Chapter 3:

The State of the Nation's Ecosystems: What We Know and What We Don't Know

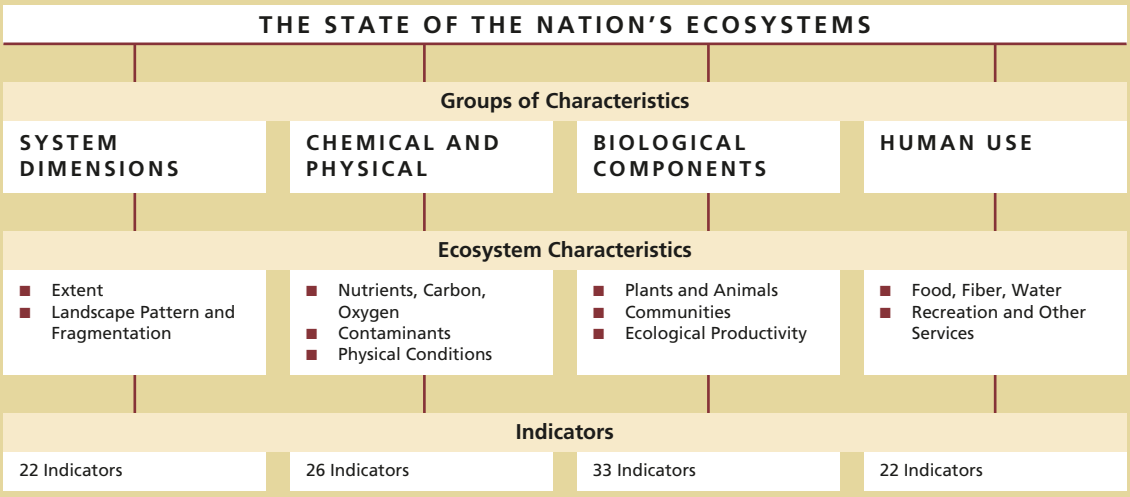
Choosing Indicators and Data

This report is the collective effort of close to 150 researchers, organized into seven committees, working over nearly five years. A multidisciplinary "Design Committee," with members drawn from industry, environmental groups, government, and universities, identified ten key characteristics of ecosystem condition that are valued by Americans and that, in our judgment, need to be addressed in any credible, balanced and useful report. These ten characteristics describe the physical dimensions of the systems, their chemical and physical conditions, the status of their biological components, and the amounts of goods and services people receive from them (see Figure 3.1). We also decided to report on these indicators for the nation as a whole and for six major ecosystem types that have long been the focus of policy debate, research, management, and monitoring—coasts and oceans, farmlands, forests, freshwaters, grasslands and shrublands, and urban and suburban areas.

Six ecosystem-specific work groups, each with representation from business, environmental, academic, and government institutions, identified between 15 and 20 specific indicators for each system, as well as a set of "core national indicators." The indicators were selected based on their importance; no indicator was ruled out simply because the data to report on it is not currently available. Each of the ecosystem-specific work groups then carefully examined potential data sources for reporting on each indicator. We used data only if it met high professional standards for integrity and overall quality and allowed us to report on most of the United States, and if there was a reasonable likelihood that the underlying measurements would be repeated over time. Key data gaps became apparent and are identified throughout the report.

Finally, we obtained the required data from the government agencies and private organizations that collect and maintain them. Our primary focus was to present current conditions and to lay the groundwork for future reporting, but wherever possible we sought datasets with records long enough to

Figure 3.1. The State of the Nation's Ecosystems: Characteristics and Indicators



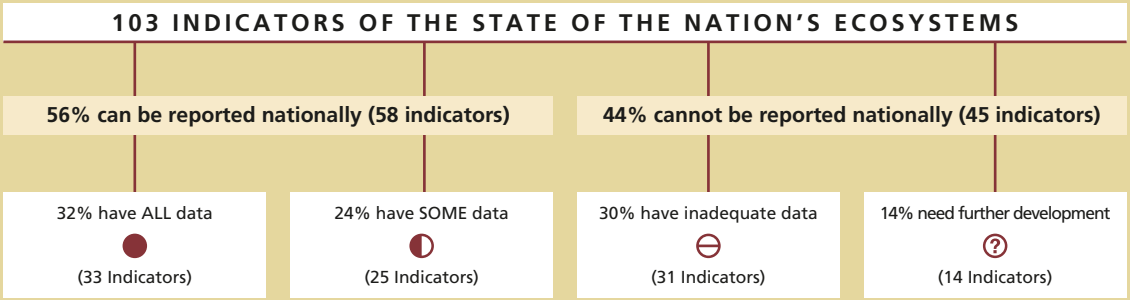
reveal trends. When they were available, we compared data on current conditions with widely accepted reference points, primarily regulatory and related standards and guidelines, while recognizing that there are judgments involved in setting such standards. In many cases, we also provided data on a regional basis, allowing comparisons between regions.

The State of the Data for Reporting on the Nation's Ecosystems

In seeking data, we found a classic case of a glass that is both half empty and half full. In applying the selection criteria outlined above, we found adequate data for more than half of the selected indicators, with trends or other context information on many of these, allowing us to report meaningfully on many aspects of ecosystem condition. However, substantial gaps remain, and until and unless these gaps are filled, Americans will not have access to a complete picture of the "state of the nation's ecosystems." Even with these gaps, however, consistent tracking and reporting of those indicators for which we found adequate data would produce a much more useful picture of the state of the nation's ecosystems than has ever been available.

Our full analysis of data availability and gaps is presented in the Appendix, p. 199. Highlights are summarized in Figure 3.2 and described below.

Figure 3.2. The State of the Data



- This report presents 103 indicators. Data are adequate to support national reporting for 58. Of these, we have all the desired data for 33 indicators (●). Important gaps remain for the other 25 indicators (◐).
- Of the 58 indicators with data, we present trends for 31. For 11 other indicators, we provide comparisons against widely accepted standards, or against undisturbed or "reference" conditions. For the remaining 16 indicators, neither trends nor appropriate reference points were available.
- We provide no data for 45 indicators. For 31 of these, data availability is the only impediment to national reporting. These indicators are clearly marked with a "data not adequate for national reporting" label and with this icon: ⊖.
- For the other 14 indicators for which no data are reported, the problem is more fundamental: a lack of agreement on how the relevant ecosystem characteristic can be measured most meaningfully and effectively. For these indicators, additional work is required in the appropriate scientific communities to build a consensus on the specific measurements that should be reported. Indicators in this category are marked with an "indicator development needed" label and with this icon: ⓘ.
- Data availability varies by ecosystem: about three-fourths of forest indicators have some or all data, contrasting with grasslands and shrublands and urban and suburban areas, where only about 40% have data. Data availability also varies by ecosystem characteristic: more than 80% of the indicators of ecosystem extent, chemical contamination, and the quantities of food, fiber, and water produced in ecosystems have some or all data, while for several characteristics (landscape pattern and fragmentation, biological communities, and recreation and other services), fewer than a third of the selected indicators have adequate data for national reporting.

The State of the Nation's Ecosystems

What follows is a very brief overview of the findings of this report. In it we present highlights of both actual ecosystem conditions and the availability of data and indicators. We have organized this summary according to the ten major aspects of ecosystem condition that form a key part of our reporting framework. These characteristics are identified in Figure 3.1, and are discussed in detail in Chapter 2. The table on pages 28 and 29 shows all indicators included in this report.

While the summary below does not generally provide highlights of indicators for which adequate data are not available, such indicators are just as important as those for which data *are* presented. It is what should be measured that is important, not whether it has been measured yet.

System Dimensions: Extent

The acreage of a particular ecosystem type (or for features like shorelines and rivers, their length) is a basic characteristic of their condition. Gains or losses in the area devoted to different ecosystem types, or in the acreage devoted to particular uses of land, such as wilderness areas or livestock grazing, change the landscape in important ways. Gains or losses within an ecosystem type—for example, conversion from one forest type to another—are also important.

We present 15 indicators of ecosystem extent. For 13 of these indicators, we located either full or partial data. Historical trend data are available for eight of these.

Systems Dimensions: Extent

Core National
- ◐ Ecosystem Extent

Coasts and Oceans
- ◐ Coastal Living Habitats
- ◐ Shoreline Types

Farmlands
- ● Total Cropland
- ● The Farmland Landscape

Forests
- ● Forest Area and Ownership
- ● Forest Types
- ● Forest Management Categories

Fresh Waters
- ◐ Extent of Freshwater Ecosystems
- ◐ Altered Freshwater Ecosystems

Grasslands/Shrublands
- ● Area of Grasslands and Shrublands
- ◐ Land Use

Urban/Suburban
- ● Area of Urban/Suburban Lands
- ⊖ Total Impervious Area
- ? Stream Bank Vegetation

● *Complete data available*
◐ *Partial data available*
⊖ *Data not adequate for national reporting*
? *Indicator development needed*

Highlights: Ecosystem Extent

- Forests and grasslands and shrublands each occupy about a third of the land area of the lower 48 states, and croplands about a quarter; wetlands and urban and suburban areas each occupy a few percent of the total area. See Table 3.1.
- Since European settlement, the area of both forest and grasslands and shrublands has declined by about a third. Each had initially occupied about half of the land area of the lower 48 states.
- Since the 1950s, the area of forests has declined by about 1%, and the area of croplands by about 5%. Nonfederal grassland/shrubland area

Table 3.1. Core National Extent Measurements (lower 48 states)

Ecosystem	Core National Extent Measurements	Area in Millions of Acres	Percent of Land Area[a]	Estimated Presettlement Area (as % of Total Land Area)	Changes from 1950s, Millions of Acres (%)[a]
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

[a] 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.

has decreased since the 1980s by about 3%. The area of urban and suburban lands, although comparatively small, has increased considerably.[1]

- The acreage of wetlands has declined by more than half since European settlement, with both freshwater wetlands and coastal wetlands declining (by 10% and 8%, respectively) since the 1950s, although the rate of loss has slowed in recent decades. There are inadequate data to report on coastal wetlands on the West Coast.
- The acreage of forests that are replanted for future harvest and those in wilderness areas and national parks has increased over the past 50 years. Information on land use in grasslands and shrublands is not available.

System Dimensions: Fragmentation and Landscape Pattern

Scientists agree that the pattern of ecosystems on the landscape affects their condition. For example, whether forests are found in large patches or small, and how these patches intermingle with other ecosystem types within a region, affects their value as habitat for different species and the quantities of other goods and services they provide. However, there remain considerable gaps in scientific understanding about which aspects of the size, shape, and proximity of patches of an ecosystem type matter most in different ecosystems and to different species.

System Dimensions: Fragmentation and Landscape Pattern

Core National
- ? Fragmentation and Landscape Pattern

Farmlands
- ⊖ Fragmentation of Farmland Landscapes by Development
- ⊖ Shape of "Natural" Patches in the Farmland Landscape

Forests
- ◐ Forest Pattern & Fragmentation

Grasslands/Shrublands
- ⊖ Area and Size of Grassland/Shrubland Patches

Urban/Suburban
- ● Patches of Forest, Grasslands/Shrublands, and Wetlands
- ? Suburban/Rural Land Use Change

● Complete data available
◐ Partial data available
⊖ Data not adequate for national reporting
? Indicator development needed

We identified seven indicators of fragmentation and landscape pattern. Data are available for only two of these, and those data are for a single point in time only (i.e., no trends). There is no consensus on what should be measured as a national-level indicator of fragmentation and landscape pattern.

Highlights: Fragmentation and Landscape Patterns

- Landscape pattern and fragmentation are important, but they can be measured in many different ways. No single method has appeared that is "best" for all ecosystems.
- About two-thirds of all points in both eastern and western forests are surrounded by an "immediate neighborhood" (roughly 250-foot radius) that is mostly forested (90% or greater forest cover). About a quarter of all forest points are surrounded by larger (roughly 2½-mile radius) neighborhoods that are mostly forest.
- About half of all natural lands (forests, grasslands and shrublands, wetlands) in urban and suburban areas are in patches smaller than 10 acres.

Chemical and Physical: Nutrients, Carbon, Oxygen—Chemical Building Blocks of Life

Four elements—carbon, oxygen, nitrogen, and phosphorus—play key roles in ecosystems. Nitrogen and phosphorus are important plant nutrients, but human activities sometimes increase their levels to a degree that causes water quality problems. Carbon stored as organic matter in soil improves soil fertility. Moreover, increased storage of carbon in ecosystems can offset emissions of carbon dioxide, of concern because of climate change. Finally, water must have sufficient oxygen if aquatic animals are to survive.

We selected 12 indicators related to nitrogen, phosphorus, carbon, and oxygen. Full or partial data are available for eight of these. For six of these indicators with data, we provide comparisons to regulatory standards or similar benchmarks. For two, we present trend data.

Highlights: Nutrients, Carbon, Oxygen

- The amount of nitrogen carried by major U.S. rivers has increased over recent decades. The amount carried by the Mississippi River, which drains 40% of the lower 48 states, has tripled since the 1950s.
- Farmland streams and groundwater have higher levels of nitrate than those in forests or urban and suburban areas.
- About 20% of groundwater wells and 10% of streams tested in farmland areas exceeded the federal drinking water standard for nitrate.
- Farmland and urban/suburban streams have similar phosphorus levels; both are higher than forest streams.
- At least half of larger rivers in the United States, three-fourths of streams in farmland areas, and two-thirds of urban/suburban streams had phosphorus levels at or exceeding the limit recommended by the Environmental Protection Agency (EPA) for avoiding excess algae growth.
- From the 1950s to the 1990s, carbon stored in trees increased by 80% in the East and remained constant in the West.
- There are inadequate data for national reporting on areas with depleted oxygen in coastal waters.

Chemical and Physical Conditions: Nutrients, Carbon, Oxygen

Core National
- ● Movement of Nitrogen

Coasts and Oceans
- ⊖ Areas with Depleted Oxygen

Farmlands
- ● Nitrate in Farmland Streams and Groundwater
- ● Phosphorus in Farmland Streams
- ⊖ Soil Organic Matter

Forests
- ● Nitrate in Forest Streams
- ◐ Carbon Storage

Fresh Waters
- ◐ Phosphorus in Lakes, Reservoirs, and Large Rivers

Grasslands/Shrublands
- ⊖ Nitrate in Groundwater
- ⊖ Carbon Storage

Urban/Suburban
- ● Nitrate in Urban/Suburban Streams
- ● Phosphorus in Urban/Suburban Streams

● Complete data available
◐ Partial data available
⊖ Data not adequate for national reporting
? Indicator development needed

Chemical and Physical: Chemical Contaminants

Our indicators of chemical contamination generally present two aspects of this issue. First, we report the number of contaminants detected in streams, groundwater, sediments, or fish tissue, which provides a perspective on how widespread such chemicals are. However, because the presence of contaminants does not necessarily mean that levels are high enough to cause problems, we also report on how frequently regulatory and other guidelines or standards are exceeded. See Table 3.2 for a summary of findings.

Table 3.2. Summary of Findings of Contaminants Indicators

	Percent with One or More Contaminants Detected	Percent with One or More Contaminants Exceeding Aquatic Life Guidelines[a]	Percent with One or More Contaminants Exceeding Human Health Guidelines
Streams			
All	100%	77%	13%
Farmlands (pesticides only)	100%	84%	4%
Urban/Suburban	100%	100%	5%
Groundwater			
All	90%	Not applicable	26%
Farmlands (pesticides only)	61%	Not applicable	Less than 1%
Stream Sediments	99%	48%	Not applicable
Freshwater Fish	94%	50%	Data Not Available
Coastal Sediments (estuary data only)	100%	60%	N/A
Coastal Fish	Data Not Available	Data Not Available	Data Not Available

[a] For fish, guidelines used refer to fish-eating wildlife, such as eagles and other predatory birds. For coastal sediments, the figure presented here (60%) includes sediments with concentrations exceeding guidelines for possible harmful effects (19% with 1-4 such contaminants; 39% with 5 or more such contaminants), as well as those whose contaminant levels exceed guidelines for probable effects (2%).

Note: The data presented here reflect testing for different chemicals in different environmental media—some compounds typically are found in stream water, for example, but not in sediments. Tested contaminants include many pesticides, selected degradation products, polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), volatile organic compounds, other industrial contaminants, trace elements, nitrate, and ammonium. See the technical note for the national contaminants indicator, p. 210, for details.

Chemical and Physical Conditions: Contaminants

Core National
◐ Chemical Contaminants

Coasts and Oceans
◐ Contamination in Bottom Sediments

Farmlands
● Pesticides in Farmland Streams and Groundwater

Fresh Waters
See the core national, farmlands, and urban/suburban indicators.

Urban/Suburban
● Air Quality
◐ Chemical Contamination

● *Complete data available*
◐ *Partial data available*
⊖ *Data not adequate for national reporting*
? *Indicator development needed*

We present five indicators of chemical contamination. All have at least partial data, and all include some comparison to regulatory standards or similar benchmarks. Trend data are available for only one indicator.

Highlights: Chemical Contaminants

- All or almost all streams, groundwater, sediments (stream and estuarine), and freshwater fish sampled have at least one contaminant at detectable levels.
- Thirteen percent of streams and 26% of groundwater tested had at least one contaminant at a concentration that exceeded human health standards. (Farmland streams and groundwater show fewer exceedances, but these data cover only pesticides.)
- Guidelines for protection of aquatic life are exceeded more often than are human health standards. Half or more of the streams, freshwater fish, and coastal sediments had at least one contaminant that exceeded aquatic life guidelines.

Chemical and Physical: Physical Conditions

The physical makeup and condition of an ecosystem is critical to its functioning. For example, ocean temperature determines what kind of fish and other aquatic animals will live or thrive in an area, the depth to groundwater influences the ability of plants to survive, and the degree of erosion affects both soil quality in farmlands and the degree of off-farm impacts from sedimentation. Because these physical conditions are different for different ecosystems, we include a wide variety of indicators of key physical conditions.

Chemical and Physical Conditions: Physical

Coasts and Oceans
⊖ Coastal Erosion
● Sea Surface Temperature

Farmlands
● Soil Erosion
⊖ Soil Salinity

Fresh Waters
● Changing Stream Flows
⊖ Water Clarity

Grasslands/Shrublands
● Number and Duration of Dry Periods in Streams and Rivers
⊖ Depths to Shallow Water

Urban/Suburban
? Urban Heat Island

● *Complete data available*
◐ *Partial data available*
⊖ *Data not adequate for national reporting*
? *Indicator development needed*

We selected nine indicators of physical conditions. Adequate data for national reporting, including time trends, were available for four of these.

Highlights: Physical Conditions

- Since 1982, the area of cropland with high potential for wind erosion decreased by one-third (to 63 million acres, or 15% of croplands); the area with high potential for water erosion also dropped by a third, to 89 million acres (22% of croplands).
- The number of streams or rivers with major changes in flow compared to a 1930–1949 reference period increased slightly from the 1970s to 1990, to 60%. Streams with high flows well above the 1930–1949 reference period increased markedly after the 1980s, to about 30% of streams. Changes in low flows were more modest.
- Compared to the 1950s and 1960s, fewer grassland/shrubland streams have at least one day with no flow (about 15% in the 1990s), and when no-flow periods occur, they are generally shorter.
- While data are available for sea surface temperature, no trends (either warming or cooling) are evident.

Biological Components: Plants and Animals

Individual species of plants and animals are fundamental building blocks of ecosystems. Species-oriented indicators in this report include those focusing on the percentage of species in particular areas or

ecosystems that are at risk of extinction; the degree to which non-native species are gaining a foothold and spreading; and the frequency of unusual mortality events among selected groups of species.

Sixteen indicators relate to plant and animal species, and complete or partial data are available for eight. Three indicators have sufficient data to report trends.

Highlights: Plants and Animals

- 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. However, because the number of at-risk species is affected both by the number of naturally rare species and by a variety of human activities, it is difficult to interpret these data without information on trends in the number of at-risk species. Trend information is not currently available.
- When species ranked as "vulnerable" are included, about a third of all plant and animal species are "at risk." The degree of risk for "at risk" species varies considerably, from those species at relatively low risk, to those that are in imminent danger of extinction.
- About 20% of native freshwater animal species are ranked as "imperiled," as are 9% of forest and grassland/shrubland animals. An ecosystem with a larger percentage of at-risk species does not necessarily have a larger percentage of species that are declining, because some ecosystems have more naturally rare species. Again, it is difficult to interpret these numbers without information on trends, which is not available.
- The only national data on non-native species are for birds and freshwater fish. Only 1% of the 350 major watersheds in the U.S. have no non-native fish; almost two-thirds have between 1 and 10 non-native fish, and the rest have more. In grassland and shrubland areas, populations of invasive and native, non-invasive bird species were changing in about the same proportion for most of the past 35 years.
- About 20% fewer incidents of unusual waterfowl mortality occurred in 1990–1995 than in the previous two 5-year periods. Particularly large mortality events for marine mammals occurred in 1992 (more than 2500 sea lions) and 1999 (215 harbor porpoises and 270 gray whales).

Biological Components: Plants & Animals

Core National
- ◐ At-Risk Native Species

Coasts and Oceans
- ⊖ At-Risk Marine Species
- ? Non-native Species
- ◐ Unusual Marine Mortalities

Farmlands
- ? Status of Animal Species in Farmlands Areas
- ? Native Vegetation in Areas Dominated by Croplands

Forests
- ◐ At-Risk Native Species
- ⊖ Area Covered by Non-native Plants

Fresh Waters
- ◐ At-Risk Native Species
- ◐ Non-native Species
- ◐ Animal Deaths and Deformities

Grasslands/Shrublands
- ◐ At-Risk Native Species
- ⊖ Non-native Plant Cover
- ● Population Trends in Invasive and Non-invasive Birds

Urban/Suburban
- ⊖ Species Status
- ⊖ Disruptive Species

● *Complete data available*
◐ *Partial data available*
⊖ *Data not adequate for national reporting*
? *Indicator development needed*

Biological Components: Communities

Biological communities are the more-or-less stable groupings of plants and animals found in particular habitats. These interacting communities form the biological "neighborhood" within which individual species exist, and their condition reflects a broad array of influences on an ecosystem. As with the indicators of physical condition, indicators of biological community condition differ greatly among ecosystems.

Fifteen indicators describe the condition of biological communities. All or partial data are available for only four of the 15 indicators, and trends for only one. Six indicators lack adequate national data, and five of the indicators require additional development.

Biological Components: Communities

Core National
- ? Condition of Plant and Animal Communities

Coasts and Oceans
- ? Harmful Algal Blooms
- ◐ Condition of Bottom-Dwelling Animals

Farmlands
- ⊖ Soil Biological Condition
- ? Stream Habitat Quality

Forests
- ◐ Forest Age
- ● Forest Disturbance: Fire, Insects, and Disease
- ⊖ Fire Frequency
- ⊖ Forest Community Types with Significantly Reduced Area

Fresh Waters
- ⊖ Status of Freshwater Animal Communities
- ◐ At-Risk Freshwater Plant Communities
- ? Stream Habitat Quality

Grasslands/Shrublands
- ⊖ Fire Frequency
- ? Riparian Condition

Urban/Suburban
- ⊖ Status of Animal Communities in Urban/Suburban Streams

● *Complete data available*
◐ *Partial data available*
⊖ *Data not adequate for national reporting*
? *Indicator development needed*

Biological Components: Ecological Productivity

Core National
- ● Plant Growth Index

Coasts and Oceans
- ◐ Chlorophyll Concentrations

● *Complete data available*
◐ *Partial data available*
⊖ *Data not adequate for national reporting*
? *Indicator development needed*

Highlights: Communities

- At least half of the estuary area in the Mid-Atlantic, South Atlantic, and Gulf of Mexico regions has bottom-dwelling animal communities that are "undegraded," compared to an undisturbed site; about one-fifth has "degraded" bottom-dwelling animal communities. Data are not available for other regions.
- About 65% of eastern timberlands and 30% of western timberlands are less than 60 years old. About 5% of eastern timberlands and 35% of those in the West are 100 or more years old. (Data for the roughly one-third of forests that are not classified as "timberlands" are not yet available.)
- Since 1980, wildfires in both forests and grasslands and shrublands have affected between 2 and 7 million acres per year, down from a high of 52 million acres in 1930. (While national data do not show an overall increase in acreage burned over the past 20 years, data from national forests, which are mostly in the West, do show an increase.) Insect damage in forests affected between 8 and 46 million acres per year over the past 20 years; the overall trend is downward.
- About 12% of freshwater wetland plant community types are considered at very high risk of being eliminated, and a total of 60% are considered to be at risk of elimination.

Biological Components: Ecological Productivity

The amount of plant growth in an ecosystem is a direct measure of the amount of energy (from the sun) entering the ecosystem and thus of the amount of energy available to all organisms in the system.

This report includes two related indicators: one measures the solar energy captured by plants across the United States, which is closely related to the amount of plant growth, while the other reports on the concentration of chlorophyll in coastal waters, a measure of growth of algae. Data are available for both.

Highlights: Ecological Productivity

- For plant growth nationwide, no overall upward or downward trends are apparent over the 11-year period for which data are available. However, there is large year-to-year variation, both regionally and by ecosystem type.
- Data on coastal chlorophyll concentrations are available for only three years, which is too short to determine trends.

Human Uses: Production of Food and Fiber and Use of Water

Ecosystems produce goods that meet a variety of societal demands. In this report, we include 13 indicators of major ecosystem-related commodities. Most of these indicators describe the goods society derives from ecosystems; several also provide information on the ability of the system to continue producing those goods. Data, including trends, are available for ten of these indicators.

Highlights: Production of Food and Fiber and Use of Water

- Agricultural production has increased by about 85% since the 1950s, although there were noticeable fluctuations within the overall increasing trend.
- Per-acre yields of the major crops grown in the United States have increased dramatically over the past 50 years. For all five major crops (corn, wheat, soybeans, hay, and cotton), the increase in yield was close to, or greater than, 100%, with corn yields increasing almost fourfold. The amount of key inputs required to produce a unit of farm output—with the exception of pesticides—has decreased; pesticide inputs have leveled off since 1980.
- Timber harvest is about 40% higher than it was during the 1950s, but it is lower now than at its peak in the 1980s.
- Annual timber growth in both the East and West regions exceeds harvest on both public and private timberlands. This has been largely true for the past 50 years. Private lands account for almost 90% of total harvest.
- Freshwater withdrawals for various human uses increased nearly 60% from 1960 to 1980, when they dropped sharply, followed by a gradual increase.
- The number of human disease outbreaks attributable to contaminated drinking water has declined significantly overall since the mid-1970s; during the same period, the number of outbreaks associated with recreational contact increased significantly. Since 1990, there have been fewer than 20 outbreaks per year in each category.
- Marine fish landings grew by about 10% from the mid-1970s, when reliable data became available, to the mid-1990s. Recent declines mean that current levels are about equal to those of the late 1970s.
- Nationally, from 1981 to the present, about 40% of fish stocks with known population status had decreasing population trends, while about 20% had increasing trends. Population trends are not known for about three-quarters of commercially important stocks.
- The number of range-fed cattle decreased slightly during the 1990s, to about 93 million animals.

Human Uses: Food, Fiber, & Water

Core National
- ● Production of Food and Fiber and Water Withdrawals

Coasts and Oceans
- ● Commercial Fish and Shellfish Landings
- ◐ Status of Commercially Important Fish Stocks
- ⊖ Selected Contaminants in Fish and Shellfish

Farmlands
- ● Major Crop Yields
- ● Agricultural Inputs and Outputs
- ● Monetary Value of Agricultural Production

Forests
- ● Timber Harvest
- ● Timber Growth and Harvest

Fresh Waters
- ● Water Withdrawals
- ⊖ Groundwater Levels
- ● Waterborne Human Disease Outbreaks

Grasslands/Shrublands
- ● Production of Cattle

● *Complete data available*
◐ *Partial data available*
⊖ *Data not adequate for national reporting*
? *Indicator development needed*

Human Uses: Recreation and Other Services

Ecosystems provide "services" to people, such as soil building, plant pollination, natural flood control, and the like, as well as outdoor recreation. We defined nine indicators in this category, seven of which deal with either the number of days of recreational activity or the quality or availability of recreational resources. Data are inadequate for national reporting on all but one of these indicators; partial data, with no trends, are available for one indicator, and two require further development before data availability can be assessed.

While there have been efforts to characterize and measure ecosystem services, there is currently little agreement on how such characteristics measures should be defined, and no national data on conditions or trends. We therefore identify, in two instances, the need for indicators of ecosystem services, but recognize that these indicators require additional development.

Human Uses: Recreation and other Services

Core National
- ◐ Outdoor Recreation
- ? Natural Ecosystem Services

Coasts and Oceans
- ⊖ Recreational Water Quality

Farmlands
- ⊖ Recreation on Farmlands

Forests
- ⊖ Recreation in Forests

Fresh Waters
- ⊖ Freshwater Recreation Activities

Grasslands/Shrublands
- ⊖ Recreation on Grasslands and Shrublands

Urban/Suburban
- ⊖ Publicly Accessible Open Space per Resident
- ? Natural Ecosystem Services

● *Complete data available*
◐ *Partial data available*
⊖ *Data not adequate for national reporting*
? *Indicator development needed*

Highlights: Recreation and Other Services

- "Fitness activities," such as walking and biking, and nature viewing—each with more than 10 billion "recreation days" per year—are by far the most common outdoor recreation activity for which information is available. Swimming and beachgoing, which together account for about 5 billion recreation days, is the next most popular activity.
- It is not possible to report on the amount of recreation taking place in specific ecosystem types, like forest or grasslands/shrublands. For most recreational activities, it is not possible to distinguish freshwater activities from saltwater.
- Indicators of ecosystem services, such as soil building and pollination, require additional development.

Notes

1. We estimated urban/suburban land area using a satellite-based method that does not allow for comparison with previous estimates. However, data from the Economic Research Service (see the core national extent indicator, p. 40) indicate that the area of urban lands has grown by more than 300% since the 1950s. Also, as noted below, the USDA Natural Resources Inventory showed substantial increases in nonfederal developed lands from 1982 to 1997.