The Challenges Facing Michigan Water Supply: Phytoremediation

By: Gwenyth Geiger
12th Grade, Caro High School
Sponsoring Garden Club :
Caro Garden Club

Word Count: 749

Phytoremediation. This word was the start of my passion. Phytoremediation is an environmentally friendly method for cleaning up contaminated soil, water, and air using plants. [1] This process uses plants that can filter, take in, and clean up many types of contaminants including metals, pesticides, fuel, oil, and so much more. It specifically utilizes processes such as Phytostabilization, Phytodegradation, and Phytovolatilization. [2]Phytostabilization aims to retain contaminants in the soil and prevent further dissipation. Contaminants can be balanced in the roots or within the rhizosphere. [3]Phytodegradation is when enzymes, such as Dehalogenase, Laccase, Nitrilase, Nitroreductase, Peroxidase, and Phosphatase, degrade organic contaminants within plant tissues. In Phytodegradation, organic contaminants are taken up in the roots, metabolized in plant tissues, and altered into less toxic materials. [4]Phytovolatilization is a process driven by the evapotranspiration of plants and involves the absorption of contaminants by plant roots, which transforms them into a gas and then releases them into the atmosphere.

One specific problem I see in the world is water quality. Everyone in the world needs it, but access to fresh clean water is decreasing, especially in the Great Lakes,

---

[1] *U.S. Environmental Protection Agency | US EPA*, www.epa.gov/sites/default/files/2015-04/documents/a_citizens_guide_to_phytoremediation.pdf.
[2] "Phytoremediation." *Nature*, www.nature.com/scitable/knowledge/library/phytoremediation-17359669/#:~:text=Phytostabilization.
[3] "Plant-formed enzymes with known photodegradation activity." *https://www.researchgate.net*, www.researchgate.net/figure/5-Plant-formed-enzymes-with-known-phytodegradation-activity_tbl3_286101923.
[4] Limmer and Burken, Matt and Joel. "Phytovolatilization of Organic Contaminants." *https://pubs.acs.org/doi/10.1021/acs.est.5b04113*, pubs.acs.org/doi/10.1021/acs.est.5b04113.

Michigan's main source of water supply.[5] One of the biggest issues in the Great Lakes, however, is that 90% of the surface water is already impaired due to contaminants including run-off, anthropogenic activities, legacy pollution, etc. I have made this problem my objective in life. I plan to attend Michigan State University in the fall to study environmental biology and microbiology, but I want to go beyond this. After I gain the education I need, I want to bring this area of study into politics. I know this is not the usual outlook for politics, but I believe it to be one of the most important things that should be discussed.

Recently I attended a program in the Michigan Capitol called Youth in Government. At this program, I wrote a bill named the H.E.L.P. Act, or the Healthy Ecosystem and Lake Phytoremediation Act. This bill was to create and Implement regional phytoremediation buffer programs throughout the State of Michigan for ecological restoration of the Great Lakes. The purpose of this bill was to take advantage of the natural plant process in a way that requires little equipment, small amounts of money, and overall benefits the environment. This program planned to utilize plants that will be determined regionally and based on that area's specific needs. Individuals would be assigned a specific plant upon acceptance of the program and after plantation, proof of utilization, and submitted documentation, they would be rewarded with a percentage allocated by the budget set by the Department of Natural Resources. In a more simplified version, my bill, if it became a law, would provide people accepted into the

[5] "Microplastics in the Great Lakes: Unsafe for Wildlife." *Environmental Working Group*, www.ewg.org/news-insights/news/2023/12/microplastics-great-lakes-unsafe-wildlife.

program the ability to implement plants that would be specified to an area's specific issue to act as a buffer, in return for money.

[6]Some examples of this program could be the planting of willows or poplars on the banks of the lake to phytoextract heavy metals like lead, cadmium, and arsenic from contaminated soils near the Great Lakes. Another example is using certain plant species, again such as willows and poplars, in detoxifying organic pollutants through enzymatic processes in their roots and rhizosphere, which they have been proven successful in. [7]One last example would be the use of plants, such as water mint, to safely purify and filter out bacterium, such as E. coli or Salmonella in water systems.

This bill was sent through almost 800 people and there was no debate or amendments on how important and beneficial this program could be for the future. The bill proceeded to be passed through both the House and Senate, and after it made its way to the Youth Governor's desk, it was signed. I know this is just one main issue, but focusing on this specific issue can cause a cascade effect and help relieve other issues ailing Michigan and its water supply. I know the program wasn't real life, but it was an example of what I wanted to do with my life. I want to take this bill and make it the real deal and hopefully get it to the real governor's desk. I don't care if it takes years, but I want to get the education necessary to bring my dreams to life. I plan to get highly educated, work hard, and be extremely determined to bring my dreams to the governor's desk and be signed into law.

---

[6] Undefined. "Phytoextraction of Risk Elements by Willow and Poplar Trees." *PubMed*, pubmed.ncbi.nlm.nih.gov/25495931/.

[7] Kellogggarden. "Plants That Clean Water." *Kellogg Garden Organics™*, 13 Feb. 2024, kellogggarden.com/blog/gardening/plants-that-clean-water/.

Word Count : 749

2023/2024 YIG Draft Bill Template

I.

Delegation:	Caro High School
Bill Sponsor	Gwenyth Geiger
Bill Co-Sponsor ID	
Title/Introductory Clause	The H.E.L.P (Healthy Ecosystem and Lake Phytoremediation) Act shall Implement regional phytoremediation buffer programs throughout the State of Michigan for ecological restoration of the Great Lakes.
Section 1.	This bill shall create a program through the Department of Natural Resources to implement guidelines and incentives in the State of Michigan for individuals to use the science of phytoremediation to combat pollution of the Great Lakes. This program shall, specifically, target contamination, including, but not limited to, run-off, anthropogenic activities, legacy pollution, and agricultural inputs which have all contributed to the impairment of roughly 99% of surface water.
Section 2.	- Phytoremediation - Phytoremediation is implemented by establishing a plant or community of plants that have been selected to provide the required remediation mechanisms. The technology exploits the natural hydraulic and metabolic processes of plants and thus is solar-driven. The technology can be applied either in situ (the natural or normal place, confined to the site of origin) where the technology is passive or ex-situ (Outside, off-site, or away from the natural location) where contaminated groundwater is extracted and treated with engineered systems (hydroponics or constructed wetlands) to treat the groundwater utilizing natural plant processes. - Phytostabilization - Phytostabilization aims to retain contaminants in the soil and prevent further dispersal. Contaminants can be stabilized in the roots or within the rhizosphere - Phytodegradation - Phytodegradation involves the degradation (degradation of a substance is the process of its breaking down into its separate parts or elements.) of organic contaminants directly, through the release of enzymes from roots, or metabolic activities within plant tissues. In phytodegradation, organic contaminants are taken up by roots and metabolized in plant tissues to less toxic substances. Phytodegradation of hydrophobic organic contaminants has been particularly successful. - Phytovolatilization - Phytovolatilization involves the uptake of contaminants by plant roots and its conversion to a gaseous state, and release into the atmosphere. This process is driven by the evapotranspiration of plants - Anthropogenic activities - anthropogenic activities include mining, release of industrial waste, incineration of fossil fuel, particularly coal, utilization of As-loaded water for irrigation, and As-based pesticides, herbicides, and fertilizers - Legacy pollution - legacy pollution or legacy pollutants are persistent materials in the environment that were created through a polluting industry or process that have polluting effects after the process has finished.

Section 3.	The program shall supply surrounding areas of the Great Lakes with plants to combat any specific environmental issues including, but not limited to, run-off contamination, pollution, sewage contamination, fuel residue, and human activity byproducts, that can be solved through the science of phytoremediation by implementing the natural processes of phytostabilization, phytodegradation, phytovolatilization to have plants extract the contaminants through natural process.
Section 4.	The program shall reward individual project initiatives in the Great Lake Region who document and submit proof of the utilization of the defined methodology of ecological correction that meets the efficacy standard of the initiative and the Department of Natural Resources. Incentives shall be allocated at the end of each year amongst eligible submissions as a percentage of the allocated budget, determined on the basis of impact/improvement as measured by the Department of Natural Resources.
Section 5.	Proposed funding for the initiative shall be allocated from 5% of the sales prices of Michigan hunting and fishing licenses as offered through the DNR. Collaborative funding shall generate approximately $1,780,131 based on the 2023 license sales price and volume statistics for the State of Michigan. Even with 5% of the profit going to this program, the DNR still profits with $30,000,000 left over for other smaller DNR programs, including fisheries, communications and customer services, law enforcement, etc. Additionally, the DNR still gets support from federal and general fund revenues. Funding for this program shall be utilized to develop a budget that shall define and fund the program start-up costs, pay for ongoing oversight of the program, and pay for participant incentive payouts. This program doesn't require high continual funding, due to it being a natural process that is managed by participants. Additionally, no funding shall be required for infrastructure, maintenance, heavy machinery, or harsh chemicals, however, yearly funding shall be required for initiatives and program operations.
Section 6.	This program, once established, shall be a long-term solution to contaminated water areas of the Great Lakes. The implementation of this program shall take place one year after passage and the cleaning process shall take an estimated 10 years to be at full efficiency.
Section 7.	

Section 8.	
What policy categories does your bill impact? (Chamber of Commerce, Civil Rights, Consumers, Doctors/Nurses/Medical, Environmental Protections, Farmers, Hospitals, Infrastructure, Law Enforcement, Local Government, Manufacturers, Organized Labor, Public Utilities, Schools, Others)	Department of Natural Resources (DNR)
Background Problem	Pollution in the Great Lakes and not enough eco-friendly programs to help alleviate environmental issues and effects in the area.

Benefits	This program shall allow phytoremediation to take advantage of the natural plant process and shall begin cleaning up the Great Lakes in a truly beneficial way. This process requires less equipment, labor, money, etc. This process also protects human health, not only by cleaning the largest freshwater lakes in the US, but also, by allowing humans to not come into contact with harmful water and harmful chemicals. This program is cost-effective, has long-lasting effects, has already been tested in many areas, and has been successful.
Drawbacks	This program shall be slow-growing, as it takes time for plants to grow, thrive, and begin their cleaning process. The Program must be careful about what plants are implemented to target specific issues so that no harmful gasses are put out, no wildlife is harmed by the plants, and the plants do not endanger already existing plant life in the area. The program shall also have to have checkups on plant life to make sure they do not perish.
Cited Resources	https://semspub.epa.gov/work/HQ/158170.pdf https://www.fs.usda.gov/nrs/pubs/jrnl/2021/nrs_2021_pilipovic_001.pdf https://www.frontiersin.org/articles/10.3389/fpls.2020.00359/full#:~:text=There%20are%20advantages%20of%20using,of%20the%20pollutants%20to%20the https://www.nature.com/scitable/knowledge/library/phytoremediation-17359669/#:~:text=Phytoremediation%20technologies%20include%3A%20(a),state%20and%20released%20into%20the https://pubmed.ncbi.nlm.nih.gov/31254865/ https://www.frtr.gov/matrix/Phytoremediation/#:~:text=Phytoremediation%20is%20implemented%20by%20establishing,and%20thus%20is%20solar%20driven. https://michiganintheworld.history.lsa.umich.edu/environmentalism/exhibits/show/main_exhibit/pollution_politics/great-lakes-pollution#:~:text=Waste%2C%20sewage%20and%20fuel%20residue,lake%20so%20that%20algae%20proliferated. https://wwmt.com/news/local/hunting-fishing-license-michigan-dnr-season-deer-ice-sales-Dustin-isenhoff-natural-resources-department-state https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/anthropogenic-activities#:~:text=The%20anthropogenic%20activities%20include%20mining,et%20al.%2C%202009 https://www.doi.gov/priorities/investing-americas-infrastructure/legacy-pollution https://wwmt.com/news/local/hunting-fishing-license-michigan-dnr-season-deer-ice-sales-dustin-isenhoff-natural-resources-department-state https://www.iosconews.com/article_6ebba5fe-832c-11ee-bafc-4fadde6efb42.html#:~:text=According%20to%20statistics%20provided%20by,from%20459%2C490%20bought%20in%202022. https://www.michigan.gov/dnr/things-to-do/fishing/license-info https://www.michigan.gov/dnr/about/funding