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## What Do Birds Do For Us?

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In Issue: [May/June 2016](#)

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*Illustrations by John James Audubon*

How do you feel about birds and bird conservation? An estimated 1,300 species are facing extinction over the next century, and many more are suffering from severe habitat loss. But does that really matter to humans?

If you happen to be a birder or a biologist, then “of course, birds have an intrinsic value, and we have an ethical obligation to conserve them,” says University of Utah ornithologist Çağan Şekercioğlu. But, even for those of us with just a passing interest in our winged neighbors, there’s plenty of credible research showing that healthy bird populations are essential to human welfare.

To name but a few of the benefits: Birds keep farmers in business; they protect our drinking water by preventing erosion; they slow the spread of disease; they keep the furniture industry supplied with timber; they provide critical environmental data. The collective term for the many ways birds (and other animals, plants, and landscapes) support and improve human life is ecosystem services. Understanding these services, and quantifying their dollar value, has been a

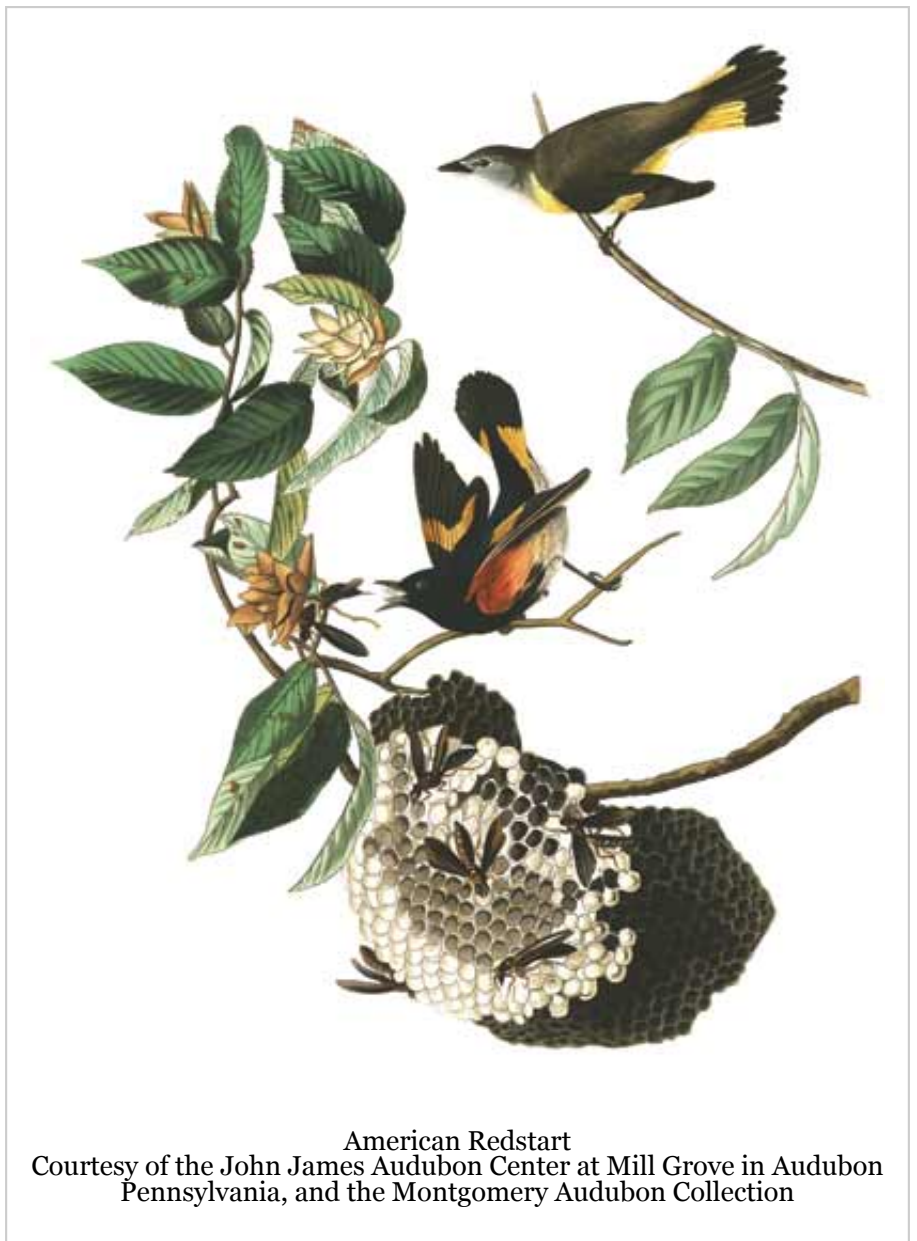
growing priority for scientists worried about the unprecedented loss of biodiversity we're now seeing — by one popular estimate, some 27,000 plant and animal species each year, many of them driven extinct by human activity.

“Until the next asteroid slams into the planet, it's people that will dictate the future course of all known life in the universe,” says Gretchen Daily, director of Stanford University's Center for Conservation Biology. “On our own watch — this 100-year span — we're projecting that half of all plants and animals that were on the planet before humanity became a big force will go extinct. Whatever survives really is a function of our activities.”

The past decade has seen an explosion of sophisticated research — and the result is a

strong body of evidence debunking the myth that bird protection is an unaffordable luxury. “For better or worse, economic arguments tend to get more attention in political debates,” says Geoffrey Heal, a microeconomist at Columbia University Business School. The new research, he says, strengthens the case that “most environmental conservation, if well structured, actually does pay off directly.”

When the Mormons settled Utah in the 19th century, their first two crop seasons were destroyed by western crickets. “Promising fields of wheat were cut down to the ground in a single day,” naturalist Edward Howe Forbush wrote in 1922. “The people were in despair. Then sea gulls came by the hundreds and thousands and, before the grain could be entirely destroyed, devoured the insects, so that the fields were freed from them. The settlers regarded this as a heaven-sent miracle.”



American Redstart  
Courtesy of the John James Audubon Center at Mill Grove in Audubon  
Pennsylvania, and the Montgomery Audubon Collection

Modern history is filled with anecdotal examples of birds saving potato fields, fruit orchards, and cranberry bogs from insect devastation. Now researchers are studying the phenomenon more formally, trying to quantify birds' value as living pest controllers. They're starting with a much-loathed insect called the coffee berry borer.

Borers are the bane of coffee farmers. The tiny insects take over individual berries and spend almost their entire life cycles inside, rendering those beans unsellable. There are no safe pesticides that kill the insects, and attempts to control them with parasitic wasps show, at best, limited success. "You work all year to protect your crop the best you can," says Peter Williams, who co-owns Kew Park Estate, a 35-acre shade-grown-coffee farm in western Jamaica. "If you're dealing with infestation rates of anything like 20 percent — which some years we do — then you're talking about a very significant economic effect."

What helps save Jamaican farmers from ruin are neotropical migrants like the black-throated blue warbler and the American redstart. These and other birds feast on the borers while the insects are first drilling through the berries' epidermis.

Matt Johnson, a professor of wildlife habitat ecology at California's Humboldt State University, has studied the birds in Jamaica's Blue Mountains — a steep and meandering landscape that produces some of the world's priciest coffee — and in the more rolling terrain where Kew Park is located. Johnson and his team set up nylon nets to keep the birds off individual plants (or small clusters). They then compared those plants to the ones birds could reach. Sure enough, the netted-off plants had measurably lower crop yields.

Insect-eating birds protect apple orchards in the Netherlands and safeguard Missouri Ozarks white oaks, whose lumber is highly sought by furniture makers. And they reduce pest levels at organic wineries. Ornithologist Julie Jedlicka, a post-doctoral fellow at the University of California, Berkeley, put up nest boxes at two Northern California vineyards. With the approval of the U.S. Department of Agriculture, she simulated a pest outbreak by pinning insect larvae to pieces of cardboard and placing them between rows of grapes. The boxes attracted insect-eating birds, which in turn devoured 3.5 times more larvae than in control plots with larvae but no boxes. Leading the influx were western bluebirds, which have suffered terrible habitat loss in California's wine country because of agricultural and urban development. The bluebirds appear to consume blue-green sharpshooters, insects with piercing, sucking mouthparts that easily spread bacteria among plants. One of those bacteria causes a deadly grape blight called Pierce's disease.

The idea of using bluebirds to kill insects proved inspirational for Napa Valley's Spring Mountain Vineyard. Ron Rosenbrand, the vineyard manager, has installed 1,000 bluebird nest boxes since 2006 — and watched the farm's once-rampant Pierce's disease disappear. "It's such

a plus to find something in Mother Nature that is a total asset,” he says. “I look at them and go, ‘Thank you for working for us.’”



Black-throated Blue Warbler

Birds stimulate economies just by being beautiful. Take a look at Magee Marsh, a 2,200-acre wildlife refuge on the Ohio shore of Lake Erie. A stopover for neotropical migrants, which rest and refuel before crossing the lake, the marsh attracts more than 100,000 birders each year. They walk along a boardwalk, through a wooded beach ridge, in hopes of glimpsing Blackburnian, prothonotary, and Kirtland’s warblers and many other species.

Along with their field glasses, these visitors bring their credit cards. Philip Xie, a professor and tourism researcher at Bowling Green State University, looked at Magee Marsh and five other Lake Erie birdwatching areas in Ohio. He calculated that the sites generated \$26 million and created 283 jobs. Because birders arrive before the lake’s summer tourists, local restaurants and hotels have bulked up their springtime payrolls. A ferry service now offers migration cruises. “We’ve effectively created a tourism season in what was the shoulder season,” says Kimberly Kaufman, executive director of the Black Swamp Bird Observatory in Magee Marsh Wildlife Area.

And that's just for one region of the country. In an economic analysis released in 2013, the U.S. Fish and

Wildlife Service calculated that, based on a 2011 survey, birders spend \$15 billion annually on travel, plus an additional \$26 billion on equipment like binoculars, camping gear, and nest boxes. That money ripples through the economy and generates \$107 billion in output, employs 666,000 people, and enriches local, state, and federal governments by \$13 billion.

Of course, none of these studies measure the personal benefits that watching a warbler can bring. Studies have shown that spending time in nature improves both cognition and mental health. "Birding is such a gateway to nature," says Ohio's Kimberly Kaufman. "It gets people outside — away from the computer, away from the television." It exposes them to fresh air and lifts their spirits. "We've been using the phrase ecotherapy," she says. "Let's face it: We can all use more joy in our lives."

Perhaps the least sexy service birds provide is eating dead bodies. "We've got an enormous amount of roadkill produced on our highways in the United States," says Travis DeVault, a research wildlife biologist with the U.S. Department of Agriculture. "I don't think anyone knows what that would look like if vultures weren't around to clean up a big portion." Though scientists have long valued scavenging birds for their sanitation services, he says, "it's pretty recently that we've begun to discover how that translates into human health."

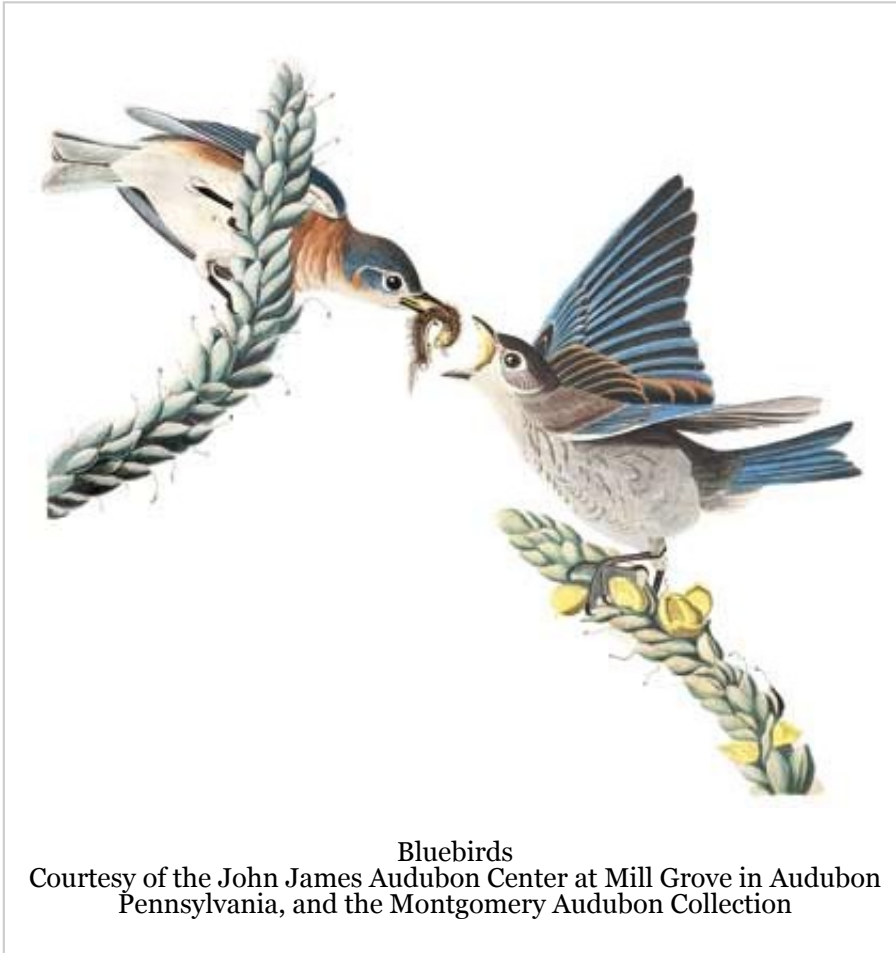
Some of that discovery has come the hard way — from a natural experiment playing out today in South Asia. Vultures are particularly valuable in India because Hinduism prohibits the slaughter and consumption of cows. The livestock, therefore, die naturally, in the open. "We don't have an organized carcass-disposal system," says Vibhu Prakash, principal scientist at the Bombay Natural History Society. "After skinning, vultures would come, and within half an hour they would finish everything that is perishable from a carcass. ... There is no mess around and no stench."

Starting in the 1990s, the populations of oriental white-backed, long-billed, and slender-billed vultures began to crash. Researchers noticed the birds' necks drooping in the wild, a sign of debilitating weakness. Within a month, they would be dead. Today their numbers have been reduced by 99 percent. Scientists traced the cause to an anti-inflammatory medicine called diclofenac, which is used as a painkiller for aging cows but also triggers fatal kidney disease in old-world vultures.

Without vultures around, feral dogs took over carcass disposal. Massive packs roam India's trash dumps, looking for piles of dead cattle to eat. With this growing canine population comes more fatal dog attacks, as well as rabies from bites. (India has the world's highest human rabies

rate.) Economist Anil Markandya has estimated almost 40 million additional dog bites in India between 1992 and 2006, resulting in about 48,000 extra deaths. He calculates that the vulture-dog connection alone produced human health costs totaling \$34 billion over 14 years.

In 2006, after a bird-friendly alternative drug was identified, India banned the veterinary use of diclofenac. While some pharmaceutical companies have cooperated, others continue to sell the human formulation in multiple-use vials large enough to medicate a cow.



Bluebirds

Courtesy of the John James Audubon Center at Mill Grove in Audubon Pennsylvania, and the Montgomery Audubon Collection

In the high mountains of the American West, there's a tree called the whitebark pine that both humans and other animals have come to rely on. Its large seeds feed grizzlies and black bears. Whitebark pine communities provide habitat for deer, elk, and raptors. And because the pines grow all the way up to the treeline, they are effective at protecting drinking-water supplies. "The mountains are the water towers," says Diana Tomback, a professor of integrative biology at the University of Colorado–Denver. The trees' roots hold the soil in place, preventing erosion. Their presence reduces the danger of avalanche. And their canopy shades the snowpack, ensuring a protracted melt rather than a sudden springtime flush.

The tree's seeds are dispersed by just one bird: the Clark's nutcracker, a black-and-white-winged cousin to the crow. The nutcracker's long, sturdy bill opens the pine cones to pluck out the

seeds, which it eats or stores inside its throat. It then buries the uneaten seeds at the depth and location that the trees often need to reproduce. “What would happen if we didn’t have the Clark’s nutcracker?” Tomback asks. “In the case of whitebark pine, it is unlikely that it could sustain itself.”

The value of the nutcracker is coming into sharper focus now that the tree is in danger. A fungal disease called blister rust and the growing menace posed by the mountain pine beetle (in part because of global climate change) have delivered what Tomback calls a “one-two punch.” In some areas, she says, “whitebark pine ecosystems are verging on nonfunctional.”

In response, the U.S. Forest Service has been growing rust-resistant whitebark pine seedlings to plant by hand. This is labor-intensive work: Specially trained climbers must ascend into the canopy twice — first to place animal-proof cages around the cones (which need water and nutrients from their parent trees), and later to harvest the cones. In nature, the seeds would germinate over two years, but the Forest Service speeds the process by specially treating the seeds before they are sown for germination. Figuring out the cost of this process has allowed Tomback to calculate the value of the nutcrackers’ dispersal services: between about \$800 and \$1,000 per acre, based on what it would cost to do the hand planting. Multiply that by about 14.3 million acres of whitebark pine forest, and that’s more than \$11 billion in the United States alone.

Throughout the world, birds are essential seed dispersers for plants that provide us with food, medicine, timber, and recreation. Among their qualifications: They travel long distances, and they assist germination when they eat fruit by removing the pulp and scratching the seed coat.



Loon

Courtesy of the John James Audubon Center at Mill Grove in Audubon Pennsylvania, and the Montgomery Audubon Collection

Since birds are highly sensitive to environmental changes, scientists routinely use them to gauge the health of ecosystems. Researchers have used tree swallows, for example, to study the impact of a wide range of toxins: PCBs in the Great Lakes and Hudson River, pulp-mill effluent in Western Canada, petroleum in Wyoming's North Platte River, metals in New Jersey. Their work has shown that contaminants that land in aquatic sediment don't remain there; they work their way up the terrestrial chain.

Likewise, scientists have been monitoring the health of common loons in New York's Adirondack Park to understand the impact of atmospheric mercury from coal-burning power plants and incinerators. A 2012 report by the Maine-based Biodiversity Research Institute (BRI) calls the birds "excellent sentinels of threats impacting aquatic ecosystems. They live more than 20 years, are at the top of the food web, and are very territorial." By measuring the loons' breeding success and correlating it to mercury contamination, the BRI has been able to provide "evidence for the need to stringently regulate mercury and acidic emissions on national and global scales."

Scientists use bird abundance to measure everything from wetlands health to radioactive contamination. Some of the most innovative work uses birds to study climate change. At Oregon State University, researchers use microphones to mechanically monitor bird songs in the western Cascade Mountains during (and before) the breeding season. "The minute the bird arrives from its wintering grounds, you know when it showed up," says Matt Betts, an associate professor of landscape ecology. "Then, if you start comparing those data across years, you can get some idea of how arrival times shifted."

Betts says the program is too new to offer up much data. And he's quick to stress that birds alone can't tell scientists everything they need to know about ecosystem health. "There haven't been very many rigorous tests — we still need more information on whether birds are going to well-represent other components of biodiversity," he says. "But that said, if there are major problems, we're going to pick it up with birds."

Pest control, public health, seed dispersal, ecotourism, environmental monitoring — these are some of the ways birds benefit humans. There are many others:

Pollination is often the realm of bees, bugs, and butterflies. But more than 900 bird species worldwide pollinate, too, and their sophisticated sense of geography suits them well to the task. The durian munjit, a wild fruit that is collected and eaten in northern Borneo, relies exclusively on spiderhunters, members of the sunbird family. The Canary chiffchaff pollinates the Canary bell-flower, an ornamental plant with edible fruit that grows on Spain's Canary Islands. (It was cultivated in the royal garden of England's Hampton Court Palace as early as 1696.) And when the cold weather keeps insects away,





Tree Swallows

Courtesy of the John James Audubon Center at Mill Grove in Audubon Pennsylvania, and the Montgomery Audubon Collection

China’s winter-flowering loquat tree reproduces with the help of the light-vented bulbul and the Japanese white-eye. The loquat’s fruit is eaten in many forms and is used medicinally.

Seabird guano — rich in nitrogen, phosphorus, and other nutrients — “provides an important source of fertilizer and income to many people living near seabird colonies,” according to Utah’s Şekercioğlu. This has been true for centuries: Guano was considered essential to Incan agriculture, “upon which their civilization was based,” wrote Edward Howe Forbush in 1922. Two years earlier, ornithologist Robert Cushman Murphy declared that the best Peruvian guano was 33 times as effective as barnyard

manure based on its nitrogen content. “Unfortunately,” Şekercioğlu writes, guano production “is one of the most threatened of avian ecosystem services, due to the rapid decline of seabirds worldwide.” Among the culprits are fishing longlines, which entrap birds such as black-browed albatrosses.

Birds possess skills that historically made them useful to militaries. During World War I, pheasants detected oncoming hostile aircraft at long distances and “gave the alarm by their insistent cries,” says one account; canaries, of course, sensed poison gas; gulls followed submarines in search of garbage. Carrier pigeons successfully navigated through shellfire (and past bullets aimed at them). They transported messages that helped the Allies capture German submarines and that saved the crews of downed seaplanes and a sunken minesweeper. It turns out birds aren’t just useful. They’re bona fide heroes.

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Barry Yeoman is a freelance journalist in Durham, North Carolina. This article was adapted, with permission, from “[Follow the Money](#),” which ran in the March-April 2013 issue of *Audubon* magazine.