CBC

The Climate Bird Count?

By Scott Weidensaul

On the surface, nothing would seem simpler or more straightforward.

If the planet is getting warmer, as the evidence clearly shows it is, then birds—those metaphorical canaries-in-the-coal-mine of environmental change—should be shifting their range, abundance, and distribution in response.

Any birder can name a few examples. In the 20th century, once-southern species like Northern Cardinals, Turkey Vultures, Tufted Titmice, and Northern Mockingbirds pioneered their way into Canada; today, Black Vultures, Red-bellied Woodpeckers, and Carolina Wrens are following a similar track. More recently in the Alaskan Arctic, Inupiat villagers on the North Slope have been seeing a new bird for which their language has no name; we call them American Robins.

And yet, trying to link the shifting range of a particular species of bird to the subtle changes in temperature, wind, or moisture brought on by greenhouse gases—and at the same time tease out the host of other variables that may include habitat alteration, reordered vegetation patterns (which may themselves be a function of global warming), even how many bird feeders we humans

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are hanging in our backyards—is an incredibly difficult, often frustrating task.

Welcome to Dan Niven's world.

For the next several years, Niven—Audubon's senior scientist for bird conservation—will be immersing himself in such conflicting signals, trying to build a realistic picture of how climate change is affecting North America's birds. To accomplish this, he and other Audubon researchers are, for the first time, combining decades' worth of Christmas Bird Count results with other enormous data sets, especially the 40-year-old Breeding Bird Survey (BBS), conducted at more than 4,000 sites across North America every summer.

The result, he believes, will be not only an unprecedented look at how climate is reshaping North America's bird populations, but also a way to predict which birds, and which critical bird habitats, will be most vulnerable to climate change in the years to come. "Birders have been talking for years about how many of the birds they see on Christmas Counts are much farther north than they used to be. Now we finally have a chance to quantify those observations," Niven says.

Just analyzing the combined CBC and BBS data sets would itself be quite an achievement, says CBC director Geoff LeBaron. "Eventually this analysis will cover all 550 species that are in both the CBC and BBS databases. This will be the first time anyone's done such a broad analysis, and the first time the CBC and BBS have been combined in this way," he says.

But Greg Butcher, Audubon's director of bird conservation and one of the lead scientists on the new project, says the Audubon team is hoping to do a lot more. "When you look at the CBC data, you see a whole lot of birds moving around [in response to environmental change], but you don't get a sense of which ones are the winners and which ones are losers," Butcher says. "So one thing we want to do is a threat analysis, both for Important Bird Areas [IBAs] and WatchList species, to look at which sites and which birds are most vulnerable to climate change."

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Although the shorthand phrase is "global warming," scientists expect the reality of climate change to be much messier and more complicated. Computer models differ somewhat in the details, but all of them predict that while many areas will become warmer, some will actually cool. Some regions will become wetter than they are today, others drier. Some coastal sites, including critical tidal wetlands, will disappear beneath rising ocean levels. Plant hardiness zones, which have already shifted north dramatically in recent decades, will continue to change.

"But how will that affect the species for which an IBA was designated? We're going to look regionally, across the continent, to get a sense of what the winners and losers will be in this global warming game we're playing," Butcher says.

Some of the apparent losers are already clear. Birds that breed in montane areas—Bicknell's Thrush in the East, White-tailed Ptarmigan and the rosy-finches in the western mountains—are going to lose habitat as forest zones move higher upslope. The same thing will happen in the Arctic as forests migrate north. "The tundra species are right at the top of the list," Butcher says. "There's a whole suite of shorebirds and waterfowl that nest all the way up in the Arctic and are going to run out of room up there. Already, Snow Buntings are declining a lot."

"It's not just a case of rare birds becoming extinct, but common birds becoming rare," he says.

Niven, Butcher, and other Audubon scientists will look at the 40-year period stretching from 1967 through 2006—a stretch with solid, standardized CBC coverage across the continent, and also one that overlaps with the lifetime of the Breeding Bird Survey, which is jointly coordinated by the U.S. Geological Survey and the Canadian Wildlife Service.

Together, the two data sets compliment each other nicely, each one filling in gaps in the other. "The Breeding Bird Survey has good information on more than 400 species, and the CBC on about 450. Between the two of them, we have good coverage on 550 species of North American birds," Butcher says.

This will not be the first time scientists have mined CBC data to look at how birds respond to winter climate. In 1988, Dr. Terry L. Root (now a senior fellow at Stanford University's Center for Environmental Science and Policy, and an expert on how organisms respond to climate change) used CBC data to show that the northern winter range limits of 62 species of birds were tightly linked to the average minimum temperature in January; further research here and in Europe has confirmed the link between climate and the range, abundance, and migration timing for many birds.

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But the CBC also poses some unique hurdles to scientists trying to mine its secrets—researchers like Dr. Wesley M. Hochachka, the assistant director of bird population studies at Cornell University's Lab of Ornithology. He tried several years ago to use count records to look at how birds' ranges were shifting in response to climate, and came up short, in part because of the analytical tools available to him at the time, but also because of the count itself.

"One challenge with the CBC is that it was never designed to answer one specific, very focused question like this," says Hochachka. "If you made it so rigorous, tried to control for every variable like participant effort, it wouldn't be fun for people to participate in. You have to balance enjoyment with producing data that have enough signal in them. You keep trying and refining, but it's a big, messy data set. On the plus side, of course, this is the longest-running data set of its kind in the world—there's nothing else like it. The challenges come in part from knowing where the data become really, really useful," he says.

The CBC started in 1900 with just 25 sites, mostly in the Northeast. While it grew quickly, Hochachka says, it wasn't until the 1960s that the density and geographic range of the counts became statistically useful for this kind of analysis. And there are still big gaps in the geographic coverage, because the CBC circles tend to clump where there are large human populations. "For example, you have Nevada, with a huge area and very few people. The same with the middle of the continent, and of course the boreal region of Canada and Alaska," he says.

But there's still a lot you can do with those data, especially when cross-referenced with the BBS results. "The analysis for now is simply trend data—what species are up, what species are down, at the state versus regional versus continental level," Geoff LeBaron says. "But we want to look deeper than that. We'll turn to whether the CBC has shown range shifting. Has the center of abundance shifted for particular species? What are they keying in on—is it the temperature gradient, or rainfall, or the edge of the snow cover?"

One of the beauties of using CBC data is that the count pulls back the curtain on many birds that other surveys miss. The BBS, for example, only extends into the southern tier of Canada, and it misses a lot of the boreal and Arctic breeding birds—many of which winter largely or entirely within the CBC coverage area.

"This is the first time we're getting good population trend data on many of these birds, and we're finding big trends, trends that really jump out at you," Dan Niven says. "For example, we've seen really big declines in Harris's Sparrows, and a big increase in Merlins."

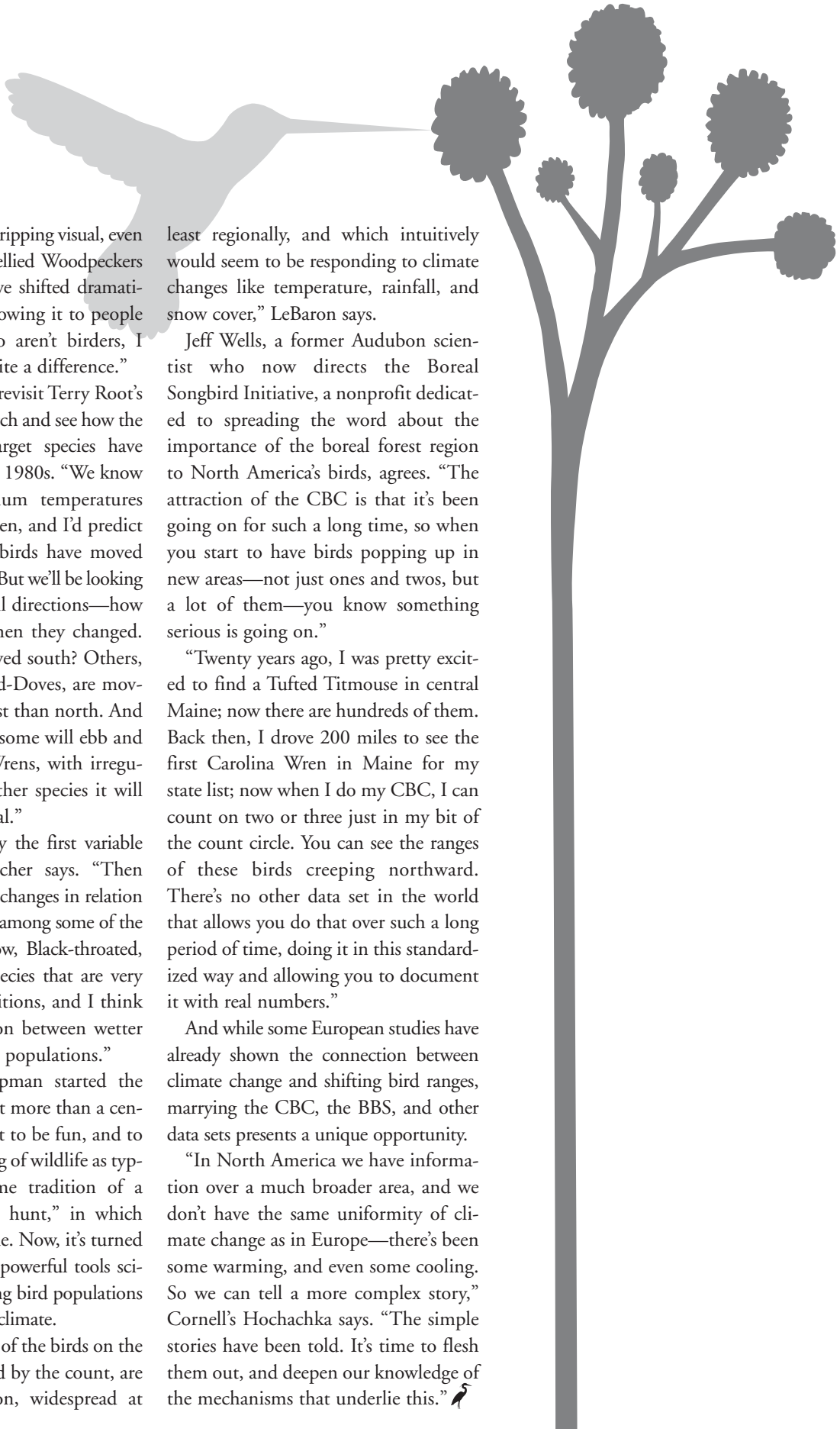
The breeding range of Rusty Blackbirds, which nest across the boreal forest, only touches the northern edge of the BBS coverage area—but these flocking blackbirds winter entirely within the CBC area. BBS data show an extraordinarily steep decline in Rusties, up to 10 percent a year for the past three decades. Christmas Count data, Niven says, show an alarming decline as well, but not as steep as the BBS might suggest. "Because almost 100 percent of the Rusty Blackbirds winter in the CBC area, we have fairly high confidence in that trend," he says. So why the difference between the two surveys? "It could be that Rusty Blackbirds are being most affected by climate change and habitat loss, acid rain, whatever, on the southern edge of their breeding range, which is the part covered by the BBS," Niven speculates.

Just because a bird is moving north, however, doesn't mean that the reason is solely or even primarily climatic. Butcher ticks off a litany of examples—cardinals, titmice, big increases in northern populations of robins, bluebirds, and crows, and increasing numbers of what had been Mexican wintering birds shortstopping in the United States. "You'd think this was pretty clearly climate change, but birds respond to food, cover, shelter—so the way humans change the landscape has a big effect on them," says Butcher. "In some respects people are responding to climate change in what they plant, and maybe birds are responding to people responding to climate change."

Some trends are hard to quantify because of growing sophistication in field identification, like the increasing numbers of *Empidonax* flycatchers reported on CBCs. "We're tossing them out—no one knew how to deal with them 40 years ago," Butcher says.

But hummingbirds wintering in the East and South (perhaps because people are planting more mid-winter flowers, thanks to warming) are a different matter, he thinks. "Hummers—that one's real," Butcher says. "That phenomenon is just unbelievable."

The first maps should be ready by this winter, and Niven expects them to have an impact beyond the world of birding.



"It should be a pretty gripping visual, even for species like Red-bellied Woodpeckers that birders know have shifted dramatically. But if you're showing it to people on Capitol Hill who aren't birders, I think it will make quite a difference."

The team will also revisit Terry Root's groundbreaking research and see how the ranges of her 62 target species have changed since the late 1980s. "We know that January minimum temperatures have gone up since then, and I'd predict that all 62 of those birds have moved north," Butcher says. "But we'll be looking at range changes in all directions—how far, how fast, and when they changed. Have some birds moved south? Others, like Eurasian Collared-Doves, are moving more strongly west than north. And it won't be smooth—some will ebb and flow, like Carolina Wrens, with irregularities, while with other species it will be much more gradual."

Temperature is only the first variable they'll examine, Butcher says. "Then we're going to look at changes in relation to moisture, especially among some of the sparrows. Lark Sparrow, Black-throated, Cassin's—these are species that are very sensitive to wet conditions, and I think we'll find a correlation between wetter conditions and better populations."

When Frank Chapman started the Christmas Bird Count more than a century ago, it was meant to be fun, and to counter overharvesting of wildlife as typified by the gruesome tradition of a Christmas Day "side hunt," in which anything was fair game. Now, it's turned into one of the most powerful tools scientists have for tracking bird populations in an era of changing climate.

"In a nutshell, a lot of the birds on the CBC are well-sampled by the count, are recognizable, common, widespread at least regionally, and which intuitively would seem to be responding to climate changes like temperature, rainfall, and snow cover," LeBaron says.

Jeff Wells, a former Audubon scientist who now directs the Boreal Songbird Initiative, a nonprofit dedicated to spreading the word about the importance of the boreal forest region to North America's birds, agrees. "The attraction of the CBC is that it's been going on for such a long time, so when you start to have birds popping up in new areas—not just ones and twos, but a lot of them—you know something serious is going on."

"Twenty years ago, I was pretty excited to find a Tufted Titmouse in central Maine; now there are hundreds of them. Back then, I drove 200 miles to see the first Carolina Wren in Maine for my state list; now when I do my CBC, I can count on two or three just in my bit of the count circle. You can see the ranges of these birds creeping northward. There's no other data set in the world that allows you do that over such a long period of time, doing it in this standardized way and allowing you to document it with real numbers."

And while some European studies have already shown the connection between climate change and shifting bird ranges, marrying the CBC, the BBS, and other data sets presents a unique opportunity.

"In North America we have information over a much broader area, and we don't have the same uniformity of climate change as in Europe—there's been some warming, and even some cooling. So we can tell a more complex story," Cornell's Hochachka says. "The simple stories have been told. It's time to flesh them out, and deepen our knowledge of the mechanisms that underlie this."