. As The Wildlands Project has shown, dreaming with a map and crayon can motivate people to work toward a future that is better than the present. A wild land map can show not just where the wild lands are, but where they could be. If done well, wild land maps based on the attributes described above can help identify the specific changes necessary to restore wildness to degraded landscapes and begin the job of building a system of wild lands, rather than simply defending an ever-shrinking wild land base.

## Acknowledgments

---

This paper was originally presented at the Sixth World Wilderness Congress in Bangalore, India, in October 1998 and was greatly improved by the feedback received from Congress delegates.

The authors would like to express their gratitude to Susan Balikov, who developed some of the original ideas that made this work possible but who left The Wilderness Society prior to its completion. We miss you.

## References

- Aplet, G. H. 1999. On the nature of wildness: exploring what wilderness really protects. *Denver University Law Review* 76: 347-367.
- Bayet, F. 1994. Overturning the doctrine: indigenous people and wilderness – being aboriginal in the environmental movement. Reprinted as pages 314-324 in: *The great new wilderness debate* (J. Baird Callicott and Michael P. Nelson, eds.). University of Georgia Press, Athens. 997 p.
- Birch, T. H. 1990. The incarceration of wildness: wilderness areas as prisons. Reprinted as pages 443-470 in: *The great new wilderness debate* (J. Baird Callicott and Michael P. Nelson, eds.). University of Georgia Press, Athens. 997 p.
- Bryant, D.; Nielsen, D.; Tangley, L. 1997. *The last frontier forests: ecosystems and economies on the edge*. World Resources Institute, Washington, DC.
- Caicco, S. L.; Scott, J. M.; Butterfield, B.; Csuti, B. 1995. A gap analysis of the management status of the vegetation of Idaho (U.S.A.). *Conservation Biology* 9:498-511.
- Carhart, A. H. 1961. *Planning for America's wildlands: a handbook for land-use planners, managers and executives, committee and commission members, conservation leaders, and all who face problems of wildland management*. National Audubon Society, National Parks Association, The Wilderness Society, and the Wildlife Management Institute. The Telegraph Press, Harrisburg, PA. 97 pp.
- Cohen, M. P. 1984. *The pathless way: John Muir and American wilderness*. University of Wisconsin Press, Madison. 408 pp.
- Cole, D. 1996. Ecological manipulation in wilderness: an emerging management dilemma. *International Journal of Wilderness* 2(1):15-19.
- Cox, J.; Kautz, R.; MacLaughlin, M.; Gilbert, T. 1994. Closing the gaps in Florida's wildlife habitat conservation system. Florida Game and Freshwater Fish Commission, Tallahassee, FL.
- Denevan, W. 1992. The pristine myth: the landscape of the Americas in 1492. Reprinted as pages 414-442 in: *The great new wilderness debate* (J. Baird Callicott and Michael P. Nelson, eds.). University of Georgia Press, Athens. 997 pp.
- Edwards, T.; Homer, C. G.; Bassett, S. D.; Falconer, A.; Ramsey, R. D.; Wight D. W. 1995. *Utah Gap Analysis: an environmental information system.. Final Project Report 95-1*, Utah Cooperative Fish and Wildlife Research Unit, Utah State University, Logan.
- Frome, M. 1997. *Battle for the wilderness*, Rev. ed. University of Utah Press. 278 pp. p.12
- Gomez-Pompa, A.; Kaus, A. 1992. Taming the wilderness myth. Reprinted as pages 293-313 in: *The great new wilderness debate* (J. Baird Callicott and Michael P. Nelson, eds.). University of Georgia Press, Athens. 997 pp.
- Kendeigh, S. C.; Baldwin, H. I.; Cahalane, V. H.; Clarke, C. H. D.; Cottam, C.; Cottam, W. P.; Cowan, I. M.; Dansereau, P.; Davis, Jr., J. H.; Emerson, F. W.; Haig, I. T.; Hayden, A.; Hayward, C. L.; Linsdale, J. M.; Macnab, J. A.; Potzger, J. E. 1950-51. Nature sanctuaries in the United States and Canada, a preliminary inventory. *The Living Wilderness* 15(35):1-45.
- Kulla, A. 1998. Effects of noxious weeds on wilderness, recreation, and tourism. Speech presented April 7, 1998, at the Colorado Weed Summit, Denver, CO (unpublished).
- Leopold, A. 1921. The wilderness and its place in forest recreational policy. *Journal of Forestry* XIX(7):718-721. p. 719
- Leopold, A. 1925. Wilderness as a form of land use. Reprinted as pages 75-84 in: *The great new wilderness debate* (J. Baird Callicott and Michael P. Nelson, eds.). University of Georgia Press, Athens. 997 pp.
- Leopold, A. S.; Cain, S. A.; Cottam, C. M.; Gabrielson, I. N.; Kimball, T. L. 1963. Wildlife management in the national parks. Reprinted as pages 103-119 in: *The great new wilderness debate* (J. Baird Callicott and Michael P. Nelson, eds.). University of Georgia Press, Athens. 997 pp.
- Lesslie, R.; Maslen, M. 1995. *National Wilderness Inventory handbook of procedures, content, and usage* (Second edition). Australian Heritage Commission. Australian Government Publishing Service, Canberra.
- Marshall, R. 1930. The problem of the wilderness. Reprinted as pages 85-96 in: *The great new wilderness debate* (J. Baird Callicott and Michael P. Nelson, eds.). University of Georgia Press, Athens. 997 pp.
- Marshall, R. 1933. *The people's forests*. Harrison Smith, and Robert Haas, New York. pp. 177-178.
- Nabhan, G. P. 1995. Cultural parallax in viewing North American habitats. Reprinted as pages 628-641 in: *The great new wilderness debate* (J. Baird Callicott and Michael P. Nelson, eds.). University of Georgia Press, Athens. 997 pp.
- Nash, R. 1982. *Wilderness and the American mind*, 3<sup>rd</sup> edition. Yale University Press, New Haven, CT. 425 pp.
- The Nature Conservancy. 1998. *Ecological processes at the ecoregional scale: considerations for portfolio design: guidelines for ecoregional team leaders from the stewardship expert team*. Unpublished draft manuscript, August 1998. 19 p.
- Olson, S. 1938. Why wilderness? Pages 97-102 in: *The great new wilderness debate* (J. Baird Callicott and Michael P. Nelson, eds.). University of Georgia Press, Athens. 997 pp.
- Plumwood, V. 1998. Wilderness skepticism and wilderness dualism. Pages 652-690 in: *The great new wilderness debate* (J. Baird Callicott and Michael P. Nelson, eds.). University of Georgia Press, Athens. 997 pp.
- Snyder, G. 1990. *The practice of the wild*. North Point Press, New York. 190 pp. p.14.
- Strand, M. 1996. Untitled. In: *Testimony: writers of the West speak out on behalf of Utah wilderness* (S. Trimble and T.T. Williams, comps.). Milkweed Editions, Minneapolis, MN.
- Thoreau, H. D. 1862. *Walking*. Pages 592-630 in: *The portable Thoreau* (Carl Bode, ed.). Penguin Books, New York. (1982). 698 pp.
- Turner, J. 1996. *The abstract wild*. University of Arizona Press, Tucson.
- The Wildlands Project. 1992. *The Wildlands Project: plotting a North American wilderness recovery strategy*. Wild Earth (Special issue).
- The Wilderness Society. 1989. *The National Wilderness Preservation System 1964-1989* (map). The Wilderness Society, Washington, DC.
- Whitney, S. 1997. Solitude: an endangered value of wilderness. Signpost for Northwest trails. April 1997:33-34.
- Worf, B. 1997. Response to "Ecological manipulation in wilderness" by Dr. David Cole. *International Journal of Wilderness* 3(2): 30-31.