Strategies and an Action Plan for Protecting and Restoring Wetland and Floodplain Functions

The Natural Floodplain Functions Alliance Wetland Mapping Consortium
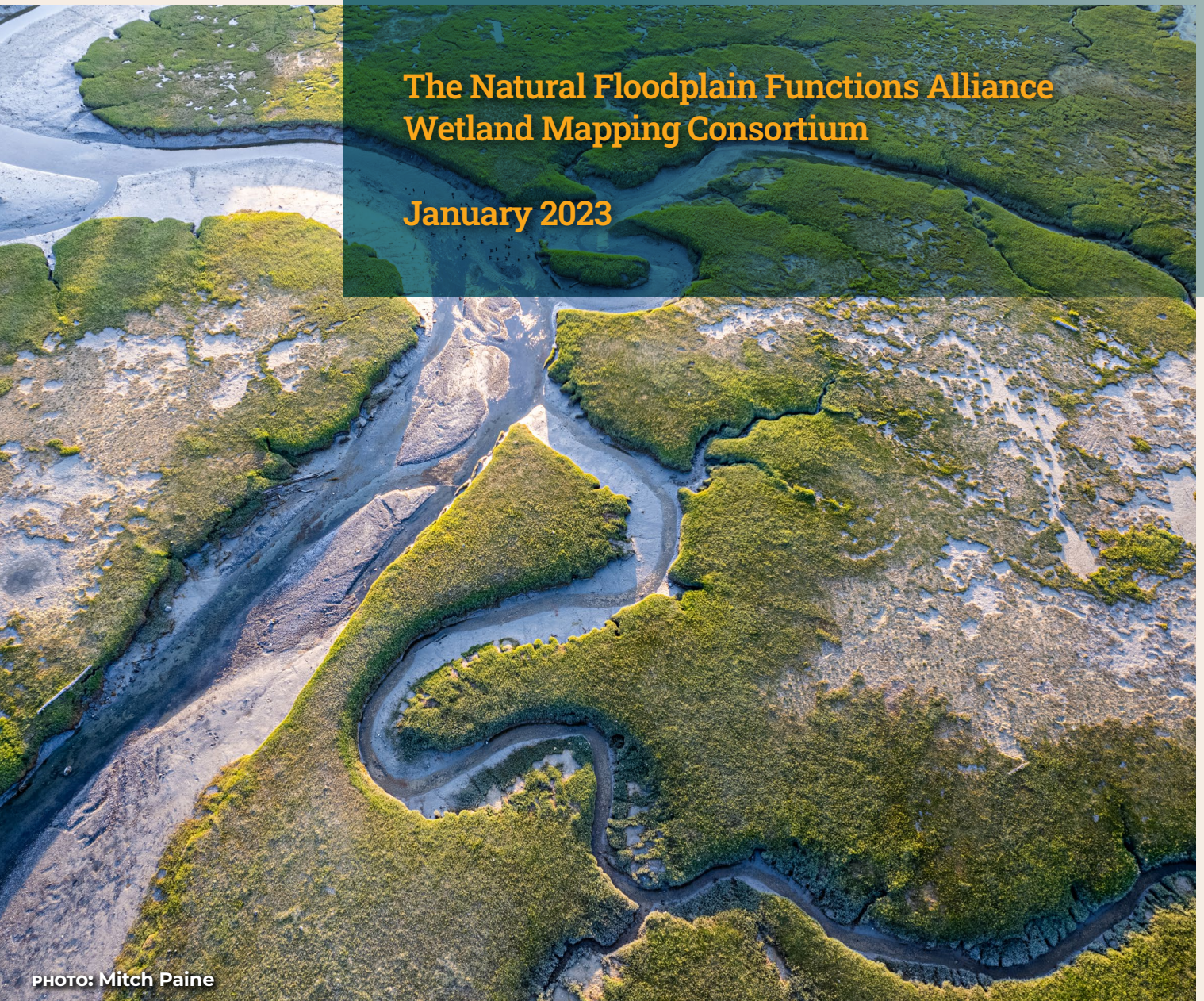
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Report Abstract

The Natural Floodplain Functions Alliance (NFFA) and the Wetland Mapping Consortium (WMC) developed and hosted a series of workshops focused on identifying barriers and opportunities for formulating a new national strategy that would enable greater protection and restoration of floodplains, including the wetlands within them, and the beneficial functions they provide. This report compiles the findings of these workshops and provides an action plan to protect and restore wetland and floodplain functions in the United States.

The NFFA is an affiliation of nonprofit and private organizations, government agencies, and individuals working to promote and encourage activities at all levels of government that protect and restore the natural resources and functions of floodplains.

The WMC is an interdisciplinary group of wetland scientists and managers interested in mapping and monitoring wetlands with remotely sensed images and using the resulting products to best manage wetland resources, ultimately resulting in increased conservation of wetlands and the enhanced delivery of wetland ecosystem services.

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Acknowledgements

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[2] Please note this report has not been formally reviewed by the EPA. The views expressed are solely those of the authors, and the EPA does not endorse any products or commercial services mentioned.

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List of Acronyms

Abbreviation	Name
ASFPM	Association of State Floodplain Managers
BCA	Benefit-Cost Analysis
CEQ	Council on Environmental Quality
CRS	Community Rating System
CWA	Clean Water Act
EO	Executive Order
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FIFM-TF	Federal Interagency Floodplain Management Task Force
FIRM	Flood Insurance Rate Map
GIS	Geographic Information System
NAWM	National Association of Wetland Managers
NBS	Nature Based Solutions
NEPA	National Environmental Policy Act
NFFA	Natural Floodplain Functions Alliance
NFIP	National Flood Insurance Program
NGO	Non-Governmental Organization
NNL	No Net Loss
NOAA	National Oceanic and Atmospheric Administration
UNP	Unified National Program
US	United States
USACE	United States Army Corps of Engineers
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
WMC	Wetland Mapping Consortium

Table of Contents

Executive Summary

The concept of developing a unified national strategy for protecting and restoring wetland and floodplain functions is not a new one. In fact, one only has to look back at the 1972 Clean Water Act itself to find language in support of protecting and restoring wetland functions, and President Carter's 1977 Executive Order 11988, which states: "Each agency shall provide leadership and shall take action to … restore and preserve the natural and beneficial values served by floodplains."

The Federal Interagency Floodplain Management Task Force (FIFM-TF) was established in 1975 within the U.S. Water Resources Council to carry out the responsibility of the president to prepare for Congress proposals necessary for a Unified National Program for Floodplain Management. Yet here we are today, still existing in a vacuum devoid of any unified national strategy or agenda. There are serious consequences for our inaction, as seen in the billions of dollars lost in built capital and thousands of lives lost due to the direct removal of floodplain capacity and functions, compounded by the increasing intensity and frequency of hurricanes, storm surge, and floods from a rapidly changing climate.

In recognition of this, a group of scientists, policy analysts, and academics from the nonprofit, academic, government, and private sectors came together to develop a series of workshops with the goal of reigniting interest in launching a national strategy and action plan for the protection and restoration of wetland and floodplain functions.

When this effort began in 2017, the United States was in transition from the Obama Administration to the Trump Administration. This transition resulted in a dramatic shift in federal policy and priorities that eliminated support for research and funding for climate change mitigation or adaptation efforts. Many state and federal employees were prohibited from acknowledging climate change or using the term "climate change" in any professional capacity. In contrast to this shift in federal priorities and policies, extreme weather events continued to increase in frequency and intensity.

The United States is currently under the leadership of the Biden Administration, which has made climate change resiliency a priority. Billions of dollars have been released in support of protecting and restoring our nation's stock of natural capital, including wetlands and floodplains, as a way to mitigate and adapt to the impacts of climate change. However, the nation is still without any unified national leadership to coordinate such a tremendous initiative. According to a study done by the Pew Research Center in 2020 , two thirds of Americans believe the federal government should do more to reduce the impacts of climate change.

It is past time for the federal government to honor its promise for a unified national strategy to protect and restore the natural functions of floodplains. Hurricane Ian was one more sobering reminder of how vulnerable our communities are to the impacts of climate change; there is no more time to delay. The following strategies and recommendations are intended to provide a launching pad to reignite federal leadership and support for a unified national program and action plan for protecting and restoring the natural and beneficial functions of wetlands and floodplains. The goal is to support greater climate resiliency and, in turn, safer and healthier communities for all Americans. ■

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[2] Tyson, A. and Kennedy, B. (June 23, 2020). Two-Thirds of Americans Think Government Should Do More on Climate. www.pewresearch.org/science/2020/06/23/two-thirds-of-americans-think-government-should-do-more-on-climate

Strategies and an Action Plan for Protecting and Restoring Wetland and Floodplain Functions

Introduction

Wetland and floodplain functions are critically important to sustain our quality of life, as they store and convey floodwater, provide critical habitats for wildlife, improve water quality, capture carbon and nutrients, and recharge groundwater. Recognizing the importance of our nation's wetlands, Congress enacted the Emergency Wetlands Resources Act of 1986, requiring the U.S. Fish and Wildlife Service (USFWS) to conduct national status and trends studies and report to Congress every decade.

As noted in the USFWS 1991 report, in the early 1600s, the area that was to become the conterminous United States had approximately 221 million acres of wetlands. About 103 million acres remained as of the mid-1980s.[3] In 2011, the next decadal report was released in which Ken Salazar, secretary of the Department of the Interior at the time, reported to Congress: "While I am heartened to note that the Nation is making important progress in the conservation of our wetland resources, there is also reason for concern and continued diligence. Findings from this study indicate that between 2004 and 2009, wetland losses outdistanced wetland gains."[4]

PHOTO: **Mitch Paine**

These losses have resulted in increased flooding, releases of carbon and methane into the atmosphere, degraded drinking-water quality, polluted streams and rivers, and loss of wildlife habitat. These effects are exacerbated by climate change, which impacts every sector of our lives — from public safety and public health to our economy and the condition of our ecosystems that support all life on earth.

Unfortunately, due to a lack of meaningful federal commitment and direction to tracking similar gains or losses in floodplain functions and extent, we cannot cite nationwide statistics and communicate floodplain loss in the same way we do for wetlands. This lack of any comprehensive, nationally led data and analysis for floodplain functions and extent has resulted in disjointed and unstable efforts focused on policy, funding, and communication in support of protecting and restoring floodplains in the U.S. Increased flooding has been a significant and high-profile impact from climate change, and we have witnessed a significant intensification of precipitation events in most parts of the United States over the last 15 years.

According to the National Oceanic and Atmospheric Administration (NOAA), in 2021 there were 20 extreme weather disasters with losses exceeding $1 billion each that affected the United States. These events were largely water-driven and included drought, floods, severe storms, tropical cyclones, wildfire, and a winter storm.

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[3] Dahl, T.E. and Johnson, C.E. (1991). *Status and Trends of Wetlands in the Conterminous United States, Mid-1970s to Mid-1980s.* U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.

[4] Dahl, T.E. (2011). *Status and Trends of Wetlands in the Conterminous United States, 2004 to 2009.* U.S. Department of the Interior; Fish and Wildlife Service, Washington, D.C.

Overall, these events resulted in the deaths of 724 people and cost $152.6 billion in damages.[5] Record flooding in 2017 alone resulted in over $8.7 billion in losses paid by the National Flood Insurance Program (NFIP). As flooding events become more frequent and extreme due to climate change, it will be critical to manage our floodplains more effectively to safely store and convey floodwater in order to make our communities more resilient.

Increasingly, efforts to protect and restore the natural functions of floodplains and wetlands are being utilized to improve watershed health and to support climate change adaptation and mitigation. In order to effectively protect and restore wetlands and floodplains, however,

substantial effort must be made to identify their location and understand how they presently or could potentially function within the larger landscape and watershed. The functions of wetlands and floodplains do not occur in a one-dimensional setting; they occur in a dynamic, interconnected landscape with physical, chemical, and biological components that produce multiple ecosystem services and benefits for wildlife and people. However, the floodplains of many streams and rivers, especially those in rural areas, are not mapped at all by the Federal Emergency Management Agency (FEMA), leaving states like Vermont with approximately 80% of their watercourses unmapped for potential flood risk. ■

Floodplains and Their Functions

Floodplains are generally flat areas of land next to a river, stream, or coastal fringe, which may or may not have a direct hydrological connection to a watercourse, and which will be inundated with water during high flows (i.e., flood-prone).

A **riverine floodplain** consists of two parts: the flood channel and the geomorphic floodplain. The first is the main channel of the watercourse itself, and the land immediately adjacent to the channel where most of the conveyance and high-velocity flows occur during a flood. Channels can sometimes be seasonal, meaning the channel is dry for part of the year. Beyond the channel is the geomorphic floodplain, which extends from the outer edges of the flood channel to the bluff lines of a river valley. Bluff lines, also called valley walls, mark the area where the valley floor begins to rise into bluffs.

A **coastal floodplain** is typically fringe wetland area along large tidal or nontidal water, such as oceans, bays, and lakes that are prone to high risk of coastal flooding primarily from weather-related storm events. These events are characterized by storm surge, flooding, heavy waves, and erosion. One of the most important functions of coastal floodplain wetlands is to reduce the energy of storm surges — provided that these wetlands remain intact and have a wide horizontal area through which to dissipate energy and absorb flood waters. For example, during Hurricane Sandy, coastal floodplain wetlands saved more that $625 million in flood damages, and they typically reduce damages by an average of 10-20%. Coastal floodplain wetlands provide a protective buffer between open water and upland natural or built infrastructure.
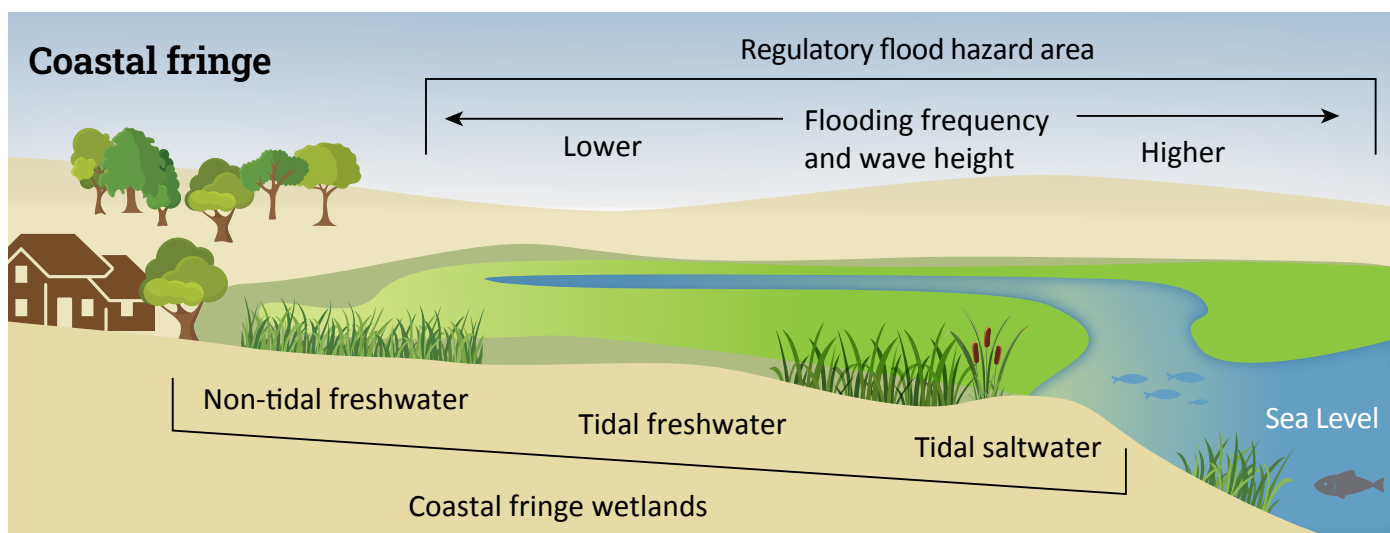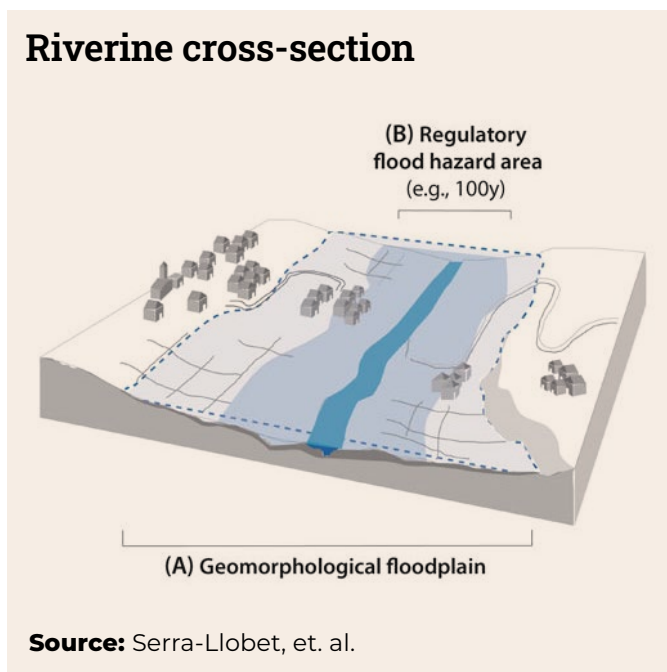
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[5] NOAA National Centers for Environmental Information (2022). U.S. Billion-Dollar Weather and Climate Disasters. www.ncdc.noaa.gov/billions

Although there are multiple wetland types, and not all exist within floodplains, nearly all floodplains contain wetlands, which act as key providers of floodplain functions. Those functions provide the critical ecosystem services and benefits that support public health and safety, climate resiliency, wildlife, and much more. Throughout the rest of this document, we will simply refer to "floodplain functions;" however, that language is intended to be understood as also referring to the wetland functions within the floodplains where they exist.

Flooding is a natural process that forms and maintains floodplains and coastal zones. Periodic flows of water that overtop the banks of a river and encroach upon coastal areas are the lifeblood of the riparian corridors, marshes, beaches, and other natural areas. Valley width and gradient, the seasonal variability of flow, incessant wave action, and intermittent extreme events all combine to determine both the physical structure and the biological diversity of flood-prone areas.

Floodplain bio-geomorphology describes the ecological interactions between hydrology, geomorphology, and biology of floodplain environments. These interactions result in functioning floodplain landscapes and generate the incredible value that floodplains provide to society — including flood conveyance and moderation, water-quality improvements (i.e., sediment and nutrient storage), carbon sequestration, aquifer recharge, and habitat for aquatic organisms. However, for a floodplain to function in a manner that maximizes these benefits for people and the environment, floodplain bio-geomorphology must be supported. Research demonstrates that four key attributes must be attained:[6]

Riverine cross-section

(B) Regulatory flood hazard area (e.g., 100y)

(A) Geomorphological floodplain

Source: Serra-Llobet, et. al.

Coastal fringe

Regulatory flood hazard area

Flooding frequency and wave height

Lower ← → Higher

Non-tidal freshwater

Tidal freshwater

Tidal saltwater

Sea Level

Coastal fringe wetlands

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[6] American Rivers (2016). Reconnecting Rivers to Floodplains. www.americanrivers.org/conservation-resource/reconnecting-floodplains

■ **Connectivity:** A functioning floodplain is physically accessible by water from its adjacent river or stream to allow an exchange of water, nutrients, sediment, and organisms.

■ **Variable Flow:** A functioning floodplain is connected to a river capable of producing flows with magnitudes large enough to inundate the floodplain. Additionally, a river must produce such flows at specific times of the year, for adequate spans of time, and at variable return frequencies to maximize a full range of ecological functions. Together, variable flow describes the necessary timing, magnitude, duration, and frequency of flows that support local biota.

Table 1. Natural Resources and Functions of Floodplains

Naturally functioning floodplains provide a number of environmental and economic benefits, which fall into three general categories: hydrological, biological, and societal. This table is adapted from the 1994 document
A Unified National Program for Floodplain Management.

Hydrological Resources	Biological Resources	Societal Resources
Natural Flood and Erosion Control ● Provide flood storage and conveyance ● Reduce flood velocities ● Reduce flood peaks ● Reduce sedimentation	**Biological Productivity** ● Support high primary productivity ● Enhance biodiversity ● Maintain ecosystem integrity ● Preserve wetland functionality	**Wild and Cultivated Products** ● Enhance agricultural lands ● Provide sites for aquaculture ● Protect and enhance forest land
Water Quality Maintenance ● Filter nutrients and pollutants from runoff ● Process organic wastes ● Moderate temperature fluctuations	**Fish and Wildlife Habitats** ● Provide breeding and feeding areas ● Create waterfowl habitats ● Protect habitats for rare and endangered species	**Recreational Opportunities** ● Provide areas for active and passive uses ● Provide open space ● Provide aesthetic values
Groundwater Recharge ● Promote infiltration and aquifer recharge ● Reduce frequency and duration of low surface flows		**Areas for Scientific Study and Outdoor Education** ● Contain cultural resources (historic and archaeological) ● Provide opportunities for environmental studies ● Provide "wild" natural areas for experiencing and enjoying nature

- **Spatial Scale:** A functioning floodplain must have the space to accommodate inundation and river dynamics, and the resulting habitat- and landscape-forming processes that occur.

- **Habitat and Structural Diversity:** Diversity of sediment erosion and deposition conditions, gradients of hydrologic connectivity, ecological succession, and naturally accumulated debris generate habitat supportive of terrestrial and aquatic organisms. Ideally, these features emerge from co-occurrence of the previous three attributes.

When human activities alter the attributes of a functional floodplain, they can disrupt floodplain bio-geomorphology, resulting in a reduction or destruction of floodplain functions. Restoration of beneficial floodplain functions requires consideration of these attributes in addition to a focus on community protection from flood risk.

Despite what science indicates about functioning floodplains, floodplain boundaries in the United States are generally identified according to the standard set by the NFIP: the 1% annual-chance floodplain, also known as the "100-year floodplain" or the regulatory floodplain. This is the area FEMA uses to create flood hazard–area maps that communities use to regulate development in flood-prone areas. These flood hazard–area maps, or Flood Insurance Rate Maps (FIRMs), do not include information about floodplain function and must be periodically updated to capture the natural evolution and restored floodplain bio-geomorphology and function. ■

PHOTO: **Mitch Paine**

The Loss of Functioning Floodplains and the Need for Continued Action

Due to unrestricted historical development, management of flood-prone areas has long been development-centric. The typical strategy has been to confine the waterway or water body to a predefined size and capacity that maximizes the extent of developable or agricultural land and also keeps the flood water away from people and their property (hence the birth of the term "floodway"). Under such a framework, the floodplain served a singular, human-centered role as a conveyance network to pass the "excess" water as quickly as possible, without consideration of the loss of ecological function; the potential damage to downstream property owners; or the cultural, economic, or environmental effects of that strategy.

Millions of dollars in public and private investment are spent annually across the country attempting to contain streams and rivers within their channel during high flows, in order to protect adjacent lands from flooding and minimize damage to property and infrastructure within the river corridor. The socioeconomic drivers that have led to these drainage practices include settlement of riversides for arable land and the development of industry, roadways, and other settlements within floodplains.

This centuries-long effort to reduce inundation flooding by channelizing flow, disconnecting historic floodplains, and draining the land has significantly increased fluvial erosion-related damages and has had a significant adverse impact on the natural resources and functions of floodplains. In addition, loss of connectivity between streams and floodplains has caused extreme scour and deposition, smothering aquatic habitats and obstructing movement of aquatic organisms. This often results in the near complete loss of the hydraulic processes that, at natural levels, form rich mosaics of floodplain and wetland habitat.

The loss of functioning floodplains is contributing to water-resources management challenges across the nation, including increased flooding and erosion, poor water quality, drought, and loss of biodiversity. However, no comprehensive assessment of the quantity of functioning floodplains existed at the time of this workshop series, making it difficult to effectively measure and communicate the impact that floodplain loss has at a national scale. What is clear is that functioning floodplains are a necessary solution to address the climate change and biodiversity crises that we face today. ■

Developing a National Action Plan to Protect and Restore Floodplains

In 2017, the National Association of Wetland Managers (NAWM) began facilitating a discussion between the Natural Floodplain Functions Alliance (NFFA)[7] and the Wetland Mapping Consortium (WMC)[8] about the possibility of creating a multi-year initiative to improve floodplain mapping programs. The intent was to integrate geospatial data and functional assessment methods being developed and used by the wetland-mapping community to identify wetland and floodplain functions in support of nature-based solutions[9] for reducing flood risk. A Steering Committee was established with individuals from each organization, and NAWM began hosting monthly conference calls.

The Steering Committee identified an ultimate long-term goal of developing a baseline national classification standard for functional assessment of wetlands and floodplains. This standard would incorporate regional environmental variations and could be tailored for different project goals and state/local policies, to better inform land-use decisions and provide greater project outcomes with multiple co-benefits. The Steering Committee decided to hold three annual workshops to facilitate accomplishing this goal, bringing together subject-matter experts from across the country and disciplines.

On April 10, 2018, NAWM convened the NFFA and the WMC for the first workshop, "Exploring Opportunities for Integrated Mapping and Functional Assessment of Riverine and Coastal Floodplains and Wetlands." The overall goal of this workshop was to discuss current and potential opportunities to integrate geospatial mapping and functional assessments of coastal and riparian wetlands and floodplains to improve land-use decisions and resource management, and to reduce risk from the impacts of flooding, sea level rise, and other extreme weather events.

On Sept. 30, 2019, the second workshop, "Data Needs, Gaps and Interoperability for Integrated Mapping and Functional Assessment of Riverine and Coastal Floodplains and Wetlands," was held. The goals for this workshop included identifying: 1) a core list of functions (i.e., wetland, riparian, coastal) useful for floodplain management and land-use decisions; 2) currently available techniques, tools, and approaches; and 3) gaps for data, funding, and tool accessibility.

The third workshop, "Federal Program and Policy Changes Needed to Advance Integrated, Functional Mapping of Floodplains and Wetlands for Nature-Based Solutions," was originally planned for 2020. However, due to the COVID-19

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[7] In 2011, the NAWM and the Association of State Floodplain Managers (ASFPM) joined forces to create the NFFA, an affiliation of nonprofit and private organizations, government agencies, and individuals dedicated to the protection, restoration, and management of natural floodplain resources.

[8] In 2008, the NAWM founded the WMC, an interdisciplinary group of wetland scientists and managers interested in mapping and monitoring wetlands with remotely sensed images and using the resulting products to best manage wetland resources – ultimately resulting in increased conservation of wetlands and the enhanced delivery of wetland ecosystem services.

[9] The authors of this report support The White House Coastal Resilience Interagency Working Group definition of nature-based solutions as "actions to protect, sustainably manage, and restore natural or modified ecosystems (land, water, coastal, or ocean) that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits (e.g., coastal protection, reduced flooding, decreased heat-island effects)."

pandemic, the in-person workshop was replaced with an interim half-day virtual workshop, held on Feb. 10, 2021. Participants in this workshop compared the findings of the second workshop to existing policy and programs in order to identify necessary changes or advancements to support nature-based approaches to flood-risk reduction using functional assessment data. Reports from these three workshops can be found on NAWM.org.

Given the abbreviated format of the third workshop, a fourth workshop was added, titled "Developing an Action Plan for No Net Loss of Floodplain Functions." This final workshop was also moved to a virtual format due to the continuing global pandemic, and was spread across three half-day sessions from Nov. 30 to

Dec. 2, 2021. The goal for this workshop was to develop an action plan with clear recommendations and near-term actions leading to no net loss of floodplain functions[10] and reduced flood risk in local communities. The workshop was designed around four breakout sessions, each focusing on a different topic that the previous workshops identified as being central to developing a path forward: policy, data, funding, and communication. These breakout sessions provided plenty of time for group discussion and brainstorming on each topic.

The remainder of this report is organized based on these four pillars, and documents the workshop findings, policy recommendations, and suggested next steps. ■

1

POLICY:
Programs, Practices, Regulations, and Institutional Barriers

I. Introduction

In the United States, floodplains and their functions are managed by a confusing web of local, state, and federal policies and programs. Until the 1960s, the federal government's involvement in floodplain management focused on the use of structural flood management projects like levees and dams. As flood disaster costs escalated, "non-structural" strategies (e.g., insurance, risk communication, and mitigation) to avoid flood losses began to increase in popularity.

The NFIP was created in 1968 to: "(1) encourage State and local governments to make

appropriate land use adjustments to constrict the development of land which is exposed to flood damage and minimize damage caused by flood losses [and to] (2) guide the development of proposed future construction, where practicable, away from locations which are threatened by flood hazards."[11] In addition to offering flood insurance for properties, the NFIP requires communities to prepare Flood Insurance Studies, including the supporting FIRMs, and establish minimum standards to guide future development in floodplains by adopting and enforcing a local floodplain management ordinance. Notably, the law and policies guiding the NFIP's mapping

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[10] Workshop participants overwhelmingly agreed that "no net loss" was an inadequate goal, resulting in a shift to "protection and restoration of floodplain functions."

[11] 42 U.S.C. § 4001

and land-use standards are primarily aimed at addressing flood losses, and do not directly address the other functions and benefits served by floodplains.

The NFIP's Community Rating System (CRS) promotes comprehensive floodplain management planning, analysis, and evaluation related to protection of the natural functions of floodplains, including habitat. Communities that produce maps to identify the natural functions and resources of their flood-prone areas can receive CRS credit for taking that step toward broader management of their local floodplains. However, FEMA's Risk Mapping, Assessment, and Planning program generally only includes data on flood elevation, hydrology, infrastructure, hydraulics, and land use for the purpose of local floodplain management and regulatory compliance, and prior to April 2022,[12] to inform NFIP insurance rates. Floodplain management efforts would be dramatically improved if they could be informed by geospatial data that describes functions of floodplains (including wetlands, streams, and rivers) as a component of a larger watershed assessment to support more strategic local land-use decisions and reduce risk.

At the same time the NFIP was developed, the modern environmental movement was gaining steam. Landmark laws to protect and preserve natural ecosystems and their functions were passed, including the National Environmental Policy Act (NEPA) in 1969, the Clean Water Act (CWA) in 1972, and the Endangered Species Act in 1973. Today, these laws play an important role in safeguarding and preserving the natural and beneficial functions of floodplains, as do a myriad of federal land-management programs, including the Wild and Scenic Rivers System, the National Refuge System, the Coastal Zone Management System, and Natural Resource Conservation Service conservation programs, to name just a few.

Federal agencies like the USFWS, NOAA, the U.S. Forest Service (USFS) and the U.S. Army Corps of Engineers (USACE) also play an important role in restoring aquatic and coastal ecosystems, including floodplains and wetlands. However, other federal agencies frequently undertake actions that can have unintentional negative impacts on floodplains, thereby increasing flooding and fluvial erosion and/or harming the natural and beneficial functions of floodplains. Roads and highways funded by the Department of Transportation can act as levees, disconnecting rivers from floodplains; public housing constructed by the Department of Housing and Urban Development is often built in areas susceptible to flooding; and the USACE regularly constructs levees and other water-resources infrastructure that can result in harm to functional floodplains and wetlands.

By 1977, it had become clear to federal leaders that this dispersed approach to floodplain management was problematic and that a unified federal approach was needed. The landmark Executive Order 11988 (EO 11988), "Floodplain Management," that was signed in 1977 enshrined the importance of natural floodplains into federal policy and charged every federal agency with taking "action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and **to restore and preserve the natural and beneficial values served by floodplains …** ."[13]

Almost two decades later, interagency efforts to improve implementation of EO 11988 resulted in the 1994 revisions to *A Unified National Program for Floodplain Management* by the FIFM-TF, which noted that "relatively undisturbed

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[12] On April 1, 2022, FEMA implemented Risk Rating 2.0, which set NFIP premiums using a more comprehensive suite of data than the agency has used in the past to address rating disparities by incorporating more flood-risk variables. These include flood frequency, multiple flood types — river overflow, storm surge, coastal erosion, and heavy rainfall — and distance to a water source, along with property characteristics such as elevation and the cost to rebuild (but not the value of floodplain functions).

[13] United States, Executive Office of the President [Jimmy Carter]. Executive Order 11988: Floodplain Management (May 24, 1977). www.archives.gov/federal-register/codification/executive-order/11988.html

floodplains or those that have been restored to a nearly natural state provide a wide range of benefits to both human and natural systems. Some of these benefits are static in nature (e.g., providing aesthetic pleasure) and some are dynamic processes (e.g., moderating the erosive power of floods and filtering nutrients)." Unfortunately, implementation of the Unified National Program (UNP) has been inconsistent, largely due to inconsistent political support.

Over the past decade, scientific understanding of how floodplain functions work within the larger landscape context has increased, particularly regarding their ability to support climate adaptation and mitigation goals. This has resulted in a greater overall public and political support for projects that protect and restore the natural and beneficial functions of floodplains, along with implementation of what are now commonly referred to as "nature-based solutions" (NBS).

In 2015, EO 11988 was amended by EO 13690, the Federal Flood Risk Management Standard,

to include the requirement: "Where possible, an agency shall use natural systems, ecosystem processes, and nature-based approaches when developing alternatives for consideration."[15] Implementing Guidelines for EO 11988 and EO 13690[16] provide detailed descriptions of how agencies must minimize potential harm not only to "lives and property," but also "natural and beneficial floodplain values," and must also "restore" and "preserve" natural and beneficial values of floodplains.[17]

FEMA defines NBS as "sustainable planning and design, environmental management, and engineering practices that weave natural features or processes into the built environment to promote adaptation and resilience." However, in practice, NBS include a much broader variety of techniques to protect, enhance, or restore the functions and ecosystem processes found within our nation's stock of natural capital to support the provision of myriad ecosystem services and benefits that contribute to our quality of life.[18]

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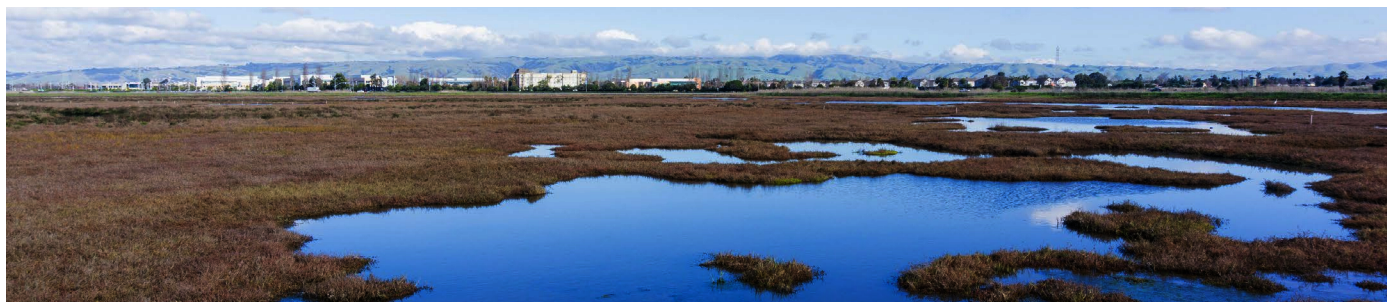
[15] Executive Office of the President. Executive Order 13690 ((Jan. 30, 2015). "Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input." 80 FR 6425. Doc. #2015-02379. www.federalregister.gov/documents/2015/02/04/2015-02379/establishing-a-federal-flood-risk-management-standard-and-a-process-for-further-soliciting-and

[16] FEMA (Oct. 8, 2015). "Guidelines for Implementing Executive Order 11988, Floodplain Management, and Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input". FEMA-2015-0006-0358. https://www.fema.gov/sites/default/files/documents/fema_implementing-guidelines-EO11988-13690_10082015.pdf

[17] "Restore" means to reestablish a setting or environment in which the natural and beneficial values of floodplains could again function. Where floodplain values have been degraded by past actions, the agency must identify, evaluate, and implement measures to restore the values diminished or lost. The functions of many of the nation's degraded floodplains can be partially or fully restored through remedial action. "Preserve" means to prevent modification to the natural floodplain environment, or to maintain it as closely as possible to its natural state. This term applies foremost to floodplains showing little or no disruption by man. If an action will result in harm to or within the floodplain, the agency must design or modify the action to assure that it will be carried out in a manner that preserves as much of the natural and beneficial floodplain values as possible.

[18] Please see footnote 10 with The White House Coastal Resilience Interagency Working Group definition.

Examples of Nature-Based Solutions that Restore Floodplain Functions

Every floodplain restoration project is different. The conditions of the impacted floodplain will determine the tactics and tools that must be used to restore floodplain functions. Examples include:

Levee set-backs are projects that realign an existing levee or berm further back from the river channel in such a way that allows for dynamic processes and for water to spread across the floodplain during high water events. Missouri River levee L-536, in northwest Missouri in Atchison and Holt Counties, was breached in 7 locations during historic flooding in 2019. Instead of rebuilding in place, a levee setback project was implemented under the USACE's Public Law 84-99 program, reconnecting over 1,000 acres of floodplain. See: **"Large-Scale Levee Setback Playbook"** by The Nature Conservancy for more information.

Levee set-back, Missouri River.
PHOTO: Route 3 Films

Floodplain reconnection on incised streams using low-tech, process-based restoration seeks to mimic beaver activity in hopes of enticing these natural river engineers to return. Removal of beaver and other land disturbances have led many creeks to incise deeper into their valleys, resulting in floodplain disconnection, lower water tables, and dryer landscapes. Installing low-tech, hand-built structures that mimic natural beaver dams can slow water and capture sediments which raises the stream channel, resulting in reconnection of incised streams with the floodplain and adjacent wetlands so that more frequent inundation of the floodplain occurs.

Low-tech, process-based restoration, Trail Creek, CO. PHOTO: Jackie Corday
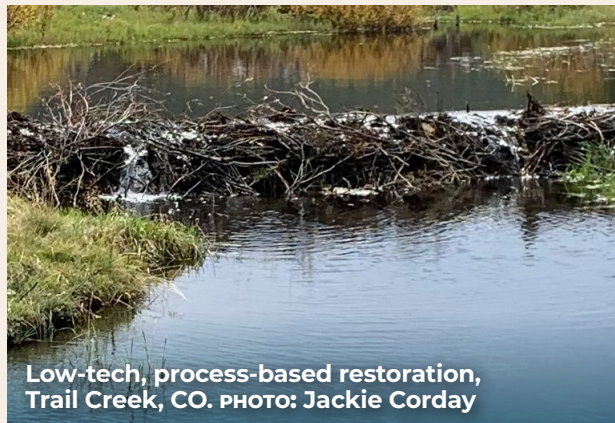
Urban floodplain restoration projects involve the acquisition of developed floodplain land, remove buildings and infrastructure, and restoration of natural functions. These projects may involve a variety of actions including willing seller programs, land acquisition, floodplain reconnection, riparian restoration, etc. A prominent example is Johnson Creek in Portland, Oregon. After severe flooding in 1996 and the Endangered Species listings of local salmon, the city of Portland created the Johnson Creek Willing Seller Land Acquisition Program to help move flood-prone residents out of danger. The acquired properties were restored to natural conditions.

Urban floodplain restoration, Johnson Creek, OR. PHOTO: hiddenhydrology.org

In recent years, NBS have become a common component of federal and state policies and programs, including the following:

■ The American Recovery and Reinvestment Act of 2009 established a Green Project Reserve, dedicating 20% of the EPA's Clean Water State Revolving Loan Funds to green infrastructure projects.

■ In 2007, Congress established a new Water Resources Policy that requires protection and restoration of the environment and avoiding harm to floodplains. In 2016, 2018, and 2020, Congress specifically required that the USACE consider nature-based alternatives when planning water-resources projects. The USACE Engineering With Nature program is working to integrate nature-based solutions into its projects and practices.

■ FEMA began to encourage maintaining or restoring natural floodplain functions in hazard mitigation projects with the Hazard Mitigation Assistance Unified Guidance in 2010, and NBS received higher preference in the project criteria for the Building Resilient Infrastructure and Communities Program launched in 2020.

  ● As of July 2022, the Biden-Harris administration has taken several steps to increase the use of NBS, including:

  ● Launching the "America the Beautiful" initiative to conserve at least 30% of U.S. lands and waters by 2030

  ● Releasing a *Compendium of Federal Nature-Based Resources for Coastal Communities, States, Tribes, and Territories* [19]

  ● Developing the Nature-Based Solutions Roadmap,[20] the first federal strategy to scale up nature-based solutions

  ● Issuing a valuation guidance to help agencies account for ecosystem servicesthrough the Office of Management and Budget (pending)

  ● Launching the first U.S. National Nature Assessment under the U.S. Global Change Research Program (pending)

An increasing number of states are also establishing programs or policies to support the use of NBS, including protection and restoration of floodplains. For example:

■ Washington's Floodplains by Design Program is an ambitious public-private partnership working to reduce flood risk and restore habitat along Washington's major rivers.

■ Vermont's Department of Environmental Protection launched a Functioning Floodplain Initiative to develop methods and mapping to identify high-priority projects to restore and protect stream, wetland, and floodplain functions.

■ California's Central Valley Flood Protection Plan prioritizes multi-benefit projects that reduce flood risk and restore floodplain habitat. ■

II. Discussion

Workshop participants engaged in robust discussions about the policy-related challenges they experience and observe while working to protect and restore floodplain functions, including the following:

High administrative burdens are common.
There are dozens[21] of potential funding sources that project managers must track to fund their projects. Many of these programs have extensive proposal, tracking, and/or reporting requirements

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[19] The White House (April 2022). Compendium of Federal Nature-Based Resources for Coastal Communities, States, Tribes, and Territories. www.noaa.gov/sites/default/files/2022-04/Nature-based-Solutions-Compendium.pdf

[20] White House Council on Environmental Quality, White House Office of Science and Technology Policy, White House Domestic Climate Policy Office (November 2022). Opportunities to Accelerate Nature-Based Solutions: A Roadmap for Climate Progress, Thriving Nature, Equity, & Prosperity. Report to the National Climate Task Force. https://www.whitehouse.gov/wp-content/uploads/2022/11/Nature-Based-Solutions-Roadmap.pdf

[21] The *Compendium of Federal Nature-Based Resources for Coastal Communities, States, Tribes and Territories* lists 48 federal programs that support nature-based projects, and this compendium does not include natural-resources protection programs or fluvial programs.

that can be particularly difficult or impossible for smaller, under-resourced, and/or disadvantaged communities to navigate.

Inconsistencies exist among federal agency missions, requirements, and objectives. Many federal agency programs have misaligned or conflicting missions, requirements, and objectives. For instance, NFIP land use–management regulations are intended to manage floodplain development and ensure that development does not increase flood heights. Due to this narrow focus and requirement, many workshop participants shared that they found it challenging to obtain floodplain permits for in-stream or floodplain restoration projects required to comply with water-quality and endangered-species recovery objectives, because FEMA defines these actions as forms of development.

Protection and restoration of floodplain functions is not integrated into the statutory and legal framework of floodplain management. While the UNP for Floodplain Restoration establishes co-equal goals of reduction of flood damage and protection and restoration of floodplain functions, this language is not codified in law. The NFIP's statutory language fails to require or even encourage protection and restoration of floodplain functions, except as voluntary activities under the CRS.

The UNP for Floodplain Management has suffered from a lack of sustained and bipartisan political support. The UNP is managed by an interagency task force and is subject to the shifting goals of the administration in office. This results in lengthy lapses in work and shifting priorities whenever there is a change in administration. This inconsistency means the program has rarely been implemented in a reliable or measurable manner.

Enforcement of EO 11988 and EO 13690 is inconsistent and not tracked. EO 11988 requires agencies to "restore and preserve the natural and beneficial values served by floodplains,"

and EO 13690 requires agencies to "use natural systems, ecosystem processes, and nature-based approaches when developing alternatives for consideration." Compliance with these EOs is typically conducted through environmental reviews required under the NEPA, but no tracking occurs to ensure that agencies are meeting the requirements of these EOs.

There is no federal goal related to protection and restoration of floodplains. The federal government has never set a specific goal for protection and restoration of floodplain ecosystems and policies, and programs are not designed to achieve a quantifiable increase in natural floodplain habitat through protection/preservation of existing natural floodplains and restoration of damaged and disconnected floodplains. There is no comprehensive dataset to measure and map floodplain functions, and without consistent data and tools, floodplain functions cannot be integrated into flood-risk maps in a consistent manner.

Workshop discussions highlighted that fundamental policy changes are needed to elevate and integrate protection and restoration of floodplain functions into our nation's regulatory and management framework for floodplain management. While efforts have been made to integrate these two goals for over 40 years, it is clear that more structural strategies are needed to achieve change. Since floodplain management is spread across dozens of agencies and programs, and is the shared responsibility of local, state, and federal governments, we recommend a strategy that encompasses these actions (more detail provided under Implementation Actions below):

1. Reinvigorate and reimagine the UNP for Floodplain Management.

2. Identify and implement targeted, strategic changes that will integrate protection and restoration of floodplains throughout both federal and state policies and programs that influence floodplains.

3. Enable local and state governments to build capacity for and implement protection and restoration of floodplains.

The policy changes recommended below are achievable only if implemented in conjunction with initiatives to improve the science and data of floodplain functions, to communicate the benefits and effectiveness of floodplain functions to the public and decision-makers, and to provide adequate and consistent funding to states and local communities to effectively implement projects and programs to support protection and restoration of floodplains.

Workshop participants noted that these challenges must be addressed in a manner that both fosters timely and accurate communications of changes in flood risk and enables local and state partners to implement restoration projects in a timely and cost-effective manner, thereby meeting legal and statutory requirements to improve water quality and recover endangered species. Local communities and states from multiple FEMA regions have experienced these challenges; thus a comprehensive, holistic national strategy is needed to align floodplain management and ecosystem-restoration programs and policies, and to enable the implementation of innovative and integrated strategies by states, Tribes, and local communities. ■

III. Implementation Actions

Near/Mid-Term Actions:

■ Reinvigorate and reimagine the UNP for Floodplain Management.

● The U.S. presidential administration should reinitiate a federal interagency group (the Water Resources Council, FIFM-TF, or Mitigation Framework Leadership Group)

to implement the UNP for Floodplain Management, EO 11988, and EO 13690.

◆ Non-governmental organizations (NGOs) should make a formal request to the administrators of agencies in the Water Resources Council.

◆ NGOs should advocate for protection and restoration of floodplain functions being included in administration priorities, such as the National Nature Assessment, America the Beautiful, and Environmental Justice initiatives.

● The administration should establish a federal Floodplain Functions Initiative to map and track floodplain functions.

◆ NGOs should advocate for authorizing legislation to support the initiative, including funding data needs and developing critical-input datasets, assessment models, and tool interfaces.

■ Identify and implement targeted, strategic changes that will integrate protection and restoration of floodplains throughout federal and state policies and programs that influence floodplains.

● The administration and federal agencies should capitalize on rulemakings and initiatives to integrate protection and restoration of functioning floodplains into existing and future policies and programs that influence floodplains. Upcoming opportunities include:

◆ Potential FEMA rulemaking on 44 CFR, Part 60, Criteria for Land Management and Use[22]

◆ USACE rulemaking to develop agency-specific implementing procedures for the Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies

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[22] On Oct. 12, 2021, FEMA issued a Request for Information to receive the public's input on revisions to the NFIP's floodplain management standards for land management and use regulations, as well as input on how the NFIP can better promote protection of and minimize any adverse impact to threatened and endangered species and their habitats. Next steps had not been announced at the time of publication. See www.reginfo.gov/public/do/eAgendaViewRule?pubId=202204&RIN=1660-AB11.

◆ EPA CWA rulemaking defining Waters of the United States and defining bio-geomorphic characteristics and dynamic riverine and coastal processes as new criteria essential to restoring and maintaining the chemical, physical, and biological integrity of the nation's waters

● FEMA should convene a national discussion on floodplain mapping to develop a new approach to mapping and modeling flood risk that identifies and incorporates floodplain functions.

● NGOs with floodplain policy expertise should:

◆ Map out opportunities to include protection and restoration of floodplains in existing programs and policies, and develop language recommendations and consistent terminology and definitions.

◆ Identify where Congressional direction will be needed to amend existing policies and create new programs and policies to support protection and restoration of floodplains and watershed-scale approaches.

■ Enable local, state, and Tribal governments to build capacity for and implement protection and restoration of floodplains.

● Undertake an assessment of successful local, state, and Tribal programs to protect and restore floodplains, and identify the key building blocks of successful programs.

Long-Term Actions:

■ Educate decision-makers (e.g., federal agency leadership and Congress) about the multiple benefits of functioning floodplains and key programs to support protection and restoration of floodplains.

■ Develop guidance on model local, state, and Tribal policies and programs to achieve protection and restoration of floodplain functions.

■ Enable and encourage states (via incentives and/or regulations) to implement programs that build capacity for local and Tribal

communities to plan and implement projects to protect and restore floodplains (with an emphasis on watershed scale).

■ Delegate floodplain management authorities to states and Tribes with integrated (multi-benefit) floodplain management programs.

■ Authorize and fund the National Nature Assessment to occur every five years, and specifically measure the quantity and quality of floodplains and their functions.

■ Reform benefit-cost analysis (BCA) to better account for the ecosystem services of all ecosystems, including floodplains.

■ Establish measurable federal goals to protect and restore floodplains, and authorize a dedicated program that will enable local communities, states, and Tribes to protect and restore floodplains.

IV. Recommendations

■ Reinvigorate the UNP for Floodplain Management and provide sustained funding in order to advance an integrated and multi-benefit floodplain management approach that reduces flood losses and enables protection and restoration of floodplain functions. This effort should include:

● Stronger legal authority for the UNP and dedicated annual funding

● A governance structure that empowers local, state, Tribal, and regional leadership and fosters watershed-level initiatives

● Shared leadership between federal agencies with missions to reduce flood losses and protect and restore natural resources

■ Reform existing programs and regulations, including the NFIP, CWA, and Farm Bill, to better enable protection and restoration of floodplain functions.

■ Establish a pilot program to delegate regulatory and administrative authority for floodplain management, including permitting, mapping, and distribution of mitigation funding to

states and Tribes that demonstrate capacity to implement an integrated and multi-benefit floodplain management approach that reduces flood losses and enables protection and restoration of floodplain functions.

■ Increase federal resources for watershed-level planning.

■ Convene a national, federal-interagency discussion on floodplain mapping to develop a new approach to mapping and modeling flood risk that better incorporates floodplain functions and allows for dynamic river processes to occur where appropriate. ■

2 FUNDING:
Opportunities and Constraints for Implementation

I. Introduction

The economic-related challenges associated with floodplain protection and restoration are multi-layered and intersecting. As with all infrastructure projects, accessing funding to support planning and implementation of projects to protect and restore floodplain functions is a persistent challenge for local communities and practitioners. While theoretically there are dozens of programs that could be utilized to invest in the protection and restoration of floodplains, there are few programs that can be used expressly for these purposes. The abundance of programs also brings challenges with implementation.

II. Discussion

Workshop participants recognized multiple ways in which federal restrictions could stand in the way of projects, including a confusing matrix of programs and agencies to track, conflicting objectives of federal programs, restrictions on funding certain project components (e.g., land acquisition), and inflexible processes that do not allow states and locals to prioritize projects of highest need.

Another major theme discussed in the workshops is the role that traditional BCA plays on green-lighting a project to protect or restore floodplains. Federal and state programs generally rely on an institutional decision-making structure that values quantifiable, monetary gain. This structure does not adequately quantify the economic value that functional floodplains can provide to communities, nor does it recognize the intrinsic value held by floodplains and other natural ecosystems. As a result, natural floodplains and the benefits they provide are either undervalued or not considered at all when investment decisions are made.

In addition, traditional BCA for infrastructure investments typically evaluates the costs and benefits of an individual project. When it comes to floodplains and natural ecosystems in general, multiple projects within a watershed can provide increasingly cumulative benefits as more and more floodplains are protected and restored. Workshop participants were particularly inspired during a discussion of using watershed-wide data on functioning floodplains to inform project investments, determine cost-effectiveness, and ease permitting burdens in order to facilitate project delivery.

Finally, existing policies (i.e., EO 11988, 11990, and 13690) which are intended to deter federal investments in floodplains that would destroy their natural and beneficial functions are not enforced. Lack of comprehensive data and project tracking has resulted in a lack of information about the degree to which these policies effectively drive development to higher ground.

Workshop participants identified the following funding challenges:

- Despite EO 11988 and 13690, federal funding is still being used to develop floodplains.

- BCA continues to drive decision-making.

- Traditional economic analysis does not adequately account for the socioeconomic and environmental benefits of floodplains, or the costs of damage to floodplains.

- Watershed-level strategies are needed to protect and restore floodplain functions at scale, but BCAs are typically performed on a project-by-project basis. This is ineffective, inefficient, and limits the ability of communities to implement projects.

- Current BCA methods do not utilize a discount rate that accounts for the increase in value and function of NBS over time as these ecosystems mature, versus the inevitable and well-documented depreciation of value and function of hard infrastructure.

- Communities need increased access to private funding to leverage as cost-share for federal funding, or federal funding that eliminates or significantly reduces cost-share requirements.

- Federal post-disaster programs favor maintaining the status quo by reinvesting in flood-prone areas and focusing on economic damage inflicted, rather than local needs.

- Local communities and practitioners do not have capacity or access to tools and resources to support their efforts to protect and restore floodplains.

- Existing policies and programs intended to ensure equity and inclusion (e.g., NEPA) are not adequate or implemented as intended.

- Current funding and technical-assistance program structures tend to favor or prioritize wealthy communities.

- Federal programs have numerous and varied restrictions and red tape that can make it hard for states and communities to implement watershed or state-level strategies and direct funding to their state priorities.

- Local community budgets are significantly dependent on private property taxes, which is a disincentive for communities considering protecting or restoring floodplains. This also creates an incentive to allow developers to rush in and redevelop floodplains after a disaster, resulting in properties and communities experiencing repeated losses. ◼

III. Implementation Actions

Objective: Influence and invest significant federal resources in programs that support protection and restoration of floodplains.

- Assess the core initiatives, programs, and policies that drive or could drive funding for protection and restoration of floodplains within agencies, and identify needed reforms.

- Develop a set of recommendations for how states/Tribes can utilize federal funding sources, including development and infrastructure programs, to support protection and restoration of floodplain functions in a more flexible manner, including pooling funding sources that can support multipurpose/multi-benefit projects.

  - Develop a list of programs and recommendations and distribute them to state and Tribal floodplain management staff and other relevant staff.

- Identify or develop ways in which various pots of federal funding can be combined for single projects that have multiple benefits and meet multiple agency goals, such as National Fish and Wildlife Foundation funding programs.

- Revise federal funding decision-making structures to better incorporate the functions

of floodplains and other social and ecological outcomes.

- Develop recommendations for BCA changes.

■ Assess and identify success factors of state and regional initiatives (e.g., Floodplain By Design, California's Central Valley Flood Protection Plan, Vermont and Colorado initiatives) for funding floodplain protection and restoration, along with how they can be translated to federal programs.

■ Engage with CEQ and federal agency leadership to discuss how EO 11988, 11990, and 13690 could be interpreted and implemented to more successfully protect and restore floodplains.

- Work with the U.S. Department of Housing and Urban Development to ensure its programs are aligned with the above EOs.

■ Enhance communication of funding needs and benefits of floodplain protection and restoration.

- Strengthen relationships and establish regular communication channels between NGO leaders and federal agencies, and develop formal agreements to enable and build capacity for investments that protect and restore floodplains.

- Develop clear and compelling messaging in support of floodplain protection and restoration that can be used by multiple stakeholders to communicate funding needs to federal agencies and others.

- Develop a repository for background data that illustrates the need for a comprehensive national strategy for protection and restoration of floodplain functions, including current projects and their benefits to support messaging and advocacy campaigns.

- Encourage and provide mechanisms for communication from local stakeholders, government, and landowners to request funding and understand funding opportunities.

IV. Recommendations

■ Federal agency BCA should be reformed to account for ecosystem services of floodplains and social and environmental factors.

■ The federal government should establish one central location for to apply for funding for nature-based solutions projects, including floodplain restoration.

■ The federal government should pilot innovative funding mechanisms, including pooling conservation and hazard-mitigation funding sources in order to support multi-benefit, nature-based projects.

■ Federal agencies should update guidance for EO 11988, 11990, and 13690 to implement the federal flood-risk management standard and fully integrate nature-based solutions alternatives into federal project planning.

■ The federal government should establish a new federal funding source for projects that protect and/or restore floodplain functions.

■ Congress should annually appropriate funding for the FIFM-TF (or a similar interagency group).

■ States should create integrated floodplain management programs aimed at reducing flood losses and protecting and restoring floodplain functions, and federal agencies should align programs to support these state initiatives. ■

3 DATA:
Science-Based Decision Support, Tools, and Analysis

I. Introduction

Past experience has demonstrated that the most effective natural-resource policies and management strategies are based on a foundation of scientific observations, data, and predictions. However, the collection of such data requires not only the development of science-based protocols, but the governance and funding necessary to produce this information across an operationally meaningful geography.

Over the past two decades, a variety of agencies and organizations have begun working to develop data and models that quantify the costs of floodplain development, wetland loss, and stream channelization, and balance the costs of degraded water quality and repeated flood damage with the ecosystem benefits of functioning floodplain-wetland systems. It is clear from these efforts that floodplain management spans multiple geographic and socioeconomic scales, and that successful data development and assessments must be supported by all levels of government (i.e., federal, Tribal, state, and local agencies).

Due to the high levels of expertise, cost, and time necessary to create the foundational datasets necessary to parameterize landscape-scale functional assessment models, it is critical that these datasets are maintained and updated over time, and that new models appropriately leverage existing datasets.

At the federal level, landscape-scale geospatial datasets created according to established federal standards (e.g., the National Hydrography Dataset, the National Wetlands Inventory, and the National Land Cover Database) can be used to provide both base inventories of key landscape elements (e.g., floodplain extent, wetlands, soil types, land use, and land cover) and broad estimates of hydrologic and geomorphic connectivity. Ideally, these national datasets should be accompanied by even finer resolution data, including field measurements, that allow the development of site-specific restoration plans. These two types of data are complementary, with each supporting planning and accounting at scales that are critical to promoting the conservation and restoration of floodplains and their benefits.

Ultimately, the data required to support activities from river-reach to watershed-scale restoration of natural stream, wetland, and floodplain functionality must come from a variety of sources, programs, and agencies. Although funding and broad priorities may be established by the federal government, changes in land practice to restore functioning floodplains are largely at the discretion of local communities and landowners and state/federal technical data. Therefore, it is important for data and tools to support decision-making at both scales of governance, and facilitate communication and collaboration across organizations. The identification and prioritization of natural-resource conservation and restoration projects will benefit significantly from a coordinated, multi-agency, publicly accessible data structure that provides access to and dissemination of current, robust data that is collected using agreed-upon standards and definitions that are applicable to various geographic extents and scales. ■

II. Discussion

Addressing current information needs of floodplain managers and policymakers will require development of a new dataset that provides actionable information on a variety

of floodplain functions. This dataset should be supported through the development of new Federal Geographic Data Committee (FGDC) standards, as well as a governance and funding structure. Since production and governance of many of the foundational datasets necessary to develop floodplain-function data (e.g., the National Wetlands Inventory and the National Hydrography Dataset) currently resides with multiple federal agencies and state governments, a new multi-agency governance structure/coalition will be key to supporting related data management, analysis, and interoperability.

National Standard. There would be immense utility for a common national standard that supports data adaption and expansion across spatial scales to quantify the natural functions of floodplains at local and regional levels. While state and local decisions do not require a national model, tools developed at a state/local level are not always accepted by federal agencies. This necessitates a nationally consistent dataset and workflow to quantify functions that are federally approved and adopted while also able to be adapted at a local level. This would allow data input from multiple sources and the ability to step-down that data and ensure it meets non-national needs.

The national standard must support a finer-scale option, to allow incorporation of more granular info and data as available. The design of such a system can be patterned after the efforts of several federal and state agencies that are providing or have made efforts to reconcile current datasets/tools, such as the USFS National Riparian Areas Base map with USFWS's National Wetlands Inventory, and NOAA's national water model with, for instance, finer-scale land use and land-cover data generated at the state level.

Design. The system will need to identify and define individual ecosystem functions, methods for measuring these functions, accuracy requirements at relevant spatial/temporal scales, and a monitoring and assessment component.

Ideally, a decision-support system is needed that assists users through the functional analysis and captures the data at the appropriate scale.

The standard should include design characteristics that allow for state, Tribal, and local flexibility and adaptability, and there may be regional variations. The goal is to not be so prescriptive that it limits advancements (e.g., some states are leading the way). Applicability at the local level is vitally important in producing options for decisions at that scale. The standard needs to incorporate predictive future conditions that will help supplement local comprehensive planning and potential trade-offs regarding floodplain functions and ecosystem benefits.

Clear expectations and limitations of a standard should be available to practitioners to support acceptance and usability of the data and related tools. Considering that there may be states or local organizations or governments that are proactively ahead, a national standard may benefit from systems, principles, practices, and recommendations that have already been applied at the local level. A coalition could set the federal baseline standards, and state and local contacts could refine or localize the standards through the existing hazard mitigation or other planning processes.

Lead Coalition. We envision this endeavor being led by a coalition of agencies in collaborative partnerships with state/local/Tribal representatives, NGOs, academia, and public-private partnerships. One of the first steps in forming a coalition will be to identify existing and overlapping roles of agencies involved to develop an organizing framework. In general, FEMA has regulatory limitations that would preclude it from serving in a coalition lead role. Rather than have a regulatory agency (e.g., FEMA, the EPA, the USACE, the Federal Highway Administration) serve a lead role, perhaps the coalition should be jointly led by NOAA, the USFWS, the U.S. Geological Survey, and the U.S. Department of Agriculture, which already have a Memorandum

of Understanding for water-related applications. Alternatively, since agencies have different and changing priorities, an interagency consortium, such as the Water Resources Coordinating Council, Integrated Water Resource Science and Services, and/or FIFM-TF, may be more appropriate to lead the initiative.

Successful advancement requires dedicated funding to individual agencies with governance over key parts of the standard and related governance and policies, including mechanisms to keep agencies on task and ensure they work together. Many agencies can contribute data and information to support functional-analysis products, and there is a growing call for shared governance, which the coalition would facilitate.

There are many considerations in the formation of this coalition, including determining under what authority or purview it would be established (e.g., EO or Congressional action). An EO can begin the effort and lead to additional action within Congress to support and fund the activities. The success of this effort also depends on increased and/or new funding allocations for the maintenance of foundational input datasets, including the National Wetlands Inventory and National Hydrography Dataset. ■

III. Implementation Actions

Near/Mid-Term Actions

■ Develop a series of pilot demonstrations (three or more) that could be expanded or refined to serve as components for a model national Geographic Information System (GIS)-based watershed-level dataset to support decision-making and investments to protect and restore floodplains.

- Select those pilots based on whether they are serving as decision-support tools for projects that are actually getting completed at the local level.

- Create a concept paper and justification for this dataset and associated tools.

■ Establish broad data production and dissemination requirements, including information on what functions/services should be addressed, related definitions, and acceptable levels of granularity and uncertainty.

- Determine how data will support overall goals, how it will be used, and by whom.

- Create a comprehensive definition of floodplains to fully identify floodplain functions (i.e., not one based on probability of flooding).

- Identify data needed to support evaluation of individual floodplain functions.

■ Review available datasets and methods necessary to meet dataset production and dissemination requirements.

- Include a list of critical-input datasets, including floodplain and wetland maps.

- Include monitoring and assessment components.

■ Identify specific dataset and methodological gaps.

- Develop an initial budget and deliverables to address gaps.

■ Establish steps for authorizing legislation for funding data needs, including the development of critical-input datasets, an assessment model, and a tool interface.

■ Develop a strategic messaging pitch for funding aligned with the Bipartisan Infrastructure Law legislation.

- Beyond the American Rescue Plan Act and Infrastructure Investment and Jobs Act, create a targeted strategy for specific funding, and work with the Council on Environmental Quality (CEQ) on overall coordination of funds.

■ If a dedicated source of funding is not established near-term, develop steps for a combined funding mechanism from various agencies.

Strategies and an Action Plan for Protecting and Restoring Wetland and Floodplain Functions

- Establish and fund a federal interagency effort to consistently and collaboratively map floodplain functions, expand the science of floodplain functions, and track protection and restoration of floodplain functions nationwide.

Ongoing/Long-Term Actions

- Establish a long-term oversight team (e.g., governance or stewardship board) for decisions and actions related to data that includes federal/state/Tribal agencies, NGOs, academia, and private stakeholders.

- Develop or improve foundational datasets needed to parameterize estimates of landscape-scale floodplain function and associated tools, including floodplain and wetland maps, and regular updates of data.

- Develop a GIS-based watershed-level floodplain function-analysis tool to support decision-making and investments to protect and restore floodplains.

  - Create a concept paper and justification for this analysis tool.

- Determine how local, state, or Tribal climate-action plans and contributing data can support floodplain protection and restoration planning. ■

IV. Recommendations

- Develop the overarching authority for identifying, cataloging, and disseminating federal data related to floodplain management, functions, and nature-based restoration/management.

- Establish common definitions of floodplain and ecological functions.

- Identify and assemble a floodplain-functions data coalition.

- Inventory existing floodplain-relevant data, including roles for creation and maintenance.

- Identify opportunities for funding data development, including critical inputs (e.g., the National Wetlands Inventory and National Hydrography Dataset), at the national, state, and local levels.

- Develop a new FGDC standard for floodplain functional data.

- Develop geospatial data that quantify floodplain functions.

- Ensure that these new data can be used to support climate change resiliency.

- Create a data stewardship and oversight model.

- Use the new dataset to conduct socioeconomic evaluations and public outreach that include underserved communities.

- Use the new dataset to implement protection and restoration practices. ■

4 COMMUNICATION:
Consistent, Aligned Messaging and Inter-Agency Coordination

I. Introduction

While funding resources and data acquisition are vital to help develop and support floodplain management and policy, clear and effective communication regarding the important ecosystem services and benefits that floodplain and wetland functions provide can be a catalyst for actionable progress. There is a glaring need to have a shared vision and consistent terminology that encompasses these functions and values, and to communicate them widely to the public and decision-makers. Communications must also be consistent at all levels of governance at the national, Tribal, state, regional, and local level. It is particularly important to effectively and consistently communicate this information so that it can be understood by the public and decision-makers, particularly at the local and regional level, which is the geographic scale for many nature-based projects.

Communication regarding science and ecosystem functions to broad-based audiences is not an easy task. Education and messaging should be clear and concise, and is more effective when it relates directly to audience experiences. When communicating among multiple levels of government and across communities with different environmental, social, and economic conditions, messaging will require adaptive measures to be effective and gain buy-in. For instance, messaging conveying the importance of floodplain functions for flood-risk management to agency leaders and members of Congress will be noticeably different than messaging to local communities experiencing effects from frequent flooding, and different still among various populations within the community.

Guidelines should be developed at the federal and state levels with the intent of being built upon and tailored to a particular regional and/or landscape/watershed scale for local implementation. These guidelines are a communication tool themselves, which can: 1) provide technical information; 2) help recruit and build support among stakeholders within the particular watershed or geographic landscape where the work will be done; and 3) explain how to access a variety of funding resources. To support effective implementation at the local level, communication should be bidirectional between all levels, including informative feedback channels. In essence, this creates a community of practice, which makes it easier to direct and apply supporting funds for floodplain-improvement success that is based on a stakeholder-engagement process.

To realize the full outreach and communication potential in support of floodplain protection and restoration and NBS, this community of practice must include the experience of all relevant stakeholders and practitioners. This diversity in experience and knowledge will help ensure that floodplain protection and restoration policies and actions are accepted as critical contributors to the achievement of multiple dimensions of resilience and sustainability. As this community of practice is developed, expectations should be moderated and evaluated. Establishing and communicating realistic expectations and goals for NBS projects is important to address any misperceptions that protection and restoration of floodplain functions through NBS is cheap and easy. Rather, it is often initially costly while providing long-term economic efficiency.

Once established, this community of practice will need to develop a general communication and outreach framework for funders, researchers, policymakers, and practitioners that builds on new and existing concepts of floodplain functions and implementation of NBS. However, care must be taken to prevent the misuse of floodplain functions and NBS concepts to avoid misunderstanding, misrepresentation, and unintended consequences. The strength of a well-developed and scientifically grounded community of practice is that it can employ an integrative, systemic approach that prevents it from becoming misappropriated by those in favor of natural-resource exploitation versus protection and restoration. ◼

II. Discussion

While it will be necessary to create a reorganized and unified communication structure and guidelines at the federal and state levels, the most impactful outreach needs to happen at the local level. To be effective, this will require baseline, overarching, and consistent messages and terminology delivered from federal and state programs that can be used as part of communications at the local level. However, this communication will be different and could contain refined messaging and education based on local conditions. Local communication will primarily consist of conversations with stakeholders, which require effective active-listening skills to understand flooding issues and concerns, identify local flood-prone areas, and learn how communities have been affected and what their values are (e.g., are they also concerned about potential co-benefits such as wildlife habitat and clean drinking water?).

The relationship between floodplains, streams, and wetlands and the multitude of functions and values these systems provide is well-established. There is documented evidence that poor land-use decisions can lead to devastating floods, often with significant socioeconomic costs such

as loss of property and lives. These impacts do not affect all communities equally. The economic benefits from protecting and restoring natural floodplains are well-documented and should always be part of communications around floodplain and wetland functions and values. Case-study examples are typically powerful in explaining these benefits to the public and to decision-makers, and many demonstrate cost savings by protecting existing natural floodplains versus retrofitting and restoring floodplains once development has occurred.

The public is aware of flooding and understands its impacts, but is not readily aware of the causative processes (i.e., those operating at larger spatial and temporal scales) and the remedies available. Additionally, the causes of flooding associated with poor land-use decisions stemming from under-valuing floodplains and the functions provided are often not well known or communicated. Most land-use decisions happen locally, which underscores the need for clear and consistent communication of social, economic, and environmental floodplain benefits to local stakeholders. Using natural and nature-based criteria for decisions will shorten the latency in decision-making and create the framework for protection and management efforts that will be supported by local communities.

Local stakeholders are the key to successful floodplain stewardship. Communication campaigns should be formed with an understanding of what is happening at the community level. This helps identify the needs for flood-risk reduction and protection and restoration of floodplains so they can function naturally. Consideration should be given to how academia can assist in working with communities, and the roles for private/public partnerships, insurance companies, and the real estate industry. Funding, guidelines, and technical assistance can be delivered from the federal and state levels, but application of such is best implemented using a local planning process developed by and with stakeholders, including

identifying opportunities for incorporating natural and nature-based solutions.

An important need is a national policy that encourages and supports interagency communications within the suite of federal agencies that work in this arena. This could be accomplished through additional federal interagency task forces and workgroups. There is also a need for additional coordination of federal programs and consistency in the interactions of federal agencies and states and local communities. Programs like the USACE Silver Jackets are a good start, but that program needs additional funding and staffing. Additionally, FIFM-TF serves an important role in interagency collaboration and communication. Its mandate should be expanded to include this important role through dedicated authority and funding. If that is not feasible, an entity should be created with relevant federal agencies to establish methods to communicate regularly on the federal policies and guidelines involving the nation's water resources.

The issue of liability and responsibility of each federal agency and how that works in a coordinated group is a key challenge to accomplishing this task. How are these liabilities and responsibilities shared? The political optics of an interagency group are appealing, but operational staff are challenged to accomplish work in their own agency and can be stretched thin. It can be difficult for agencies to share or obtain funding for outcomes outside of their mission. Eliminating agency silos to create cross-agency collaboration will be crucial for progress. Forward-thinking leadership will be needed within the agencies, the presidential administration, Congress, and NGOs to create and nurture this type of cooperation. The lessons learned from the history of the FIFM-TF create a good case study on this issue. ◼

III. Implementation Actions

Near-Term/One-Time Actions

◼ Establish or identify one national, multi/interagency entity to facilitate coordination, communication, and implementation, and obtain federal commitment to support these efforts.

- ● Develop a communications plan and messaging that addresses why floodplains are important, how they are being lost, and the need to develop national policies.

- ● Establish an effective slogan that spreads the message in a simple way (e.g., Give Rivers their Floodplain; Flow Back Better).

- ● Mimic communications models that were effective in support of the federal "no net loss of wetlands" initiative or that were used by the USACE Engineering with Nature program.

◼ Conduct a preliminary assessment of federal programs to identify deficiencies and successes in interagency coordination/communications.

- ● Highlight areas for replication or improvement, with the intent of developing new communications products.

◼ Develop a communications/outreach strategy and framework for states to provide technical support/expertise to local communities, and obtain local/regional input through multi-stakeholder engagement. Increase state capacity to provide this support and communications tools for success.

- ● Encourage integration of messaging about the functions and values of floodplain functions into local planning processes.

- ● For more rural states and states with limited-capacity communities, encourage the push to come from state efforts or watershed partners that can provide support to communities.

- ● Develop multi-state or regional networks.

- ● Add protection/restoration of floodplains to

USACE Silver Jacket priorities and increase their funding capacity to communicate the associated benefits.

- Create simple channels of two-way communication between state and local stakeholders.
- Consider how state nonpoint source (e.g., CWA 319) programs can be integrated and utilized for outreach and communication.

- Incorporate coordination requirements into federal funding opportunities, including grant applications and requests for proposals. Develop a framework/guidance with examples of best practices to support coordination across programs.

  - Integrate floodplain restoration and protection into existing plans (e.g., Hazard Mitigation, Climate Adaptation, MS4/stormwater, environmental justice initiatives).
  - Encourage coordination for state NFIP offices through the FEMA Tiered State Framework, which is meant to encourage aspirational goals.

    - ◆ **Example Program:** River Stewards and Wetland Work Groups in New Mexico that focus federal funding through state administration to local communities.

- Utilize local/regional events (e.g., flooding, endangered species impacts, large physical/infrastructure projects, flood awareness week) as drivers for implementing this process, engaging and educating stakeholders, and obtaining cooperation and support.

  - Follow major weather events with public service announcements showing how NBS prevented damages.
  - Use FEMA's mapping-update process to facilitate this discussion with communities.

- Create a scientifically based Community of Practice focused on floodplain functions and NBS, fostering an integrative, systematic approach.

- Identify the stakeholders and practitioners to establish the community of practice.
- Identify associated groups or organizations, such as the American Society of Civil Engineers, to create key partnerships.
- Develop a general framework for funders, researchers, policymakers, and practitioners that builds on new and existing concepts of floodplain functions and implementation of NBS.

- Develop toolboxes with materials/templates for consistent messaging that can be locally and regionally adapted, including documents and videos based on best practices from social science.

  - Create and/or compile photos, videos, and case-study examples for NBS.
  - Utilize decision-support tools and models to support powerful, data-driven stories.
  - Establish and publicize repositories for this information.
  - Develop diverse and trusted communications with local, state, and Tribal agencies.

Long-Term/Ongoing Actions

- Continually identify and engage additional agencies, entities, and stakeholders in coordinated communication efforts.

  - Refine messaging to resonate with diverse communities and their needs and values.
  - Engage corporations for public/private partnerships.

- Develop case studies and assessments of how federal program refinements and state-support frameworks are working to communicate success and identify areas for improvement.

  - With baseline data to quantify function, develop annual impact reports on the status of floodplain protection/restoration (e.g., American Rivers Dam Report).

- Consider a follow-up to the Association of State Floodplain Managers (ASFPM) Riverine Erosions Hazards White Paper.[23]

■ Develop a process/framework for state, Tribal, regional, and local programs to coordinate messaging with other relevant programs and agencies (e.g., hazard mitigation, water, wildlife, stormwater, flood insurance, homeland security).

■ Refine materials and templates for consistent, locally adapted messaging, and identify and address gaps in materials as part of creating a repository of materials.

- Collaborate with other groups/coalitions that have done this, such as ASFPM.

- Develop mechanisms for continuous updates and improvements to the repository.

■ Develop materials/templates for a consistent series of training workshops/webinars by existing practitioners, based on best practices for planning, design, and construction of nature-based projects and solutions, and preservation of floodplain functions. ■

IV. Recommendations

■ Create training for agencies to be able to communicate floodplain functions and values consistently, and develop mechanisms for interagency communication and collaboration, with an understanding of the mission of each agency and shared goals.

■ Develop communication tools to clearly explain the natural processes of floodplains and associated wetlands and to highlight beneficial natural functions showing reduction in flood risk and resulting social and economic benefits. Consider including landscape scale-assessment datasets of functioning floodplains (see above). Help communities understand underlying

flood risk and the benefits of NBS and flood mitigation.

■ Determine a strategic communication effort with Congress, federal, state, and Tribal officials to raise the importance of flood-hazard risk management and floodplain benefits to enable supportive funding and guidelines directed at the local land-use/decision-making level.

■ Adopt social science techniques for communication with stakeholders that compel beneficial action. Show successful examples.

- Community groups, community connections, and neighbor-to-neighbor communication can be a powerful tool in realizing change in local land-management and land-use decisions.

■ Identify and remove barriers to protecting floodplains. For example, communicate with local land-use decision-makers to prevent built structures in floodplains and remove incentives that allow this, such as the local entity receiving property tax revenue from these built structures. Create alternative incentives or new disincentives instead.

■ Maintain a wide perspective on the types of communication tools available, where they are best used, and the best communication products. Consider static methods such as advertisements and signs/markers in communities, all types of social media, informative mapping products, and visual/audio media.

■ Develop a community of practice that includes stakeholders, practitioners, and multiple levels of governance to support the use of new and existing datasets and concepts for protection and restoration of floodplain functions using NBS. This community of practice should be trained and versed with the ability to effectively communicate about floodplain functions and values. ■

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[23] The Association of State Floodplain Managers Riverine Erosion Hazards Working Group (February 2016). ASFPM Riverine Erosion Hazards White Paper. asfpm-library.s3-us-west-2.amazonaws.com/ASFPM_Pubs/ASFPM_Riverine_Erosion_White_Paper_2016.pdf.

Conclusion

The original title of the final workshop that resulted in this report was "Developing an Action Plan for No Net Loss of Floodplain Functions," but it very quickly became clear that workshop participants believe that "no net loss" is an inadequate goal. The benefits that functioning floodplains provide to society and the environment are vast, including flood conveyance and moderation that reduces flood damages, improved water quality, carbon sequestration, groundwater recharge, habitat for fish and wildlife, and more. Even though the United States does not track the quantity and extent of functioning floodplains at a national scale, our experiences and data at the local and regional scales make it clear that the loss of functioning floodplains is contributing to water-resources management challenges across the country, including increased flooding and erosion, poor water quality, drought, and loss of biodiversity. If we are to reverse the trend of floodplain loss and adapt to the challenges of climate change, we must commit to increase the extent and condition of functioning floodplains across the nation by protecting what remains and restoring what has been damaged.

The need for a national strategy to measure and enable protection and restoration of floodplains, including the wetlands within them and the beneficial functions they provide, is more essential now than ever. In 2022, the United States authorized a once-in-a-generation investment in infrastructure with the passage of the $1.2 trillion Infrastructure Investment and Jobs Act. A significant portion of this funding will inevitably be spent on projects in floodplains, or on projects that will have direct or indirect impacts on floodplains and flooding. To ensure that the national impact of these investments is an increase rather than a loss of functioning floodplains (and their subsequent benefits), it is imperative that we initiate a comprehensive, nationally led strategy to develop data and analysis for floodplain functions, make the necessary policy changes and funding investments, and effectively communicate the values of functioning floodplains to the nation.

This report lays out strategies and recommends actions to address the policy, funding, data, and communications challenges related to floodplains. Implementing these strategies and actions will require partnership and investment by champions of functioning floodplains from all levels of government, academia, nonprofits, and the private sector. Perhaps most critically, it will require federal leadership and support for a unified national program and action plan for protecting and restoring the natural and beneficial functions of wetlands and floodplains. ■

References

American Rivers (2016). Reconnecting Rivers to Floodplains. www.americanrivers.org/conservation-resource/reconnectingfloodplains

American Rivers (November 2022). Restoring Western Headwater Streams with Low-Teck Process-Based Methods: A Review of the Science and Case Study Results, Challenges, and Opportunities. Version 1.0. https://www.americanrivers.org/wp-content/uploads/2022/12/FINAL_LTPBR-White-Paper_Nov2022-SHARE.pdf

Association of State Floodplain Managers (September 2008). Natural and Beneficial Floodplain Functions: Floodplain Management—More than Flood Loss Reduction. s3-us-west-2.amazonaws.com/asfpm-library/FSC/General/ASFPM_Natural_Floodplain_Functions_2008.pdf.

Dahl, T.E. and Johnson, C.E. (1991). Status and Trends of Wetlands in the Conterminous United States, Mid-1970s to Mid-1980s. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.

Dahl, T.E. (2011). Status and Trends of Wetlands in the Conterminous United States, 2004 to 2009. U.S. Department of the Interior; Fish and Wildlife Service, Washington, D.C.

Executive Office of the President. Executive Order 13690 ((Jan. 30, 2015). "Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input." 80 FR 6425. Doc. #2015-02379. www.federalregister.gov/documents/2015/02/04/2015-02379/establishing-a-federal-flood-risk-management-standard-and-a-process-for-further-soliciting-and

Federal Interagency Floodplain Management Task Force (1994 revision). A Unified National Program for Floodplain Management. https://s3-us-west-2.amazonaws.com/asfpm-library/Digital+Coast/unified_floodplain_mgmt_1994.pdf

FEMA (Oct. 8, 2015). "Guidelines for Implementing Executive Order 11988, Floodplain Management, and Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input". FEMA-2015-0006-0358. https://www.fema.gov/sites/default/files/documents/fema_implementing-guidelines-EO11988-13690_10082015.pdf

NOAA National Centers for Environmental Information (2022). U.S. Billion-Dollar Weather and Climate Disasters. www.ncdc.noaa.gov/billions

Parsons, B., L. Marshall, M. Buckley, J. Loos. (June 2020). Economic Outcomes of Urban Floodplain Restoration: Implications for Puget Sound. https://www.americanrivers.org/wp-content/uploads/2020/06/AR-Economic-Outcomes-Report.pdf

Serra-Llobet, A., Jähnig, S.C., Geist, J., Kondolf, G.M., Damm, C., Scholz, M., Lund, J., Opperman, J.J., Yarnell, S.M., Pawley, A., Shader, E., Cain, J., Zingraff-Hamed, A., Grantham, T.E., Eisenstein, W. and Schmitt, R. (2022). Restoring Rivers and Floodplains for Habitat and Flood Risk Reduction: Experiences in Multi-Benefit Floodplain Management From California and Germany. Front. Environ. Sci. 9:778568.https://www.frontiersin.org/articles/10.3389/fenvs.2021.778568/full

Serra-Llobet, A., Tourment, R., Motane, A., and Buffin-Belanger, T. (2022). Managing Residual Risk Behind Levees: Comparing USA, France, and Quebec (Canada). J. Flood Risk Manage. e12785. doi:10.1111/jfr3.12785

Task Force on the Natural and Beneficial Functions of the Floodplain (June 2002). The Natural and Beneficial Functions of Floodplains: Reducing Flood Losses By Protecting And Restoring The Floodplain Environment. www.hud.gov/sites/documents/DOC_14217.pdf.

The Nature Conservancy (2021). Large-Scale Levee Setback Playbook. St. Louis, Missouri. https://www.nature.org/content/dam/tnc/nature/en/documents/MOLeveeSetbackPlaybook_singlepages-complete.pdf

The White House (April 2022). Compendium of Federal Nature-Based Resources for Coastal Communities, States, Tribes, and Territories. www.noaa.gov/sites/default/files/2022-04/Nature-based-Solutions-Compendium.pdf

Tyson, A. and Kennedy, B. (June 23, 2020). Two-Thirds of Americans Think Government Should Do More on Climate. www.pewresearch.org/science/2020/06/23/two-thirds-of-americans-think-government-should-do-more-on-climate

United States, Executive Office of the President [Jimmy Carter]. Executive Order 11988: Floodplain Management (May 24, 1977). www.archives.gov/federal-register/codification/executive-order/11988.html

United States, Executive Office of the President [Joseph R. Biden, Jr.]. Executive Order 14072: Strengthening the Nation's Forests, Communities, and Local Economies. (April 22, 2022).

White House Council on Environmental Quality (2015). Updated Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies. obamawhitehouse.archives.gov/administration/eop/ceq/initiatives/PandG.

Chapter III — Interagency Guidelines obamawhitehouse.archives.gov/sites/default/files/docs/prg_interagency_guidelines_12_2014.pdf.