



## Chapter 4: Core National Indicators

America's ecosystems are enormous, and enormously diverse. They range from deep ocean trenches to wide grassy plains, from above the Arctic Circle to the tip of Florida. In this chapter, rather than focusing on specific ecosystems, as we do in succeeding chapters, we present ten indicators that describe key characteristics of the entire array of America's ecosystems.

These ten core national indicators provide a broad, yet succinct, description of the condition and use of ecosystems in the United States. They describe and track changes in key aspects of the area and configuration of ecosystems, significant chemical and physical conditions, biological components, and the goods and services that people derive from these systems. In doing so, they parallel the indicators presented in the six following chapters, each of which focuses on a single ecosystem. These chapters also cover ecosystem area and configuration, chemical and physical properties, biological components, and human uses, but they do so using a larger number of indicators that focus on a subset of the nation's lands and waters.

### What can we say about the condition and use of U.S. ecosystems, based on these core national indicators?

Partial or complete data are available for seven of the ten core national indicators. Four of the seven have data from a long enough period to judge trends, and one uses federal benchmarks to help readers judge the significance of ecosystem conditions. The three indicators for which data are not presented require further development.

After the following brief summaries of the findings and data availability for each indicator, the remainder of this chapter consists of the indicators themselves. Each indicator presentation offers a graphic representation of the available data, defines the indicator and explains why it is important, and describes either the available data or the gaps in those data.

### System Dimensions

The national indicators include two measures of extent and pattern. The first is the most basic description of the state of our nation's lands and waters, the area of each of the component systems and how they change through time. The second measure, not yet developed, will describe the intermingling of the various system types across the national landscape.

- **What is the area of the six major ecosystem types?** Grasslands and shrublands and forests each occupy about a third of the area of the lower 48 states, and farmlands about a quarter. The area of forest and grasslands and shrublands has declined since European settlement, as has the area of freshwater wetlands, and the extent of cropland and urban and suburban areas has grown. More recent trends show decline in forest, croplands, grassland and shrublands, and freshwater wetlands, and increases in urban and suburban areas (Table 4.1).

The area of ecosystems is a very basic characteristic but, for various reasons, is complex to report. The main reason is that the area of different ecosystems is often tallied by different agencies, using different methods and definitions of the systems. Satellite remote sensing, which can provide an integrated view, is available at the appropriate scale for only one time period (1992) and thus cannot provide information on changes in the area of different ecosystems.



Table 4.1. Core National Extent Measurements (lower 48 states)

Ecosystem	Core National Extent Measurements	Area in Millions of Acres	Percent of Land Area <sup>a</sup>	Estimated Presettlement Area (as % of Total Land Area)	Changes from 1950s, Millions of Acres (%) <sup>a</sup>
Grasslands and Shrublands	Total area (not including pastures)	683	36%	52%	Declining, amount and rate unknown
Forests	Total area	618	33%	48%	-9 (-1.1%)
Farmlands	Area of croplands	455	24%	—	-23 (-4.8%)
Freshwater	Area of Freshwater Wetlands	94	5%	11%	-11 (-10%)
Urban and Suburban areas	Urban and suburban lands	32	1.7%	—	Increasing, amount and rate unknown
Coasts and Oceans	Coastal brackish water	Unknown	—	Unknown	Unknown

Source: Grasslands and shrublands and urban and suburban areas: Multi-Resolution Land Characterization Consortium and the U.S. Geological Survey; data are for 1992. Forests: USDA Forest Service Forest Inventory and Analysis program; data are for 1997. Croplands: USDA Economic Research Service (see p. 91 for estimates from other agencies); data are for 1997. Freshwater and coastal wetlands: U.S. Fish and Wildlife Service; data are for mid-1990s. Coverage: lower 48 states.

<sup>a</sup> This table does not include 100% of lands in the United States. For example, urban and suburban areas, as defined in this report, do not include all developed areas (some developed areas are too small to be considered “suburban” or “urban”). Thus, declines in the area of forests, grasslands and shrublands, croplands, and freshwater wetlands are not—nor should they necessarily be—offset by corresponding gains in urban and suburban lands. In addition, the area of wetlands and portions of urban and suburban areas may also be counted as croplands, forests, or grasslands and shrublands. For these reasons, the figures in this table should not be added to obtain an overall estimate of U.S. land area.

Table 4.1 presents estimates from multiple sources, which means that care must be taken in comparing and adding data about different ecosystems and in tracking gains and losses from one system to another.

- **How fragmented are natural lands into smaller, more isolated patches? How are developed lands intermingled within the natural landscape?** This indicator requires further development. There is widespread recognition that these patterns are important ecologically and that they can affect people’s quality of life, but there is less agreement among scientists on the most appropriate indicators to use in measuring such patterns and the most appropriate geographic scales on which to apply them. This report includes several indicators of fragmentation and landscape pattern—for forests (p. 120), farmlands (pp. 93 and 94), grasslands/shrublands (p. 163), and urban/suburban areas (pp. 182 and 183)—but these indicators focus on different aspects of fragmentation and pattern from system to system. This indicator requires further development.

### Chemical and Physical Conditions

Out of the many important indicators of chemical and physical condition, we have identified two as national indicators. Nitrogen is a vital plant nutrient, but if present in excess it can cause ecological problems, especially in coastal waters. One indicator tracks the amount of nitrogen that leaves the land and is delivered to coastal waters. The second is a multipart indicator that tracks such contaminants as pesticides, PCBs, and heavy metals in streams, sediment, groundwater, and fish.

- **How much nitrogen leaves watersheds across the country, and how much is delivered to coastal waters?** Delivery of nitrogen from rivers and streams to coastal waters can cause excess algae growth, which reduces recreational and aesthetic values and can contribute to low-oxygen conditions. Watersheds in the upper Midwest and Northeast contribute the most nitrogen per square mile to rivers and streams. The amount of nitrate carried by the four largest rivers in the United States increased over the past few decades, with the amount carried by the Mississippi River—which drains more than 40% of the area of the lower 48 states—tripling since the 1950s.



- **How often are chemical contaminants found in ecosystems, and how often do they exceed standards and guidelines for the protection of human health and aquatic life?** This indicator describes the numbers of contaminants that can be detected and the frequency with which concentrations exceed applicable standards or guidelines. The indicator covers stream water, streambed and coastal sediments, freshwater and saltwater fish, and groundwater. Numbers of contaminants found, and the frequency with which they exceed applicable standards or guidelines, vary by ecosystem. For example, all streams tested averaged one or more contaminants at detectable levels throughout the year, as did 94% of freshwater fish samples and about 90% of groundwater wells tested. About three-quarters of stream samples and half of stream sediments tested had one or more compounds that exceeded guidelines for the protection of aquatic life, and about 60% of estuary sediments exceeded levels that indicate probable negative effects on aquatic life. About 15% of stream sites and one-quarter of groundwater wells had concentrations of contaminants that exceeded standards or guidelines for the protection of human health. No trend data are available for this indicator.

### Biological Components

Three indicators describe biological conditions. The first tracks how many plant and animal species are at risk of extinction, because plants and animals are important as components of ecosystems and because people value them for many reasons. A second indicator, not yet developed, will measure how much of U.S. lands and waters are altered, to varying extents, from natural conditions. A third indicator tracks trends in annual plant growth, the energy that drives and sustains ecosystems.

- **How many native plant and animal species are at different levels of risk of extinction?** About 19% of native animal species and 15% of native plants species in the U.S. are ranked as “imperiled” or “critically imperiled”; such species are typically found in 20 or fewer places, may have experienced steep or very steep declines, or display other risk factors. In addition, about 4% of animals and 1% of plants are, or are believed to be, extinct. When species ranked as “vulnerable” are included, about one-third of all plant and animal species are “at risk.” The degree of risk for any particular plant or animal species varies considerably, from those species at relatively low risk, to those that are in imminent danger of extinction. Hawaii has a much higher percentage of at-risk plants and animals than any other region, followed by the Pacific Coast. The Midwest and Northeast/Mid-Atlantic have the lowest percentages.  
Interpreting these figures is complicated, however, because the rankings are influenced by differences in the number of naturally rare species among regions and species groups, as well as by different types and levels of human activities that can cause species declines.
- **What fraction of U.S. lands and waters are highly managed or highly altered, and what levels of disturbance are found on natural/semi-natural lands?** How highly managed or altered an area is affects the type of species the area can support, and this directly influences the goods and services available from the area. This indicator requires further development. It is possible to identify areas that are physically altered (that is, they have a high percentage of asphalt, concrete, etc.) or highly managed (that is, they are farms, forest plantations, golf courses, etc.). However, it is not now possible to distinguish among the different levels of disturbance in natural/semi-natural lands.



- **What are the trends in plant growth in different regions and different ecosystems?** The plant growth index utilizes satellite data to estimate the amount of energy (sunlight) that is captured by plants. Changes in this index, over large regions, could signal changes in ecosystem functioning that may affect crop yields, timber growth, or other ecosystem outputs. No overall trend in plant growth can be seen for the 11-year period for which data are available, either nationally or within any region or ecosystem type. Year-to-year variation is quite high, and this variation is similar among regions and ecosystems. During 2000, plant growth nationwide was less than the 11-year average. Growth was about average in the Pacific states and the Midwest and lower than the 11-year average in the other four regions. Plant growth was farthest below the 11-year average in the Southwest.

### Human Use

People rely—in many ways—on the goods and services that ecosystems provide. We distill these ways into three core national indicators. The first focuses on the commodities we get from natural ecosystems: the crops, livestock, fish, timber, water, and other goods that are sold on the market. The second tracks another major use, outdoor recreation. A third indicator, not yet developed, will focus on other services provided by ecosystems, such as flood protection and purification of air and water.

- **How are the quantities of key ecosystem-related commodity goods changing over time?** Over the past half-century or so, agricultural and forest production and freshwater withdrawals have all increased. Agricultural production grew the fastest; its growth has generally been at a higher rate than that of the U.S. population. Forest production has generally tracked population growth; in the late 1970s and early 1980s, production increased to record levels, but it has fallen somewhat in more recent years. Withdrawals of freshwater increased faster than population through 1980, declined by about 10% by the mid 1980s, and has grown slowly since then. Marine fish landings grew slowly from the late 1970s, when reliable statistics became available, through the mid-1990s, but have declined since then. Most of the regional patterns of food and fiber production and water withdrawals match the national patterns above.
- **How often do people take part in outdoor recreation activities, and which kinds?** “Fitness activities” such as walking and biking are by far the most common outdoor recreation activity for which information is available. Nature viewing and swimming and beachgoing are next in terms of overall popularity, followed by outdoor social activities like picnics and family gatherings. Altogether, people camped and hiked about as much as they went to picnics and family gatherings, and more than they hunted and fished. For many water-related activities (e.g., swimming, boating), it is not possible to distinguish whether the activity took place in fresh or salt water.
- **What other services, such as soil building and flood protection, are provided by natural ecosystems?** This indicator requires further development. There is widespread recognition that such services are important to society, but measuring them is quite challenging.



### A Note about Regions

Data for three of these core national indicators (at-risk native species, p. 52; plant growth index, p. 56; and production of food and fiber and water withdrawals, p. 58) are presented on a regional basis, while a fourth (movement of nitrogen, p. 46) is presented in mapped form. The regional scheme, developed specially for this project, is also used to report the at-risk species indicators in the forest, grasslands and shrublands, and freshwater chapters. See Map 4.1.

Map 4.1. Regions Used for Reporting Selected Core National Indicators

