



Chapter 6:

Indicators of the Condition and Use of Farmlands

America's farmlands are part of a larger "farmland landscape," a landscape they both define and are defined by. The farmland landscape includes fields and orchards, pastures and vineyards, which we refer to as "croplands." It also includes the hedgerows, streams, ponds, wetlands, prairies, and woodlots that enliven an agricultural setting, as well as lands set aside under government programs. All over the nation, from the endless wheatfields of the Midwest to the picturesque dairy farms of Pennsylvania Dutch country to the avocado groves of California, the farmland landscape provides Americans, and the world, with an abundance of food and fiber, along with an image of beauty and order that figures large in the American imagination.

What can we say about the condition and use of U.S. farmlands?

Eighteen indicators describe the condition and use of farmlands in the United States. Full data are available for nine of these indicators, a larger percentage than for any other ecosystem type. Five of these nine have a long enough data record from which to judge trends, and three can be compared to a regulatory standard or similar benchmark. For six indicators, we report no data, and three measures require additional refinement or other development before data availability can be assessed.

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 page 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 goods and services that we obtain from farmlands depend on both the acreage of land producing crops and other farm products and the acreage and pattern of the forests, grasslands, and urban areas mixed within the farmland landscape. Four key indicators describe the dimensions of the farmland system.

- **How much land is used directly for production of crops and livestock?** Croplands, including pasture and haylands, cover between 430 and 500 million acres (estimates from different agencies vary), or about a quarter of the land area of the United States (excluding Alaska) in 1997. Cropland acreage has declined since the 1950s, but because official estimates vary, it is difficult to determine exactly how much farmland has been converted to other uses.
- **How much of the farmland landscape is forest, grassland or shrubland, wetlands, or developed land?** Some noncropland areas provide wildlife habitat or serve as streamside buffers or windbreaks, and all these areas add to the visual character of the farmland landscape. In all regions but the Midwest, croplands make up 50–60% of the farmland landscape; the remainder is forest, wetlands, or grasslands and shrublands. In the Midwest, croplands make up about 75% of the farmland landscape.
- **How intermingled are croplands and urban and suburban development?** Increased development in farming areas can interfere with traditional farming practices and may make farming economically unviable. For example, new residents are often opposed to long-standing farming practices like field application of manure, and rising property values, and property taxes, may drive farmers out of business. Data are not adequate for national reporting on this indicator.

- **How much of the “natural” area in farmlands is in patches of different shapes?** The size and shape of these “natural” patches help determine the ecological services they provide, including erosion control and wildlife habitat. Data are not adequate for national reporting on this indicator.

Chemical and Physical Condition

Six indicators describe the chemical and physical condition of farmlands, three that characterize farmland streams and groundwater and three that tell us the state of the soil. (We complement these measures with two biological indicators related to water and soil—see Biological Components, below.)

To describe the condition of farmland streams and groundwater, we include measures of pesticides, and of nitrate and phosphorus—two important nutrients that, if present in excess, can cause problems. An indicator measuring the quality of stream habitat complements these measures (see Biological Components, below). To characterize the suitability of soils for growing crops, our indicators track changes in soil organic matter, in the potential of the soil to erode by wind and water, and in soil salinity. A complementary indicator describes the microscopic animals in cropland soils (see Biological Components, below).

- **How much nitrate is there in farmland streams and groundwater?** High levels of nitrate in drinking water—especially untreated well water—are a human health concern, and nitrate from the nation’s rivers contributes to algal blooms in coastal waters. About 20% of the groundwater wells and 10% of the stream sites tested had nitrate concentrations that exceeded federal drinking water standards. Monitored streams and groundwater in farmland regions have higher concentrations of nitrate than those in urban and suburban or forested areas.
- **How much phosphorus is there in farmland streams?** About three-fourths of farmland stream sites had phosphorus concentrations that exceeded the level recommended by the Environmental Protection Agency to protect against excess algae growth. Concentrations of phosphorus in monitored farmland streams were similar to those in urban/suburban streams, and much higher concentrations than streams in forested areas.
- **How many pesticides are found in farmland streams and groundwater, and how often do they exceed federal standards and guidelines?** Eighty-three percent of monitored streams in farmland areas had at least one pesticide whose concentration exceeded aquatic life guidelines; 4% had at least one compound that exceeded human health standards or guidelines. All streams had at least one pesticide at detectable levels throughout the year, and 75% had an average of five or more. Fewer than 1% of groundwater sites in farmland areas had pesticides in concentrations that exceeded human health standards, and 40% of groundwater sites had no detectable pesticides.
- **How much organic matter is there in cropland soils?** Organic matter improves the ability of soils to hold water, provides nutrients for crops, reduces erosion, and can help to support soil microorganisms. Data are not adequate for national reporting on this indicator.
- **How much cropland is subject to erosion by wind or water?** From 1982 to 1997, the acreage of U.S. farmland with the greatest potential for wind erosion decreased by nearly a third, to about 63 million acres, or about 15% of U.S. croplands. The area with the greatest potential for water erosion also decreased by nearly a third, to 89 million acres, or about 22% of U.S. croplands.
- **How much cropland soil has high salt levels?** High-salinity soils, which typically result from irrigation in arid climates, can reduce the ability of soils to support plant growth. Data are not adequate for national reporting on this indicator.



Biological Components

Four indicators describe the biological condition of farmlands. Continuing from the three soil indicators noted above, the first biological indicator measures the condition of microscopic animals in cropland soils. The second indicator focuses on the wildlife that live in the farmland landscape, a third reports on native and non-native plants in those parts of the farmland landscape that are not used for production, and a fourth measures stream habitat quality—the sediments in the streambed, the stability of stream banks, and similar physical attributes. The latter three indicators require additional development.

- **What is the condition of the microscopic animal communities in cropland soils?** The condition of nematodes (roundworms) in the soil is a good indicator of overall soil condition. Data are not adequate for national reporting on this indicator.
- **What is the condition of wildlife in areas that are heavily dominated by farmlands?** Additional work is necessary to develop an indicator that describes the condition of species that prosper in the farmland landscape and of those that depend on the kind of habitat that existed before conversion to agriculture.
- **In areas that are heavily dominated by croplands, is most of the remaining noncropland vegetation native or non-native?** Non-native vegetation often provides less suitable wildlife habitat. This indicator requires further development.
- **What is the quality of the habitat in streams in farmland regions?** Stream habitat quality often reflects the effects of activities, including farming practices, in the watershed. This indicator requires further development.

Human Use

Four indicators measure the human use of farmlands. Three focus on aspects of production: the first tracks changes in the yield per acre for five major crops; the second tallies total agricultural output and changes in the inputs, such as fertilizer and labor, used to produce farm goods; and the third focuses on the dollar value of farm sales, which depends on both the amount of goods produced and the prices farmers receive. The fourth indicator focuses on another human use of farmlands, recreation.

- **How has the per-acre yield of major crops changed over time?** Since 1950, per-acre yields of corn, wheat, and cotton have more than doubled, with corn yield increasing almost fourfold. Of major crops, soybean yields went up the least, but still nearly doubled.
- **How have farm output and the inputs (pesticides, fertilizers, labor, land, etc.) needed to produce that output changed over time?** U.S. agricultural output has been increasing steadily since 1950, while the major inputs required to produce a unit of output—with the exception of pesticides—have decreased. Pesticide use has leveled off since 1980.
- **What is the value of the nation's production of crops and livestock?** The gross value of agricultural output (adjusted for inflation) was about \$180 billion in 1999, or about 10% more than in 1950. Over the past half-century, however, there have been major fluctuations, from a low of \$140 billion in 1959 to a high of about \$260 billion in 1973. Livestock sales have consistently accounted for about half of all agricultural value.
- **How much recreation takes place on farmlands?** A considerable amount of recreation takes place on farmlands—hunting and fishing, for example—and some farmers depend on income from such activities. Data are not adequate to report nationally on this indicator.

What do we mean by “farmlands” or the “farmland landscape”?

Lands used for production of annual and perennial crops and livestock—croplands—are the heart of the farmland ecosystem. However, croplands are found within a larger landscape that includes field borders and windbreaks, small woodlots, grassland or shrubland areas, wetlands, farmsteads, small villages and other built-up areas, set-aside lands, and similar areas not used for production. This overall landscape is referred to as the *farmland landscape* in this report. Some indicators describe the condition of cropped lands, while some describe the more broadly defined farmland landscape.

In general, we have excluded lands enrolled under the Conservation Reserve Program from the estimates presented here for croplands; these lands are included, however, in indicators dealing with the larger farmland landscape. In addition, lands used for intensive animal raising or feeding, often called feedlots or confined animal feeding operations, are clearly a part of the overall agricultural landscape, and some of these areas are included in the estimates of cropland that we present. However, it is also likely that some, located in otherwise nonagricultural settings and not owned by farmers/producers, are not included. The acreage involved is believed to be negligible compared to other types of cropland.

The farmland landscape inevitably overlaps with other ecosystems. Most notably, pastures are considered “croplands,” since they are clearly part of farming operations. They are also considered part of the grasslands/shrublands ecosystem, since they are grass-covered (perhaps with scattered trees or shrubs) and thus provide some of the services and values and share many characteristics of that ecosystem. (The fact that some farmers harvest hay from native prairies further blurs the distinction between these two ecosystems.) In addition, by defining the farmland landscape to include noncropland areas surrounding and intermingled with croplands, we obviously incorporate lands covered with forest, grassland or shrubland, wetlands, and suburban development.

The production of livestock is clearly an agricultural activity, but not all land used for livestock production is considered as part of the farmland landscape. For example, while pastures are included as croplands, many cattle spend significant portions of their lives grazing on grasslands or shrublands that are not subject to significant management and that we report as grasslands / shrublands, not croplands.

Clearly, distinguishing between these lands is at times difficult.

Map 6.1. Natural Resources Conservation Service Regions



A Note about Regions

One indicator (Farmland Landscape, p. 92) in this section presents data using the USDA Natural Resources Conservation Service (NRCS) regions (see Map 6.1). The data presented in the indicator do not include Alaska and Hawaii, but, when such data become available, these two states will be included. Two indicators (Soil Erosion and Monetary Value of Agricultural Production, pp. 100 and 108) present their data using maps at a finer scale of resolution.

If data were available, several indicators—

Fragmentation of Farmlands Landscapes by Development; Size and Shape of “Natural” Patches in the Farmland Landscape; Soil Organic Matter; Soil Salinity; and Soil Biological Condition—would also be presented using the NRCS regions.