The Use of Organic Lawn Chemicals in Mitigating Harmful Runoff

NRCA Student: Charlotte Simari
Community Partner: Nina Miller, Darien Land Trust

Abstract

In recent years many homeowners have been spraying their lawns with chemicals including fertilizers that have been running off into lakes and causing a potential toxic environment for the organisms that are living in these lakes. The nitrogen in fertilizers can cause hypoxia within the lake, draining it of dissolved oxygen and the chemicals in other lawn products can create a harmful change in pH.[5]

This study focuses on the difference between non organic lawn chemicals and organic chemicals. I hypothesize that the organic lawn chemicals will not allow as much harmful material to get through the soil into the water. In order to confirm this, there was a measurement of the amount of pH and Nitrate in the water beneath the "lawns" to see if anything had changed.

Nitrate concentrations increased much faster and much more significantly in the non organic lawns and pH fluctuated the most in this non organic lawn. The non organic lawn is allowing most of the chemicals that are put on it to get through the soil and into the water meaning that it is most likely the most dangerous lawn to have near any body of water.

Introduction

Organic lawn care came into vogue once many people saw the potential dangers of these lawn chemicals. These concerns were usually focused on animals that would roll around on the grass, come in contact with these chemicals, and become sick.[3,4] They did not yet recognize the potential danger in the water.

Non organic chemicals can cause hypoxia (low or depleted oxygen) within bodies of water due to the runoff of nitrogen from fertilizers. This runoff can promote growth of undesirable plants and promote the growth of algae. Algae can interfere with the ability of dissolved oxygen in the lake to reach other organisms and can block off needed sunlight. Further, toxic algal blooms have been known to cause liver failure in humans and other animals.[2]

There have also been certain salts found in non organic lawn chemicals that can degrade soil's ability to retain fertilizer, allowing more of the chemicals to flow into the water.[5,6] As more fertilizer is needed to maintain the lawn, these salts create gaps in the soil which do not allow it to hold as much water.

In this project the differences in the changes in the water caused by these chemicals were monitored to see if there was a significant difference between the two of them.

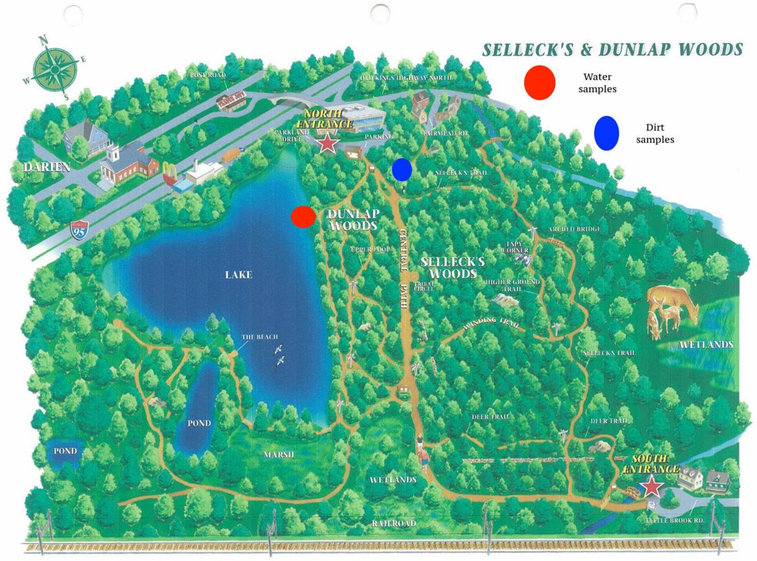

Fig 1. A map of Selleck's woods indicating where water (red) and soil (blue) samples were taken

Methods and Materials

In order to measure the change in chemical runoff I placed small, simulated "lawns" in bins on top of three small containers filled with lake water and tested them every month for nitrate and pH. There were small holes in the bins in order to allow some of the water to flow into the "lake". Each of the bins was treated differently. Bin 1 (organic bin) was treated with organic lawn chemicals according to the directions on the chemicals. Bin 2 (non organic lawn) was treated with non organic chemicals according to the directions on the chemicals. Bin 3 (control) was treated with nothing except water and seeds.

Fig 2. Testing strips used

Fig 3. The materials used to treat the "lawns". From left to right: an insect killer; an organic and non organic herbicide; grass seed; and non organic and organic fertilizer

Fig 4. The simulated lawns and body of water

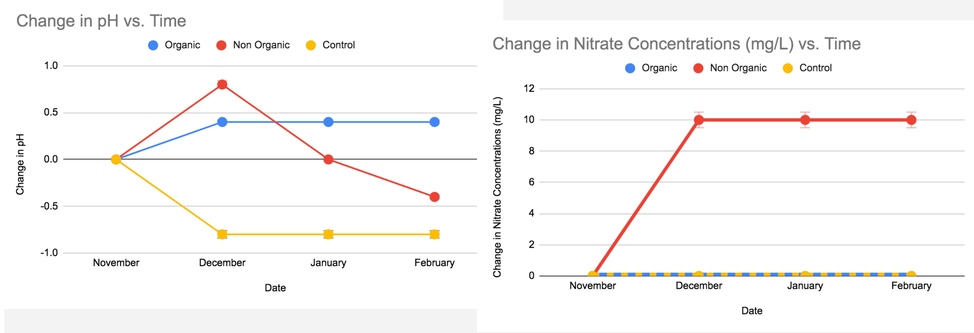

Fig 5. (Left) Graph comparing the pH of each of the water over time. (Right) Graph comparing Nitrate concentrations of the water over time.

Results

The water beneath the non organic lawn had the most significant nitrate increase. The organic and control lawns did not experience any change or enough change to be reflected in our tests. The nitrate concentration increased quickly in the water with the non organic lawn and then stayed constant throughout the rest of the trial.

The pH changed for all of the waters, even with the control. The control and the non organic lawn had significant declines as the pH of the control started at 6.8 and declined to 6.0. The pH of the non organic lawn started at 6.8, increased to 7.4 and then declined to 6.4. The organic chemicals made the pH rise, but it rose once and stayed consistent throughout.

Conclusions

The data support that lawn chemicals can impact water quality and it is necessary to mitigate the possibility of harmful runoff. The organic chemicals appear to cause the least change in the water quality for both pH and nitrate in this study.

The organic fertilizer pH level increased once and then stayed consistent. A change in water quality can damage an ecosystem. The decrease in pH can create a more acidic environment which is more likely to kill organisms living in that water. This decrease in pH when near an ocean can also cause coral bleaching.

The concentration in nitrate is not as significant, but it does increase with the non organic lawn chemicals.

While this data shows that organic lawn chemicals can be better for water quality, planting anything near a body of water (shown by the control) could lead to a change in water quality. More studies would likely need to be done in order to test the other variables that could slip from the chemicals into the soil. The soil, in future studies, should also be tested to see the damage that the organic chemicals can do. With this study it can be inferred that the organic lawn chemicals are better for the soil, but it is not certain.

References

Diaz, R., and Rosenburg, R., Introduction to Environmental and Economic Consequences of Hypoxia *International Journal of Water Resources Development* 1(27): 71-82 (2011).

Kibria, Golam (2016). Blue-green algal/cyanobacterial blooms (BGA), climate change and BGA impacts on water quality, fish kills, recreation, crops, seafood, livestock, wild animals and humans.

Marshal, S., Orr, D., Bradley, L., and Moorman, C. A Review of Organic Lawn Care Practices and Policies in North America and the Implications of Lawn Plant Diversity and Insect Pest Management. *Hort Technology* 25(4):437-446 (2015).

Soldat, D., Stier, J., Kerns, J., and Williamson, C. Organic and Reduced-Risk Lawn Care *Cooperative Extension* (2011).

Yang, J. Washday Lawn Watering *Environmental Science and Technology* 5(5):380 (1971).

Zhang, T., Wu, B., Sun, T., Ye, Y., and Chen, H., Sorption and degradation of wastewater-associated pharmaceuticals and personal care products in agricultural soils and sediment *Water Science and Technology* 68(5): 991-998 (2013).

Acknowledgements

I would like to thank Nina Miller for helping me gather so much knowledge on this topic and providing me with so many resources.

I would like to thank Amy Cabaniss for helping me structure this project and helping me find a community partner.