



# Federal Landscape Scale Wetland Functional Assessment Workshop

## Summary Report

The Association of State Wetland Managers, Inc. May 2021



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## Executive Summary

In partnership with the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), the Association of State Wetland Managers (ASWM) facilitated the Federal Landscape Scale Wetland Functional Assessment Workshop on May 25<sup>th</sup>-26<sup>th</sup>, 2021. Identified in collaboration with multiple federal agency partners, the goal of the workshop was to develop a federal community of practice around landscape scale wetland functional assessment to highlight current federal activities and to identify future needs and opportunities. Over the two-day workshop, more than 40 participants from 13 different federal agencies participated in a series of presentations and facilitated discussions.

Landscape scale wetland functional assessments were defined by the workshop steering committee as protocols that characterize chemical, physical, and biological *processes* that occur in multiple wetlands simultaneously using geospatial analysis, such as remote sensing. In comparison to functional assessments, conditional assessments address the chemical, physical, and biological *integrity* of wetlands assessed through indicators, and assessments of ecosystem services address the societal *benefits* provided by wetlands. In addition to the landscape scale, the steering committee also defined comprehensive and rapid assessments. Comprehensive assessments are relatively intensive and time-consuming primarily field-based approaches conducted at the specific wetland site scale, whereas rapid assessments are relatively simple (compared to comprehensive) and time-efficient protocols typically conducted at the specific wetland site scale and involving a field component. Although the workshop focused on landscape scale functional assessments, the workshop included presentations describing a range of wetland assessment types and scales, recognizing that this information is often synergistic.

Grounded in these shared definitions, presentations from eight federal agencies revealed a wide range of projects focused on or related to landscape scale wetland functional assessment. Driven by a diverse set of mandates, federal agencies are focused on assessing a wide range of functions, from surface and groundwater storage to carbon sequestration. These presentations documented past and current federal activities and discussions in facilitated breakout sessions identified the following future needs, opportunities, and next steps.

### **Workshop participants identified three future directions for landscape scale wetland functional assessment:**

1. Wetland functional assessment data, especially those at the landscape scale, have been increasingly sought-out and relied upon by decision-makers to inform a wide array of wetland policy and management decisions. This trend will continue as we seek to address today's challenges, including climate change, conservation-oriented infrastructure development, and effective wetland restoration.
2. The accuracy and spatial and temporal resolution of landscape scale wetland functional assessment data will improve through time. The rate of improvement will be determined by the degree to which barriers (see below) are addressed.
3. The impact of landscape scale wetland functional assessment will be enhanced as methods and data for monetizing wetland functions (i.e., assessing ecosystem services) improve.

### **Barriers to landscape scale wetland functional assessments identified by the workshop participants included:**

- a. Resource barriers: Access to and availability of resources emerged as a primary barrier to landscape scale wetland functional assessment. These barriers include both monetary and human resources.
- b. Data and other scientific barriers: Workshop participants identified barriers posed by insufficient input data for parameterization, calibration, and validation, as well as other scientific limitations.

Critical input data that have not been consistently available include contemporary USFWS NWI and field data. In addition to data availability, insufficient field and geospatial data quality and consistency is a limitation. Other critical scientific barriers include the lack of shared terminology, as well as a widely endorsed, documented national protocol for landscape scale wetland functional assessment and associated standards.

- c. **Institutional barriers:** Institutional barriers include infrequent and inconsistent inter- and intra-agency communication compounded by varying agency priorities, definitions, and policy constraints on data sharing. Support from senior leadership will be critical to addressing all barriers.

**Workshop participants identified six broad steps that are necessary to continue to build a federal community of practice and to support the quality and availability of landscape scale wetland functional assessment methods and associated data:**

1. **Seek Additional Resources:** The success of all listed actions will largely depend on obtaining more resources for wetland functional assessment, including funding, staff time, and access to technology.
2. **Improve External Communication:** Many of the primary barriers to enhanced landscape scale wetland functional assessment (e.g., lack of resources) could be partially addressed by better communicating the importance of these data to a variety of audiences.
3. **Enhance Inter- and Intra-agency Communication:** Enhanced communication and leveraging of resources between and within agencies would speed the improvement of wetland functional data and better leverage resources.
4. **Identify Gaps and Develop Innovative Solutions:** Additional effort is needed to identify data gaps in order to inform a broad array of administrative, and when possible, agency priorities and to develop solutions that best meet those needs.
5. **Enhance Foundational Inputs:** The identification and implementation of new opportunities to enhance assessment inputs (e.g., geospatial and field data) is critical to improving the quality and impact of resultant functional assessment data. Foundational inputs, including wetland maps and field data, should be easy to access, contemporary, consistent, and interoperable (when possible).
6. **Improve the Delivery of Assessment Results and Tools:** Improved mechanisms to disseminate landscape scale wetland functional assessment data, as well as related datasets, would increase their impact, and may support enhanced future availability of resources. It would be especially helpful if these data were disseminated via robust, easily accessible, open-source, and interactive access points.

## Potential Next Steps

After identifying existing barriers and opportunities to advance landscape scale wetland functional assessments, workshop participants identified four opportunities that could be addressed in the near-term.

1. **Develop future workshops on landscape scale wetland functional assessment that include non-federal partners.** This will allow for more diversity of perspectives and potentially illuminate additional coordination opportunities.
2. **Seek to better understand various agency definitions, purviews, and mandates related to wetland functional assessment, as well as functional data requirements (e.g., functions of interest and dataset specifications).** This information could be compiled within a report or peer-reviewed publication.

- 3. Brief and otherwise engage existing inter-agency groups about the importance of landscape scale wetland functional assessments.** These groups should include but not be limited to the Interagency Coastal Wetland Working Group and the National Technical Committee for Wetland Vegetation.
- 4. Conduct an inventory of existing landscape scale protocols.** This comparative analysis could begin with a matrix of existing tools, their inputs/outputs, and where they are being implemented.
- 5. Create outreach tools to clearly highlight the benefits of landscape scale wetland functional assessment.** Tools could include high impact visual media, like Esri StoryMaps, as well as media stories, handouts, and presentations.
- 6. Develop new mechanisms to fund the production and maintenance of foundational geospatial data.** Policies and governance which highlight the importance of foundational geospatial data, including the Geospatial Data Act of 2018 and the Water Subcabinet, could be leveraged to support this action.

## **Introduction**

The foundational need to evaluate the functions and values of wetlands has remained a priority for scientists, conservations, and natural resource managers since its emergence in the 1970s.<sup>1</sup> Regulatory agencies, public land management agencies, infrastructure agencies, and wetland restoration and management agencies have diverse mandates and decision-making priorities that shape the broad spectrum of functional assessment approaches at varying scales that exist today.

Conducting functional wetland assessments at the landscape scale creates the opportunity to consider wetlands in a broader context, from adjacent land uses to hydrological and ecological factors. For example, wetland managers and regulating agencies need to assess the environmental impacts of proposed projects and activities not just on wetlands, but also on adjacent waters, floodplains, riparian areas, and uplands. In addition, determining the restoration potential of a wetland requires consideration of the broader hydrologic regime, related ecosystems, and land uses. Wetland functions and values are also inherently tied to the landscapes within which they are located. For example, the ability of a wetland to filter and store pollutants is impacted by multiple factors including upstream land uses and pollution sources.<sup>2</sup>

## **Goals**

The goal of this initial workshop was to develop a federal community of practice around landscape scale wetland functional assessment leading to enhanced collaboration, and improved science-based decision-making to protect and restore wetlands and their ecosystem services. As a first step in developing a federal community of practice, the purpose of this workshop is to provide an opportunity to document past and current federal activities and accomplishments, as well as future needs, opportunities, and next steps.

## **Workshop Summary**

The Association of State Wetland Managers in partnership with the National Wetlands Inventory (NWI) hosted the Federal Landscape Scale Wetland Functional Assessment Workshop on May 25<sup>th</sup>-26<sup>th</sup>, 2021. Over the two-day workshop, more than 40 participants from 13 different federal agencies participated in a series of presentations and facilitated discussions.

Landscape scale wetland functional assessments were defined by the workshop steering committee members as protocols that characterize chemical, physical, and biological processes that occur in multiple wetlands simultaneously using geospatial analysis, such as remote sensing. In comparison to functional assessments, conditional assessments address the chemical, physical, and biological integrity of wetlands assessed through indicators, and assessments of ecosystem services address the societal benefits provided by wetlands. In addition to the landscape scale, the steering committee also defined comprehensive and rapid assessments. Comprehensive assessments are relatively intensive and time-consuming primarily field-based approaches, whereas rapid assessments are relatively simple (compared to comprehensive) and time-efficient protocols typically conducted at the specific wetland site scale and involving a field component. Although the workshop focused on landscape scale functional assessments, the workshop

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<sup>1</sup> Novitzki, Richard P., et al. (1999). Restoration, Creation, and Recovery of Wetlands: Wetland Functions, Values, and Assessment. U.S. Geological Survey. National Water Summary on Wetland Resources. USGS Water Supply Paper 2425. Available online <<https://water.usgs.gov/nwsum/WSP2425/functions.html>>.

<sup>2</sup> Kusler, Jon. (2006). Recommendations for Reconciling Wetland Assessment Techniques. Association of State Wetland Managers. Available online <<https://www.aswm.org/pdf/lib/reconciling.pdf>>. P. 99-101.

included presentations describing a range of wetland assessment types and scales, recognizing that this information is often synergistic.

## **Day 1 Presentations**

The presentations during Day 1 included discussions from the U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), National Oceanic and Atmospheric Administration (NOAA), Natural Resources Conservation Service (NRCS), U.S. Geological Survey (USGS), U.S. Army Corps of Engineers (USACE), U.S. Forest Service (USFS), and U.S. Environmental Protection Agency (USEPA). The presenters provided an overview of a wide range of projects related to landscape scale wetland functional assessment, from longstanding conceptual approaches to relatively new process-based models. The presentations revealed that federal agencies are focused on assessing a wide range of functions using conceptual, empirical, and process-based approaches. Each agency is driven by a diverse set of mandates which result in varying methods and applications. Across agencies, the importance of geography and scale was identified as a critical consideration.

### ***Wetland Landscape Position, Landform, Water Flow Path, and Waterbody Type Assessment.***

***Presenter: Ralph Tiner, Retired USFWS.***

Following a workshop introduction from Marla Stelk of ASWM and Megan Lang of USFWS, Ralph Tiner provided an overview of the origins of LLWW (“landscape position, landform, water flow path, and waterbody type”) and how it is applied. He described how LLWW leverages the HGM (“hydrogeomorphic”) approach to wetland functional assessment with the NWI dataset and classification system. Tiner discussed how adding LLWW descriptors can increase the functionality of the NWI database and can be used to predict wetland functions at different geographic scales.

### ***Wetland Mapping on BLM lands. Presenter: Melissa Dickard, BLM.***

Melissa Dickard gave a presentation about BLM’s lentic mapping approach using the NWI database to inventory present-day wetlands on BLM lands, interpreting additional hydrogeomorphic metrics using LLWW and HGM, correlating wetland functions to wetland data, identifying historic and Potentially Restorable Wetlands (PRWs), and then identifying priority wetlands for preservation, enhancement, and restoration. Dickard discussed how the BLM validates the dataset using pre- and post-mapping field analysis. To date, the BLM has invested \$3.6 million in mapping efforts across approximately 200,000 square miles.

### ***Habitat Equivalency Analysis. Presenter: Natalie Cosentino-Manning, NOAA.***

Natalie Cosentino-Manning provided an overview of NOAA’s Habitat Equivalency Analysis (HEA), which was first formalized in 1992 to quantify damages to wetlands associated with oil spills under the Damage Assessment, Remediation, and Restoration Program (DARRP). Cosentino-Manning described how the combination of analyzing the injuries to the resource using a Habitat Equivalency Analysis and the productivity of restoration per acre using a Resource Equivalency Analysis allows NOAA to quantify the amount of restoration required to compensate the public for the injury. She provided a case study from Castro Cove near San Francisco, CA where the HEA process was used to determine that 203 acres of salt marsh, mudflat, and subtidal habitat would be needed to compensate for the injuries to Castro Cove from Chevron.

### ***Conservation Effects Assessment Project. Presenter: Joseph Prenger, NRCS.***

Joseph Prenger discussed NRCS’s Conservation Effects Assessment Project (CEAP), which was initiated under the 2002 Farm Bill, to quantify the effects and effectiveness of conservation practices and programs authorized under the Farm Bill and to better inform planning and implementation processes of those programs through the development of geospatial tools. A peer-reviewed panel identified 11 regions for

regional assessments that resulted in seven initial studies between 2006 and 2010. Prenger described a variety of wetland functional assessments that are conducted through CEAP, including modeling in the prairie pothole region led by USGS and remote sensing and hydrologic modeling efforts led by USEPA Office of Research and Development (ORD) that will be conducted in the Upper Mississippi Basin. He then presented a case study from the Mid-Atlantic Regional Project that is conducting a functional assessment of depressional wetlands in the Coastal Plain of Delaware, Maryland, Virginia, and North Carolina using remote sensing, modeling, and field data collection. Prenger concluded by describing an upcoming project at the University of Florida to determine impacts of forest management on hydrologic functions of geographically isolated wetlands in southeastern pine landscapes.

***Ecosystem Services Assessment and Valuation. Presenter: David Mushet, USGS.***

David Mushet built on the prior presentation by Joseph Prenger by discussing in more detail ecosystem service assessment and valuation in the Prairie Pothole region led by USGS. Mushet described the integrated landscape modeling (ILM) partnership between USGS and U.S. Department of Agriculture (USDA) to identify, evaluate, and establish models to better quantify ecosystem functions and services, particularly for wetlands. He discussed the application of the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) model (developed by the Natural Capital Project at Stanford University) and its focus on amphibian habitat, waterfowl habitat, grassland bird habitat, pollination, plant diversity, and carbon storage/GHG flux. Mushet then described the Agricultural Policy Environmental Extender (APEX) model developed for analyzing the conservation effects of depressional wetlands in agricultural landscapes at the field scale. The APEX model also quantifies carbon/storage HGH flux like the InVEST model, but focuses on flood water storage, water quality improvement, and sediment entrapment. These models can work in partnership to provide improved information regarding the ecosystem services that wetlands provide.

***Using Function and Condition Assessments in Compensatory Mitigation. Presenter: Michelle Mattson, USACE.***

Michelle Mattson provided an overview of the USACE's 2008 Mitigation Rule, different assessment tools developed by states and Corps districts, and specific project examples. Mattson discussed the development of the Mitigation Rule and related requirements, including assessments of wetland function and condition where practicable. She also discussed the framework used by the USEPA to determine how a site compares to an impact site, reference site, or regional condition. The first level uses resource inventories and maps developed using geospatial tools, such as NWI. The second level uses rapid field-based assessment to evaluate function or condition, such as HGM. The third level uses intensive assessment to validate the rapid field-based assessment of level 2. This involves field-based analysis to determine specific functionality, such as vegetation monitoring at the site. Mattson concluded with a discussion of several project examples, including the implementation of multiple mitigation projects at Sulphur Creek in Laguna Niguel, CA using HGM and the California Rapid Assessment Method (CRAM).

***Columbia River Basin Stream Monitoring (PIBO Effectiveness Modeling). Presenter: Brett Roper, USFS.***

Brett Roper discussed the PACFISH/INFISH Biological Opinion (PIBO) effectiveness modeling initiated in 1998 to monitor riparian and wetland areas in the Upper Columbia River Basin on USFS and BLM lands. This modeling approach was developed to assess the effectiveness of new standards and guidelines as a result of changes to Forest Plans in the 1990s. The study includes 1,200 managed sites and 240 reference sites across multiple states in the Columbia Basin and focuses primarily on fish-bearing streams with gradients 0% - 4%. Roper specifically described efforts to monitor vegetation conditions and how this can inform broader land management approaches. He provided the assessment of willows as an example where the relationships between vegetation height, fish growth, and insect inputs are all connected to grazing practices. Roper concluded with a discussion about how and when these data can help to improve decisions, particularly compared with remote sensed data.

***Wetland Functions at the Watershed Scale: Insights from Big Data and Modeling. Presenters: Heather Golden, Charles Lane, and Jay Christensen, USEPA.***

Heather Golden presented on behalf of a joint research project with Charles Lane and Jay Christensen at the USEPA. She discussed efforts to better understand the cumulative effects of non-floodplain wetlands (NFWs) at different watershed scales and sizes. Golden discussed how NFWs may be able to attenuate flooding and mitigate excess nutrients at the watershed scale, which led to the group's research question to understand how downgradient streamflow and water quality functions change with NFW loss and restoration across landscapes. She described how the research group used the Soil and Water Assessment Tool (SWAT) model to analyze hydrology and various wetland baseline layers, including NWI data. The results of their analysis in the Nahunta River Watershed in North Carolina show that NFW losses result in increased peak flows and decreased base flows. In the Cedar River Watershed in Iowa, the researchers found that NFWs reduce nitrate yields across the basin. Golden concluded that more research is needed to better understand the mechanisms that drive cumulative wetland effects downstream, how landscapes with multiple wetlands interact with climate change impacts and nutrient-based water quality issues, and the seasonal influence of wetlands on water quality at different spatial scales.

**Day 2 Presentations**

The presentations during Day 2 included discussions from USEPA, USACE, BLM, and USFS. Building on presentations from Day 1, the focus of these presentations was centered around a diverse array of protocols and datasets that either are or could be used to benefit landscape scale wetland functional assessment. The day began with two presentations focused on different types of functional assessments that vary by scope and scale. Then the presentations shifted more towards discussions of condition assessments and how they may be used to inform functional assessments. The presentations focused on conditional assessments at different scales, ranging from the National Wetlands Condition Assessment (NWCA) led by USEPA to the Proper Functioning Condition (PFC) protocol used by the BLM and USFS. The diverse approaches in protocols, geography, and scale that agencies use in relation to wetland assessments were again highlighted by the presenters.

***Regional Wetland Functional Assessment Method. Presenters: Erica Sachs, USEPA and Paul Minkin, USACE.***

Erica Sachs and Paul Minkin gave a joint presentation about the development of the New England Wetland Functional Assessment (NEWFA) that was designed to rapidly assess functional capacity across multiple states. The NEWFA applies to all wetland types and assesses function using three categories (water quality maintenance, hydrologic integrity, and biota support) and models to determine Functional Capacity Grade (FCG). Both Sachs and Minkin discussed some challenges in the development of the NEWFA, including the availability of regional datasets, the resolution of national data layers, and landscape level variables that don't have existing data layers. The presenters discussed wetland width and buffer integrity as two examples of landscape level variables where there were challenges in collecting and analyzing the data.

***HGM Wetland Assessments. Presenter: Kyle Gordon, USACE.***

Kyle Gordon provided an overview of the Wetlands Regulatory Assistance Program (WRAP) under the USACE that provides scientific support for the agency. Gordon then described the HGM assessment approach used to assess the capacity of wetlands to perform functions relative to similar wetlands in the region. It is applied to characterize baseline information at impact and mitigation sites, determine mitigation requirements, identify ecological performance standards, determine mitigation banking credits, and to monitor and quantify the effectiveness of restoration and mitigation projects. Gordon then provided

examples of national guidebooks and a summary of the HGM National Action Plan. He also reviewed guidelines for developing regional guidebooks as well as current and planned regional guidebooks. Gordon concluded with a case study from the Mississippi River Mainline Levee Enlargement and Seepage Control project where HGM was applied to assess wetland functional capacity, determine compensatory mitigation, and inform mitigation performance standards.

***Rapid Wetland Condition Assessments. Presenters: Bruce Pruitt and Kyle Gordon, USACE.***

Bruce Pruitt reviewed the development of rapid wetland condition assessments beginning with a desktop assessment and initial survey in Phase 1 and then establishing reference standards, identifying watershed management strategies, and providing technology and knowledge transfer in Phase 2. Pruitt discussed the tradeoffs inherent in rapid assessments between speed and accuracy. He emphasized that precision is critical for rapid assessments to ensure that there is consistency between practitioners, that it is reproducible for different sites, and that practitioners can determine differences from attainable reference conditions. Stratifying or classifying wetlands helps to narrow the focus to wetlands with similar functions to simplify the models, reduce the amount of data needed, and minimize the level of natural variability. Step phasing in rapid assessments facilitates adaptive monitoring, reduces the amount of data, promotes random sampling, and can help reduce overall costs. Pruitt concluded with an example of the Maryland Wetland Assessment Method.

***BLM Assessment, Inventory, and Monitoring (AIM) program for Wetlands. Presenter: Lindsay Reynolds, BLM.***

Lindsay Reynolds described the BLM's National Assessment, Inventory, and Monitoring (AIM) Program developed in 2004 to assess the status of BLM lands at multiple scales. AIM uses a standardized approach to assess natural resource conditions under three protocols (terrestrial, lotic, and lentic) and to identify trends. It is founded on five principles: 1) structured implementation, 2) standardized field measurements, 3) appropriate sample designs, 4) data management and stewardship, and 5) integration with remote sensing. Reynolds described the draft Riparian and Wetland Monitoring Methods, which are being developed for assessments where land and water systems intersect, such as for fens and bogs, wet meadows, seeps and springs, or floodplains. This protocol is currently under pilot testing across a diverse range of wetland and riparian systems. Reynolds also described the lotic AIM developed for monitoring of rivers and streams. Lotic AIM involves quantitative monitoring condition and trend of stream and river systems. Multiple Indicator Monitoring (MIM) also involved quantitative monitoring of stream condition and trend, and also has short-term grazing monitoring included. BLM's third approach to monitoring streams and rivers includes a well-established qualitative assessment approach called Proper Functioning Condition (PFC) assessment.

***BLM Qualitative Assessment Wetland and Riparian Areas (Proper Functioning Condition) and Community, Place-based Conservation. Presenters: Lindsay Reynolds and Laura Van Riper, BLM.***

Lindsay Reynolds provided an overview of Lentic (Riparian and Wetland) Proper Functioning Condition (PFC) assessments. PFC assessments are qualitative data collected by a team of hydrology, soils, and vegetation professionals and includes collecting information about a wetlands' soils, hydrology, and vegetation functions. Laura Van Riper provided of the federal inter-agency National Riparian Service Team (NRST) established in 1996 by the BLM and the USFS together with NRCS and other partners. The purpose of the NRST is to foster collaboration across ownerships and jurisdictions to address complex technical and social riparian issues. Van Riper described the NRST as one part of the Creeks & Communities (C&C) Network, also composed of State Riparian Teams and Agency Coordinators. Landowners or managers can invite the NRST to act as an independent third party for place-based problem-solving assistance. Van Riper concluded with a discussion of how the NRST brings together diverse parties to build relationships and foster trust, establish shared information, and create shared visions and common understandings for riparian function and management.

**National Wetland Condition Assessment. Presenter: Amanda Nahlik, USEPA.**

Amanda Nahlik described the history of the National Wetland Condition Assessment (NWCA) stemming from an increasing need to provide national data about the conditions of ecosystems across the country. The NWCA is part of the National Aquatic Resource Surveys (NARS), established in 2007 by USEPA to assess the conditions of lakes, rivers and streams, coastal waters, and wetlands. Nahlik discussed how the NWCA protocol uses field visits to collect surface water data, soils data, and vegetation data at sample points across the country. These data are then used to develop statistically valid estimates of wetland conditions. She also described how the NWCA protocols, although designed to characterize wetland condition, may be used to inform wetland functions as well.

**National Riparian Protocol, Multiple Indicator Monitoring, Proper Functioning Condition Monitoring. Presenter: Kate Dwire, USFS.**

Kate Dwire provided a review of several aquatic monitoring protocols used by the USFS with specific examples from the field. The USFS National Riparian Core Protocol (NRCP) is used to assess the response of riparian vegetation to disturbance. Dwire described the vegetation monitoring and physical features protocols for the NRCP. This monitoring protocol is utilized at the project level, primarily for restoration or in relation to specific management actions. She also described the BLM and USFS Multiple Indicator Monitoring (MIM) of stream channels and streamside vegetation. The MIM protocol uses data collected from designated monitoring areas (DMAs) along the “greenline,” which is a line of live perennial vegetation, rock, or embedded large wood near the water’s edge. Using the MIM monitoring frame, short-term and long-term indicators are collected. The MIM protocol is largely used to assess impacts from grazing. Dwire also described the BLM and USFS Proper Functioning Condition (PFC) Assessment that uses an experienced interdisciplinary team to qualitatively assess the functionality of 17 different hydrologic, vegetative, and geomorphic attributes and processes. The PFC protocol helps to inform and prioritize management, monitoring, and restoration. It is primarily used to assess the function of perennial and intermittent streams and the associated riparian areas. She concluded with a case study of USFS PFC for fens.

**Groundwater-Dependent Ecosystems Inventory Protocols. Presenter: Eddie Gazzetti, USFS.**

Eddie Gazzetti described the Groundwater-Dependent Ecosystems (GDEs) Inventory protocols established to inventory, monitor, and assess ecosystems such as springs, fens, and wetlands that are groundwater-dependent. The GDE Inventory includes three levels of field guides. The first is used to qualitatively identify and characterize GDEs. The second is used to quantitatively describe major GDE attributes. The third level uses site-specific design and is conducted in areas where activities have a significant impact on GDEs. Each level has different requirements for field surveys. Gazzetti described the level one field guide which involves characterizing location, physical properties, the absence or presence of species, and baseline conditions of hydrology, soils, and biology. He concluded with a discussion of the GDE database entitled Springs Online that allows for querying of specific GDE sites.

**Breakout Group Summaries**

After the presentations concluded on each day of the workshop, the presenters and participants were split up into four breakout rooms for further discussion. The steering committee established a set of guiding questions for the breakout rooms for each day.

**Day 1:**

- 1) What is the future direction of landscape scale wetland functional assessment?
- 2) What are the primary barriers to implementing landscape scale wetland functional assessment?
- 3) Can you identify examples of challenges you have encountered and solutions that have worked or have not?

- 4) What needs to be accomplished to contend with barriers and actuate this future?

**Day 2:**

- 1) Review barriers and opportunities from day 1.
- 2) Based on today's presentations (or other input), any new thoughts on the following questions from yesterday's discussion:
  - a. What are the primary barriers to implementing landscape scale wetland functional assessment?
  - b. Can you identify examples of challenges you have encountered and solutions that have worked or have not?
  - c. What needs to be accomplished to contend with barriers and actuate this future?
  - d. What specific opportunities should we explore to help address those barriers?
- 3) How can we leverage this workshop and the work of our agencies in this arena to ensure our agency leadership is successful in meeting the Administration's objectives?

**The following summarizes the themes that emerged following the workshop presentations through the breakout group discussions:**

- 1) Future directions for landscape scale wetland functional assessments

The workshop participants identified three future directions for landscape scale wetland functional assessments:

- a. Wetland functional assessment data, including those at the landscape scale, have been increasingly sought-out and relied upon by decision-makers to inform a wide array of wetland policy and management decisions. This trend will continue as we seek to address today's challenges, including infrastructure development, climate change, and effective wetland restoration.
- b. The accuracy and spatial and temporal resolution of landscape scale wetland functional assessment data will improve through time. The rate of improvement will be determined by the degree to which barriers (see below) are addressed.
- c. The impact of landscape scale wetland functional assessment will be enhanced as methods and data for monetizing wetland functions (i.e., assessing ecosystem services) improve.

Discussions among workshop participants also emphasized that landscape scale wetland functional assessments are a priority across multiple federal agencies, but that it can be hard to gain momentum for inter-agency efforts. Participants identified an increasing need for advanced modeling and high-quality field data to help refine landscape scale functional assessments. Additionally, workshop participants emphasized the importance of different contexts, such as urban vs. rural lands, as well as different scales in the development and implementation of landscape scale functional assessments.

- 2) Primary barriers to landscape scale wetland functional assessments

Workshop participants identified three primary barriers for the national implementation of landscape scale wetland functional assessments:

- a. Resource barriers: Access to and availability of resources emerged as a primary barrier to landscape scale wetland functional assessment. These barriers include both monetary and human resources.
- b. Data and other scientific barriers: Workshop participants identified barriers posed by insufficient input data for parameterization, calibration, and validation, as well as other scientific limitations. Critical input data, that have not been consistently available include contemporary USFWS NWI and field data. In addition to data availability, poor data quality and consistency is a limitation. Other critical scientific barriers include the lack of shared terminology, as well as a widely endorsed, documented national protocol for landscape scale wetland functional assessment and associated standards.
- c. Institutional barriers: Institutional barriers include infrequent and inconsistent inter- and intra-agency communication compounded by varying agency priorities, definitions, and policy constraints on data sharing.

In summary, the need for more resources emerged as a primary barrier to successful implementation of landscape scale wetland functional assessment for the nation. This includes funding for a wide range of project needs, but especially additional staff. Current federal staff time is generally not sufficient to manage, yet alone conduct national scale wetland functional assessment. The lack of resources is a master variable – largely controlling the ability to contend with other barriers.

Additionally, workshop participants identified data and scientific barriers, including the lack of high quality geospatial and field data. The NWI dataset is the foundation of landscape scale wetland functional assessment. Unfortunately, it is not contemporary and does not meet current Federal Geographic Data Committee endorsed standards in large portions of the U.S. This is a fundamental challenge to moving landscape scale wetland functional assessment forward. In addition, high quality field data, which are needed for calibration and validation of landscape scale wetland functional assessment models, are also lacking. Another significant scientific barrier is the fact that the federal family lacks a commonly accepted, documented national protocol for landscape scale wetland functional assessment and associated standards and thus a methodological framework to move functional assessment forward. Participants identified the importance of scale in functional assessments and the inability of one-size-fits all approaches to address geographic differences.

Workshop participants voiced concern regarding institutional barriers, including infrequent and inconsistent inter- and intra-agency communication. This lack of communication is compounded by varying agency priorities, definitions, and policy constraints on data sharing, as well as policy shifts between federal administrations. Addressing these barriers would allow more strategic, efficient allocation of resources to address landscape scale wetland functional assessment. Support from senior leadership will be critical to addressing this and other barriers.

### 3) Overcoming barriers to landscape scale wetland functional assessments

Workshop participants engaged in robust discussions in the breakout groups around opportunities to overcome some of the identified barriers to landscape scale wetland functional assessments. In summary, the participants emphasized the importance of improving access to resources, including through actions such as developing new permanent funding mechanisms to support production and maintenance of data as well as collection of high-resolution geospatial data. They also highlighted the importance of internal and external communication, including outreach regarding the importance of wetland functions and the establishment of shared definitions and

understanding between federal agencies. Additionally, workshop participants addressed necessary improvements to landscape scale functional assessment techniques and access to information, including geospatial assessment inputs. Finally, the improvement of data dissemination was discussed. Please see below for more information.

1. **Seek Additional Resources:** The success of all listed actions will largely depend on obtaining more resources, including funding, staff time, and access to technology. Internal and external communication (actions 2 and 3) will be critical for actuating this need, as will carefully scoping-out the need, benefits, and workflow of future projects (action 4).
  - a. Identify and develop new vehicles and mechanisms for the regular funding of landscape scale wetland functional assessment, including the funding of data analysis and input data production.
    - i. Seek to anchor funding to a more permanent source – e.g., Great Lakes Restoration Initiative, RESTORE Act and perhaps the Farm Bill.
  - b. Consider developing new vehicles to transfer funds and formalize collaboration (e.g., Memorandum of Understanding) in the future.
2. **Improve External Communication:** Many of the primary barriers to enhanced landscape scale wetland functional assessment (e.g., lack of resources) could be partially addressed by better communicating the importance of these data to a variety of different audiences.
  - a. Convert wetland functions to services to emphasize the importance of wetland functions.
  - b. Connect data to people through story-telling and high-impact visual media (e.g., StoryMaps).
  - c. Seek to tie wetland functional assessment to various outreach campaigns (e.g., American Wetlands Month) – including social media (e.g., Twitter).
  - d. Cultivate relationships with external organizations (e.g., The National Audubon Society, The Nature Conservancy, and Ducks Unlimited) to enhance outreach.
3. **Enhance Inter- and Intra-agency Communication and Collaboration:** Enhanced communication and leveraging of resources between and within agencies would support strategic use of limited funds.
  - a. Seek to better understand various agency definitions, purviews and mandates related to wetland functional assessment, as well as functional data requirements (e.g., functions of interest and dataset specifications).
  - b. Cultivate buy-in from senior leadership, in part by tying this effort to administrative priorities and governance structures (e.g., Water Subcabinet).
  - c. Brief and seek support from interagency groups (e.g., Interagency Coastal Wetland Working Group)
  - d. In addition to workshops like this one, projects or initiatives should be developed to serve as a catalyst for enhanced exchange (e.g., USGS Powell Center, National Science Foundation synthesis centers, journal special editions, and conference sessions).
  - e. Establish inter-agency training courses with public participation).
4. **Identify Gaps and Develop Innovative Solutions:** Additional effort is needed to identify data gaps that are responsive to a broad array of administrative, and when possible, agency priorities and to develop solutions that best meet those needs. Solutions should be robust in

- the face of current challenges, including climate change. Discussions will need to be iterative over an extended period of time.
- a. More effort needs to be made to better understand the trade-offs between and leveraging of multiple wetland assessment levels and approaches (e.g., remote sensing and geospatial analysis, as well as conceptual, empirical and process-based models).
    - i. What are the trade-offs associated with different approaches for wetland functional assessment – e.g., conceptual versus process based? How do we better leverage these approaches?
    - ii. What approaches are best for getting at different services, and what are the associated uncertainties?
  - b. See action 3 above for ideas regarding how to catalyze these discussions.
5. **Enhance Foundational Inputs:** Identify new opportunities to enhance assessment inputs that are critical to improving the quality and impact of resultant data. Foundational inputs, including geospatial data (e.g., NWI) and field data, should be easy to access, contemporary, consistent, and interoperable (when possible).
- a. New mechanisms to fund the production and maintenance of foundational data (e.g., NWI and NHD) need to be developed.
  - b. A central repository for relevant input data (e.g., field observations) would be helpful, especially if data are well validated and documented.
6. **Improve the Delivery of Assessment Results and Tools:** Improved mechanisms to disseminate landscape scale wetland functional assessment data, as well as related datasets should enhance the impact and therefore support for these data. It would be especially helpful if these data were disseminated via robust, easily accessible, open-source, and interactive access points.
- a. Consider investigating existing opportunities for data delivery, including the GeoPlatform, Agricultural Conservation Planning Framework, and USGS EarthMap.



## **Appendix A. Workshop Agendas**

### **AGENDA**

#### **DAY 1: OVERVIEW OF CURRENT LANDSCAPE SCALE FUNCTIONAL ASSESSMENTS AND ENHANCEMENT OPPORTUNITIES** **May 25, 2021**

**ALL TIMES ARE IN EASTERN DAYLIGHT TIME**

<b>12:00pm-12:20pm</b>	Welcome, Review Workshop Goal and Agenda, Introductions
<b>12:20pm-12:40pm</b>	Wetland Landscape Position, Landform, Water Flow Path, and Waterbody Type Assessment. Presenter: Ralph Tiner, Retired FWS.
<b>12:40pm-1:00pm</b>	Wetland Mapping on BLM lands. Presenter: Melissa Dickard, BLM.
<b>1:00pm-1:20pm</b>	Habitat Equivalency Analysis. Presenter: Natalie Cosentino-Manning, NOAA.
<b>1:20pm-1:35pm</b>	BREAK
<b>1:35pm-1:55pm</b>	Conservation Effects Assessment Project. Presenter: Joseph Prenger, NRCS.
<b>1:55pm-2:15pm</b>	Ecosystem Services Assessment and Valuation. Presenter: David Mushet, USGS.
<b>2:15pm-2:35pm</b>	Using Function and Condition Assessments in Compensatory Mitigation. Presenter: Michelle Mattson, USACE.
<b>2:35pm-2:55pm</b>	Columbia River Basin Stream Monitoring (PIBO Effectiveness Modeling). Presenter: Dr. Brett Roper, USFS.
<b>2:55pm-3:15pm</b>	Wetland Functions at the Watershed Scale: Insights from Big Data and Modeling. Presenters: Heather Golden, Charles Lane, and Jay Christensen, USEPA.
<b>3:15pm-3:30pm</b>	BREAK
<b>3:30pm-4:30pm</b>	Breakout Discussions
<b>4:30pm-5:00pm</b>	Summarize Findings and Next Steps

## AGENDA

### **DAY 2: OVERVIEW OF RELATED EFFORTS AND OPPORTUNITIES TO LEVERAGE RESOURCES** **May 26, 2021**

**ALL TIMES ARE IN EASTERN DAYLIGHT TIME**

<b>12:00pm-12:20pm</b>	Welcome, Review Workshop Goal, Agenda, and Findings from Day 1
<b>12:20pm-12:40pm</b>	Regional Wetland Functional Assessment Method. Presenters: Erica Sachs, USEPA and Paul Minkin, USACE.
<b>12:40pm-1:00pm</b>	HGM Wetland Assessments. Presenter: Kyle Gordon, USACE.
<b>1:00pm-1:20pm</b>	Rapid Wetland Condition Assessments. Presenters: Bruce Pruitt and Kyle Gordon, USACE.
<b>1:20pm-1:35pm</b>	BREAK
<b>1:35pm-1:55pm</b>	BLM Assessment, Inventory, and Monitoring (AIM) program for Wetlands. Presenter: Lindsay Reynolds, BLM.
<b>1:55pm-2:15pm</b>	BLM Qualitative Assessment Wetland and Riparian Areas (Proper Functioning Condition) and Community, Place-based Conservation. Presenters: Lindsay Reynolds and Laura Van Riper, BLM.
<b>2:15pm-2:35pm</b>	National Wetland Condition Assessment. Presenter: Amanda Nahlik, USEPA.
<b>2:35pm-2:55pm</b>	National Riparian Protocol, Multiple Indicator Monitoring, Proper Functioning Condition Monitoring. Presenter: Kate Dwire, USFS.
<b>2:55pm-3:15pm</b>	Groundwater-Dependent Ecosystems Inventory Protocols. Presenter: Eddie Gazzetti, USFS.
<b>3:15pm-3:30pm</b>	BREAK
<b>3:30pm-4:30pm</b>	Breakout Discussions
<b>4:30pm-5:00pm</b>	Summarize Findings and Next Steps

## Appendix B. Participant List

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## **Appendix C. Breakout Room Discussion Questions**

### **DAY 1: OVERVIEW OF CURRENT LANDSCAPE SCALE FUNCTIONAL ASSESSMENTS AND ENHANCEMENT OPPORTUNITIES**

1. What is the future direction of landscape scale wetland functional assessment?
2. What are the primary barriers to implementing landscape scale wetland functional assessment?
3. Can you identify examples of challenges you have encountered and solutions that have worked or have not?
4. What needs to be accomplished to contend with barriers and actuate this future?
5. What specific opportunities should we explore to help address those barriers?

### **DAY 2: OVERVIEW OF RELATED EFFORTS AND OPPORTUNITIES TO LEVERAGE RESOURCES**

1. Review barriers and opportunities from day 1.
2. Based on today's presentations (or other input), any new thoughts on the following questions from yesterday's discussion:
  - a. What are the primary barriers to implementing landscape scale wetland functional assessment?
  - b. Can you identify examples of challenges you have encountered and solutions that have worked or have not?
  - c. What needs to be accomplished to contend with barriers and actuate this future?
  - d. What specific opportunities should we explore to help address those barriers?
3. How can we leverage this workshop and the work of our agencies in this arena to ensure our agency leadership is successful in meeting the Administration's objectives?