

Birds

Birds are a conspicuous component of many ecosystems. They have high body temperatures, rapid metabolisms, and occupy high trophic levels. Because they can respond quickly to changes in resource conditions, birds are considered good indicators of ecosystem health. In other words, changes in bird populations may indicate changes in the biotic or abiotic components of the environment upon which they depend. In addition, birds are highly detectable compared to other vertebrates, and they can be efficiently surveyed with the use of several standardized methods. Birds also come under the legal mandates of the Migratory Bird Treaty Act and, in some cases, the Endangered Species Act (ESA). Monitoring changes in bird population and community parameters can be an important component of any comprehensive, long-term monitoring program. In addition, some studies suggest that bird reproduction rates vary with habitat quality, leading to higher densities in superior habitat (Bock and Jones 2004). However, perhaps the most compelling reason to monitor birds is that birds themselves are inherently valuable. The high aesthetic and spiritual values that humans place on native wildlife are acknowledged as part of the National Park Service (NPS) mandate: “to conserve . . . the wild life therein . . . unimpaired for the enjoyment of future generations.” Birdwatching, in particular, is a popular, longstanding recreational pastime in the U.S., and it forms the basis of a large and sustainable industry. This is especially evident in the American Southwest, where the high diversity of birds creates some of the best birdwatching opportunities in the country. Although several large-scale programs, such as the Breeding Bird Survey, have been initiated in the U.S., they are often insufficient to document local changes in bird populations at the park and network scales. Monitoring birds is especially critical given population declines for some species in recent decades, especially neotropical migrants. NPS I&M bird monitoring programs will compliment these other efforts by providing managers with information on changes to bird populations in their parks and protected areas.

Distribution and Life History

Hundreds of species of birds occur in the American Southwest. For example, the Sonoran Desert supports more than 350 bird species, and the northern portion of the Chihuahuan Desert supports more than 450 bird species. In addition to there being a large number of species in the Southwest, there are a multitude of resources that describe the distribution and

OVERVIEW



PHOTO: GREG LAVATY

Yellow-billed cuckoo

life history of American birds. Thus, rather than attempting to duplicate such information here, we refer readers to some of these alternative sources. Our intention is not to endorse any particular source, but to identify some of the more common resources for distribution and life history information. This information on sources is presented in the last section of the overview, entitled “Sources of Distribution and Life History Information.”

Additionally, lists of birds that occur in particular parks in the American Southwest (see Figure 1 below), and elsewhere, can be found at the following NPS website (<http://www.nps.gov/oia/NPSBirds.html>). Lists of federally threatened and endan-

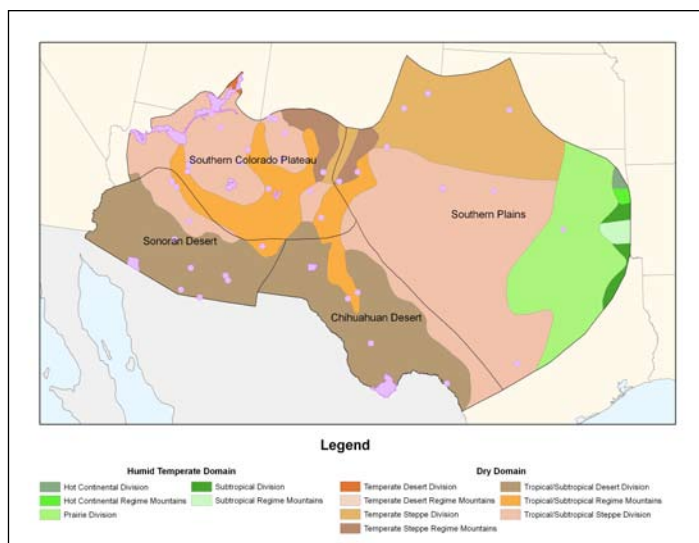


Figure 1. Major ecological regions and NPS networks in the Southwest.

gered bird species at individual parks can be obtained at the NPS ESA Database (<http://www.nature.nps.gov/biology/endangeredspecies/database/search.cfm>). Also of interest, Partners in Flight (PIF) has produced regional and state Bird Conservation Plans (BCPs) that target bird species and habitats for conservation. These lists and plans can be found at (<http://www.blm.gov/wildlife/pifplans.htm>).

Ecological and Park Management Context

Ecosystems are driven by an interaction of factors including regional climate, natural disturbances, anthropogenic stressors, and species-specific attributes that can affect species abundance and overall community patterns (Holmes and Johnson 2007). Natural forces include regional climatic and atmospheric conditions, such as precipitation and wind, and natural disturbances such as extreme climatic events (e.g., drought, flood), fire, disease, insect outbreaks, and herbivory and trampling (Holmes and Johnson 2007). Disturbances, for example, can directly affect the survival and productivity of bird species, and they can affect bird species indirectly through habitat effects. Anthropogenic stressors (e.g., habitat fragmentation, fire suppression or exclusion) can affect birds by affecting the structure and function of ecosystems (Holmes and Johnson 2007).

One of the primary goals of monitoring birds is to detect change over time and to use this information to understand the state of the parks' ecosystems. Monitoring in the NPS is intended to aid in the development of broadly based, scientifically sound information on the current status and long-term trends in the health, composition, structure and function of park ecosystems. Because birds respond to environmental features in predictable ways, monitoring concurrent changes in bird populations and habitat features can provide NPS managers with information they need to assess their actions. For instance, semi-desert grasslands throughout the American Southwest are being affected by the encroachment of mesquite and other shrubs into areas once dominated by perennial grasses. Grassland-obligate birds respond predictably to this change in structure: their local populations are declining. Identifying the percent and area of shrub encroachment into the semi-desert grassland can provide both an early warning of changes to bird communities and a target threshold of encroachment that managers can use to take action (e.g., fire use or mechanical treatments).

Both population-based and community-based monitoring projects are being conducted in the Southwest. For example, in the SODN, managers have chosen three avian population

parameters to estimate and monitor for landbirds: density, relative abundance, and occupancy. Each parameter has different properties that vary in terms of the quality of information gained and the estimated cost of measurement. Density is the most desirable parameter and facilitates estimates of total population change (e.g., number of individuals lost or gained) over time. Relative abundance provides an estimate of the ratio of overall population change among years; because this parameter has drawbacks related to variation in detectability, it will be measured only when density estimates are not possible. Occupancy, especially useful when monitored along with density, will allow monitoring changes in the number of sampling units occupied by a species over time (i.e., presence or absence) and allows adjustments for imperfect detectability during estimation (MacKenzie et al. 2002). The field methods (the point-transect distance-sampling method at fixed points) used for estimating all three parameters will be the same, although the analyses and evaluation procedures used to estimate trends will differ.

In the SCPN, bird communities were chosen for monitoring as an indicator of the overall condition of upland and riparian ecosystems. The bird monitoring focuses on several habitats where integrated upland or riparian monitoring is also occurring. The bird community monitoring consists of breeding-season surveys that use variable circular plot methodology. At each sampling point, an eight-minute survey is performed. Observations of birds by sight or call are recorded. Related habitat monitoring includes ground cover, canopy closure, vegetation cover, and forest-structure attributes. In upland habitats, nest success for selected breeding species may also be monitored.

The management response to changes in bird populations and communities will vary, depending on the type and severity of the change and its underlying cause. In some cases, however, the link between changes in bird populations and other environmental features may simply be unknown, either because the cause of change within the park is not perceptible or because the environmental change is taking place outside park boundaries. Cross-boundary issues and other factors are making cooperation among land-management entities increasingly necessary, and NPS officials are actively engaged in these efforts. As these large-scale partnerships develop, so, too, will tools for landscape-level restoration that may positively influence bird populations and communities.

In general, threats to landbird communities in the American Southwestern (described below) are both numerous and growing in extent and severity. Current and future stressors and drivers of regional bird communities include global climate change and diseases such as West Nile virus.

Threats and Concerns

Several of the major threats and concerns regarding birds within the Southwest include: climate change, invasive exotic plants, land use (including development, water management, and livestock grazing), altered fire regimes, and disease. Examples of additional threats include visitor use and air pollution.

Climate Change

Climate change is an emerging threat that may affect bird communities in a variety of ways. The latitudinal range for some species of birds is already shifting northward (in the northern hemisphere), and additional shifts are likely (Price and Root 2005). Further, unless all ecosystem components shift in concert, habitats are likely to be disrupted (Burkett et al. 2005), resulting in changes in abundance and loss of some species (Root and Schneider 2002; Price and Root 2005). Climate change may also be leading to a change in the timing of migration (Parmesan and Yohe 2003). Increases in temperature and precipitation can further lead to changes in vegetation and insect abundance (Root and Schneider 2002), which in turn may affect several life history constraints (Root 1988), as well as the reproductive strategies of birds (e.g., tradeoffs between egg size and clutch size [Jarvinen 1994]).

Invasive Exotic Plants

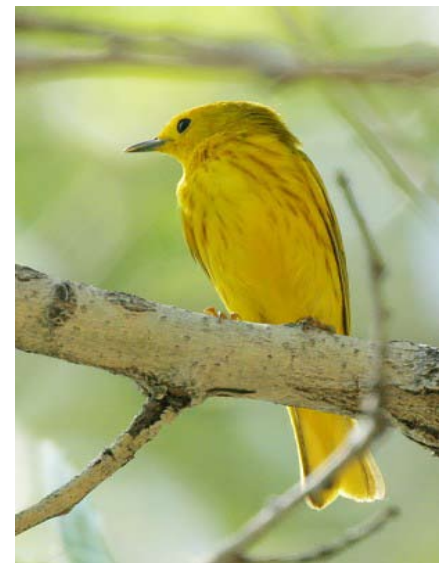
Invasive exotic plants can cause dramatic changes in bird communities. For instance, semi-desert grasslands throughout the Southwest region are being affected by the encroachment of mesquite and other shrubs into areas once dominated by perennial grasses. Grassland-obligate birds have responded predictably to this change in structure with declines in local populations. Similarly, shrub-steppe communities (e.g., sagebrush [*Artemisia* spp]) are vulnerable to invasion by non-native species such as cheatgrass (*Bromus tectorum*). Declines in habitat quality and changes in fire regimes have led to invasive exotic plant species gaining a competitive advantage over native species. Such vegetation changes can cause shifts in bird communities from obligates of a given habitat type to generalists and/or to obligates of the altered habitat type. Conversion of habitat to agricultural uses also can decrease the resiliency of an area to invasions. While grazing and other agricultural practices are restricted within boundaries of national parks, changes outside jurisdictional boundaries can have significant effects on migratory species, including many birds that are of interest for monitoring.

Land Use

Land-use changes within and around the parks can lead to the direct loss or alteration of habitat. It can also result in habitat

fragmentation, which also can decrease the overall quantity or quality of habitat. Land-use change may further impact migratory routes and schedules. Habitat for some species of concern in the Southwest has been fragmented and degraded by urban growth. Some of the resulting effects include: vegetation change due to groundwater withdrawal and urban development; and replacement of historic native species with those that are either non-native or adapted to the agricultural, commercial, or residential environments. Parks located along the U.S./Mexican border may also suffer impacts associated with illegal immigration, smuggling, and related law enforcement. An additional example of land-use impacts includes changes in vegetation structure in riparian areas due to shifts in flooding, stream width, and accretion of sediments (Scott et al. 2003).

Livestock grazing may influence bird community composition by disturbing the vegetation or by altering vegetation structure (Mosconi and Hutto 1981; Holmes and Johnson 2007). Grazing can lead to the reduction of native plants and changes in plant community composition, structure, and distribution (Holmes and Johnson 2007). Grazing in riparian areas can affect water quality, increase erosion and sedimentation, reduce vegetative cover, and promote invasive plant establishment. Such modifications may lead to avian responses such as reduced breeding productivity, changes in species distribution and abundance, and changes in bird community composition and dynamics (Holmes and Johnson 2007).



Yellow warbler

PHOTO: ROBERT SHANTZ

Altered Fire Regimes

Fire, historically more frequent and widespread, has been a key factor in shaping the ecology of the American Southwest. Native plant species evolved in tune with periodic fires and evolved adaptations to fires that occur at a particular frequency, season, and extent. Fire influences ecosystem processes and patterns, such as nutrient cycling and plant community composition and structure. The arrival of European and American settlers led to dramatically altered fire regimes and fire suppression. Systematic fire suppression continued in more

recent years. As a result, single, large-scale catastrophic fires now play a larger role in ecosystem functioning. Altered fire regimes can lead to: changes in vegetation structure, composition, diversity, and functioning of ecosystem processes; increased erosion and decreased hydrologic function; and loss of wildlife habitat. These habitat effects may lead to avian responses such as changes in breeding productivity, changes in species distribution and abundance, and changes in bird community composition and dynamics (Holmes and Johnson 2007).

Disease

West Nile Virus

West Nile virus (WNV) is a potentially serious illness that can affect nearly 200 bird species. WNV is most apparent during periods of adult mosquito blood-feeding by continuous transmission between mosquito vectors and bird reservoir hosts

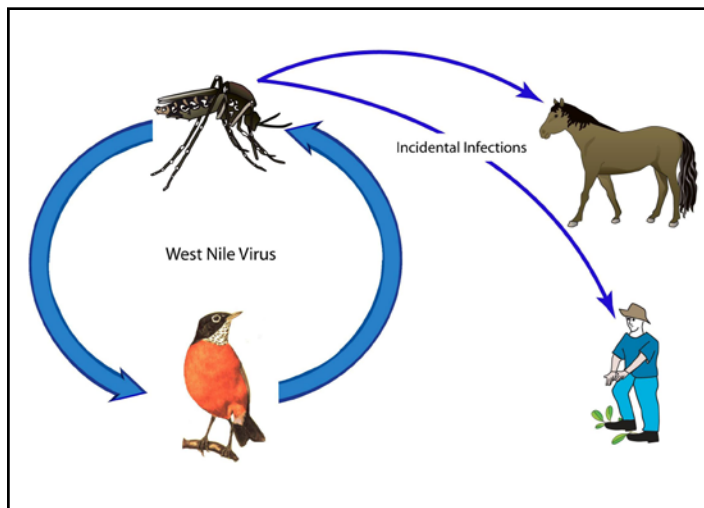


Figure 1. The West Nile Virus transmission cycle.

(Figure 1). Competent bird reservoirs will sustain an infectious viremia (virus circulating in the bloodstream) for 1 to 4 days after exposure, after which these hosts develop life-long immunity. A sufficient number of vectors must feed on an infectious host to ensure that some survive long enough to feed again on a susceptible reservoir host. People, horses, and most other mammals are not known to develop infectious-level viremias very often, and thus are probably “dead-end” or incidental-hosts (Figure 1). In addition to being a potential threat to humans and other vertebrates, WNV may be having a dramatic impact on at least some species of birds (Stokstad 2007).

More information about the ecology and virology of WNV can be found on the Centers for Disease Control and Preven-

tion (CDC) website:

URL: <http://www.cdc.gov/ncidod/dvbid/westnile/index.htm>

or at the USGS National Wildlife Health Center website:

URL: <http://www.cdc.gov/ncidod/dvbid/westnile/index.htm>.

Up-to-date maps of the cumulative infections detected in birds, humans, or mosquitoes for any given year can be found on the USGS disease map website, prepared in collaboration with the CDC & ArboNET surveillance system:

URL: http://diseasemaps.usgs.gov/wnv_us_bird.html.

Avian Influenza

Avian Influenza, or bird flu, is a highly pathogenic infection caused by avian influenza (flu) viruses. Although this is an emerging concern, the virus has not been reported in the Western Hemisphere since a bird pandemic began in Asia in late 2003. Avian influenza, however, has spread across 60 countries since 2003 and has killed millions of birds as well as some humans. Given the rapid spread of the virus across Eurasia in 2006, some observers expect it to appear in the Western hemisphere at any time. Up-to-date information about this disease can be found at:

The Department of Health and Human Services, CDC

URL: <http://www.cdc.gov/flu/avian/>,

The U.S. Department of State

URL: <http://www.state.gov/g/avianflu/>,

or the USGS National Wildlife Health Center

URL: http://www.nwhc.usgs.gov/disease_information/avian_influenza/index.jsp.

Sources of Distribution and Life History Information

Field Guides

There are many good field guides for birds ranging from general guides to North American birds to ones specializing in particular geographic areas or taxonomic groups. Here are a few sources of information on available field guides:

The American Bird Conservancy – URL: <http://www.abc-birds.org/>

The American Birding Association – URL: <http://www.americanbirding.org/index.html>



PHOTO: ROB BENNETTS

Common nighthawk

The Cornell Lab of Ornithology – URL: <http://www.birds.cornell.edu/>

Comprehensive Species References

Life Histories of North American Birds – Arthur Cleveland Bent.

Arthur Cleveland Bent (1866-1954) was one of America's greatest ornithologists. Bent and his collaborators present comprehensive information about courtship, nesting, eggs, young, plumages, food, behavior, voice, enemies, and more in a twenty-one volume series (1919-1968) entitled *Life Histories of North American Birds*.

Birds of North America – American Ornithologists' Union, the Cornell Laboratory of Ornithology and the Philadelphia Academy of Natural Sciences.

Birds of North America is probably the most comprehensive, authoritative and up-to-date resource available on the biology of North American birds. The print version was the culmination of a joint 10-year project by the American Ornithologists' Union, the Cornell Laboratory of Ornithology and the Philadelphia Academy of Natural Sciences. An online version is also available and described below.

Electronic Resources

Birds of North America Online – URL: <http://bna.birds.cornell.edu/BNA/>

The Birds of North America (BNA) is a comprehensive reference covering the life histories of North American birds. Edited by Drs. Alan Poole and Frank Gill, this series provides detailed scientific information (18 volumes, 18,000 pages in total) for each of the 716 species of birds nesting in the USA and Canada.

eNature – URL: <http://www.enature.com/fieldguides/>

eNature was initially launched in February 2000 and was acquired by the National Wildlife Federation in 2001. NWF

handed over management of eNature.com to the Shearwater Marketing Group (a privately-held company providing marketing services to both non-profit and private sector clients, focusing primarily on wildlife and nature) in 2007. The site's core content consists of wildlife information about almost 6,000 individual species and is the same data set used to create the printed Audubon Field Guides.

USGS, Patuxent Bird Identification InfoCenter – URL: <http://www.mbr-pwrc.usgs.gov/id/framlst/infocenter.html>

This site presents photographs, songs, videos, identification tips, maps, and life history information for North American birds.

SORA: Searchable Ornithological Research Archive – URL: <http://elibrary.unm.edu/sora/>

The SORA project is an open access electronic journal archive and is the product of a collaboration between the American Ornithologists' Union, the Cooper Ornithological Society, the Association of Field Ornithologists, the Wilson Ornithological Society, and the University of New Mexico libraries and IT Department. This archive provides access to an extensive Ornithological literature of international scope and detailed material documenting the history of ornithology in North America over the last 120 years. The content of this site includes the following titles: *The Auk* (1884-1999), *The Condor* (1899-2000), *The Journal of Field Ornithology* (1930-1999), *The North American Bird Bander* (1976-2000), *Pacific Coast Avifauna* (1900-1974), *Studies in Avian Biology* (1978-1999), and *The Wilson Bulletin* (1889-1999). Also available with browse-only capability is *Ornithologia Neotropical*.

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Cinnamon teal

PHOTO: BRAD MANCHAS