United States Department of Agriculture

RCA Appraisal

Soil and Water Resources Conservation Act

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CHAPTER 3

The State of the Land

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Agriculture has been described as a "leaky" system. That is, some tradeoffs are unavoidable among the competing demands that we place upon our farmers, ranchers, and forest landowners: To produce food, feed, fiber, and fuel for consumption in the United States and for export; to provide habitat for wildlife; to provide scenic vistas and recreational opportunities; and to do all of these things and more with minimal environmental impact.

More than two-thirds of the land in the conterminous 48 States is in private farms, ranches, and forests. The stewardship of these lands is closely linked to the quality of our environment. Farmers, ranchers, and forest landowners have made great strides in protecting the Nation's natural resource base, but maintaining these gains requires a continuing commitment to assessing and addressing important natural resource issues and concerns. This chapter provides an overview of the natural resource conditions and trends on U.S. agricultural and forest lands.

Soil health

Healthy land begins with healthy soils. Metrics for soil health include soil erosion, soil salinity, and soil carbon, which are affected by natural soil and site conditions, and by management. Healthy soils support—

- **Clean water** by transforming harmful substances and chemicals to nontoxic forms, cycling nutrients, and partitioning rainfall to keep sediment, nutrients, and pesticides out of lakes and streams;
- **Clean air** by keeping dust particles out of the air and storing carbon from the atmosphere; and
- **Healthy plant growth** by storing nutrients and water and providing structural support through a receptive rooting medium.

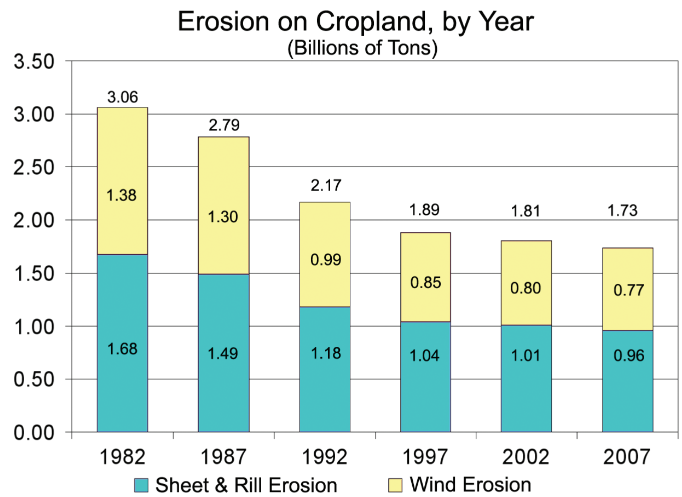
Soil erosion on cropland

Farmers reduced total cropland erosion by 43 percent between 1982 and 2007 (USDA-NRCS 2009) (fig. 3-1). Total sheet and rill erosion on cropland declined from 1.68 billion tons per year to 960 million tons per year, and erosion due to wind declined from 1.38 billion tons per year to 765 million tons per year.

On a per-acre basis over the 25-year period 1982 to 2007, average annual sheet and rill erosion rates on cropland declined more than 30 percent, from 4.0 tons per acre per year in 1982 to 2.7 tons per acre per year in 2007. Wind erosion rates dropped from 3.3 to 2.1 tons per acre per year during the same period. The bulk of the reductions occurred

Figure 3-1.

Trends in cropland erosion, conterminous 48 States, 1982–2007



Cropland includes cultivated and non-cultivated cropland.

Source: 2007 National Resources Inventory, Natural Resources Conservation Service, USDA

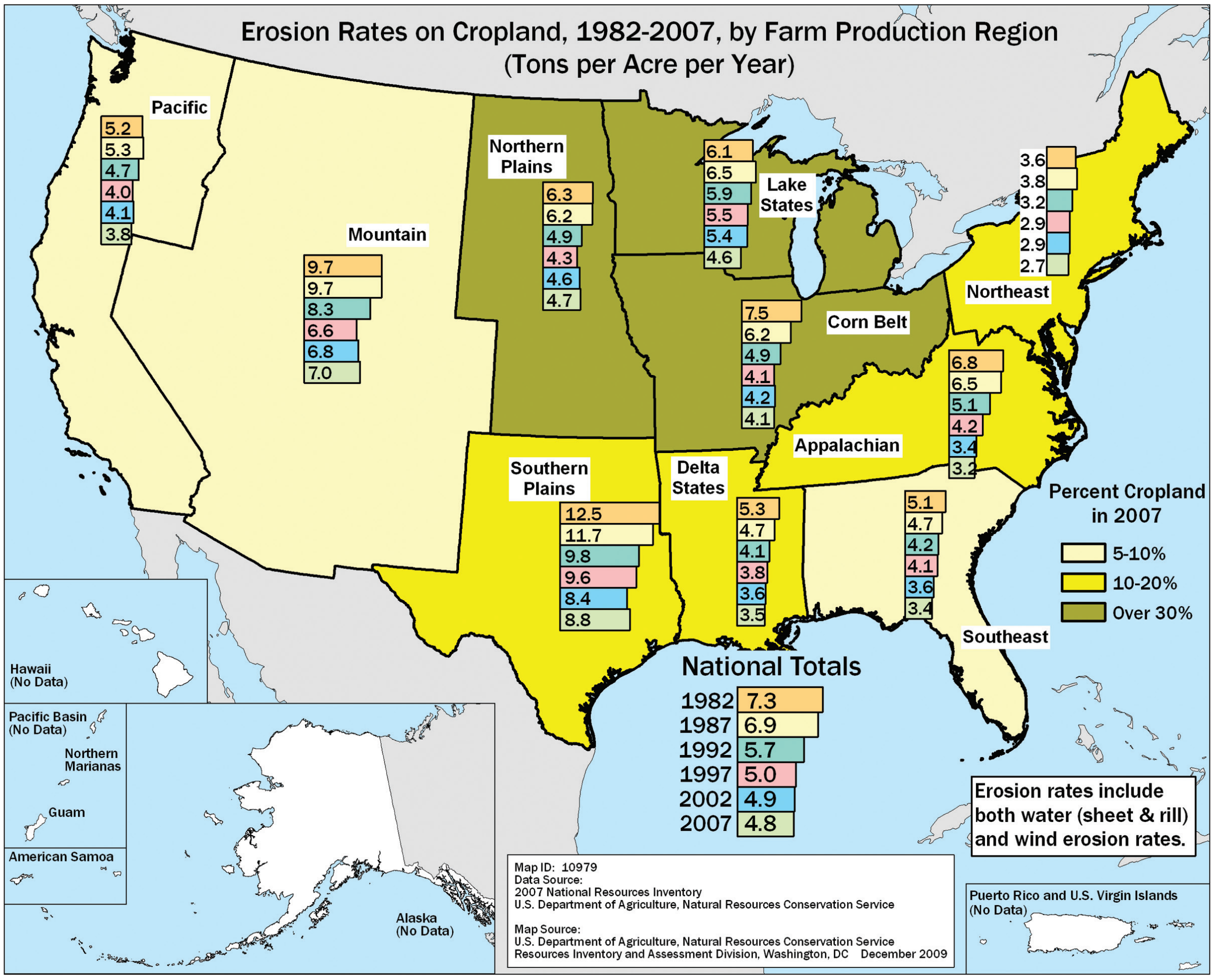
in the decade following implementation of the Conservation Reserve Program (CRP), conservation compliance, and other provisions of the Food Security Act of 1985. As a result of this Act, farmers retired much of the most highly erodible cropland and applied additional conservation practices on vulnerable cropland. Although the rate of decrease in soil erosion has slowed since 1997, the general downward trend in sheet and rill erosion and wind erosion continued through 2007.

Soil erosion on cropland is concentrated geographically because of the combined effects of climate, soil characteristics, landscape features, and cropping and land management practices (fig. 3-2). Fifty-four percent of total sheet and rill erosion occurs in two of the 10 farm production regions—the Corn Belt and the Northern Plains—where crop production is most intense. Most of the wind erosion occurs in regions where the soils are typically dry, vegetation is sparse, and winds are strong.

Natural soil formation processes replace a certain amount of soil lost through erosion. Excessive erosion is that share of erosion above the soil loss tolerance level (T), the maximum rate of annual soil erosion that will permit crop productivity to be sustained economically and indefinitely. Excessively eroding cropland soils are concentrated primarily

Figure 3-2.

Erosion rates on cropland, by farm production region, 1982–2007



Source: 2007 National Resources Inventory, Natural Resources Conservation Service, USDA

The many forms of soil erosion

Soil erosion is a natural geologic process that involves the breakdown, detachment, transport, and redistribution of soil particles by water, wind, or gravity. Water erosion occurs when the combined power of rainfall energy and overland flow overcome the resistance of soil particles to detachment. Although some soil erosion supports natural ecologic functions, excessive erosion can reduce the productive capacity of the land, impair the quality of water and air, and cause other onsite and offsite problems.

Sheet and rill erosion occurs when rainfall and water runoff initially remove a fairly uniform layer, or sheet, of soil from the surface of the land. Eventually, small channels, or rills, form as rainwater collects and flows over an unprotected soil surface.

Concentrated-flow erosion can follow sheet and rill erosion. Rills can enlarge and deepen into small channels that, when filled with sediment from adjacent land, are called **ephemeral gullies**. If the channels continue to enlarge and are not filled in with material from adjacent land, a condition known as **classic gully erosion** develops.

Another form of concentrated-flow erosion is **streambank erosion**, which often stems from unchecked sheet and rill or gully erosion in uplands and the absence of streamside vegetation.

Irrigation-induced erosion results from sprinkler or surface irrigation for agricultural production. It can take the form of sheet and rill or concentrated-flow erosion.

Wind erosion also removes soil and in extreme cases can generate dust storms that cause significant health and property damage, reduce visibility, and close highways.

Water erosion data from the National Resources Inventory include only sheet and rill erosion and do not consider concentrated flow erosion or streambank erosion.

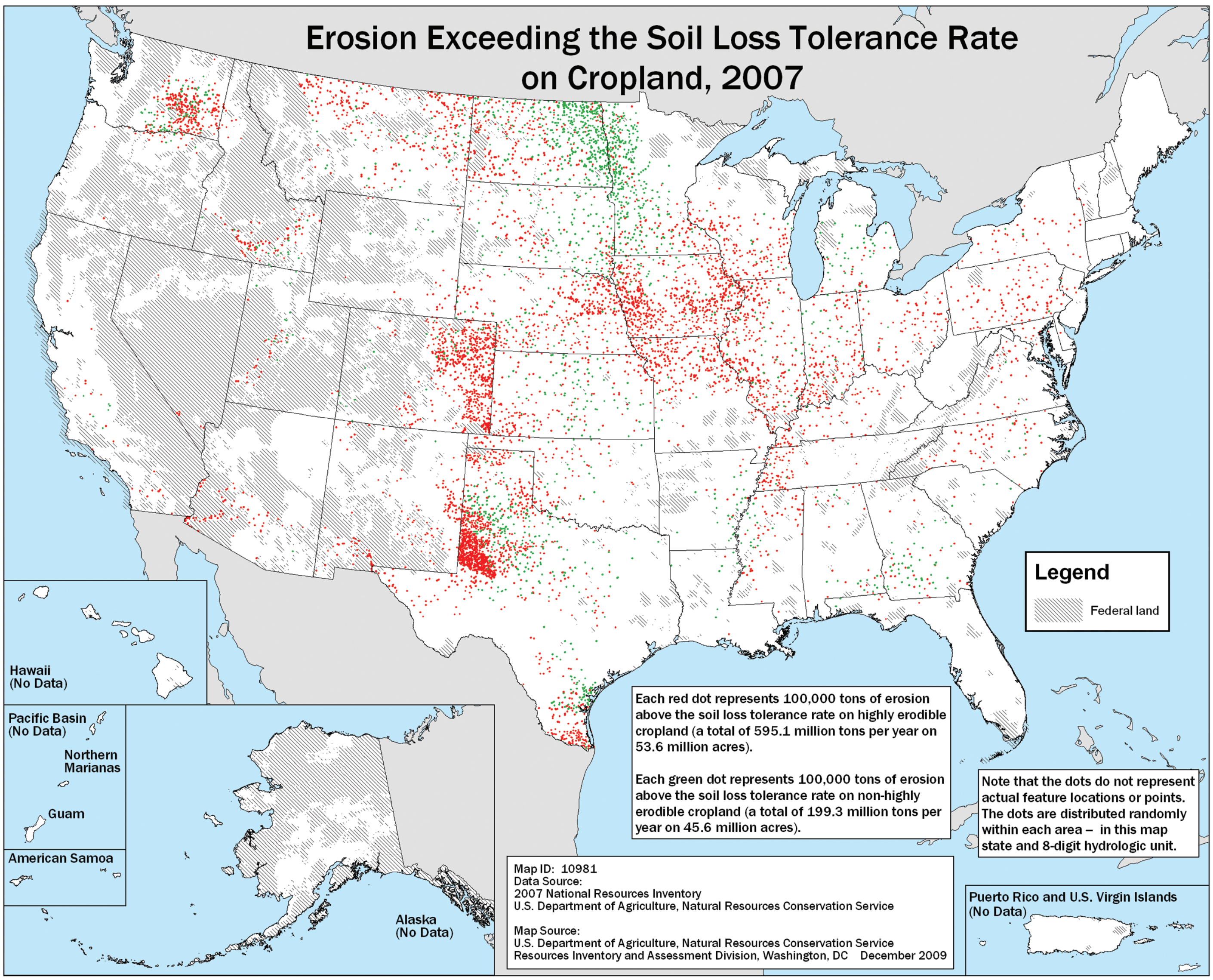
in the Great Plains, the Corn Belt, the Lake States, and the Palouse area of Washington State (fig. 3-3).

Figures 3-4, 3-5, and 3-6 show that throughout the period 1982 to 2007 most excessive cropland erosion occurred on highly erodible cropland.

- Figure 3-4 shows that the proportion of non-highly erodible cropland acres eroding above T decreased gradually from 29 percent in 1982 to 18 percent in 2007. There were about 294 million acres of non-highly erodible cropland in 1982, compared to 259 million acres in 2007—a decrease of 12 percent over the period.
- Figure 3-5 shows that the proportion of highly erodible cropland acres eroding above T also decreased, from 67 percent in 1982 to 55 percent in 2007. Additionally, the acreage of highly erodible cropland decreased by 22 percent, from 125 million acres in 1982 to 98 million acres in 2007, as these lands were enrolled in CRP or converted to other land uses.
- Figure 3-6 shows that although total erosion on highly erodible and non-highly erodible cropland had declined by 2007, the bulk of the erosion still occurred on the highly erodible cropland. Highly erodible cropland made up 30 percent of all U.S. cropland in 1982 but contributed 57 percent of total cropland erosion; 76 percent of total erosion on highly erodible cropland was above T. In 2007, highly erodible cropland contributed 52 percent of total cropland erosion on only 27 percent of the cropland; 66 percent of total erosion on highly erodible cropland was above T.

Figure 3-3.

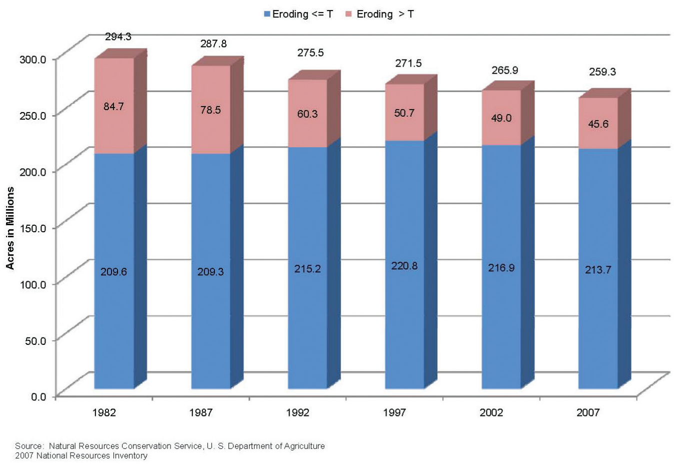
Erosion exceeding the soil loss tolerance rate on cropland, conterminous 48 States, 2007



Source: 2007 National Resources Inventory, Natural Resources Conservation Service, USDA

Figure 3-4.

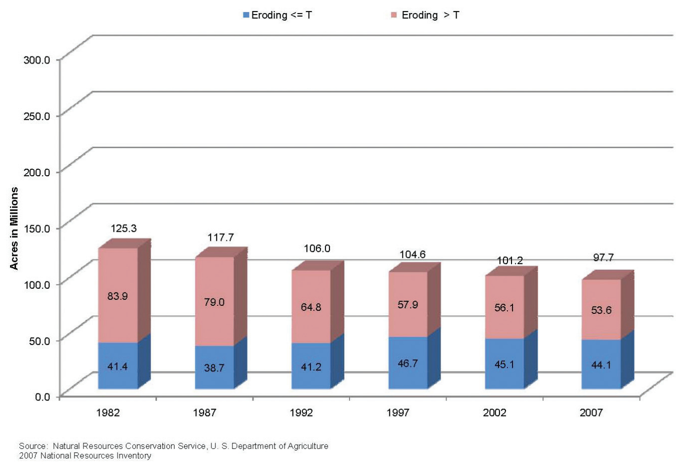
Non-highly erodible cropland & erosion relative to the tolerable erosion rate (T)



Source: 2007 National Resources Inventory, Natural Resources Conservation Service, USDA

Figure 3-5.

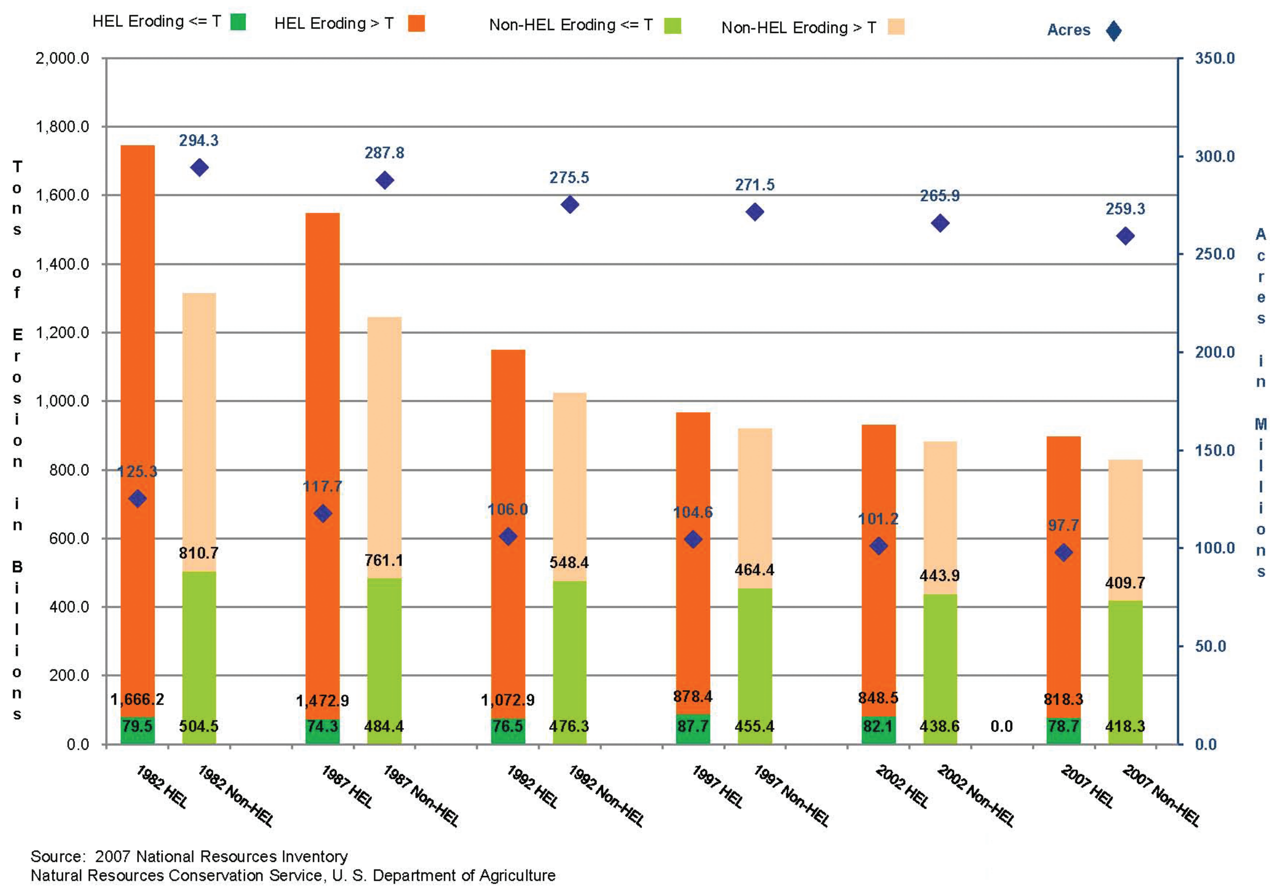
Highly erodible cropland & erosion relative to the tolerable erosion rate (T)



Source: 2007 National Resources Inventory, Natural Resources Conservation Service, USDA

Figure 3-6.

Total erosion on highly erodible and non-highly erodible cropland relative to the tolerable erosion rate (T)



Source: 2007 National Resources Inventory, Natural Resources Conservation Service, USDA

Soil carbon sequestration

The level of organic carbon in the soil is an important measure of soil health. Soil organic matter provides a receptive medium for plant roots, promotes the infiltration of water, and supplies nutrients to plants. Soil organic carbon also is the largest terrestrial carbon reservoir. Estimates of organic carbon content in the top 40 inches of soil range from—

- 16 to 67 tons per acre in cropland soils,
- 21 to 73 tons per acre in forested soils,
- 19 to 65 tons per acre in rangeland soils, and
- 14 to 182 tons per acre in soils in other land uses (fig. 3-7).

Through photosynthesis, plants combine carbon dioxide with water and with the aid of light energy form sugars that make up plant matter. Soil organic carbon content increases when plants leave carbon in the soil as decomposing organic matter. Although deep, undisturbed rangeland and forested soils have the highest levels of soil carbon near the soil surface, in many areas these soils are shallow or rocky and have less volume available for organic carbon storage than do the deep, rock-free soils typically used for crop production. In the United States, cropland soils have higher average levels of soil organic carbon stocks than do the other land uses.

The current soil organic carbon stocks for forest land and grasslands are likely lower than they were before European settlement because cropping, erosion, grazing, and other factors depleted those stocks to some extent. Although conventional tillage speeds up organic matter decomposition and lowers soil carbon stocks, most cropland soils today are farmed using some form of conservation tillage that involves less soil disturbance and leaves more surface residue. Conservation tillage can, over time, conserve or enhance soil organic carbon, and its continued use could increase current levels of soil carbon stocks by 15 percent.

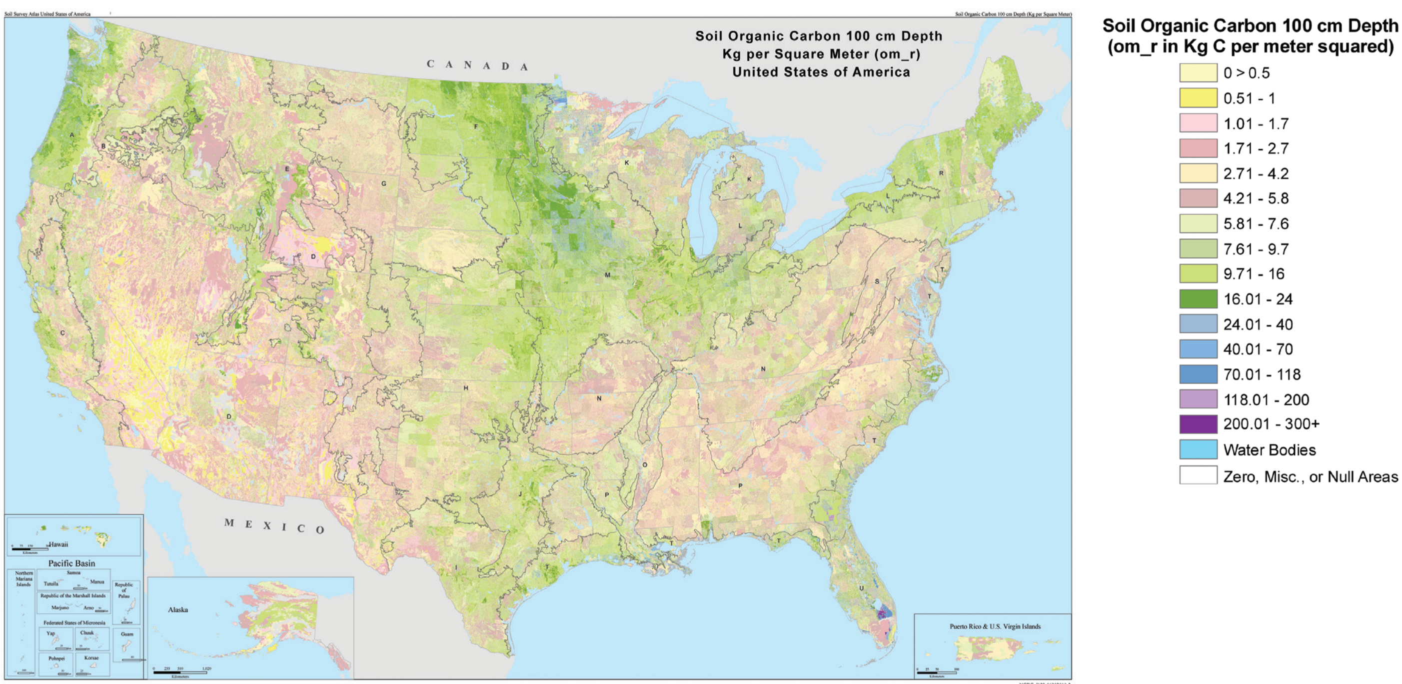
Determining soil organic carbon content

Soil organic carbon values are based on soil properties estimated from laboratory data from more than 25,000 sites analyzed for the National Cooperative Soil Survey. Although the data set is large, it represents a limited number of the soils in the United States, and land cover and agricultural management were not considered in site selection. Thus, estimates of soil organic carbon stocks for specific soil and land cover combinations have considerable uncertainty. The Rapid Assessment of U.S. Soil Carbon for Climate Change and Conservation Planning currently underway will help reduce this uncertainty. This one-time inventory, however, is addressing only broad soil and land cover groups and is not designed to address rates of change in soil organic carbon stocks.

Figure 3-7.

Soil organic carbon stocks

Soil organic carbon stocks are highest in the upper Midwest, an area dominated by cropland on deep soils, and in the heavily forested Pacific Northwest and Northeast.

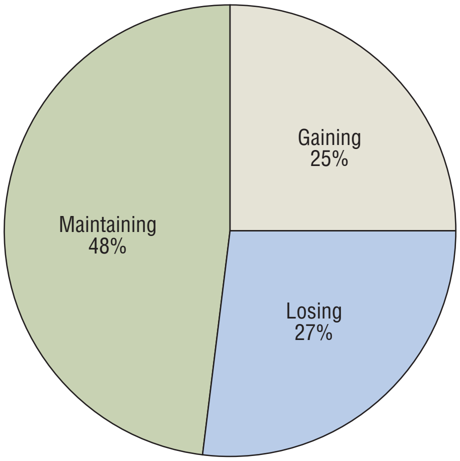


Source: USDA-NRCS

Figure 3-8 shows that nearly three-fourths of U.S. cropland is maintaining or increasing soil organic carbon levels. “Maintaining” means that a loss or gain in soil organic carbon over 20 years cannot be detected with routine soil sampling.

Figure 3-8.

Soil carbon trends on U.S. cropland, percent of acres by status



Source: Preliminary data, CEAP Cropland Assessment, conterminous 48 States

Soil salinity

Soil salinity reduces crop yields and leads producers to adopt more salt-tolerant crops. Where salinization is severe, crop production may be abandoned. Soil salinity can be attributed to—

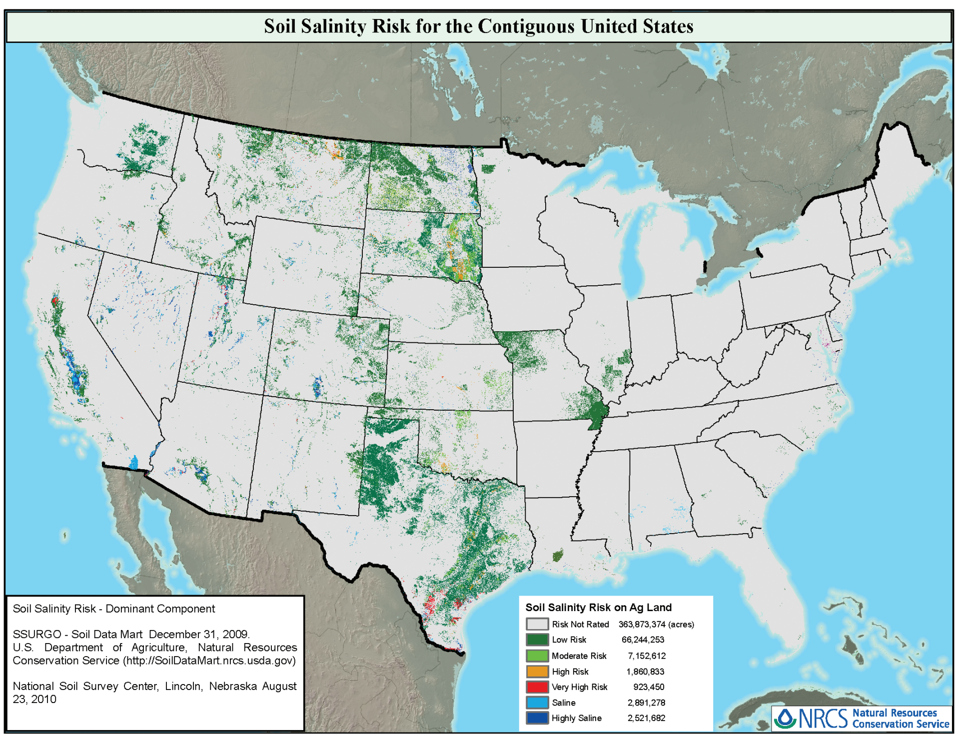
1. Salt accumulations in arid areas from past geologic and climatic conditions;
2. Salt enrichment from saline high water table wicking and saline irrigation water;
3. Salts weathering into the soil from soil minerals in semiarid and subhumid areas; and
4. Sea water influence in low-lying coastal areas.

In addition to these natural factors, inefficient irrigation and drainage can cause or accelerate soil salinization through leaching and evapotranspiration.

Saline soils occupy approximately 5.4 million acres of cropland in the conterminous 48 States. Another 76.2 million acres are at risk of becoming saline. The San Joaquin Valley, for example, which makes up the southern portion of California’s Central Valley, is among the most productive farming areas in the United States. However, irrigation-induced salt buildup in the soils and groundwater is threatening continued productivity and sustainability (Schoups et al. 2005) (fig. 3-9). As climate changes, areas in the southwestern United States are at greatest risk of increasing salinity levels.

Figure 3-9.

Salinity-affected soils and soils at risk



Source: NRCS SSURGO

The soil salinity data used in this report are from various vintages of soil survey projects over several decades and represent less than optimal laboratory data and observations. The Soil Survey Program of USDA NRCS is updating information for soil surveys.

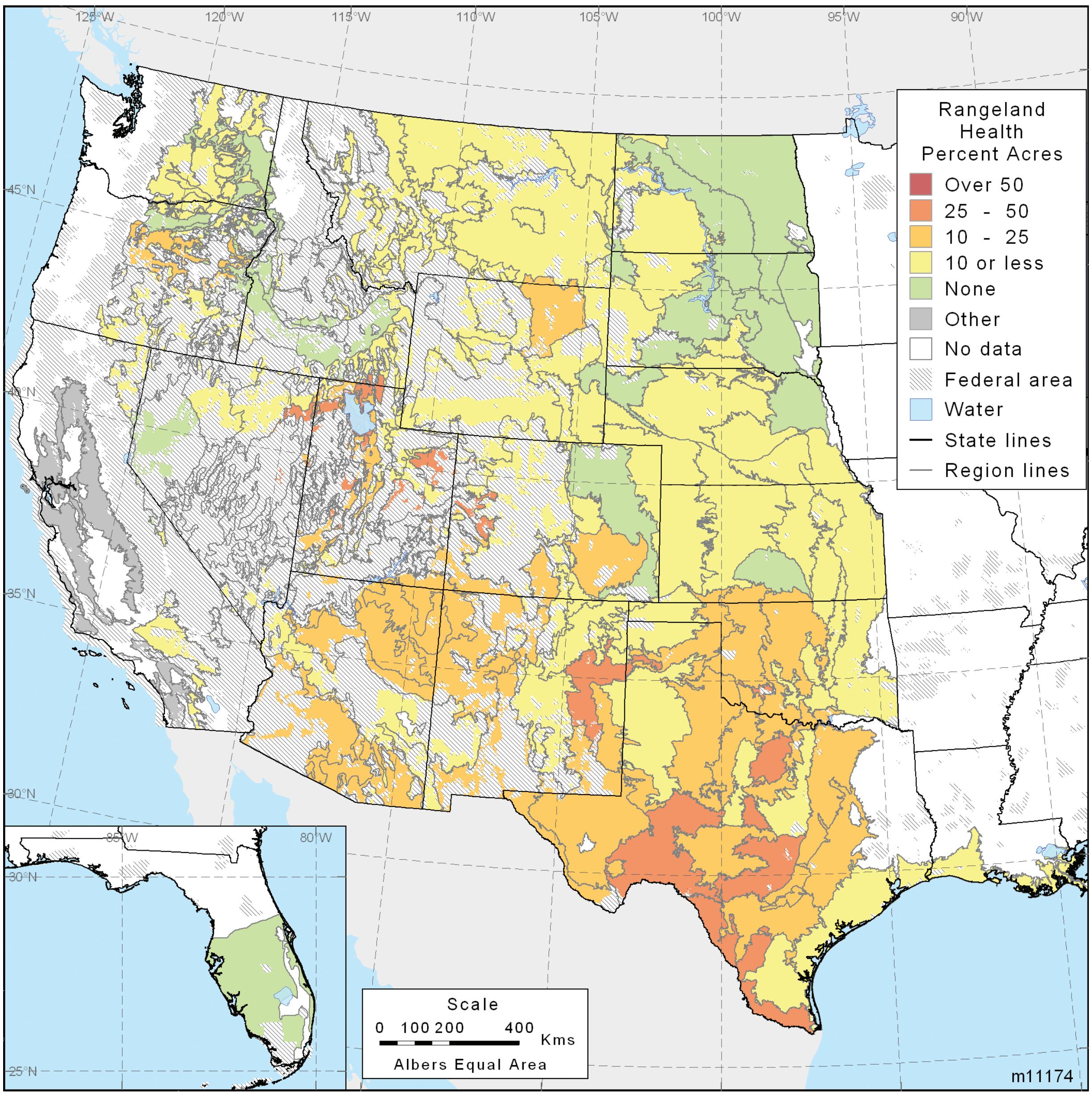
Rangeland health

A longstanding challenge for rangeland policy and management has been how to determine optimal conditions in the variety of types of ecosystems found in rangelands. A new rangeland health inventory system uses local knowledge to establish reference points, or reference conditions, for particular types of land, which allows assessment of site conditions at a specific time.

To determine range health at NRI sample locations, experts with knowledge of soil, hydrology, and plant relationships evaluated 17 different rangeland health indicators (Pyke et al. 2002) on the degree of departure (none-to-slight, slight-to-moderate, moderate, moderate-to-extreme, and extreme-to-total) from expected levels in the ecological site description (Pellant et al. 2005). Rangeland health at each location was determined by the median rating for soil and site stability, hydrologic function, and biotic integrity. Nearly 80 percent of the Nation's 409 million acres of non-Federal rangeland are relatively healthy. However, the remaining 20 percent (about 82 million acres) depart at least moderately from the reference condition for one or more of the three attributes of rangeland health described below (fig. 3-10).

Figure 3-10.

Rangeland showing departure from reference conditions for all three attributes of rangeland health: Soil and site stability, hydrologic function, and biotic integrity



Source: USDA-NRCS/NRI Rangeland Resource Assessment

At least 9 percent of rangeland acres have at least moderate departure from reference condition for all three attributes:

1. **Soil and site stability** is the capacity of a site to limit wind and water erosion. Less than 12 percent of U.S. rangeland has at least moderate departure from expected site conditions for soil and site stability.
2. **Hydrologic function** characterizes the capacity of the site to capture, store, and safely release water from rainfall, run-on, and snowmelt and to resist or recover from degradation. About 14 percent of U.S. rangeland has at least moderate departure from expected site conditions for hydrologic function.
3. **Biotic integrity** is the capacity of a site to support characteristic functional and structural plant communities in the context of normal variability, and to resist or recover from disturbances. About 18 percent of U.S. rangeland has at least moderate departure from expected site conditions for biotic integrity.

Soil erosion on rangeland

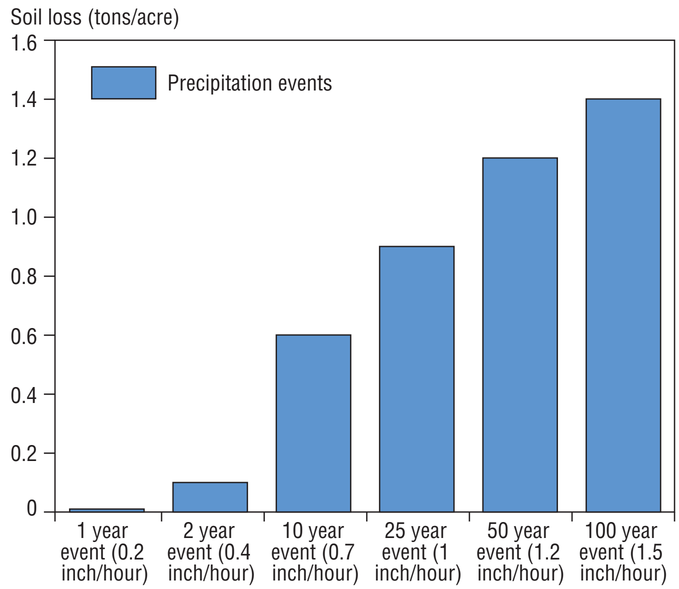
Tolerable soil loss rates on arid rangeland soils are typically lower than those on Midwestern cropland soils; many arid rangeland soils are shallower, have slower rates of soil formation in the dry climates typical of rangeland, and support vegetation that grows more slowly and provides less ground cover. Water erosion is less than 1 ton per acre per year on more than two-thirds of U.S. rangeland, between 1 and 2 tons on about one-sixth, and exceeds 2 tons on about one-sixth.

Average annual erosion rates on rangeland, however, do not tell the whole story. Most soil loss occurs during intense storms that generate large amounts of runoff, but such storms are rare. Consequently, while soil erosion is much less than average during most years, once-in-a-century storms can generate greater than 100 times average annual soil loss in less than a day. In Elko, NV, for example, historic data indicate that rainfall intensity has exceeded 1 inch per hour only four times per century (fig. 3-11).

Erosion is not distributed uniformly across non-Federal rangelands (fig. 3-12). Twenty percent of the area of non-Federal rangeland produces more than 65 percent of total soil erosion (USDA-NRCS 2010). More than 31 percent of U.S. non-Federal rangeland is vulnerable to unsustainable average

Figure 3-11.

Relationship of soil loss to precipitation for a sagebrush site on a loamy soil near Elko, NV



Source: USDA Agricultural Research Service

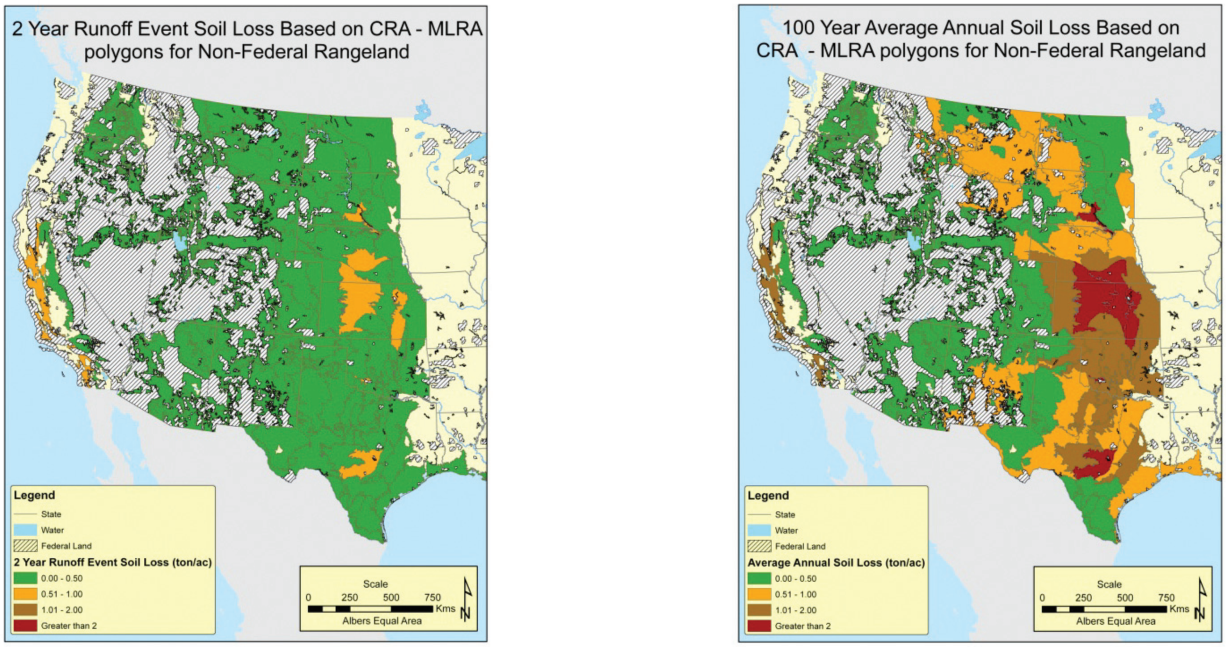
annual soil loss; these most vulnerable acres are predominantly in the central and southern Great Plains (fig. 3-12) although vulnerable acres can be identified in each State. Soil disturbance and lack of vegetative and ground cover are the most important factors that contribute to erosion on rangeland (Wilcox et al. 2003, Pierson et al. 2009, Bartley et al. 2010a, Bartley et al. 2010b, Urgeghe et al. 2010). Areas with low to moderate soil erosion rates can be treated and erosion controlled through minor changes in management such as moving the locations of salt or supplemental feeding areas to redistribute livestock.

In the arid and semi-arid parts of the country where rangelands dominate, wind erosion can generate dust storms that cause significant health and property damage, and can even result in highway closures or accidents due to low visibility. Rangeland vegetation limits dust emission to extremely low levels. If rangelands, including much of the land currently protected by CRP in the Great Plains, are cultivated, the potential for wind erosion increases dramatically. Potential effects vary regionally (fig. 3-13).

Figure 3-12.

Average annual water erosion rates on western rangelands

Over the course of a century, the average annual water erosion rates are highest in the Central Plains from central Texas to South Dakota because the annual precipitation is higher there than in the intermountain States Arizona, Nevada, New Mexico, and Utah.

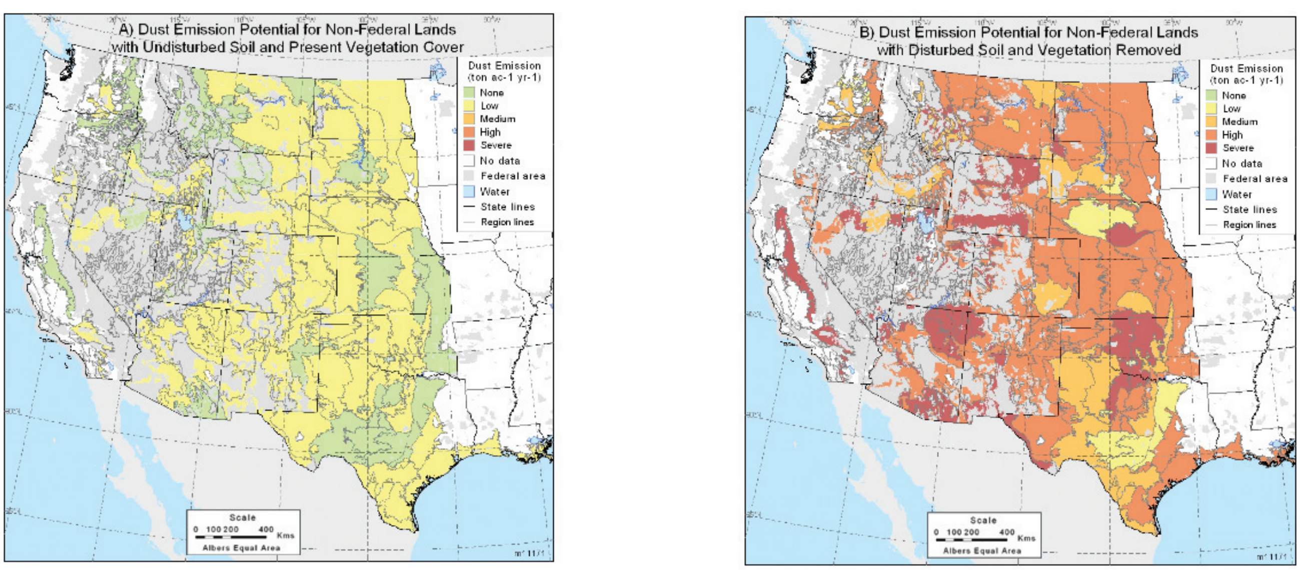


Source: USDA-Agricultural Research Service

Figure 3-13.

Potential effects of soil and vegetative disturbance on western rangelands

Dust production from rangelands is minimal when soils are vegetated and not intensively disturbed, which is typical for rangeland soils (left). Vegetation removal combined with intense disturbance, such as overgrazing, intensive off-highway vehicle use, or cultivation, dramatically increases potential wind erosion. Areas with soils more susceptible to wind erosion and soils having higher concentrations of fine particles (silt and clay) are at greater risk of high dust emission if intensively disturbed.

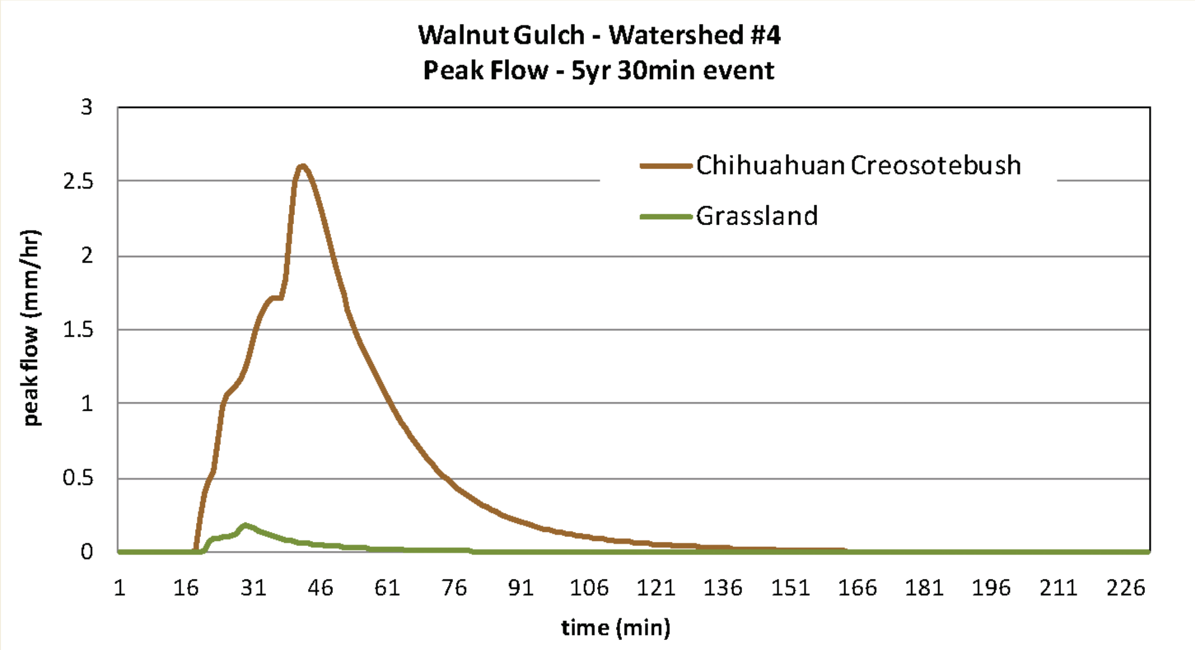


Source: USDA-Agricultural Research Service

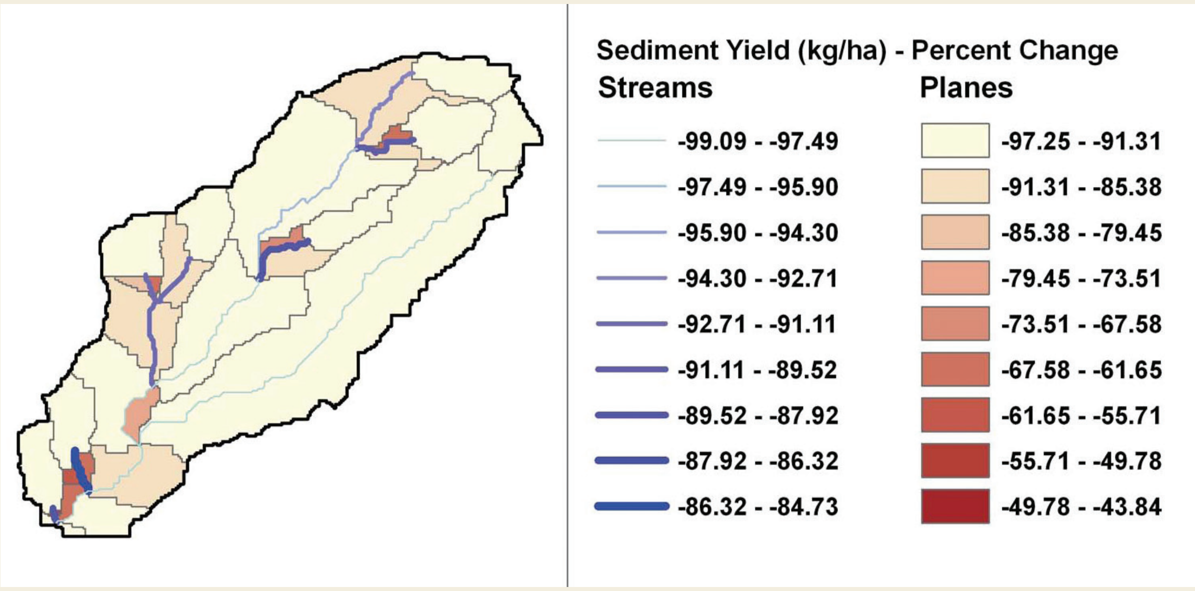
Brush Management on the ARS Walnut Gulch Experimental Watershed in southern Arizona

The Automated Geospatial Watershed Assessment tool was used to estimate the benefits of brush management to reduce the invasive species creosotebush and the benefits of reseeding practices to restore the watershed to native desert grassland. Benefits were found to be enhanced soil moisture and forage production, and significantly reduced surface runoff and soil erosion from water.

Change in peak flow (mm/hr) after removing the brush and restoring to desert grassland in southern Arizona



Change in sediment yield (kg/ha) after removing the brush and restoring to desert grassland in southern Arizona



Source: USDA Agricultural Research Service

Invasive plant species on rangeland

Non-native plant species occur on nearly 50 percent of non-Federal rangelands, and account for at least 50 percent of the land cover on more than 5 percent of these lands. Most non-native plant species cause no problems and in some cases are considered beneficial. Crested wheatgrass, for example, is an introduced species that is relatively easy to establish and commonly recommended for forage production and soil stabilization in arid regions (USDA-NRCS 2010). Under some conditions, however, some non-native species have become invasive. Once established, these species have been difficult to eradicate. Where they replace significant proportions of native plant communities, they can modify vegetation structure, the fire regime, soil erosion rates, and forage production. These changes in turn can have significant effects on wildlife populations.

Some non-native invasive herbaceous species can outcompete native species and reduce forage availability for wildlife and livestock. The annual bromes, which are the most widespread of the invasive plants, are highly invasive in many shrub communities including sagebrush and piñon and juniper savannas. Communities of annual bromes can be highly flammable from late spring through early fall. Other important non-native invasive plants include medusahead and *Centaurea* and *Cirsium* species (USDA-NRCS 2010).

Some native woody shrubs such as juniper and mesquite can invade areas replacing native grasses and forbs. Dense stands reduce habitat and forage for domestic animals and wildlife and can increase the potential for soil erosion. Deep root systems of woody species may reduce water availability to both plants and animals. Invasive juniper species, including eastern redcedar, are widespread, but are especially prevalent in the Great Plains from the Canadian border to the Gulf Coast. Juniper species often invade areas that have historically been disturbed, for example, in some areas where overgrazing was common during early settlement years (fig. 3-14).

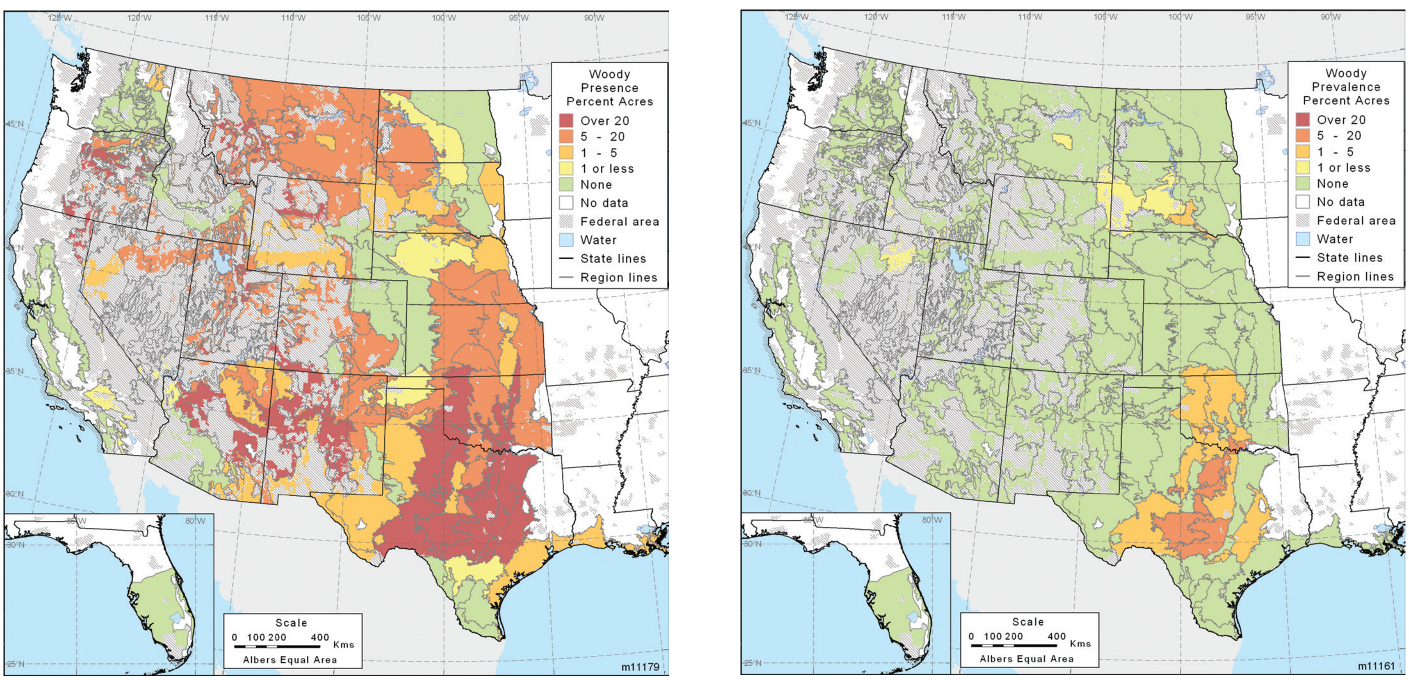
Forest health

Forests provide a vast array of public goods and services, such as clean water, timber, wildlife habitat, and recreational opportunities. Forest insect pests and diseases and forest fires are intrinsic components of naturally functioning forest ecosystems, but they also can have detrimental effects (USDA Forest Service 2009). Native and exotic pests have killed trees on millions of acres of U.S. forests. Similarly, wildfires have severely damaged forests and the waters and wildlife that depend upon them.

Figure 3-14.

Prevalence of invasive juniper species on rangelands in the 17 western States

Areas of rangeland where invasive juniper species are present (left), and areas where invasive juniper species make up at least 50 percent of the land cover (right)



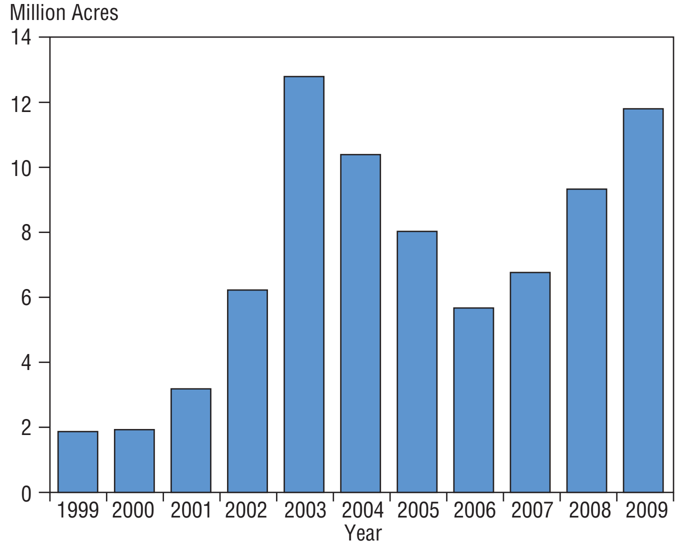
Source: USDA-NRCS/NRI Rangeland Resource Assessment

Forest insect pests and diseases can reach outbreak levels when susceptible forest conditions are combined with weather stress. Periods of below-normal precipitation and above-normal temperatures can stress trees and reduce their resistance to insects and pathogens. The Forest Service's Forest Health Monitoring (FHM) Program determined that a large increase in tree mortality from 2002 through 2009 was largely due to increased bark beetle activity in the West following severe regional drought (fig. 3-15).

A national risk assessment, completed in 2006 under the FHM program, identified areas where more than 25 percent of the trees greater than 1 inch in diameter are expected to die within 15 years due to insects and disease (Krist et al. 2007) (fig. 3-16). More than 27 million acres of non-Federal forest lands—an area about the size of Louisiana—were deemed to be at risk of mortality due to insect pests and diseases.

Figure 3-15.

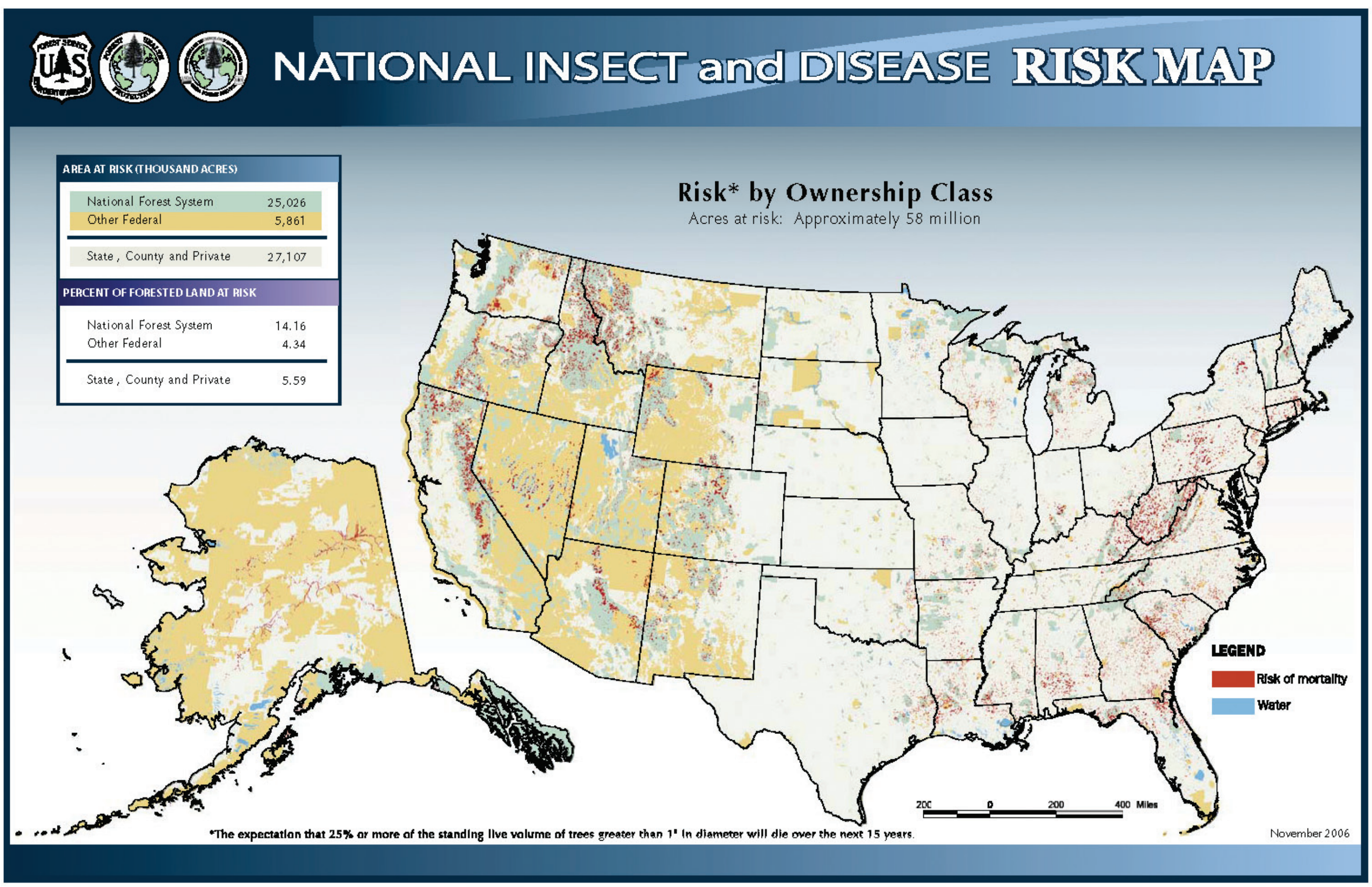
Acres with outbreak levels of tree mortality, 1999–2009



Source: USDA Forest Service

Figure 3-16.

Areas with potential risk of greater than 25 percent tree mortality due to insects and diseases

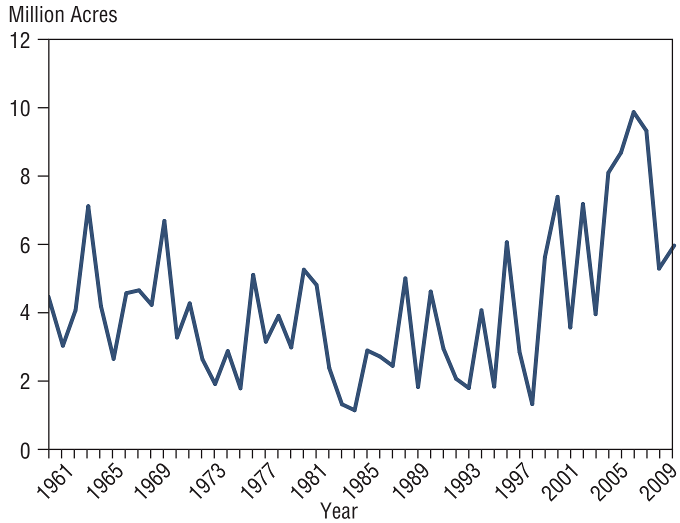


Source: USDA Forest Service

Fire is a major disturbance in many forests of the United States. The annual amount of area burned varies depending on weather conditions, fuel loading, and forest stand conditions. Much of the recent increase in area burned is due to increased fuel loads and recent changes in weather, especially in the western United States. The total forested area burned in 2006 was the largest fire-affected acreage during the period 1960 to 2009 (fig. 3-17). The Forest Service's Fire Modeling Institute has developed the Wildland Fire Potential Model to identify areas across the country with the greatest risk of forest damage due to wildfire under extreme conditions (Menakis 2008). Watersheds where private forests have the highest wildland fire potential are concentrated heavily in the Western and Southeastern United States (Stein et al. 2009) (fig. 3-18).

Figure 3-17.

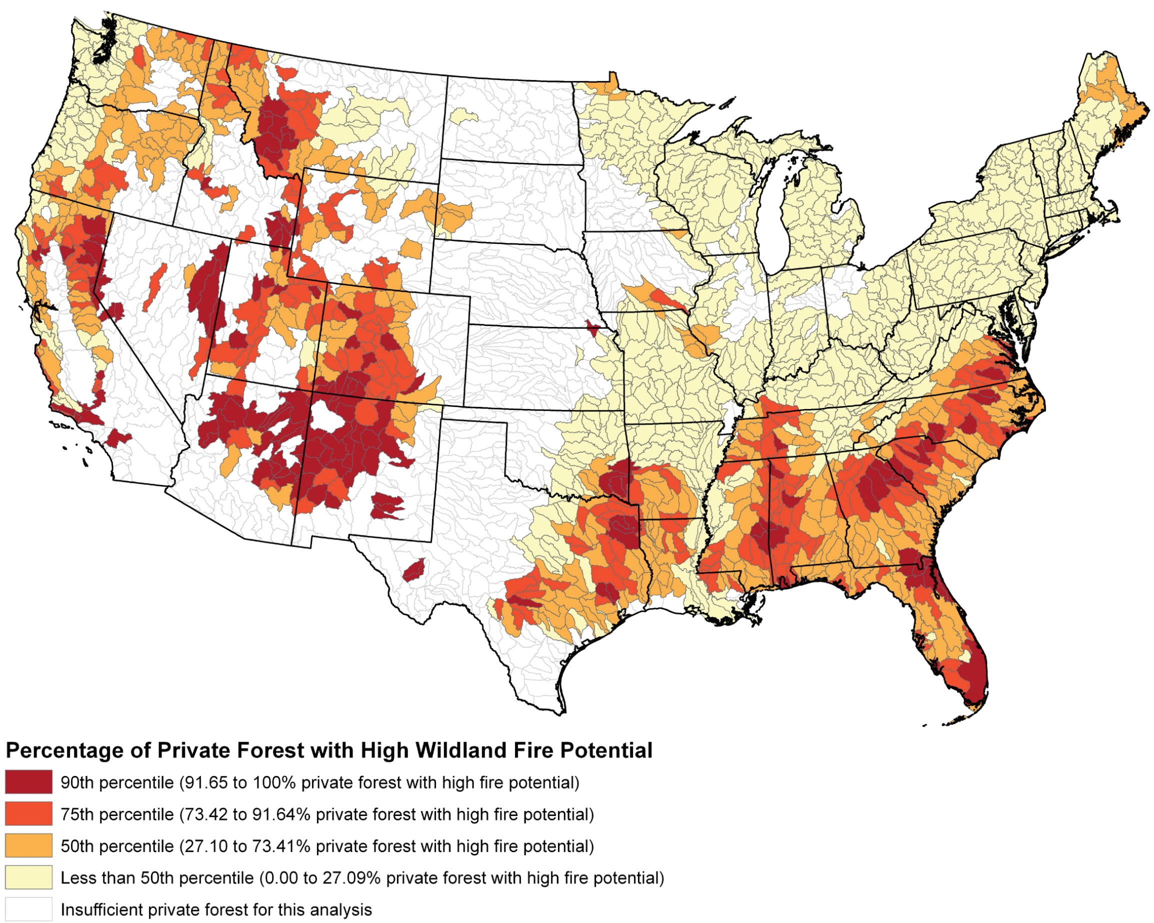
Total area of wildfires, 1961–2009



Source: USDA Forest Service

Figure 3-18.

Percentage of private forest with high wildfire potential



Source: USDA Forest Service

Invasive plant and animal species

An estimated 50,000 non-native plant and animal species have been introduced into what is now the United States since European settlement. Many of these plants and animals are beneficial; introduced plants such as rice, corn, and wheat and introduced cattle and poultry species are the underpinning of the U.S. agricultural economy, providing more than 98 percent of U.S. food production valued at about $800 billion annually (Pimentel et al. 2005).

Some of the deliberate and unintentional introductions of plants, animals, and pathogens, however, are invasive. Biological invasions by non-native species impose an enormous cost on agriculture, forestry, fisheries, and human food security and health. Many introduced species compete with or prey upon native species, hybridize with them, and carry diseases to them. Invaders can change ecosystems by altering hydrology, nutrient cycling, water use, and other ecosystem processes. Invasive weeds cause agricultural production losses and degrade water catchments, estuarine systems, and fisheries and clog rivers and irrigation systems.

Current environmental, economic, and health costs of invasive species are estimated to exceed $138 billion per year—an estimate that some consider conservative (Pimentel et al. 2005). Examples of invasive species include—

- The West Nile virus, which kills or sickens mainly birds but also mammals;
- The whirling disease parasite, which kills wild as well as farm-raised fish;
- The sudden oak death fungus, which kills oaks and other trees and shrubs, and the white nose syndrome fungus, which is decimating bat populations;
- Plants such as kudzu, water hyacinth, leafy spurge, saltcedar, Russian olive, and knapweed, which displace native plants or choke waterways;
- Invertebrates such as fire ants, which kill poultry chicks and livestock, and invasive mollusks, which outcompete native species and damage municipal water facilities;
- Vertebrates such as introduced rat species, which destroy stored grains and spread diseases, and feral swine, which damage crops and wildlands and also transmit disease.

Invasive species are "plants, animals, and other organisms whose introduction causes, or is likely to cause, economic or environmental harm, or harm to human health" (Executive Order 13112, February 3, 1999). The invaders spread by way of several pathways, and since many of these species infest areas not also inhabited by their natural biological controls, their spread is unrestricted and their impacts often costly. Only a small fraction of introduced non-native species become established, and only about 10 percent become invasive and harmful.

Use of some invasive species as biofuel feedstocks, and potential hazards and concerns are presently being discussed. For example, under a Conservation Innovation Grant from NRCS, Montana State University is developing innovative ideas for managing invasive plants in the upper Missouri River watershed. More than 1 million acres within the watershed are infested with Russian olive and saltcedar, which are potential sources of biomass for energy production.

The challenge of feral swine

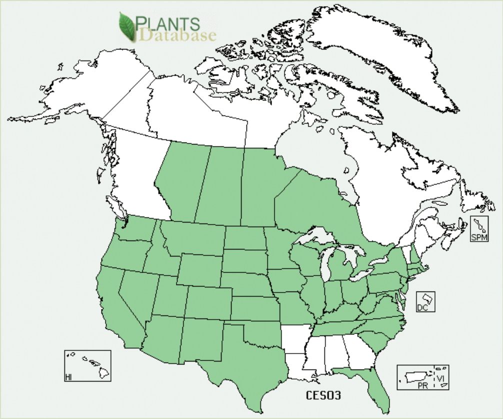
Pigs are thought to have been introduced into the United States by the early European explorers. Over time, many pigs were released or escaped into the wild, especially in the southeastern United States. Despite ongoing efforts to control their spread, wild pigs have increased both their range and population size (West et al. 2009). Estimates of the feral swine population range as high as 5 million (Pimentel 2007) in as many as 39 U.S. States (West et al. 2009).

Feral pigs are considered pests because they feed by rooting and grazing, which destroys crops and causes ecological damage in the form of reduced water quality, increased soil erosion, damage to trees and other native plants, and transmission of disease. Damage and control costs have been estimated to be around $1.5 billion annually (Pimentel 2007).

These animals have few natural predators in the United States, although in some locations alligators, bears, and large cats prey on them. Wild pigs are hunted in many areas, but hunting alone is unlikely to control them especially where habitat conditions are favorable. Because the pigs quickly learn to avoid single-control techniques, the best control mechanism appears to be a combination of techniques.

PLANTS Database

The USDA PLANTS Database (http://plants.usda.gov/index.html) provides standardized information about the vascular plants, mosses, liverworts, hornworts, and lichens of the United States and its territories, including invasive species. The map below shows the U.S. States and Canadian provinces where the yellow starthistle has spread. This invasive plant was introduced to the United States in contaminated seed from its native Eurasia in the 1800s. It crowds out native species and is toxic to horses.



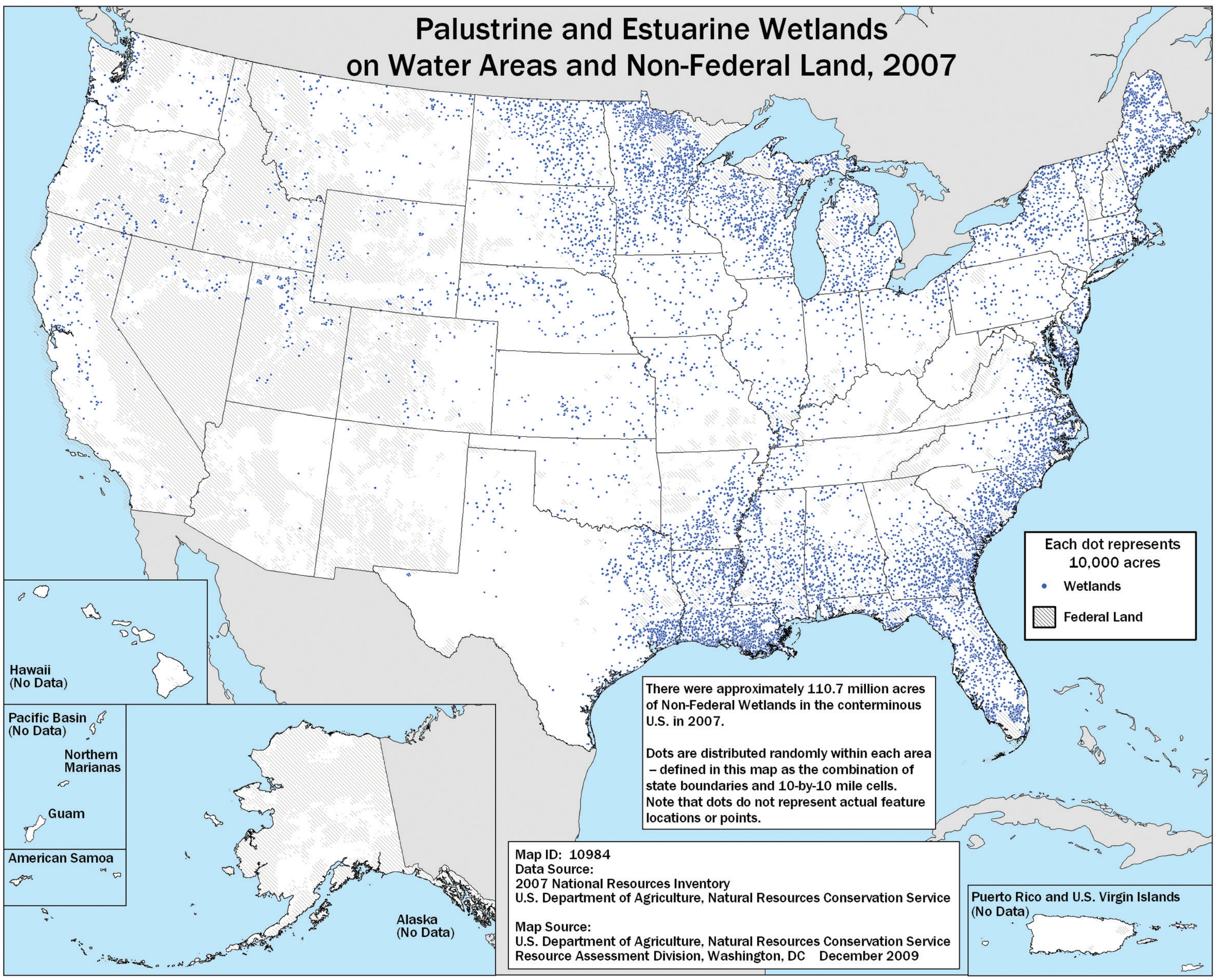
Wetlands

Wetlands are a condition of the land found across land uses. They are protected at the Federal, State, and local levels because of the valuable ecological services they provide. Wetlands filter nutrients, trap sediments and associated pollutants, improve water quality, provide fish and wildlife habitat, reduce floodwater runoff peaks, recharge aquifers, buffer shorelines from storm impacts, and produce food and fiber for human consumption and use. Wetlands conservation is supported by a growing awareness of their values by Federal, State, and local programs and the efforts of private organizations.

Wetlands cover about 111 million acres of non-Federal land and water in the conterminous United States (fig. 3-19), which is about half the acreage of wetlands that existed at the time of European settlement. The two principal wetland types are Estuarine and Palustrine. Estuarine wetlands occur in the tidal zones of coastal states where freshwater streams enter the ocean or where wetland emergent vegetation occurs in tidal waters partially diluted by fresh water. About 57 percent of U.S. wetlands occur in the Lake States, Southeast, and Delta States; wetlands are least abundant in the Pacific, Corn Belt, and Mountain States (fig. 3-20).

Figure 3-19.

Location of wetlands, conterminous 48 States, 2007

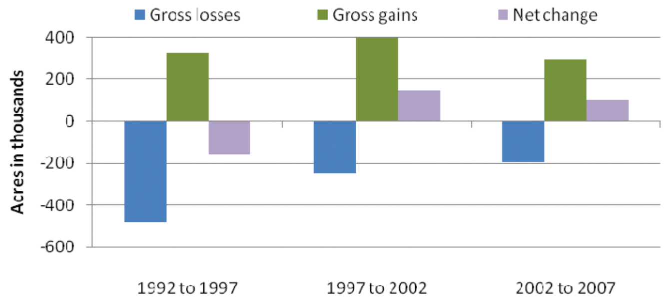


Source: 2007 National Resources Inventory, Natural Resources Conservation Service, USDA

The decade 1997 to 2007 was the first in which wetland gains outpaced losses. During this period, there was a modest net gain in wetland area of about 250,000 acres—a gross gain of some 690,000 acres less a gross loss of 440,000 acres (fig. 3-21). Sixty percent of gross wetland losses during the period 1997 to 2007 were due to urban and industrial development and about 15 percent to agriculture. Conversion of wetlands to agricultural uses during this period averaged over 6,500 acres per year, or about one-fourth the rate of conversion during the early 1990s. Conversely, more than 59 percent of wetland gains occurred on agricultural lands. Net gains were recorded in the Corn Belt and Northern Plains, a net loss was reported in the Southeast, and total wetland acreage remained stable in the other regions.

Figure 3-21.

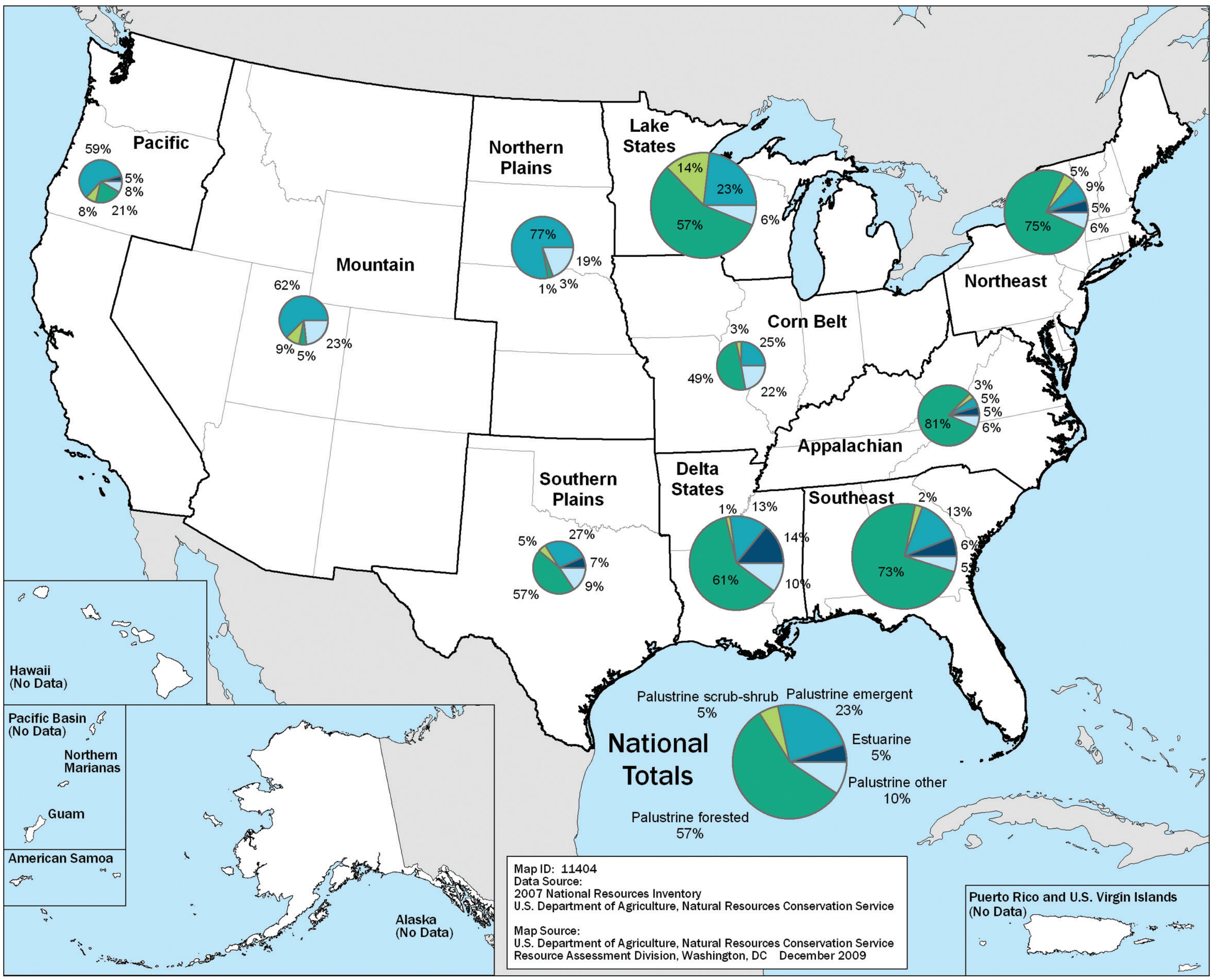
Losses and gains in Palustrine and Estuarine wetlands, conterminous 48 States, 1992–2007



Source: 2007 National Resources Inventory, Natural Resources Conservation Service, USDA

Figure 3-20.

Palustrine and estuarine wetlands by Farm Production Region, 2007



Source: 2007 National Resources Inventory, Natural Resources Conservation Service, USDA

Wetland conservation practices in the Prairie Pothole Region

As part of the Conservation Effects Assessment Project (CEAP), the U.S. Geological Survey (USGS) conducted a comprehensive, stratified survey of wetlands and catchments in the Prairie Pothole Region of the Upper Midwest and northern Great Plains—204 wetlands in 1997 and 270 catchments in 2004. These areas represented a subset of about 5 million acres of wetland and grassland systems established on Conservation Reserve Program (CRP) and Wetlands Reserve Program (WRP) lands. The purpose of the survey was to gather data for estimating a variety of ecosystem services provided by prairie pothole wetlands and catchments.

Principal findings include the following:

- Restoration practices improved the distribution and species richness of the native plant community, but not to the point of full site potential.
- Catchments with a history of cultivation had less soil organic carbon in the upper soil profile than did native prairie catchments.
- Wetlands on program lands have significant potential to intercept and store precipitation that otherwise might contribute to downstream flooding; conservatively estimated, wetland catchments on program lands could capture and store an average of 1.1 acre-feet of water per acre of cropland.
- Conversion of cultivated cropland to herbaceous perennial cover through CRP and WRP enrollments reduced total soil loss from uplands by an average of almost 2 million tons per year, potentially resulting in the delivery of less sediment and associated nutrients to sensitive offsite ecosystems such as lakes, streams, and rivers.
- Restored catchments provide at least some necessary resources for a diversity of bird species that cropland catchments do not; CRP and WRP enrollments led to increases in the number of grassland areas that exceeded published nesting area requirements for the five area-sensitive grassland bird species evaluated in the study.

Wildlife habitat

While a variety of productive wildlife habitat types are found in agroecosystems, much of the original grassland and wetlands in the Corn Belt, northern prairies, and California's Central Valley; the original bottomland hardwood forested wetlands of the Southeast; and the sagebrush habitats of western rangelands have been converted to agricultural use (Noss et al. 1995, Tewksbury et al. 2002). Although the United States harbors significant biodiversity, approximately one third of all species are at-risk or of conservation concern (Stein et al. 2000). The U.S. Fish and Wildlife Service lists 578 animal species as threatened or endangered in the United States under the Federal Endangered Species Act (fig. 3-22). Moreover, thousands of additional species are at risk of becoming threatened or endangered (fig. 3-23). Agriculture is listed as a source of endangerment for 45 percent of listed or proposed fishes and 64 percent of mussels; water pollution from all sources has been identified as a source of endangerment for 55 percent of fishes and 97 percent of mussels (Wilcove et al. 1998). Figure 3-24 shows the concentrations of plant and animal species considered at risk but not listed as threatened or endangered, largely in the mountainous areas in the East and the West, in Florida, parts of the Gulf Coast, and Hawaii.

More than one third of the listed animal species are fishes (140) or clams (70), highlighting the disproportionate number of aquatic listed species and the importance of aquatic habitats for their survival and recovery. Nearly 70 percent of the nation's freshwater mussels, more than half of the crayfish species, and more than one-third of freshwater fishes are at risk (Stein et al. 2000). Thirty-nine percent of all known North American freshwater fish and diadromous fish (those that migrate between salt and fresh water) are imperiled—more than double the proportion imperiled in 1989 (Jelks et al. 2008).

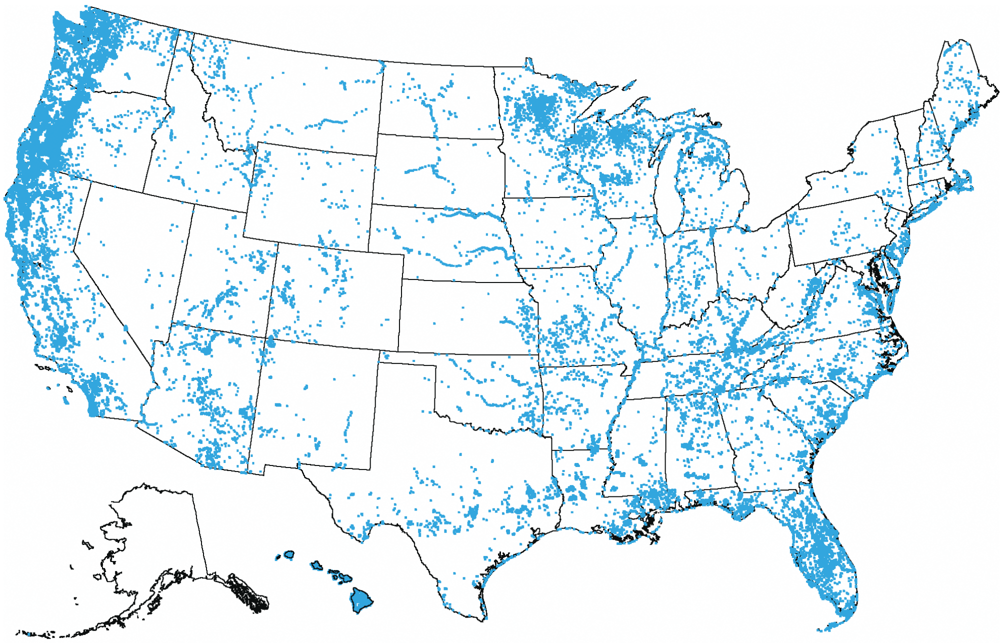
Bird populations are useful indicators of the status of other wildlife species that inhabit the same environments. There are more than 800 bird species in North America. Of bird groups in general, those experiencing the greatest population declines in recent decades include Hawaiian birds, seabirds and coastal shorebirds, grassland birds, and arid-land birds (North American Bird Conservation Initiative, U.S. Committee 2009). Threats to sagebrush habitats pose risks to greater sage-grouse and other sage-steppe dependent species (Knick et al. 2003).

Although the human footprint has caused significant changes to original ecosystems, productive fish and wildlife habitats do remain in agricultural landscapes, and USDA conservation programs are contributing significantly to collaborative efforts to conserve and restore important habitat functions (Haufler 2005). Grassland habitats can be restored or enhanced through conservation practices and programs on agricultural lands.

Figure 3-22.

Distribution of federally listed threatened and endangered species

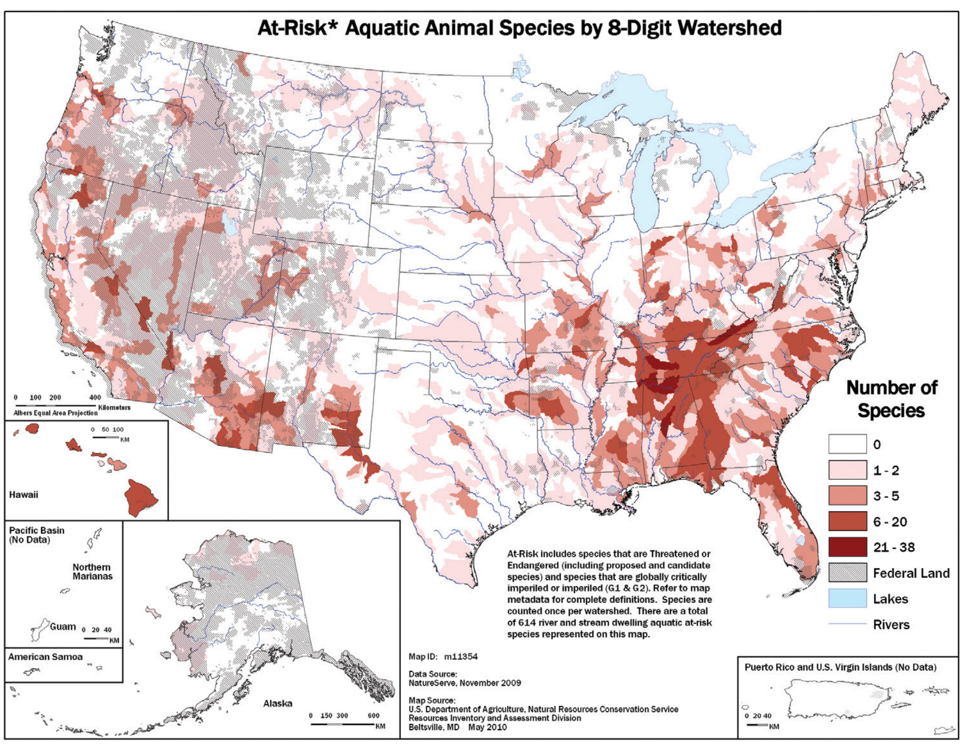
Each dot on the map represents a known occurrence of threat or endangerment. The patterns are most dense where water is present, reflecting the vulnerability of aquatic species.



Source: State Natural Heritage Data Centers (1996), cited in Stein et al. 2000.

Figure 3-23.

Areas of endangerment for aquatic animal species on non-Federal land and water



Source: NatureServe

For example, recent stabilization of long-term declines in Henslow's sparrow populations has been attributed to the presence of grassland habitats provided by Conservation Reserve Program (CRP) enrollments in Midwestern states (Herkert 2007). Likewise, CRP grasslands are contributing to meeting population goals of priority grassland birds in the Great Plains (McLachlan et al. 2007, McLachlan and Carter 2009).

In response to recent population declines, coordinated efforts have been made to set population goals, habitat objectives, and conservation strategies for northern bobwhites (Dimmick et al. 2002), greater sage-grouse (Connelly et al. 2004), prairie grouse (Vodehnal and Haufler 2007), and other priority birds through various bird habitat joint ventures.

USDA Sage-Grouse Initiative preserves vital habitat

The greater sage-grouse, a ground-dwelling bird inhabiting the sagebrush steppe ecosystem of the American West, has experienced a significant decline in population and habitat over several decades. The USDA Natural Resources Conservation Service (NRCS) Sage-Grouse Initiative (SGI) is accelerating implementation of conservation practices that would protect the birds and improve their habitat. NRCS and the Fish and Wildlife Service (FWS) of the United States Department of the Interior are collaborating to address potential Endangered Species Act (ESA) issues before they become intractable problems.

The SGI includes monitoring and evaluation to measure the biological response of sage-grouse populations to the initiative. Range-wide sage-grouse core areas have been mapped to gauge practice effectiveness, adaptively improve program delivery, and ensure that practices benefit the largest number of birds. Initiative-sponsored research is underway in Montana, Wyoming, and Oregon to assess benefits of grazing systems and encroached conifer removal. At least 525 ranches are participating in the initiative.

The Initiative employs the "conferencing" section of ESA to secure from FWS reasonable certainty for cooperators who voluntarily implement NRCS-sponsored conservation practices. NRCS cooperators will be in compliance regarding sage-grouse under ESA if the sage-grouse species is listed as threatened or endangered.

Establishment of field buffers promotes wildlife habitat

The Habitat Buffers for Upland Birds practice (Practice Code CP33) is the first Federal conservation practice to target species-specific population recovery goals of a national wildlife conservation initiative (the Northern Bobwhite Conservation Initiative). This practice offers incentives to landowners for establishment of a diverse native herbaceous community along crop field edges to provide habitat for northern bobwhite and other upland birds.

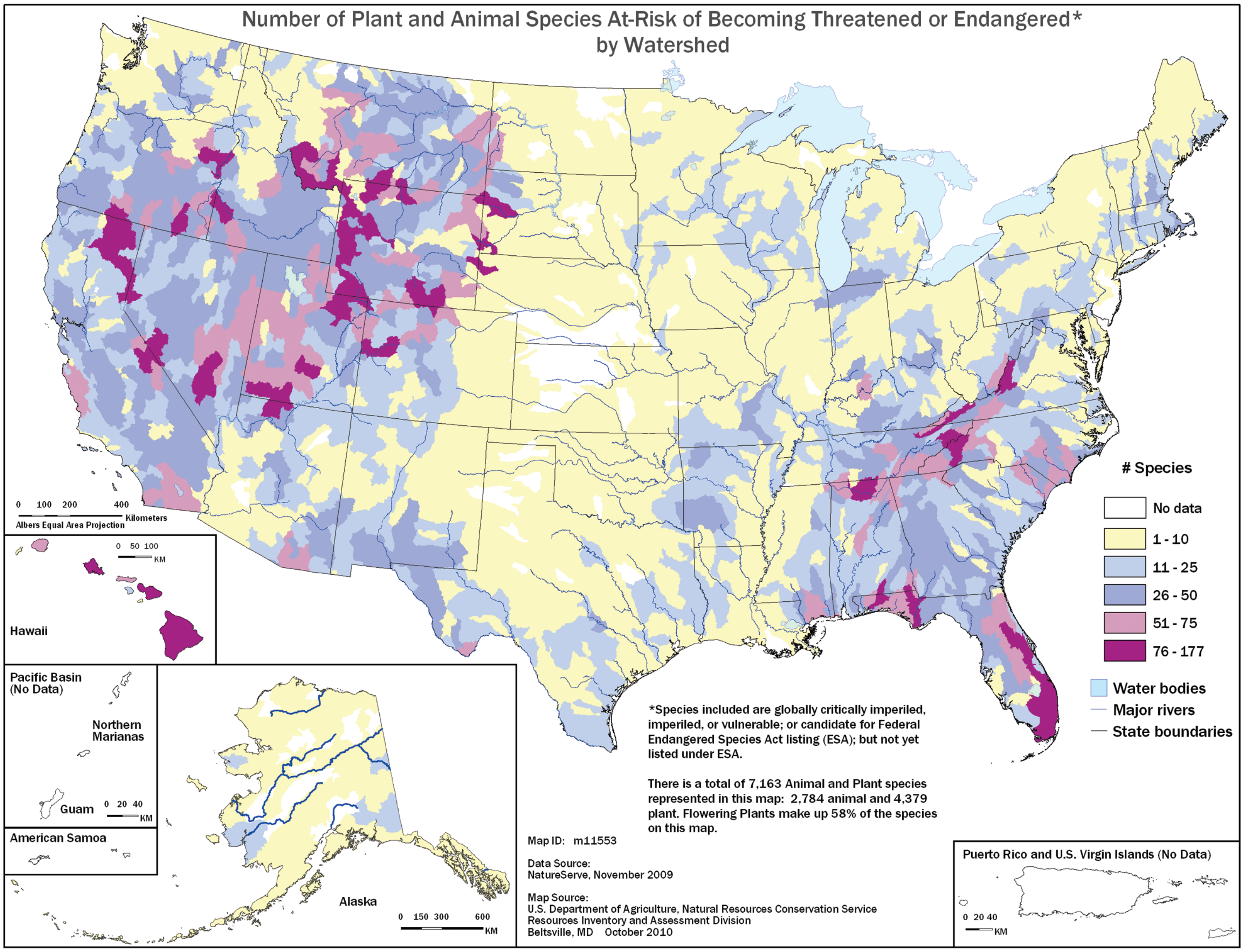
The USDA Farm Service Agency (FSA) administers the Continuous Conservation Reserve Program (CCRP), under which the CP33 practice is supported. FSA allocated 250,000 CP33 acres to 35 states within the bobwhite range for establishment of 30- to 120-foot upland habitat buffers under 10-year contracts. More than 209,000 CP33 acres were enrolled between 2004 and the end of 2009.

The results? A Conservation Effects Assessment Project (CEAP) wildlife study found that over a 14-State area, breeding bobwhite densities were 70 to 75 percent greater and fall bobwhite covey densities were 50 to 110 percent greater around CP33 fields than around unbuffered crop fields. This positive response to CP33 increased each subsequent year of the study. Several upland songbirds, such as dickcissel and field sparrow, also responded strongly to CP33 in the landscape. Area-sensitive grassland birds such as the grasshopper sparrow, however, exhibited little response.

These findings show that conservation buffers supported by CP33 and through conservation programs such as the Environmental Quality Incentives Program (EQIP) and Wildlife Habitat Incentive Program (WHIP) entail relatively small changes to primary land use yet can provide essential wildlife habitat in productive working agricultural landscapes. Broader application of this effective conservation practice can be used to accomplish regional recovery of bobwhite populations.

Figure 3-24.

Distribution of plant and animal species at risk of becoming threatened or endangered, by watershed



Source: NatureServe

Conclusion

Because farms, ranches, and forests make up more than 85 percent of the non-Federal area of the conterminous 48 States, the quality of the environment is linked with stewardship of those lands. Sound stewardship requires a continuing commitment to assessing and addressing important natural resource issues and concerns.

In general, natural resource trends on agricultural and forest lands are headed in the right direction. Soil erosion on cropland is down, and the bulk of the Nation's grasslands and non-Federal forest lands are in good condition. Soil carbon stocks are stable or increasing in most places. Although agriculture is a source of endangerment for many wildlife species, productive habitats remain in the Nation's farms, ranches, and forests. For the first time, wetland gains from agriculture are outpacing wetland losses to agriculture.

Despite these gains, many conservation issues remain to be addressed. Erosion will always be a concern where crops are grown and livestock are grazed. Non-native, invasive plants and animals are growing concerns on rangeland and cropland and in postharvest storage facilities. Expected changes in climate patterns will require adaptations in farm and forest management. Through the Conservation Effects Assessment Project (CEAP), USDA seeks to provide quantitative measurements of conservation benefits and more precisely identify conservation treatment needs.

USDA conservation programs strive to maintain a balance between food security and a healthy environment. Chapter 4 outlines USDA's current suite of conservation approaches.

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