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Wetlands Restoration

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Introduction

As humanity has grown and developed extravagant cities with complex socioeconomic relationships, fueled by robust agriculture, it has become easy to overlook the very nature that has allowed humanity to thrive. Just about every aspect of life is directly affected by wetlands, providing protection for sensitive ecosystems from erosion such as beaches, sustaining and filtering groundwater, enriching the environment with nutrients and minerals, and much more. However, in the 21st century, we find that roughly 50% of the Earths wetlands have been destroyed. Whether these areas have disappeared due to water drainage, pollution, removal of vegetation, or grazing, this has become one of the biggest threats to our environment and communities. Since the 1980's, awareness of the importance of wetlands and how they benefit wildlife, water quality, and communities overall has grown and with it, attempts to re-establish and rehabilitate wetlands. Every wetland possesses three main characteristics which include a supply of water, hydric soils, and vegetation. Restoring these areas entails returning one or more of these elements to a site, depending on the kind of damage. This poster will analyze the general process and techniques used for wetland restoration.

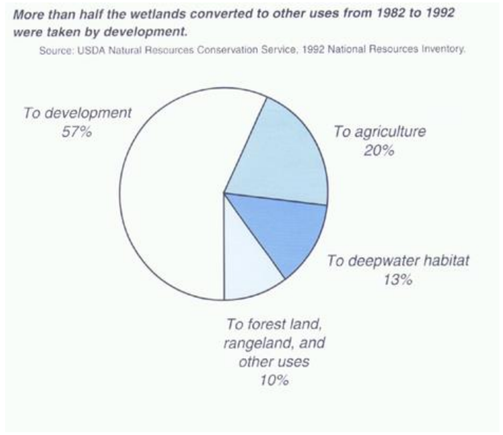

Figure 1: Uses for converted wetlands between 1982 and 1992.

Sensitive Unit

The monitoring and maintenance of healthy water levels is crucial for the continued success of a wetland restoration project. Wetlands actively act as a storm buffer to reduce flooding during heavy storms, so monitoring the water levels within a given wetland is important to ensure that the wetlands are not overflowing and are able to act as a sink for storm waters. It is also important to monitor the water levels throughout the wetland restoration process to ensure that the restoration method used is effective at reaching the desired water levels post restoration. Water level data loggers, such as the Solinst level logger, are used to continually monitor these water levels, collecting data as frequently as every 15 minutes or so. These loggers can measure the elevation of the water during extreme weather events and during the restoration process, ensuring that the wetlands can handle the storm water influx and that the restoration process is successful

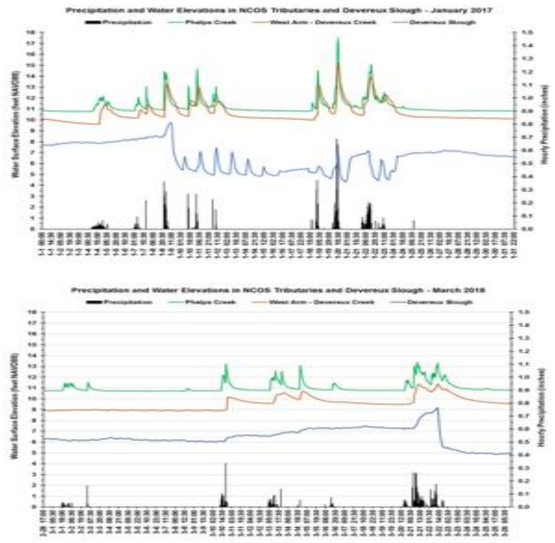

Figure 3. Graphs depicting the measured water levels pre and post wetland restoration, measured with a water logger.

Process Description

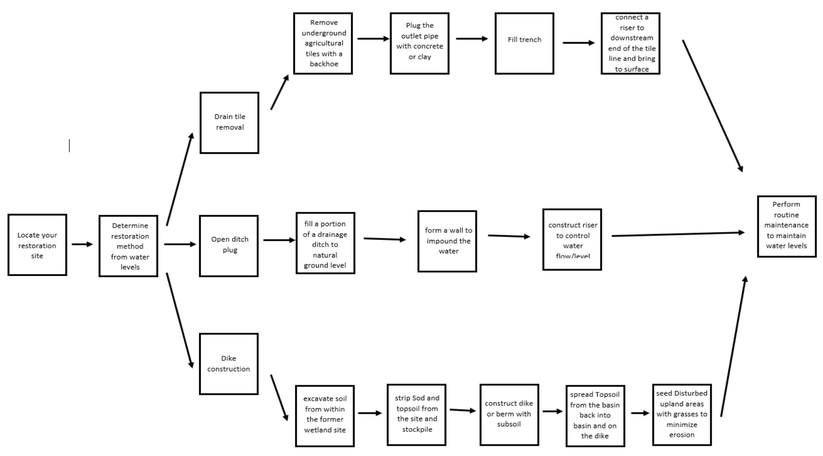

Figure 2. Flowchart detailing the steps involved in a standard wetland restoration process including site determination, choosing restoration method (Open ditch plugging, underground drain tile removal, or dike construction), and continued maintenance of the restored wetland site post restoration

Impact on Ecosystem Services

"Wetlands are among the most productive ecosystems in the world, comparable to rain forests and coral reefs." (EPA, June 2018). The estimated dollar value of wetlands worldwide, as of 1997, is $14.9 trillion (Costanza et al. 1997).

Pros:

Increase in water levels in the coming years due to climate change will negatively impact cultures and economies.

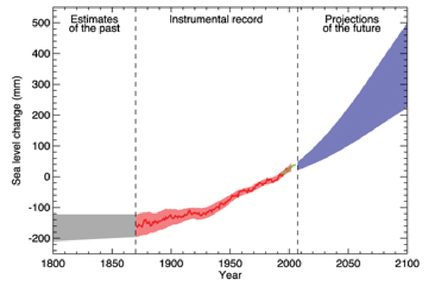

Figure 4. Represents the change in sea levels from 1800 to 2100 (EPA).

Wetlands naturally reduce the impacts of water levels rising through the following:

- Protect against tropical storms and reduce flooding.
- Reduces erosion.
- Provides crucial industry for both commercial and recreational use. "Wetlands provide an essential link in the life cycle of 75 percent of the fish and shellfish commercially harvested in the U.S., and up to 90 percent of the recreational fish catch. (EPA, May 2006)"

Pollution is one of the greatest challenges' humanity faces today with the vast negative affects towards climate change, personal health and well-being, and the endangering of critical species. Wetlands also positively address many of these problems:

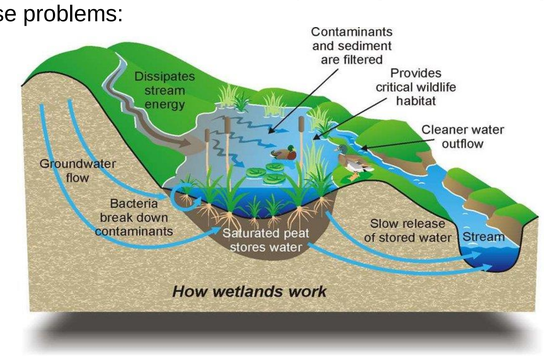

Figure 5: Depicts the purification of water that flows through wetlands (Haspeck, 2020).

- Protects and improves water quality through natural filtration.
- Provides fish and wildlife habitat for many endangered and at-risk species.
- Moderates' groundwater levels and maintains surface water during dry seasons
- Reduces pollution from agriculture and factory runoff.

Cons:

Wetland restoration does have some downsides such as large upfront costs and maintenance, can't remove highly toxic chemicals and limiting land developments. However, the estimated benefits to cost is zero to nine depending on the location. Meaning at the least it will pay for itself but, at the most for every dollar spent there will be nine dollars in return according to the USDA (USDA, May 2015).

Research

Hypothesis: Restoring wetlands will decrease the pollution found in rivers, streams and other bodies of water.

Procedure:

- Identify degraded wetlands that are connected to water systems affected by pollution with similar ecosystems.
- Isolate a control group of wetlands that will not be restored.
- The test groups will be wetlands that are undergoing restoration, using different methods of restoration.
- Determine the levels of pollution found in the wetlands as well as the bodies of water, in which they are connected to, prior to any restoration.
- Monitor and record pollution levels of the control groups, test groups, and their respective water systems every month.
- Continue this process for five years regardless if the method of restoration has been completed.

Analysis:

- Data collected over the five-year time period is compiled.
- Analyze data for any patterns or lack thereof, that will lead to a conclusion that is either in support or against the hypothesis.
- If the data is in support of the hypothesis, then the data for the test groups can be compared to determine which restoration method is the most effective.

Objectives:

- Gain a better understanding of how wetlands remove pollution from the environment.
- Identify which process of restoring wetlands is the most efficient and effective, based on the removal of pollutants.
- Determine the economic and social value of wetland restoration through its removal of pollutants from the environment.

References

1. "Wetland Restoration Techniques." *Michigan United Conservation Clubs*, Department of Natural Resources, www2.dnr.state.mi.us/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/Resource_Dir/Acrobat/Wetland_Restoration_Techniques.PDF.
2. Why Are Wetlands Important?" *EPA*, Environmental Protection Agency, 13 June 2018, www.epa.gov/wetlands/why-are-wetlands-important#:~:text=Some%20of%20these%20services%2C%20or,unique%20natural%20characteristics%20of%20wetlands.
3. Constanza, R. R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R.V. O"Neill, J. Paruelo, R.G. Raskin, P. Sutton, and M. van der Belt. 1997. "The value of the world's ecosystem services and natural capital." Nature 387:253-260
4. *Economic Benefits of Wetlands*. EPA, May 2006, www.epa.gov/sites/production/files/2016-02/documents/economicbenefits.pdf.
5. Dardis, Deborah. "Louisiana's Disappearing Wetlands." *Wetlands and Coastal Erosion*, Southeastern Louisiana University, 12 July 2010, www2.southeastern.edu/orgs/oilspill/wetlands.html.
6. Haspeck, Marika. (2020). Pre-Research literature review for a Project on the effects of heavy metal resistant bacteria on the uptake capacity of plant populated bioswales - M.Haspeck 31120.
7. "Wetlands Benefits and Costs Vary With Location." *USDA ERS - Wetlands Benefits and Costs Vary With Location*, USDA, 4 May 2015, www.ers.usda.gov/amber-waves/2015/may/wetlands-benefits-and-costs-vary-with-location/#:~:text=The%20study%20found%20that%20the,in%20major%20corn%2Dproducing%20areas.
8. "Wetland Restoration Techniques." *Wetland Restoration Techniques - Michigan Department of Natural Resources*, Private Land Partnerships, www2.dnr.state.mi.us/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/Resource_Dir/Acrobat/Wetland_Restoration_Techniques.PDF.
- "Wetlands Values and Trends." *Natural Resources Conservation Service*, www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/rca/?cid=stelprdb1042133.
- Lane, Tricia, and Tricia Lane. "Water Level Data Critical For Successful Coastal Wetland Restoration." *On The Level Blog*, 22 Jan. 2020, www.solinst.com/onthelevel-news/water-level-monitoring/water-level-datalogging/water-level-data-wetland-restoration/.