Biodiversity Issues: Do They Involve Wisconsin Birds?

by Stanley A. Temple

In recent years there has been growing concern about the preservation of biological diversity—or biodiversity—in Wisconsin as well as the rest of the world (Wolf 1987, Wilson 1988). The issue reached a peak in Wisconsin when the U.S. Forest Service issued plans for the future management of National Forests in the state. Many environmentalists felt that these management plans failed to safeguard the natural biodiversity of the National Forest lands and the State of Wisconsin, as a whole. An ongoing dialogue between concerned parties and legal action have catapulted preservation of biodiversity onto center stage as a major environmental issue of our times. What is biodiversity and is preserving it an issue with which Wisconsin ornithologists should be concerned?

What is Biodiversity?

Biodiversity is the cumulative variety that characterizes life on earth. It is basically a measure of how many different types of “things” comprise the living components of our world. The “things” that are usually measured fall into three categories: genetic diversity which is revealed as the individual variations within species and between different species, species diversity which is reflected in the number of species that occur on a particular area, and community diversity which is revealed as the variations in the types of species that are found in different regions or ecosystems.

Genetic diversity is a characteristic of living organisms. If you were to closely examine individual Eastern Screech Owls, for example, you would find that they differed from one another in a number of ways. Some might be the result of age or various things that had happened during the bird’s life, but most would be the result of the individual’s genetic constitution. Some individual owls, for example, have inherited genes for red coloration from their parents, whereas others inherited genes for gray coloration. There are many other differences between individuals that are caused by their genetic constitution or genotype, and since birds rarely produce “identical twins,” each bird has slightly different genotype than the other.
members of its species. Sometimes this genetic variation between individuals is related to where the bird lives, and we describe the birds as being of different subspecies because of these differences. Sandhill Cranes from the far northern portions of the species’ range have genes for small body size, and we call them Lesser Sandhill Cranes. Cranes from further south have genes for large body size, and we call them Greater Sandhill Cranes.

All birds show these types of genetic variation within species, but there is also even greater genetic variation between different species. The cumulative genetic diversity of birds is the sum of all the unique genetic variations within and between species. These variations are the result of the process of evolution.

Species diversity is a conspicuous feature of the earthly landscape. Each particular place on earth has a different assemblage of species that occurs there. Different places have different numbers of species and different types of species. There are more bird species in a square mile in Wisconsin, for example, than in a similar-sized area of Alaska. Even within local areas, differences in species diversity occur. In southern Wisconsin there are more bird species in a square mile of deciduous forest than in a square mile of corn field.

There are nearly 9,000 species of birds in the world. The greatest avian species diversity on earth almost certainly occurs in the tropical forests of South America where hundreds of species can be found in relatively small areas, and nearly one-fifth of the world’s bird species can be found in a single country, like Colombia.

No matter where you sample avian species diversity, however, there is a strong relationship between species diversity and the size of the area on which you measure it. The larger the area sampled, regardless of where you are on earth, the greater will be the diversity of species recorded. There are, for example, almost four times as many bird species in a 1,000-acre deciduous forest in Wisconsin than in a 10-acre forest.

Species diversity is correlated not only with area but with many other features of the landscape, and a general pattern emerges. Species diversity tends to be highest in areas that feature a complex variety of habitats. There will, for example, be more bird species in a township composed of a mixture of forest, grasslands, and wetland habitats than there will be in a township dominated by a single habitat.

Community diversity—or ecosystem diversity, as it is also called—is the highest level of biodiversity. It has to do with variations in the types of organisms that are found together—and hence are part of the ecological community—at different places. Obviously as you visit different locations there are different communities and types of species to be found. The bird community of a Wisconsin grassland or prairie is composed of different species than the bird community of a deciduous forest, and only a few species would be part of both communities.

Variation between communities also occurs at a local scale. The bird community of a young forest stand is different from the bird community of a more mature forest of the same type. You would expect to find fewer bird species breeding in a 5-year-old aspen forest than in a 50-year-old stand.
Genetic diversity, species diversity and community diversity encompass the rich variety of life on earth. Loss of biodiversity in any of its three major components diminishes the overall diversity of life. Furthermore, the loss of some types of diversity may be irreversible. The extinction of a species permanently and irrevocably reduces biodiversity (Ehrlich and Ehrlich 1981). The species is lost, the unique genetic information the species carried is lost, and the community in which the species lived is deprived of a member.

**HOW IS BIODIVERSITY THREATENED?**

In today’s world the threats to biodiversity are great (Myers 1979, Ehrlich and Ehrlich 1981). Since life began some 3.5 billion years ago biodiversity has been maintained through a dynamic balance between evolution and extinction. New species evolve, new genetic information results from changes in an organism’s DNA, and communities develop in response to changes in the physical environment. At the same time species go extinct, unique genetic material is lost, and communities undergo changes as the earth’s environment changes.

Today, the balance has been shifted by human activities, and the overall diversity of life is definitely being reduced. This reduction affects birds as well as other organisms. In recent centuries birds have been going extinct at an unprecedented rate (Hoage 1986). Since 1680, when the Dodo became extinct, bird species have disappeared at a rate of approximately one species every 3.5 years. Based on the growing number of endangered birds that are now threatened with extinction, it is estimated that the extinction rate for birds will reach one species lost every 6 months by the year 2000.

The loss of all these avian species obviously reduces the world’s diversity of birds. Furthermore, many of the extinct and endangered birds have unique characteristics shared by no other birds. The genetic basis for those unique characters is lost when an extinction occurs or when a species becomes so rare that its genetic diversity is diminished (Office of Technology Assessment 1987). When habitats are destroyed or altered by human activities, the diversity of the landscape is reduced and biotic communities that include birds are lost or changed.

**BIODIVERSITY IN WISCONSIN**

Wisconsin can be considered a microcosm of the rest of the world when it comes to biodiversity concerns. The species diversity of the State has been diminished by the extinction or extirpation of dozens of species. It has also been augmented by introductions of exotic organisms and the spread of other species. Few, however, would conclude that the losses of birds such as the Passenger Pigeon or Trumpeter Swan have been satisfactorily replaced by the addition of Rock Doves or Mute Swans!

On a more local scale in Wisconsin, losses of species diversity have been even greater. Greater Prairie-chickens and Sharp-tailed Grouse, for example, no longer occur in southern Wisconsin, where native prairies and oak openings formerly were the main habitats of these species. Birds that require extensive tracts of habitat are being eliminated from regions of the state where habitat fragmentation has resulted in habitat patches too small and
isolated to sustain populations. Furthermore, fragmentation now threatens birds in parts of the state where extensive tracts of habitat exist, such as in the forests of northern Wisconsin.

The diversity of communities in the State is threatened by the almost total loss of certain types of habitats. Oak openings are all but gone from Wisconsin, tallgrass prairies are reduced to a few tiny remnants, older mature stands of forests have given way to younger second growth forests subject to short rotation forestry practices, and wetlands have been greatly reduced by draining. The diversity of such habitats across the landscape has been replaced by the reduced diversity of agriculture, suburbs and other intensely used lands.

The genetic diversity of some species in Wisconsin has been reduced. Greater Prairie-chickens, for example, are now isolated in small populations that are cut off from other populations by severe fragmentation of grassland habitats. In such small isolated populations genetic variation is steadily lost.

WHAT SHOULD ORNITHOLOGISTS DO?

Aldo Leopold produced one of the most quotable statements on how society should react to threats to biodiversity. He observed that the first rule of intelligent tinkering is to save all the parts. Saving all the parts of biodiversity will take some special efforts on the part of conservationists. Unless we make a concerted effort to prevent losses of biodiversity there will be further erosion.

Wisconsin ornithologists should be concerned about biodiversity, they should take stock of the biological diversity in their local environment and be aware of human activities that might threaten that diversity. They should also be aware of how local threats to diversity relate to regional and global issues.

LITERATURE CITED


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