

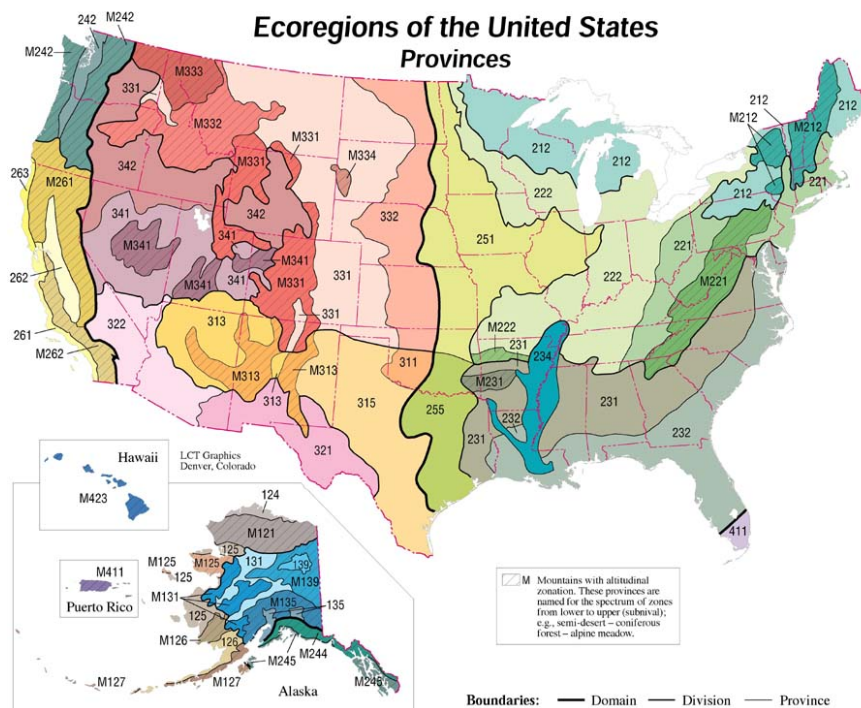
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# Ecoregional Landscape Design

The natural ecosystem patterns and processes of the surrounding region can inspire designs of landscapes that sustain themselves.

By Robert G. Bailey



The 1995 USDA Forest Service ecoregion province map by Bailey

This article addresses patterns of ecosystems within a region and what these patterns signify in terms of the processes that create them and goes on to explain their relevance to design of sustainable landscapes.

## What is an Ecoregion?

Ecoregion maps show the earth's surface subdivided into identifiable areas based on macroscale patterns of ecosystems. These ecoregions delimit large areas within which local ecosystems recur more or less throughout the region in a predictable pattern. For example, trees that respond to additional moisture on north-facing slopes are seen repeatedly throughout the foothills and mountains of the semiarid and arid regions of the American West.

### What are the American Ecoregions?

There are various schemes for the division of the United States into ecoregions ranging in number from 37 to 119 provinces. The map accompanying this article shows the USDA Forest Service scheme developed from the work of Bailey (devised in 1976 and revised in 1995). These regions are climate based following a classification developed by German geographer-meteorologist Vladimir Köppen in 1931. The basic assumption is that climate governs energy and moisture gradients, thereby acting as the primary control over more localized ecosystems.

### Why are They Important?

The patterns of ecosystems are not random, but are linked to ecological, economic, and cultural processes that create them. Within the Great Plains, for example, ponderosa pine and shrub islands within grasslands indicate isolated sites of rocky soil conditions, forming reservoirs of water for taproots.

### What is Ecoregional Design?

Ecoregional design is the act of understanding the patterns of a region in terms of the processes that shape them and then applying that understanding to design and planning. For example, instead of channeling storm runoff into concrete drains then to a sewage system, natural drainage swales can be left undeveloped, providing sponges for flood protection.

When we design ecologically we observe how regions function and try to maintain their functional integrity. The tropical rainforest, for instance, provides so much oxygen that it can be considered as a lung of the biosphere. So we should not use it only for massive lumbering, but instead, take advantage of its other resources, such as medicine, many not yet discovered.

Changing the natural pattern by adding subdivisions, roads, or other elements changes the ecological functions. For example, animals change their routes, water flows are changed in direction and intensity, erosion commences, etc.

### Landscaping and Restoration

Each ecoregion has a characteristic pattern of sites. Understanding the pattern of sites and the processes that shape them provides design inspiration for urban and suburban landscapes that are in harmony with the region they are embedded within. For example, as Figure 1 shows, desert plants thrive on the arid south side of this Golden, Colorado house. The north side is moist and humid and is planted accordingly with mesic species such as spruce. The deciduous homestead tree, a pattern from the 1880s, is placed to provide summer shade but permit winter light. Where water concentrates at the site's low point, wetland species are planted that have higher moisture requirements.

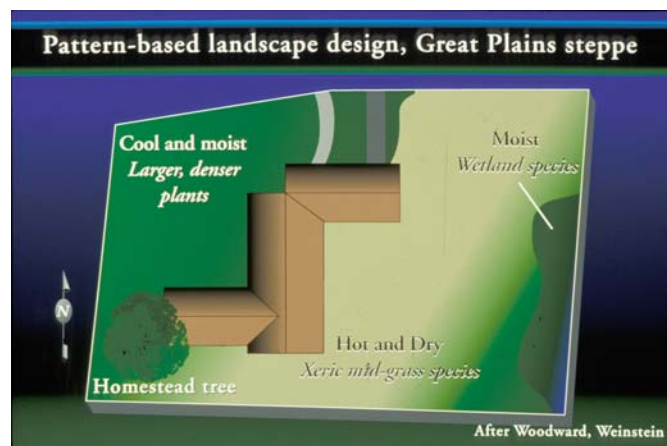


Figure 1

Furthermore, like streams, cities do not exist independently of what surrounds them. Classifying metropolitan areas by ecoregion forms a baseline for selecting native plants for landscaping as well as transferring information among similar cities. In cool and temperate areas, evergreen trees should be planted to provide windbreaks on the north and west sides of houses, and deciduous trees on the west and south sides for shade in summer. In hot-humid areas, deciduous trees should be planted on the west and south sides of the house for shade and perhaps on the north side as well. In hot-arid areas, trees and shrubs should be planted around the house to shade the house walls and create a microclimate and moderate temperatures. Stevie Daniels' *The Wild Lawn Handbook* (New York: Macmillan, 1995) has advice for regional wildscaping. It provides a list of tree species that are appropriate for regions around the country. *Landscaping with Nature* by Jeff Cox (Emmaus, PA: Rodale Press, 1991) lists the most typical native plants—wildflowers, ferns and grasses, and woody plants and vines—for each of nine ecoregions, covering the entire United States. A source of ecoregion native plant information also can be found in the author's *Description of the Ecoregions of the United States* (Washington, DC: USDA Forest Service, 1995). Using this approach, one can quickly characterize the "original and appropriate" ecology of that region and use that information to help guide design.

As noted by Mariette Nowak (*Wild Ones Journal*, May/June, 2002), selecting plant species from within your ecoregion is the best way to select plant species. This is because, although the same species may be found in several states or regions, the plants may have subtle differences in their genetic make-up in different areas of their native ranges. These locally adapted populations, called ecotypes, have different limits of tolerance to temperature, light, or other factors. The possibility of genetic variations has often been overlooked in applied ecology, with the result that restocking or transplanting has often failed because plants from remote regions were used.

Landscape designers ignore microclimate at their peril: mistakes can mean higher temperatures and energy costs. Massive amounts of concrete placed on the south and west sides of a building can increase ambient air temperature by as much as 20 degrees, significantly increasing the building's cooling load and energy consumption. Also reflected light from south- and west-facing windows creates high temperatures, and thus increases the evaporative loss of water from nearby plantings. Deciduous shade trees and ground covers strategically planted in these exposures can be used to mitigate the situation. Designers should select and place new plants to blend with the existing ecosystem. In addition, they should emphasize the use of native plants and those that are suitable to the region's climate.

For plants that are suited to the regional climatic context, we need to examine the region's legible plant patterns. Denver's context, for example, is semi-arid steppe consisting of native short grasses and bunchgrasses. Urbanization over the last 150 years has created a number of plant patterns that are in response to satisfy the need for comfort and protection from Denver's strong, cold, drying winds and shelter from its summer heat. Many of the plants in this region are native to other regions with wet, temperate climates. Many of these patterns are *unsustainable* in Denver's climate. For example, bluegrass lawns are common but depend on imported water, fertilizer, and maintenance. One way to create sustainable landscapes would be to plant a blue grama and buffalo grass lawn. These drought-tolerant grasses are native to the steppe, where they receive 280 to 360 millimeters of precipitation annually usually between May and July, sometimes in the form of fierce rainstorms.

Once established, they do not require irrigation; whereas it is possible for a mesic bluegrass lawn to need over 640 millimeters of supplemental water per season.

Buffalo grass grows 10 to 30 centimeters tall. They spread by stolons (the above-ground stems). They creep across the soil, growing as much as 5 centimeters a day, and put down roots to grow new tufts of grass in bare spots. Buffalo grasses have seeds that contain germination inhibitors. This is an adaptation to the variability of the precipitation in this region. The grasses will only germinate if climatic conditions are suitable. They will lie dormant for years during a drought waiting for wet conditions to return. As a consequence, plant cover may be difficult to establish without supplemental irrigation at the onset. Once established, the accumulation of too much litter is detrimental to the regeneration of the grasses. The plant cover may become patchy, and weeds such as thistle become established. If the steppe vegetation is to be maintained in its original form, a certain amount of grazing is therefore indispensable. This was provided in earlier times by buffalo, antelope, and locust. Nowadays, the grass needs to be mowed occasionally in order to reduce such accumulation.

These grasses that are resistant to drought take up water both through their roots and through direct absorption through the blades of grass. They are so good at utilizing the limited water that is available, that too much water drowns them. For example, in Joan Woodward's *Waterstained Landscapes: Seeing and Shaping Regionally Distinctive Places* (Baltimore: Johns Hopkins University, 2000, p. 57) she describes how aggressive irrigated grasses like bluegrass as well as weeds can march right in and take over. "Buffalo grass is not a good competitor for choice spots but very tenacious in marginal locations where juicy grasses dare not tread," says Woodward. This is a problem in urban environments where irrigated water from adjacent property soaks into the soil and flows toward arid sites. This allows the more aggressive weeds and imported grasses to outcompete the dryland grasses. Not only that, there has been a shift in the moisture conditions in urban settings due to irrigation and the growth of trees and structures. This limits the drying effects of winds that define the regional environments of semiarid regions like the Great Plains. As a result, despite our best intentions, the cumulative effects of urbanization limit our ability to replenish native species in urban settings, sometimes resulting in patchy, weedy, unsuccessful attempts. The moral is: context or surroundings is very important in how a site will operate because the adjacent system affects the site through sheltering, affects on climate, etc.

The old saying "if a little is good; then a lot more is better" can lead to failure in attempts to revegetate disturbed sites, especially with grasses. For example, there are many ski slopes in the semi-arid mountains of the West. Sometimes seeds are applied at too heavy a rate in these areas in an attempt to get grasses to come in as thickly as possible to protect the bare land surface. What happens is the seeds germinate all right but quickly use up all the available soil moisture. Without irrigation, there are too many plants to survive until the moisture is replenished by rainfall. Consequently, all the plants soon die and the revegetation process has to be started all over again. The results will be the same unless the climatic conditions of the region are taken into consideration.

In the hot Mojave Desert of southern Nevada, the lawns of Las Vegas drain the city's resources because of the water it takes to maintain them. That's why the Southern Nevada Water Authority has started offering homeowners money to rip up all or part of their lawn and replace it with less water-dependent, indigenous flora. Other

states, including New Mexico, California and Arizona, have instituted similar financial-incentive plans to save water. The National Wildlife Federation offers an official backyard wildlife habitat seal to those who curtail their lawns in favor of native plants that feed and shelter indigenous wildlife and require less pesticide and water.

For years the American lawn has been cultivated in inhospitable climates from coast to coast and maintained with vast amounts of fertilizer, pesticides, and water. The gardening writer Michael Pollan in his book, *Second Nature* (New York: Atlantic Monthly Press, 1991), has described such lawns as “nature under totalitarian rule.” But in Las Vegas and other communities, the trend is changing. Whether because of water restrictions, an increased concern about pesticide and fertilizer pollution of streams, or a backlash against the unending labor required to keep lawns green and mowed, more homeowners are letting their lawns go wild. A source of information about this new approach to lawn ecology is *Redesigning the American Lawn* by F.H. Bormann et al. (New Haven: Yale University Press, 1993), whose authors criticize the “industrial lawn,” composed only of grasses and expunged of any extant weeds. They advocate the “freedom lawn,” which allows a diversity of plants to crop up naturally. Such lawns are expressions of regional differences.

Until recently, few designers have explored the underpinnings of regional landscape design. The pioneer in this field is landscape architect Joan Woodward, who has provided guidance on applying regional sensibility to landscape design in the Denver Front Range (Woodward 2000). Another landscape designer working to achieve the same objective is Judith Phillips. In her book, *Natural by Design* (Santa Fe, Museum of New Mexico Press, 1995),

she presents a thorough treatment of landscape design, planting, and maintenance in the ecosystems of the arid southwestern United States. It is based on an understanding of why and how plants grow where they do within the region. Landscape meaning and regional thinking are an important part of an ecosystem approach to home gardening, say Mark Francis and Andreas Reimanns in their book, *The California Landscape Garden* (Berkeley, University of California Press, 1999). They used California’s natural beauty



Figure 2. Garden, Central California Coast. Photograph by INDIGO/Hammond & Playle, Architects; reproduced with permission.

and habitat as a starting point for inspiring Californians to see their gardens as extensions of the surrounding landscape and responsive to the various regions of the state. This is the same approach employed by bioregional landscape designers Jonathan Hammond and Bruce Playle (Figure 2).

Joan Woodward calls her approach pattern-based design. This approach is distinguished from another popular design approach called Xeriscape.<sup>1</sup> Xeriscape design, or water conservation design, involves zoning plants for microclimate control,

<sup>1</sup> Xeriscape is a registered trademark held by the National Xeriscape Council.

reducing turf areas, and reducing evapotranspiration through the use of mulches and efficient irrigation. Xeriscape design promotes the “greening” of semiarid garden landscapes while encouraging water conservation. This is the principal goal; designing for regional distinctiveness is not a stated goal. The pattern-based design differs from Xeriscape by incorporating an understanding of patterns, and by remaining sympathetic to regional processes.

There are a number of public Xeriscape demonstration gardens throughout the West that are designed to educate and convince the public that water-conserving gardens can be lush and beautiful. There are also dozens of gardening books that illustrate Xeriscape principles. These gardens and books, however, are purposefully generic and apply to many design styles. Substituting drought-tolerant plants seems to be the favored model in the demonstration gardens and books. As far as I know, Woodward is the first to build on Xeriscape’s useful resource-conserving foundation and offer guidance in creating regionally distinctive landscapes: those based on a region’s legible plant patterns.

Some nurseries provide information on Xeriscaping with regionally appropriate plants. For mail order, see David Salman’s Santa Fe Greenhouse/High Country Gardens catalog.

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