*Coastal Wetland Loss Analysis*

# Summary Findings of Pilot Studies Conducted by the Interagency Coastal Wetlands Workgroup

When the U.S. Fish and Wildlife Service (FWS) National Wetlands Status and Trends report for 1998-2004 was released, it highlighted some positive wetland trends including a reduction in wetland losses on a national basis and even a net gain of wetlands in some areas. However, markedly different trends were seen in coastal watersheds (i.e., a USGS 8-digit cataloging unit or part of a cataloging unit that drains to an ocean, estuary, or bay and contains a tidal water body). Coastal watersheds exhibited a net loss of about 60,000 acres per year from 1998-2004, and this loss rate increased to 80,000 acres per year between 2004 and 2009. In response to concerns about the rate of wetland loss in coastal watersheds, the Interagency Coastal Wetlands Workgroup[1] (ICWWG) was convened to identify the causes of this wetland loss, as well as strategies to reduce and ultimately reverse the loss.

As part of this effort, the ICWWG conducted a series of pilot studies in four coastal watersheds distributed across the country—San Francisco, CA; Galveston, TX; Cape Fear, NC; and Tampa, FL—for the time period of approximately 1996-2010. Using geospatial information from the National Oceanic and Atmospheric Administration (NOAA) Coastal Change Analysis Program (C-CAP), the FWS National Wetlands Inventory (NWI) Program, and Google Earth, as well as U.S. Army Corps of Engineers' permitting data, and interviews with local-area staff, a deeper understanding of the factors behind coastal wetland loss has been gained. Three main drivers of wetland loss in these watersheds were identified: 1) rapid development, both urban and suburban; 2) some drainage practices that are associated with silviculture; and 3) insufficient restored wetland acres to offset wetland acres lost in coastal watersheds.

## The value of coastal wetlands

Coastal wetlands are among the most productive ecosystems on Earth, providing critical services to society and habitat for wildlife. Wetlands help improve water quality by filtering runoff from residential, agricultural, and urban areas; they can also buffer coastal areas against storm and wave damage and help stabilize shorelines. The economic value of coastal habitats is estimated to be in the hundreds of billions of dollars[2].

## Wetland definition

For this study, a biological definition of "wetlands" was used. The biological definition of "wetland" requires the presence of wetland hydrology alone and/or in combination with wetland vegetation or wetland soils. This is different from wetlands as defined by the federal CWA regulations, which require the presence of all three wetland indicators—hydrology, vegetation, and soil conditions. An additional difference between federally regulated wetlands and biological wetlands is that the CWA applies only to wetlands and other waters that are considered a "water of the United States[3]." The term "coastal wetland" refers to all wetlands located in coastal watersheds, including estuarine wetlands, tidal freshwater wetlands, and even non-tidal freshwater wetlands.

1 Chaired by the Environmental Protection Agency, also includes the Army Corps of Engineers, U.S. Fish and Wildlife Service, U.S. Geological Survey, National Oceanic and Atmospheric Administration, U.S. Department of Agriculture, and U.S. Department of Transportation.

2 Restore America's Estuaries. 2006. The Economic and Market Value of Coasts and Estuaries: What's At Stake? Pendleton, L. (ed.) 175 pp.

3 https://www.epa.gov/sites/production/files/2015-06/documents/clean_water_rule_40_cfr_230_3.pdf

## Development

### Trends

Development accounted for the majority of the wetland loss in the Cape Fear (55%), Tampa Bay (98%), and Galveston Bay (89%) watersheds. In the San Francisco Bay watershed development accounted for 39% of the wetland loss, but the remaining 61% of the loss was to barren land. Barren land is often associated with land cleared for development, so development in one stage or another was the major cause of wetland loss in the San Francisco Bay watershed as well. The pilot studies indicate that population growth, insufficient or ineffective land use planning, a lack of legal protection for wetlands, and changes in hydrology were the driving factors behind wetland loss associated with development.

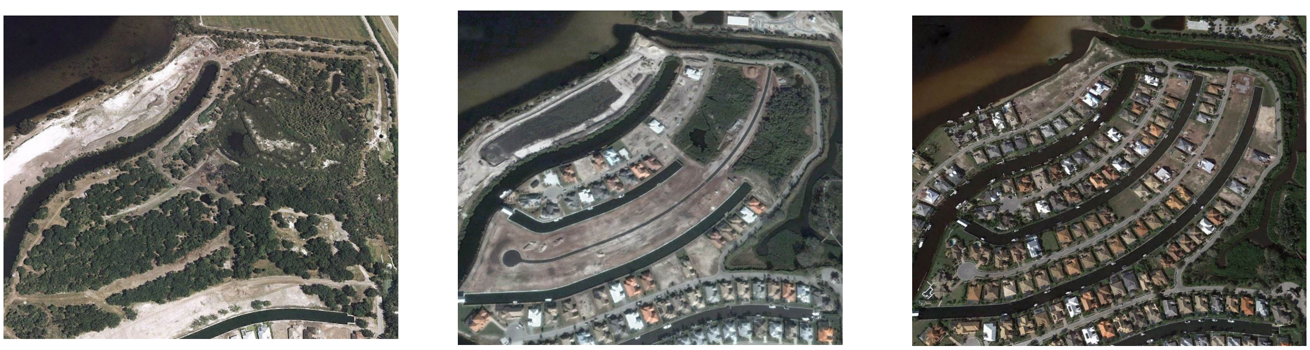
### Drivers

**Population:** Population pressures in the pilot study watersheds are intense and increasing, leading to a higher demand for housing, commercial development, and infrastructure. For example, the San Francisco Bay watershed's population grew from 2.9 million in 1995 to 3.6 million in 2010, with a projected population of 4.9 million by 2040. The Tampa Bay area grew from a population of about 1.5 million in 1995 to over 2 million in 2010, with a projected population of 3 million by 2040. New development is often constructed in farmland neighboring other developed areas which sometimes includes former wetlands. Wetlands that have been drained to allow the cultivation of crops are often very good sites for wetland restoration. Once these former wetlands have been developed, that opportunity for restoration is lost.

**Land Use Planning**: Not all of the pilot study areas had comprehensive land use plans to manage growth and protect natural resources such as wetlands. Tampa Bay and San Francisco Bay/Delta do have extensive comprehensive land use plans that integrate wetlands into planning. However, these plans are largely voluntary and their effectiveness could be improved through enhanced legal protection of wetlands.

**Legal Protection:** Section 404 of the CWA establishes a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Activities in waters of the United States regulated under this program include fill for development. In some of the pilot studies, wetlands lost to development were not regulated at the federal level under the CWA because they were not determined to be jurisdictional. In these areas, unless there are other forms of state, city, or county protections, wetlands can be lost without considering avoidance, minimization, or compensation strategies. This was a common factor for wetland loss in the Galveston Bay pilot study area.

**Changes in Hydrology:** Drought, ditching, and other local or regional factors (e.g., construction of The Intracoastal Waterway) can change hydrology making wetlands appear drier than they would under unaltered conditions. When these areas are proposed for development, landowners may not be aware that their property contains wetlands and may fail to seek permits, leading to uncompensated and perhaps avoidable losses.



2002 2006 2016

*Tampa area wetland fill for development. Maps accessed through Google Earth Pro, data © USGS (2002), DigitalGlobe (2006), and Landsat/Copernicus (2016).*

### Conclusions and need for recommendations

All pilot studies indicated that development was the largest component of wetland loss in coastal watersheds. While the economic drivers underlying wetland loss are numerous, the current trajectory points to continued population growth and further urban expansion in coastal watersheds. Reducing wetland loss in coastal watersheds will require new and intensified efforts to identify wetlands in often disturbed landscapes, apply more comprehensive legal protections, effectively compensate for unavoidable impacts, and engage local and regional agencies and individuals in developing and implementing watershed plans that support healthy coastal wetlands and the ecosystem services they provide.

## *Silvicultural Activities*

### Trends

The two FWS Wetlands Status and Trends reports for 2004-2009[4] identified change from forested wetlands to upland forested plantations as a factor in wetland loss in the southeastern United States. It is important to note that harvesting of trees alone was not considered a wetland loss, and that most forested wetlands under intensive management for wood production did not become uplands. However, a small percentage of forested wetlands appear to be lost under these circumstances, and the cumulative loss is substantial due to the large area that is affected and the long period of time over which these practices occur. Silviculture—the growing and cultivation of trees—involves different practices such as planting, thinning, harvesting, etc., and there is limited information on the effects of these activities on forested wetlands.

4 Dahl, T.E. 2011. Status and trends of wetlands in the conterminous United States 2004 to 2009. U.S. Department of the Interior; Fish and Wildlife Service, Washington, D.C. 108 pp.

T.E. Dahl and S.M. Stedman. 2013. Status and trends of wetlands in the coastal watersheds of the Conterminous United States 2004 to 2009. U.S. Department of the Interior, Fish and Wildlife Service and National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 46 pp.

The Cape Fear study area was selected to explore this topic in more detail. Based on land cover changes observed in some forested wetlands lost to development, there appeared to be a pattern of forested wetlands first converted to pine plantations and later converted to development under circumstances that did not require CWA authorization because the area was observed to lack wetland hydrology. Site visits and extensive conversations were held with local and regional wetland and forestry experts to gain a better understanding of this issue.

### Drivers

**Ditching and Draining:** In the Coastal Plain of the southeastern United States, lands in silviculture have been ditched and drained to enhance production and profitability. Ditching declined in the late 1990s and early 2000s due to changing ownership of much of the industrial forest lands in the southeast U.S. New ditches are still constructed occasionally and old ditches continue to affect drainage, although they are often not maintained. The goal of this ditching was to remove only surface water through “minor drainage.” Minor drainage should not convert wetlands to uplands, but this appears to be happening in some circumstances. Determining how and where these ditches might be causing wetlands to become uplands is extremely difficult because of a lack of long-term field monitoring of forested wetlands in silviculture. States have established Best Management Practices (BMPs) for silviculture, some of which address ditching, but even when the BMPs address ditching they only apply to ditches created after the CWA was enacted (1972).

**Drought:** In the fourteen-year period (1996–2010) studied, the Cape Fear watershed experienced drought in all but four years. Drought makes wetlands drier and thus easier to access with heavy machinery, creating the potential for additional disturbance of wetlands that might lead to these losses.

### Conclusions and need for recommendations

Wetland loss associated with intensive management of forested plantations and related drainage practices is an issue that requires further investigation. The multitude of interacting factors that result in wetland loss and associated land conversion will be challenging to quantify let alone control, but could be better accounted for within forest management plans. Clearly, improved monitoring at multiple spatial scales and more detailed analysis is needed to better support the development and implementation of enhanced silvicultural best management practices to decrease wetland vulnerability.

## *Wetland Restoration in Coastal Areas*

### Trends

C-CAP data from the pilot studies demonstrated that gains in wetland acreage, whether from restoration projects or other causes, were exceeded by wetland acreage loss. For example, in the Tampa Bay watershed, between 1996 and 2010 C-CAP showed a net loss of 33,055 acres of wetlands, despite more than 17,605 acres of wetlands that were gained through restoration. A net loss of wetlands was seen in all pilot study areas, indicating that restoration efforts were not able to keep up with losses. This trend was also seen in the FWS/NOAA Status and Trends of Wetlands in Coastal Watersheds reports.

### Drivers

**Wetland Acreage:** In the Tampa Bay and San Francisco Bay-Delta watersheds, local-area staff were surprised that there had been a net loss of wetlands, given the amount of wetland restoration projects in those areas. However, wetland restoration projects are often conducted in existing wetlands that are badly degraded (instead of areas that are no longer wetlands). Restoration of these areas is important because it increases wetland function. However, restoration of existing wetlands does not increase wetland acreage. Therefore, restoration projects in former wetlands are also important since they result in a gain of wetland acreage as well as function.

**Cost of Restoration in Coastal Watersheds:** While the pilot studies did not examine the cost of wetland restoration in coastal watersheds, land prices and construction costs are generally highest in coastal areas, which can make restoration in coastal areas much more expensive than restoration in other areas. When funding is limited or there are pressures to restore the largest amount of wetlands possible, restoration of non-coastal wetlands is often preferred over restoration of coastal wetlands, creating an imbalance in the proportion of restoration in coastal versus non-coastal areas. This imbalance is exacerbated by the fact that wetland losses are more concentrated in coastal watersheds.

### Conclusions and need for recommendations

Loss of coastal wetlands has far outpaced restoration efforts. The demand to develop land in coastal watersheds will only increase with time as the coastal population continues to increase and as a result, coastal wetlands are at increasing risk of loss. There is a great need to ensure that compensatory mitigation and voluntary restoration efforts are replacing wetland acres as well as function, and that the types and location of wetlands being restored are commensurate with wetlands being lost.

# Additional Findings

## Sand and Gravel Mining

Sand and gravel mining is regulated under the CWA where there is a discharge of pollutants, including dredged or fill material, into waters of the United States. However, if the excavation is conducted without a discharge of dredged or fill material, then the activity is not regulated under Section 404 of the CWA. In Galveston, mining operations are being designed to excavate without resulting in a regulated discharge. There are no requirements that wetlands mined this way be restored, which has led to a significant loss of palustrine forested wetlands, often leaving open water pits in their place. These open water pits do not provide the same ecological services as the previous wetland type.

## Mapping and Monitoring

The pilot study process highlighted an overall need for the continued collection of wetland maps and monitoring data. Wetland maps and monitoring data—including NWI Wetlands Status and Trends, C-CAP, and NWI Inventories of Change—were instrumental in formulating the findings and recommendations of this report. These datasets vary in spatial and temporal resolution, and, for this reason, provide complementary information that can be paired to best address natural resource management needs. For example, C-CAP data are collected in 30 meter pixels, and are updated every 5 years, which provides a good screening level for wetland changes over larger geographies, but limits their utility for examining change within individual parcels of land. On the other hand, NWI data are collected at the spatial resolution necessary to examine these parcel-scale changes and were used in these pilot studies to supplement C-CAP data. However, NWI change data were not available for the entire study area and had a more limited temporal resolution.

In order to effectively manage complex and dynamic resources like wetlands in coastal watersheds it is important that wetland maps and monitoring data are collected regularly at multiple spatial and temporal resolutions. Ideally these efforts would be coordinated to enhance data quality, reduce production costs, and best support the need for actionable information. Landscape scale wetland maps and monitoring data are most effective for decision support when coupled with on-the-ground monitoring so that geospatial data can be validated and best interpreted. Landscape scale mapping and monitoring along with field data collection are needed to better understand the extent of wetland loss and change, as well as the drivers and implications of these alterations.


*National Wetland Inventory Map: U.S. Fish and Wildlife Service National Wetland Inventory (NWI) geospatial dataset overlaid on a true color aerial photograph. Polygon color indicates NWI classification code type (dark green = palustrine forested; light green = palustrine emergent; blue = palustrine unconsolidated bottom). Complete NWI classification codes are included for each polygon. For a detailed explanation of codes, please visit: https://www.fws.gov/wetlands/Data/Wetland-Codes.html.*