

# Surveying bird biodiversity from space?

December 16 2009, by Dave Tenenbaum

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(PhysOrg.com) -- A fundamental rule of wildlife ecology says that diverse habitats foster greater biodiversity: The Amazon has far more species than Greenland. But how do habitat and biodiversity relate in a state like Wisconsin, with its range of farms, forests, wetlands, cities, suburbs and highways?

In a presentation at the fall meeting of the American Geophysical Union today (Dec. 16), Patrick Culbert, a Ph.D. student in the University of Wisconsin-Madison Department of Forestry and Wildlife Ecology, reported on a study correlating satellite images with results from an annual survey of breeding birds.

The strongest relationship between satellite imagery and bird biodiversity was found in the Laurentian mixed [forest](#) ecoregion province, an area of mixed deciduous and coniferous forests, Culbert says. The region includes the southern halves of Wisconsin and Michigan, southeastern Minnesota, and portions of Indiana, southern Illinois and southern Missouri.

Culbert's survey used Landsat images, taken around the year 2000, covering parts of Wisconsin, Minnesota, Michigan, Iowa, Illinois, Indiana and Missouri. The images covered about 585 "routes" of the annual Breeding Bird Survey. During the survey, amateur ornithologists traverse these 25-mile routes and record which species of birds they hear singing.

Culbert compared the number of bird species along the routes with

measures of "habitat complexity," which is how wildlife ecologists describe the range of niches within a particular location. A forest with many levels of vegetation or an area with a mixture of wetlands and forest are two examples of complex habitat that, in repeated studies, tend to support higher biodiversity.

To explore the same relationship on a larger scale, Culbert says he focused on variation among the pixels in [satellite images](#). "Some areas have a richer texture in the pattern of pixels than others. In an agricultural field, all the pixels are very similar, but in an old growth forest, we see lots of gaps, with a much more varied texture."

And more species of birds would live in an old-growth forest than in a farm field.

Measures of biodiversity can have a practical significance in land-use decisions, says Volker Radeloff, an associate professor who is Culbert's adviser. Radeloff says the current effort grew from previous studies by graduate students who focused on smaller areas. "A scrub desert in New Mexico had a pretty strong relationship between landscape texture and species diversity. And there was a very strong correlation in grasslands around Fort McCoy, Wis., but these were on much smaller areas. Patrick is studying the Upper Midwest to see if what worked on tens of square miles can be expanded to a broader area."

"We are trying to come up with a quick, easy way to identify areas with high biodiversity," says Culbert, "because we don't have a good handle on where it is and where it's not. Birds are a good indicator of habitat quality, because they are mobile and can quickly respond to changing conditions, and the breeding bird survey provides a wealth of data because it has been performed annually since the 1960s."

Eventually, the goal is to make a "plug-and-play" system that could use

remote sensing to support a more realistic and logical approach to planning, says Radeloff. "The habitat changes that ensue from building a new subdivision, highway or mall inevitably affects the mix of the species that live on that land."

Although the need to predict land-use changes is growing along with the expanding human footprint, "The traditional data-gathering approach of wildlife ecology is too slow to advise local governments about land use," Radeloff says. "If somebody says, 'We want to develop this land,' and you ask for five years to do a survey to get the answers, you will no longer be asked. For land managers, this could be a huge step forward."

Scientific results that could help a planning commission or a county board are not useful when sequestered in obscure journals, Radeloff says. "We want biodiversity to be a key measure when people decide on land use. We are learning a lot about the relationship of bird biodiversity to [habitat](#) features, and Patrick, by making the data useful, is making a major contribution."

Provided by University of Wisconsin-Madison

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