

## **CASE STUDY #4 – ACID RAIN AND BIRDS**

From [http://www.news.cornell.edu/releases/Aug02/acid\\_rain\\_birds.hrs.html](http://www.news.cornell.edu/releases/Aug02/acid_rain_birds.hrs.html)

### **Background information**

A large-scale study has for the first time shown a clear link in North America between acid rain and widespread declines across the breeding range of a songbird, the wood thrush. Calcium depletion affecting the birds' food is a possible cause, Cornell University ecologists say.

Using data collected by thousands of volunteer citizen-scientists in the Birds in Forested Landscapes project, scientists at the Cornell Lab of Ornithology showed that the wood thrush is less likely to attempt to breed in regions that receive high levels of acid rain.

Acid rain is the broad term used to describe several ways that a weak solution of inorganic acids, such as nitric and sulfuric acid, falls out of the atmosphere as rain, snow, mist and fog. Sulfur dioxide (SO<sub>2</sub>) and oxides of nitrogen (NO<sub>x</sub>) are the primary causes of acid rain. In the United States, about two-thirds of all SO<sub>2</sub> and one-fourth of all NO<sub>x</sub> come from electric-power generation that relies on burning fossil fuels, such as coal.

### **Effects of acid rain on bird populations**

High elevations, such as the Adirondack, Appalachian and Great Smokey mountains as well as the Allegheny Plateau, where the amount of acid deposited in precipitation could be highest, show long-term declines of up to nearly 5 percent annually in wood thrush populations. Although the exact mechanism leading to the declines is still unknown, it may well be related to the leaching of calcium from the soil by acid rain. European studies of heavy acid-rain regions similarly have linked declining bird populations to acid-rain-induced depletion of soil calcium.

Previous studies had shown that calcium-depletion can affect breeding birds in a number of ways. In particular, shortages of calcium-rich foods, such as snails and snail shells, might be critical at egg-laying time, when calcium demand is highest for female birds, or during the nesting period, when calcium supplements are often provided to growing young.

However, low levels of soil calcium might also affect a wide range of prey, such as earthworms, millipedes and centipedes, pillbugs and other insects that adult birds need to nourish themselves and feed their young. Fallen, decaying leaves and other natural litter on the forest floor could decompose more slowly under acidic conditions. At the same time, acidic conditions could also increase the amounts of toxic aluminum and heavy metals (such as lead, cadmium and mercury) that the wood thrush ingests. The birds may be finding less good-quality food and having to work harder to find it, which could potentially lead individual thrushes to attempt breeding elsewhere.

Cornell ecologists used data collected in sophisticated statistical analyses to produce a model that predicted where acid rain's effects might be most severe for a bird whose life and reproductive success depend on food it finds on the forest floor. The model predicts that, after statistically adjusting for several other factors (soil, vegetation, topography, thrush abundance), the probability of a wood thrush breeding is much reduced at a highly acidified site. The negative effects of acid rain might also be heightened by such factors as high elevation and habitat fragmentation.

Population declines in other songbird species also could be attributable, at least in part, to acid rain. In some places, there appear to be many fewer birds than there used to be, and these often appear to be the same places most severely impacted by acid rain.