

CHICAGO WILDERNESS



CLIMATE CHANGE AND
REGIONAL BIODIVERSITY:
A Preliminary Assessment and Recommendations
for Chicago Wilderness Member Organizations

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City Hall green roof photo courtesy of the City of Chicago

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Chicago Wilderness

Dear Reader,

The enclosed document, *Climate Change and Regional Biodiversity: A Preliminary Assessment and Recommendations for Chicago Wilderness Member Organizations*, was prepared by the Chicago Wilderness (CW) Climate Change Task Force and approved for public distribution by the CW Executive Council in June 2008. The Preliminary Assessment discusses the projected effects of climate change within the CW region, the potential impacts of climate change on the region's biodiversity, and current actions undertaken by CW member organizations to address climate change impacts. It also recommends actions individuals and organizations can undertake to reduce greenhouse gas emissions, and to develop strategies to lessen the impacts of climate change on the region's ecosystems.

This document is intended to provide CW member organizations and others with accurate, basic information about climate change and regional biodiversity impacts to support public communication efforts. Its conclusions are based on a review of recent scientific publications discussing region-specific projections for climate change effects and potential impacts on biodiversity. The topics addressed and the recommendations made are based on discussion among Task Force members, as well as numerous comments provided by reviewers representing

each of the CW Teams, CW staff, and other scientists and professionals within CW member organizations.

Although the findings presented in the Preliminary Assessment and Recommendations document reflect the best current research and analysis available to the Task Force, the document is preliminary in nature, and reflects the uncertainties and complex challenges climate change presents to the scientists, natural resource managers, and others working to protect regional biodiversity. It is anticipated that updated versions will be developed as our understanding of climate change and its impacts on regional biodiversity improves over time.

Comments and inquiries are welcomed, and should be addressed to Robert Sullivan, Program Manager, Environmental Sciences Division, Argonne National Laboratory, at sullivan@anl.gov or to CW staff member Christopher Mulvaney, Science & Natural Resources Teams Coordinator, cmulvaney@chicagowilderness.org. The Task Force thanks the many reviewers whose thoughtful comments greatly improved the document, as well as Chicago Wilderness staff who provided critical support during its development. Special thanks are due also the City of Chicago Department of Environment, who generously donated staff time to assist with graphic design and development tasks.



Photo courtesy of John Hayes, Argonne National Laboratory

Chicago Wilderness Climate Change Task Force

CLIMATE CHANGE AND REGIONAL BIODIVERSITY: A Preliminary Assessment & Recommendations for Chicago Wilderness Member Organizations

SITUATION ANALYSIS

“CLIMATE CHANGE” REFERS TO a substantial change in the Earth’s climate for an extended period of time. “Global warming” refers to climate change that includes an increase in the average temperature near the Earth’s surface. Although the Earth’s climate changes naturally, global warming is now occurring rapidly, primarily because of the addition of excess carbon dioxide and other “greenhouse gases” to the atmosphere from human activities, such as fossil fuel burning and deforestation. These greenhouse gases trap heat in the atmosphere that would normally be radiated into space, and the atmosphere warms as a result. The Intergovernmental Panel on Climate Change, an international scientific body tasked to evaluate the risk of climate change caused by human activity, has concluded that evidence for the “warming of the climate system is unequivocal.”¹ The potential for rapid and lasting climate warming poses a significant challenge for biodiversity conservation.²

Species’ abundance and distribution are dynamic, relative to a variety of factors, including climate. As climate changes, the abundance and distribution of plants and animals also will change,^{3,4,5} and is already doing so.^{5,6,7,8} Regional biodiversity is already severely impacted by habitat loss and disturbance, invasive species, pollution and other stressors⁹; climate change will interact with and in some cases exacerbate

the negative effects of these existing stressors¹⁰ and it will also introduce new stressors that will further impact the native species in this region.

Although there is some uncertainty about the exact nature and severity of climate-change-related impacts anticipated for the Chicago Wilderness region, a number of scientific studies project the following impacts:

- Increased duration and intensity of heat waves in summer, with higher levels of humidity and evaporation;^{9,11}
- Milder winters with fewer extremely cold days;⁹
- A longer growing season, with fewer frost days;⁹
- Changing patterns of rain and snowfall; overall, somewhat more rain may fall, but in fewer rain events of greater intensity, and the ratio of snow to total precipitation is expected to decrease;^{9,12}
- Increased frequency of extreme weather events, leading both to more frequent and more severe dry spells as well as more flooding from heavy rains;^{1,9,12}
- Changes to water resources including reduced water levels in streams, wetlands, and lakes; more frequent flooding due to heavier rain events; and lower water quality;^{5,9,12} and
- Reduced ice cover on area lakes, including Lake Michigan, with generally warmer water temperatures.^{9,12}

As climate changes, the abundance and distribution of plants and animals also will change, and is already doing so.



American Goldfinch photo courtesy of the Chicago Zoological Society

These changes in climate are expected to impact regional biodiversity in a variety of direct and indirect ways:

- Changes in the timing of natural events such as blooming, leaf drop, nesting and egg laying, migration, onset of hibernation, etc.^{7,8}
- Loss of suitable habitat for some species and increases in habitat for other species;
- Gradual shifting of mobile species (generally northward) as temperatures increase,^{5,6,8}
- Disruption of ecological communities due to differential responses of species to climate change;¹⁰
- Disruption of predator-prey relationships and other inter-specific relationships;⁸ and
- Increased threats from invasive species, and insect and disease pathogens.^{5,8}

These impacts on native biodiversity will result in changing abundance and distribution of fish, wildlife, and plant species. At this time, it is impossible to state with precision which species will be affected by climate change, or exactly how, but increasing scientifically-based evidence suggests that many species in the Chicago Wilderness region will show effects. Species for which the Chicago Wilderness region is near the southern end of their range may be at particular risk.⁹ Species for which the Chicago Wilderness region is near the northern end of their range may increase in abundance, and species currently not found in the region may appear.

Research has suggested that impacts from climate change may contribute to a reduction in habitat for some native trees, including northern red oak, black cherry, and sugar maple. Species such as paper birch, black ash, quaking aspen, big-toothed aspen, and butternut may become more rare or disappear from the region altogether. Habitat for some species currently found in the region may expand, including bur oak and wild plum. Research has suggested that climate change may result in conditions favorable to the growth of more southerly species⁹ and therefore this region may have increased importance for these species.

Climate change will also impact the region's animals. For example, a number of bird species will experience significant changes in their



Northern red oak leaves photo courtesy of the Kentucky Division of Forestry

distribution. As many as 44 species of birds that currently breed in Illinois may no longer breed in the state by the end of the century, including such familiar and widespread species as tree swallow, black-capped chickadee, white-breasted nuthatch, house wren, gray catbird, red-eyed vireo, yellow warbler, ovenbird, scarlet tanager, chipping sparrow, Baltimore oriole and American goldfinch. Some bird species with more southerly and westerly distributions could move into Illinois.¹³ Some research has suggested that climate change may also negatively impact pollinator species; when plants and pollinators respond differently to climate change, pollinator reproductive success may be reduced.^{14,15} In general, insect growth will be favored by higher temperatures, which may result in greater damage from insect pests.⁹

Also, because some species are associated with rare natural communities that are fragmented in this region, their ability to move within or to new habitat in response to climate change will be limited. Climate warming will be a particular challenge for endangered, threatened and other at-risk species because the additional stresses associated with climate change and the interaction of climate change with other stressors (such as habitat fragmentation and invasive species) may push them beyond their ability to cope.¹⁰ Highly specialized or endemic species, such as Karner blue butterfly,^{16,17} are likely to be susceptible to the additional stresses of changing climate, as are species dependent on wetlands and streams, due to projected decreases in both water levels and water quality.⁹

Changing climate may favor the spread of invasive species which generally are more adaptable than native species,^{9,18-21} however, invasive species that prefer cooler and wetter conditions may not compete as well against some native species in the future,

Climate warming will be a particular challenge for endangered, threatened, and other at-risk species.



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RECOMMENDATIONS FOR FURTHER ACTION

IMMEDIATE ACTION IS NEEDED to address the effects of climate change on biodiversity in the Chicago Wilderness region. Current management strategies have generally assumed relatively stable climactic conditions; incorporating climate change into biodiversity preservation strategies presents unique challenges. Land use planning strategies that focus on land acquisition, preservation and sustainable growth, critical components of existing efforts to protect regional biodiversity, need to be modified to include policies and programs to mitigate the impacts of climate change. Conservation planning is needed to help assure that species can migrate freely to keep ecosystem disruption to a minimum, for example along river corridors. Planning efforts must also account for the increasing importance of some ecosystems, such as grasslands and oak woodlands, as more northern communities and species retreat.

Because fossil fuel consumption is a major contributor to global warming, it is important that individuals, businesses, and organizations of the Chicago Wilderness region take immediate steps to reduce energy consumption (see the Chicago Wilderness Website at www.chicagowilderness.org for energy saving tips). Because reduced water availability and degraded water quality will impact many species in our region, it is important to conserve and manage water resources more diligently.

We must become energy literate, learn about the impacts of energy usage on climate change and the environment, and speak out about climate change to our local, state, and Federal elected officials and other decision makers, as well as other members of our communities. We must encourage national and international efforts by governments, industry, environmental, and other organizations to reduce greenhouse gas emissions and to develop effective adaptive management strategies for combating negative effects of climate change on biodiversity.

Finally, we must continue sound conservation management in the CW region to ensure ecosystem resilience in the face of the challenges climate change will bring.

which could benefit regional ecosystems. Climate changes will likely amplify current management challenges involving habitat fragmentation, urbanization, disease, parasites, and water management.¹⁴

WHAT'S BEING DONE

GOVERNMENT, INDUSTRY, EDUCATIONAL INSTITUTIONS, environmental, religious and other organizations throughout the Chicago Wilderness region are taking action to protect regional biodiversity from the impacts of climate change, to increase efficiency of energy and water use, and to reduce greenhouse gas emissions.

The regional scientific community is currently developing more precise models to determine the anticipated effects of climate change in the Chicago Wilderness region, as well as strategies for minimizing negative impacts of climate change on regional biodiversity. In addition, they are starting programs to monitor both the negative and positive effects of climate change on regional biodiversity, as well as conducting scientific research on climate change impacts and adaptive management strategies. Research is being conducted to determine the carbon storage potential of regional native landscapes, which hold significant promise for climate change mitigation through carbon sequestration.^{22, 23}

Other efforts that are being undertaken by Chicago Wilderness and other regional organizations include energy and water conservation, the use of alternative fuels and renewable energy sources, carbon trading initiatives, and other strategies to reduce regional greenhouse gas production.

Immediate action is needed to address the effects of climate change on biodiversity in the Chicago Wilderness region.



Scarlet tanager photo courtesy of the National Park Service

REFERENCES

1. Intergovernmental Panel on Climate Change (2007) Fourth Assessment Report Climate Change 2007: Synthesis Report Available at: <http://www.ipcc.ch/ipccreports/ar4-syr.htm> Accessed 1/7/08
2. Lovejoy, T., and L. Hannah, editors. (2005) *Climate Change and Biodiversity*. Yale University Press, New Haven, Connecticut (Preface page x).
3. Hannah, L., T. Lovejoy, and P. Schneider. (2005) Biodiversity and climate change in context. In Lovejoy, T., and L. Hannah, editors. *Climate Change and Biodiversity*. Yale University Press, New Haven, Connecticut.
4. McKenney DW, Pedlar JH, Lawrence K, Campbell K, and MF Hutchinson (2007) Potential Impacts of Climate Change on the Distribution of North American Trees. *BioScience*: Vol. 57, No. 11 pp. 939–948 (December 2007)
5. Government Accounting Office (2007) *Climate Change: Agencies Should Develop Guidance for Addressing the Effects on Federal Land and Water Resources* (August 2007)
6. Hitch, A., and P. Leberg (2007) Breeding Distributions of North American Bird Species Moving North as a Result of Climate Change. *Conservation Biology* Vol. 21, No. 2, 534–539 (June 2007)
7. Bradley, N.L., Leopold, A.C., Ross, J., and H. Wellington (1999) Phenological changes reflect climate change in Wisconsin. *Proceedings of the National Academy of Sciences*, Vol. 96, pp. 9701–9704 (August 1999)
8. Parmesan, C. (2006) Ecological and evolutionary responses to recent climate change. *The Annual Review of Ecology, Evolution, and Systematics* 37:637–69. Available online at: http://cns.utexas.edu/communications/File/AnnRev_CCimpacts2006.pdf Accessed 1/20/07.
9. Easterling, D. and T. Karl (2000) Potential Consequences of Climate Variability and Change for the Midwestern United States. In *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*, by the National Assessment Synthesis Team, US Global Change Research Program, Chapter 6, pp.167–188.
10. Lovejoy, T. (2005) Conservation with a changing climate. In Lovejoy, T., and L. Hannah, editors. *Climate Change and Biodiversity*. Yale University Press, New Haven, Connecticut.
11. Ebi, K., and G. Meehl (2007) Heatwaves & Global climate change - The Heat is On: Climate Change & Heatwaves in the Midwest. Excerpted from the full report, *Regional Impacts of Climate Change: Four Case Studies in the United States*. Prepared for the Pew Center on Global Climate Change (November 2007)
12. Hall, N.D. and B. Stuntz (2007) *Climate Change and Great Lakes Water Resources*. Prepared for the National Wildlife Federation. (November 2007)
13. Price, J. F., (2007) *Global Warming & Songbirds: Illinois*. American Bird Conservancy and National Wildlife Federation. Available online at <http://www.abcbirds.org/newsandreports/globalwarming/Illinois.pdf> Accessed 5/7/08.
14. Committee on the Status of Pollinators in North America, National Research Council (2007) *Status of Pollinators in North America (Free Executive Summary)* Available online at <http://www.nap.edu/catalog/11761.html> Accessed 5/7/08.
15. Earthwatch Institute (2006). *Climate Change Threatens Pollination Timing*. ScienceDaily. Available online at <http://www.sciencedaily.com/releases/2006/08/060809234056.htm> Accessed 4/27/08.
16. Michigan Department of Natural Resources, (2005) *Michigan Wildlife Action Plan. Section 3. SGCN Status & Species Specific Issues, Subsection 3.3.4 Insects*. Available online at http://www.michigandnr.com/publications/pdfs/huntingwildlifehabitat/WCS/Outline/3_3_4_SGCN_insects.pdf Accessed 5/7/08.
17. Wiley, A. (2007) *Conservation of butterflies in an era of global climate change*. Master's Thesis submitted in partial requirement for a M.S. in Sustainable Development and Conservation Biology College of Chemical and Life Sciences, University of Maryland at College Park. Available online at http://www.wam.umd.edu/~aswiley/ScholarlyPaper/Scholarly%20Paper_Aleta%20Wiley_August%202007.pdf Accessed 5/7/08.
18. Thomas, C. (2003) Climate change and habitat fragmentation. In *Global Climate Change and Biodiversity*. University of East Anglia, Norwich, UK, pp 22–23, April.
19. Dukes, D. (2003) Hotter and weedier? Effects of climate change on the success of invasive species. In *Global Climate Change and Biodiversity*. University of East Anglia, Norwich, UK. April 2003.
20. Thuiller, W., Richardson, D., and G. Midgely. (2007) Will climate change promote alien plant invasions? In Nentwig, W. ed., *Biological Invasions, Ecological Studies*, Vol. 193, Springer-Verlag, Berlin Heidelberg, pp. 197–211.
21. Tilman, D., and C. Lehman. (2001) Human-caused environmental change: Impacts on plant diversity and evolution. *Proceedings of the National Academy of Sciences of the United States of America* 98(10):5433–5440. Available at: <http://www.pnas.org/cgi/reprint/98/10/5433.pdf> Accessed 1/20/07.
22. Lal, et al. (2004) Climate Change and Food Security. *Science* 304, 1623
23. Euliss et al. (2006) North American prairie wetlands are important nonforested land-based carbon storage sites. *Science of The Total Environment*, Volume 361, Issues 1-3, 15 May 2006, Pages 179-188.