



Watershed Academy Web

Distance Learning Modules on Watershed Management

<http://www.epa.gov/watertrain>

Birds: Bellwethers of Watershed Health



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Introduction

Because they respond to basic changes in landscape and habitat condition, birds can be good indicators of watershed health (Figure 1). Birds are also well-studied and very popular with the public. This module will introduce how birds respond to changes in watersheds, and how landscape conditions can be managed to help birds and improve overall watershed health. Many of this module's photos and graphics were provided courtesy of the American Bird Conservancy's (<http://www.abcbirds.org/>) magazine **Bird Conservation**.

You can complete this module in 1/2 to 1 hour.

What are the goals of this module?

This module is designed to help you learn about these three topics:

1. The nature of bird diversity in watersheds and how birds use different parts of the watershed as habitats.
2. How changes in watersheds affect birds and how different species can be monitored to obtain information on the health of watershed habitats.
3. What measures individuals and land managers can take to protect and restore watersheds to help birds and, thereby, improve overall watershed health.

Each section contains useful information, websites for further investigation of the topics, or boxes with examples or more detail to illustrate the concepts.

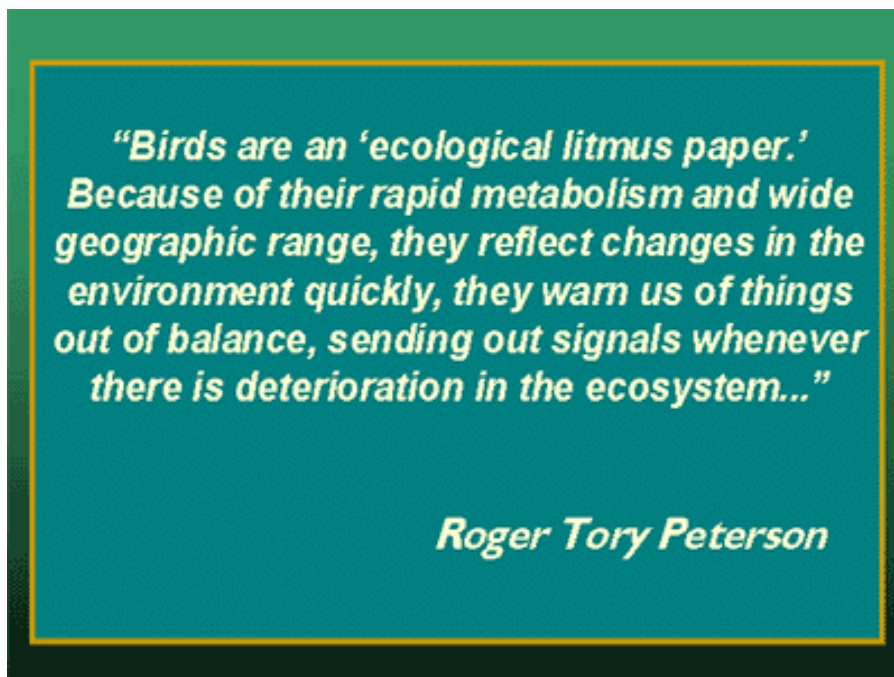


Figure 1

What are birds worth?

Birds are very visible and popular animals with a huge public following. Approximately 63 million Americans watch birds and spend over \$20 billion on bird-related activities and materials every year! Birds also support people. In the U.S. in 1991, there were more than 190,000 people employed in bird-related jobs.

Bird Conservation magazine documents the fact that **birds are big business**. In 1991, five states generated more than one-quarter of a billion dollars in retail sales related to the non-consumptive use of birds (see Figure 2 on the next page). California topped the list with \$623 million in retail sales. And, while birds may not pay taxes, bird-related recreation generates tax revenue--\$516 million in federal income tax and \$306 million in state sales tax in 1991 alone (Figure 3).

The number of bird hunters is decreasing, but waterfowl and game bird hunters still spend huge sums each year. In 1996, hunters spent almost \$1.3 billion dollars on travel and equipment to hunt migratory birds, such as doves and waterfowl.

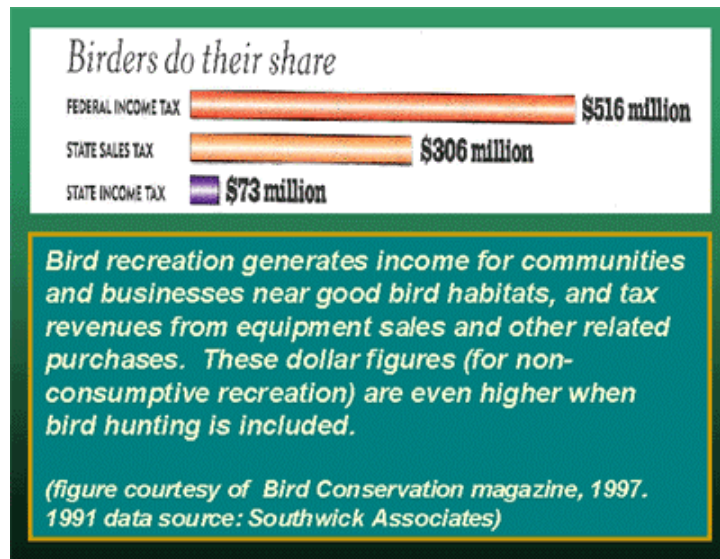


Figure 3

What impacts on watersheds also affect birds?

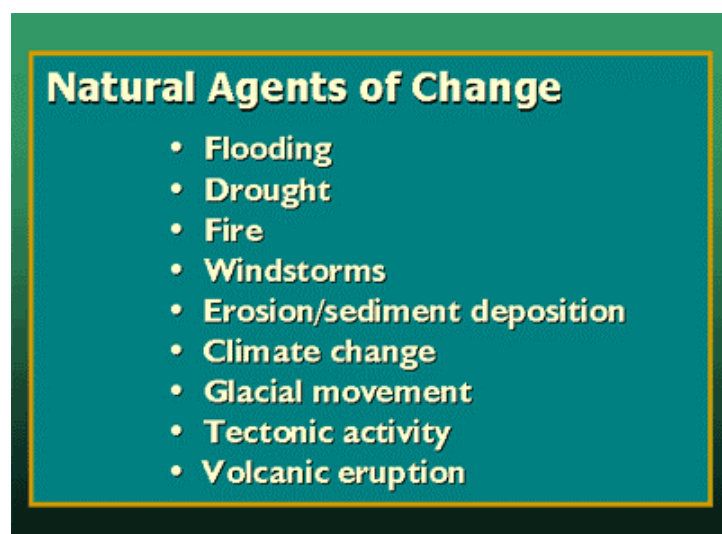


Figure 4

Human and natural factors can cause watershed change. Some change in watersheds is natural and is driven by natural disturbances such as floods and fire (Figure 4). However, human activities may cause impacts more severe in frequency and magnitude than natural agents of change alone. The beneficial natural functions of watersheds may be impaired or destroyed by a variety of human-caused impacts (see Figure 5). Review the module Agents of Watershed Change (<http://www.epa.gov/watertrain/agents/index.html>) for more complete background on this topic.

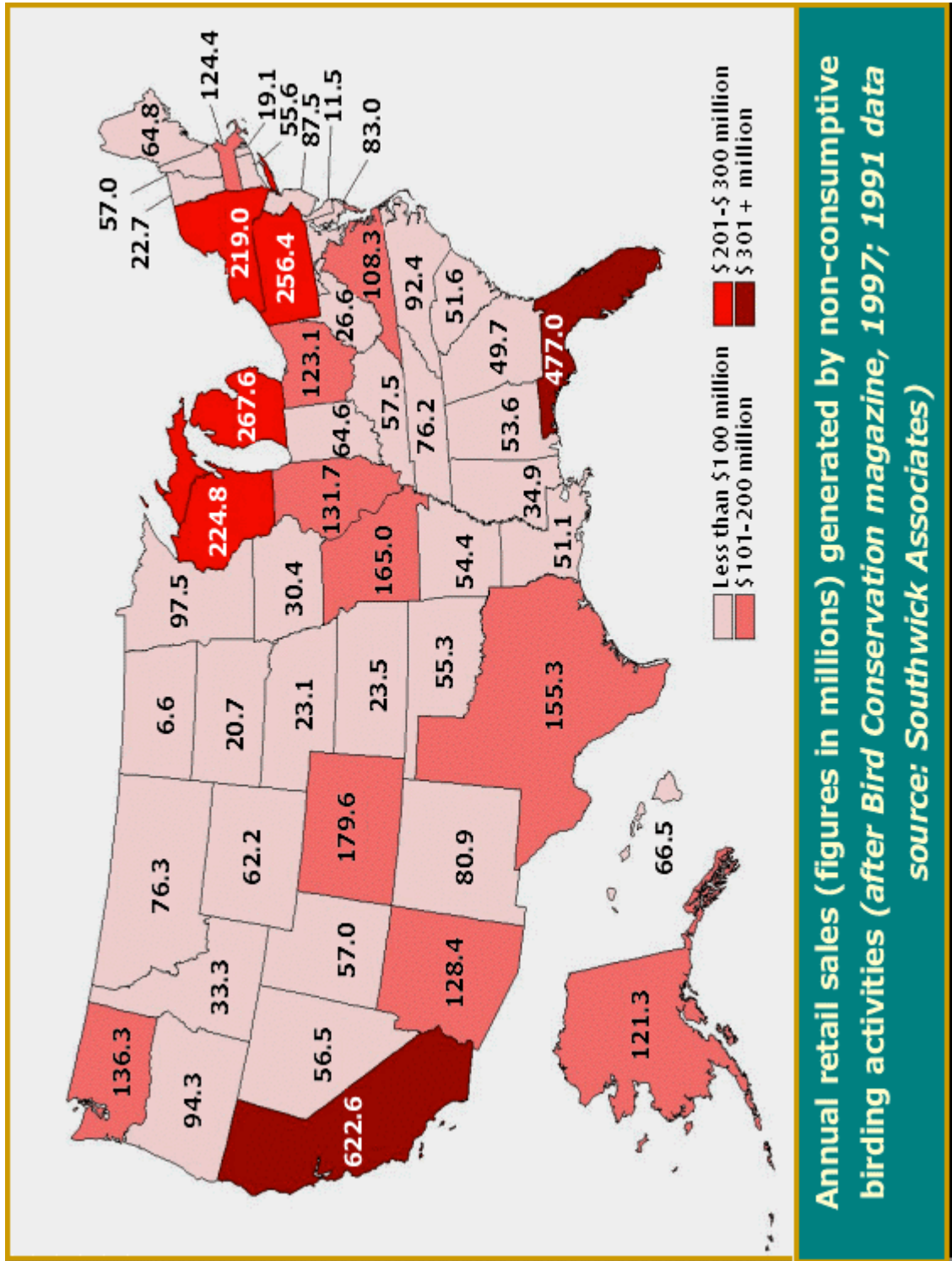


Figure 2

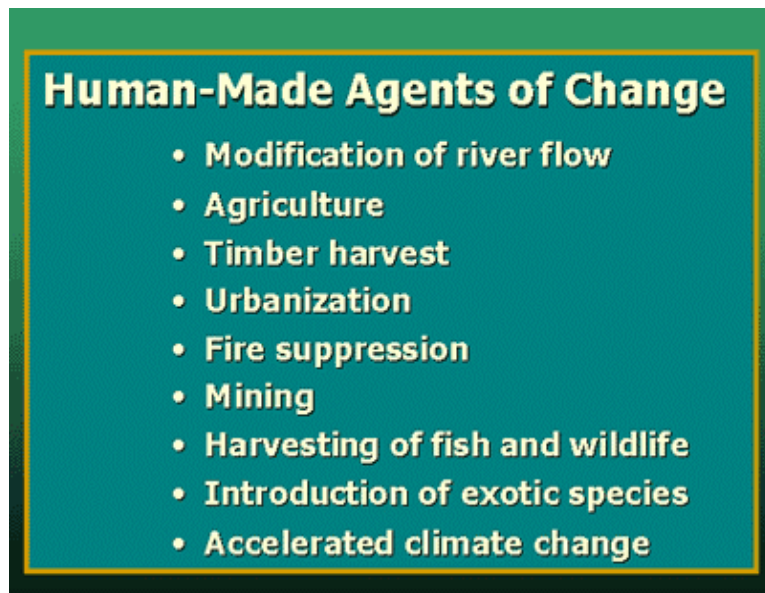


Figure 5

Several types of human-caused impacts are most likely to affect birds. Probably the greatest impact to birds is from habitat loss due to land use changes (Figure 6), which includes the conversion of natural ecosystems--rivers, wetlands, grasslands, and forest--to mining areas, timber harvest zones, agricultural lands, and urban uses. These impacts can cause chemical, physical, and biological changes. For example, some agricultural activities can reduce natural habitats, increase sedimentation to rivers, increase nutrient runoff, and add chemical pollutants to upland, wetland and aquatic systems.

Urbanization often eliminates habitats, increases sediment, heavy metal and nutrient loads to waters, and changes the rate and amount of runoff reaching rivers.

Such impacts to watershed habitats are recorded in decreased numbers of waterfowl due to loss of wetlands, fewer migratory songbirds as a result of forest fragmentation, or losses of bird species dependent on rare or limited habitats.



Figure 6

Invasive and Non-native Species

Another major factor reducing the quality of native bird habitats is the introduction of invasive and non-native plant and animal species (Figure 7). People have brought thousands of species to North America from other parts of the world, and we continue to do so at an increasing rate. Some of these species become severe stresses in watersheds (Text Box 1) and some particularly affect birds (Text Box 2). The Fish and Wildlife Service estimates that non-native, invasive species destroy approximately 4600 acres of indigenous habitat per day and researchers estimate that non-native species cause over \$136 billion of damage every year.

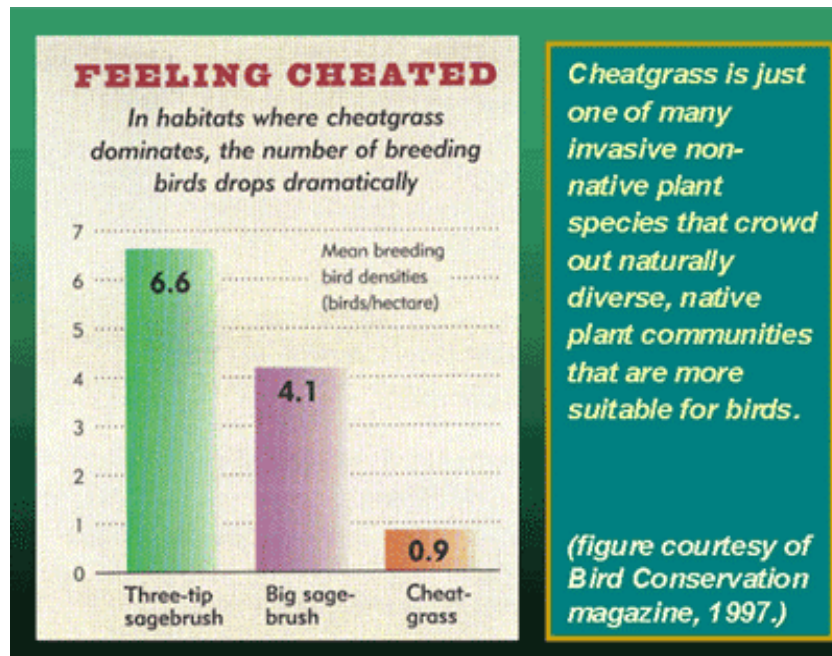


Figure 7

Alien Invaders Wipe Out Natives.....

Thousands of non-native species have been brought to the U.S. from around the world either intentionally or accidentally. However they got here, these alien invaders have wiped out native species, changed the natural biodiversity, and even altered the functioning of entire ecosystems. For example, cheatgrass, a grass from Eurasia and the Mediterranean, has most probably permanently transformed the steppe-shrub ecosystems of the western U.S. The plant was introduced in the 1800s and now covers over 100 million acres of the inter-mountain west. It has successfully pushed out the bunchgrasses native to the region by changing soil nutrient dynamics and by decreasing the fire cycle to every 3 to 5 years, a frequency bunchgrasses cannot survive. In addition, cheatgrass and other non-native plant invaders are implicated in the decline of the Sage Grouse. Once numbering over a million, less than 200,000 of the birds remain.

Read more at: <http://www.blm.gov/weeds/> and at <http://tncweeds.ucdavis.edu/>.

Text Box 1

Of House Sparrows, Bluebirds, and Men

Non-native bird species have had significant impacts on our native avifauna. Consider the plight of the Bluebird. Both eastern and western species are beautiful and popular species that visit feeders and nest in small tree cavities at the edge of forests. Because Bluebirds are so visible, many people have seen them evicted or excluded from prime nesting sites by the aggressive non-native House Sparrow, a bird brought to the U.S. by an Englishman who thought it proper to release into the American environment all the bird species mentioned in Shakespeare's writings (the same man was responsible for releasing the Common Starling). The House Sparrow is now one of the most common birds in the U.S. and is responsible for reducing nesting opportunities for many indigenous species, and it may have contributed to declines in Bluebird numbers in the past few decades. Bluebird lovers have found that nest boxes with openings no larger than 1 to 1-1/8" will allow Bluebirds to nest but will exclude the unwanted House Sparrows.

Read more at Rainier Audubon's site: <http://www.rainieraudubon.org/bib/nestbox/sparrow-starling-info.htm>.

Text Box 2

A particularly destructive non-native predator of birds is the domestic cat, particularly those that become wild in natural areas (Figure 8). There are over 100 million feral and domestic cats in the U.S. A study of cat predation on birds in Wisconsin showed that, in that state alone, cats were estimated to kill on the order of 39 million birds per year. The American Bird Conservancy site (<http://www.abcbirds.org/cats/catsindoors.htm>) provides more information on the damage cats do each year to the bird population.



Figure 8

Pollution and Pesticides



Figure 9

Pollution and pesticides remain significant stressors on some bird populations (Figure 9). Pollutants from agriculture, logging activities, urban uses, and other human activities can significantly degrade watershed habitats. Water quality regulations have been effective at controlling point sources of pollution. But, non-point source pollution from overland runoff and air deposition is still a significant contributor to the degradation of soil and water. Use of pesticides and other toxins can also directly and indirectly affect bird species (Text Box 3).

Raptor Revival

Most Americans are now well aware that the Bald Eagle had declined to near extinction by the 1970s due to the indirect effects of the pesticide, DDT. This chemical caused eggshell thinning and reproductive failure. The combination of species protection under the Endangered Species Act and the banning of DDT use by the EPA has led to the Eagle's heartening recovery from only about 450 pairs in the late 1960s to over 4,500 pairs today. DDT had the same effect on many other species Osprey, White and Brown Pelicans, and Peregrine Falcons and all are recovering. This great success story makes it clear that we can improve conditions for birds. But, pesticides are still a problem in the U.S. and around the world. Over 5 billion pounds of pesticides are applied worldwide each year and these chemicals are killing birds. Recently, biologists found that over 6,000 Swainson's Hawks were killed in Argentina by insecticide spraying. The American Bird Conservancy worked with local and international agencies to end this problem in Argentina proving once again that change is possible.

Read more about pesticides and birds at <http://www.abcbirds.org/>.

Text Box 3

For example:

- In 1992, Dr. David Pimentel and his colleagues at Cornell University estimated that bird losses due to pesticide use cost the U.S., conservatively, over \$2 billion per year based on losses to hunting and other revenues.
- Other studies have reported that Canada Geese, duck species, and Brant have been killed by parathion and methyl parathion, carbofuran, and diazinon. The EPA has estimated that carbofuran alone kills 1 to 2 million birds each year in the United States. Worldwide, it is estimated that up to 67 million birds are killed each year by pesticides.
- Selenium pollution in agricultural drain water was found at Kesterson National Wildlife Refuge to cause deformities and death in exposed birds.

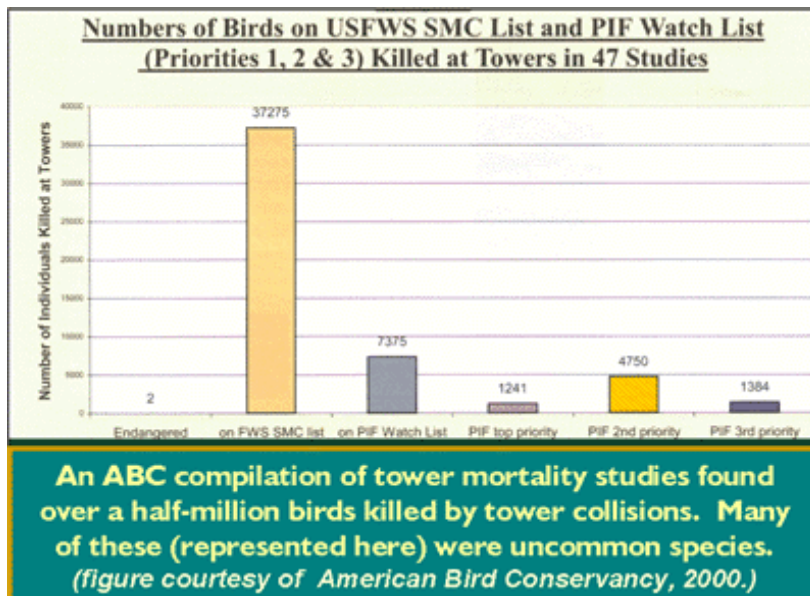


Figure 10

Source: Shire, Brown & Winegrad, Communication Towers: A Deadly Hazard to Birds, American Bird Conservancy, June 2000, Washington, DC.

See the American Bird Conservancy site (<http://www.abcbirds.org/pesticides/pesticideindex.htm>) for more information on the effects of pollutants and pesticides on birds.

Towers and Structures

Towers and structures, especially those lit at night, are other significant sources of bird mortality (Figure 10). Not only do cellular phone towers, huge antennae, and tall buildings change the aesthetic quality of our surroundings, but these structures also kill millions of birds every year. According to a report compiled by the

American Bird Conservancy (ABC), Hawk Mountain Sanctuary and the U.S. Fish and Wildlife Service, there are over 77,000 communication towers in the U.S. The U.S. Fish and Wildlife Service estimates that 4-5 million birds are killed when they collide with the towers or guy wires that stabilize the towers. But, the loss of birds may be as great as 40 million per year. Most of these are neotropical migratory birds trying to navigate their migratory routes (Figure 11). Lights on towers and buildings disorient migratory birds and contribute to the mortality. The ABC report documented losses to 230 different species, 51 of which are rare, threatened, or endangered. Migratory bird mortality is expected to increase as the number of cellular telephone towers and other tall structures increase. Fatal Light Awareness Program (FLAP) at <http://www.flap.org/> and TowerKill.Com at <http://www.towerkill.com> are good sites for further information.

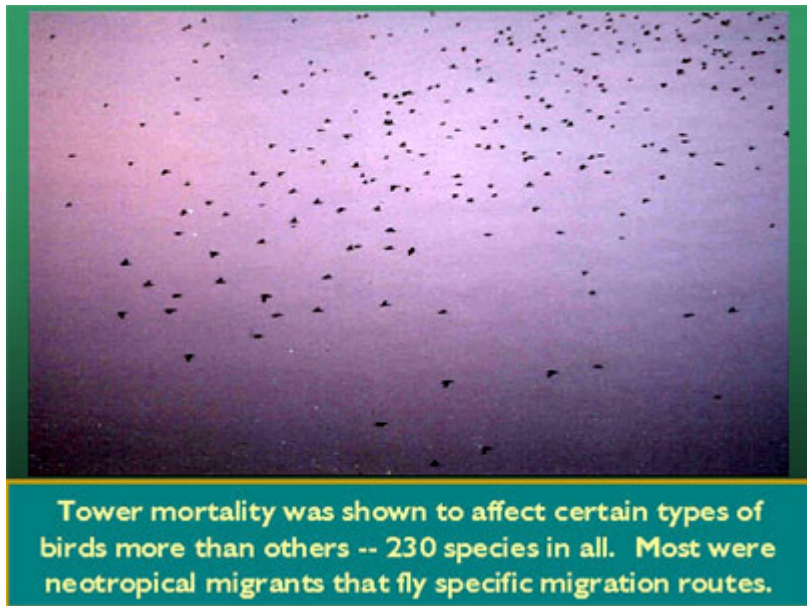


Figure 11



Figure 12

Why are birds important indicators of watershed health?

In the Why Birds? page of their website (<http://www.audubon.org/bird/wb.html>), the National Audubon Society lists these reasons why birds are valuable indicators of watershed condition.

Birds live in a wide range of habitats and they can be affected by many different impacts including land use changes, invasive species and pollution. They can integrate and accumulate environmental stresses and can indicate when some aspects of watershed health are being compromised (Figure 13).



Figure 13



Figure 14

Birds are easy to observe and study, and many species have already been well-studied. Researchers have studied many aspects of bird physiology, taxonomy, and ecology (Figure 14). In addition, long-term trend data on bird population trends from volunteer monitoring programs greatly add to our understanding of how birds are doing over time. The Audubon Christmas Count, conducted for 100 years, is the longest running avian data set.

Birds are important to the public; people notice when birds are declining and will take action to improve conditions for birds (Figure 15). For example, public interest in birds has resulted in the success of many volunteer monitoring programs, such as FeederWatch and the Audubon Christmas Bird Count (see <http://www.birdsource.org/>). See the BirdCast website at http://www.birdsource.org/birdcast/birds_bioindicators.html for more information on birds as indicators of environmental quality and for ideas on how people can help birds survive.

Birds in watersheds: Resident and migratory species

To use birds as indicators of watershed health, we need to know what birds characteristically live in which parts of watersheds. There are over 600 bird species in the U.S., some of which are resident species and others are migratory species.

Resident birds, those that live in the area year-round, can tolerate the yearly range of conditions in their favored upland, wetland, or aquatic habitats. Both their nesting and foraging habitat must be protected in their home watersheds for these species to survive.

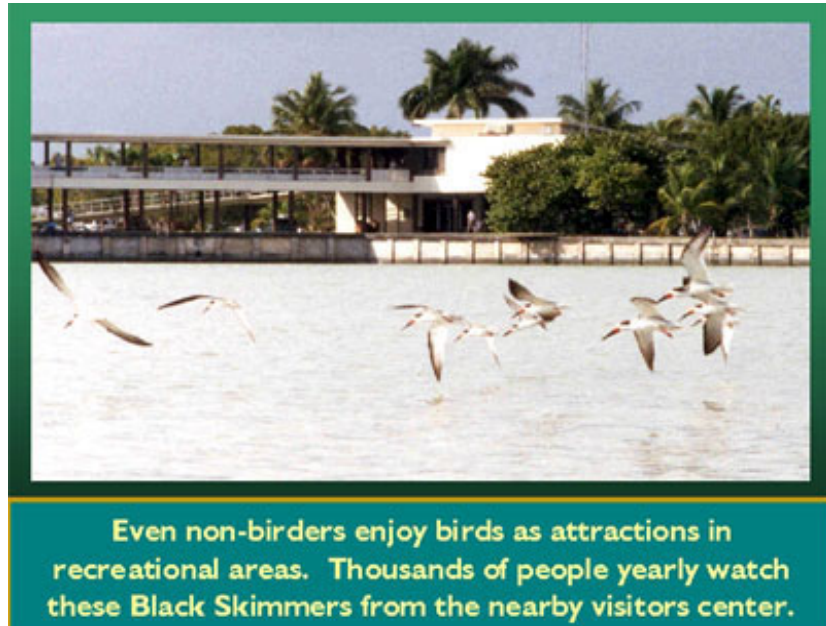


Figure 15

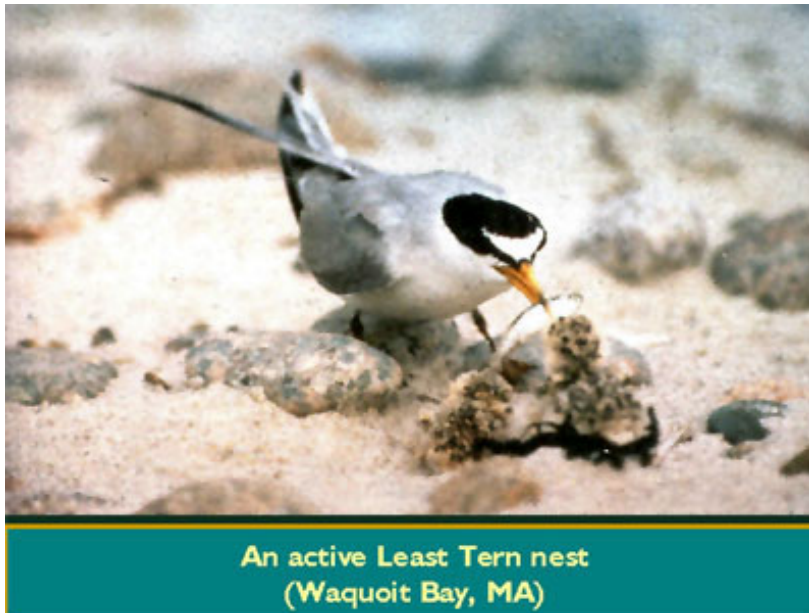


Figure 16

Migratory birds either nest in the U.S. and then fly south for the winter or they nest in Canada and winter in the U.S. Migrants may depend on specific habitats, such as foraging sites along their migratory route, for survival. These species are sensitive to changes in diverse habitats and can tell us about the impacts occurring in U.S. watersheds. For example, approximately 50% of migratory species depend on U.S. wetlands, and these birds are indicators of declines in wetland quality and quantity.

Some watershed habitats and examples of their resident and migratory birds include the following:

Coastal shoreline habitats:

- **American oystercatchers** reside year-round in coastal rocky zones where they pry open oysters and clams for a living.
- The **Red Knot**, a species of sandpiper, nests in the arctic tundra and migrates in winter along both the U.S. east and west coasts, foraging in mudflat zones of salt marshes (Figure 17).



Figure17



Figure 18

Marsh and open water habitats:

- The **Great Blue Heron**, a resident species in much of its range, nests in trees near water in colonies, called rookeries. They forage year-round for fish and other aquatic organisms in shallow salt to fresh water (Figure 18).
- **Osprey** migrate to Mexico, Central, and South America in the winter and nest in the summer over open water throughout the U.S. They feed themselves and their young with fish caught in these waters.

Riparian (stream-side) habitat:

- **Swainson's Hawk** is a migratory, western hawk that nests in tall stream-side (riparian) trees and forages for rodents in grasslands nearby (Figure 19).
- **Louisiana Waterthrushes** nest in riparian habitats next to streams in the eastern U.S. and forage on large aquatic insect species that occur only in clean water.

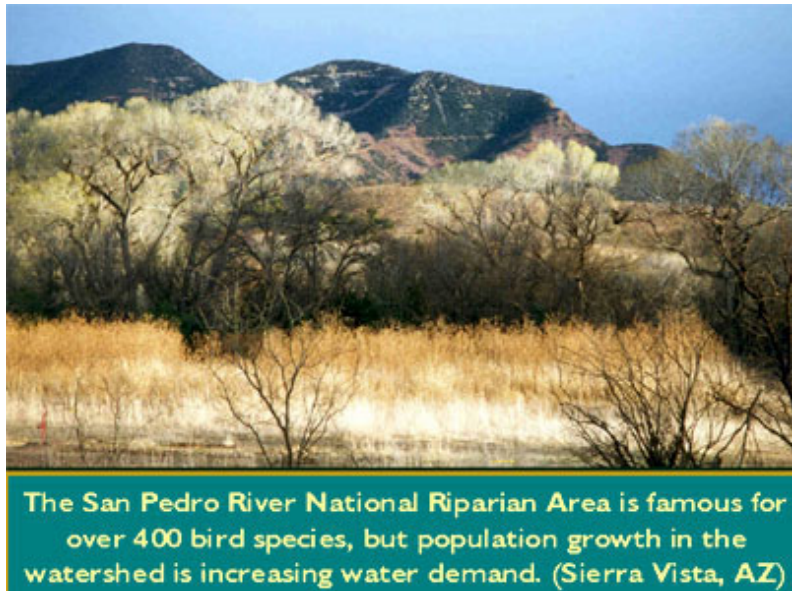


Figure 19

Grassland habitat:



Figure 20

- **Short-eared Owls** are resident in parts of their mid-western and western range. This species is dependent on large tracts (greater than 250 acres) of open habitat for survival. See The Raptor Center website for more information on this and other birds of prey (<http://www.raptor.cvm.umn.edu/>).
- **Henslow's Sparrow**, a rare, migratory species, breeds in tall grasslands from New England to Kansas and winters in grasslands and longleaf pine forests from southern North Carolina along the Gulf Coast to eastern Texas.

Forest habitat:

- The **Saw-Whet Owl** is a small, common owl of dense woodland habitats east of the Mississippi. It requires tree cavities, usually found in dead or older trees, for successful nesting. The Saw Whet winters in its breeding range (Figure 21).

- **Prothonotary warblers** are migrants that nest east of the Mississippi in floodplain forests and winter in mangroves and riparian forests in Central America. Both the breeding and wintering habitats of this warbler are being fragmented or destroyed.

What can birds tell us about watershed health?

Because of their dependence on different habitats, birds can be good indicators of some changes to watersheds. For example:

- **The fish-eating Osprey** is sensitive to pollutants that bioaccumulate in fish. In the 1960s, Osprey had declined greatly due to the effects of DDT. Since EPA banned the use of DDT, Osprey numbers have increased significantly (Figure 22).
- **Swainson's Hawk** numbers have declined due to the loss of the riparian forests in which they nest. In California, for example, approximately 95% of the original riparian forest has been lost to agriculture, urbanization, flood control, and dams. This species is an indicator of the presence of healthy riparian forest, which in watersheds, has many other important benefits, including water filtration, water retention, stream shading for fish, and providing food for aquatic insects that fish and birds eat.

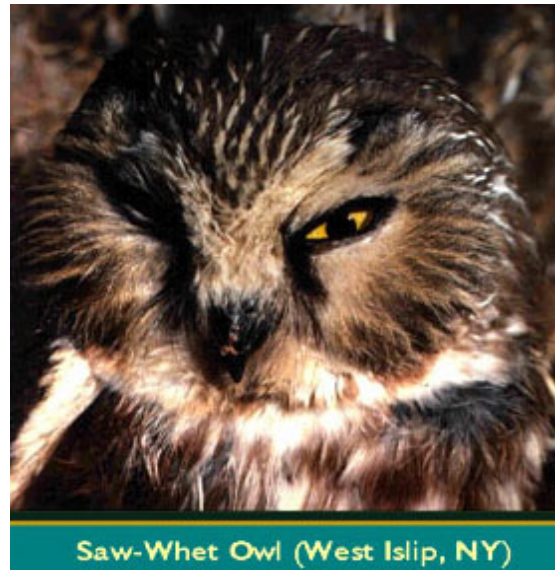


Figure 21

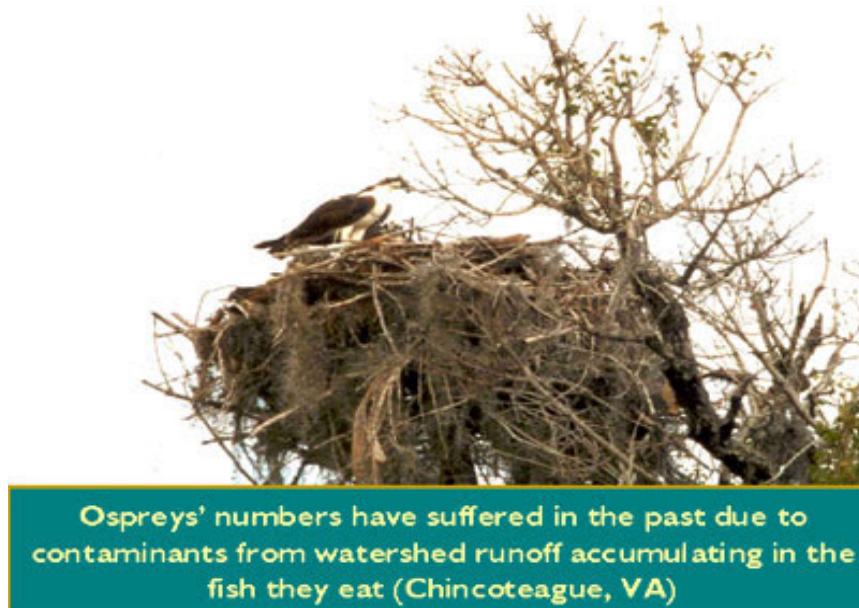


Figure 22

- **A number of warbler and thrush species** are declining due to the fragmentation of the forest habitat in which they nest. Fragmentation not only reduces useful habitat, but it allows predators, such as domestic cats, easier access to vulnerable nests (Figures 23 and 24).
- **Many grassland species**, such as Henslow's Sparrow and Meadowlarks in the east and Burrowing Owls and Loggerhead Shrikes in the west, are declining due to the conversion of grasslands to agriculture and urban uses. Pesticide use may also be a factor in the decline of some of these species.
- **Hundreds of thousands of migratory birds** are killed each year when they collide with towers and buildings during their migration at night. Some species are severely affected, such as the rare Tennessee Warbler, a bird commonly killed by towers.



Figure 23

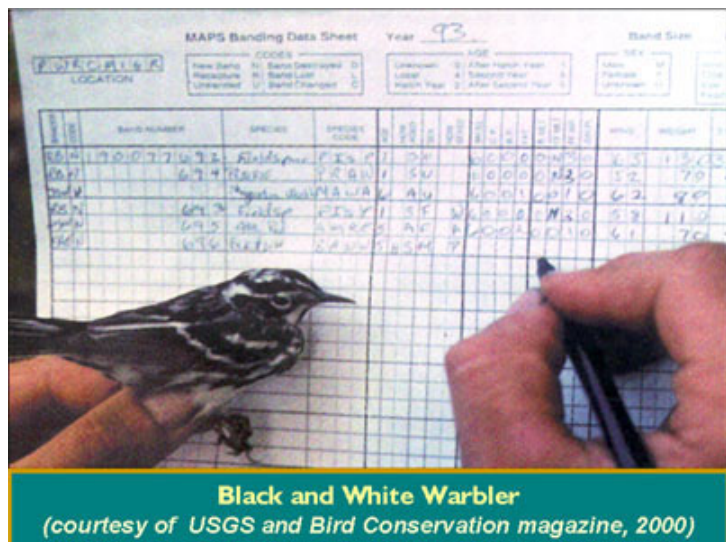


Figure 24

Birds have been included in many projects as monitors of habitat restoration success and general habitat health. Here are just a few cases.

- **Along the Anacostia River in Washington DC**, a number of agencies have worked for a decade to restore the former freshwater, tidal habitat at the 77-acre Kenilworth marsh. This area was once an important waterfowl and wetland bird nesting area and restoration work sought to restore the native wetland vegetation community to once again attract nesting species. The restoration work has helped re-establish native wild rice as well as several pairs of Marsh Wrens, a species not found nesting in the area since the 1940s.
- **A riparian restoration project** at the south end of the San Francisco Bay has been monitored for bird use for the past 10 years by Coyote Creek Riparian Station. Results of the monitoring showed that some species preferred the restoration sites over the older

growth habitat. In particular, there has been an increase in birds that eat insects found on leaves and twigs, species such as the migratory Orange-crowned Warbler. The bird data indicate that the restoration area is succeeding as a functioning riparian corridor for migratory birds. Find more information on this monitoring project in the Spring 2000 issue of Volunteer Monitoring on the EPA website at http://www.epa.gov/volunteer/vm_index.html.

- **The LoonWatch Program** uses the success of loons as a way to assess habitat quality in and around lakes in Wisconsin, Minnesota, and Ontario. Since loons are sensitive to pollutants in water and fish, loss of wetland habitat, and disturbance to their nests, the presence of loons is one indicator of wetland habitat health.
- **Research projects** have also been designed to understand how birds respond to changes in the landscape. Text Box 4 describes monitoring of restoration sites to see if they were used by the endangered Least Bell's Vireo. Next, read about a study that examined the response of bird diversity to a range of watershed conditions (Text Box 5).

Riparian Habitat Bellwether

The quality of habitats can be assessed by who lives there, and species with particular needs can be especially good indicators of good condition. In the case of riparian, or streamside, habitat in southern California, the Least Bell's Vireo is an indicator of high quality habitat. This species is an obligate riparian breeder, and because over 95% of the original streamside habitat has been destroyed in California, this bird is now a state and federally endangered species. Several highway projects recently destroyed habitat supporting the Least Bell's Vireo and four restoration sites were established to reinstate that lost habitat for the bird. Monitoring and research showed that the restoration sites supported breeding Vireos in 3 to 5 years. The birds require a good supply of insects for food and a well-developed, multi-layered, natural forest in order to breed successfully. This type of habitat structure is maintained by flooding, a disturbance natural to this system. These sensitive birds have shown they are good indicators of healthy riparian systems supported by natural flooding regimes.

Kus, B.E. 1998. Use of restored riparian habitat by the endangered Least Bell's Vireo. *Restoration Ecology*, 6:75-82.

Text Box 4

Surviving in Suburbia

Bird species number, or diversity, can be a useful indicator of watershed condition. In northern California, a researcher measured the number of bird species found in different land use types in the San Francisco Creek watershed. Bird species were counted in six land use types which represented a human disturbance gradient from relatively undisturbed natural habitat (oak woodland) to recreational open space and golf course to residential, office park, and finally urban business district. Results showed that most of the 21 oak woodland species gradually dropped out as the landscape became more modified by human activity. These biodiversity numbers are clear indices of watershed change. The results also showed that the number of species and bird biomass actually increased over the oak woodland at the recreational open space and golf course sites. Although up to 8 oak woodland species dropped out at these sites, they were replaced by more species, most of which were widely distributed, abundant species such as the House Finch, American Robin, and Brewer's Blackbird. These results show that it is important to consider not just the number of species, but the identity of species.

Blair, R.B. 1996. Land use and avian species diversity. *Ecological Applications*, 6:506-519.

Text Box 5

What factors should land managers consider to protect birds?

Bird diversity and abundance are indicators of the condition of watershed habitats, both terrestrial and wetland (Figure 25). To keep these biological indicators healthy, watershed conditions should be managed to encourage bird survival and reproduction.

Click [here](#) for a checklist of items that managers, landowners, and citizens should consider in order to protect resident birds and migratory species from human activities (Text Box 6).

Here are some general considerations for protecting birds and their habitats:

- Both nesting and foraging habitat for resident birds should be protected from habitat loss and degradation, non-native species, and pollutants.
- Protect nesting habitat from temporary disturbances during the breeding season, so that nesting birds are not disturbed.
- For migratory species, protect their critical nesting, foraging, or stop-over habitat.
- Remove or minimize migratory barriers and obstacles, such as communication towers.
- Find out what species of birds live in your area, especially sensitive species; protect and restore the habitat conditions they require. The next frames will help you learn where to collect this information.

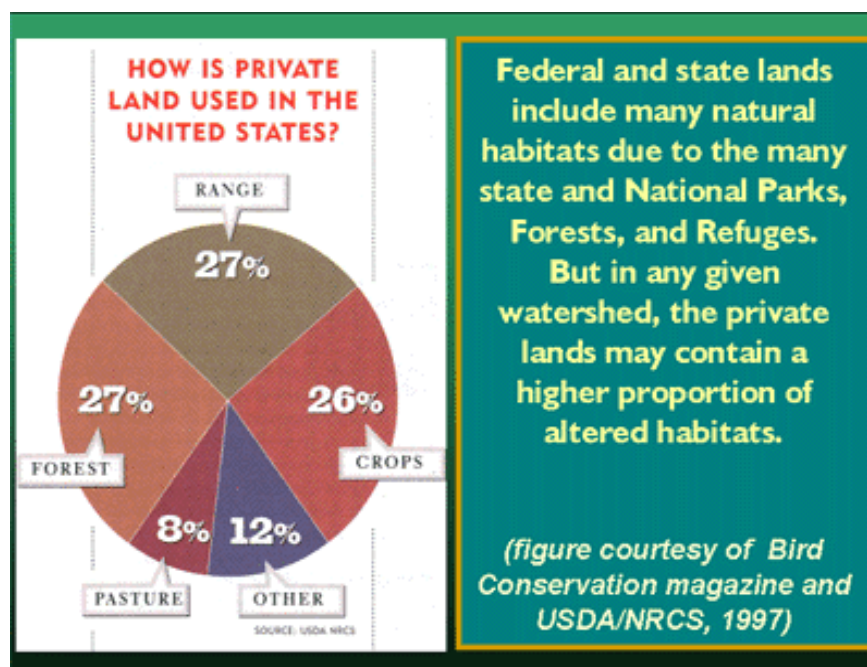


Figure 25

Birds and Watersheds Checklist

Resident Birds

Protect foraging areas year-round from:

- Habitat destruction (avoid, minimize, or compensate for losses)
- Cats and non-native species
- Pesticide use that would harm birds or reduce prey
- Incompatible adjacent land uses

Protect nesting areas year-round from:

- Human encroachment and disturbance
- Construction too near nest sites
- Cats and non-native predators
- Pesticide use that would harm birds or reduce prey

Other considerations:

- Do not fragment existing habitat
- Connect foraging and nesting areas with appropriate habitat
- Restore habitat as part of development projects, when appropriate

Migratory Species

- Protect important foraging stop-over areas from habitat loss, fragmentation, or alteration. Such areas include mudflats for shorebirds and foraging fields for geese.
- Study the effect of towers and buildings on migratory bird kills.
- Prevent placement of towers that will harm birds; eliminate towers and lighted features whenever possible.
- Remove other obstacles from migratory bird routes, especially heavily used migratory bird corridors.
- Maintain and restore migratory corridors, especially riparian zones.
- Do not use pesticides or cause other disturbances in high bird use areas.

Text Box 6

What information exists on species found in different regions?

How can land managers and the public find out what birds live in their watersheds? A number of resources can provide these data. An excellent source is the Partners in Flight (PIF) Bird Conservation Plans on the PIF website at <http://www.partnersinflight.org/pifbcps.htm>. This resource lists species of concern in areas around the country (Figure 26).

Another source is the Breeding Bird Survey (BBS) at <http://www.mp2-pwrc.usgs.gov/bbs/> which provides data on breeding bird populations over time. Results from the last Audubon Christmas Count will list most winter species. Check the "Links" page of the American Birding Association website for Christmas Count data for some states (<http://americanbirding.org/abalinks/linkspage3b.htm>).

Local sources of bird information include bird species lists from local Audubon Society chapters and Breeding Bird Atlases for your state, county, or region, also available from your local Audubon chapter. Some statewide bird atlases are listed on the Links" page of the American Birding Association website <http://americanbirding.org/abalinks/linkpage3b.htm>.

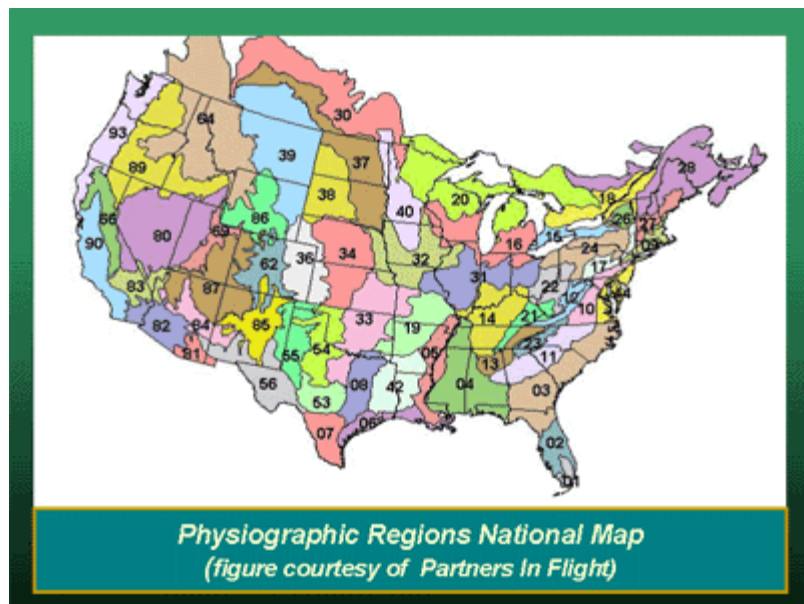


Figure 26

What information exists on the status of bird species?

There are several large-scale bird monitoring programs in the U.S. that are providing information on how well different species or groups of species are doing. Some of these include:

- **North America Breeding Bird Survey (BBS).** Started in 1966, the BBS is a large-scale survey of North American birds with the primary objective of estimating population change for songbirds. The program is run by Patuxent Wildlife Research Center, US Department of the Interior, Laurel, MD, USA. The website is a good source of information about distributions and population changes of North American birds (Figure 27). See <http://www.mbr.nbs.gov/bbs/bbs.html>.
- **Aububon Christmas Counts.** Since 1900, thousands of volunteers have counted birds in the U.S. on specified days around the holiday season. This program, sponsored by the National Audubon Society, collects monitoring data on winter bird populations. For analysis of these data, see www.mbr-pwrc.usgs.gov/bbs/cbc.html.



Figure 27

- **International Shorebird Survey.** Shorebirds have been counted since 1974 at over 400 sites, mostly in the U.S., in this survey coordinated by the Manomet Center for Conservation Sciences (<http://www.manomet.org/WHSRN/Shorebird%20Surveys.htm>).
- **The WatchList**, developed by Partners In Flight/National Audubon Society, ranks bird species in trouble by trends in their population numbers and by threats to their survival. See the WatchList at <http://www.audubon.org/bird/watch>.
- **BirdCast.** This collaborative effort uses radar to track migratory birds and puts this information on the internet. It allows people to follow migratory bird flocks in real time. See <http://www.birdsource.org/birdcast>.
- **Project FeederWatch.** Since 1987, over 14,000 citizens in the U.S. and Canada have collected data between November and April on the birds visiting their feeders. See <http://birds.cornell.edu/PFW/> for information on the project and how you can participate.

Click on "EPA and Bird Conservation" for more information sources on bird monitoring programs in the U.S. (<http://www.epa.gov/owow/birds/>). See also the Cornell Laboratory of Ornithology site <http://www.birdsource.org/> and the American Birding Association site <http://americanbirding.org/> for thorough lists of monitoring programs.

What steps might land managers take to protect and restore their watershed's habitats for birds?

1. Inventory bird species diversity.
 - Conduct an assessment of bird species diversity (number and identity of species) of breeding and migrating species in the area of interest.
 - Map important foraging areas, breeding sites, and migratory stop-over sites.
2. Assess impacts to birds and their habitats from human activities and avoid those impacts.
 - Using the bird biodiversity and mapping information generated, determine whether planned projects will reduce, fragment, or degrade important bird habitat.



Figure 28

- To better understand the impacts of human activities, do an environmental impact assessment (EIA). This tool provides a valuable process and structure for assessing impacts to the natural environment. For federal projects and in some states, project evaluation under the National Environmental Policy Act or state environmental impact assessment statute may be required. Already completed EIA documents could provide information that could help in evaluating future impacts to bird habitat.
3. Manage watersheds for birds by protecting and restoring all habitat types, managing for a mix of habitat types; allow or create disturbances typical to the natural habitats (such as fire and flooding).
 - Talk with land preservation groups such as The Nature Conservancy to learn the best approaches to preserving and managing bird habitat.
 - Work with local wildlife agencies, Waterfowl Joint Ventures, or federal agencies such as the Natural Resource Conservation Service or FWS to restore bird habitat.
 4. Develop a watershed monitoring plan for birds and monitor bird species diversity and abundance.



Figure 29

5. See the Watershed Academy Web module, Overview of Watershed Monitoring, for basic monitoring plan design. The module can be found at: www.epa.gov/watertrain/monitoring/. A PDF version of this module is available at: www.epa.gov/watertrain/PrintPDF.htm/.
6. See the protocols developed by EPA's Bioassessment Wetland Working Group (BAWWG) for bird monitoring protocols (see the EPA website at <http://www.epa.gov/owow/wetlands/bawwg/>). The U.S. Fish and Wildlife Service and the non-profit group called Institute for Bird Populations also have bird monitoring protocols.

What programs fund bird habitat acquisition and restoration?

Land management, restoration, or acquisition to improve watershed conditions takes funding. Fortunately, a wide array of funding sources for such projects exist. Here are just a few:

- **U.S. Fish and Wildlife Service**
 - **Partners for Fish and Wildlife.** This program funds habitat acquisition and restoration for all species. <http://partners.fws.gov/>
 - **Private Stewardship Grants Program.** This grant funds efforts that benefit species listed or proposed as endangered or threatened under the Endangered Species Act of 1973. http://endangered.fws.gov/grants/private_stewardship.html
 - **North American Wetlands Conservation Act Grants Program.** This program includes both large and small grant opportunities for projects designed to restore wetlands, especially those that will aid waterfowl and rare species. <http://northamerican.fws.gov/NAWCA/grants.htm>
 - **The Neotropical Migratory Bird Conservation Act Grant Program.** This is a matching grant program to fund projects that promote the conservation, and perpetuate healthy populations of neotropical migratory birds. http://birdhabitat.fws.gov/NMBCA/eng_neo.htm

- **U.S. Environmental Protection Agency**
 - **Five-Star Restoration Program.** Small grants are given to community partnerships that want to restore naturally functioning habitats. <http://www.epa.gov/owow/wetlands/restore/5star/>
 - **Wetlands Program Development Grant.** This grant funds projects that build the capacity of states, tribes, and local governments to effectively protect wetland and riparian resources. <http://www.epa.gov/owow/wetlands/grantguidelines/>

- **National Oceanographic and Atmospheric Administration (NOAA)**
 - **Community Based Restoration Grants.** This program funds partnerships undertaking restoration projects, especially those focused on coast resources (Figure 30). <http://www.nmfs.noaa.gov/habitat/restoration/community/index.html>

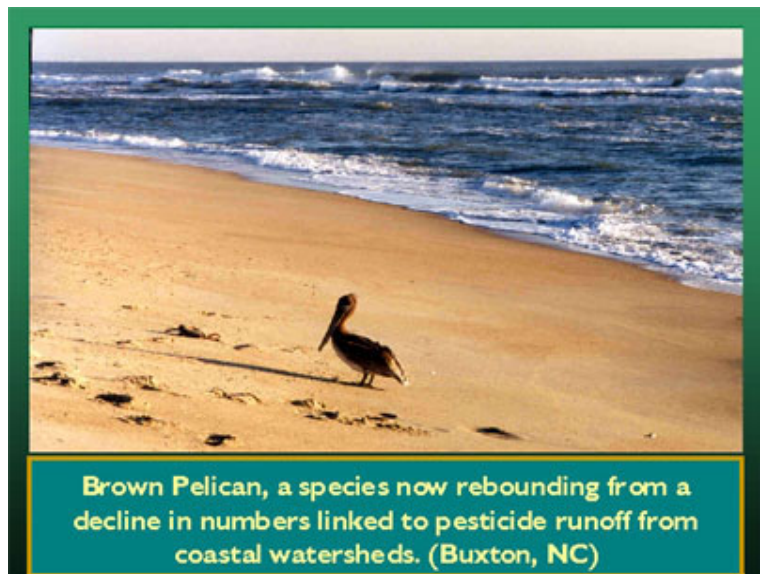


Figure 30

- **USDA Natural Resource Conservation Service (NRCS)**
 - **Wetlands Reserve Program** (<http://www.nrcs.usda.gov/programs/wrp/>) and
 - **Conservation Reserve Program.** (<http://www.fsa.usda.gov/pas/publications/facts/html/crpcont00.htm>)

These two popular programs are designed to return retired agricultural land to wetland.

- **Wildlife Habitat Incentives Program.** This is a voluntary program for people who want to develop and improve wildlife habitat on private lands. It provides both technical assistance and cost sharing to help establish and improve fish and wildlife habitat. <http://www.nrcs.usda.gov/programs/whip/>
- **Non-profit organizations** such as The Nature Conservancy at <http://www.tnc.org> , The National Fish and Wildlife Foundation at <http://www.nfwf.org/>, and Ducks Unlimited at <http://www.ducks.org/>.
 - **General Challenge Grants** (National Fish and Wildlife Foundation). These grants are awarded to projects that address priority actions promoting fish and wildlife conservation and the habitats on which they depend. (http://www.nfwf.org/programs/grant_apply.htm)
 - **Migratory Bird Conservancy** (National Fish and Wildlife Foundation). This is a bird conservation grant fund supported by donations from birding businesses and their customers, and matched by NFWF. (<http://www.conservebirds.org/>)
- **State-level programs** administered by state wildlife agencies, soil and water conservation districts, environmental protection departments, wetland and water quality programs. See the Association of State Wetland Managers website (<http://www.aswm.org/>) and the International Association of Fish and Wildlife Agencies website (<http://www.sso.org/iafwa/>) for a start on state-level resources.
 - **State Wildlife Grant Program** (U.S. Fish and Wildlife Service). The SWG program provides funds to help develop and implement programs that benefit wildlife and their habitat, including species that are not hunted or fished. Although not directly eligible for these grants, third parties such as nonprofit organizations may benefit from these funds by working directly with their states to see if either grants or partnering opportunities are available.
- **NOAA Community-Based Restoration** is a program that partners with national and regional organizations to solicit and co-fund proposals for locally-driven, grass roots restoration projects that address important habitat issues within communities. (<http://www.nmfs.noaa.gov/habitat/restoration/funding.html>)

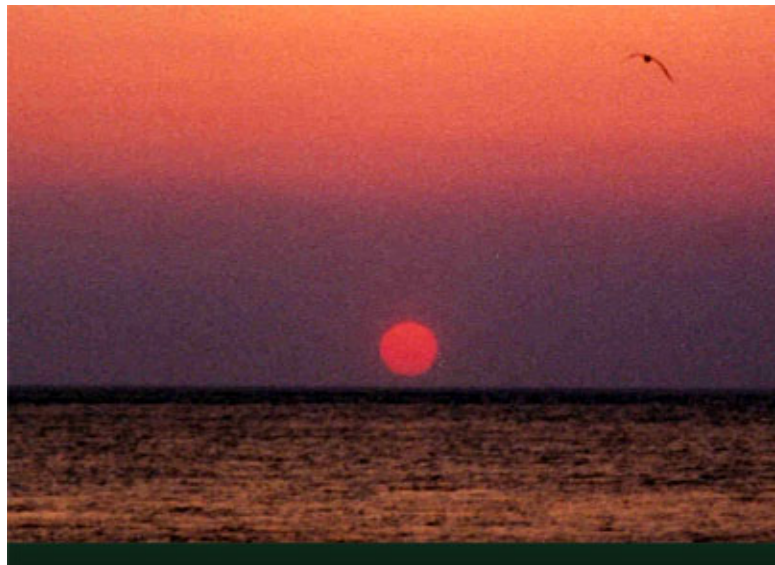


Figure 31

This module has focused on the importance of birds as watershed health indicators and has provided information on how

watershed managers and others interested can improve watershed conditions. For managers who receive questions from the public on how people can help birds, direct the public to the resources listed in Text Box 7.

People Helping Birds

For citizens who want to do more for birds, see the EPA website at <http://www.epa.gov/owow/birds/intro.html> to read about how to:

- Undertake some of the suggestions given by American Birding Association in Thirty Things You Can Do To Help Birds (<http://www.americanbirding.org/>).
- Educate yourself on bird conservation issues.
- Participate in "citizen science programs". National ones include: BBS, Audubon Christmas Counts, FeederWatch, Backyard Bird Count, and MAPS. Look for local watershed projects, non-profit groups, or government agency projects that monitor birds through volunteer efforts. See a list of some citizen science projects at <http://birds.cornell.edu/>.
- Enhance the environment for birds by working with local conservation projects, such as watershed protection programs.
- Participate in local, state, or national initiatives to protect birds.
- Enhance your property for birds by planting native species or providing nesting sites.
- Help birds with your personal life-style choices, such as keeping your cat indoors, avoiding pesticides, and buying bird-friendly products.

Text Box 7

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