Climate Change and Birds

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SUMMARY

Worldwide climate data clearly indicate that our climate is changing – it's getting warmer.

Climate change has the potential to be a very powerful influence on the future status of breeding, migrant, and wintering birds in Wisconsin, and around the globe. Research shows that bird populations are already beginning to respond to a warming climate. For example, the ranges of many species of North American birds are shifting northward while some migrating species are arriving at breeding grounds earlier in the spring and staying later in the fall.

World-wide, under conservative estimates of habitat loss and expected warming (2.8° C), by the year 2100 we may see the extinction of 400-550 bird species (4.0-5.5% of the world's total).

The WBCI Issues Committee recommends that individuals, businesses, agencies, and non-governmental organizations immediately take the actions discussed in Appendix 1 to minimize their greenhouse emissions, plan for climate change effects, and adopt strategies to adjust conservation planning with climate change as a primary consideration.

DISCUSSION

- Recent research (Mann et al. 1999) shows that the final half of the 20th century was warmer than any period in the past 1,000 years. Around the globe, the 1990s were the warmest decade ever recorded, with 2005 being the warmest year ever recorded. Furthermore, the United Nations Intergovernmental Panel on Climate Change (IPCC) reports that the years 1995-2006 were among the 12 warmest years recorded since 1850. The IPCC predicts an increased global mean temperature of between 1.8° C to 4.0° C (3.24° F to 7.2° F) by the year 2100 (IPCC WGI Fourth Assessment Report, 2007) available: http://www.ipcc.ch/ipccreports/ar4-wg2.htm. These temperature increases are the result of climate warming, which are directly attributable to human activities (IPCC). One outcome of a warming planet is that the onset of spring is occurring in the Arctic weeks earlier than it did just 10 years ago, according to a long-term survey of life in the Arctic. Specifically, rising temperatures are causing snow to melt sooner than it did previously, resulting in an extension of the summer period and ecosystem disruption (Hoye et al. 2007). A case in point is that arctic temperatures in Alaska and western Canada have increased over the past half-century by as much as 3-4° C (Hassol 2004).
- The recent report "Birds and Climate Change: Ecological Disruption in Motion" from the National Audubon Society (NAS 2009) demonstrates significant

northward displacement of the center of distribution for 177 of 305 (58%) species tracked by the Christmas Bird Count (CBC) over the past 40 years. As detailed in this report, average temperatures for the month of January rose in excess of 5 degrees Fahrenheit within the boundaries of the continental United States within that same 40-year time period. The distribution of birds within years along latitudes correlate with temperatures within years, and rates of population change are correlated with rates of change of temperatures. The report explains that impacts vary across the array of species studied on the CBCs. Increasing temperatures may prove harmful to waterfowl populations as hotter and drier conditions cause excessive drying of wetlands. Forest birds are at risk from changing conditions caused by warming. Climate change exacerbates other threats, including melting permafrost, sea level rise, effects of invasive plants, and increased risk of extinction for 20-30% of animal and plant species.

- Increasing evidence suggests that climate change is already affecting bird species that migrate altitudinally (i.e., seasonal movement between different elevations in mountainous regions). Climate change may be causing a disjunction between the phenology at lower altitudes and higher altitudes. For instance, climate changes at lower altitudes caused American Robins *(Turdus migratorius)* to move to higher altitudes for breeding by an average of 14 days earlier than they did in 1981, only to find the higher altitudes still covered in snow (Inouye et al. 2000).
- Climate change is also partially responsible for the poleward shift of bird species' ranges (LaSorte and Thompson 2007). Specifically, utilizing Audubon Christmas Bird Count (CBC) data for 254 species of wintering birds in North America from 1975 to 2004, the analysis demonstrated that climate change in concert with varying sets of regional anthropogenic (human-caused) driving factors is potentially responsible for observed range shifts. These factors taken together must be considered in conservation planning and adaptive management decision-making.
- A key factor that determines a migratory bird's reproductive success, survivorship, and hence fitness, is the timing of their arrival on breeding and over-wintering grounds (Cotton 2003). As a result, changes in the onset of arrival at the breeding grounds can have repercussions for many generations to come. In fact, climate change has affected the onset of breeding in Tree Swallows (*Tachycineta bicolor*) across North America (Dunn and Winkler 1999). Similarly, in Europe the breeding date has advanced for dates of some passerines (Both et al. 2004). Within Sauk County, Wisconsin, earlier spring arrivals for some species of birds have similarly been attributed to climate change (Bradley and Leopold 1999).
- Early spring arrivals, early nesting, and late fall departures are being noted for some bird species across many areas around the world. For instance, early spring arrival dates and fall departure dates of migratory birds are now extended by as much as two weeks each season (Root and Hughes 2005). Over the past 40 years a long-term study site in Wisconsin has shown that migrants have been arriving a minimum of 4 days (median dates) earlier. These early arriving species include: Ruby-throated Hummingbird (*Archilochus colubris*), Black-billed Cuckoo

(*Coccyzus erythopthalmus*), Blue-gray Gnatcatcher (*Polioptila caerulea*), Hermit Thrush (*Catharus guttatus*), Blue-winged Warbler (*Vermivora cyanoptera*), Tennessee Warbler (*Oreothlypis peregrina*), Black-throated Green Warbler (*Setophaga virens*), Black-and-white Warbler (*Mniotilta varia*), Mourning Warbler (*Geothlypis philadelphia*), Rose-breasted Grosbeak (*Pheucticus ludovicianus*), Bobolink (*Dolichonyx oryzivorus*), and Baltimore Oriole (*Icterus galbula*) (Lange 2008).

- Using the alteration of species' geographic ranges, climate predictions from the IPCC, and an accompanying set of expected habitat-loss predictions, Sekercioglu et al. (2008) calculated the risk of extinction for more than 8,400 terrestrial bird species worldwide. Extrapolating from a likely outcome provided by the IPCC—a rise of 2.8° C by 2100—a total of 400-550 bird species may become extinct during this century. If temperatures increase more, then the number of species affected would increase as well, due to a phenomenon called the "escalator effect." That is, as the planet warms, species that currently breed at higher altitudes and latitudes may hit the "climate escalator", whereby the species can no longer go up (i.e. farther north or higher elevation), because they are at the northern or elevational limit. Hence, the only outcome for these species may be extinction (Sekercioglu et al. 2008).
- Migration rates for plant species due to climatic warming may not keep pace with potential rates of warming (Malcom et al. 2005). Forest landscape models show that climate change may quickly and dramatically alter the present status and geographic range of plant communities in Wisconsin (Mladenoff, 2007), and bird communities along with them. As global temperatures rise, our Wisconsin climate will no longer be suitable for some plant species, which will likely result in profound changes to our native plant communities. In turn, many of Wisconsin's bird species will be markedly affected as they are intricately tied to the plant communities they inhabit. Precisely how these changes will affect bird populations and distribution in Wisconsin is not yet fully understood. However, two climate change models, the Canadian Climate Center (CCC) and the Hadley (U.K.) Center for Climate Prediction and Research (Hadley), forecast the extirpation or decrease in abundance by the year 2100 of many bird species that typically breed in Wisconsin, due to changes in habitat or inability to tolerate temperature increases. The list of species that will be extirpated includes such familiar birds as White-throated Sparrow (*Zonotrichia albicollis*), Red-breasted Nuthatch (*Sitta canadensis*), Mourning Warbler (*Oporornis philadelphia*), Pine Warbler (*Dendroica pinus*), Blackburnian Warbler (*Dendroica fusca*) and others (Matthews et al. 2004). In fact, upwards of 78 bird species in the eastern United States will decrease in abundance as the result of climate change (Matthews *et al*. 2004; Table 1). These two climate change models provide overlapping interpretations of the data, but each suggests detrimental changes may be in store for many of Wisconsin's birds.

RECOMMENDED ACTIONS

The WBCI Issues Committee asks that individuals, businesses, agencies, and non-governmental organizations take action as soon as possible to minimize their greenhouse emissions, plan for climate change effects, and adopt strategies to adjust conservation planning with climate change as a primary consideration. (See Appendix 1 for ways that individuals, agencies, and businesses can minimize their contribution to climate change.)

The WBCI Issues Committee concurs with the following recommendations regarding climate change from The Wildlife Society: Final Position Statement: Global Climate Change and Wildlife.
http://wildlife.org/wp-content/uploads/2014/05/global.climate.change.11.21.11.pdf

1. Encourage global reduction in anthropogenic (human-caused) sources of carbon dioxide and other greenhouse gas emissions contributing to global climate change and the conservation of CO2-consuming photosynthesizers (i.e., plants).
2. Encourage government wildlife agencies and wildlife educational institutions to educate wildlife students, biologists, managers, and the general public about the potential effects of climate change and ways to account for it in wildlife planning and management.
3. Encourage state and federal wildlife agencies, non-profit organizations, and private landowners to consider climate change and variability when developing long-range wildlife management plans and strategies.
4. Encourage implementation of state and federal monitoring programs for wildlife and wildlife habitats expected to be most sensitive to climate change and variability, such as alpine species, habitat specialists, slow reproducers, and non-vagile species.
5. Encourage agencies to develop flexible budgetary processes to allow managers to act appropriately to manage the effects of climate change and variability.
6. Encourage the International Association of Fish and Wildlife Agencies to establish a climate change and variability staff position to facilitate greater interstate and international cooperation among agencies in all aspects of education, planning, monitoring, and research involving climate change and wildlife.
7. Educate the public about climate change and its effects on wildlife.
8. Encourage terrestrial carbon sequestration projects that protect and restore natural ecosystems such as bottomland hardwood forest, prairie grasslands, and seasonal wetlands.
9. Advocate management activities that will reduce factors that contribute to ecosystem stress (urbanization, pollution, habitat fragmentation and conversion, ozone depletion, etc.), thereby contributing to the ability of wildlife populations to adapt to future climate changes.

Research Needs

Additional research is needed in Wisconsin and the Great Lakes region that focuses on the effects of climate change on bird populations and distribution. Factors investigated

should include climate-induced changes in plant communities, early spring arrival and late fall departure of migrant birds, changes in egg-laying dates, and the effects of climate change on bird productivity and survival.

Table 1. Species expected to incur population losses or extirpation from Wisconsin under two climate models (from Matthews et al. 2004).

Species Name	CCC Climate Model*	Hadley Climate Model**
Blue-winged Teal	**yes1**	**yes**
Common Loon	**Yes**	**yes**
American Bittern	**Yes**	**yes**
Great Egret	**Yes**	**yes**
Gray Partridge	**Yes**	**yes**
Ruffed Grouse	**Yes**	yes, except extreme N. WI
Northern Harrier	significant losses	significant losses
American Kestrel	losses in Southern WI	losses in Southern WI
Sora	**Yes**	**yes**
American Coot	**Yes**	**yes**
Spotted Sandpiper	losses in Southern WI	losses in Southern WI
Wilson's Snipe	**Yes**	**yes**
Ring-billed Gull	**Yes**	losses in Eastern WI
Black Tern	**Yes**	**yes**
Black-billed Cuckoo	significant losses	significant losses
Yellow-bellied Sapsucker	**Yes**	significant losses
Least Flycatcher	**Yes**	significant losses
Warbling Vireo	Losses	losses
Blue-headed Vireo	Losses	losses
Horned Lark	Losses	losses
Cliff Swallow	**Yes**	losses
Tree Swallow	Losses	losses
Bank Swallow	Losses	losses
Black-capped Chickadee	significant losses	significant losses
Red-breasted Nuthatch	**Yes**	**yes**
Brown Creeper	significant losses	significant losses
Winter Wren	**Yes**	significant losses

Sedge Wren	significant losses	significant losses
Veery	**Yes**	significant losses
Swainson's Thrush	**Yes**	**yes**
Hermit Thrush	significant losses	significant losses
Wood Thrush	Losses	losses
Cedar Waxwing	Losses	losses
Blue-winged Warbler	**Yes**	losses
Golden-winged Warbler	**Yes**	**losses**
Nashville Warbler	**Yes**	losses
Northern Parula	Losses	**yes**
Yellow Warbler	Losses	losses
Magnolia Warbler	**Yes**	significant losses
Black-thr. Blue Warbler	**Yes**	**yes**
Yellow-rumped Warbler	**Yes**	**yes**
Black-throated Green Warbler	**Yes**	losses
Blackburnian Warbler	**Yes**	**yes**
Pine Warbler	**Yes**	**yes**
Black-and-white Warbler	Losses	losses
American Redstart	Losses	losses
Ovenbird	significant losses	significant losses
Northern Waterthrush	**Yes**	losses
Mourning Warbler	**Yes**	**yes**
Common Yellowthroat	significant losses	significant losses
Canada Warbler	significant losses	significant losses
Chipping Sparrow	Losses	losses
Clay-colored Sparrow	**Yes**	**yes**
Vesper Sparrow	Losses	losses
Savannah Sparrow	Losses	losses
Song Sparrow	Losses	losses
Lincoln's Sparrow	**Yes**	**yes**
Swamp Sparrow	**Yes**	losses
White-throated Sparrow	**Yes**	**yes**
Dark-eyed Junco	**Yes**	**yes**
Rose-breasted Grosbeak	Losses	losses
Bobolink	Losses	losses
Baltimore Oriole	Losses	losses

Yellow-headed Blackbird	**Yes**	**yes**
Brewer's Blackbird	**Yes**	**yes**
Purple Finch	Losses	losses
Evening Grosbeak	**Yes**	**yes**
American Goldfinch	Losses	

1 A 'yes" indicates potential for extirpation within the Wisconsin geographic range of this species; "losses" indicate that some level of population loss may occur.

Note: Species listed in bold type are considered Species of Greatest Conservation Need in the Wisconsin Wildlife Action Plan --
http://dnr.wi.gov/topic/WildlifeHabitat/profiles.asp

*****Canadian Climate Center climate model predictions (Boer et al. 2000)
**Hadley Center for Climate Prediction and Research (Mitchell et al. 1995)

RESOURCES

American Bird Conservancy – Threats to Birds: Climate Change
http://abcbirds.org/threat/climate-change/

National Wildlife Federation and American Bird Conservancy -- The Birdwatcher's Guide to Global Warming
http://online.nwf.org/site/DocServer/birdwatchers_guide.pdf?docID=7521

Wisconsin Initiative on Climate Change Impacts -- http://www.wicci.wisc.edu/index.php

Wisconsin Initiative on Climate Change Impacts – Wildlife Working Group
http://www.wicci.wisc.edu/wildlife-working-group.php

American Association for the Advancement of Science – What We Know: The Reality, Risks, and Response to Climate Change
http://whatweknow.aaas.org/get-the-facts/

Avian migration phenology and global climate change
http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=218739

British Trust for Ornithology - Birds and Climate Change - A global review of the impact of climate change on birds
http://www.bto.org/news-events/press-releases/birds-and-climate-change-global-review-impact-climate-change-birds

Climate change has affected the breeding date of tree swallows throughout North America.

http://www.researchgate.net/publication/216769001_Dunn_P._O._Winkler_D._W._Climate_change_has_affected_the_breeding_date_of_tree_swallows_throughout_North_America._Proc._R._Soc._Lond._B_266_2487-2490

Climate models and ornithology – Auk 2008
http://www.bioone.org/doi/full/10.1525/auk.2008.125.1.1

David Suzuki Foundation – Climate Change: Impacts and Solutions
http://www.davidsuzuki.org/Climate_Change/

Effects of Climate Change on Biological Diversity in Western North America: Species Losses and Mechanisms
http://www.ciesin.org/docs/002-262/002-262.html

U.S. Environmental Protection Agency – Climate Change Indicators in the United States: Bird Wintering Ranges
http://www3.epa.gov/climatechange/science/indicators/ecosystems/bird-ranges.html

Intergovernmental Panel on Climate Change: Climate Change 2014: Synthesis Report
https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf

National Audubon Society, Audubon's Birds and Climate Change Report: 314 Species on the Brink
http://climate.audubon.org/

National Oceanic and Atmospheric Administration: Climate Web Page
http://www.noaa.gov/climate.html

National Wildlife Federation – Global Warming
http://www.nwf.org/Wildlife/Threats-to-Wildlife/Global-Warming.aspx

Natural Resources Defense Council – Global Warming
http://www.nrdc.org/globalWarming/f101.asp

Pew Center on Global Climate Change
http://www.pewclimate.org/

Potential impacts of climatic change upon geographical distributions of birds – Ibis 2006
http://www3.interscience.wiley.com/cgi-bin/fulltext/118619871/PDFSTART

Royal Society for the Protection of Birds – Climate Change
http://www.rspb.org.uk/forprofessionals/policy/climatechange/

Smithsonian Migratory Bird Center: Full Annual Cycle Climate Change Vulnerability Assessment for Migratory Birds of the Upper Midwest and Great Lakes Region
http://nationalzoo.si.edu/scbi/migratorybirds/science_article/?id=401

Effects of climate variation on trophic interactions in a high elevation riparian ecosystem and bird community
http://www.umt.edu/mcwru/personnel/martin/docs/ResearchProjectsDetails/ClimateEffectsonHighElevation.aspx

U.S. Fish & Wildlife Service - Climate Change
http://www.fws.gov/home/climatechange/

USGS – National Climate Change and Wildlife Science Center
https://nccwsc.usgs.gov/

WWF Global: One of the biggest threats to humanity & nature -- The impacts of global warming -- http://wwf.panda.org/about_our_earth/aboutcc/

News Articles

BBC News: Climate changes disrupt birds
http://news.bbc.co.uk/2/hi/science/nature/2658459.stm

NPR: Spring is Early, and So Are the Birds
http://www.npr.org/templates/story/story.php?storyId=5521938

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APPENDIX 1 - WAYS THAT INDIVIDUALS, AGENCIES AND BUSINESSES CAN MINIMIZE THEIR IMPACT ON CLIMATE CHANGE.

What Individuals Can Do: Each change can make a difference.

- Work to reduce your home heating and electricity use. A more energy-efficient home will lower your utility bills and reduce the emissions that cause climate change. Turn off electronics like computers, TVs, and radios when they are not being used. Furthermore, consider unplugging unused equipment and appliances when not in use as many still use electricity when in the off position. Find out how you can increase energy efficiency in your home:
  We Energies: http://www.we-energies.com/energy-saving_ideas/tips/index.htm
- Choose energy-efficient appliances. New refrigerators, for example, use 40% less energy than models made just 10 years ago. Visit the US Environmental Protection Agency's (EPA) and US Department of Energy's (USDE) Energy Star program web site: http://www.energystar.gov/
- Check the EPA/USDE ratings for the next car you intend to buy to make sure it's fuel efficient and low polluting. A typical SUV uses almost twice the fuel – and releases nearly twice the emissions – of a modern station wagon, although both

seat the same number of passengers.
Visit http://www.fueleconomy.gov/feg/bestworst.shtml to find the most fuel-efficient vehicles.

- Walk, bike, carpool, or take mass transit to get to your regular destinations each week.
- Learn about the impacts of air travel and consider vacationing closer to home. http://www.davidsuzuki.org/issues/climate-change/science/climate-change-basics/air-travel-and-climate-change/
- If you are moving, choose a home within a 30-minute bike, walk, or transit ride from your work, school, and other daily destinations.
- Compost all organic waste and recycle paper, cardboard, cans, and bottles to help reduce the greenhouse gas emissions associated with landfills.
- Reduce fuel use and resulting emissions caused by shipping foods long distances: choose foods that are locally-grown, organic, and low on the food chain (i.e. fruits, vegetables, grains) whenever possible. Make the most of seasonal foods.

What Businesses Can Do

- Purchase energy-saving models of office appliances and equipment, such as EnergyStar-approved computers, LCD monitors, printers, and photocopiers. Not only will this help save energy, but it will save money, too.
- Explore energy- and money-saving initiatives offered through your energy supplier:
  We Energies: http://www.we-energies.com/business/bus_emgt_tools.htm
- Design for lighting intensity of 1.0 watts per square foot or less. Over-lighting wastes energy and produces glare.
- Install lighting controls to turn lights on only when needed and to provide the required amount of light. For example, Phillip's Ledalite has several product lines designed to maximize energy conservation and a website with additional information on energy-efficient lighting.
  http://www.ledalite.com/technology
- Encourage employees to take alternative modes of transportation (car-pooling, cycling, public transit, or walking) for their daily commute at least once a month. Offering incentives to employees may help facilitate changes in their behavior.
- Reduce your staff's environmental impacts from air travel by using video-conferences for meetings whenever possible.
- Create a recycling program and decrease paper use. For example, make copies double-sided. Instead of recycling paper that has been printed on one side, use it as scratch paper or print drafts of documents on the other side. Visit http://www.environmentaldefense.org/papercalculator/ to see how choosing the right type of paper can save wood, water, and energy and cut pollution and solid waste.
- If you have a fleet of vehicles, try using the most energy-efficient, low-emission models possible. Companies participating in PHH Arval's GreenFleet program

have reduced emissions on average by 14% and operating costs by 4%. https://www.elementfleet.com/element-advantage/fleet-consulting/

- Upgrade and/or retrofit your office building so that it is energy efficient. This can have long-term financial paybacks. For example, instead of spending more than $3 million to build a new leisure center, the District of Mission, British Columbia, Canada, upgraded its existing leisure center. It replaced the refrigeration plant and hot water boiler systems and installed energy-efficient lighting systems among other measures. As a result, Mission will enjoy annual energy savings of $74,000.
- Visit Power Smart for businesses to find out how your company can cut pollution and save money with clean, efficient energy technology.

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