WETLAND DESTRUCTION IN THE CHESAPEAKE BAY

Source: Chesapeake Bay Program

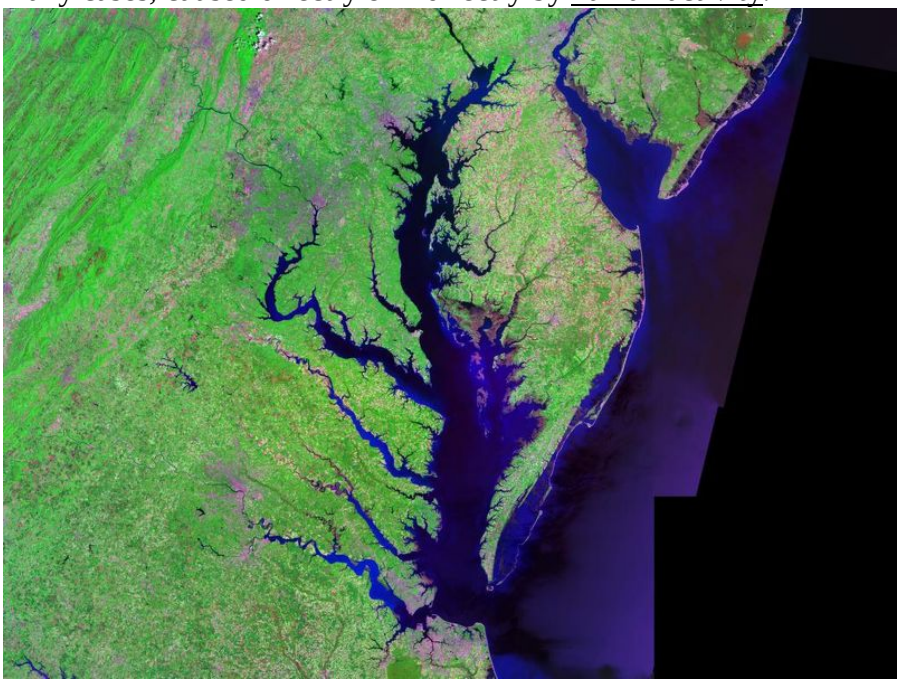
The Chesapeake Bay (38° 32′ 35″ N, 76° 4′ 32″ W) is the largest estuary in the United States. It lies off the Atlantic Ocean, surrounded by the states of Maryland and Virginia. The Chesapeake Bay's watershedcovers 64,299 square miles (166,534 km^2) in the District of Columbia and parts of six states: New York, Pennsylvania, Delaware, Maryland, Virginia, and West Virginia.

Source: DEMIS Basemap/Peter Saundry

More than 150 rivers and streams drain into the bay. Much of the bay is quite shallow: at the point where the Susquehanna River flows into the bay, the average depth is 30 feet (9 m),

although this soon diminishes to an average of 10 feet (3 m) from the city of Havre de Grace for about 35 miles (56 km), to just north of Annapolis. On average, the depth of the bay is 21 feet (7 meters), including tributaries; over 24% of the bay is less than 6 ft (2 m) deep. There are roughly 490,000 acres of wetland within the reach of the Chesapeake Bay's tide.

The Chesapeake Bay is currently experiencing heavy wetland destruction in the form of erosion, hardened shorelines, and the like due to numerous factors, such as human settlement, rising sea level, and vegetation loss. This destruction of the wetlands in the Chesapeake Bay causes a massive disruption in the various ecosystems found in the bay and also has effects on the people living within the bay's vicinity. The Chesapeake Bay watershed has lost 60 square kilometers of wetland to commercial and residential development since 1990. The area of marshes and other tidal wetlands has decreased by fifty percent since the late 1800's. This loss of wetland is, in many cases, caused directly or indirectly by human activity.



Source: NASA

Benefits of wetlands

Riparian buffer zones

Wetlands lie between land and water, and serve as riparian buffer zones (RBZ) by decreasing the rate at which pollutants enter the Chesapeake Bay. When polluted storm water runs off the land, it passes through wetlands before it enters the Bay. Riparian buffer zones significantly improve the quality of the water which passes through it. Overland storm flows entering from the uplands may be cleansed of suspended particulates: adhering nutrients, inorganic toxins, and pesticides,

as well as some dissolved nutrients and toxins. During flooding events, water entering the RBZ may also be cleansed of sediments, nutrients, and toxic materials because of particulate trapping and the binding of materials onto the soils and leaf litter within the RBZ.This prevents pollutants and sediments from affecting fish and amphibian egg development, and improves the general water quality of the Bay.

Export of Energy-Rich Nutrients to Deeper Waters

Eugene Odum's and John Teal's hypothesis, which has been supported by many studies, states that salt marshes export energy-rich materials to deeper waters. These materials include reduced nitrogen compounds, and dissolved and particulate organic matter. These exports support ecosystem metabolism and fuel deep water food webs. Because these nutrients support the producers which form the base of the deep water food chains, this export process is critical in maintaining a balanced and steady deep water ecology.

Erosion control

Wetlands also help control erosion along the shores. They dissipate the water flow energy, absorb and hold large volumes of storm water runoff and flood water, and then gradually release it over time. Wetlands help protect developed areas like neighborhoods and business areas from floods and waves by stabilizing the shore lines.

Wetlands of the Chesapeake Bay Source:Chesapeake Bay Program

Approximately 57 percent of the sediments which enter the Chesapeake Bay are the product of tidal erosion. Tidal erosion is a combination of both fastland erosion (shoreline) and nearshore erosion (the shallow water close to the shore). Sediment is the third largest pollutant in the Bay and its tributaries. An excess amount of sediment suspended in the water column is a main contributor to degraded water quality, damages critical habitats like SAV (submerged aquatic vegetation) beds and oyster bars, and damages living resources like water fowl, shellfish, and finfish. Suspended sediment reduces the amount of critical sunlight that is available to support

healthy, thriving SAV communities. By controlling erosion, wetlands reduce the amount of sediment which enters and becomes suspended in the Chesapeake Bay water column, and in turn contributes to the over all health of the Bay.

Habitat

Wetlands provide habitat for hundreds of species of mammals, birds, invertebrates, and fish. They are one of the mostbiologically diverse ecosystems in the world, behind coral reefs and rain forests. A few examples of organisms which depend on wetlands are frogs, muskrats, marsh-nesting birds, shrimp, fiddler crabs, marsh crabs, marsh periwinkles and ribbed mussels. A reason for the dependence of a large number of species on wetlands is their high rates of net primary production. Wetlands are usually shallow bodies of water, so nutrients from the bottom are very close to the surface. This allows various plants and algae to thrive as the requirements for photosynthesis are readily available. Wetlands also serve as habitats for important shellfish and fin-fish crops like oysters, quahogs, scallops, soft-shell clams, blue crabs, and winter flounder.

Economic Significance

Many types of fish change location as they go through different stages of life. A lot of ocean fish spend their youth in shallow water wetlands until they are strong enough swimmers to survive in the open ocean, and big enough to avoid heavy predation. Studies have shown that the availability of habitat and the survival of fish are definitely linked. Therefore, the disappearance of wetlands leads to the decline of the fish which depend on them.

Wetlands are a critical habitat for juvenile fish. SAV beds serve as nurseries for various fish species, some commercially important, and provide them with shelter and protection from larger predators. Juvenile shrimp, menhaden, bluefish, and striped bass depend on coastal marshes for shelter and food. These fish live in deeper water as adults, but as juveniles would be vulnerable to predation in open water. As juveniles in the wetlands, they are considered invader species and, for the period of time that they occupy the habitat, they out compete the resident species. Because of this, the juveniles achieve a fast growth rate within the wetlands. The fish population depends on these wetlands in order for proper juvenile development into their mature stage. The U.S. fishing economy depends on these common open water fish, and therefore depends on the wetlands in the Chesapeake Bay.

Three quarters of the nation's fish production depends on marshes and wetland environments. Fishing contributes over $152 billion to the economy of the United States and employs 2 million Americans. The U.S. Department of Commerce reports that Americans spent

$41.2 billion on seafood products in 1996: $34.4 billion was spent on domestic seafood, and $6.8 billion on imported seafood. We sold $8.7 billion worth of fishery products to foreign buyers, about $6 billion of which were produced in wetlands.

As well as being natural habitats for marine life, the shallow, nutrient rich waters which surround the wetlands are potential efficient sites for aquaculture. It has been proposed that high densities of shellfish could be grown in the estuaries surrounding the wetlands, and as they suspension feed, water clarity would improve. This would be done as an effort to restore the oyster population in the Chesapeake Bay, and in turn, the oyster industry.

Factors Which Contribute to Wetland Destruction Sea level rise

One of the identified causes of wetland erosion in the Chesapeake Bay is sea level rise. The sea level in the Chesapeake Bay has been rising at a rate of 30-40 cm/century since the mid-19th Century. Sea level rise contributes to tidal erosion by increasing the area of shoreline that is exposed to the weathering effects of the waves and storm surges. This higher exposure to abrasive forces leads to faster soil erosion than if only a small portion of the shoreline is exposed. Current sea level rise is due partly to human-induced global warming, which will increase sea level over the coming century and longer periods. Increasing temperatures result in sea level rise by the thermal expansion of water and through the addition of water to the oceans from the melting of continental ice sheets. Thermal expansion is currently the primary contributor to sea level rise and is expected to remain so over the course of the next century. Glacial contributions to sea-level rise are less important, and are more difficult to predict and quantify.

Loss of submerged aquatic vegetation


Z. Marina Source: Tayside Biodiversity Partnership Local Action Plan

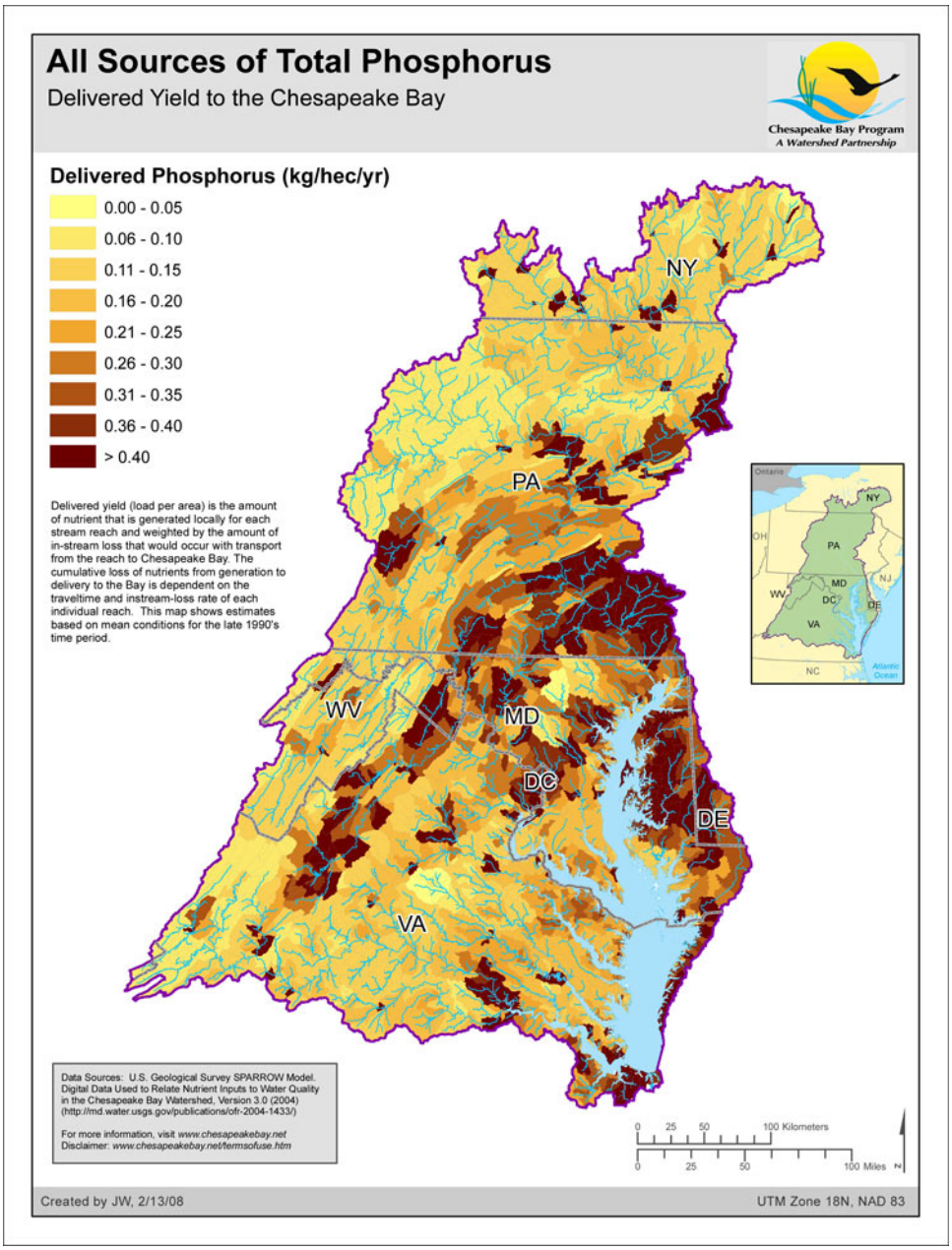
Another major cause of wetland loss is the loss of Submerged Aquatic Vegetation (SAV) which help prevent large amounts of erosion from occurring. Reasons for loss of SAV are varied. One cause of the loss of SAV, which occurred around 1931-32 was a pandemic that radically affected the *Z. marina* population causing a sharp decline in its distribution. *Z. marina*, also known as eelgrass, is a type of seagrass native to the Chesapeake Bay. Growing fully submerged in the

water, it controls the amount of erosion in its habitat by slowing the current and increasing the amount of sedimentation and stabilizing the seabed that it grows on through its roots.
Introduced species of SAV also pose a threat to the indigenous SAV species found in the bay. One such species, *M. spicatum*, outcompeted some of the native species of SAV, causing their decline. A more recently identified cause for SAV decline is the change in water quality of the entire Chesapeake Bay. The erosion and runoff of sediment and other pollutants from locations farther inland into the bay cause a decrease in sunlight both directly and through the formation of algal blooms, which in turn slow the rate of SAV growth or even kill populations of SAV. Aside from the effects the loss of SAV has on wetland loss, there are also effects on the fauna of the Chesapeake Bay region. SAV are highly productive and serve as a food source for waterfowl and as a habitat for many species of aquatic life. Thus, SAV loss also causes a decline in fauna present in the bay either because of migration or death.

Shoreline hardening

As the human population develops coastal areas, shorelines are hardened. Any shore lined with rocks wood or concrete is considered a **hardened shoreline.**
These hardened shorelines interfere with natural tidal erosion, and block wetland formation. As natural wave action occurs, the shallow areas directly in front of the hardened shorelines erode, and increase the sediment suspended in the water. This decreases the amount of sunlight that can reach underwater bay grasses. From 1988 to 2000, an average of approximately 19 miles of shoreline in Virginia was hardened every year. Between 1978 and 1997 more than 300 miles of tidal shoreline were hardened in Maryland.

Agricultural Runoff and Eutrophication



Sources of Phosphorus Runoff in the Chesapeake Bay Source:

Maryland is dependent on its agricultural industry. Fertilizer runs off into the Chesapeake Bay watershed and eventually enters the Bay. When the fertilizer enters the bay, nitrogen and phosphorous levels increase.

Nitrogen and phosphorous are the main nutrients that are required to sustain aquatic biological activity.

Phosphorous is the limiting factor in most fresh water systems, and nitrogen is the limiting factor in coastal and marine waters. However, as a result of elevated input, these nutrients reach concentrations in excess of basic nutrient requirements. This initiates rapid growth in producers like phytoplankton and algae.

In shallow areas, excess algae block the necessary sunlight for submerged aquatic grass growth, which degrades habitats and causes the loss of grass beds.

Increases in nitrogen loads reshuffle the composition of producers in shallow estuaries, fostering epiphytes, benthic macro-algae, and phytoplankton, and consequently impare seagrass meadows. In deeper areas, as the dead algae decomposes, it uses up the available oxygen in the water. This can create areas with oxygen levels too low for certain organisms to survive. This is especially harmful in the summer when oxygen in the bottom waters is replenished slowly because little mixing with oxygen-abundant surface waters occur. Many organisms occupying the bottom of the bay like oysters, clams and worms, which provide food for crabs and fish, cannot survive this prolonged low-oxygen period.

Wetland Restoration

Wetland restoration is the employment of various techniques to reconstruct the wetlands in an area to closely match the conditions there prior to human disturbance. Restoration involves not only the reconstruction of the physical environment of an area, but also the reincorporation of plant and animal life that used to populate the ecosystem being restored. The main goal of wetland restoration in reconstructing the wetland ecosystems in an area is so that the ecosystem services that it provides become reestablished. More often than not, for restoration to be successful, factors which are causing the degradation of the wetland in the first place must be mitigated. This involves identifying and addressing problems not only within the vicinity of the wetland but also within the entire watershed of the wetland. Problems that are usually given particular attention are nutrient runoff problems, problems with the flow and siltation from the wetland's tributaries, and pollution problems. In addition to addressing these problems during the actual restoration of the wetland, it is also necessary to enact long term action to maintain the sustainability of the ecosystem.

Efforts Currently Being Undertaken

United States Army Corps of Engineers

The United States Army Corps of Engineers (USACE) is a government organization that deals with environmental engineering issues such as the restoration of ecosystems. Of the projects that

the USACE is currently working on in the Chesapeake Bay is the Smith Island Restoration Project. The project was authorized in 2007 after a feasibility report in 2001 was completed. Although the project is currently on hold as of 2009 due to funding issues, there have already been measures taken to lessen the severity of the situation. During the feasibility study, the town of Tylerton was recommended to be placed under protection, which was completed. A jetty project is also underway in Rhodes Point on the same island.

The Chesapeake Bay Program

The Chesapeake Bay Program is a coalition of people and organization, including local governments, federal and state agencies, non-profit organizations, and academic institutions. In 2000, the Bay Program set a goal to achieve a net gain of 25,000 acres of tidal and non-tidal wetlands in the Chesapeake Bay watershed by the year 2010. This would be completed through various volunteer projects. As of 2007, the project had achieved about 50% of its 25,000 acre goal.

Source : http://www.eoearth.org/view/article/51cbef3b7896bb431f69d3e8/?topic=51cbfc78f702fc2ba8129e62