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Challenges & Solutions in Coastal Wetlands

Findings, Gaps & Priorities

By Marla J. Stelk and Jeanne Christie
Prepared by the Association of State Wetland Managers

October 2016



About The Association of State Wetland Managers

The Association of State Wetland Managers (ASWM) is a nonprofit membership organization established in 1983 to promote and enhance protection and management of wetland resources, to promote application of sound science to wetland management efforts and to provide training and education for our members and the public. ASWM's members and partners include states and tribes, federal agencies, nonprofit partners, wetland professionals, educators, wetland enthusiasts and many others. The main common goal between these groups is a better understanding of wetlands and how to protect the resources throughout the Nation.

OUR GOALS:

- Help states develop and implement wetland regulatory and management programs
- Improve the coordination of wetland programs and policies at all levels of government
- Provide training and capacity building for state wetland programs
- Facilitate the integration of wetlands into water resources and watershed management
- Build conservation and restoration partnerships among states, tribes, local governments, nonprofits, and other interested parties
- Translate wetland science into fair and reasonable government policies
- Encourage minority participation in wetland protection, restoration and management
- Integrate wetlands into broader landscape and resource management initiatives.

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Introduction

In February of 2016, the Association of State Wetland Managers (ASWM) was awarded a grant by the U.S. Fish and Wildlife Service (FWS) in support of the Service's commitments in the National Ocean Policy Implementation Plan. ASWM undertook four tasks: (1) develop, design, and deliver a symposium on silviculture practices and impacts; (2) develop and promote three webinars on threats to coastal wetlands through ASWM's "Improving Wetland Restoration Success" webinar series; (3) develop three additional webinars on the challenges and benefits associated with the demands of specific coastal wetlands ecosystem services through the Natural Floodplain Functions Alliance webinar series; and (4) develop a white paper based on information shared during the symposium, webinar presentations, research, and collaboration with state agencies, federal agencies, tribal agencies, and non-governmental organizations.

This white paper (task #4), is divided into three topic areas addressing major threats to coastal wildlife. The three subject matter areas include: (1) wetland protection and management; (2) wetland restoration; and (3) natural coastal defenses. This effort is intended to identify gaps and priorities that can be addressed in future years by ASWM and other organizations. Our goal for this project is to identify specific actions likely to reduce coastal wetland losses, improve wetland health, and increase coastal wetland acreage to support vital habitat and ecosystem services for coastal wildlife.

I. Wetland Protection & Management

The U.S. has lost an estimated 50% of the wetlands that were present in the coterminous U.S. at the time of European settlement. Currently there are an estimated 110.1 million acres of wetlands in the United States.¹ An essential component of any national strategy for accomplishing no net loss and net gain of wetlands, including coastal wetlands, must include strategies for retaining existing wetlands.

Maintaining wetlands health is as important as maintaining wetland acreage. The various functions provided by wetlands – wildlife habitat, water quality improvement, flood water retention, recreation opportunities, etc. – are often directly related to wetland health. The first ever national wetland condition assessment undertaken by the U.S. Environmental Protection Agency and states in 2011 found that 48% of the nation's wetlands are in good health, 20% in fair condition and 32%

¹ <https://www.fws.gov/wetlands/Status-And-Trends-2009/KeyMessages.html>

in poor condition. Surface hardening (soil compaction), vegetation removal, ditching, and the abundance of non-native plants were identified as the leading threats to the health of existing wetlands.²

A. Silviculture and Coastal Wetland Loss

The coastal watersheds of the southeastern United States contain an estimated 20,000 to 30,000 square miles of forested wetlands. These forested wetlands provide important ecological services such as flood control, habitat for ducks and recreational fish species, and many others. A significant proportion of these forested wetlands is intensely managed for silviculture and is therefore important economically to the communities where they occur.

A 2013 report produced by the FWS National Wetlands Inventory (NWI) entitled, “Status and trends of wetlands in the coastal watersheds of the Conterminous United States 2004 to 2009”³ indicated that in coastal watersheds wetlands are being lost to non-wetlands at a much higher rate than they are being lost in inland watersheds. A large portion of this loss is correlated with forested wetlands in areas of active silviculture. When forested wetlands become non-wetland areas they are more likely to be converted to other uses such as agriculture or urban development, resulting in a loss of not only wetlands, but also forest land. The report of wetland losses on silviculture land, however, was not well received by the silviculture industry and a significant amount of controversy resulted from it.

In an effort to better understand the underlying reasons for the findings of the Status and Trends report, as well as what the silviculture community was reporting, ASWM agreed to work with members the Interagency Coastal Wetlands Workgroup and host a symposium at the Society of Wetland Scientists Annual Meeting in Corpus Christie, Texas on Thursday, June 2nd, 2016. A planning committee was organized very early in the process, which consisted of ASWM staff, federal agency staff, silviculture industry representatives, academics, and private practitioners.

The workgroup discovered early on that nomenclature was going to be a significant hurdle. Underlying much of this was the fact that the silviculture industry recognizes and defines wetlands through a Clean Water Act jurisdiction lens, whereas the FWS Status and Trends evaluates wetlands based on aerial imagery and onsite QA/QC. In addition, the Status and Trends report defines wetlands through the Cowardin system of classification which is chiefly a vegetative classification system that does not require positive confirmation of wetland vegetation, hydrology and soils, the delineation method used under the Clean Water Act.

The NWI does not differentiate between wetlands that are subject to Clean Water Act jurisdiction and those that are not. These differences can lead to two very different

² <https://www.epa.gov/national-aquatic-resource-surveys/national-wetland-condition-assessment-2011-results>

³ <https://www.fws.gov/wetlands/Documents/Status-and-Trends-of-Wetlands-In-the-Coastal-Watersheds-of-the-Conterminous-US-2004-to-2009.pdf>

perspectives on “wetland loss”, since even wetlands that meet the Clean Water Act scientific criteria for wetlands are not always jurisdictional.⁴

Therefore it was necessary to evaluate the Status and Trends data and findings in the context of the overall wetland resource, while simultaneously acknowledging that the silviculture industry data and findings were focused on the wetlands subject to Clean Water Act jurisdiction. Wetlands that are jurisdictional under the Clean Water Act are subject to the silviculture exemption under Section 404. Those that are not jurisdictional were not regulated or protected under the Clean Water Act.

Pursuant to Section 404 (f)(1)⁵ of the Clean Water Act the following activities do not require a permit to be carried out:

- Established (ongoing) farming, ranching, and silviculture activities such as plowing, seeding, cultivating, minor drainage, harvesting for the production of food, fiber, and forest products, or upland soil and water conservation practices
- Maintenance (but not construction) of drainage ditches
- Construction and maintenance of irrigation ditches
- Construction and maintenance of farm or stock ponds
- Construction and maintenance of farm and forest roads, in accordance with best management practices
- Maintenance of structures such as dams, dikes, and levees

However, if one of the activities listed as exempt represented a *new use* of the water, and the activity would result in a *reduction in reach or impairment of flow or circulation* of regulated waters, including wetlands, the activity would not be exempt. Both these conditions must be met in order for the activity to be considered non-exempt (and therefore requiring a permit). In general, any discharge of dredged or fill material associated with an activity that converts a wetland to upland is not exempt and requires a Section 404 permit.

The goal of the symposium was to bring together experts in wetland science, silviculture, and remote sensing to address outstanding questions about what might be causing forested wetland loss, including: the effect of different types of ditches on wetland hydrology over the short and long term; the effectiveness of other silviculture best management practices in sustaining forested wetlands; and how forested wetlands are affected by changes in soil and hydrology across landscapes, (i.e. temporal changes in the hydrology, climate change, and evapotranspiration rates). Presentations were followed by question and answer sessions and panel discussions to provide the opportunity for participants to identify areas for further research and future action.

Presentations included:

- Managing Forested Wetlands of the Southeastern and Gulf Coastal Plains: What the heck is silviculture anyway? (Presenter: Jim Shepard, Auburn University)

⁴ [Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in *Rapanos v. United States* & *Carabell v. United States*](#)

⁵ <https://www.epa.gov/cwa-404/exemptions-permit-requirements>

- Forested Wetlands and the Forest Products Economy in the South (Presenter: Fred Cabbage, North Carolina State University)
- Status and Trends of Forested Wetlands in the Coastal Watersheds of the U.S. (Presenter: Mitch Bergeson, U.S. Fish & Wildlife Service)
- Hydrology and Water Balance of Forested Wetlands in the Southeastern United States (Presenter: John Stanturf, USDA Forest Service)
- Silvicultural Operations in Forested Wetlands: Effects on Soils and Hydrology (Presenter: Mike Aust, Virginia Tech)
- Longterm Water table, Water balance, and Evapotranspiration of Drained Pine Plantation Forests on Southeastern Atlantic Coastal Plain (Presenter: Devendra Amatya, USDA Forest Service)
- Section 404 and the Silviculture Exemption (Presenter: Mike Wylie, U.S. Environmental Protection Agency)
- Forestry Best Management Practices to Minimize Harvesting Effects to Wetland Soils and Hydrology (Presenter: Erik Schilling, National Council for Air and Stream Improvement, Inc.)
- Application of Hydrologic Models & Tools for Managing Silviculture Systems in Forested Wetlands (Presenter: Ge Sun, USDA Forest Service)
- Modeling Effects of Silviculture Drainage on Wetland Hydrology-DRAINMOD, Field Data, and Results (Presenter: Wayne Skaggs, North Carolina State University)

In designing the symposium the work group members sought to gain a better understanding of whether the losses identified by the FWS Status and Trends report reflected losses that 1) did in fact occur (silviculture representatives did not support that the loss figures were accurate), 2) had occurred as a result of practices carried under the silviculture exemption (and were therefore potentially illegal), 3) had occurred prior to the Clean Water Act regulation went into effect in 1972 (and were legal), 4) had occurred in nonjurisdictional wetlands, or 5) reflected some combination of these and other factors.

Did the wetland losses reflected in the FWS report occur? This issue was not resolved during the symposium. While the FWS Status and Trends staff were confident that the losses did occur, there was insufficient time to fully investigate this topic on the program. Members of the silviculture community had very detailed questions about how the study was carried out, how QA/QC was conducted, and the consistency or inconsistency between FWS Status and Trends wetlands and wetlands subject to Clean Water Act jurisdiction. In addition, because trees grow over a period of decades and aerial imagery does not reveal what is happening under the tree canopy, the Status and Trends report may be identifying wetland losses that occurred many years prior to the five years spanned by the report. Finally, Mike Wylie of the U.S. Environmental Protection Agency provided an update on the areas identified as jurisdictional wetlands under the new regional supplement to the federal wetlands delineation manual for the southeast. The revised criteria have potentially increased the areas that meet the three scientific criteria (wetland soils, hydrology and

vegetation). While areas subject to jurisdiction need to meet both scientific and legal criteria to be regulated, this change is likely to create additional complexity.

An additional finding is that the FWS Status and Trends program should reach out early to the silviculture community when reports come out so that there is the opportunity for the community to understand the findings and their relevance to silviculture before the report is formally released to the media. Part of this effort would be to address some of the nomenclature barriers identified during the planning stages of the symposium so that the findings are easily understandable to the silviculture community.

Did the wetland losses identified occur prior to when the Clean Water Act regulation went into effect? This issue was not resolved during the symposium. As discussed previously, trees that are part of a silviculture operation grow over a period of years. If the aerial photography used to carry out the FWS Status and Trends report does not occur around the timeframe trees are harvested, significant time can pass before aerial imagery captures the loss. In addition the impact of ditching or other practices that occurred decades previously may have a cumulative temporal component as well. In the presentation by Dr. Wayne Skaggs, one study found that subsurface drainage intensity increased over time in soils. This was directly counter to the presumption that a subsurface drainage in wetland areas in silviculture would be increasingly impaired over time without ongoing maintenance. Additional data collection and analysis with respect to when and what practices have been established on silviculture lands is needed to better understand and inform best management practices (BMPs).

Are practices carried under the silviculture exemption adequate to prevent loss? Again, this issue was not resolved during the symposium. A number of the presentations explored this topic summarizing studies with interesting results. For example, in one study summarized by Dr. Erik Schilling, heavy equipment operators were encouraged to use their machines extensively on the site to increase soil compaction in an experiment to determine whether this activity interfered with recovery. At the end of the research project, there was no indication that the heavy equipment had ever been used there. Dr. Schilling was careful to qualify the findings by pointing out that the site was in an active floodplain and frequent deposition of sediment from flood waters might have aided in the recovery. In another presentation by Dr. Skaggs, the effect of silviculture practices to establish trees in wetlands was analyzed with the finding that areas immediately adjacent to shallow ditches were fully drained while the areas in the middle between the ditches retained wetland hydrology. During a later panel, there was discussion about how deep a ditch could be and remain in compliance with the silviculture exemption and it appeared that the appropriate depth of a ditch and/or criteria for establishing appropriate depth had not been established.

Did the losses reflect some combination of activities carried out under the silviculture exemption, activities that occurred before the Clean Water Act was enacted and/or some combination of these and other factors? Again, the presentations

and discussion highlighted areas that merit further exploration. There was discussion about the potential impacts of changes in annual precipitation and temperature in recent years and speculation that some of the 'drier' hydric soils had been impacted (in effect "dried out"). There were questions about development pressure in the areas that were showing the greatest loss and that therefore some of the loss was associated with non silviculture activities unique to those counties. There was recognition that there is diversity in silviculture BMPs from state to state. Additionally, there is the possibility that certain practices have a 'cumulative effect'; i.e., that over time, forested wetlands subject to the same practices over and over again could get drier or wetter as a result of those BMP's.

The resolution of these and other questions will require further investigation, study, field observations and research. The symposium served to highlight many of the complexities that need to be examined to gain a deeper understanding of the relationship between silviculture practices in wetlands and the persistence of those wetlands on the landscape.

Despite the initial sometimes heated discussion, the workgroup identified a common goal of keeping both wetlands and silviculture on the landscape; the alternative being conversion of wetland silviculture to upland agriculture or more real estate development, resulting in wetland loss as well as the loss of silviculture, an important economic driver in the south. This created positive momentum and the workgroup agreed on a symposium title, abstract and agenda as well as an impressive list of speakers.

The symposium led to the establishment of new partnerships and a shared desire to continue to jointly explore these topics among workgroup members and symposium presenters. This included a desire to continue to collaborate. In the weeks immediately following the symposium, potential next steps were identified through debriefing calls with the Interagency Coastal Wetlands Workgroup and the symposium participants. These included:

- Developing an EPA Sharepoint webpage where PDFs of the PowerPoint slides and a bibliography distributed by Jami Nettles from Weyerhaeuser could be posted and shared with symposium presenters, symposium workgroup members and the Interagency Coastal Wetlands Workgroup. (Completed)
- Contacting and working with Marinus L. Otte, Editor of Wetlands journal (Society of Wetland Scientists), to develop a special issue on wetlands and silviculture based on the presentations at the symposium. (Underway)
- Improving communication between the Interagency Coastal Wetlands Workgroup and the silviculture industry during the development of future Status & Trends reports.
- Carrying out a workshop on Wetlands and Silviculture in the southeast. (possibly organized by ASWM)
- Holding site visits to learn from each other in the Southeast, possibly in conjunction with a workshop. (possibly organized by ASWM)

- Developing a research project to cross-walk data between National Wetlands Inventory and the silviculture industry, e.g., do a blind study to compare long term hydrology, jurisdictional data on the ground, and National Wetlands Inventory (Cowardin) maps to gain a deeper understanding of whether or to what degree, NWI and CWA jurisdiction lands were consistent.
- Developing a future ASWM webinar series on silviculture and wetlands to reach a broader audience. (possibly following a workshop in the Southeast)
- Writing a white paper for the Interagency Coastal Wetlands Workgroup describing information, issues, and challenges raised during the symposium as well as research needs and next steps.

In the longer term, the activities described above will help set the stage for a broader strategy to:

- Evaluate, and revise as needed silviculture BMPs to ensure wetlands subject to the silviculture exemption comply with the Clean Water Act and continue to persist on the landscape.
- Developing specific recommendations to reverse coastal wetland loss on silviculture lands.

II. Wetland Restoration

A. Permitting Ecological Restoration of Wetlands and Floodplains

In August of 2015, President Obama said that “no challenge poses a greater threat to our future and future generations than a change in climate.” He went on to warn us that ours is “the first generation to feel the impact of climate change and the last generation that can do something about it.” Innovation will be critical to addressing the impacts from climate change. Traditional wetland and floodplain protection and restoration programs as well as hybrid systems combining natural and traditional infrastructure will both be needed to support overall watershed health. To efficiently develop these projects, however, the various programs that manage wetlands, water quality, flood protection and habitat need to find innovative ways to integrate their efforts. The benefits of integrating these programs will provide strategic opportunities to maximize multiple benefits and program efficiencies.

Historically, state and federal wetland management, habitat, flood and emergency management, and water quality programs have worked largely in isolation from each other. Increasingly, concerns have been raised that often the permits required by the various divisions and agencies may conflict with and/or cause critical delays that can impede projects to restore and protect the natural and beneficial functions of wetlands and floodplains. Given the recent federal interest in considering the value of ecosystem services, and in finding more natural alternatives to hardened infrastructure (e.g., Presidential Memorandum on Incorporating Ecosystem Services into Federal Decision Making; Presidential Memorandum on Mitigating Impacts on Natural Resources from Development and Encouraging Related Private Investment; Guidelines for Implementing Executive Order

11988, Floodplain Management, and Executive Order 13690), there are strong incentives for possible permitting conflicts to be addressed.

Conflicting goals for restoration, protection, enhancement and creation will also need to be addressed. If wetland restoration is done for one particular goal without consideration of the larger watershed context, it may have unintended negative impacts in other areas (i.e., wetland restoration can impact both upstream and downstream stream functions and vice versa; wetland creation for stormwater attenuation can conflict with wildlife habitat; etc.). To restore watershed health, it is necessary to restore the natural hydrologic system that supports it. Wetlands, floodplains, streams and other waterbodies are all part of one aquatic system and should be addressed as a unit – not as separate entities. Because responsibility for protecting streams, wetlands and floodplains may reside in different federal and state agencies, integration can be very difficult. Nevertheless, projects need to be coordinated within the larger hydrological and habitat system that could potentially be impacted. This will require greater inter-program coordination to find ways to successfully achieve multiple goals (and to minimize unintentional negative impacts).

B. Invasive Species

The issue of how to effectively address invasive species has been viewed as a significant problem by wetland restoration professionals as well as state and federal wetland program managers. There is a great deal of research and experimentation already underway in this area; however, there is also much left to be done. In addition, wetland practitioners have indicated that climate change impacts are requiring new approaches to invasive species management. This fits in within the larger need to pursue adaptive management from the start in wetland restoration activities – a best practice that has been identified as an important piece of successful wetland restoration, and one which is frequently overlooked in developing wetland restoration plans.

Invasive species are opportunistic and spread vigorously on disturbed sites (e.g. where vegetation has been removed and soil compacted and/or removed). The U.S. has seen a significant demographic shift regarding human population centers, where more and more people are moving to coastal communities, thereby increasing development pressures. More development leads to more infrastructure for roads and energy transmission lines. This in turn, leads to the spread of invasive species in wetland restoration project areas that are not proactively managing for them. Ecological restoration activities are also, by their very nature, disturbances on the landscape. Restoration practices can significantly impact prevention and control of invasive species on restoration sites.

On April 26th, 2016, ASWM hosted a webinar on “[Managing Invasive Species in Wetland Restoration Projects: Considerations for Common Reed, Reed Canary Grass, Purple Loosestrife, Nutria and Feral Swine.](#)” ASWM asked each of the presenters to identify the most common mistakes and/or challenges in managing their invasive species. Two presentations were about invasive fauna: nutria (Margaret “Marnie” Pepper, [USDA-APHIS-](#)

[Wildlife Services Program](#)) and feral swine (Wendy Anderson, [USDA-APHIS-Wildlife Services Program](#)).

One of the greatest challenges specifically identified for managing feral swine is educating the public about the significant health risks associated with hunting and consuming them. According to the USDA-APHIS-Wildlife Services program, “feral swine can carry at least 30 diseases and nearly 40 types of parasites that may affect people, pets, livestock, and wildlife.” Both presenters agreed that their biggest challenge, beyond the ecological damage inflicted by feral swine and nutria, is in communicating to the public to not attempt to manage these two invasive species on their own. Both presenters emphasized the importance of contacting the USDA-APHIS-Wildlife Services program for advice or assistance with damage management operations.

The webinar also included presentations on three different invasive flora species; purple loosestrife (Ben Peterson, King County, Washington), reed canary grass (Craig Annen, Integrated Restorations, LLC) and the common reed (Eric Hazelton, Smithsonian Environmental Research Center & Utah State University). One of the main causes of the spread of invasive flora species is a lack of prevention. Humans and animals act as vectors, thus all clothing, footwear, pets, tools, equipment and vehicles must be cleaned before entering and exiting any wetland restoration site by staff, contractors and the public. A combination of eradication methods is typically required, including chemical, manual and mechanical means. Understanding where invasive species have already been identified in a region is also important in order to be able to predict and plan for potential future distribution. Project managers should coordinate with existing efforts in those areas. And a long-term management plan for wetland restoration sites is essential – including a budget that includes long-term maintenance costs.

Recently, concerns about the extensive use of herbicides and the potential impacts on ecological and human health have been raised by practitioners as well as by the public. Improved training is needed in the use of herbicides and herbicide-additive systems, including adequate spray coverage, proper mixing techniques, how additives enable herbicides to penetrate thick leaf cuticles, factors that affect herbicide performance, the importance of cleaning and neutralizing spray equipment, etc. in order to ensure that no more herbicide is used than is actually necessary. Also, more research needs to be done on the potential for negative impacts through bioaccumulation of herbicide from repeated use over time, increased resistance, and non-target species mortality.

Much of the applied suppression research has been called inadequate. Most of the studies are done in artificial environments, whereas they should be conducted in field settings rather than greenhouses or small campus gardens in order to ensure external validity. Experimental units are typically too small to be ecologically meaningful. Short-term single-site experiments, and many two year studies – the typical length of a graduate thesis project – have been found to have contradictory results when compared to longer studies performed over periods of five to ten years. For example, most two year studies on the effectiveness of glyphosate on common reed show a significant reduction in its presence,

whereas over time, the efficacy of the herbicide treatment declines to the point where it becomes ineffectual in a few years.

Historically, there has been emphasis on restoring wetland structure without careful consideration and planning for dynamic processes. More research needs to be performed to identify the specific processes that are reinforcing invasions. Managers need to recognize feedback cycles that maintain both invaded and remnant states, as well as restore and/or manipulate feedbacks and other dynamic processes (litter accumulation, nutrient cycling, fire regimes, etc.) concomitant with applying direct suppression measures (e.g. herbicide use). A greater emphasis on restoring soil health also needs to be included with measures taken to deter current and future invasions.

C. Bottomland Hardwood Restoration

On Tuesday, July 12th, 2016, ASWM hosted a webinar on “[Bottomland Hardwood Restoration](#)” with Dr. John Stanturf (U.S. Forest Service) and Dr. John Groninger (Southern Illinois University). Bottomland hardwood forests, also known as river swamps, are deciduous forested wetlands typically found in floodplains along rivers and streams of the southeast and south central United States. Bottomland hardwoods provide critical ecosystem services such as wildlife habitat, reducing the risk and severity of flooding through floodwater attenuation, filtering nutrients, processing organic wastes and sediment reduction. Historically, almost thirty million acres of bottomland forests covered the Southeastern United States. Today, only about forty percent of that area remains as forested wetlands, largely due to land conversion to agriculture⁶. The primary objectives for bottomland hardwood restoration include protecting water quality, enhancing wildlife habitat, restoring hydrology, forestry, and carbon sequestration.

Some of the specific challenges for successful bottomland hardwood restoration identified by Dr. Stanturf and Dr. Groninger included poor seed quality, low plant stocking levels, lack of long term management, severely altered landscapes, invasive species and climate change. Measures that were identified by the speakers to address some of these challenges included: collecting seeds from existing stands; planting at higher densities; requiring explicit objectives that describe the expected trajectory of restoration; monitoring and reporting at various spatial and temporal scales; adaptive management planning; increasing diversity and structure; retaining a focus on ecosystem functions; accepting the inevitability of a changing biota on some sites; and multi-disciplinary training for managers.

III. Natural Coastal Defenses

A. The Ecology, Engineering & Economics of Natural Coastal Defenses

On Tuesday, March 1st, 2016, Mike Beck (Lead Senior Scientist at The Nature Conservancy and adjunct Professor in Ocean Sciences at the University of California Santa Cruz) gave a webinar presentation to the [Natural Floodplain Functions Alliance](#) (NFFA) on “[The Ecology,](#)

⁶ <https://www.epa.gov/wetlands/bottomland-hardwoods>

[Engineering & Economics of Natural Coastal Defenses.](#)” His presentation affirmed that coastal hazards are real and they are rising.

Between the years 1982–2012, coastal natural disasters killed 1.3 million people, affected 4.4 billion people, and caused greater than US\$2 trillion dollars of damage⁷. And in a recent study published in 2015, the Centre for Research on the Epidemiology of Disasters and UNISDR reported that “Weather-related disasters became increasingly frequent in the late 1990s, peaking at 401 events in 2005. Despite a decline in frequency since then, a sustained rise in the number of floods and storms pushed the average annual total up to 335 disasters per year after 2005, 14% higher than in the previous decade and more than twice the level recorded in 1980-1989.”⁸ It is predicted that the rate of change in the world’s coastal zones will continue to increase rapidly from coastal development and climate change, both of which will radically increase the risk of catastrophic damage and subsequently increase insured losses to coastal communities.⁹ Although billions of dollars are being invested to reduce risks from natural disasters and climate change, in many countries around the world, much more money is spent on disaster relief, recovery and reconstruction than on risk reduction – a downward cycle which must be reversed in order to reduce risk from flooding, storms and sea level rise. Although widely unpopular in many coastal communities, the option of relocating people and infrastructure in lieu of reconstruction is a strategy that deserves equal consideration, particularly when weighing future risks. Earlier in 2016, the members of [Biloxi-Chitimacha-Choctaw tribe](#) who lived on Isle de Jean Charles in Louisiana were reported to be the United States’ first official climate refugees. More than 1,900 square miles of tribal land has vanished in the past 80 years due to sinking land, sea level rise, and oil and gas production. The U.S. Department of Housing and Urban Development (HUD) announced in January that it had awarded the tribe \$48 million to pay for a move. At least two tribes in Alaska are considering relocation as well.

The bulk of the money being invested in risk reduction is primarily being spent on “grey infrastructure” (i.e., built infrastructure) solutions such as bulk heads and seawalls which have now been discovered to further degrade coastal ecosystems. Natural infrastructure (e.g., forests, wetlands, reefs and beaches) and hybrid infrastructure (e.g., living shorelines) solutions will need to be mainstreamed, along with greater support for ecosystem restoration, in order to protect coastal habitats and the many ecosystem services that they provide to human communities. These ecosystem services include storm surge protection, habitat for wildlife, commercial fishing opportunities, and wave attenuation – among many others. Unfortunately, coastal and marine habitats continue to be lost and degraded, reducing their ability to protect coastal habitats and human communities from increasing storms. [SNAPP \(Science for Nature and People\)](#) reports on their website, that “Global losses of coastal habitats are as high as 85% for oyster reefs, 30-50% for wetlands, and

⁷ UNISDR. (13 June, 2012) UNISDR COUNTS THE COST OF 20 YEARS OF INACTION ON CLIMATE CHANGE AND RISK REDUCTION -1.3 million killed, 4.4 billion affected, \$2 trillion economic losses – UNISDR Press release 2012-21. Switzerland.

⁸ https://issuu.com/mardi.be/docs/pand_report_2015_def

⁹ <http://snapppartnership.net/groups/coastal-defenses/>

approximately 30% for coral reefs. Often, the loss of these habitats is greatest around population centers — maximizing the loss of benefits to people.”

SNAPP, launched in 2013, is a partnership between The Nature Conservancy, the Wildlife Conservation Society, and the National Center for Ecological Analysis and Synthesis (NCEAS) at the University of California, Santa Barbara. One of SNAPP’s working groups, Coastal Defenses, has been exploring how the conservation and restoration of coastal habitats as well as the use of innovative hybrid solutions (a combination of natural habitat and built infrastructure) can help protect coastal communities versus the use of traditional grey infrastructure such as levees, sea walls and artificial barrier islands. In January, 2016, a World Bank-led group called WAVES (Wealth Accounting and the Valuation of Ecosystem Services) issued a report, “Managing Coasts with Natural Solutions,”¹⁰ that was primarily supported by the World Bank WAVES project with additional contributions from SNAPP’s Coastal Defenses project, the Lyda Hill Foundation, the Pew Marine Fellows program and the Kingfisher Foundation. The report established guidelines for measuring and valuing the coastal protection services of mangroves and coral reefs. It was found that as the first line of defense, mangroves and coral reefs provide significant coastal protection benefits. In the end, grey infrastructure is often not cost effective for risk reduction when compared to natural infrastructure and hybrid alternatives. Hybrid infrastructure approaches are a particularly good choice for urban areas where it is not possible to use large-scale nature-based solutions. Decision support tools can inform the use of natural and hybrid solutions.

Despite the many economic, social and environmental benefits of switching to a natural and hybrid infrastructure approach, there are still many barriers to their implementation. Some of the policies and factors influencing/impeding the use of nature-based defenses include:

1. There is a lack of enabling policies and incentives to integrate natural and hybrid infrastructure into current project designs.
2. The use of these approaches is still very new, so there is a lack of technical knowledge, trained professionals, and long-term studies.
3. Although it is believed that these projects are more cost-effective in the long run, they often have a high initial investment.
4. There is general confusion about the terms being used to describe this approach.

Needs identified to increase the use of nature-based defenses include:

1. Policies and incentives need to be aligned across governing scales.
2. Technical knowledge and capacity needs to be increased from policy to implementation.
3. Community support needs to be developed through greater outreach and education.
4. Results need to be translated effectively through policy briefs and through conversations with decision-makers in order to raise awareness of different options.

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<https://www.wavespartnership.org/sites/waves/files/kc/Technical%20Rept%20WAVES%20Coastal%202-11-16%20web.pdf>

B. Living Shorelines

Recently, the concept of “living shorelines” – a form of hybrid infrastructure - has been promoted as a way to protect coastal habitat and development. On Tuesday, June 7th, 2016, a presentation on “[Living Shorelines: Lessons Learned and New Opportunities](#)” was hosted by ASWM in conjunction with the Natural Floodplain Function Alliance (NFFA). This webinar included four separate presentations. Suzanne Simon, Strategic Programs Manager for Restore America’s Estuaries, provided an overview from a national perspective regarding these approaches. Bill Sapp, Senior Attorney for the Southern Environmental Law Center, discussed the newly proposed Nationwide Permit B for living shorelines. Tracy Skrabal, Southeast Regional Manager and Coastal Scientist for the North Carolina Coastal Federation, shared lessons learned in North Carolina and discussed challenges and opportunities for future living shoreline projects. And Lee Anne Wilde, Living Shorelines Program Manager for the Galveston Bay Foundation, provided a presentation of a case study for a living shoreline site on Trinity Bay near Anahuac, Texas.

Living shorelines (also referred to as soft stabilization, soft armoring and green shores) includes a variety of techniques designed to reduce shoreline erosion while also providing habitat and other important ecosystem services. The concept and practice of living shorelines is relatively new although it has been implemented on several coastal marine sites, primarily along the eastern shore of the U.S. Over the past year, ASWM has heard anecdotally from several sources that the current regulatory frameworks that provide permits for living shorelines have in and of themselves created significant institutional barriers. Current regulations were designed for traditional grey infrastructure and as such, do not easily address some of the unique design and construction techniques employed in living shorelines. Some states have developed ways to reduce these barriers. For example:

- Maryland Department of Environmental Protection State Programmatic Permit (MDSPPG-4) was developed in a cooperative effort with the Maryland Department of Environment and U.S. Army Corps of Engineers (Corps). It was designed to improve the regulatory process for applicants, reduce unnecessary duplicative project evaluations, and promote more effective and efficient use of Corps resources while providing equivalent environmental protection for aquatic resources.
- Alabama Living Shorelines General Permit (ALG10-2011) provides for the preservation and restoration of dunes, beaches, wetlands, submerged grassbeds, protection and propagation of essential fish habitat, shoreline restoration and nourishment.
- North Carolina created an hierarchy of coastal erosion control options:
 - No Action
 - Relocation of Threatened Structures
 - Non-Structural Stabilization Measures (Slope Grading, Marsh Creation, Bio- Engineering, beach nourishment)
 - Combination Approaches (Sills, Stone containment cells, breakwaters with plantings)

- Hardening Structures (Groins, Revetments, Gabions, Bulkheads)

IV. Recommendations and Next Steps

There are many challenges to protecting, restoring and managing coastal wetlands for wildlife and the many ecosystem services they provide. In the coming year, ASWM proposes to work with the U.S. Fish and Wildlife Service Coastal Program to carry out the activities below.

A. Wetland Protection and Management

With a long-term goal of improving silviculture best management practices to protect wetlands and prevent conversion, ASWM proposes to continue to work with the SWS silviculture symposium planning committee (including members of the ICWWG) and presenters from the SWS silviculture symposium to explore three issues:

- 1) the underlying causes for the wetland losses described in the Status and Trends report,
- 2) the actual current extent of alteration and loss of wetlands in coastal areas, and
- 3) the efficacy of best management practices.

The next step will be a meeting or workshop and field trip in the Southeast in 2017 to continue to explore these and other issues raised at the SWS symposium. ASWM will add to the previously identified project participants in this effort by inviting representatives from the state forestry and wetland managers, wetland mapping experts and others to participate. Working with partners, ASWM will plan and carry out the meeting and field trip and develop a white paper describing findings.

B. Wetland Restoration

ASWM proposes to hold six webinars focusing on management of invasive species in coastal wetlands. As described in this paper, there is increasing concern about climate change impacts. There is growing recognition that new approaches to wetland restoration and invasive species management are needed and these new approaches should include the use of adaptive management, coordinating responses on a regional rather than a site by site basis, utilizing multi-faceted strategies, understanding and effectively communicating trade-offs for ecosystem functions, and creating a long-term management plan with a budget that includes long-term maintenance costs. But while there is interest in pursuing these new strategies, there is a lack of information among practitioners about what is known and how to begin. The webinars will be broadcast in real time, post processed and later available on the ASWM website.

C. Natural Coastal Defenses: Wetland/Floodplain Permitting Workshop in Washington D.C.*

ASWM is a founding member of the Natural Floodplain Functions Alliance (NFFA). The Alliance is an affiliation of federal agencies, professional and nonprofit organizations, and

individuals who are dedicated to the protection and preservation of the natural functions of floodplains, which includes coastal areas. It was established to “promote, protect, and enhance the protection, restoration, and management of natural floodplain resources” through education and outreach. ASWM is working with NFFA on a proposal to bring together Federal agency staff and state and local partners to explore opportunities to identify problems and propose improved processes to carry out natural floodplain restoration. This will be a small workshop that will be held in Washington D.C. on November 29, 2016, that will be open for participation by invitation only. Case studies will be presented that demonstrate potential obstacles, and the agencies and partners will discuss possible remedies. The U.S. Fish and Wildlife Service Coast Wildlife Program will be invited to attend.

***2017 Update:** Since the release of this white paper, the NFFA workshop was held as planned. Information about the workshop, materials, notes, and other associated resources can be found on ASWM’s website at this link: <http://www.aswm.org/watersheds/natural-floodplain-function-alliance/9620-overcoming-policy-and-permitting-challenges-workshop>