Using Urban Forests to Help Communities Prepare for Climate Change in Northeast Ohio

The Great Lakes region and the many benefits it provides are being affected by climate change. Increasing temperatures and other alterations in weather patterns threaten human health, property and the economy, as well as fish, wildlife and their habitats. One way for communities to better protect themselves from the effects of climate change is through urban forestry programs. An environmentally sound urban forestry program can provide benefits for local communities and also minimize impacts, or even enhance the local environments that provide fish and wildlife habitat. This short overview introduces communities to urban forests as one way to help prepare for the impacts of climate change. It also identifies useful resources to assist with the implementation of urban forestry programs.

Climate Change in the Great Lakes Region

Climate in the Great Lakes region has already been changing, although how and how much are variable from one location to another.[1,2] Looking ahead, climate models project further changes due to carbon emissions. For the Great Lakes Region some of the climate change projections are:

- Air temperatures rising by 3.5 to 5.5ºF by mid-century;[3]
- Rising water temperatures;[4]
- Winter and spring precipitation increasing by 20 to 30 percent;[5]
- More heavy downpours and greater evaporation in summer; and
- More nutrient run-off associated with increasing spring storm events.

The Benefits of Urban Forests for Communities

Urban forests can help communities by reducing several potential impacts of climate change. At the same time, transforming yards and vacant properties into natural areas that are beneficial for wildlife can also make our neighborhoods more beautiful and increase property values.

Stormwater

Trees can help ameliorate the increased flooding we can expect due to climate change. Urban trees and green space allow more water to naturally penetrate the earth, which reduces flooding in backyards and city streets, and can reduce the strain on stormwater systems. It is estimated that a typical medium-sized tree can intercept as much as 2,380 gallons of rainfall per year and can reduce runoff and erosion from storms by about 7% with the added benefit of reducing the need for erosion control measures.[6] By reducing runoff, forested areas also help to reduce nutrient runoff and the effect of extreme droughts.

Heat

High summer temperatures threaten the health of people and wildlife alike, especially in urban areas where man-made surfaces contribute to the urban heat island effect (UHIE) and fragment wildlife habitat. The role of trees in reducing the UHIE becomes far more important as temperatures rise. Trees planted along public right-of-ways (e.g., sidewalks and medians) and throughout communities provide cooling shade, reducing the UHIE. Shaded areas also help reduce air conditioning needs and costs.

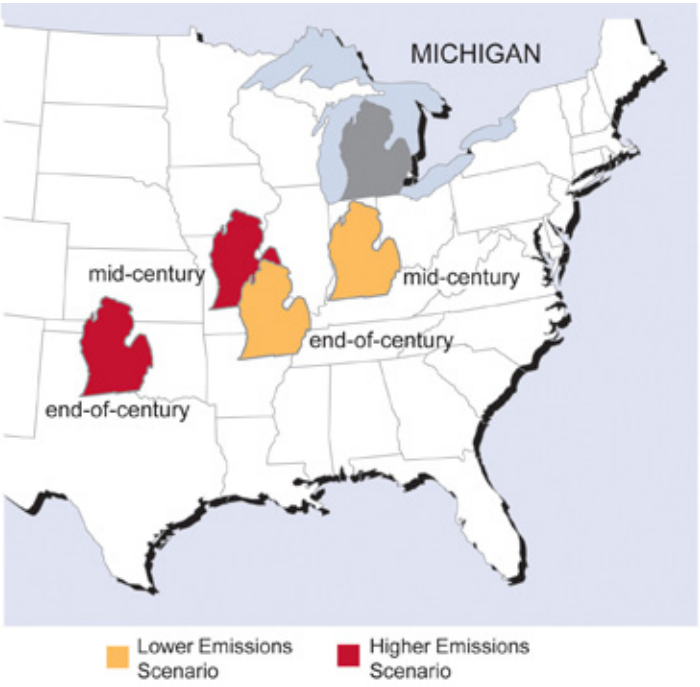

Figure 1. Climate is changing throughout the entire Great Lakes region. By the end of this century summers in Michigan are projected to be similar to current summer weather in the Kansas/Oklahoma area. Other Great Lake states are projected to experience similar changes.[7]

Air Quality

Warmer air, in combination with air pollution, contributes to an increase in unhealthy ozone levels. By keeping temperatures lower, trees help reduce the development of ground-level ozone harmful to human health. Trees also reduce air-borne pollutants such as nitrogen oxide,[8] sulfur dioxide[9] and carbon dioxide,[10] thereby helping to both reduce the magnitude of climate change and improve air quality.[11]

Ragweed, deservedly disliked by those who suffer from hay fever, grows more rapidly, produces more pollen, and may even be more allergenic with higher carbon dioxide levels and warmer temperatures. Urban forests can reduce ragweed abundance because ragweed prospers best in open habitats, not forested habitats.

Designing the Urban Forest for a Changing Climate

It is essential for successful urban forestation to take into account the shifting climate (*Figure 1*). Trees that are suitable in both the current and projected climate have the greatest likelihood of thriving. On the other hand, where the climate is suitable now for a species but not in the future, and vice-versa, a species is not likely to prosper.

Climate-Smart actions to protect and enhance the health of the urban forest include:[12]

- Understand which trees and plants in your region are appropriate for a changing climate;
- Develop a climate-smart tree species planting list; and
- Integrate climate change information into pest and invasive species management.

Models have been developed for 134 eastern U.S. tree species projecting how the most-suitable climate for each species is expected to move across the landscape.[13] Through the Climate-Smart Restoration Partnership Project for the Great Lakes and Chesapeake Bay (a partnership of NWF, National Oceanic and Atmospheric Administration (NOAA), and the Kresge Foundation), NWF has been working with partners in Lorain, OH, to restore the Black River watershed with future climate in mind.* This guidance, therefore, is based on our experiences working on that project and is focused on Northeastern Ohio.

When considering both existing and future climate suitable for these species we determined that the northeastern Ohio area would likely be suitable for 46 species.[14] Among these are red maple, black oak, white oak, mockernut hickory, hackberry, northern red oak, flowering dogwood and slippery elm.

Although not good candidates for planting because the current climate is considered unsuitable, the climate is projected to be increasingly favorable for winged elm, black hickory and blackjack oak and shortleaf pine. Alternatively, white pine and sugar maple are native to the northeastern Ohio area, but based on projected climate the area will become less suitable.

For areas throughout the eastern United States, the U.S. Forest Service Climate Change Tree Atlas can be used to assess the likely climatic suitability for tree species now and in the future.[15]

* For more information on this project: *www.nwf.org/What-We-Do/Energy-and-Climate/Climate-Smart-Conservation/Adaptation-on-the-Ground/great-lakes-projects.aspx*

After assessing climate suitability, other factors for selecting tree species for urban forests should also take into account:

- vulnerability of species to pests and invasive species;
- local soil conditions;
- using only native species (provide greatest benefit to wildlife);
- avoiding native species that could become invasive; and
- using seed sources and saplings from nearby areas.

Finally, by selecting a broad diversity of both current and future climatically-suitable trees for urban forests, the inherent uncertainty in climate models and other factors can be reduced.

Photo: National Wildlife Federation

Table 1. Projected climatic suitability for trees in northeastern Ohio.[16]

Common name	Scientific name	Suitability in historic climate	Suitability in future climate
Black walnut	**Juglans nigra**	**Okay**	**Okay**
Black willow	**Salix nigra**	**Okay**	**Okay**
Chokecherry	**Prunus virginiana**	**Okay**	**Okay**
Eastern cottonwood	**Populus deltoides**	**Okay**	**Okay**
Eastern redbud	**Cercis canadensis**	**Okay**	**Okay**
Eastern white pine	*Pinus strobus*	Okay	**LOW**
Flowering dogwood*	**Cornus florida**	**Okay**	**Okay**
Northern red oak*	**Quercus rubra**	**Okay**	**Okay**
Pin oak	**Quercus palustris**	**Okay**	**Okay**
Red maple*	**Acer rubrum**	**Okay**	**Okay**
River birch	**Betula nigra**	**Okay**	**Okay**
Serviceberry	**Amelanchier spp.**	**Okay**	**Okay**
Shagbark hickory	**Carya ovata**	**Okay**	**Okay**
Shortleaf pine	*Pinus echinata*	**LOW**	Okay
Silver maple	**Acer saccharinum**	**Okay**	**Okay**
Slippery elm*	**Ulmus rubra**	**Okay**	**Okay**
Swamp white oak	**Quercus bicolor**	**Okay**	**Okay**
Sycamore	**Platanus occidentalis**	**Okay**	**Okay**
Wild plum	**Prunus americana**	**Okay**	**Okay**
Yellow-poplar	**Liriodendron tulipifera**	**Okay**	**Okay**

* Species likely to fare best in both existing and future projected climate

Useful Resources for Urban Forestry in a Changing Climate

Eastern US Climate Change Tree Atlas.
www.nrs.fs.fed.us/atlas/tree/tree_atlas.html

i-Tree: Tools for Assessing and Managing Community Forests.
www.itreetools.org/

The Value of Green Infrastructure for Urban Climate Adaptation.
ccap.org/assets/THE-VALUE-OF-GREEN-INFRASTRUCTURE-FOR-URBAN-CLIMATE-ADAPTATION_CCAP-February-2011.pdf

Climate Considerations for Management of Natural Areas and Green Spaces in the City of Chicago (although focused on Chicago, the recommendations are applicable to other regions).
adapt.nd.edu/resources/1107/download/Climate_Considerations_Chicago_FINAL.pdf

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