

## Wetlands

Wetlands support a variety of fish and wildlife species and contribute to the aesthetic and environmental quality of the United States. Millions of Americans use freshwater wetlands annually for hunting, fishing, bird watching, and other outdoor activities. Coastal wetlands provide valuable nursery, feeding, breeding, staging, and resting areas for an array of fish, shellfish, mammals, and birds (Dahl, 2000). In addition, wetlands serve as ground water recharge areas and filter contaminants from surface runoff (Mitsch and Gosselink, 1986) and can buffer coastal areas against storm and wave damage as well as stabilize shorelines (Stedman and Dahl, 2008). Destruction or alteration of wetlands, therefore, can have wide-ranging biological, chemical, and hydrological impacts.

Various lines of evidence suggest that when European settlers first arrived, wetland acreage in the area that would become the contiguous 48 states was more than twice what it is today (Dahl, 1990). Since then, extensive losses have occurred due to draining and filling. In addition to the sheer loss of wetland acreage, major ecological impacts also have resulted from the conversion of one wetland type to another, such as clearing trees from a forested wetland or excavating a shallow marsh to create an open water pond. These types of conversions change habitat types and community structure in watersheds and impact the animal communities that depend on them (Dahl, 2000).

This indicator presents data from the U.S. Fish and Wildlife Service's Wetlands Status and Trends survey. This survey provides an estimate of the extent of all wetlands in the contiguous U.S., regardless of land ownership. The Status and Trends survey uses a probabilistic design, based initially on stratification of the 48 contiguous states by state boundaries and physiographic subdivisions. Within these subdivisions are located more than 5,000 randomly selected 4-square-mile (2,560-acre) sample plots. These plots are examined with the use of aerial imagery. Field verification is conducted to address questions of image interpretation, land use coding, and attribution of wetland gains or losses; plot delineations are also completed. Between 1985 and 2009, 18–32 percent of the sample plots were field-verified (Dahl, 2000, 2006, 2011). The Fish and Wildlife Service used the Cowardin et al. (1979) definition of wetlands, which is part of the draft national standard for wetland mapping, monitoring, and data reporting as determined by the Federal Geographic Data Committee.

This indicator shows trends in the total extent of wetlands, as well as the extent of several types of freshwater and intertidal wetlands. In this analysis, freshwater wetlands include forested, shrub, emergent, and non-vegetated wetlands (e.g., shallow ponds). Intertidal wetlands include marine areas (e.g., tidal flats and sandbars) and estuarine areas (vegetated or not) that are exposed and flooded by the tides. Data on wetland extent are described from several Status and Trends analyses: 1950s-1970s, 1970s-1980s, 1980s-1990s, 1998-2004, and 2004-2009 (Frayer et al., 1983; Dahl and Johnson, 1991; Dahl, 2000, 2006, 2011). For the most recent period, the indicator also describes sources of wetland loss or gain, which the survey divided into five distinct land use categories along with an "other" category reflecting all other land use types (Dahl, 2011).

The Status and Trends survey did not include wetlands along the Pacific Coast until 2004. To avoid biasing the results, Exhibit 1 of this indicator does not include the addition of Pacific wetlands when calculating the rate of change from 1998 to 2004, and Exhibits 2 and 3 track Pacific Coast wetlands separately from other areas.

### What the Data Show

Total wetland acreage has declined since the 1950s, but the rate of loss appears to have slowed over time. From the 1950s to the 1970s, an average of 458,000 acres was lost per year (Exhibit 1). The period from 1998 to 2004 saw an increase in total wetland area, at a rate of 32,000 acres per year, while the most recent study period (2004-2009) experienced losses of 13,800 acres per year.

Gains and losses have varied by wetland type. Freshwater forested wetlands, which make up more than half of all freshwater wetlands, lost acreage from 1954 to 1997 but have shown gains since 1997 (Exhibit 2). Freshwater emergent wetlands show a similar trend with gains in the 2000s (Exhibit 2). Among freshwater categories, forested wetlands have sustained the greatest absolute losses since the 1950s, about 10 million acres, while emergent wetlands have shown the largest percentage loss (about 18 percent). Conversely, the extent of freshwater shrub wetlands increased from 1954 to 2009, suggesting that some of the gains and losses in specific categories may reflect conversion rather than outright wetland loss or gain (Dahl, 2011). Shallow freshwater ponds, meanwhile, have increased steadily throughout the last 50 years, with current acreage more than twice what it was in the 1950s (Exhibit 2), although still much less in absolute terms than the other wetland types.

Since the 1950s, intertidal wetland acreage has decreased (Exhibit 3). This category includes marine, estuarine vegetated, and estuarine non-vegetated wetlands. Both estuarine types lost acreage overall, but long-term trends indicate that losses of intertidal wetlands have slowed over time, with estuarine non-vegetated wetlands actually gaining acreage over the last decade. The Pacific Coast, added to the study in 2004, accounts for about 700,000 acres of intertidal wetlands. The extent of wetlands along the Pacific Coast remained fairly stable between 2004 and 2009.

Between 2004 and 2009, urban development, rural development, silviculture, and conversion to deepwater (e.g., the disappearance of coastal wetlands or flooding to create reservoirs) all contributed to losses in wetland acreage (Exhibit 4). However, the net change in wetland acreage was positive on agricultural lands (100,020 acres) and on lands classified as "other" (389,600 acres). This "other" category includes conservation lands, areas in transition from one land use to another, and other lands that do not fall into the major land use categories as defined in Dahl (2011).

### Limitations

- Because it focuses on national totals, this indicator does not provide information about regional differences in wetland creation and destruction. For example, a separate detailed analysis of wetland acreage in eastern coastal watersheds (including freshwater, estuarine, and marine types) reveals that despite the overall nationwide gain in wetland acreage between 1998 and 2004, eastern coastal watersheds experienced a net loss of wetlands during this period, and the majority of these losses occurred in freshwater wetlands (Stedman and Dahl, 2008).
- Different methods were used in some of the early schemes to classify wetland types. As methods and spatial resolution have improved over time, acreage data have been adjusted, resulting in changes in the overall wetland base over time, thus reducing the accuracy of the trend.
- Ephemeral waters and effectively drained palustrine wetlands observed in farm production are not recognized as wetland types by the Status and Trends survey and are therefore not included in the indicator.
- Forested wetlands are difficult to photointerpret and may have been underestimated by the survey.
- The aerial imagery used for this survey generally does not allow detection of small, isolated patches of wetland less than about an acre.
- Alaska and Hawaii are not included in the Status and Trends survey, and wetlands along the Pacific coast (both freshwater and saltwater) were not included prior to 2004.

### Data Sources

Data for this indicator were obtained from Dahl (2011). Historical trends are based on data originally presented in earlier Fish and Wildlife Service reports (Dahl, 2000, 2006; Dahl and Johnson, 1991; Frayer et al., 1983).

### References

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. FWS/OBS-79/31.

Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service.

<http://www.fws.gov/wetlands/documents/classification-of-wetlands-and-deepwater-habitats-of-the-united-states.pdf> (PDF) (142 pp, 29.8 MB).

Dahl, T.E. 2011. Status and trends of wetlands in the conterminous United States 2004 to 2009. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service. <http://www.fws.gov/wetlands/Status-And-Trends-2009/index.html>.

Dahl, T.E. 2006. Status and trends of wetlands in the conterminous United States 1998 to 2004. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service. <http://www.fws.gov/wetlands/Status-And-Trends/index.html>.

Dahl, T.E. 2000. Status and trends of wetlands in the conterminous United States 1986 to 1997. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service. <http://www.fws.gov/wetlands/Status-And-Trends/index.html>.

Dahl, T.E. 1990. Wetlands losses in the United States 1780s to 1980s. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service. <http://www.fws.gov/wetlands/Documents/Wetlands-Losses-in-the-United-States-1780s-to-1980s.pdf> (PDF) (20 pp, 2.32 MB).

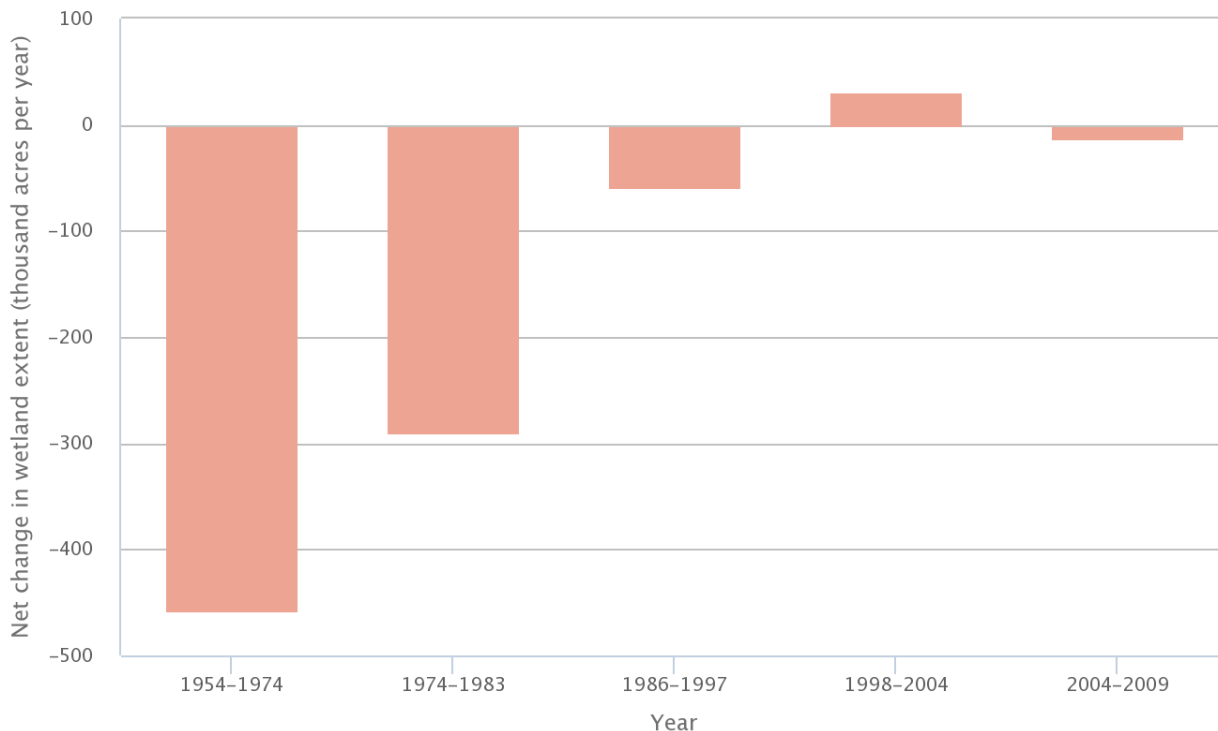
Dahl, T.E., and C.E. Johnson. 1991. Status and trends of wetlands in the conterminous United States, mid-1970s to mid-1980s. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service. <http://www.fws.gov/wetlands/Status-And-Trends/index.html>.

Frazer, W.E., T.J. Monahan, D.C. Bowden, and F.A. Graybill. 1983. Status and trends of wetlands and deepwater habitats in the conterminous United States, 1950s to 1970s. Ft. Collins, CO: Colorado State University. <http://www.fws.gov/wetlands/Status-And-Trends/index.html>.

Mitsch, W.J., and J.G. Gosselink. 1986. Wetlands. New York, NY: Van Nostrand Reinhold Company, Inc.

Stedman, S., and T.E. Dahl. 2008. Status and trends of wetlands in the coastal watersheds of the eastern United States, 1998 to 2004. Washington, DC: National Oceanic and Atmospheric Administration, National Marine Fisheries Service; U.S. Department of the Interior, Fish and Wildlife Service. <http://www.fws.gov/wetlands/Documents/Status-and-Trends-of-Wetlands-in-the-Coastal-Watersheds-of-the-Eastern-United-States-1998-to-2004.pdf> (PDF) (36 pp, 8.82 MB).

### Exhibit 1. Average annual change in wetland acreage in the contiguous U.S., 1954-2009

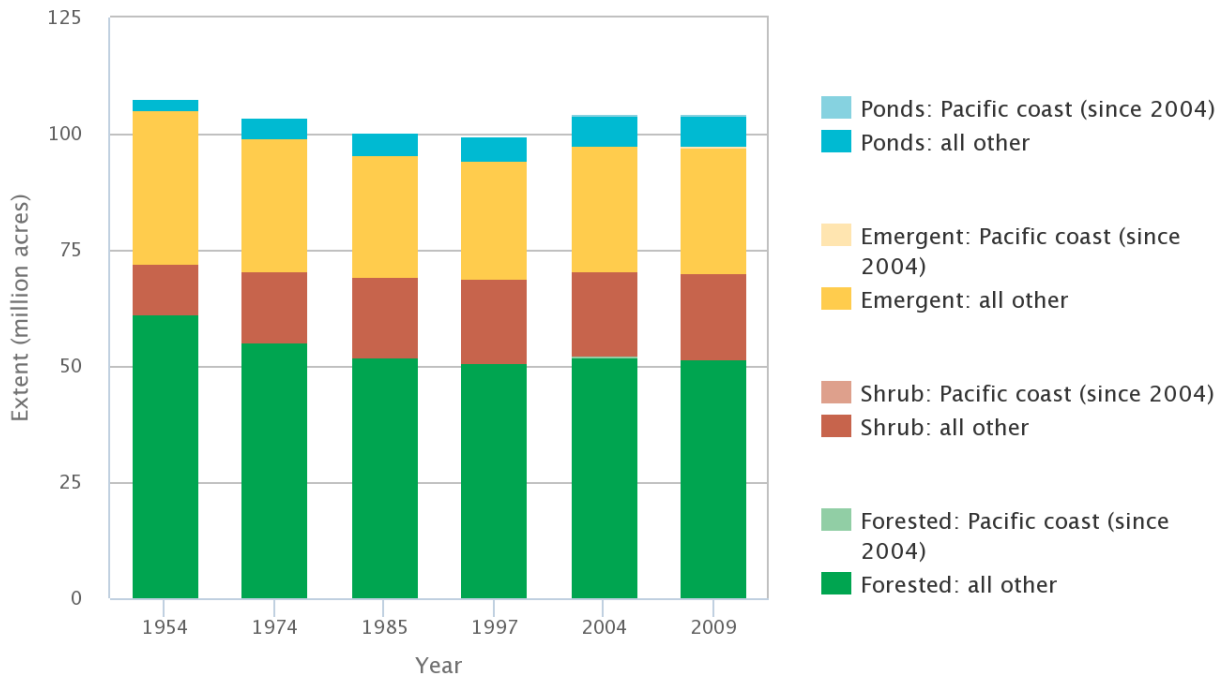


The rate of change for 2004-2009 includes wetlands along the Pacific coast. Previous periods do not.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

**Data source:** Dahl, 2011

## Exhibit 2. Extent of selected freshwater wetlands in the contiguous U.S., 1954–2009



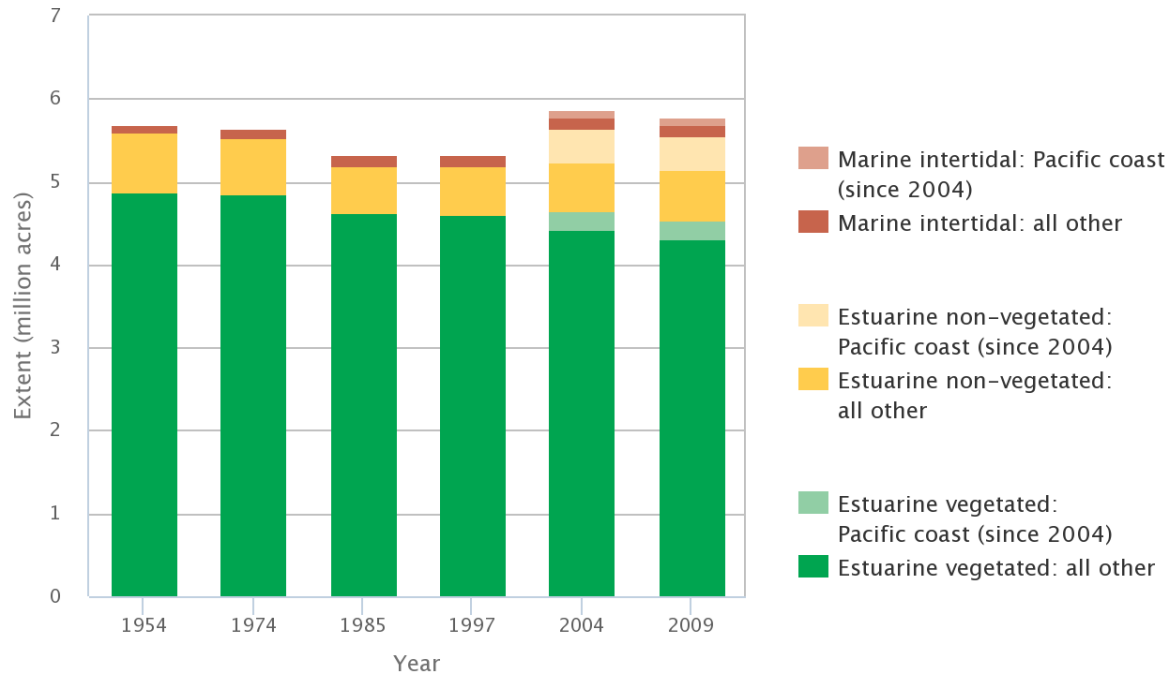
No analysis was conducted during the 1960s.

Prior to 2004, surveys did not include freshwater wetlands along the Pacific coast.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

**Data source:** Dahl, 2011

**Exhibit 3. Extent of marine and estuarine wetlands in the contiguous U.S., 1954–2009**



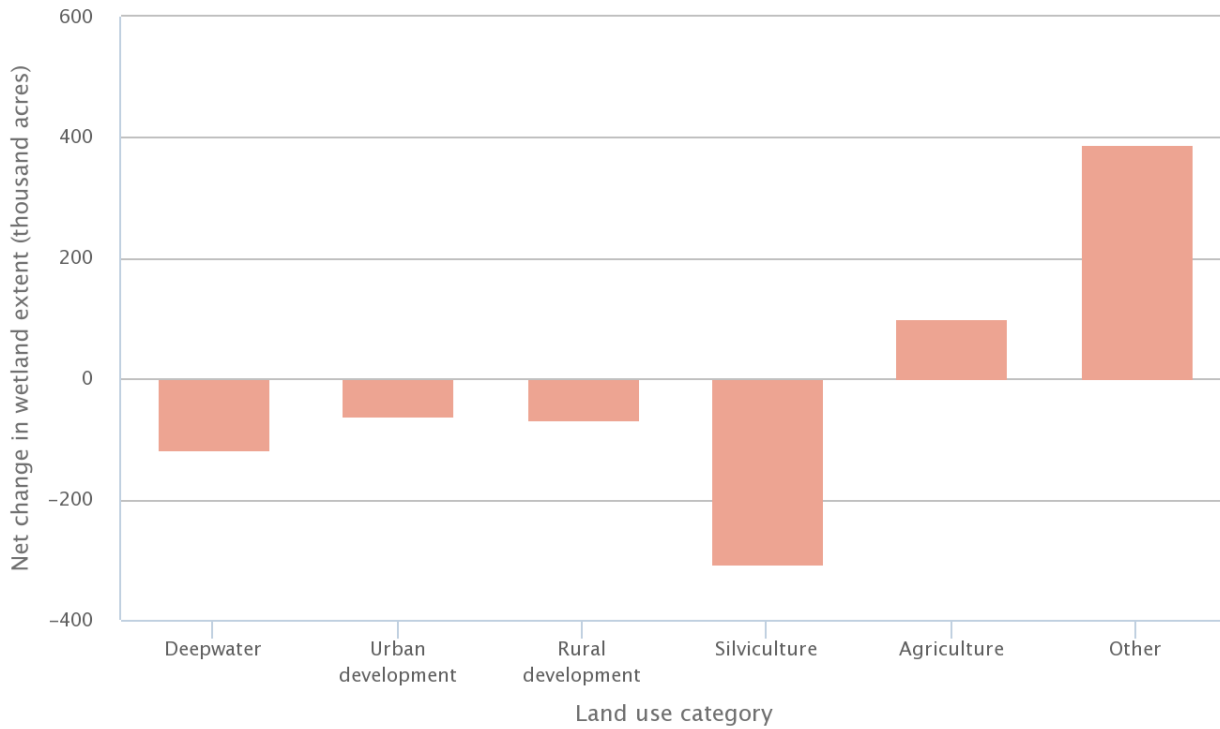
No analysis was conducted during the 1960s.

Prior to 2004, surveys did not include marine or estuarine wetlands along the Pacific coast.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

**Data source:** Dahl, 2011

**Exhibit 4. Sources of wetland gain and loss in the contiguous U.S., 2004–2009**



"Other" includes lands that do not fit into any of the other five categories, such as conservation land and land in transition between different uses.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

**Data source:** Dahl, 2011