



SYSTEM DIMENSIONS	CHEMICAL AND PHYSICAL	BIOLOGICAL COMPONENTS	HUMAN USES
Extent Pattern	Nutrients, Carbon, Oxygen Contaminants Physical	Plants and Animals Communities Ecological Productivity	Food, Fiber, and Water Recreation and Other Services

② Fragmentation and Landscape Pattern

Fragmentation and Landscape Pattern

Indicator Development Needed

What Is This Indicator, and Why Is It Important?

Fragmentation of ecosystems into small patches can reduce habitat for wildlife species that require larger, connected patches. It can hinder the movement of some species and introduce predators, parasites, and competitors associated with different land uses. Fragmentation can also alter the frequency and extent of fire and affect the dispersal and regeneration of plants. Suburban and urban development, farmlands, roads, railroads, powerline corridors, and other land uses cause various kinds and degrees of fragmentation.

Species that require large, unbroken expanses of habitat are often most sensitive to the effects of fragmentation. In some cases, the effects of fragmentation on sensitive species are a direct result of changes in the size and arrangement of suitable habitats across the landscape. In others, impacts are due mainly to more frequent interactions of species with humans, vehicles, or predators, or to other factors associated with an intruding land use.

People also react to changing landscapes. Areas that were primarily forest, grasslands, or shrublands but are now fragmented by other uses or bisected by roads provide a very different level of solitude and visual attraction. Likewise, the character of farm landscapes and communities changes radically when they are broken up by suburban development.

Human activity can also create landscapes that are less varied than the landscapes historically experienced by native species. Particularly in the West, natural fires create a patchy landscape, where forest and grasslands are intermingled in a mosaic that supports many different species. Fire suppression and the large fires that result after long periods of suppression can create broad expanses of very similar vegetation, with negative effects on species that thrive on the formerly varied landscape.

Landscape patterns affect people and other species in different ways and at different geographic scales. Some species are very sensitive to fragmentation, while others are more tolerant. Some effects, such as the changes that occur in farming communities undergoing suburbanization, operate at a county level, while other effects, such as those affecting forest birds, involve distances measured in feet or yards. The magnitude of fragmentation and its context are also important. A single incursion may not cause significant effects, but many such changes taken together may have a larger impact. Similarly, a modest amount of fragmentation in an abundant habitat may not be significant, but the same amount of fragmentation in a rare habitat may be cause for concern.

Why Can't This Indicator Be Reported at This Time? There are clear and obvious linkages between landscape patterns, the kinds of plants and animals that thrive in a region, and the ways in which people use the land. However, there are many different ways to characterize these patterns and the ways in which they are changing, and scientists do not agree on a single "best" measure. Additional work is necessary to select the specific features that should be measured, the geographic scale at which they should be monitored, and how they should be reported and interpreted.



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② Fragmentation and Landscape Pattern *(continued)*

This report includes measures of fragmentation or landscape pattern for grasslands and shrublands (p. 163), farmlands (pp. 93 and 94), forests (p. 120), and urban and suburban areas (pp. 182 and 183). Although some of these indicators require additional research, it is clear that there is more agreement among scientists on how to measure landscape pattern for specific ecosystem types than there is for an overall national measure.

What Steps Are Necessary To Achieve Reliable National Coverage? This is an area of active scientific investigation. Many possible indicators are being evaluated to determine which ones, or which combinations, provide the best view of the important changes that are occurring in the American landscape.

There is no technical note for this indicator.