VERMONT CENTER FOR ECOSTUDIES
UNITING PEOPLE & SCIENCE FOR CONSERVATION

Research Notes
Number 1 ♦ October 2007

Northeastern birds pictured from top to bottom: Blackpoll Warbler, Black-throated Blue Warbler, Bicknell's Thrush, Spruce Grouse, Three-toed Woodpecker. All photos © Bryan Pfeiffer/Wings Photography.

Climate Change and Northeastern Birds

VCE Biologists Predict Declines in High-Elevation Bird Species

New research involving biologists at the **Vermont Center for Ecostudies (VCE)** predicts that the current pace of carbon dioxide emissions and rising global temperatures will cause major declines in some of the Northeast's most iconic bird species, including Common Loon, Black-capped Chickadee, and the rare Bicknell's Thrush.

VCE biologists Kent McFarland and Dan Lambert, studying birds in the mountains of New York and New England, conclude that the most vulnerable birds may be those nesting in high-elevation forests of spruce and fir. Rising mean summer temperatures, as little as 1°C (or 1.8°F), would eventually reduce by more than half the critical mountain habitat for many nesting bird species.

The findings are included in a scientific paper titled "The Potential Effects of Climate Change on Birds of the Northeast," to be published next spring in the journal *Mitigation and Adaptation Strategies for Global Change*.[1] The research is a project of the Northeast Climate Impacts Assessment, a collaboration among VCE, the Union of Concerned Scientists, and a team of 50 scientists and economists.

Bicknell's Thrush, with its fluty song and fascinating breeding ecology, is a rare and classic mountain bird species. It nests only in high-elevation "islands" of spruce and fir across the Northeast and eastern Canada. For more than 15 years the thrush and its montane habitat, including the work for this study, were priorities of VCE biologists during their tenure at the Vermont Institute of Natural Science (VINS). Now independent of VINS, VCE continues to research montane birds and habitats.

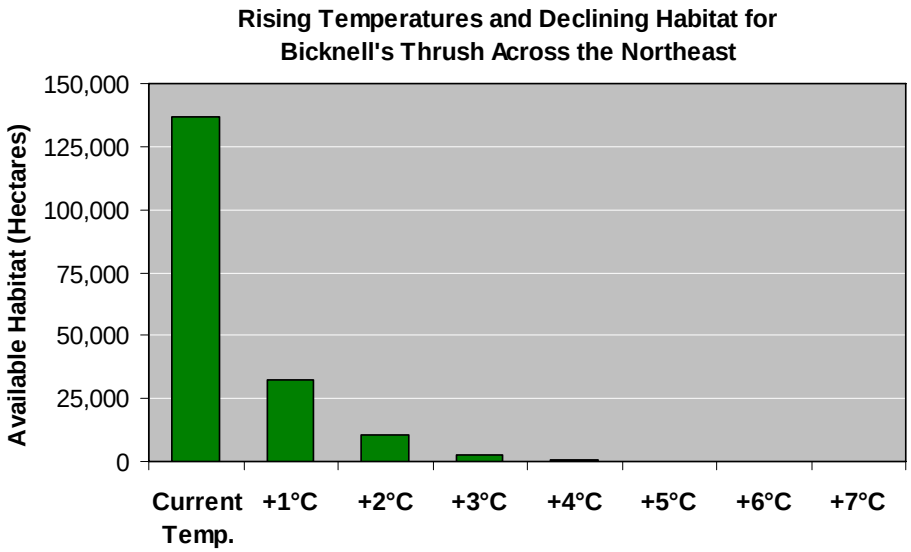
Relying on their body of published work with the thrush, McFarland and Lambert first identified a temperature range that corresponds with the bird's current distribution. After all, these islands of spruce-fir habitat can exist in the mountains of the Northeast only at certain latitudes, elevations and temperatures.

Next, using sophisticated computer modeling, the VCE biologists simulated warming, in one-degree increments, and measured how it would change the availability of suitable habitat for Bicknell's Thrush. Since mountains can't move or change their elevation, temperature remains a variable and critical factor in determining the location of the spruce-fir zone.

The VCE biologists found that regional warming of even 1°C will reduce potential Bicknell's Thrush habitat by more than half, and an increase of 2°C may be enough to eliminate all breeding sites from the Catskill Mountains of New York and most of Vermont. These projected temperature increases are widely accepted as likely before the end of this century. Indeed, summer temperatures are projected to rise on average by 2.8°C under a lower-emissions scenario envisioned in the research and 5.9°C under a higher-emission scenario. At this upper end, possible by late in the century, suitable habitat for Bicknell's Thrush is predicted to disappear entirely from the Northeast.

[1] Citation: Rodenhouse, N.L., S.N. Matthews, K.P. McFarland, J.D. Lambert, L.R. Iverson, A. Prasad, T.S. Sillett, and R.T. Holmes. 2008. Potential effects of climate change on birds of the Northeast. *Mitigation and Adaptation Strategies for Global Change*. In press. (PDF)

The disappearance of the Bicknell's Thrush's spruce-fir habitat is fairly simple to envision. And its gradual loss has the potential to affect not only Bicknell's Thrush but many other mountain songbirds as well. These include montane breeding populations of Spruce Grouse, Three-toed Woodpecker, Black-backed Woodpecker, Yellow-bellied Flycatcher, Gray Jay, Boreal Chickadee and Blackpoll Warbler.



Recall that the spruce-fir zone essentially amounts to a cap, or a habitat island, on suitable mountains in the Northeast. Bicknell's Thrush cannot exist in habitat found below the spruce-fir zone's lower elevation. It is similar to polar bears unable to survive at latitudes below the arctic circle.

Yet under the rising mean temperatures examined by the VCE biologists, the spruce-fir zone literally loses ground. Warming climate causes the lower boundary of this zone to gradually retreat up the mountain. The spruce-fir forest and its suite of plant and animal communities are therefore limited to progressively higher, smaller, and more isolated patches. Indeed, other research suggests that an upward shift in the lower spruce-fir zone may already be underway on northeastern mountains. Encroaching upon the retreating spruce and fir is a zone of mixed woods and hardwoods common throughout mountains of the Northeast and eastern Canada. It remains unclear at this point exactly how the forest communities would respond and how long it would take for the spruce-fir zone to retreat. But under a higher carbon dioxide emission scenario, the model predicts that a mean temperature increase of 3°C could eventually eliminate most Bicknell's Thrush habitat from the Northeast. After 5°C of summer warming, remnant patches of suitable habitat would persist only in New Hampshire's Presidential Range (55 hectares) and on Mount Katahdin in Maine (20 hectares).

In addition to the VCE biologists' contribution, the research publication features an analysis of the effects of climate change on as many as 150 other birds species across the Northeast. Although any given location can simultaneously gain and lose bird species, the report predicts declines in some of the Northeast's most familiar, colorful and musical songbirds, including Black-capped Chickadee, Wood Thrush, and Baltimore Oriole. The report's broader conclusion:

> Large changes in bird communities of the Northeast are likely to result from climate change, and these changes will be most dramatic under a scenario of continued high emissions. Indeed, high-elevation bird species may currently be at the threshold of critical change with as little as 1°C warming reducing suitable habitat by more than half. Species at mid-elevations are likely to experience declines in habitat quality that could affect demography. Although not all species will be affected adversely, some of the Northeast's iconic species, such as Common Loon and Black-capped Chickadee, and some of its most abundant species, including several neotropical migrants, are projected to decline significantly in abundance under all climate change scenarios. No clear mitigation strategies are apparent, as shifts in species' abundances and ranges will occur across all habitat types and for species with widely differing ecologies.

VERMONT CENTER FOR ECOSTUDIES
UNITING PEOPLE & SCIENCE FOR CONSERVATION
PO Box 420
Norwich, VT 05055
802.649.1431
www.vtecostudies.org

The Vermont Center for Ecostudies (VCE) is an independent research group with a mission to study and conserve wildlife. VCE brings 20 years of experience to our goal of promoting conservation practices that benefit biodiversity. With a reach extending from northern New England through the Caribbean to South America, our work in wildlife research and population monitoring unites people and science for conservation.