Creating a climate-smart Great Lakes region: Guiding the application of climate science to ecological restoration practices

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What does "climate-smart" mean?

-Efforts to prepare for or cope with impacts of climate change.
-Integrating climate science into conservation actions.
-Designing and implementing projects that will maximize the effectiveness of restoration investments under current and expected future climate conditions.

Are we trying to build resistance, resilience or facilitate change?

Resistance — Ability to withstand a disturbance without significant loss of function.

Resilience — Ability of an ecosystem to return to its functional state after being disturbed.

Facilitate Change —To intervene in the ability of species and ecosystems to respond adapt.

GUIDANCE SPECTRUM FOR CONSERVATION DECISION-MAKING IN A CHANGING CLIMATE

SLOW — Speed of Change — RAPID

RESISTANCE — FACILITATION OR ACCEPTANCE

RESILIENCE

Climate-Smart Restoration Process

STEP 1: Identify Restoration Goals and Targets
-Species
-Habitat
-Ecosystem

STEP 2: Identify Restoration Project Approaches
-Protect key ecosystem features
-Maintain/Improve diversity
-Restore natural functions

STEP 3: Assess Vulnerability to Climate Change
-Assess the components of vulnerability (sensitivity, exposure, adaptive capacity)
-Summarize vulnerability

STEP 4: Identify Climate-Smart Options
-Reduce sensitivity
-Reduce exposure
-Enhance adaptive capacity

STEP 5: Select and Implement Options
-Prioritize by urgency/importance
-Prioritize by benefits/metrics of success
-Prioritize by costs/feasibility

STEP 6: Monitor, Review, Revise
-Incorporate new science
-Evaluate effectiveness of options
-Revisit one or more of the previous steps

Restoring the Great Lakes Coastal Future provides technical guidance for the design and implementation of climate-smart restoration projects. It outlines this six-step process to run restoration goals through a climate change lens.

FOR A COPY OF RESTORING THE GREAT LAKES COASTAL FUTURE:
http://www.nwf.org/News-and-Magazines/Media-Center/Reports/Archive/2011/Restoring-the-Great-Lakes-Coastal-Future.aspx

Scientists and resource managers are examining how to balance near-term restoration goals for species or habitats with achieving ecologically functional, self-sustaining systems that can persist under likely future conditions resulting from climate change. Managers can no longer assume that historical averages or trends will remain unchanged when setting their restoration goals, and must instead anticipate an increasingly different and uncertain climate. Given this new reality, state and federal agencies, non-governmental organizations, and others concerned with conservation are challenged with designing and implementing projects that will maximize the effectiveness of restoration investments under both current and expected future climate conditions. These projects are referred to as "climate-smart." In the Great Lakes region the Great Lakes Restoration Initiative (GLRI) is the largest program to support on-the-ground ecological restoration and toxic clean-up. In 2010 $475 million was allocated through the GLRI to the Environmental Protection Agency (EPA) for on-the ground ecological restoration projects. Many of the most prevalent habitat restoration efforts funded under GLRI programs in the Great Lakes region could be vulnerable to a wide variety of climate change impacts. For example: - Changes in water temperatures and flow regimes may result in reduced target species utilization or degradation of restored in-stream habitats. - Increased air temperature and decreased soil moisture content could result in reduced growth or even overgrowth of restored riparian vegetation. - Warming may facilitate the establishment of southern fish species into the Great Lakes or the contraction northward of cold-water dependent species. - Climate change impacts such as changing temperatures, reduced ice cover, runoff patterns, and lake chemistry will interact with a range of issues related to contaminants, including changing the pattern of input of toxic materials into freshwater systems. - Toxicants can also increase species' sensitivity to various climate change impacts, for instance by decreasing thermal tolerance. Guiding restoration projects to be "climate-smart," includes: providing an initial suite of information to assist in the planning and implementation, addressing vulnerability of project goals to climate change and to modify actions as necessary over time. This guidance follows a 'bottom-up approach,' utilized to adjust restoration activities to address the realities of climate change. The approach starts with specific restoration goals (e.g., restoring critical habitat for a particular endangered species or setting maximum allowable pollutant levels); identifying how climatic variables influence those conservation goals (e.g., the influence of temperature on species' health and reproduction or the toxicity of pollutants); determining plausible physical and ecological changes under a range of climate scenarios; and finally, identifying and evaluating options for reducing the vulnerability of one's restoration goals to those projected changes.

How does the Great Lakes ecosystem differ from other ecosystems affected by climate change?

. It is a water-abundant micro-climate containing 20% of the world's freshwater.
. There is a potential for water level decline as wintertime evaporation increases.
. Lake Superior is the fastest warming freshwater body in the world.
. Lake Erie is particularly susceptible to algal blooms with increased precipitation.
. Water levels are managed at Lakes Superior and Ontario primarily for shipping.
. Invasive species have significantly changed the ecosystem.
. Downscaled climate projections for the region are limited.

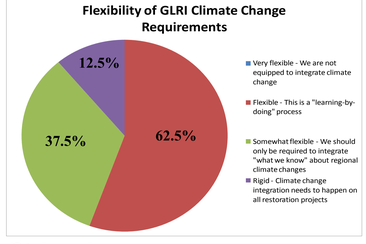
The Great Lakes Restoration Initiative (GLRI)

The GLRI is the largest investment in the Great Lakes for decades. There are five main focus areas to the GLRI:

1.Cleaning up toxics and areas of concern;
2.Combating invasive species;
3.Promoting nearshore health by protecting watersheds from polluted run-off;
4.Restoring wetlands and other habitats; and
5.Working with partners on outreach.

GLRI support requests outline climate change as a factor but it is not currently required. Some agencies are giving additional support for projects that work to integrate climate change impacts.

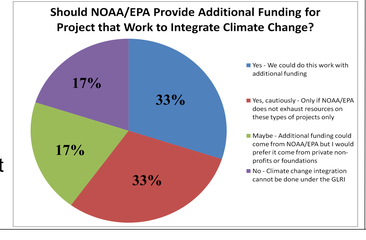
What could NOAA and EPA require of applicants to the Great Lakes Restoration Initiative (GLRI)?: A Survey of Great Lakes Stakeholders[1]



. Require relevant projects to demonstrate climate readiness--i.e., ask if restoration project will be impacted by climate change and, if so, applicant should demonstrate how they have accounted for those impacts in project design.
. Prioritize projects that have urban climate adaptation benefits in addition to ecosystem restoration benefits.

Stakeholder responses:

. Require collaboration with state climatologists.
. Incentivize wetland restoration for run-off control and carbon sequestration.
. Innovate ways to deal with changes to stratification.
. Streamline knowledge sharing throughout entire life-cycle of grant.



1. Stakeholders in this case include 110-organizations who are members of the Healing our Waters Coalition.

Healing Our Waters — Great Lakes Coalition Priority Areas

Priority Area Prioritization Process Methodology

. Identify though an expert panel workshop criteria to use in identifying and prioritizing geographic areas.
. Use this criteria to identify and prioritize (ideally through consensus) geographic areas for restoration and protection focus.
. Survey other scientists to obtain additional input on the prioritization process.

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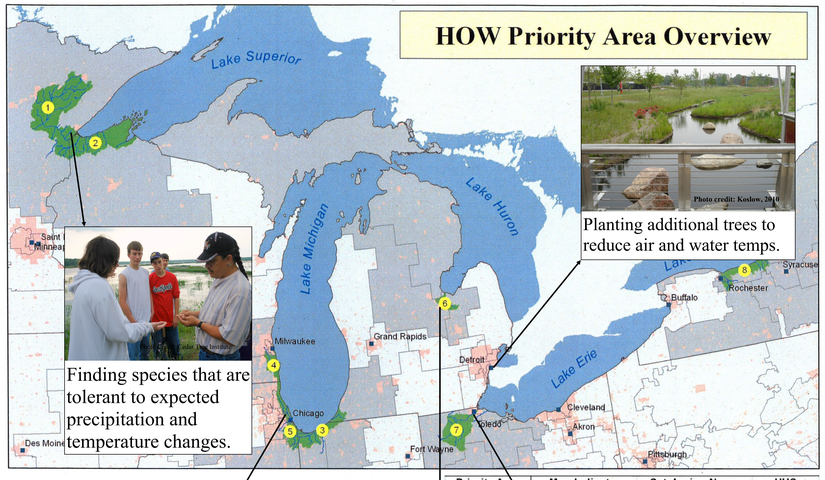
Criteria identified through consensus:
• Severity of problem(s) (i.e., of specific stresses or impairments)
• Likelihood of timely improvement (following restoration or prevention measures)
• Risk of new degradation (if nothing new is done)

Applying Climate-Smart Process to Healing Our Waters — Great Lakes Coalition Priority Restoration Areas



Planting additional trees to reduce air and water temps.

Finding species that are tolerant to expected precipitation and temperature changes.

Priority Area	Map Indicator	Cataloging Name	HUC
Area A	1	St. Louis	04010201
Area A	2	Beartrap-Nemadji	04010301
Area B	3	Little Calumet-Galien	04040001
Area B	4	Pike-Root	04040002
Area B	5	Chicago	07120003
Area C	6	Saginaw	04080206
Area D	7	Lower Maumee	04100009
Area E	8	Irondequoit-Ninemile	04140101

Map produced by Ducks Unlimited Great Lakes/Atlantic Regional Office
www.ducks.org

HEALTHY LAKES HEALTHY LIVES
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Extending the boundary of park area northward to facilitate species movement.

Tier "buffers" restored to deal with changing water levels.

Monitoring air and water temperatures, flow, invasive species, vegetation and wildlife migration patterns.

References
Environmental Protection Agency. Great Lakes Restoration Initiative. Accessed Fall 2011. http://www.epa.gov/greatlakes/glri/
Glick, Patty; Koslow, M.; Hoffman, J.; Inkley, D. 2011. Restoring the Great Lakes Coastal Future: Technical Guidance for the Design and Implementation of Climate-Smart Restoration Projects. National Wildlife Federation: Updated September 2011. 66 pgs.
Glick, Patty; Staudt, A.; Stein, B. 2009. A New Era for Conservation: Review of Climate Change Adaptation Literature. National Wildlife Federation: March 2009. 69 pgs.