Statewide Summary for Texas

By Larry Handley[1], Kathryn Spear[1], Jim Gibeaut[2], and Cindy Thatcher[1]

Background

The Texas coast (Figure 1) consists of complex and diverse ecosystems with a varying precipitation gradient. The northernmost portion of the coast, extending from Sabine Lake to Galveston Bay, is composed of salt, brackish, intermediate, and fresh marshes, with humid flatwoods inland (Moulton and others, 1997). Coastal prairies are found across the entire coast. From Galveston Bay to Corpus Christi Bay, rivers feed into large bays and estuarine ecosystems. Barrier islands and peninsulas exist along the coast from Galveston Bay to the Mexican border. The southernmost portion of the coast is composed of wind-tidal flats and the hypersaline Laguna Madre. The Laguna Madre lacks rivers and has little rainfall and restricted inlet access to the Gulf. Semiarid rangeland and irrigated agricultural land can be found inland.

Approximately 6 million people live in Texas' coastal counties (U.S. Census Bureau, 2010; Texas GLO, 2013). Seventy percent of the state's industry and commerce occurs within 160.9 km (100 miles) of the coast (Moulton and others, 1997). Texas ports support 1.4 million jobs and generate $6.5 billion in tax revenues (Texas GLO, 2013). Chemical and petroleum production and marine commerce thrive on the Texas coast. Agriculture, grazing, commercial and recreational fishing, and recreation and tourism are

[1] U.S. Geological Survey National Wetlands Research Center, 700 Cajundome Blvd., Lafayette, LA 70506

[2] Harte Research Institute for Gulf of Mexico Studies, Texas A&M University - Corpus Christi, 6300 Ocean Drive, Unit 5869, Corpus Christi, Texas 78412

strong industries along the coast and in adjacent areas; oil and gas production, agriculture, and tourism are the state's three largest industries.

Seafood landed at Texas ports valued $240 million in 2011, and recreational saltwater fishing alone provided nearly 17,000 jobs (Texas GLO, 2013). Fishes directly dependent upon wetland habitats include multiple shrimp species, blue crab, eastern oyster, black drum, flounder, sheepshead, and snapper. Texas has the highest number of hunters, anglers, and hunting expenditures in the nation (U.S. Fish and Wildlife Service, 2012). Hunting yields $2.3 billion for the state, and recreational fishing yields $3.2 billion. Texas is the top birding destination in the Nation. Tourism in Texas generates $7.5 billion for the state, and wildlife viewing generates $2.9 billion.

Statewide Status and Trends

The most recent status data for Texas were collected during varying time periods for different parts of the State (see Chapter A, Figure 4 for more detail). This status includes 112,758 hectares (278,630 acres) of estuarine emergent wetlands, 222,212 hectares (549,096 acres) of palustrine emergent wetlands, and a total of 334,969 hectares (827,727 acres) of emergent wetlands in coastal Texas (Figure 2). Historical trend data for coastal Texas are examined in the Galveston Bay and Corpus Christi, Nueces, and Aransas Bays chapters.

Causes of Change

Texas experienced an average annual net loss of 2,185 hectares (5,400 acres) of all vegetated coastal wetlands from the mid-1950s to the early 1990s (Moulton and

others, 1997). Projected sea level rise in Texas may put an additional 314,554 hectares (777,280 acres) of coastal wetlands at risk (U.S. Fish and Wildlife Service, 2012). The loss of estuarine emergent wetlands in Texas has been caused by loss or conversion to estuarine subtidal bays, palustrine emergent wetlands, lacustrine reservoirs, and other forms of land development (Moulton and others, 1997). These changes have occurred because of submergence, erosion, and subsidence caused by underground water, oil and gas extraction, and the creation of dredge spoil sites, roads, levees, and other manmade developments along the coast (Moulton and others, 1997). The loss of palustrine emergent wetlands has been caused primarily by loss or conversion to agricultural land, urban and rural development, palustrine farmed land, lacustrine reservoir construction, and natural succession to scrub-shrub and forested land. Some emergent wetland change was caused by the invasion of the non-native Chinese tallow tree (White and others, 1993).

Population growth along the Texas coast is high; approximately one quarter of the state's population currently lives in its coastal counties (Texas GLO, 2013). By 2050, the coastal population is projected to increase by 50 percent. Population growth has resulted in increased use and contamination of Texas' coastal waters. Natural events, such as hurricanes, can cause damage to emergent wetlands. Excessive loads of nutrients and sedimentation, along with heavy use, alteration and development of Texas' coast, has affected the health of the ecosystem (White and others, 1993). As Texas' coastal population continues to grow, the increased pressure of residential and commercial development and use will further strain these systems.

Overview of Emergent Wetland Restoration Efforts

Several wetland restoration efforts have been completed and continue to be proposed for the Texas coast. Agencies from different levels (federal, state, and local) help fund these projects. State and federal agencies involved in coastal wetland restoration include the National Oceanic and Atmospheric Administration, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Department of Agriculture Natural Resources Conservation Service, Texas Water Development Board, Texas Parks and Wildlife, Texas General Land Office, and Texas Commission on Environmental Quality. The primary local entities who are implementing, monitoring, and managing the State's emergent wetlands restoration projects include Coastal Bend Bays & Estuaries Program, Galveston Bay Foundation, Galveston Bay Estuary Program, and several other non-profit organizations such as The Nature Conservancy, Ducks Unlimited, and others, as well as universities located along the coast.

These organizations rely heavily on volunteers from local communities to help with restoration efforts. Since 1987, approximately 85 projects have been funded along the Texas coast dedicated to wetland restoration efforts by federal and state agencies in collaboration with local and private partners (NFWF, 2012; Galveston Bay Foundation, 2014; NOAA, 2014; Texas GLO, 2014). The majority of these restoration efforts are along the upper Texas coast, specifically in the Houston/Galveston region (approximately 60 projects), followed by the central and lower Texas coast (approximately 20 and 5 projects, respectively). The Texas General Land Office is tasked with granting permits

for restoration projects to ensure that they meet the goals and policies of the Coastal Management Program. The major state-funded coastal and wetland restoration projects in Texas occur through the Coastal Erosion Planning and Response Act.

Overview of Monitoring, Restoration, and Enhancement Opportunities

Restoration has become an increasingly important component of coastal management because of the historical losses, predicted future losses from anthropogenic disturbance and relative sea-level rise, and the important ecosystem services that wetlands provide (Feagin and Wu, 2006). Degraded salt marsh systems are the target of intensive restoration efforts in the Gulf of Mexico (Day and others, 2005). One of the most extensively restored areas along the Texas coast has been in Galveston Bay through several non-profit organizations (Staszak and Armitage, 2013; NOAA, 2014). Restoration efforts throughout the Texas coast include shoreline protection from wave erosion, using dredged material to restore wetland loss, vegetation planting, and removing invasive species such as the Brazilian pepper tree (*Schinus terebinthifolius*), Chinese tallow tree (*Triadica sebifera*), and salt cedar (*Tamarix ramosissima*) (TPWD, 2011). Smooth cordgrass (*Spartina alterniflora*) is a common choice in vegetation species planted along the Texas coast for restoration efforts.

Ecosystem-level restoration and monitoring approaches, which can include elements of wetland hydrology, vegetation cover and diversity, establishment of epifauna communities, health of plant roots, soil stability, and improving poor water salinity and pH, are likely to be the most effective management tools for restoring wetlands (Gedan and others, 2009). Wetland restoration projects should be monitored closely the year after

completion to evaluate the technique used to restore the area as well as the status of the health of the restored wetland. It is important to continue monitoring restored sites years after completion because some marsh characteristics, such as nitrogen and organic carbon content, develop on a decadal timescale (Craft and others, 1999). Reference sites are commonly used to compare restored sites, but are unavailable for some characteristics when anthropogenic influences are high, as in the case for the Galveston Bay area (Lotze, 2010; Staszak and Armitage, 2013).

After evaluating restored wetlands, studies have shown that there is little difference between terraced restoration marshes and nearby reference marshes in Galveston Bay in terms of the percent aquatic edge (Feagin and Wu, 2006). Terracing—a method that uses existing bottom sediments to form terraces or ridges at marsh elevation—appears to be an efficient strategy for the sole purpose of creating aquatic edge for fisheries production, but it appears not to match other aspects of reference marshes in terms of their habitat composition or spatial configuration (Feagin and Wu, 2006).

References Cited

Craft, C., Reader, J., Sacco, J.N., and Broome, S.W., 1999, Twenty-five years of ecosystem development of constructed *Spartina alterniflora* (Loisel) marshes, Ecological Applications, 9, 1405–1419.

Day, J.W., Jr.; Barras, J.; Clairain, E.; Johnston, J.; Justic, D.; Kemp, G.P.; Ko, J.Y.; Lane, R.; Mitsch, W.J.; Steyer, G.; Templet, P., and Yañez-Arancibia, A., 2005, Implications of global climate change and energy cost and availability for the restoration of the Mississippi Delta. Ecological Engineering, 24(4),253–265.

Feagin, R. A., and Wu, X. B., 2006, Spatial Pattern and Edge Characteristics in Restored Terrace Versus Reference Salt Marshes in Galveston Bay. Wetlands, 26(4), 1004–1011.

Galveston Bay Foundation, 2014, Retrieved from http://galvbay.org/.

Gedan, K.B., Silliman, B.R., and Bertness, M.D., 2009, Centuries of human-driven change in salt marsh ecosystems, Annual Review of Marine Science, 1, 117–141.

Lotze, H.K., 2010, Historical reconstruction of human-induced changes in U.S. estuaries, In: Gibson, R.N., Atkinson, R.J.A., and Gordon, J.D.M. (eds.), Oceanography and Marine Biology: An Annual Review, Volume 48. Boca Raton, Florida: CRC Press, pp. 267–338.

Moulton, D.W., Dahl, T.E., and Dall, D.M., 1997, Texas Coastal Wetlands: Status and Trends, mid-1950s to early 1990s, U.S. Fish and Wildlife Service, Albuquerque, New Mexico, 32 p.

National Fish and Wildlife Foundation (NFWF), 2012, Retrieved from http://www.nfwf.org/gulf/Documents/NFWF_projects_Texas.pdf.

National Oceanic Atmospheric Administration (NOAA), 2014, Retrieved from https://restoration.atlas.noaa.gov/src/html/index.html.

Staszak, L. A., and Armitage, A. R., 2013, Evaluating Salt Marsh Restoration Success with an Index of Ecosystem Integrity. Journal of Coastal Research, 287, 410–418.

Texas General Land Office (Texas GLO), 2013, The Texas Coast: Shoring Up Our Future, http://www.shoringuptexas.org/.

Texas Parks and Wildlife Department (TPWD), 2011, The Dangers of Invasive Species, http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_br_w7000_0942.pdf.

U.S. Census Bureau, 2010, Coastline Population Trends in the United States: 1960 to 2008, P25-1139, http://www.census.gov/prod/2010pubs/p25-1139.pdf.

U.S. Fish and Wildlife Service, 2012, Texas Coastal Program brochure, U.S. Fish and Wildlife Service Coastal Program, http://www.fws.gov/southwest/texascoastal/index.html.

White, W.A., T.A. Tremblay, E.G. Wermund, Jr., and L.R. Handley, 1993, Trends and Status of Wetland and Aquatic Habitats in the Galveston Bay System, Webster, Texas, 225 pages.

Figure 1. Texas state map.

Figure 2. Most recent status of Texas emergent wetlands, 1991-2011.