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Overview of Vol.7, No.3 – Coastal Ecosystems

An Overview of Long-term Coastal Restoration Projects

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Coastal ecosystems are some of the world's most biologically important areas. Rich in species and genetic diversity, coastal ecosystems are essential in storing and cycling nutrients, protecting shorelines, and filtering pollutants (Bryant et al. 1995). Many different species rely on the habitat provided by these ecosystems for foraging, nesting, spawning, and nursery grounds. These areas are also popular with humans. Recreation and industry use coastal areas heavily; half of the world's coastal ecosystems are threatened by human activity (Bryant et al. 1995).

Coastal areas are complex systems that are important for marine and freshwater flora and fauna. Dynamic in nature, water cycles in and out of coastal areas with daily tides and throughflow. The exchange of minerals, removal of detritus, and nutrient cycling is important for the health of these areas. Communities act as important interfaces between freshwater and marine, terrestrial and aquatic systems. The degradation of coastal ecosystems imperils species that rely on this habitat.

The popularity of coastal areas for recreation and industry has subjected them to impacts. Development has occurred on many coasts as resorts and vacation areas expand. Bill Peters writes about problems encountered when a mangrove forest is lost to a golf course development. Barb Peichel and Sara Bauer write about difficulties met when natural habitats are modified or used for industrial purposes. Coastal areas have been drained, filled, dredged, and impacted by sedimentation, nutrient increases, hydrology altering activity, pollutants, and non-native species. Restoration in these areas can be difficult due to changing water levels, loss of hydrologic connectivity, and complexity of systems.

Restoring coastal ecosystems has proven to complicated. These ecosystems provide extra challenges due to their dynamic nature. Human activity has affected coastal ecosystems more heavily than any other marine habitat (Bryant et al. 1995). Altered around the world by development, pollution, and habitat destruction, restorations have been done to restore plants, animals, and communities. This chapter covers long-term restoration projects in Florida, Alaska, the Great Lakes, and Vietnam. Ultimately these restorations have enabled managers to gain better understanding of what is necessary to restore these specific habitats.

Over time, restoration goals have trended from habitat for a specific species to restoration of historic ecosystem states. This trend is especially seen in projects on the Great Lakes. From beginnings of habitat enhancement for fish or waterfowl, restorations now focus on entire ecosystem functioning. Three case studies are described by Peichel to show the forward progress of restorations. The ability of these projects to succeed in the long-term has been increased by the amount of monitoring that is now being done. Monitoring pre- and post- restoration has had an impact on how successful and adaptive management is in restorations. Collection of data has made the need for mid-course corrections more easily recognized and implemented, increasing the long-term success of a restoration.

The importance of monitoring restorations is also evident in the article by Sara Bauer. Monitoring of sea otter populations has given insights on the recovery of the species. The oil spill event of the Exxon Valdez in 1989 impacted the coastal community of the Prince William Sound. Sea otters were affected heavily after the spill. While they are now listed as fully recovered, numbers remain low. Information from monitoring has shown that the intertidal community that sea otters rely on has not recovered. Without this important link in the sea otter food chain, a complete recovery of sea otters

cannot be expected. Monitoring has allowed scientists to discover this problem in the coastal ecosystem. Knowing where the impacts of the oil spill are still being seen enables the next step in the restoration process to be more efficient and increases success.

The importance of the dynamic nature of water through coastal systems is exhibited by the Windstar wetland mitigation site described by Bill Peters. Development of a golf course in Florida required mitigation of a mangrove-forested wetland because of destruction during construction. The failure of a connecting channel caused inadequate tidal flushing which resulted in lower functioning of the site. Stagnant water and anaerobic conditions caused by this failure did not provide the correct environmental conditions needed for mangrove forest establishment. The loss of dynamic waterflow inhibited detrivores, reforestation, and plant growth. While this problem was not completely devastating, it has slowed down the restoration process dramatically.

Inadequate hydrology was also seen on the Tram Chim Nature Reserve in Vietnam. Located on the Mekong River Delta, the area is typically inundated with 30 cm to 1 m of water for 3-6 months during the year. During the American-Vietnam war, the Tram Chim area was drained in order to eliminate areas for the Vietcong to hide and was left as a wasteland. In 1984, dikes were built around the Nature Reserve to restore water resources. This initial return of hydrology was met with the successful return of many plants and animals to the area. Unfortunately, the restoration plans maintaining the hydrologic cycle were controversial and the work did not continue. Without the movement of water, the area was beginning to degrade again. The return of fluctuating hydrology to the landscape in 2001 has shown habitat improvements, and managers are hopeful that the restoration will now continue to improve.

The dynamic nature of coastal areas and the movement of water demand that restorations have cooperation with surrounding landowners, residents, and scientists. Restoration of the Tram Chim Nature Reserve in Vietnam is an example of how important this relationship is to a project. As explained by Pacovsky, the restoration of natural fluctuations of water across the landscape have been important in returning species to the area. Pacovsky illustrates how essential it was for mangers to have the cooperation of local citizens and politicians. Without this cooperation, restoration plans went unimplemented for 15 years. Gaining the trust of the local residents and ensuring their livelihood were important steps in allowing the restoration to continue. Restorations cannot be isolated, the connectivity of coastal ecosystems to areas surrounding them is too critical in their functioning. The long-term attempt of this restoration emphasizes how important communication and cooperation are in these processes.

The four long-term restorations projects on coastal ecosystems in this chapter have common problems. The Great Lakes and Prince William Sound both suffer the effects of toxic substances. Tram Chim Nature Reserve and Great Lakes projects depict how important politics and communication are in the direction and funding restoration projects receive. The positive benefits of monitoring are seen in all of the restoration projects in this chapter. Without some type of monitoring, the conditions of these areas would be unknown and many valuable lessons and restored areas would be lost. Hydrology is the main problem that affects all of these projects. Hydrology can act as a problem in spreading pollutants, but is also the only way for these ecosystems to function normally. Restoring coastal ecosystems is not possible if natural hydrology cannot be returned. The projects in this chapter illustrate the importance of this ecosystem function.

Long-term restorations in coastal areas have revealed how important all of the components of an ecosystem are to the health and success of an area. The ability to follow these areas for 10-20 years has allowed for insight on processes, functioning, and connectivity of all systems. Using these projects as models, managers should be able to avoid obstacles that these early restorations faced. Lessons on communication, cooperation, hydrology, and monitoring are important results from the four restorations

discussed. As human impacts continue to degrade these biologically important coastal areas, restoration will be more essential in conserving the species that depend on this ecosystem.

Resources:

Bryant, Dirk et al. 1995, "Coastlines at Risk: An Index of Potential Development-Related Threats to Coastal Ecosystems," WRI Indicator Brief (World Resources Institute, Washington, D.C.).