Bird Calls

A new online checklist program turns recreational birders into global "biological sensors." By Jim Robbins

On a warm morning not long ago on the shore of a small prairie lake outside Montana's state capital, Bob Martinka trained his spotting scope on a towering cottonwood tree heavy with blue heron nests. He counted a dozen of the tall, graceful birds and got out his smartphone, not to make a call but to type the number of birds and the species into an app that sent the information to researchers in New York.

Martinka, a retired Montana Fish, Wildlife & Parks biologist and an avid bird watcher, is part of the global ornithological network eBird. Several times a week he heads into the mountains to scan lakes, grasslands, even the local dump, and then reports his sightings to the Cornell Lab of Ornithology, a nonprofit organization based at Cornell University.

"I see rare gulls at the dump quite frequently," Martinka says, scanning a giant mound of bird-covered trash.

Tens of thousands of birders are now what the lab calls "biological sensors," turning their sightings into digital data by reporting where, when, and how many of which species they see. Martinka's sighting of a dozen herons is a tiny bit of information, but such bits, gathered in the millions, provide scientists with a very big picture: perhaps the first crowd-sourced, real-time view of bird populations around the world.

Birds are notoriously hard to count. While stationary sensors can measure things like carbon dioxide levels and highway traffic, it takes people to note the type and number of birds in an area. Until the advent of eBird, which began collecting daily global data in 2002, so-called one-day tallies were the only method.

While counts like the Audubon Christmas Bird Count and the Breeding Bird Survey bring a lot of people together on one day to make bird observations across the country, and are scientifically valuable, they are different because they don't provide year-round data.

And eBird's daily view of bird movements has yielded a vast increase in data—and a revelation for scientists. The most informative product is what scientists call a "heat map": a striking image of the bird sightings represented in various shades of orange according to their density, moving through space and time across black maps. Now, more than 300 species have a heat map of their own.

"As soon as the heat maps began to come out, everybody recognized this is a game changer in how we look at animal populations and their movement," says John W. Fitzpatrick, director of the Cornell Lab. "Really captivating imagery teaches us more effectively."

It was long believed, for example, that the United States had just one population of orchard orioles. Heat maps showed that the sightings were separated by a gap, which means there are not one but two genetically distinct populations.

Moreover, the network offers a powerful way to capture data that was lost in the old days. "People for generations have been accumulating an enormous amount of information about where birds are and have been," Fitzpatrick says. "Then it got burned when they died."

No longer: eBird has compiled 141 million reports, or bits, and the number is increasing by 40 percent a year. In May 2013, eBird gathered a record 5.6 million new observations from 169 countries. Martinka's sighting of 12 herons at once, for example, is considered one species observation, or bit.

The system also offers incentives for birders to stay involved, with apps that enable them to keep their life lists (records of the species they have seen), compare their sightings with those of friends (and rivals), and know where to look for birds they haven't seen before.

"When you get off the plane and turn your phone on," Fitzpatrick says, "you can find out what has been seen near you over the last seven days and ask it to filter out the birds you haven't seen yet, so with a quick look you can add to your life list."

The system is not without problems. Citizen scientists may not be as precise in reporting data as experienced researchers are, like the ones in the Breeding Bird Survey. Cornell has tried to solve that problem by hiring top birders to travel around the world to train people in methodology. And 500 volunteer experts read the eBird submissions for accuracy, rejecting about 2 percent. Rare-bird sightings get special scrutiny.

The engine that makes eBird data usable is machine learning, or artificial intelligence—a combination of software and hardware that sorts through disparities, gaps, and flaws in data collection, improving as it goes along.

> "It's a really neat tool. If you see one bird or a thousand, it's significant."

"Machine learning says, 'I know this data is sloppy, but fortunately there's a lot of it,' " Fitzpatrick says. "It takes chunks of this data and sorts through it to find patterns in the noise. These programs are learning as they go, testing and refining and getting better and better."

Still, some experts question eBird's validity. John Sauer, a wildlife biologist with the U.S. Geological Survey, says that bird watchers' reports lack scientific rigor. Rather than randomness, he says, "you get a lot of observations from where people like to go." And he doubts that Cornell has proved the reliability of its machine learning efforts.

Still, the information has promise, he says, "and it's played a powerful role in coordinating birders for recording observations, and encouraging bird watching."

And the data is being used by a wide array of researchers and conservationists.

Cagan H. Sekercioglu, a professor of ornithology at the University of Utah who has used similar bird watching data in his native Turkey to study the effects of climate change on birds, calls eBird "a phenomenal resource." He says it was "getting young people involved in natural history, which might seem slow and old-fashioned in the age of instant online gratification."

Data about bird populations can help scientists understand other changes in the natural world and be a marker for the health of overall biodiversity. "Birds are great indicators because they occur in all environments," says Steve Kelling, director of information science at the Cornell bird lab.

A decline in eastern meadowlarks in part of New York State, for example, suggests that their habitat is shrinking—bad news for other species that depend on the same habitat. In California, eBird data is being used by some planners to decide where cities and towns should steer development.

The data is also being combined with radar and weather data by BirdCast, another Cornell bird lab project that forecasts migration patterns with the aim of protecting birds as they move through a gauntlet of threats. "We can predict migration events that would be usable for the timing of wind generation facilities to be turned off at night," Fitzpatrick says.

In California, biologists use the migration data to track waterfowl at critical times. When the ducks are headed through the Central Valley, for example, biologists can ask rice farmers to flood their fields to create an improvised wetland habitat before the birds arrive. "The resolution is at such a level of detail they can make estimates of where species occur almost at a field-by-field level," Kelling says.

The data from eBird has been used in Britain, too, combined with that of a similar program called BirdTrack, which uses radar images, weather models, and even data from microphones on top of buildings to record the sounds of migrating birds at night.

And for bird watchers, the eBird project has given their pastime a new sense of purpose. "It's a really neat tool," Martinka says. "If you see one bird or a thousand, it's significant."

Jim Robbins is a freelance journalist in Helena. A version of this article originally appeared in The New York Times. *Used with permission.*

INFOGRAPHIC: LUKE DURAN/*MONTANA OUTDOORS*. SOURCE: EBIRD.COM

Follow that bird

Annual occurrence of lazuli buntings migrating north into the Lower 48 during 2013 from eBird reports. In varying shades of orange, the "heat maps" shows how densities varied during a six-month period.