



## FOCUS

### EFFECTS OF CLIMATE CHANGE ON BIRD DISTRIBUTIONS AND MIGRATION PATTERNS

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**T**he Great Lakes region supports more bird species than anywhere else in the conterminous US except for northern New England [F6-1]. The region is the only place in the world where the endangered Kirtland's Warbler breeds. This species nests in young (5-23 years old) jack pine stands with specific vegetation characteristics found mainly in areas of northern lower Michigan. The Great Lakes region is important for many migrating birds as well. Hawk Ridge, located just outside Duluth, Minnesota, and areas along the Detroit River are corridors for the Broad-Winged Hawk migration. The Upper Mississippi/Trempeleau National Wildlife Refuges, located along the Mississippi River between Minnesota and Wisconsin and continuing farther south into Illinois and Iowa, host more than 100,000 Canvasbacks (>20% of the world's population) and more than 200,000 ducks of other species during their annual southbound fall migration. Bald Eagles also use this refuge, with more than 600 being found there in the winter [F6-2]. To date, more than 40 globally important sites (e.g., sites that regularly provide habitat for 1% or more of the world's population of a bird species) have been identified in the Great Lakes region including nine in Minnesota, five in Wisconsin, and eight in Michigan [F6-3].

## Economic and Ecological Impacts

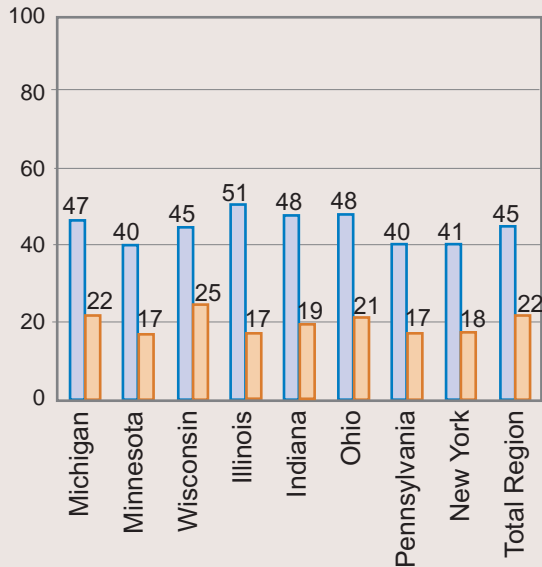
The diversity and abundance of birds have an overall positive economic impact in region. Nearly \$3.5 billion was spent on wildlife-watching activities in 1996 in the Upper Great Lakes region (Minnesota, Wisconsin, Michigan) alone [F6-4]. The majority of this amount was spent on watching or feeding birds. An earlier survey found that “non-consumptive” (e.g., non-hunting) bird use generated \$590 million in retail sales in Michigan, Minnesota and Wisconsin, and supported more than 18,000 jobs [F6-5]. Additionally, more than \$3.8 billion was spent on hunting in Michigan, Minnesota and Wisconsin in 1996 although this figure includes expenditures not only for migratory bird hunting (mostly waterfowl) but also expenditures for big-game (e.g., deer and moose) and small-game hunting. Birds also provide many important ecological services to ecosystems in the region. For example, Blue Jays are a major disperser of oak seeds; several species of warblers are largely responsible for holding down numbers of eastern spruce budworm larvae, eating up to 98% of the non-outbreak larvae; and birds in general consume up to 98% of the overwintering codling moth larvae in orchards. Also, while birds are not the principal vertebrate predator of gypsy moths (the white-footed deer mouse is), they do play a role in holding down numbers of this pest. Birds also play a role in many Native American communities. Birds, or bird parts, are used in some religious ceremonies and also form a component of the subsistence lifestyles in these communities.

While people certainly care about birds, it is difficult to estimate how changes in bird distributions might affect the economics of consumptive or non-consumptive bird use. Shifts in regional spending are likely as some birdwatching and hunting sites become less favorable and different sites become more favorable. Although many birdwatchers and hunters might simply adjust to the reduction in species richness in their areas, they will experience the loss of well-being that accompanies a reduction in their preferred activities. Shifts in the distributions and abundances of wildlife are likely to have a greater impact on Native Americans in that their communities are often geographically restricted and unable to follow the wildlife in response to the changing climate.

## Bird Distributions and Climate Change

Recent studies (Figure F6-1) have suggested that bird distributions may change quickly in response to climate change – the average latitude of occurrence of 43% of the warblers has shifted north in the last 20 years, by an average of more than 44 miles (70 km) [F6-6]. In contrast, only three species (6%) were found significantly farther south and those represented overall expansions of the species’ ranges. In most of the remaining species, the range showed a northward trend but it was not enough to be statistically significant. While it is impossible at this time to attribute this shift to climate change alone it does indicate that at least some of the warblers might be susceptible to even slight changes in climate. Early studies [F6-7, F6-8] of potential climate change impacts on the habitat of this species projected a potential rapid loss of this habitat type [F6-9]. This was of particular concern because, although jack pines have a broad distribution, Kirtland’s Warblers are not known to breed outside of this very small area. In recent years, Kirtland’s Warblers have been found breeding on the Upper Peninsula of Michigan with isolated sightings in Wisconsin and Ontario. While this is encouraging, populations in this area will need to increase in order to offset the risk of habitat loss in the core of its

## Perching Birds



## Warblers

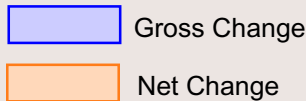
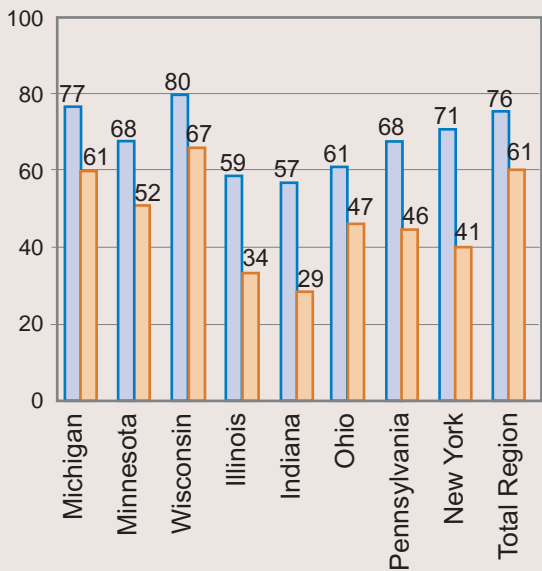


Figure F6.1: Reductions (%) in the number of perching bird species and warbler species from the equilibrium Canadian Climate General Circulation model. The gross change represents the overall loss currently found in the area. The net change represents the loss of species currently found in the area offset by the species moving into the area from outside of the region.

range. The ideal habitat for this species is one in which frequent fires occur, to maintain the proper age-class and structural components of the jack pine forests. Some equilibrium climate change models project the possibility of an increasing forest fire frequency, which suggests an increase in the amount of habitat available for this species. Even if the amount of available habitat increases north of this species' current range (e.g., Michigan's Upper Peninsula and Ontario) the species will still need to colonize these new areas and have sufficient time to establish viable populations before its current habitat becomes unsuitable. While many more species will likely leave the region, some of these losses will be offset by other species moving into the region. However, more recent studies suggest that climate change will likely lead to a net reduction in the number of bird species in the Great Lakes region.

## Bird Migration in the Upper Peninsula

Of the 47 species of birds that have been noted to migrate through the region, four have now become resident on the Upper Peninsula. These are species that formerly migrated some distance south in the fall and returned in the spring. No significant change was found for 27 of the species and one species is actually arriving later. The remaining 20 species were found to be arriving an average of 19 days earlier in 1994 than in 1965. These species have many different migratory strategies, some are short-distance migrants and some migrate from Central and South America. While there is no direct link between the early arrival of these species and climate change, the earlier arrival is associated with earlier pond thaw dates in the area. This suggests that temperature increases since 1965 may be associated with these species earlier arrival

dates. The timing of migration, and the timing of breeding are thought to be tied largely to the availability of resources, predominantly food. Many bird species time their breeding such that there is a flush of insect larvae available for them to feed their young. If early spring migration leads to early breeding, then there could be a “decoupling” of birds from their dominant food resource. Unless the insects hatched at an equivalently earlier time, there might not be as much food available for the birds to feed their young. Similarly, this could lead to a breakdown of control mechanisms between predator (birds) and prey (insect larvae) potentially leading to more damaging insect outbreaks of some species.

## Waterfowl and Climate Change

Climate change may also impact the migration of other (waterfowl) species through the region [F6-10]. Declines in duck numbers from 39% to 19% are projected to occur by the 2030s. These declines will likely have an impact on waterfowl hunting opportunities and a subsequent loss of revenue associated with waterfowl hunting. These declines from loss of breeding habitat may be exacerbated by loss of migratory habitat, which still needs to be considered more thoroughly. Many of the diving duck species feed on submerged aquatic vegetation or invertebrates (including zebra mussels) to store fat in order to continue their migration. The availability of these foods, in turn, is often tied to water depth and mixing characteristics. Changes in lake water levels or temperatures could have an impact on these species. Many of the ducks also rely on the wetland marshes for food and shelter during migration. Rising lake levels could flood out potential marsh habitat while declining lake levels could dry out the marshes – making them unavailable for waterfowl. Finally, any increases in dredging necessitated by falling lake levels could introduce contaminants into the food chain that could be harmful to waterfowl.

