Lake Tides
The newsletter for people interested in Wisconsin lakes

Wetter Summer Weather Yields Water Woes

By Eric Olson, Director, UW-Extension Lakes

Summer 2017 is shaping up to be extraordinarily wet for Wisconsin, with some portions of the state seeing over two times their normal summertime rain totals. In early July, southeastern Wisconsin experienced nearly a foot of rain in one 24-hour period, causing riverway flooding and requiring boating restrictions on numerous lakes. Wet summer weather often leads to poor lake water clarity and algal blooms. To understand why that's the case, we need to look closer at what influences water quality, how watersheds function, and the impacts of land use change on runoff.

Most of our concern with lake water quality focuses on how clear the water appears. Volunteers and professionals collect Secchi disc measurements to allow us to track clarity over time and across different water bodies. Researchers can compare measured clarity with water samples to understand why clarity varies over time and across lakes. The amount of suspended algae and sediment in the water is often the main determinant of how clear the water appears. Abnormally wet summer weather will increase the amounts of sediment, nutrients and algae found in a typical lake. Additionally, blue green algae blooms are more common in warm, nutrient rich (eutrophic) bodies of water. Runoff from hot summertime rains provide the perfect fuel for algal blooms, but it's not the rainwater by itself that's driving change.

Rainwater alone is relatively nutrient poor, but once it makes contact with the ground and becomes stormwater runoff, it picks up a range of sediment particles and delivers them to

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Jake Vander Zanden

Fish and other aquatic animals were directly effected by low oxygen levels from a blue-green algae bloom on Lake Mendota, brought on by this summer's mid-June heavy rains.

Learn more about Lake Mendota's recent blue-green algae bloom and the science behind lake health: http://blog.limnology.wisc.edu/madison-in-bloom-blue-green-algae-hits-lake-mendota/

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Impervious surfaces are hard, man-made surfaces such as rooftops, driveways, roads, parking areas and patios where rain and melting snow can no longer soak into the ground.

streams, rivers, and lakes. In any single rain event, there is a direct relationship between the amount of rain, the volume of runoff, and the capacity of that runoff to carry larger and larger particles. We observe this on exposed soils whenever runoff is heavy enough to create rivulets or even gullies. The volume of runoff reaching a river or lake is closely related to the land use and percent of a watershed covered by impervious surfaces.

Lynn Markham from the Center for Land Use Education has produced a short online video exploring the impacts of impervious surfaces on water: https://youtu.be/UPjPnaGNB1c

Prior to European settlement, forests and prairies dominated the landscape and Wisconsin's watersheds mostly lacked impervious surfaces (except places with exposed bedrock). The topography of the land surrounding lakes was complex and uneven, with decaying logs and myriad holes from places where trees had blown down from hundreds of years of storms. This situation was ideal for lake clarity, since most runoff would be slowed down and would soak into the ground before reaching open water.

The City of Milwaukee is estimated to be 46% covered with impervious surfaces.

Madison Area Municipal Stormwater Partnership and the Dane County Land & Water Resources Department have collaborated to create "Ripple Effects," an online clearinghouse for rain garden, rain barrel and yard care to protect lakes and streams: http://www.ripple-effects.com/

Today's landscape around lakes provides a stark contrast to the pre-settlement era. With tractors and bulldozers, humans leveled out the land and removed many low spots where rain once collected and soaked into the ground. The amount of impervious surface has dramatically increased through buildings, roads and parking lots. Beyond impervious surfaces, lawns, ditches and swales present a landscape that is intentionally designed to quickly move water away. Along roads and highways, for example, engineers require that water not be allowed to collect and soak into the ground as it would potentially reduce the lifespan of the road itself. Gutters and storm sewers are designed to efficiently get stormwater away from development and into streams, ponds, rivers and lakes.

The same logic is found on farmland, where too much standing water can reduce yield or even drown crops. Over time, plowing and tilling farmland has smoothed out the land to reduce the amount of land where water gathers and slowly soaks into the ground. Subsurface tile drains and ditches help move water away from farmland. In both farmland and cities, wetland areas that once slowed the movement of water are drastically reduced from what they were 150 years ago.

This modified landscape produces predictable results when heavy summer rains occur: massive amounts of water move fast across the land and quickly fill in low areas. The stormwater carries more sediments and nutrients, eventually depositing them into rivers and lakes. The potent water comes into lakes at or near the surface, and in summer the lake is already stratified with warm water at the top, so the new polluted runoff tends to stay near the surface. If lake levels increase from stormwater, waves at the shoreline can re-suspend nutrient rich sediments that tend to accumulate above the ordinary high water mark. Add a long period of daytime sunshine and warm air over the lake surface and you'll find a perfect condition for blue-green algae blooms.

This was the exact scenario that played out in Lake Mendota in Madison on June 16 of this year. The area had just received five days of wet weather totaling over three inches in rain. This was followed by a hot, calm, sunny day. The resulting blue green algae bloom was the largest in over 20 years, according to Dr. Stephen Carpenter, director of the UW-Madison's Center for Limnology. The bloom eventually moved into the stretch of the Yahara River that connects Mendota to Lake Monona. The riverway became a grim scene of dead fish, crayfish and even baby ducks.

In addition to land use, our weather is changing to make large summer storm events more common. Summer has always been the period when most precipitation falls in Wisconsin. On average, over a third of our annual total falls during the months of June, July and August. In recent years, a larger portion of that summer precipitation has been coming in the form of heavy rains. Records compiled by the Great Lakes Integrated Sciences and Assessments

Photos by Robert Korth

Program (GLISA) at Michigan State and the University of Michigan reveal that the amount of precipitation falling in the heaviest 1% of storms increased by 37% in the Midwest from 1958 to 2012. The researchers also project that heavier storms will increase in frequency at a faster rate than storms that are less intense.

Learn more about recent findings on rain intensity at the Great Lakes Integrated Sciences + Assessments website: http://glisa.umich.edu/

These heavy storms are creating new challenges for communities, lake organizations and landowners working to protect and improve lake water quality. The rain falls so hard and so fast that the landscape cannot absorb or slow down the water. Major storms overwhelm storm sewers and flood roads, sometimes washing them out entirely and yielding tons of soil into streams and lakes. Waste treatment plants, often located on low areas near waterways, can be inundated by floodwaters, rendering them ineffective. In response, we need to rethink our landscape and begin the work of enhancing the land's capacity to slow down and infiltrate rainwater.

While the task may seem monumental, there are signs that communities and people are taking the right steps to mitigate the potential impact of large summer storms. In and around Milwaukee, where stormwater and sanitary sewers are largely in one shared conveyance system, there is tremendous incentive to mimic the pre-settlement landscape through green infrastructure that allows water to soak into the ground rather than move across the land. This includes a range of practices from simple steps like installing rain gardens and rain barrels to more involved projects such as bioswales and cisterns. The Milwaukee Metropolitan Sewerage District plans to add 740 million gallons of stormwater capacity through green infrastructure by the year 2035, which would allow 14.8 billion gallons of water to infiltrate into the groundwater table annually.

Explore Milwaukee's green infrastructure plan: http://www.freshcoast740.com/

Since the state of Wisconsin was first settled, one half of our wetlands have been destroyed, drained or filled.

The Wisconsin Healthy Lakes program provides technical guidance and potential cost-sharing to shoreland property owners looking to install shoreland buffer, rain garden, stormwater diversion or infiltration practices. http://healthylakeswi.com/

On a smaller scale, every shoreland property owner can take simple steps to reduce the yield of summertime rain coming off of their land and going directly into the lake. Stormwater infiltration practices like French drains and rain gardens direct rainwater back into the ground, reproducing the effect of the pre-settlement landscape. Rain barrels and cisterns can store rainwater for later use and limit the amount of runoff generated by rooftops. Shoreland buffers help filter runoff moving across the land toward the lake. Property owners can also rethink the impervious surfaces on their property and either remove structures that are no longer needed or explore pervious alternatives.

We are not going to accomplish this task overnight, but we need to remember that Wisconsinites have been heavily modifying the landscape towards faster stormwater movement for about 150 years. It's reasonable to expect work to reverse this may stretch out for decades. What is most important is the direction we are headed: we need to work together to restore the land's ability to slow down and infiltrate runoff, naturally sustaining healthy waterways.