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Green Infrastructure

A Strategy for Restoring the Great Lakes and Great Communities

Adapting to extreme weather

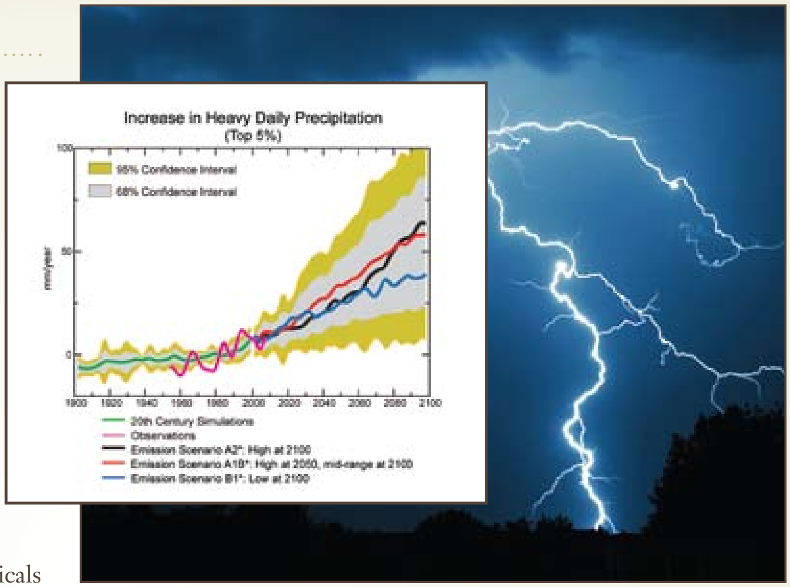
A changing climate is already shifting precipitation patterns in the Great Lakes region. Over the last decade, we've been experiencing more severe thunderstorms and wider swings in wet and dry periods. In just the last five years, we've lived through near-record snowfalls in some winters, contrasted with only a trace of snow in other years. Summers have seen localized drought and record-low lake levels, but also intense periods of drenching rains. Our weather is becoming more variable, and storms more intense.[1] This has consequences for the Great Lakes and the communities that surround them.

Intense storms can produce floods and also increase water pollution from land runoff and sewer overflows. Storms wash loads of topsoil, fertilizers, pesticides and manure from farmlands into streams that flow into the Great Lakes. In urban and suburban areas, heavy rains can fill storm sewers with a mix of oils, greases, road salt and litter from city streets, along with soil and debris from construction sites and lawn chemicals and pet waste from residential neighborhoods. Most storm sewers simply dump directly into lakes and streams, pumping an infusion of pollutants and contaminants into waterways with each storm.

In many communities, sanitary sewers and storm sewers feed into the same sewage treatment plants. In these combined systems, a big rain can simply overload the system, and the mixed overflow of raw sewage and street runoff is flushed directly into rivers or the lakes. In recent years, billions of gallons of untreated sewer and stormwater waste have been released directly into the Great Lakes or their tributaries from the combined sewer systems in cities like Detroit, Milwaukee, Toledo, Grand Rapids and dozens of other communities.

Sediments and pollution flow into Lake Michigan after a storm. Photo: Milwaukee Riverkeeper

Many cities with combined sewer and stormwater systems have undertaken major engineering projects to temporarily store an excess volume of stormwater so it can be slowly released for treatment without overwhelming treatment plants. Chicago's "Deep Tunnel" is perhaps the best known, but many other cities have built (or are in the process of building) such systems.



A changing climate means more intense storms. Graph: National Oceanic and Atmospheric Administration, National Climatic Data Center, see back page Resources, endnote 1.

These massive storage systems and other "gray infrastructure" approaches to managing stormwater are expensive. These costs typically translate into higher water rates in urban centers, where low-income neighborhoods and communities of color are disproportionately impacted.

Sometimes even the best plans and engineering fixes haven't kept up with severe storm events. As suburban development has expanded, so has the volume of stormwater that treatment plants must capture and treat from their growing service areas. Moreover, the new development has hardened the landscape with concrete and other impervious surfaces, which force rainwater or melting snow into storm sewers, rather than filtering it through the soil and groundwater system. Runoff and overflows are major factors in beach closings from high bacteria and pathogen levels. In addition, nutrient pollution is almost certainly a factor in the rise of blue-green algae in the Great Lakes region, including a form toxic to wildlife, pets, and people.

As Minnesota Congressman James Oberstar noted at a 2009 Congressional hearing, factors like these " ... will place increasing costs for stormwater control on municipal governments ... These communities will be under increasing stress—financial and environmental—in dealing with stormwater in the years to come."[2]

Green Infrastructure

A fresh approach to managing stormwater emphasizes keeping the rainwater and snowmelt on the land to the extent possible and letting it slowly percolate back into the ground. Wetlands, natural plantings along streams and rivers, rain gardens, "green roofs" and permeable pavements can capture and filter rainwater. They are leading examples of what has become known as "green infrastructure."

Green Infrastructure at a Glance

Big-picture strategies include good planning and watershed management, such as conserving and restoring wetlands and floodplains, managing rivers as whole systems (not just isolated parts), and encouraging farming practices that prevent or reduce soil erosion and limit chemical inputs.

- **Wetlands** include swamps, marshes, bogs, swales, fens, wet meadows, and vernal ponds. All play an important role in capturing and filtering surface waters, replenishing groundwater, and providing essential natural habitat for plants and wildlife. Wetlands also act as natural sponges during intense storms, providing one of best defenses against flooding.
- **Floodplains** are, by definition, the plains alongside rivers that often flood after a rapid spring snow melt or intense or prolonged rains. A natural part of river systems, floodplains can help reduce the volume and speed of floodwaters coursing down a river, and thus reduce environmental and property damage downstream. Communities and homeowners have built on many floodplains during dry years, but when floods return, losses can be disastrous, costly and tragic. Communities that keep their floodplains undeveloped (or lightly used, such as for recreational open space) are investing in cleaner water and safer communities downstream.

Site-management strategies include capturing and filtering stormwater from houses, buildings, parking lots and fields before it enters storm sewers or streams.

- **Rain barrels** capture rainwater from rooftops, rain gutters and downspouts, keeping it out of storm drains and providing a source for watering yards and gardens.
- **Downspouts** can be disconnected from drains and redirected to lawns or rain gardens, preventing rainwater from pouring directly into storm drains.
- **Rain gardens** are designed around a low area or depression to collect rainwater and allow it to seep slowly back into the ground. They are planted with hardy native plants that can tolerate wet and dry periods and have root systems that stabilize soils and absorb and filter water.
- **Infiltration** basins are larger impoundments (generally serving multiple households or small areas) that work on similar principles as rain gardens. Stormwater is diverted into a depression that has deep-rooted plants, and water slowly recedes into the ground over several days following a storm.

Green Infrastructure at a Glance

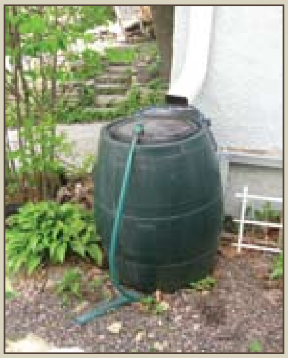
Downspouts that flow into yards can reduce stormwater overloads

Workers install a green roof at the Ford Rouge Plant.

Photo: Ford Motor Company.

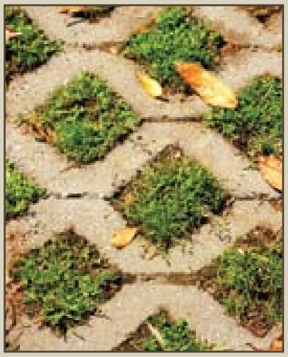
Rain gardens capture and hold rain and add beauty.

Photo: Italia Millan



Rain barrels can store rainwater and keep it out of drains.

Photo: Jane Elder



Permeable pavements allow rain to seep into the ground

Planting trees helps retain stormwater.

Photo: The Greening of Detroit.

- **Streamside buffers** include plants, shrubs and trees that grow alongside streams and rivers to provide a living barrier that slows the downhill rush of rainwater, topsoil and debris from storms. Plants stabilize stream banks and can significantly reduce soil erosion and sediment loads.
- **Filter strips** are typically a strip of grassy plantings alongside pavement or buildings that capture and filter runoff.
- **Green roofs** are designed to support rooftop grasses and plants that can capture and use rainwater. In urban areas they can also reduce the heat absorbed by tar or asphalt roofs.
- **Permeable and porous pavements** allow rain to seep into the soil instead of sheeting off into nearby landscapes or storm drains.
- **Bio-swales** are wide, shallow drainage ditches with gently sloping sides. They slow the flow of water and trap silt and pollutants in plants, rocks or riprap, providing an initial filter for runoff from developed areas before it flows into streams or storm sewers.

Benefits to Communities

Green infrastructure benefits communities in many ways.

Saving Money

Green infrastructure can accomplish many of the same goals as hard-engineered gray infrastructure at a fraction of the cost. In southeast Michigan, low-cost efforts in designated "grow zones" for natural plantings along the Rouge River are paying off as part of a watershed-wide effort to bring this heavily damaged river back to life. The Nankin Mills grow zone in Hines Park along the Middle Rouge is credited with reducing stormwater volume from a 24-hour rainfall by 6,500 cubit feet. A county report notes this would otherwise require "a $15,000 retention pond to achieve the same benefit."[3] Moreover, "Based on 2002 data, the Green Infrastructure in Hines Park ... was providing over 9.9 million cubic feet of storage for the 2-year, 24-hour rainfall (2.25 inches). The equivalent cost for more typical stormwater retention would be approximately $19.8 million."[4] The report adds, "In today's tough economy [rain gardens and grow zones] are a low-cost method of achieving some real stormwater management."[5]

Grow Zones protect water quality. Photo: Rouge River National Wet Weather Demonstration Project/ Alliance of Rouge Communities

In Grayslake, Illinois, innovative community design in the Prairie Crossing subdivision included rain gardens, swales, and alternatives to hard pavements. This translated into a savings of at least 15% in stormwater management costs compared to conventional subdivision design.[6] Similar conservation design in the Laurel Springs subdivision in Jackson, Wisconsin, saved developers more than $500,000, 60% of which came from reduced costs for stormwater management. [7]

Cleaner water means safer fish. Photo: Wisconsin DNR

Protecting Water Quality, Public Health and Safety

Cleaner water and healthier ecosystems are direct benefits from reducing and filtering runoff. Green infrastructure can also help protect drinking water supplies, prevent beach closings, and restore waters so that fish are again safe enough for human consumption. It can play a major role in replenishing groundwater that many communities depend on for drinking water and irrigation. It can also reduce the risks of flash flooding while protecting safety and property.

A major restoration project for the Maumee River is using a variety of approaches to help improve the watershed and protect Lake Erie. From working with farmers to plant streamside trees, to encouraging homeowners to create a "green ribbon" along the lower Maumee through reducing pavement and adding natural plantings, a partnership of community and national organizations is reducing runoff and stormwater flows. One of the project leaders, Gary Belan, of American Rivers explains, "Green infrastructure offers effective and low-cost solutions to the increased flooding and water pollution caused by urban and suburban areas as a result of climate change. Because of its adaptability, green infrastructure solutions can also become community projects that bring neighbors together to protect their local environment."

Improving Quality of Life

Walkers, joggers, bicyclists, and in-line skaters use the Hank Aaron Trail. Photo: Wisconsin DNR

Communities that have invested in green infrastructure are also reaping the benefits of welcoming green spaces for recreation and natural beauty—especially in urban areas. Milwaukee Mayor Tom Barret describes the city's efforts on the Menomonee River project this way: "We decided to keep the water out of the sewer system by using green infrastructure on the surface of the land, to capture and clean every drop of rain that falls on the business park before being slowly released to the river. We created a beautiful stormwater park, where people use the Hank Aaron Trail to bike and walk to Miller Stadium where the Milwaukee Brewers play baseball. There's easy public access to the Menomonee River where visitors can hike or fish for salmon and trout. Using green infrastructure made it possible to connect people and jobs and recreation at a formerly blighted area in the heart of Milwaukee."[8] Similar efforts are bringing back beauty and public enjoyment to places like Grand Rapids, Michigan, the Detroit River corridor and other Great Lakes communities that are investing in green infrastructure. [9]

Good for the Lakes, Good for our Communities and a Wise Investment

In the Great Lakes region we need to embrace green infrastructure as a core strategy to manage stormwater and protect water quality, while integrating it with conventional systems. It will help us adapt to a changing climate, reduce costs for water treatment, safeguard health and public safety, and make our communities—especially our cities—more vibrant places to live. All in all, green infrastructure is a sound strategy for healthy lakes and great communities.

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Resources:

U.S. Environmental Protection Agency. "Managing Wet Weather with Green Infrastructure." http://cfpub.epa.gov/npdes/home.cfm?program_id=298

U.S. Environmental Protection Agency. *Municipal Handbook* (Funding Options, Retrofit Policies, Green Streets, Rainwater Harvesting Policies). http://cfpub.epa.gov/npdes/greeninfrastructure/munichandbook.cfm

Southeast Michigan Council of Governments. 2008. *Low Impact Development Manual for Michigan: A Design Guide for Implementers and Reviewers.* http://library.semcog.org/InmagicGenie/DocumentFolder/LIDManualWeb.pdf

[1] U.S. Climate Science Program, *Weather and Climate Extremes in a Changing Climate*, Synthesis and Assessment Product 3.3, June 2008, Figure ES.4. Shows increase in the amount of daily precipitation over North America that falls in heavy events (the top 5% of all precipitation events in a year) compared to the 1961–1990 average. Various emission scenarios are used for future projections. Data for this index at the continental scale are available only since 1950. http://downloads.climatescience.gov/sap/sap3-3/sap3-3-final-all.pdf

[2] Environmental News Service, "Congress Looks to Green Technologies for Stormwater Control," March 23, 2009. http://www.ens-newswire.com/ens/mar2009/2009-03-23-093.asp

[3] Rouge River National Wet Weather Demonstration Project, *2008 Rouge River Progress Report*, Wayne County Michigan, p.33–34. http://www.rougeriver.com/pdfs/overview/2008%20Progress%20Report.pdf

[4] Ibid.

[5] Ibid.

[6] U.S. Environmental Protection Agency, *Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices*, EPA 841-F-07-006, December 2007. http://www.epa.gov/owow/nps/lid/costs07/documents/reducingstormwatercosts.pdf

[7] Ibid.

[8] Ibid.

[9] Ibid.