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 This research is to determine the difference in the amount of organic sediment at different locations. A sediment is any material that sinks to the bottom of a body of water (“Marriam Webster”, 2018). Sediments are immensely helpful as most of them provide nutrients to the body of water. Different type of sediments affects the water and ecosystem in various ways. Most sediments are unfortunately harmful and cause damage to the ecosystem. A real-life example of this is the Chesapeake Bay and how the sediments are affecting it.

 The Chesapeake Bay has been degrading ever since humans first came upon it and started taking its resources. However, in today’s age the Chesapeake Bay is in danger. Although it is being damaged from many things, sediments are doing damage to it as well. The main pollutants that are being watched are nitrogen, phosphorus, water clarity, and toxins. The Chesapeake Bay Foundation has been monitoring it and gave a grade to how bad it is. In their case they have an average of a D unfortunately. However, it does not mean that all hope is lost. Since 2016, the pollution has improved in all but one category in which it stayed the same (“State of the Bay Report” 2016).

 A natural occurrence called runoff unfortunately brings most of the main pollutants into the Bay in the form of sediment. As rain water washes towards a body of water, it picks up pollutants and other material along the way. It can be extremely pollutant when it comes from a farm or an agriculturally industrious area as it picks up the immense amount of phosphorus and nitrogen produced from those areas. This begs the question, why is nitrogen and phosphorus pollutants if they’re elements?

Nitrogen and phosphorus are unfortunately very common pollutants. The main sources for them come from agricultural, urban, and suburban runoff (“State of the Bay Report”, 2016). The nitrogen and phosphorus that are collected in the runoff eventually will pollute the waterways in the form of increasing algal growth. This algal growth will eventually lead to dead zones forming and making that portion of the water uninhabitable due to low oxygen content. Many studies have been done to the Bay to determine the Chesapeake Bay’s phosphorus content. One study showed how towards the middle of the Bay, it contained more organic phosphorus levels (“Characterizing Phosphorus Speciation of the Chesapeake Bay,” 2015). However, geographical features may play a part in explaining why this is the case.

 Looking at a topographic map of the Chesapeake Bay, on both sides of the Chesapeake Bay, the outskirts has the lowest elevation compared to more inland and closer towards the ocean (“Topographic Map”). This shows how runoff of natural phosphorus has a higher concentration towards the middle of the Bay as all the runoff that does not go directly into the Bay, goes downhill until they run into the Bay or a stream that flows into the Bay. After a while, it can damage the ecosystem in the Bay by providing a food source for algae. This can cause dead zones to form from the algae dying by consuming all the dissolved oxygen in the water

 Dissolved Organic Carbon comes from organic material or residue from organic life (“Organic Matter in Sediments,” 1969) that has fallen to the bottom of a body of water. The organic material that then sits on the bottom helps provide habitat for the ecosystem in that area as well as serves as a buffer for unwanted pollutants in sediments coming in. However, carbon also plays another important role in sediments not directly related to a body of water. Soil carbon provides for the ecosystem and sediments on land which eventually will get deposited into a body of water. However, why should we care about soil carbon? Soil carbon plays pivotal roles that influence the chemical, physical, biological functions of soil (“Soil Carbon in the World,” 2018). If soil carbon is low, then the soil and sediments being transported from and/or through the soil will bring possibly harmful sediments into bodies of water such as the Chesapeake Bay. Which could in time damage the Bay more than it would help it. However, this begs the question of “Why should we care about organic and dissolved organic carbon”? Dissolved organic carbon provides as a food source for aquatic food webs (“Measuring Dissolved and Particulate Organic Carbon,” 2016) making it an invaluable aspect for ecosystems. Not only does it help the ecosystem, but it helps protect the water if it is poorly buffered. This is immensely important, especially since along the Chesapeake Bay the number of forested buffers has decreased since 2015 (“State of the Bay Report,” 2016).

Many studies have been done to determine the health of the Bay. One such study has been done to determine the restoration done to the Bay. In the study they determined the major pollutants, which were the same as the state of the Bay reports’ and explained how restoration process’ have affected it. The study done by Thomas A. Jones explained how sediments can disconnect channels which in turn harms the Bay. (“Impacts on Ecosystems,” 2017). Sediments can do this by heavily deposition in a single area. Eventually, this will cause build up and the blocking or creating of the channel (“DEC Vermont Channel Erosion”, 2017). Seeing the dangers sediments pose there are attempts being made to remove sediments and fix the damage being done. This study shows how sediments can be stopped and corrected, however what are some other ways?

 Sediments can be a tricky problem to fix as they come from many sources and some sediments are helpful. However, there are some natural changes that we can use to help slowly fix it. Implementing vegetation can filter out unwanted pollutants and sediments before reaching and inside the Bay. One such vegetation is forested buffers. Forested buffers filter out unwanted sediments before it gets to the Bay and allows for cleaner and healthier water to be deposited. The Clean Water Blueprint indicates that we need to plant 14,000 acres of forested buffers along the Bay annually. Unfortunately, since 2015 the number of forested buffers has decreased over the years (“State of the Bay Report,” 2016). Another solution would increase the amount of emergent vegetation. Emergent vegetation are plants that are rooted to the bottom of a body of water. They provide a variety of benefits ranging from increasing the resilience to storms to trapping sediments and favoring accretion (“Tradeoffs among hydrodynamics and vegetation community,” 2018). Emergent vegetation would not only filter out the sediment and pollutants but also build habitat for the ecosystem allowing for more diversity.

 Sediment and Organic carbon loads are being closely watched, and have been watched for a while, as well as experimented on to determine if it has been getting worse or better throughout the years. Compared to past studies, sediments and organic carbon in the Bay are luckily comparable with other studies in the mid-Atlantic region (“Watershed Export of Fine Sediment, Organic Carbon... To the Chesapeake Bay,” 2017). However, it does not mean that the Bay is healthy. The Chesapeake Bay Foundation gave the Bay a D for pollutants that are carried from sediments (“State of the Bay Report,” 2016).

 The reasoning behind this grade comes from a variety of factors. It is not just due to the sediment deposition, but the pollutants that the sediment are carrying. Pollutants that have been tested and given an individual grade are Nitrogen, Phosphorus, Dissolved Oxygen, Water Clarity, and Toxins. The rating of D for pollutants in general comes as an average letter from all the pollutants being tested upon (“State of the Bay Report,” 2016).

 Unfortunately, most of the public is uninformed about sediments and know little to nothing about them. In fact, some of the public does not even know what a sediment is. This knowledge gap unfortunately hinders the progress of fixing and correcting any damage that sediments and the pollutants it carries. However, educating the public could not only help stop future damage but also help reverse some of the damage that has already been done to the Bay.

 With all the information given, it is believed that if a geographical location has a higher number of pollutants then it will have a higher amount of organic material found in it. This is backed up by the fact that runoff tends to go downhill and pick up pollutants and organic material found along the way. Once at the bottom and has entered the body of water, all the organic material picked up along the way will then be deposited into the water and will show in this part of the water a higher amount of organic material found at the location. Along with organic material, it also means that there will be a higher yield of pollutants in the area as well. In an area such as the Chesapeake Bay that has lower elevations in most parts, this will bring it more pollutants and organic material in a specific area. The fix for this lies within the buffers in and surrounding the Bay and body of water. If there is a higher number of forested buffers and vegetation, then it will help filter out the pollutants in the Bay. Leading to not only a healthier Bay, but a healthier ecosystem, sediment yield, and waterway.

Bibliography

1. Baker, Will. 2017. *State of the Bay Report*. Chesapeake Bay Foundation.
2. Bruckner, Monika Z.; 2016; *Measuring Dissolved and Particulate Organic Carbon (DOC and POC)*. Microbial Life.
3. Department of Environmental Conservation (DEC); 2017; *Channel Erosion*; Department of Environmental Conservation.
4. Jones, A. Thomas. 2017. *Impacts on ecosystems, corrective restoration practices, and prospects for recovery: Nine case studies in the continental United States*. The Rangeland Journal.
5. Li, Wei; et.al. 2015. *Characterizing Phosphorus Speciation of Chesapeake Bay Sediments Using Chemical Extraction, 31P NMR, and X-ray Absorption Fine Structure Spectroscopy*. ACS Publications.
6. Marriam Webster; 2018; *Definition of a Sediment*; Marriam Webster.
7. Masciandaro, Grazia; et.al. 2018. *Chapter 1 - Soil Carbon in the World: Ecosystem Services Linked to Soil Carbon in Forest and Agricultural Soils*. Academic Press.
8. Nardin, William; et.al. 2018*. Tradeoffs among hydrodynamics, sediment fluxes and vegetation community in the Virginia Coast Reserve, USA*. Estuarine, Coastal and Shelf Science
9. Welte, D. H.; et.al. 1969. *Organic Matter in Sediments*. Organic Geochemistry
10. Zhang, Qian; Blomquist, Joel D. 2017. *Watershed export of fine sediment, organic carbon, and chlorophyll-a to Chesapeake Bay: Spatial and temporal patterns in 1984–2016*. Science of the Total Environment.
11. 2018. *Topographic Map Chesapeake*. OpenStreetMap.