US FOREST SERVICE NORTHERN RESEARCH STATION

Research *Review*

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Full-Life-Cycle Bird Conservation Requires Full-Life-Cycle Research

As humans increasingly populate and affect the Earth, some bird populations have been seriously declining, for a variety of reasons. From the 1800s through the 1940s, market hunters killed many flocks of passenger pigeons, each with millions of birds, and the original populations of wild turkeys in the East. Other hunters killed millions of egrets to put their feathers on lady's hats; landowners cleared most of the habitat of the ivory-billed woodpecker; and farmers filled in many of the prairie potholes used by millions of migratory waterfowl. It's a sad litany of extinction.

Recent conservation efforts have made a difference for many bird populations—laws now regulate hunting waterfowl and upland game birds; protect all native birds; banish DDT, which destroyed eggs of birds at the top of the food chain; and established refuges and parks. Activities in support of the Endangered Species Act (1973) and conservation joint ventures are restoring many species back to historic numbers. Populations of our national bird, the bald eagle, as well as others such as the whooping crane, peregrine falcon, and Kirtland's warbler, are increasing, albeit slowly for some. But many bird populations are still declining, and it is mostly due to habitat destruction—wetlands are filled in and "developed"; forests are chopped up for building lots; bottomland forests are cleared and planted in cotton or corn; shorelands are degraded and streams are channeled, making them sterile environments for birds.

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Regrowth in a clearing in northwestern Pennsylvania.
Photo by Scott Stoleson, U.S. Forest Service.

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BIRD HABITAT RESEARCH TAKES A WIDER FOCUS

Even though there has been much research and conservation effort focused on the nesting habitats of birds here in North America, populations of many bird species still continue to decline. Most of the songbirds that nest in northeastern forests are neotropical migrants that actually spend the largest part of their annual life-cycle wintering in the tropics of Mexico, Central America, and the Caribbean. It used to be thought that any warm place with food would do as wintering habitat, but recent research has found this not to be the case. Northern Research Station (NRS) wildlife biologists David King, Scott Stoleson, and Frank Thompson are exploring the habitat needs of migrants throughout their annual cycles. In a specific example, the wood thrushes breeding in Pennsylvania forests take their newly fledged young into shrubby openings to grow and fatten for migration, then hop between food-rich stopover areas along river valleys and coastal areas to accumulate energy to fuel their hazardous southward migration to the wintering areas. There they tussle with other wood thrushes for the best winter territories with the most food and fewest predators. If this winter habitat is poor, birds can arrive back north on their breeding grounds in poorer condition, potentially threatening nesting success in what is known as "carryover effects." Because the destruction of habitat anywhere along the migratory path can threaten bird populations, conservationists are increasingly adopting strategies that account for threats throughout the annual cycle in what is called "full-life-cycle conservation."

Wood thrush after banding.
Photo by Dave King, U.S. Forest Service.

STRATEGIC PLANNING OF CONSERVATION EFFORTS HELPS SPEND FUNDS EFFECTIVELY

Efforts to conserve regional biodiversity in the face of global climate change, habitat loss, and habitat fragmentation will depend on approaches that consider population processes at many scales, local to region-wide. By combining habitat and demographic modeling, landscape-based population viability models effectively relate small-scale habitat and landscape patterns to regional population viability. Frank Thompson (Columbia, MO) and his co-workers were able to demonstrate the value of landscape-based population viability models in conservation planning. They used these models to evaluate population responses to the amount and placement of habitat restoration or afforestation on the breeding grounds, or increasing overwinter survival. Both increasing survival and managing breeding habitat potentially benefited populations. However, relying on randomly placed habitat conservation was ineffective and potentially counterproductive, whereas strategic reforestation or afforestation in protected areas of the least fragmented landscapes reversed current population declines of prairie warbler and wood thrush. Thus, strategic conservation planning helps target local actions to the places where they will be most effective.

BIRDS ARE MOST VULNERABLE JUST AFTER THEY LEAVE THE NEST

Conservation efforts are most effective when we have complete demographic information for a species of concern. Unfortunately, there still are fundamental gaps in our knowledge of the life-cycles of many birds. For songbirds (passerine birds), the period of time directly after young birds leave the nest and before they disperse and/or migrate (the post-fledging period) remains an understudied life stage. Thompson and colleagues analyzed previously published reports on survival of passerine birds after nesting and the relationships of population growth and post-fledging survival. They found that the highest mortality occurs in the first 3 weeks after birds leave the nest. In addition, greater body weight and duration of time in the nest increased survival. Nearly two-thirds of the studies examined indicated at least one habitat factor affecting survival, and 35 percent detected weather or climate effects. Thompson and colleagues also found that populations can be very sensitive to post-fledging survival, which may provide insight into why at least some bird populations in the United States are declining. Understanding factors affecting post-fledging survival can help managers improve conditions during the most crucial and dangerous period of a young bird's life.

BIRDS THAT NEST IN MATURE FOREST EAT INSECTS IN YOUNG FORESTS TO FATTEN UP BEFORE MIGRATION

Efforts to conserve declining populations of forest-interior birds have largely focused on preserving the mature forests where birds breed. Now, studies show younger forest habitats are important as well. NRS scientist Scott Stoleson (Irvine, PA), in research following up on Thompson and King's studies, recently found that forest regrowth in areas that were clearcut may be vital to birds as they prepare for fall migration. He also posits that declines in these bird species may be partly due to the increasing maturity and homogenization of forests. Openings created by timber harvesting mimic those made by natural disturbances (such as fire and wind). Stoleson examined where birds spend time after breeding season and their condition leading up to migration. For 3 years, he used constant-effort mist netting to capture songbirds and band them, and then to determine whether they were breeding or post-breeders and their overall health and condition: Were they building fat deposits? Did they carry parasites? From a total of 3,845 individuals, 2,021 (46 species) were in the post-breeding stage. Of these, 33 percent were mature-forest specialists, 22 percent were forest-edge species, and the remaining 45 percent were early-successional specialists. All 46 species were captured in regrowth areas, but only 29 species were captured within deep forests. Moreover, the birds caught in young forests in the post-breeding season were in better physiological condition, on average, than those that remained in forest interiors, suggesting that early-successional habitats within mature forest provide significant fitness benefits and are not just "mature forests in training."

WORKING LANDSCAPES IN CENTRAL AMERICA ARE WINTERING GROUNDS OF MANY NEOTROPICAL MIGRANTS

Two thirds of the songbirds in our forests are neotropical migrants, species like orioles, most warblers, and thrushes, that spend the winter south of the Tropic of Cancer and migrate north to nest. For most species, the majority of the annual cycle is actually spent on the tropical wintering grounds. Years ago, observations of wintering migrants using gardens and other disturbed habitats led ornithologists to conclude that wintering migrants were not particular about what habitat they used in the winter season. However, more detailed study has shown that food resources are often poorer and predator numbers greater in these disturbed habitats, suggesting that for many sensitive species we need to make sure the undisturbed forest habitats they use in the Caribbean, Mexico, and Central America are adequately protected in order to conserve populations.

The numerous parks and preserves that have already been established on the wintering grounds are good progress towards conservation. Realistically, though, parks can only cover so much land in areas where poor rural residents need land to farm. The key to getting farmers to protect land and thus bird habitat is enlightened self-interest. Shade coffee is

Ovenbird being examined for study.
Photo by Julianna Jenkins, University of Missouri, used by permission.

probably the best known approach for accomplishing this. In shade coffee farms, overstory trees are retained, thus increasing the value of these farms as habitat for birds relative to sun coffee or row crops. In return for maintaining these natural features, farmers may receive a higher price for their coffee. Shade coffee is often termed a "market-based solution" to conservation. Coffee is the second-most important internationally traded commodity after petroleum, and the United States imports about one-third of the world's production.

Shade coffee appears to support many migrant songbirds, but it still requires the conversion of the forest understory to coffee, making shade coffee plantations unsuitable for sensitive species such as the golden-winged warbler. The Northern Research Station's David King (Amherst, MA) worked with graduate student Richard Chandler along with USFS International Programs and the Mesoamerican Development Institute to investigate the winter habitat needs of this priority species, which has been declining steadily across most of its range in North America for the past five decades. They found that golden-winged warblers used shade coffee only if native forest was nearby, suggesting that the shade coffee strategy is not sufficient for conserving their winter habitat. Furthermore, coffee yields are lower in shade coffee plantations, potentially offsetting the price premiums farmers receive. With his colleagues, King is promoting the use of an alternative coffee cultivation system—integrated open-canopy coffee—in which forest buffers that support golden-winged warblers and other sensitive forest species are conserved adjacent to high-yielding sun coffee plantations. These farms have twice the yield as shade coffee farms, which means more money for farmers, and the carbon credits for conserving the trees within the forest buffers can yield 20 percent of the value of the coffee. Current work by King and his team is directed at scaling-up the open-canopy initiatives to entire landscapes to secure the long-term well-being of rural communities and birds alike.

Hope is the thing with feathers
That perches in the soul,
And sings the tune without the words,
And never stops at all,

And sweetest in the gale is heard;
And sore must be the storm
That could abash the little bird
That kept so many warm.

I've heard it in the chillest land
And on the strangest sea;
Yet, never, in extremity,
It asked a crumb of me.

Emily Dickinson (Amherst, MA, 1830-1886)

Juvenile acadian flycatcher after banding.
Photo by Julianna Jenkins, University of Missouri, used by permission.

WINGS ACROSS THE AMERICAS

Wildlife watching is an increasingly popular American activity, with birding being the most popular. More than 71 million people (age 16 and older) fed, photographed, or observed wildlife in 2006 and spent nearly $45 billion on their activities. Many rural communities in the United States and in Central and South America are using bird-watching tourism to help build their local economies. Bird-watching tourism is a win-win situation for all—local residents, visitors, and the birds alike.

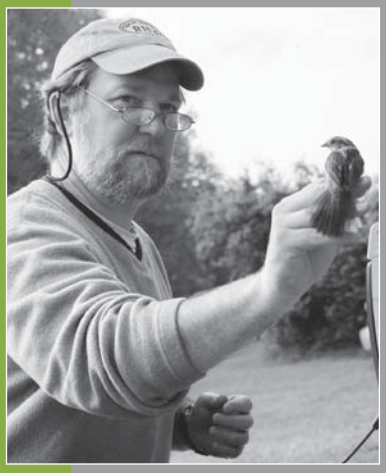
"Wings Across the Americas" is a Forest Service-wide program—the National Forest System, State & Private Forestry, Research & Development, and International Programs—that works with a wide range of partners here in the United States and other countries to conserve habitats and populations of birds, bats, butterflies, and dragonflies. The program

- **Supports habitat conservation activities on U.S. national forests and grasslands, and from Canada's boreal forest to the grasslands and wetlands of South America.**
- **Provides training opportunities for biologists, land managers, and administrators.**
- **Participates in national and international conservation initiatives.**
- **Enables partners and Forest Service employees to become more knowledgeable about global conservation needs.**
- **Organizes an annual awards program to recognize conservation partnerships involving Forest Service employees and their cooperators. NRS scientists Frank Thompson (2010) and Dave King (2009 and 2012) have won the "Wings Across the Americas" International Research and Partnership Award.**

Redstart just before banding.
Photo by Scott Stoleson, U.S. Forest Service.

BIOGRAPHIES

David I. King (right), a research wildlife biologist in the "Center for Research on Ecosystem Change" unit, is stationed at the NRS laboratory on the campus of the University of Massachusetts in Amherst. He received his PhD in wildlife and fisheries conservation/organismic and evolutionary biology (1999) and an MS in wildlife and fisheries conservation (1995) from the University of Massachusetts at Amherst; his BS is in wildlife management from Humboldt State University, Arcata, CA.



Scott H. Stoleson (left), a research wildlife biologist in the Irvine, PA, unit "Sustaining Forests in a Changing Environment," studies many facets of disturbance ecology in mixed-oak forests of the Appalachian Mountains. He received his PhD in wildlife ecology (1996) and an MES (1991) from Yale University; he earned his BA in biological sciences from Dartmouth College (1979).

Frank R. Thompson III (lower right), a research wildlife biologist stationed in Columbia, MO, is part of the unit "Sustainable Management of Central Hardwoods Forest Ecosystems and Landscapes." He is a member of the science team that prepares the "U.S. State of the Birds Report." Thompson received his PhD in wildlife biology from the University of Missouri (1987), an MS from the University of Vermont (1982), and a BS in wildlife science from Rutgers University, Cook College (1979).

RESOURCES AND REFERENCES

Web Resources:

USDA Forest Service, Northern Research Station:
- www.nrs.fs.fed.us/people/dking
- www.nrs.fs.fed.us/people/sstoleson
- www.nrs.fs.fed.us/people/thompson
- www.nrs.fs.fed.us/disturbance/climate_change/landscape_cumulative_effects/
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American Birding Association: www.aba.org
Audubon Society: www.audubon.org
Citizen science: www.eBird.org
Coffee consumption: www.coffeeresearch.org
Cornell University Laboratory of Ornithology: www.birds.cornell.edu
Emily Dickinson: www.emilydickinsonmuseum.org
Mesoamerican Development Institute: www.mesoamerican.org
The Nature Conservancy: www.tnc.org
The State of the Birds 2013—Report on Private Lands: www.stateofthebirds.org
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There are 111 NRS scientists working at 20 field offices, 24 experimental forests, and universities located across 20 states, from Maine to Maryland, Missouri to Minnesota.

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