

From Shore to Shore

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The Hard Problem with Water in Minnesota - Driveways, Parking Lots, Sidewalks, Roads, and Rooftops

John Bilotta, University of Minnesota Extension and Sea Grant, bilot002@umn.edu, (651) 480-7708

In cities and towns, on individual and commercial properties, and along vast stretches of roads in Minnesota, impervious surfaces cover our communities. Impervious surfaces include rooftops, roads, driveways, parking lots, sidewalks, and other surfaces that repel rather than absorb water. They are constructed of concrete and asphalt, and in some cases, even soil. When soil becomes compacted, turf and green space can act like impervious surfaces. Impervious surfaces all have one similar characteristic; they do not allow water to infiltrate into the ground. This has significant impacts on both the quality and quantity of water in our communities.

Impervious surfaces can prevent or minimize the recharge of groundwater by reducing the amount of water that is allowed to infiltrate (soak into) the ground. Since more than 70 percent of Minnesotans rely on ground water for drinking, preventing stormwater from percolating into the ground could lead to water shortages. Impervious surfaces also create speedy pathways for stormwater runoff that may result in excessive volume (flooding) and flow rate problems. Water quality declines when impervious surfaces provide a collection system for various pollutants. Sediment (dirt), nutrients (e.g., phosphorus, nitrogen), oil, salt, and pathogens collect on these surfaces. Rain and snowmelt wash them off and concentrate the pollutants in stormwater runoff. In many cases, polluted runoff is untreated (or insufficiently treated) and compromises Minnesota's lakes, streams,



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and wetlands. Pollutants running off the landscape have partially led to declining water quality as measured by an excess of algae and aquatic vegetation, a reduction in fish and wildlife habitat, and restrictions for human uses (recreational and water supply).

Impervious surfaces are a thread in the human infrastructure; as Minnesota's population grows so do they. By the year 2020, growth in cities, towns, and counties will result in an estimated 2428 square miles of additional impervious surface (for reference, Lake Mille Lacs is about 200 square miles). Most of this growth will occur in regions that drain into the Mississippi River: the north central hardwood forest and the north-central lakes and forest ecoregions. The Mississippi, along with the Red River, the Minnesota

River, and Lake Superior, has issues with water quality and increasingly with water quantity.

Reduce the impact.

- Limit the expansion of impervious surface on your property. Size driveways, patios, parking lots, and roads for the amount of use.
- Reduce stormwater runoff by capturing raindrops and melting snow with things like rain gardens, rain barrels, and cisterns.
- Keep pollutants off of the pavement. Properly apply fertilizers, chemicals, and ice control. Sweep up and pick up leaves, grass clippings, and pet waste.

These solutions can be implemented by individuals and communities through municipal operations and informed, responsible homeowner property management. ■

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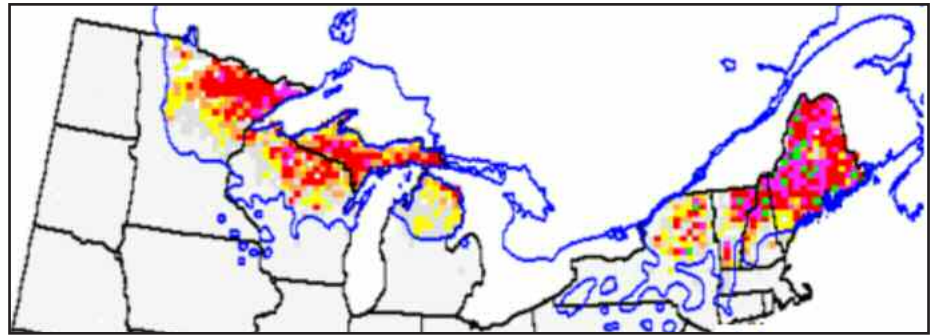
Impacts of Climate Change and Invasive Species on Minnesota Ecosystems

Lee E. Frelich, University of Minnesota, Center for Forest Ecology, freli001@umn.edu, (612) 624-3671

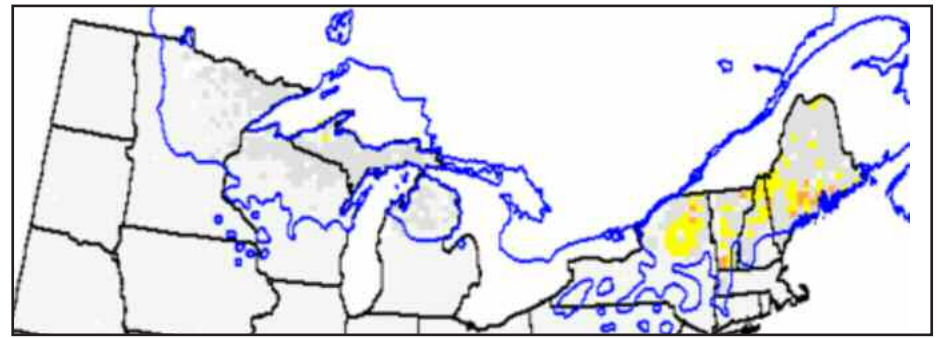
Trees migrate when the climate changes. The boreal trees in northern Minnesota, such as black spruce, have migrated from more southerly latitudes like Tennessee and Missouri to Hudson Bay and back several times over the last million years in response to natural climate changes driven by variations in the Earth's orbit. Each time there has been an interglacial, like we are in now, the ice has left Minnesota long enough for boreal species to move into the northern part of the state, while prairies dominate the southwestern region, and deciduous forests of oak, maple and basswood span the remainder.

The episode of global warming that has begun will disrupt this natural cycle. Starting with one of the warmest times of the Quaternary Period (last 2.6 million years), the current warming trend could push to climates not seen since the Pliocene and Miocene Epochs extending back 23 million years. The magnitude of climate change we expect by the end of the 21st Century for a "business as usual" CO₂ emission scenario, would, based on observations of past responses to climate change from the fossil record, lead to approximately 300 miles of northward displacement of tree ranges in Minnesota. The boreal forest biome would leave the state, along with many cold-dependent species of plants and wildlife species such as moose, lynx, and black-backed woodpecker.

However, environmental change that might be bad for one group of species is sometimes good for another; temperate tree species and prairie plants and animals will expand their ranges and replace the boreal forest. With projected summer climate similar to Iowa and Nebraska, the natural areas of northern Minnesota would convert to a mosaic of oak savanna on sandy or shallow soils, and temperate forests of oak, maple and basswood on deeper soils. Warmer temperatures are just one



Balsam fir - current inventory abundance.



*Predicted abundance 2100 - high CO₂ scenario.
Source: USDA Climate and Tree Atlas*

aspect of climate change. The direct impact of temperature on vegetation may turn out to be minor compared to changes in frequency of droughts, storms, fires and insect and disease outbreaks brought about by a changed climate.

Other environmental changes like overabundant deer populations, natural habitat conversion to other land uses, and invasive species could add more stressors to ecosystems already compromised by climate. Deer eat the seedlings of oaks, white pine, white cedar and yellow birch, which could possibly prevent the more temperate species from replacing the departing boreal species. Invasive earthworms consume the duff (or leaf litter) layer on forest floors. The duff layer is an insulator keeping the soil cool during the summer. Exotic tree pests such as the emerald ash borer will reduce the number of tree species available for

future forests. It's the cumulative impact of multiple stressors (heat, droughts, storms, fires, insects, deer, and invasive species) that alter a landscape. These additional stressors will increase the mortality rate of mature trees and prevent seedlings from replacing their parents. The stressors can exacerbate the impact of warmer. Changes in the terrestrial ecosystem will affect land-water relationships in the lake districts of Minnesota. Earthworms cause nitrogen and phosphorus to leach from the soil. As the relatively acidic community of conifers exits and deciduous trees take over, the pH values will rise. More nutrient-rich leaf litter will also increase nutrient content of lakes. Alternating droughts and periods of heavy rainfall will change the hydrological regime. The net affect will be warmer water, with more nutrients and greater variation in water levels. ■

Ten Things to Know about Planting Wet Areas

By Dan Shaw, MN Board of Water and Soil Resources, dan.shaw@state.mn.us, (651) 296-0644 and Greg Berg, Stearns County SWCD, greg.berg@mn.nacdn.net, (320) 251-7800

Shoreline and wetland plantings provide many ecological functions and add significant beauty to our landscapes. Unfortunately, waves, current, water fluctuations, pollutants, weed pressure, and grazers can make these areas a challenge to restore. A webinar developed through the LCCMR-funded "Restoring Minnesota" project (an initiative focused on education and outreach) was conducted recently to cover key topics related to planting wet areas. The webinar can be found at: <http://cce.umn.edu/restoring-minnesota>.

The following ten points were made in the webinar:

1) Wet places typically experience frequent water level fluctuations.

Certain projects are prone to water level fluctuations, including detention basins, urban wetlands, and waterbodies in agricultural areas. With repeated fluctuations, plants have a hard time adapting and often use up energy reserves. When planning a project, anticipate the extent of fluctuations and consider selecting species that are better adapted to fluctuating conditions.

2) Plants in wet places often experience strong forces such as waves, currents and ice.

Many wetland species have shallow but extensive roots that anchor them through a web of rhizomes. To help establish plants, consider using coir logs, brush bundles, cedar revetments, and floating silt curtains to protect plantings.

3) Plants in wet places can be subjected to strong biotic forces such as grazers and invasive species.

Both grazers and invasive species can have a big influence on projects. Invasive species benefit from sedimentation, increased nitrogen, and the displacement of native vegetation. Special protection may be needed to minimize



grazing by muskrat, carp, deer and geese. Wire fencing, or flagging tape between stakes is commonly used to keep geese from eating young plants.

4) Wet places are prone to erosion - temporary protection is critical.

The movement of soil can be a problem for newly seeded projects. Erosion fabrics, temporary cover crops (oats or winter wheat) and bio-control logs can help stabilize sites while seed establishes.

5) Not all wetland plants provide the same functions and values (flood retention, wildlife, water quality, stabilization, etc.).

Certain plant species are well suited to provide specific functions. Using prairie cord grass, sweet grass and riverbank sedge can slow water flow in swales and aid filtration; using willows and dogwood along stream banks can stabilize slopes; and planting wild celery, arrowhead, bulrush, or pickerelweed can promote fish and waterfowl populations.

6) The seed biology of wetland plants isn't the same as many prairie plants.

Wetland species often need to be stored moist, compared to the dry storage of prairie species. A high percentage of wetland species also need one, two, or three winters to break down their seed coats to allow for germination.

7) Wet places tend to be biotically diverse ecosystems.

Areas that transition from dry to wet plant communities often have high diversity levels. There are around 1,100 wetland species in Minnesota. Only about 25 percent of wetland species are available commercially so restoring some plant communities is complicated and challenging.

8) Survival of new plantings in wet areas is affected by timing of installation.

Wetland plants that are installed in June or July have a better chance of survival than plants installed in August or September. Plants installed later in the season may not have enough time to build up root reserves before winter (particularly in shaded areas). Using larger containers or pre-vegetated mats can increase success rates.

9) Even small differences in elevation can create major differences in suitability for species.

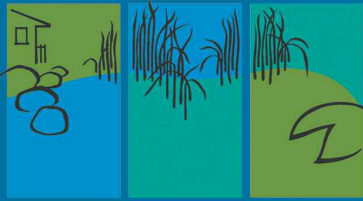
Pay attention to contours (as well as seeps and swales) when determining where to install wetland seed mixes. Wet/sedge meadow species are commonly seeded 1 to 1.5 feet above the normal pool level of a wetland or lakeshore. When planning suitable areas for emergent vegetation, look for locations that had emergent vegetation, or have it nearby.

10) Wet places require care after planting.

Monitoring and managing projects is important. Catch weeds before they become bigger problems. Conduct contingency planning to determine which invasive plants are likely to spread, and how to manage them if they become established. Proactive management helps ensure that projects will meet their wildlife, water treatment and aesthetic goals. ■

Contact

Karen Terry
University of Minnesota Extension
From Shore to Shore Editor
320-589-1711
kterry@umn.edu



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To subscribe or unsubscribe, please contact Barb LaPlante at bjla@umn.edu or 320-589-1711.

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EXTENSION

Non-native Earthworms on our Shores – Great for Fishing, not so Great for Woods

Ryan Hueffmeier, University of Minnesota, Duluth, rhueffme@d.umn.edu; (218) 720-4379

Forest before worms ...



According to the Minnesota Department of Natural Resources, in the land of 10,000 (11,842) lakes, there are 1.4 million licensed anglers. An important type of bait for those anglers are earthworms such as the Night Crawler and Angle Worm. Did you know that earthworms are not native here? Over the past several hundreds of years they have been transported from Europe to North America. Vectors of introduction include movement of plants, ship ballast (which use to be dirt and rocks) and use as fishing bait. Even if earthworms were in the current northwoods region prior to the most recent glacial period called the Wisconsin glaciation, researchers believe the glaciers and permafrost would have pushed them south or eradicated them. After the glaciers retreated, trees and other plants could grow again. Tundra transitioned to the current forested ecosystems, which have been established for the last 3,000 years.

As organic material such as leaf litter and plants die they accumulate as duff on the forest floor. Fungus and bacteria are the decomposers in this ecosystem that break down duff into forms used by plants and trees. This breaking down happens slowly, which means a thick matt of duff often covers the mineral soil. Duff provides habitat and food for plants and animals that have developed life strategies that rely on the organic layer, such as sugar maple seedlings, trillium, amphibians, and ground-nesting birds.

The benefits of earthworms that we see in agricultural and garden settings are not realized in Minnesota's native forested

Forest after worms ...



ecosystems. When earthworms are introduced they fundamentally change the soil structure and nutrient availability. One of these earthworm species is called *Lumbricus terrestris*, commonly known as the Night Crawler, and is widely used as fishing bait. Night Crawlers will consume and relocate organic material. Add other earthworm species and they can completely remove the duff layer exposing the mineral soil beneath. This change in soil and loss of duff can lead to "Forest Decline Syndrome." Forest decline syndrome affects nutrient retention, plants, soil invertebrates, amphibians, ground-nesting birds, and small mammals.

Minnesota still has earthworm-free areas. It's possible to keep them that way and to stop the introduction of new earthworm species. One way anglers can help is by throwing left over earthworms into the garbage and not into the environment. With Minnesota's strong fishing tradition, it's not a surprise that non-native earthworms are established throughout much of the state. Once earthworms are established, there are no economically feasible ways to remove them. Through outreach and education, The Great Lakes Worm Watch engages the public in documenting the distribution of non-native earthworms throughout the Great Lakes Region.

If you are interested in collecting data on the distribution of earthworms and adding to the Great Lakes Worm Watch database, please contact us at greatlakeswormwatch@gmail.com or log onto: greatlakeswormwatch.org. ■