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Environment, Ecology

Human Impacts on Salt Marshlands

Salt Marshes

Although less regarded by the public as an important ecosystem, salt marshes are among the most fertile and abundant coastal habitats on earth. According to Bromberg Gedan, Silliman, and Bertness from Brown University and University of Florida, Gainesville (2009), salt marshes provide more ecosystem services (anthropogenic benefits from nature) to coastal populations than other ecosystems. These intertidal habitats are composed of salt-tolerant grasses, herbs, and low shrubs, in great depths, and serve many functional dynamics. Salt marshes are located in a range of climates, from arctic and subtropical regions, and are always found along global coastlines. The primary function of this ecosystem is its improvement of overall water quality by filtering nutrients, pollutants, and pathogens, and provision of freshwater and habitats that support both marine and wildlife populations. This is an important function for human, plants, and animals, as it improves natural wastewater quality before reaching estuaries and coastal waters; environments that humans are exposed to, and ecosystems that depend on the salt marshes transportation of key nutrients. Salt marshes also function as a carbon sink as they store carbon in their roots and sediments, as well as natural protection from erosion, floods, and other forms of storm damage.

Coastal salt marshes have four major structural characteristics and each section has its own distinctive species. The marsh border is the area at the highest elevation away from the sea and is where marsh border species reside. The next section, the high marsh, is flooded monthly by high tides and storms and is home to tide pools with high marsh species mainly small invertebrates such as crabs, clams, and shrimps. In the low marsh’s channel and mud flats, low marsh species experience flooding twice daily during high tides. Finally, the last section of coastal salt marshes is the tidal flat or open ocean where a great array of tidal species, such as larger fish.

Salt marsh habitats are at risk by human activities such as oil spills, poor agricultural practices that result in high runoff, and general development. Inadvertently, changes in sea levels and human induced climate change also threatens salt marshes. The Ocean Health Index (2014) computes the environmental protection risks of salt marshes and notes that the destruction of salt marshes affects three main goals: carbon storage, coastal protection, and biodiversity. Not only do humans have grave ecological impacts on salt marshes, but our activities also affect the cycling matter in the ecosystem and thus alters the nitrogen, phosphorous, and carbon cycles of salt marshes.

Cycling matter into salt marsh ecosystems can have harrowing effects on its nitrogen, phosphorus, and carbon cycles. In terms of the carbon cycle, salt marshes store carbon in their surficial sediments and deposited soils. According to the Ocean Health Index, these surface sediments can contain up to 15% carbon or approximately 430 +/- 30 Tg C (Savidge and Blanton, 2013). Thus, when salt marshes are disrupted by human generated erosion or submersion, carbon dioxide is released into the atmosphere from these stored deposits and disrupt salt marshes natural carbon cycle. The effects of anthropogenic activity on salt marshes’ nitrogen and phosphorous cycles are noted in Bromberg Gedan, Silliman, and Bertness’s report, “ Centuries of

Human-Driven Change in Salt Marsh Ecosystems (2009). Salt marshes are also nitrogen sinks as they diminish nitrogen input to estuaries by naturally filtering runoff water; however, when altered or destroyed by human activities, excess nitrogen leads to toxic algal blooms and potential marine dead zones. Related, an imbalance of phosphorous can occur with unnatural changes to salt marsh ecosystems and can lead to eutrophication.

When salt marshes are destroyed or drained by human activities, there is the subsequent threat of nonnative species invasion. This leads to the depletion of existing species and grasses which are imperative to maintaining the native marine and wildlife populations. According to Gedan, Silliman, and Bertness' research (2009), an invasive species seen in almost all altered salt marshes is the intertidal Spartina species, which began in 1870 with the introduction of the hybrid species Spartina anglica in salt marshes in England. Since then, S. anglica, has displaced native species such as Zostera marina and Puccinellia maritima on on English and Dutch coasts, respectively. This invasive species has traveled across the oceans as far as southern Australia and China, eventually colonized around the globe as it was planted for coastal engineering and defense by the British. Plant invasions are problematic in all ecosystems and the same holds true for salt marshes as they significantly affect animal communities and the global food web.

Human driven activities can affect the coastal marshes dynamic yet sensitive food web which would be adversely affected by human development and onset of new species interactions. In the marsh border, plant matter is broken down by fungi, bacteria, and protozoans into detritus which is consumed by small invertebrates. Closer to the ocean, at the high and low marsh, small fish species come into the marsh at high tide and feast upon the detritus and invertebrates. The final part of the food web is in the tidal flat where larger fish species consume the small fish and the invertebrates and continue continue transporting nutrients to offshore food webs. Knowledge is a powerful tool to move the public, as can be seen as the heightened public awareness of salt marshes structure and function in the past five years, which has led to more restoration and protective management around the world. Luckily the status of salt marsh related ecosystems is well understood due to a number of recent studies undertaken by universities and researchers around the world. The economic benefits from multiple countries and ecological losses of approximate rates of current salt marsh loss are recorded on Ocean Health Index's website (2014). According to the EPA, in 2009, 1. 2 billion pounds of commercial fish and shellfish were harvested from salt marshes in Louisiana, USA, which is an estimated $244 million total harvest value; however, the economic benefits greatly outweigh the impacts on the ecosystem and human health. Moreover, salt marshes provide the spawning grounds for many species which helps maintain coastal biodiversity in not only the freshwater ecosystem but also saltwater ecosystems. Thus, developing and harvesting fish species in marsh environments even has some economic impacts as greater amounts of commercial fish harvesting could adversely affect the spawning grounds for many fish species and could lead to a decrease in fish supply globally.

Using this information, scientists and management experts can use better practices moving forward to protect this ecosystem and maintain sustainable rates of production. Tactics to restore salt marshes include eradicating invasive species and removing tidal restrictions. Politicians serve an important role in restoring salt marshes to their preimpact or reference conditions, as they can harness public awareness and make the necessary policy changes to best protect these ecosystems. For example, once coastal communities learn how salt marshes protect their vulnerable communities from storm surges and coastal flooding, they may be motivated to repair seawalls which protect salt marshes and invoke other salt marsh restoration techniques. There are cases from around the world of grassroots organizations and government sponsored environmental protection programs to restore marshlands, such as seen by the Connecticut Office of Long Island Sound Programs (OLSIP) and the Wildlife Division's Wetland Habitat and Mosquito Management Program (WHAMM), to restore salt marshes in the area. In general, greater awareness of the services of salt marshes can lead to greater action and drive by the public to protect this ecosystem.

References

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