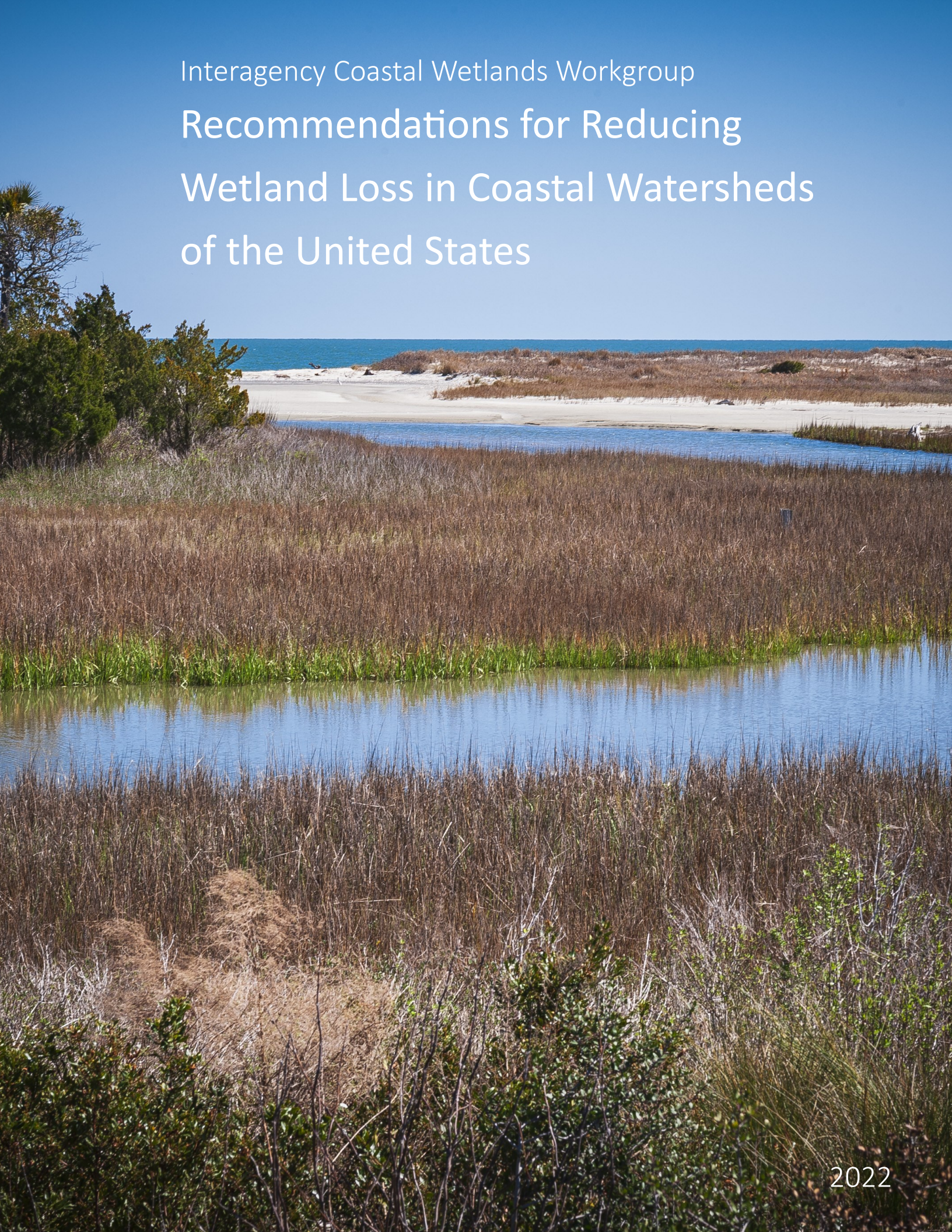
Interagency Coastal Wetlands Workgroup

Recommendations for Reducing Wetland Loss in Coastal Watersheds of the United States



2022

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This report was prepared by the Interagency Coastal Wetlands Workgroup

Chair

John Goodin, Environmental Protection Agency

Writing Team

The writing team consisted of Interagency Coastal Wetlands Workgroup (ICWWG) members from the National Oceanic and Atmospheric Administration (Susan-Marie Stedman), the U.S. Army Corps of Engineers (Jae Chung and Michelle Mattson), the U.S. Environmental Protection Agency (Jennifer Linn, Dominic MacCormack, Amanda Santoni, and Sara Schwartz), and the U.S. Fish and Wildlife Service (Megan Lang).

Members/Participants (*in alphabetical order*)

Samantha Brooke, U.S. Fish and Wildlife Service (FWS); Jae Chung, U.S. Army Corps of Engineers (USACE), Institute for Water Resources (IWR); Lynn Copeland, U.S. Geological Survey (USGS); Chris Darnell, FWS; Paul Gagnon, American Association for the Advancement of Science (AAAS) Fellow at USACE; Paul Gellerstedt, U.S. Department of Agriculture Forest Service (USFS); Nate Herold, National Oceanic and Atmospheric Administration (NOAA); Ken Kriese, Natural Resources Conservation Service (NRCS); Megan Lang, FWS; Jennifer Linn, EPA; Dominic MacCormack, EPA; Michelle Mattson, USACE IWR; Michael McDavit, EPA; Daniel McInnis, USFS; Kate Melanson, AAAS Fellow at EPA; Emily Parker, Oak Ridge Institute for Science and Education (ORISE) Fellow at EPA; Jonathan Phinney, FWS; Grace Robiou, EPA; Mike Ruth, Federal Highway Administration; Amanda Santoni, EPA; Sara Schwartz, EPA; Katherine Sheppard, NOAA; Susan-Marie Stedman, NOAA; Jan Surface, NRCS; Lenore Vasilas, NRCS; and Bill Wilen, FWS.

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Photograph on cover: Bull Island, South Carolina. Credit: U.S. EPA.

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Mangroves in Oleta River State Park, Florida.
Credit: Haley Capone. Used with permission.

Executive Summary

Between 1998 and 2004, an estimated 59,000 acres of coastal freshwater and saltwater wetlands in watersheds of the Atlantic and Gulf of Mexico were lost on average each year. From 2004 to 2009, this rate increased to 80,000 acres lost on average each year. In response to concerns about this rate of loss, the Interagency Coastal Wetlands Workgroup (ICWWG) was formed to help identify the causes of these losses and to develop strategies to address them.

This document presents recommendations, informed by previous wetland evaluations and discussions with state watershed experts, that aim to reduce and reverse the loss of wetlands in coastal watersheds. The recommendations are organized around five main themes: increasing the acreage of wetlands restored in coastal watersheds; reducing loss of coastal wetlands to development; reducing loss of coastal wetlands associated with silviculture in the Southeast; supporting the collection, enhancement, and dissemination of landscape-scale wetland monitoring data; and conducting targeted outreach. Each of these five themes contains a set of recommendations which are further broken down into potential actions. The recommendations are for program managers, non-governmental organizations, and government staff (federal, state, tribal, local, and regional) involved in coastal wetland and watershed management. In order to implement these recommendations, these entities may need to engage with additional stakeholders. The intent of this document is to help forge cooperation and build capacity to reduce coastal wetland losses nationwide. These recommendations are voluntary, and there is no regulatory obligation to implement them.

Evaluations of coastal watersheds in different portions of the conterminous United States, including an in-depth analysis of the status and trends of coastal wetland loss, form the basis of these recommendations. These evaluations involved workshops with local experts to understand the drivers of loss, successful approaches to managing loss, and remaining needs. Geospatial data were collected to qualitatively assess the amount of loss and the drivers of loss. These studies culminated in a series of Coastal Wetland Reviews[1] and the Summary Findings of the Pilot Studies.[2] It is important to note that these studies used the Cowardin definition of wetlands,[3] rather than the regulatory definition used to implement the Clean Water Act.

The ICWWG consists of representatives from the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration, the U.S. Geological Survey, the Natural Resources Conservation Service, and the Federal Highway Administration. The ICWWG commits to engage partners to build off these recommendations and to develop actionable next steps that can be undertaken in collaboration.

[1] ICWWG, 2013.

[2] ICWWG, 2017.

[3] Cowardin et al., 1976. As adopted by FGDC, 2013.

Purpose

The Interagency Coastal Wetlands Workgroup (ICWWG) is a partnership between seven federal agencies: U.S. Environmental Protection Agency (EPA), U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA), U.S. Geological Survey (USGS), Natural Resources Conservation Service (NRCS), and Federal Highway Administration (FHWA). The ICWWG was formed to reduce and reverse the trend of wetland loss in coastal watersheds in the United States. The workgroup investigates the underlying causes of wetland loss, recommends policies and programs, disseminates tools and strategies, and creates a better public understanding via education and outreach.

This report is a compilation of targeted strategies and recommendations intended to forge enhanced cooperation among entities involved in coastal wetland conservation and restoration, and to build capacity to reduce the net loss of coastal wetlands nationwide. The recommendations build on research conducted and policies evaluated during the past several years by the involved agencies and is intended for program managers in government agencies at all levels (federal, state, tribal, local, and regional), non-governmental organizations, and communities with equities in coastal watershed management. The results of the foundational research can be found in the Coastal Wetland Reviews[4] and the Summary Findings of the Pilot Studies.[5]

US Army Corps of Engineers

[4] ICWWG, 2013.
[5] ICWWG, 2017.

Background

Coastal Wetlands and Loss

Wetlands in coastal watersheds are among the most productive ecosystems on Earth, providing critical services to communities and wildlife. The term "coastal wetland" refers to all wetlands located in coastal watersheds,[6] including estuarine wetlands, tidal, and non-tidal freshwater wetlands.

Both saltwater and freshwater coastal wetlands are integral parts of coastal ecosystems. Coastal wetlands provide spawning grounds, nursery protection, shelter and food for fish, shellfish, birds, and other wildlife. More than half of the fish caught for sport or sale in the United States depend on estuaries and their coastal wetlands at some point in their life cycles.[7] The nation's coastal wetlands also provide resting, feeding, and breeding habitat for 75 percent of waterfowl and other migratory birds,[8] and nearly 45 percent of the nation's endangered and threatened species are dependent on coastal habitats.[9] 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, help stabilize shorelines, and sequester large amounts of carbon. The economic value of coastal habitats is estimated to be in the hundreds of billions of dollars.[10]

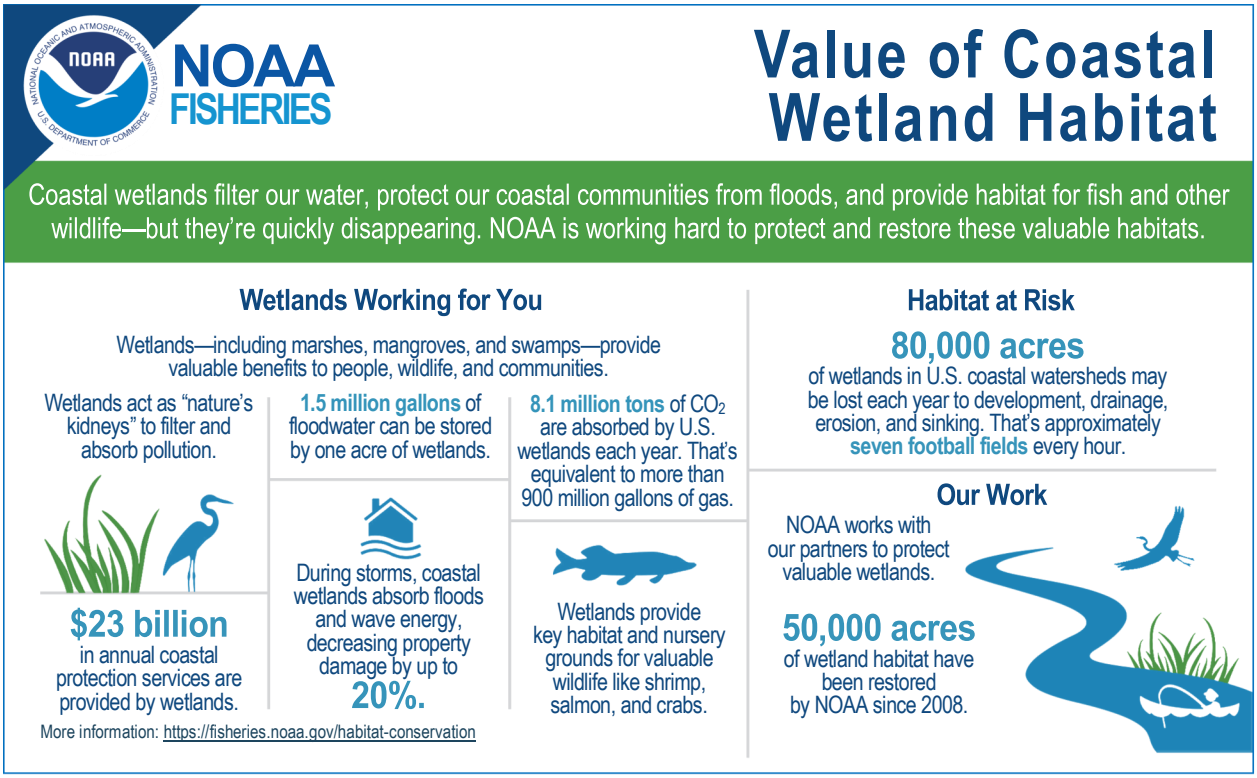

Figure 1. Infographic depicting the valuable benefits that wetlands provide to people, wildlife, and communities. Image courtesy of NOAA.

[6] 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 extend inland to the farthest extent of the 8-digit Hydrologic Unit (as defined by the USGS) that contains head of tide.
[7] Lellis-Dibble et al., 2008. As cited in Dahl and Stedman, 2013.
[8] EPA, 2005. As cited in Dahl and Stedman, 2013.
[9] USFWS, 1995.
[10] Restore America's Estuaries, 2006.

Wetlands in coastal watersheds are lost through erosion, subsidence, filling, dredging, draining, and other actions, both natural and human. They are often located in areas of high human activity (population densities in coastal counties are about five times greater than those of non-coastal counties) and those wetlands closest to the coast are in areas of high energy (winds, waves, and currents). Coastal wetland gains can occur through restoration and creation, changes in coastal geomorphology, and in response to changing hydrology.

The conterminous United States has lost about half of the wetland acreage that existed prior to European colonization.[11] The Clean Water Act (CWA) and other federal and state laws that protect wetlands have decreased the amount of loss, and restoration programs have reversed some losses. Nationally, trends for the most recent time periods included in the USFWS Wetlands Status and Trends studies (1998 to 2004 and 2004 to 2009) show a marked decrease in overall wetland loss. However, wetlands losses in coastal watersheds specifically have increased over time. Between 1998 and 2004, an estimated 59,000 acres of coastal freshwater and saltwater wetlands in watersheds of the Atlantic and Gulf of Mexico were lost on average each year.[12] From 2004 to 2009, this rate increased to an estimated average of 80,000 acres of wetlands lost in coastal watersheds each year.[13]

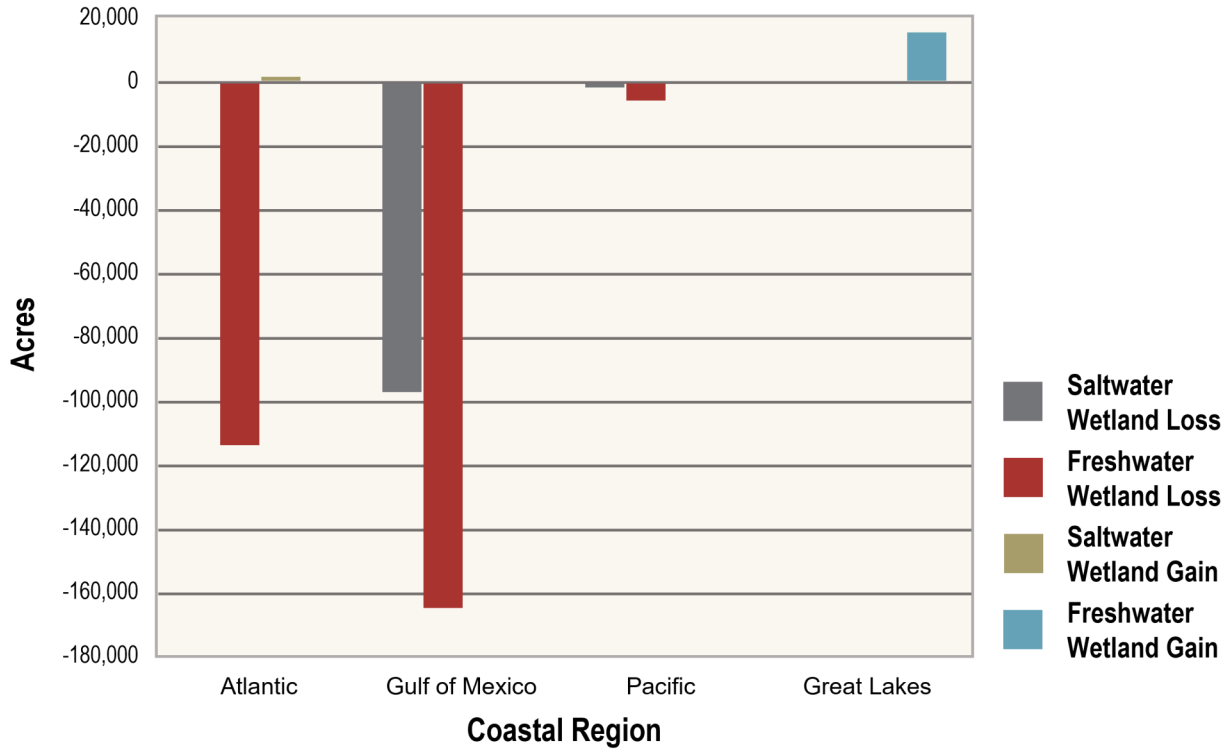

Figure 2. Wetland gains and losses in the coastal watersheds of each coastal region between 2004 and 2009, as depicted in Dahl and Stedman, 2013.

[11] Dahl, 1990.
[12] Stedman and Dahl, 2008.
[13] Dahl and Stedman, 2013.

Formation of the ICWWG

In response to concerns about the rate of wetland loss in coastal watersheds, the Interagency ICWWG was formed in 2009 to help identify the causes of these losses as well as to identify strategies to address them. The ICWWG consists of representatives from the EPA, USACE, USFWS, NOAA, USGS, NRCS, and FHWA. The overarching goal of the ICWWG is to reduce and reverse net loss of wetlands in coastal watersheds of the United States.

Initially, the ICWWG held seven regional workshops involving local, state, and federal stakeholders to identify factors driving wetland loss, recognize successful approaches for addressing this loss, and reveal remaining information needs. Findings from the workshops were released in 2013.[14]

Figure 3. Timeline showing the formation of the ICWWG and the process leading up to the release and implementation of the recommendations in this document.

Coastal Wetland Loss Pilot Studies

The ICWWG subsequently conducted a series of coastal wetland loss pilot studies to assess watershed-specific data and identify actions federal agencies can take in coordination with state, tribal, regional, and local agencies to improve management of coastal wetlands and reduce losses nationwide.

The pilot studies were conducted in four coastal watersheds along the Atlantic, Gulf of Mexico, and Pacific coasts: Cape Fear River, North Carolina; Tampa Bay, Florida; Galveston Bay, Texas; and San Francisco Bay-Delta, California. These locations were selected after considering numerous factors such as rate of wetland loss, projected population growth, diversity of wetlands, diversity of wetland loss drivers, and availability of reliable ancillary data. All four watersheds were selected because they were experiencing high or moderate coastal wetland loss, and they were predicted to experience further loss due to factors like anticipated population growth and current wetland density. These sites were also selected because there were engaged local-area federal and state agency staff that could verify the findings and suggest follow-up actions.

The ICWWG used geospatial information from NOAA's Coastal Change Analysis Program (C-CAP) to identify areas within the study sites that likely changed in land cover (including wetlands to uplands) between 1996 and 2010. This time period was selected because the available and most reliable data encompassed 1996 to 2010 when the pilot studies began in 2013. The studies also drew upon information from the USFWS National Wetlands Inventory (NWI) Program, USACE permitting data, and interviews with local-area state and federal staff to provide the ICWWG with an understanding of the factors behind coastal wetland loss.

[14] ICWWG, 2013.

The pilot studies used the Cowardin definition of wetlands[15] to align with the available trend data and provide insights on the patterns of wetland loss in an ecological context. This definition of wetlands is different from wetlands as defined by CWA regulations. CWA regulations generally require the presence of all three wetland factors: wetland hydrology, dominance of hydrophytic vegetation, and hydric soil conditions. The Cowardin definition of wetlands requires the presence of wetland hydrology and, if soils and/or vegetation are present at a site, they must be hydric or hydrophytic, respectively, to confirm wetland status. An additional difference between wetlands that are regulated under the CWA and Cowardin defined wetlands is that the CWA applies only to wetlands that meet the regulatory definition and are found to be "waters of the United States."[16]

Findings from the Pilot Studies

The Summary Findings of the Pilot Studies was published in July 2017.[17] Three main drivers of wetland loss in the study watersheds were identified: 1) intense development pressure, both urban and suburban, 2) some practices associated with silviculture in the Southeast, and 3) an insufficient amount of restored wetland acres in coastal watersheds to offset coastal wetland acres lost.

Limitations of the Pilot Studies

The pilot studies' findings are intended to provide insights regarding coastal wetland loss and potential solutions outside of the pilot areas; however, differences in landscape characteristics as well as state and local policies and socioeconomic drivers may limit the applicability of the findings to other watersheds. The pilot studies' findings cannot be used to evaluate the success of specific wetlands management programs with different definitions of wetlands (e.g., stormwater management programs, CWA Section 404).

Although the time-period used for the pilot studies is now a decade old, it represents the most recent data of its type, the same drivers of wetland loss exist, and the conclusions based on these studies are still relevant today.

[15] Cowardin et al., 1976. As adopted by FGDC, 2013.

[16] "Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material," *CFR*, title 40 §230.3.

[17] ICWWG, 2017.

Recommendations

The insights gathered from the pilot studies are the basis for the recommendations in this report. The recommendations are intended to forge enhanced cooperation between entities involved in coastal wetland conservation and restoration, and build capacity to reduce the loss of coastal wetlands nationwide. They are for program managers in government agencies at all levels (federal, state, tribal, local, and regional), non-governmental organizations, and communities with equities in coastal watershed management. In order to implement these recommendations, these entities may need to engage with additional stakeholders. The recommendations are intended to apply to coastal wetlands generally and are not intended to address specific regulatory programs (i.e., implementation of the CWA Section 404 program or compensatory mitigation as implemented under the EPA and the Corps' regulations).[18] Further, some of these recommendations are more specific while others enumerate areas of work that require further exploration.

[18] For an analysis on CWA compensation see: National Research Council, 2001.

Restoration plantings in place at North Street Salt Marsh in Fairhaven, Massachusetts. Credit: U.S. EPA.

Increase the Acreage of Wetlands Restored in Coastal Watersheds

A net loss of wetlands was seen in all four pilot study areas, indicating that restoration efforts were not able to keep up with losses. For example, between 1996 and 2010, the Tampa Bay watershed experienced a net loss of 33,055 acres of vegetated wetlands (17,605 acre gain — 50,660 acre loss),[19] and the San Francisco Bay-Delta watershed experienced a net loss of 1,096 acres (3,816 acre gain - 4,912 acre loss).[20]

Four factors contribute to the net loss of wetland area:

First, not all wetland restoration projects increase wetland acreage. In many cases, restoration is conducted in existing wetlands, which results in improved ecosystem functions and services, but does not increase wetland acreage. This type of restoration is known as rehabilitation. Only when restoration is completed in areas that were once wetlands but are now uplands (often called "former wetlands"), do restoration activities result in increased wetland acreage (as well as increased wetland functions and services). This type of restoration is referred to as re-establishment. Previous analysis suggests that rehabilitation, which provides no acreage gain, is more common than re-establishment, which does provide a gain.[21] Exact values of acreage gains are not available because the tracking of different kinds of restoration varies within and between practitioners and agencies.

Second, there is often an imbalance between where restoration is occurring and the location of the loss. Approximately one-third of the wetlands in the lower 48 states are in coastal watersheds.[22] Although the majority of the loss is occurring in coastal watersheds, the majority of the gain is occurring in inland watersheds.[23, 24] This gain results from restoration effects as well as natural and other causes. One potential contributor is that siting for restoration projects is influenced by land acquisition and implementation costs, which tend to be higher in coastal than inland areas.

Third, uncompensated wetland losses may occur as a result of unregulated activities. For example, some sand and gravel mining may be conducted in wetlands subject to CWA jurisdiction using methods that do not redeposit dredged material other than incidental fallback.[25] These operations may be conducted without a CWA Section 404 permit and may not require compensatory mitigation. Where there is only incidental fallback, operations may still result in ecological impacts that alter the wetland's structure, function, and services.

Finally, some coastal wetlands are not considered waters of the United States and therefore are not federally regulated. Unless state, tribal, or local programs protect these resources, activities that result in loss may be unregulated or unmitigated.

[19] ICWWG, 2017.
[20] ICWWG, Coastal Wetland Pilot Project San Francisco Bay-Delta Coastal Watershed, CA Summary Report.
[21] National Research Council, 2001.
[22] Stedman and Dahl, 2008.
[23] Dahl and Stedman, 2013.
[24] Dahl, 2011.
[25] "Permits for Discharges of Dredged or Fill Material into Waters of the United States," CFR, title 33 §323.2.

To address the net loss of wetlands that is occurring despite active restoration efforts, the ICWWG recommends:

- Increase the amount of restoration in coastal watersheds (1.1)
- Enhance the ability to track restored wetland acres and function (1.2)
- Enhance the reclamation and restoration of former sand and gravel mines (1.3)

1.1 Increase the amount of restoration in coastal watersheds.

Increasing restoration in coastal watersheds is an important step to ensuring these habitats continue to exist. While increasing restoration will not stop gross losses, it can play an important role in slowing net loss. This may be achieved through various efforts such as grant programs, watershed management plans, guidance, and mitigation. We recommend to:

1.1.1 Explore ways to locate more wetland restoration projects (both re-establishment and rehabilitation) in coastal areas using existing grant programs.

This could include exploring modifications to application criteria to weigh coastal site selection more heavily than inland sites or creating separate grant categories to focus on coastal areas or wetland types.

1.1.2 Identify opportunities to expand upon or create new grant programs or incentives to encourage voluntary restoration in coastal watersheds.

In addition to working within the boundaries of existing programs (Recommendation 1.1.1.), explore the opportunity to expand existing grant programs to new areas or partners.

1.1.3 Fund or incentivize the development of robust watershed management plans or similar landscape planning documents that include identifying desirable restoration opportunities.

For example, the Great Lakes Coastal Wetland Restoration Assessment, a joint initiative between the USGS and New College Florida, supports local land manager decision-making and uses the principles of geodesign to identify and assess areas with the most coastal wetland restoration potential.[26]

1.1.4 Consider developing guidance or informational products that encourage compensatory mitigation for impacts in coastal watersheds to replace the acreage lost at the impact site.

For example, develop products to assist permittees that reiterate the preference in the 2008 Mitigation Rule for in-kind compensation, and for compensation for impacts to aquatic resources in coastal watersheds to occur in coastal watersheds. Additionally, these products should express a preference that compensation projects for impacts to coastal wetlands replace lost wetland area as well as lost functions.

1.1.5 Incentivize large-scale compensatory mitigation partnership programs.

This could be especially important in underserved areas such as near-coast urban areas.

[26] USGS and New College Florida, "Great Lakes Coastal Wetland Restoration Assessment."

Incentives could explore cooperation structures among government and non-government entities to use all available resources and authorities. For example, use state-owned intertidal and subtidal areas for mitigation banks; provide tax incentives for locating mitigation banks near the coast; or use state CWA Section 401 certification authority to address mitigation for federally permitted coastal wetland impacts (perhaps through appropriate mitigation in the watershed where the impact occurred).

1.2 Enhance the ability to track restored wetland acres and function.

Using the same terminology and classification systems, as well as employing remote sensing methods, are important techniques to accurately track natural community changes across diverse regions and jurisdictions. We recommend to:

1.2.1 Federal agencies that fund wetlands restoration and conservation, to track results using the restoration approach definitions contained in the Final Rule for Compensatory Mitigation Losses of Aquatic Resources (2008).[27]

This will allow federal agencies to distinguish between areal gains and functional gains, enhance reporting consistency across agencies, and enable aggregation of data on a national basis. In 2000, the White House Wetlands Working Group established definitions of restoration and mitigation approaches: establishment, re-establishment, rehabilitation, enhancement, and preservation of wetlands and other aquatic resources (see Appendix A).[27] These definitions were adopted by several federal agencies in 2000[28] and codified by the EPA and the Corps in the Final Rule for Compensatory Mitigation for Losses of Aquatic Resources in 2008. Federal agencies have incorporated these definitions into their programs to varying degrees. At a minimum, ICWWG member agencies should work toward consistently reporting wetland conservation accomplishments broken out by category, with particular attention to distinguishing between rehabilitation (gains in function) and establishment/re-establishment (gains in area and functions). The federal agencies should also work with state agencies, local governments, and other entities engaged in wetland restoration to encourage them to use these same definitions for consistency.

1.2.2 Use a common classification system for accurate wetland data tracking and sharing across federal, state, and local agencies.

The Cowardin *Classification of Wetlands and Deepwater Habitats of the United States*[29] has been used by several federal agencies and initiatives for non-regulatory mapping purposes, including the Federal Geographic Data Committee (FGDC), the USFWS NWI program, NOAA's C-CAP program, the NRCS National Resources Inventory, and the EPA. Additionally, the Corps uses this classification in their databases: the Operations and Maintenance Business Information Link Regulatory Module (ORM) for tracking permitting and compensatory mitigation activity, and the Regulatory In-Lieu Fee and Bank Information Tracking System. Other entities at the federal, state, and local level should consider

[27] "Compensatory Mitigation for Losses of Aquatic Resources," CFR, title 33 §332.2.

[28] EPA, Corps, FWS, NOAA, USDA, FEMA, DOT, and DOE.

[29] Cowardin et al., 1979. As adopted by FGDC, 2013.

adopting this classification system to increase the consistency and accuracy of tracking wetland losses and gains.

1.2.3 *Develop minimum level guidance for geospatial tracking of parcel-scale wetland restoration. This guidance should be shared with state agencies and local governments to improve accuracy of geospatial data acquired by federal, state, and local agencies.*

The USACE South Pacific Division and several districts within the USACE have mapping and drawing guidelines that could be used as examples to develop minimum standards or guidelines that could be formally adopted by the broader regulatory agency and federal partners. At a minimum, the ICWWG agencies that fund wetland conservation projects should agree to require funding recipients to report a georeferenced digital footprint (polygon) or the latitude and longitude of points representing the extent (e.g., corner points) of each project area following agreed upon minimum standards. These standards should include the acres of wetlands or other aquatic resources established, re-established, rehabilitated, enhanced, or preserved. Note that federal wetland mapping standards have been adopted by the FGDC[30] (see section 4.3); the degree to which these standards meet the needs of parcel level wetland restoration tracking could also be explored.

1.2.4 *Explore creating or engaging existing regional working groups that can coordinate with states, local governments, and restoration practitioners.*

These regional groups could review practices and work to align their aquatic resource restoration and mitigation definitions, classification and definition of "wetlands," geospatial tracking standards, data reporting requirements, and local ordinances that regulate or otherwise protect aquatic resources (see also 2.4 and 2.5.2). Short trainings or workshops on the definitions, their uses by regulatory agencies to date, and the application of the Cowardin system could be part of the working group's duties to improve consistency when reporting wetland impacts and restoration accomplishments. When GIS minimum mapping and drawing standards are adopted by federal agencies, trainings should be made available. Alignment between identification/classification systems can be a challenge; governments will need to develop strategies to navigate those differences to ensure that relevant data and findings can be easily translated for consistent analysis and monitoring.

1.3 Enhance reclamation and restoration of former sand and gravel mines.

The Galveston pilot study showed that when sand and gravel mining activities occur in coastal watersheds, this activity can be a large contributor to the loss of coastal wetlands. This pilot study also showed that there was very little reclamation of federally unregulated sand and gravel mines resulting in the loss of wetlands to open water pits. We recommend to:

[30] FGDC and USFWS, 2009.

1.3.1 Identify federal regulatory authorities over specific construction mining methods, compile an inventory of existing state regulatory authorities, and identify best management practices for sand and gravel mine operations and reclamation (with a goal of restoring naturally functioning habitat).

Since sand and gravel mining occur across the nation, there is an opportunity to encourage consistency through activities associated with highly valuable wetland and aquatic natural resources. State coordination is critical to achieving meaningful progress in implementing reclamation of sand and gravel mines within coastal watersheds.

1.3.2 Develop voluntary measures for incentivizing mine reclamation using minimal construction and post-mining best management practices that allow for natural restoration of wetland functions.

This could be used in states without sand and gravel mining guidelines. In states with mining regulations, a gradient of best management practices could be identified from minimal to full restoration of natural wetland functions.

1.3.3 Inventory former sand and gravel mines that have been abandoned without regulatory or reclamation requirements and assess the potential for wetland mitigation banking, advanced mitigation planning, or voluntary restoration of these resources.

Abandoned mines may present excellent opportunities for bankers to purchase affordable land or secure the land use rights, provided they address all applicable requirements.

Urban sprawl can mean development moves into coastal wetland areas. Credit: USFWS/Ryan Hagerty.

Reduce Loss of Coastal Wetlands to Development

In the coastal wetland pilot studies, development accounted for a significant percentage of the total net wetland loss in the watershed: 55 percent in Cape Fear, 98 percent in Tampa Bay, 89 percent in Galveston Bay, and 39 percent in San Francisco Bay-Delta. 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.

Coastal wetland loss due to development can be subdivided into two broad classes: those wetlands that are regulated by CWA Section 404 and those that are not. Wetlands that do not meet the definition of "waters of the United States" are not federally regulated under the CWA Section 404 program. Some states and municipalities have additional regulations in place that offer protection for wetlands.

Impacts to wetlands regulated under CWA Section 404 may require compensatory mitigation as a condition of permitting. Where impacts occur to wetlands that do not fall within the jurisdiction of CWA Section 404, these federal provisions do not apply, and wetland protection may be afforded by existing state or local regulations, new state or local regulations, and voluntary actions.

Development is a substantial component of wetland loss in the pilot watersheds and nationwide. Status and Trends reports for wetlands in the conterminous United States, including coastal wetlands, show that urban and rural development accounted for 61 percent or 140,400 acres of wetland loss from 1998 to 2004.[31] Between 2004 and 2009, the percentage of loss attributed to development dropped to 23 percent, but the acreage of that loss decreased only slightly to 128,570 acres.[32] A comparison of USACE permitting data from their automated data collection system for 1997 to 2010,[33] and C-CAP and NWI data also suggests that development is one cause of wetland loss in the pilot watersheds and that some unregulated or unauthorized loss of wetlands is likely to have occurred. However, a direct comparison is not possible due to differences in wetland classification between datasets. Furthermore, 17 out of 33 Coastal Zone Management programs cite development and fill as one of the top three stressors for coastal wetlands.[34]

[31] Dahl, 2005.

[32] Dahl, 2011.

[33] USACE, "ORM Jurisdictional Determinations and Permit Decisions."

To address the loss of wetlands to development, the ICWWG recommends:

- Improve and increase the use of voluntary programs to protect wetlands from development (2.1)
- Improve interagency coordination to protect wetlands from development and its indirect effects (2.2)
- Increase use of a broader array of federal authorities to protect wetlands from impacts of development (2.3)
- Support local planning to increase acreage of protected coastal wetlands (2.4)
- Enhance state and tribal protections for wetlands, including those wetlands that are not otherwise regulated (2.5)

2.1 Improve and increase the use of voluntary programs to protect wetlands from development.

Voluntary programs are an important aspect of wetland protection because they complement regulatory programs and can limit impacts to wetlands that are not otherwise regulated by state, tribal, or federal agencies. We recommend to:

2.1.1 Explore and expand financial incentives to promote wetland protection.

Mechanisms such as conservation easements have been successful in protecting some land from development through incentives and tax credits. There may be opportunities to support or expand existing conservation programs or develop new incentives. Federal agencies, states, and NGOs such as land trusts should intentionally coordinate to support conservation easements for coastal wetlands.

2.1.2 Facilitate incorporation of wetland components into state and local stormwater retention projects.

Retention basins could be managed to help increase and protect wetland functions and services within the basin, as well as to allow for controlled discharge of flows downstream in manners that are not erosive and more conducive to creating and maintaining stable wetland systems. This could be coordinated through voluntary long-term planning.[35] State or local governments may also choose to incorporate this premise into stormwater ordinances.

2.2 Improve interagency coordination to protect wetlands from development and its indirect effects.

Interagency coordination among federal agencies and between federal and state counterparts can help transfer valuable knowledge of wetland science and management. Lessons learned by one agency can be transferred to other agencies at federal, state, and local levels. This knowledge can help develop policies that avert losses of wetlands. We recommend to:

[34] NOAA, "The Coastal Zone Enhancement Program."
[35] EPA, 2016.

2.2.1 *Coordinate with the NRCS and state agencies to explore connections between agricultural practices and wetlands development, and provide information to agricultural land managers.*

For example, some agricultural practices may change the quality of wetlands such that less mitigation is required when there are permitted wetland impacts. This may indirectly affect the amount of mitigation if agricultural lands are developed.

2.2.2 *Investigate how state-level Coastal Zone Management Program plans could improve wetland conservation by coordinating with NOAA Office for Coastal Management (OCM) as well as state and Territory Coastal Management Programs (CMPs).*

For example, NOAA-OCM hosts an annual Project of Special Merit (PSM) competitive funding opportunity authorized under the Coastal Zone Management Act (CZMA) Section 309. The objective is to encourage each State or Territory CMP to improve its program in nine specified areas of national importance. Each PSM funding cycle selects one or two of these national enhancement area priorities and invites CMPs to develop innovative projects to further those enhancement strategies. Wetlands are identified as one of the nine priority areas that can be selected as the focus of the PSM funding program.

2.2.3 *Improve information exchange between state and tribal CWA Section 401 and 402 personnel and local and federal entities to assess the potential direct and indirect impacts of development to wetland hydrology.*

Certain activities that require CWA Section 401 certifications or 402 permits (in wetlands or proximate uplands) have the potential to alter wetland hydrology directly or indirectly. State regulatory agencies under CWA Sections 401 and 402 may have the ability to address alterations to hydrology, and coordination with those agencies can minimize effects to wetlands.

2.2.4 *Promote or fund the establishment of corridors preserved for coastal wetland migration inland in response to sea level rise and subsidence.*

This could be achieved through state or local easement programs, land use decisions, or land acquisition.

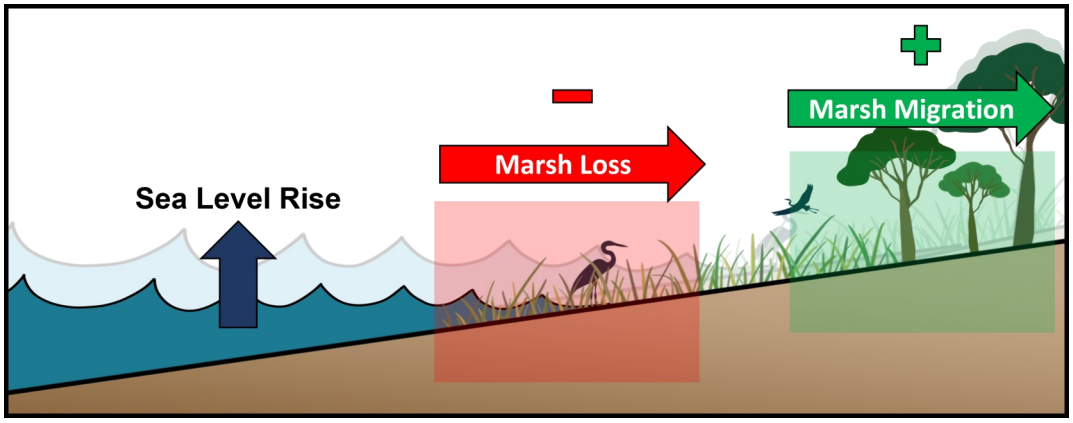

Figure 4. Diagram of habitat changes in coastal wetlands with sea level rise, including the loss of marsh to water and the migration of vegetation upland. Image by Kate Melanson.

2.3 Increase use of a broader array of federal authorities to protect wetlands from impacts of development.

The Clean Water Act and the Rivers and Harbors Act play an important role in avoiding, minimizing, and compensating for unavoidable impacts to wetlands. However, the extent of these authorities' benefits to wetlands is limited to those that meet the definition of "waters of the United States." In such situations, other authorities may offer additional opportunities to conserve wetlands, for example, by considering them as a unique hazard mitigation and resiliency resource. We recommend to:

2.3.1 Investigate the use of Federal Emergency Management Agency (FEMA) programs as tools for protecting wetlands.

Through its voluntary Community Rating System, FEMA could encourage floodplain management activities (e.g., conserving wetlands) that exceed the minimum National Flood Insurance Program requirements and offer discounted flood insurance premiums. Additionally, FEMA's Hazard Mitigation Assistance Guidance[36] promotes the restoration of floodplains and associated wetlands as effective methods for hazard mitigation planning.

2.3.2 Coordinate with floodplain experts to encourage incorporation of wetlands into floodplain planning and management.

2.3.3 Engage the U.S. Department of Housing and Urban Development (HUD) to assess the use of wetlands in their disaster recovery authorities and to promote the protection and restoration of wetlands on a broader scale.

HUD's disaster mission includes response, recovery, and mitigation, as well as support for community recovery using programs such as Community Development Block Grants and the Housing Recovery Support Function. Studies on the potential for wetlands to prevent storm damage can inform the role that HUD can play in wetland conservation. A 2018 study outlines the potential for wetlands to serve as a cost-effective approach for managing coastal flood risks.[37]

2.3.4 Engage insurance companies and climate resiliency experts in increasing the acres of wetlands considered in resiliency and protection planning.

For example, The Nature Conservancy partnered with the Lloyd's of London insurance company to publish a report assessing the role of coastal wetlands in flood damage reduction.[38]

2.4 Support local planning to increase the acreage of protected coastal wetlands.

The incorporation of wetland protection, conservation, and restoration in local planning, including county and municipal planning, can help reduce wetland loss, particularly to wetlands that are not otherwise regulated under federal or state law. Municipal land use designations guide the decisions on parcels of land within cities and counties. Additionally, the American Planning Association supports actions to achieve no overall net loss of wetland resources. We recommend to:

[36] Federal Emergency Management Agency, 2015.
[37] Reguero et al., 2017.
[38] Narayan et al., 2017.

2.4.1 Facilitate the development of comprehensive local plans to encourage informed development decisions.

Planners should explore watershed planning opportunities within larger management initiatives like Special Area Management Plans (SAMPs), coastal land use plans, as well as flood management and resilience ordinances. The National League of Cities has a land use webpage with relevant resources.[39] Additionally, the Maine Vernal Pools SAMP is a good example of a collaborative land management process that brings local, state, and federal agencies together alongside local and regional stakeholder groups to promote the strategic management of aquatic resources, proactively applying conservation principles at the landscape level. The SAMP is informed by current research, responsive to local plans for growth and development, and incorporates market mechanisms into its design.[40]

2.4.2 Develop local planning best practices for wetland protection.

Local, state, and federal entities should work together to collect and synthesize best practices for wetland protection in local planning. These best practices can facilitate knowledge transfer and can be shared as a resource for municipal planners. There are many examples of wetland protection being incorporated into planning documents through wetland ordinances, voluntary approaches, or other methods. Some model examples can be viewed on the EPA's website for Incorporating Wetlands Protection and Restoration in Planning Documents.[41] Additionally, engaging Coastal Zone Managers could assist in facilitating the connection between wetland protection and local planning.

2.5 Enhance state and tribal protections for wetlands, including those wetlands that are not otherwise regulated.

States and tribes can protect wetlands by using their state or tribal level authorities. They can add to protections provided by federal programs or compliment them by providing broader coverage. Some states already provide such coverage. For example, out of the 23 coastal states,[42] 14 have some form of dredge or fill permit program.[43, 44] The remainder use CWA Section 401 certification alone (two states) [45] or in combination with a coastal permitting program (eight states)[46] to address impacts to wetlands in the state (or a subset of wetlands such as tidal wetlands). We recommend to:

2.5.1 Continue to provide technical and financial assistance from EPA and other federal agencies for enhancing state and tribal programs broadly.

2.5.2 Support ways states and tribes can better protect coastal wetlands that are not otherwise regulated.

For example, convening new or existing workgroups to explore frameworks such as permitting mechanisms and delineation methodologies.

[39] National League of Cities, "Land Use."
[40] Calhoun et al., 2016.
[41] EPA, "Incorporating Wetlands Protection and Restoration in Planning Documents."
[42] Excluding the Great Lake states and U.S. territories.
[43] California, Connecticut, Florida, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Oregon, Rhode Island, Virginia, Washington.
[44] EPA and Army, 2020.
[45] Alaska, Hawaii.
[46] Alabama, California, Delaware, Georgia, Louisiana, Mississippi, South Carolina, Texas.

Brandon's Pond in the coastal plain of North Carolina. Photo courtesy NC Wetlands.

Reduce Coastal Wetland Loss Associated with Silviculture in the Southeast

Both the national and the coastal watershed-specific Wetlands Status and Trends reports for 2004 TO 2009 identified change from forested wetlands to upland forested plantations as the dominant factor in wetland loss in the Southeast with almost 30,000 acres lost per year.[47, 48] Notably, harvesting of trees alone was not considered a wetland loss and most forested wetlands under management for wood production did not become uplands. However, a smaller percentage of forested wetlands appear to be lost to uplands, likely due to hydrological alterations.

Cumulatively, the loss of coastal wetlands to silviculture is substantial due to the large area of coast that has been affected over a long period of time. The Cape Fear pilot 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 were multiple instances of forested wetlands converted first to pine plantations and later to development, under circumstances that may not have required CWA Section 404 authorization. Extensive conversations were held with local and regional wetland and silvicultural experts and site visits were conducted to begin to gain a better understanding of the problem.[49] Two major issues were identified during these conversations and site visits: 1) communication regarding silviculture and wetlands can be improved, and 2) the hydrology of wetlands used for silviculture is extremely complex and not fully understood.

Wetland loss associated with forested plantations or management of lands for timber production requires further investigation. Improved monitoring and analysis are needed to better support the development and implementation of silvicultural best management practices to decrease wetland vulnerability.

To address the loss of coastal wetlands associated with silvicultural activities, the ICWWG recommends:

- Increase the understanding of forested wetland loss mechanisms in areas managed for timber production (3.1)
- Improve interagency coordination and stakeholder engagement in forested wetland conservation (3.2)
- Develop or improve tools to enhance protection of forested wetlands in timber production (3.3)

[47] Dahl, 2011.

[48] Dahl and Stedman, 2013.

[49] Fifth Interagency Conference on Research in the Watersheds, 2015.

3.1 Increase the understanding of forested wetland loss mechanisms in areas managed for timber production.

The process and driving factors associated with forested wetlands changing to uplands is complex. Therefore, additional information-gathering and research is needed so that solutions can be tailored to specific drivers and ecological circumstances. We recommend to:

3.1.1. Examine why some forested wetlands in silviculture remain wetlands and others become uplands.

Given that the majority (80 percent) of the forested wetlands that were harvested in the Southeast seem to have been unaffected in terms of wetland status, it is important to identify the factors that govern whether forested wetlands managed under a silvicultural system remain wetlands or change to become uplands.[50] Federal agencies should partner with academia, NGOs, and states to investigate differences in soil types, hydrology, landscape position, artificial drainage characteristics, silvicultural systems used, tree species/varieties, and other relevant factors for forested wetlands in silviculture that do and do not change to non-wetland areas. Remote sensing data (such as aerial photographs), the USFWS inventories of change data, state forestry data, and field visits (where possible) should be used to help gather the information necessary to better characterize the effects of timber production on wetland status.

3.1.2. Synthesize data on the effects of forestry practices on forested wetland hydrology.

Hydrology (encompassing water balance, inundation, and soil saturation in the root zone) is one key parameter in determining whether an area is wetland or upland, and other wetland parameters often directly depend on hydrology. Therefore, if forested wetlands are becoming uplands, some change in hydrology is most likely involved. Federal agencies should partner with academia to conduct a literature review and synthesis of existing information on the hydrologic impacts of drainage and other forestry practices. Of particular importance is water table monitoring data for forested wetlands. If such data are found to be lacking, federal agencies should partner with state forestry agencies and other appropriate partners to develop monitoring protocols and collect needed data.

3.1.3. Refine hydrologic models for forestry practices.

Federal agencies should partner with academia, NGOs, and states to augment and improve existing models for predicting the effects of forestry ditches on water table drawdown. The modeling should incorporate factors such as surface storage, volume of drainable soil, and connection to drains to provide reliable estimates of minimum ditch spacing and depth needed to preserve wetland hydrology. Existing modeling should also be expanded to incorporate additional soil types and a variety of ditch depths and spacing. As appropriate, any effects of sea level rise should be incorporated into these models. Finally, additional field verification of modeling efforts should be conducted.

[50] ICWWG, Coastal Wetland Pilot Project Cape Fear Coastal Watershed, NC Summary Report.

3.1.4. Review the implementation of existing wetland guidance and statutory provisions for silviculture, including CWA Section 404(f) exemptions.

Pursuant to CWA Section 404(f)(1), discharge of dredged/fill materials associated with silviculture practices are exempt from CWA Section 404 permit requirements, unless the activities are recaptured under CWA Section 404(f)(2). Federal agencies (e.g., EPA, Corps) could conduct an analysis of silviculture-related CWA Section 404 authorizations, exemption determinations, and related guidance, and compile lessons learned from this analysis. The results of this assessment could be used to make recommendations regarding management practices that would reduce hydrologic impacts associated with forest management.

3.2 Improve interagency coordination and stakeholder engagement in forested wetland conservation.

Many federal, state, and local agencies are involved in the management and conservation of forested wetlands in silviculture. Improved coordination among these agencies and with landowners is essential to reducing the loss of wetlands within forested plantations. We recommend to:

3.2.1 Improve interagency communication and coordination for the protection of forested wetland hydrology.

Federal agencies should identify and implement model approaches for interagency communication and coordination (especially between state forestry agencies, Corps, EPA, and USDA) on forested wetland management. These approaches should specifically address best practices to aid in the protection of forested wetland hydrology (e.g., best practices for monitoring drainage, best practices for identifying forested wetlands that may be at risk of loss to a non-silvicultural use, and best practices for helping ensure drainage does not result in a wetland becoming a non-wetland, per 3.2.2).

3.2.2 Develop practices for maintaining wetland hydrology in forested wetlands in silviculture.

Building on the success of Best Management Practices currently used to protect water quality in forested wetlands, work with industry, state forestry agencies, and academia to develop similar practices to maintain wetland hydrology in wetland forests in silviculture. Such Hydrologic Management Practices could be developed with existing information, but revised whenever new information, such as findings from refined hydrological models (see 3.1.3), becomes available as other parts of these recommendations are implemented.

The ICWWG should work with forest certification programs, such as the Sustainable Forestry Initiative, the Forest Stewardship Council, and the American Tree Farm System, to incorporate guidelines for maintaining the hydrology of forested wetlands into their standards or recommended practices.

3.2.3 Explore how existing voluntary conservation programs could be used for protecting forested wetland hydrology.

Analyze existing easement programs, such as the Agricultural Conservation Easement Program, the Conservation Reserve Program, and the Healthy Forests Reserve Program, and determine how these programs can be best used to protect forested wetlands.

3.2.4 Engage stakeholders in preserving forested wetlands.

Government agencies should engage the forestry industry in areas with forested wetland loss to upland forested plantations to better understand audiences for wetland preservation efforts. This includes working with large managed plantations and individual small operations, as well as timberland investment management organizations and real estate investment trusts. Using information on areas most vulnerable to forested wetland loss, agencies should concentrate landowner outreach efforts in identified areas.

Once improved practices are identified through recommendations 3.1.2 and 3.2.2, the EPA should update their Watershed Academy Website module on "Forestry Best Management Practices in the Watersheds," "Forest Wetland Management" section, to reflect these advances.

3.3 Develop or improve tools to enhance protection of forested wetlands in timber production.

The information gained from the recommendations above should be used to develop new tools and improve existing ones that can help reduce the loss of forested wetlands in silviculture. We recommend to:

3.3.1. Develop tools to rank forested wetlands based on vulnerability to wetland loss as a result of silvicultural activities.

Using the information on factors that govern whether forested wetlands managed under a silvicultural system remain wetlands or change to uplands, develop tools that will allow landowners, land management agencies, NGOs, and others to target wetland preservation and restoration efforts in areas most at risk.

Longleaf pine, Cedar Point, North Carolina. Credit: Alfred Brock. Used with permission.

Tijuana River National Estuarine Research Reserve in southern California.
Credit: NOAA/Tijuana River NERR.

Support the Collection, Enhancement, and Dissemination of Landscape-Scale Monitoring Data

Landscape-scale wetland monitoring data, namely data disseminated through the USFWS National Wetlands Inventory (NWI) Program Wetlands Status and Trends reports, catalyzed the formation of the ICWWG. The pilot studies further emphasized an overall need for the continued collection and further refinement of wetland maps and landscape scale monitoring data to best inform the ICWWG's adaptive management process aimed at decreasing net wetland loss. These geospatial data, including those collected in support of NOAA C-CAP, the NWI Comprehensive Change Analysis, and the NWI Wetlands Status and Trends efforts, were instrumental in formulating the findings and recommendations of the pilot studies. Improved and/or continued collection of landscape-scale wetland monitoring data is needed to fully understand the extent of wetland loss and change, as well as the drivers and implications of these alterations at a national and regional scale.

To ensure the continuous collection and analysis of data and maps to inform decision-making the ICWWG recommends:

- Continue to support and improve the USFWS NWI Coastal Watersheds Wetlands Status and Trends reports (4.1)
- Produce new USFWS NWI Comprehensive Change Analysis in areas identified as experiencing high levels of wetland loss (4.2)
- Update the NWI geospatial dataset within coastal watersheds (4.3)
- Continue support for and improve the resolution of C-CAP products (4.4)
- Strengthen coordination between NOAA C-CAP and USFWS NWI (4.5)
- Support the development of techniques to improve the mapping of forested wetlands (4.6)

4.1 Continue to support and improve the USFWS NWI Coastal Watersheds Wetlands Status and Trends reports.

The USFWS NWI Wetlands Status and Trends project not only catalyzed the formation of the ICWWG but also provides a quantitative metric with which to track progress. In this way, Wetlands Status and Trends data facilitate an adaptive management process through which the increasing trend of net wetland loss in coastal watersheds can be reduced or reversed. The USFWS produces a national

Wetlands Status and Trends report, as well as regional reports, such as the coastal watersheds reports. The coastal watersheds reports provide a higher level of spatial attribution, as well as discussion focused on coastal watershed change drivers, controls, and implications in order to best inform management and policy decisions relevant to this portion of the United States. We recommend to:

4.1.1 Continue to support, improve, and produce decadal national and coastal watersheds Wetlands Status and Trends reports.

Produce these reports to best facilitate and determine the effectiveness of management and policy actions designed to reduce or reverse coastal wetland loss, including those proposed by the ICWWG.

4.2 Produce new USFWS NWI Comprehensive Change Analyses in areas identified as experiencing high levels of wetland loss.

The USFWS Wetlands Status and Trends effort produces highly accurate acreage estimates of wetland gain and loss, as well as conversion to other wetland types at a national or regional scale, but this information is not available at finer spatial scales through the Status and Trends effort. However, spatially and even more categorically detailed information on wetland acreage and change has been provided through production of NWI Comprehensive Change Analyses. This information has been used by the ICWWG and others to better understand the drivers and controls of wetland gain, loss, and change trends in specific locations that are representative of broader scale coastal watershed trends. We recommend to:

4.2.1 Prioritize production of Comprehensive Change Analyses data in areas with high levels of net wetland loss.

Comprehensive Change Analysis data should be produced in areas that have been identified as experiencing high rates of wetland loss as part of the coastal watersheds Status and Trends effort and/or NOAA C-CAP products. A higher priority should be placed on producing Comprehensive Change Analyses for areas experiencing high levels of net wetland loss due to change drivers that are exerting pressure over larger areas.

4.3 Update the NWI geospatial dataset within coastal watersheds.

NWI Wetlands Status and Trends and Comprehensive Change Analysis efforts provide acreage estimates of wetland extent, type, and change, but these efforts do not directly provide geospatial data to the public over large areas. Instead, this information is contained within the NWI geospatial dataset which is disseminated to the public through the NWI Wetlands Mapper. The NWI geospatial dataset is typically produced at a spatial scale of one-half acre.

The classification system and mapping standards used to produce the NWI geospatial dataset are endorsed by the FGDC, and the NWI geospatial dataset serves as the wetlands layer of the National Spatial Data Infrastructure. However, these data are relatively resource intensive to produce and thus the dataset is only updated within coastal watersheds as resources allow. The average collection year

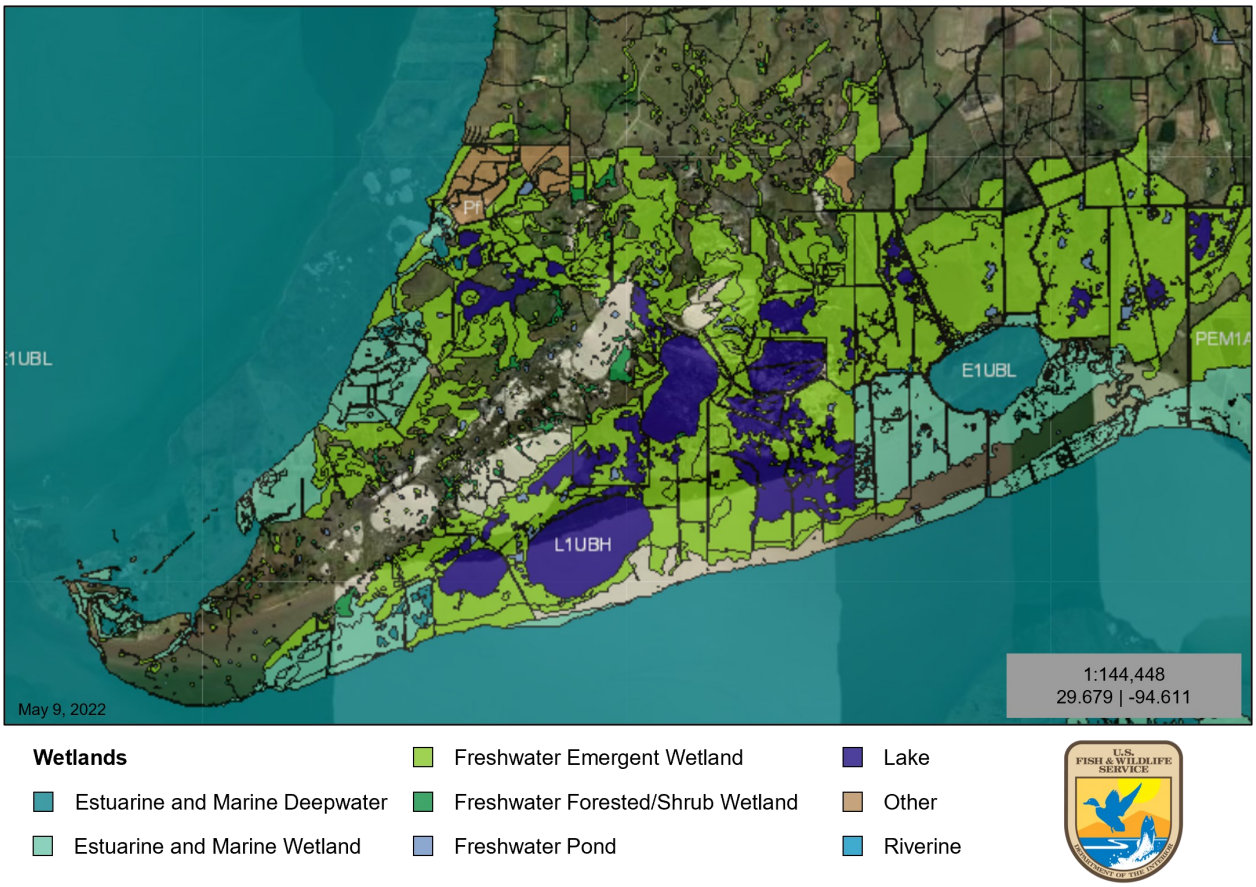

Figure 5. Wetland map of Smith Point, Texas, from the USFWS National Wetlands Inventory Mapper. Maps and data can be found at https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/.

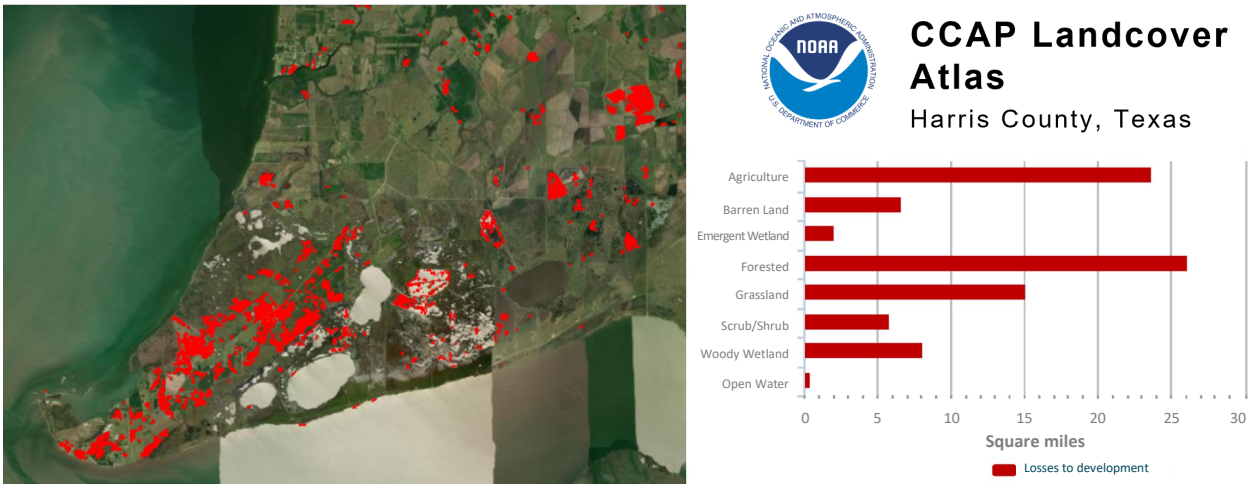

Figure 6. Losses to development at Smith Point, Texas, and the Harris County land cover change statistics from 2006 to 2016, from the NOAA Coastal Change Analysis Program. Maps and data can be found at https://bit.ly/3spHqoZ.

of the data within NWI is 1998 for coastal watersheds as defined in the pilot studies and 2001 within Hydrologic Unit Code 12 watersheds abutting the coastline. This information is commonly used by land owners and other private citizens to make informed land acquisition and management decisions. In addition, federal, state, tribal, and local natural resource managers and policy-makers use the NWI geospatial dataset to guide their decision making, often through incorporation of the dataset within decision support systems. We recommend to:

4.3.1 Develop a long-term plan for updating the NWI geospatial dataset in coastal watersheds at minimum once every decade.

Due to the relatively rapid rate of wetland change occurring within coastal watersheds, the NWI geospatial dataset should be updated at least every decade for these areas to best support decision making by private citizens, as well as government and NGOs.

4.4 Continue support for and improve the resolution of C-CAP products.

NOAA C-CAP currently provides 30-meter spatial resolution information on wetland extent and change for coastal watersheds using eight wetland classes. NOAA C-CAP data were the primary geospatial data used to determine wetland trends within all pilot study watersheds. However, the 30-meter spatial resolution limits the applicability of the C-CAP dataset at the parcel or local level, the level at which most wetland change occurs. We recommend to:

4.4.1 Refine C-CAP data to a 1-meter spatial resolution.

This refinement could substantially improve the quality and detail of information available for coastal wetland decision support for state and local planners. The improved information on wetland location and area (particularly in areas with historical wetlands) could be more closely coordinated with NWI updates and provide change information that is more useful at a local scale.

4.5 Strengthen coordination between NOAA C-CAP and USFWS NWI.

The USFWS NWI geospatial dataset and NOAA C-CAP products vary in level of classification detail and accuracy, as well as spatial and temporal resolution, and thus provide complementary information that can be combined to best address a wide range of natural resource management needs. For example, C-CAP data are currently collected at a moderate spatial resolution using generalized wetland categories and are updated every 5 years. This provides a good screening level for wetland changes over larger geographies but does not provide the categorical or spatial detail necessary to fully understand the causes of wetland loss. NWI geospatial data are produced at a finer spatial resolution with much more categorical detail and lower levels of uncertainty but are updated less frequently, which is inadequate in areas of rapid change like coastal watersheds. Thus C-CAP data are necessary to provide spatially explicit information on wetland change over relatively short time-periods, whereas NWI geospatial data are necessary to more fully understand the causes of wetland change and support decision-making at the parcel scale. We recommend to:

4.5.1 *Better coordinate C-CAP and NWI efforts.*

C-CAP and NWI efforts should be better coordinated to enhance data quality, reduce production costs, and best support the need for actionable wetlands information within coastal watersheds. NWI data are currently used as an input to C-CAP data production models and have been used to better understand the drivers of uncertainty within the C-CAP dataset.

In the future it may be possible to use C-CAP data to prioritize NWI geospatial dataset updates in coastal watersheds.[51] In this way, available funds for NWI geospatial dataset updates could be prioritized for use where wetland land cover is most likely to have changed. Similarly, NWI Comprehensive Change analyses could be conducted in areas that are identified by C-CAP as having a high likelihood of wetland change. Higher spatial resolution (1 m) C-CAP data that are currently in development could provide an enhanced mechanism to prioritize NWI dataset updates, or even serve as a starting point for production of the more detailed NWI dataset.

4.6 Support the development of techniques to improve the mapping of forested wetlands.

Enhanced forested wetland maps would better guide the adaptive management of forested wetlands with the end goal of reducing net forested wetland loss. Due in large part to the inherent difficulty of detecting hydrology below the forest canopy combined with the similarity in plant species between many forested wetlands and surrounding uplands, forested wetlands, especially drier-end and evergreen forested wetlands, are difficult to map. Thus, current forested wetland maps contain a greater level of uncertainty than maps of many other wetland types. The importance of improving these maps is underlined by the fact that forested wetlands are the most common wetland type in the coastal United States, and the United States as a whole, and the majority of freshwater wetland losses are occurring within forested wetlands. We recommend to:

4.6.1 *Support investigations of whether newer types of imagery or image processing techniques could be used to improve forested wetland maps.*

Potential imagery to explore includes synthetic aperture radar, light detection and ranging (LiDAR), and high temporal resolution multispectral imagery. These efforts should focus not only on refining the extent and location of forested wetlands within mapping and monitoring data, but also better characterize water regimes. This support could be provided to the research community through existing grant programs, initiated within existing federal programs, or in collaboration with state mapping experts. These efforts should be coordinated with existing forest monitoring efforts, such as the USDA's Forest Inventory and Analysis Program.

[51] Note that C-CAP data are not available throughout the United States.

Ecotourism in Mobile, Alabama.
Credit: U.S. EPA.

Conduct Targeted Outreach and Stakeholder Engagement

Impacts to wetlands sometimes occur due to a lack of understanding of: 1) where wetlands are located, 2) the federal, state, tribal, and local requirements that pertain to activities in wetlands, 3) the important ecosystem services that coastal wetlands provide, 4) the types of activities that harm wetlands, and 5) the availability of programs for conserving wetlands. Outreach can enhance understanding by identifying where gaps in understanding exist and how to best address them. Outreach can also assist in implementing specific recommendations through targeted plans that identify the specific problem to be addressed, the stakeholder groups that should be engaged, and the best mechanism for reaching those stakeholders. The audience of these outreach efforts will reach beyond the entities targeted for this document, and the implementation of each recommendation will require varying levels and styles of engagement.

To conduct targeted outreach, the ICWWG recommends:

- Identify and address gaps in public understanding regarding coastal wetland loss (5.1)
- Identify recommendations that require outreach and stakeholder engagement to be effective, and implement appropriate outreach plans (5.2)

5.1 Identify and address gaps in public understanding regarding coastal wetland loss.

The ICWWG should engage outreach specialists within its member agencies and other entities (such as state and local coastal/wetland management organizations and planning associations) to identify gaps in public understanding that may be hampering coastal wetland conservation efforts. Using this information, the ICWWG and partner entities should develop and implement an outreach plan to address these gaps.

5.2 Identify recommendations that require outreach and stakeholder engagement in order to be effective and implement appropriate outreach plans.

The ICWWG should determine which recommendations in this document require outreach efforts in order to be implemented successfully. For example, stakeholder engagement to bridge misunderstandings between the wetland and forestry communities is essential to address coastal wetland loss related to silviculture. The ICWWG and partner entities should then develop targeted outreach plans for these recommendations and include the following elements:

- What human behavior the outreach effort is attempting to change (e.g., landowners in coastal areas not applying for wetland conservation programs);
- The target audience of each action (e.g., owners of agricultural land in coastal watersheds);
- The best outreach tool(s) for reaching the target audience (e.g., mailings, web site, meetings);
- How the effectiveness of the outreach will be evaluated.

Braided river delta with red and green flora at low tide in Lower Cook Inlet, Kachemak, Bay Alaska. Credit: NOAA Fisheries.

Next Steps

These recommendations are the product of significant investigations, geospatial analyses, and input from state, local, and federal agency resource experts to identify key coastal wetland challenges and opportunities for improved management approaches. The results of this research can be seen in the Coastal Wetland Reviews[52] and the Summary Findings of the Pilot Studies.[53] In developing these recommendations, the ICWWG identified actions federal agencies can take in coordination with state, tribal, local, and regional agency partners, as well as other stakeholders.

The aim of this effort is to provide a roadmap of collaboration examples, communication strategies, and future avenues for alignment of programs and practices. By enumerating programmatic needs and opportunities and proposing collaborative approaches with local landowners, managers, and decision-makers, this document can serve as a guide or supplement to ongoing efforts that will improve management of coastal wetlands and reduce losses nationwide.

The ICWWG plans to translate this set of recommendations into actionable steps and measurable results. Select recommendations may be well suited for a place-based approach to implementation, making a collaborative approach even more essential. These recommendations cannot be implemented and evaluated by a single agency or the ICWWG alone, thus the ICWWG is committed to engaging partners in moving forward in a cooperative manner to better manage our valuable coastal wetland resources.

[52] ICWWG 2013.
[53] ICWWG 2017.

Planting beach grass in Maryland.
Credit: Maryland Department of Natural Resources.

Appendix A

White House Wetlands Working Group Definitions of Wetland Conservation Activities[54]

Enhancement - the manipulation of the physical, chemical, or biological characteristics of a wetland (undisturbed or degraded) site to heighten, intensify, or improve specific function(s) or to change the growth stage or composition of the vegetation present. Enhancement is undertaken for a purpose such as water quality improvement, flood water retention or wildlife habitat. Enhancement results in a change in wetland function(s) and can lead to a decline in other wetland functions but **does not result in a gain in wetland acres.** This term includes activities commonly associated with the terms enhancement, management, manipulation, and directed alteration.

Establishment - the manipulation of the physical, chemical, or biological characteristics present to develop a wetland on an upland or deepwater site that did not previously exist. Establishment results in a gain in wetland acres (and function).

Protection/Maintenance - the removal of a threat to, or preventing decline of, wetland conditions by an action in or near a wetland. Includes purchase of land or easements, repairing water control structures or fences, or structural protection such as repairing a barrier island. This term also includes activities commonly associated with the term preservation. Protection/Maintenance does not result in a gain of wetland acres or function.

Restoration - the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded wetland. For the purpose of tracking net gains in wetland acres, restoration is divided into:

> **Re-establishment** - the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to former wetland. Re-establishment results in rebuilding a former wetland and results in a gain in wetland acres (and functions).
>
> **Rehabilitation** - the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions of degraded wetland. Rehabilitation results in a gain in wetland function but does not result in a gain in wetland acres.

[54] *"Compensatory Mitigation for Losses of Aquatic Resources," CFR title 33 §332.2.*

Appendix B: Photography and Figure References

Photos

Cover Bull Island, South Carolina. Credit: U.S. EPA. https://www.flickr.com/photos/usepagov/50017048532/in/album-72157684536684685/

p. iv Mangroves in Oleta River State Park, Florida. Credit: Haley Capone. Used with permission.

p. 9 Restoration underway at North Street Salt Marsh in Fairhaven, Massachusetts. Credit: U.S. EPA. https://www.flickr.com/photos/usepagov/43610483130/in/album-72157674637978068/

p. 15 Urban sprawl. Credit: USFWS/Ryan Hagerty. https://www.flickr.com/photos/usfwshq/8427451222/

p. 21 Brandon's Pond in the coastal plain of North Carolina. Credit: NC Wetlands. https://www.flickr.com/photos/ncwetlands/50185109167/in/photolist-2jsFNwT-2jsBG5P-2jsEthw/

p.25 Longleaf pine. Credit: Alfred Brock. Used with permission.

p. 26 Tijuana River National Estuarine Research Reserve in southern California. Credit: NOAA. https://www.flickr.com/photos/usoceangov/9953347176/in/album-72157621684711085/

p. 32 Ecotourism in Mobile, Alabama. Credit: U.S. EPA. https://www.flickr.com/photos/usepagov/5984379883/in/album-72157627301429550/

p. 35 Kachemak Bay, Alaska at low tide. Credit: NOAA Fisheries. https://www.flickr.com/photos/usoceangov/15827610165

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Figures

Fig. 1 https://www.fisheries.noaa.gov/infographic/infographic-value-coastal-wetland-habitat

Fig. 2 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 p.

Fig. 3 Timeline showing the formation of the ICWWG and the process leading up to the release and implementation of the recommendations in this document.

Fig. 4 Diagram of habitat changes in coastal wetlands with sea level rise, including the loss of marsh to water and the migration of vegetation upland. Image by Kate Melanson. Adapted from https://wmap.blogs.delaware.gov/2021/03/22/sea-level-rise-marsh-migration-and-coastal-resilience/

Fig. 5 https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/

Fig. 6 https://coast.noaa.gov/ccapatlas/ and https://coast.noaa.gov/digitalcoast/tools/snapshots.html

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