DATA NEEDS, GAPS AND INTEROPERABILITY FOR INTEGRATED MAPPING AND FUNCTIONAL ASSESSMENT OF RIVERINE AND COASTAL FLOODPLAINS AND WETLANDS

Sept. 30, 2019

A Natural Floodplain Functions Alliance and Wetland Mapping Consortium Workshop

This paper presents the topics, key findings and next steps from a one-day workshop held as part of a multi-year initiative exploring innovative ways to integrate geospatial data and functional assessment of riparian and coastal wetlands and floodplains.

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Table of Contents

BACKGROUND:..... 1

WORKSHOP SUMMARY 3

PRESENTATION ABSTRACTS 4

1) An Interactive GIS-Based Tool to Guide Floodplain Protection and Restoration in the Mississippi River Basin – Eugene Yacobson, Conservation Information Manager IV, The Nature Conservancy 4

2) Vermont's Partnership for Functioning Floodplains – Mike Kline, Fluvial Matters, LLC (formerly Program Manager for Vermont DEC Rivers Program) 5

3) Building Capacity for Watershed and Community Resiliency in Wisconsin's Lake Superior Basin – Andy Robertson, Geospatial Services Executive Director, Saint Mary's University of Minnesota, and Kyle Magyera, Local Government Outreach Specialist, Wisconsin Wetlands Association 6

4) Iowa Watershed Approach: A vision for a more resilient Iowa – Larry Weber, Edwin B Green Chair of Hydraulics, University of Iowa 6

GROUP DISCUSSIONS..... 7

1) Identifying datasets, databases, models, and approaches that are applicable to each level of the pyramid and levels of agency/organizational involvement. 7

2) Identifying Priority Functions for Assessment and Methods for Quantifying/Scoring Function Provision..... 8

3) Identifying Key Agencies/Organizations and Others for Implementation and Useful Resources, Publications and Projects. 10

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BACKGROUND:

In 2017, ASWM began facilitating a discussion between the Natural Floodplain Functions Alliance (NFFA) and the Wetland Mapping Consortium (WMC) about the possibility of creating a multi-year initiative to improve floodplain mapping by integrating geospatial data being developed and used by the wetland mapping community to identify wetland and floodplain functions. The two groups identified individuals from each organization to participate in a Planning Committee. The Planning Committee began holding monthly conference calls and decided to hold three annual workshops with a final long-term goal of developing a baseline national classification standard for functional assessment of wetland and floodplain functions that could be built on based on regional environmental variations as well as different project goals and state policies to better inform land-use decisions and reduce risk in local communities.


2018 NFFA-WMC Workshop in Silver Spring, MD

On Tuesday, April 10, 2018, the NFFA and the WMC hosted the first of the three planned workshops at the Tommy Douglas Conference Center in Silver Spring, Maryland entitled, "Exploring Opportunities for Integrated Mapping and Functional Assessment of Riverine and Coastal Floodplains and Wetlands." The overall goal of the initial workshop was to discuss current and potential opportunities to integrate geospatial mapping and functional assessments of coastal and riparian wetlands and floodplains, in order 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.

Some of the common recurring themes expressed during the workshop included:

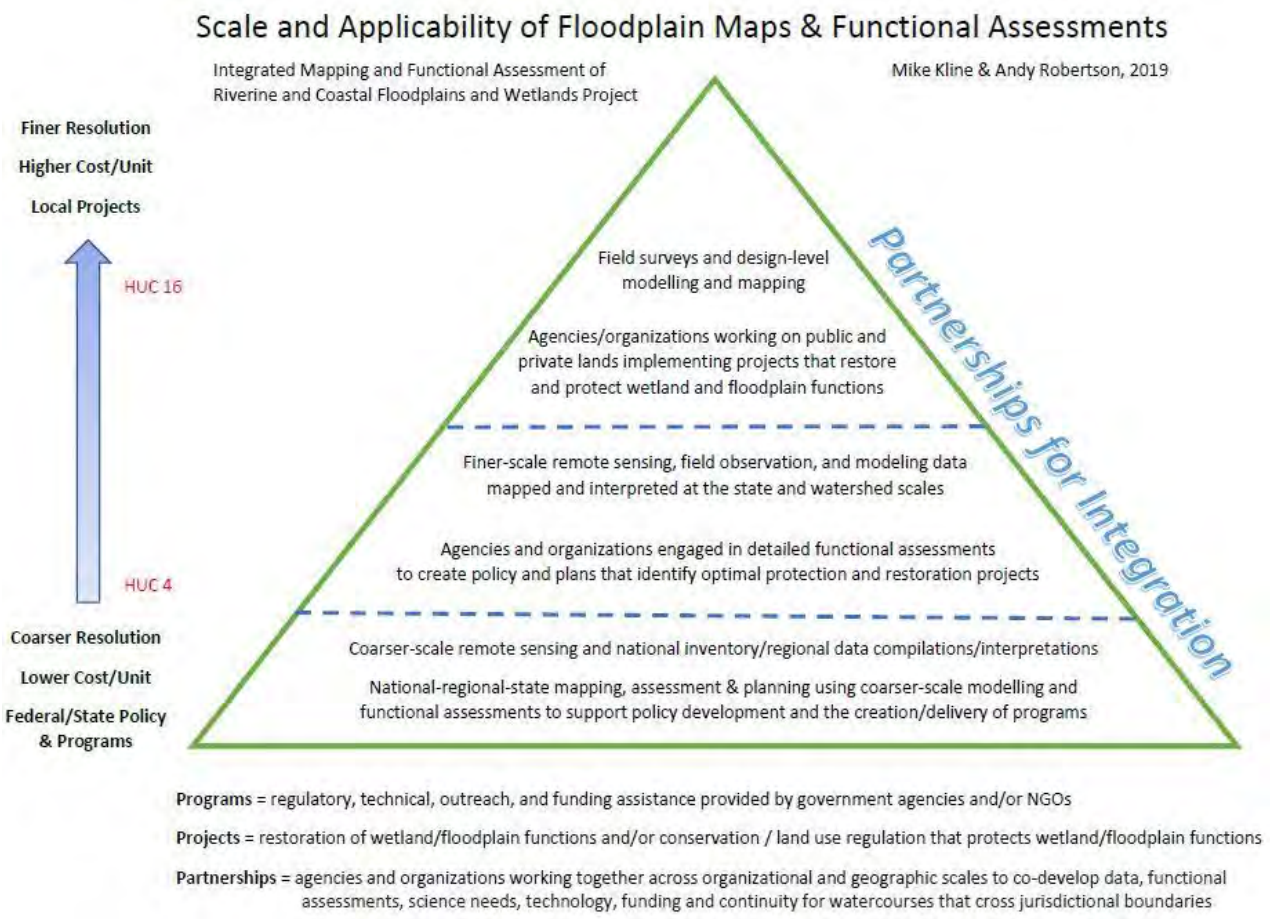
- There is a need for improved communication among professionals, knowledge sharing, tools, models.
- Partnerships, likely and unlikely, are critical to provide technical assistance, combine funding, expertise, etc.
- Digital data availability is important (identify who has it, where it is, and how to obtain it).
- Continuity of knowledge is key (stop reinventing tools and/or data that is already out there).
- Existing mandates and legislative tools need to be leveraged.
- We need to clearly articulate use cases to demonstrate success and generate fiscal support.
- We need to innovate and embrace technology while bridging the gap.
- Mapping efforts need to be tied to societal needs, hazards and costs.

- Social science needs to be embraced in order to tell the story of social significance.
- Avoidance should be a priority.
- Tools can be complex, but results should be easy to explain.
- We need to provide clear, consistent, accessible, and consumable messaging about the benefits and enhanced decision-making tools provided by integrating maps and providing site specific information about natural floodplain functions and services.

After the success of the first workshop, the Planning Committee continued to meet regularly and planned a second workshop scheduled for September 30, 2019. The goal of the 2nd workshop was to identify, 1) a core list of functions (wetland, riparian, coastal) that are useful for floodplain management and land-use decisions, 2) identify current techniques, tools and approaches that are available, and 3) where the gaps are for data, funding and tool accessibility. The third and final workshop, to be held in 2020, will focus on identifying the important program and policy changes that need to be made to implement this advanced, and more comprehensive, floodplain mapping approach. Both the first and second workshops were supported by a general grant from the Association of State Floodplain Managers Foundation. The 2nd workshop was also supported by the U.S. Environmental Protection Agency and The Nature Conservancy.

WORKSHOP SUMMARY

On September 30, 2019, the second workshop in this series was held at The Nature Conservancy headquarters in Arlington, VA. Thirty-four people participated in the workshop, including 11 federal agency staff, 3 university staff, 4 state agency staff, 15 non-profit staff and/or representatives and 1 private consultant. The day began with an introduction to the conceptual scale and applicability diagram framework that Mike Kline (Fluvial Matters, Inc.) and Andy Robertson (Saint Mary's University of Minnesota) developed to guide the development of the day's agenda as shown below.



Kline and Robertson discussed the need to develop a stronger community of practice that will work at all levels of the pyramid. Each level of the pyramid represents different scales of sensing and assessment – from coarser scale to a more granular local scale. The pyramid framework was used to show an hierarchical strategy for gathering information and providing decision support, yet also supporting the idea that feedback among each scale is necessary to inform efforts at each level of the pyramid and ensure that the right tools are developed and/or used at the right scale. Data information and scale will help drive policy and implementation. Based on this framework, the workshop focused on four different case studies at different scales to derive lessons learned and inform future efforts.

Afterward, presentations were given (abstracts are included below) that focused on different sections of the pyramid, including:

- An Interactive GIS-Based Tool to Guide Floodplain Protection and Restoration in the Mississippi River Basin (Eugene Yacobson, The Nature Conservancy)
- Vermont's Partnership for Functioning Floodplains (Mike Kline, Fluvial Matters, Inc. – formerly Vermont Department of Environmental Conservation)
- Building Capacity for Watershed and Community Resiliency in Wisconsin's Lake Superior Basin (Andy Robertson, Saint Mary's University of Minnesota and Kyle Magyera, Wisconsin Wetlands Association)
- The Iowa Watershed Approach: A Vision for a More Resilient Iowa (Larry Weber, Iowa Flood Center)

PRESENTATION ABSTRACTS

1) **An Interactive GIS-Based Tool to Guide Floodplain Protection and Restoration in the Mississippi River Basin** – Eugene Yacobson, Conservation Information Manager IV, The Nature Conservancy

Eugene Yacobson, The Nature Conservancy

For many decades, floodplains in the Mississippi River Basin (MRB) have seen extensive degradation, conversion, and hydrologic disconnection, leading to severe disruption of natural processes and contributing to the vast hypoxic "dead zone" in the Gulf of Mexico. Large-scale floodplain restoration is a critical strategy for restoring the health of the MRB, with potential to yield benefits for water quality, wildlife, and human communities that are increasingly vulnerable to extreme flood events. With limited resources available to accomplish this strategy, it is critical to identify high-impact areas to target for investment in floodplain projects. In this presentation we will share a spatial analysis and web-based decision tool designed to identify priority opportunities for floodplain restoration and protection. This project leverages a state-of-the-art, large-scale floodplain model and integrates a variety of basin-wide spatial datasets including nutrient export, denitrification potential, likelihood of future floodplain development, critical habitat benefits, and human exposure to flood damage. The interactive online tool provides regional, state, and local stakeholders with portfolios of priority sites, integrating selected aspects of these data inputs at their discretion. Potential sites are identified at multiple, nested watershed scales and for distinct potential management actions including protection, restoration, and hydrologic

reconnection. Overall, this project fills an urgent need to increase the pace of floodplain restoration and to direct resources towards floodplain projects likely to have the greatest impact on restoration of the MRB and the most benefits for communities in the region.

2) **Vermont's Partnership for Functioning Floodplains** – Mike Kline, Fluvial Matters, LLC (formerly Program Manager for Vermont DEC Rivers Program)

Mike Kline, Fluvial Matters, LLC

A partnership of Vermont agencies and organizations is developing and applying data and mapping methodologies to support river reach and watershed-scale restoration of stream, wetland, and floodplain function. The identification and prioritization of natural resource conservation and restoration projects will be vastly improved through a publicly accessible mapping platform. The state-led initiative seeks to garner local community support by publicizing and tracking the accumulation of the natural and socio-economic assets derived from connected and naturally functioning floodplains, including: fish and wildlife habitat, water quality, avoided damage from floods and fluvial erosion, and the storage of carbon affecting the earth's climate. Vermont's "Partnership for Functioning Floodplains" will build assessments and strategic project plans by integrating our watershed-scale mapping, field, and modeling data with data and maps made available through federal agencies and research institutions working at the national level, for example: EPA's TMDL development in Vermont; FEMA supported hazard mitigation planning; and the EPA and USFWS development of National Wetland Inventory Maps.

Our goal is to have the tools that will shift the annual public and private expenditures in river and floodplain management from post-flood channelization works and structural stormwater practices to nature-based solutions derived from the hydrologic reconnection of rivers, floodplains and wetlands. The purpose of this initiative is to develop and apply methods for mapping and quantifying opportunities to reconnect streams, wetlands, and floodplains. Fundamental to this effort will be outputs and outcomes that connect with people at relatable natural and socio-economic scales. Changes in land practice to restore functioning floodplains are largely at the discretion of local communities and landowners and state/federal

technical and funding assistance programs must be geared toward local asset management.

3) **Building Capacity for Watershed and Community Resiliency in Wisconsin's Lake Superior Basin** – Andy Robertson, Geospatial Services Executive Director, Saint Mary's University of Minnesota, and Kyle Magyera, Local Government Outreach Specialist, Wisconsin Wetlands Association


Andy Robertson, Saint Mary's University of Minnesota

The coastal watersheds of the Lake Superior Basin (LSB) have endured decades if not centuries of hydrologic disturbance. Several northwestern Wisconsin communities are vulnerable to flooding and burdened with the financial demands of infrastructure management and disaster recovery in the wake of five or more Presidential Disaster Declarations since 1999. Changes in land use and land cover alter hydrology and sediment delivery, with corresponding effects on water quality, instream and riparian habitat and biotic composition. For over 60 years, watershed conservation efforts to improve water quality have largely focused on restoring and protecting hydrology in efforts characterized as "slow the flow". This approach seeks to reduce peak flows with landscape-scale watershed restoration approaches that increase in-channel roughness, upland roughness, upland retention and infiltration. The WWA 2018 report - Exploring the Relationship Between Wetlands and Flood Hazards in the Lake Superior Basin - revealed that erosion-induced drainage is actively reducing the storage of headwaters and upper watershed wetlands and preventing other natural infrastructure, such as floodplains and riparian forests, from fully going to work during storms. To help communities respond to this urgency, WWA is piloting place-based work to assess and help address degraded wetland and stream conditions in the Marengo River Watershed (i.e., Ashland, Bayfield County). The LSB Pre-Disaster Mitigation and Watershed Resiliency initiative will develop and apply methods for mapping and quantifying opportunities to reconnect streams, wetlands, and floodplains. Fundamental to this effort will be outputs and outcomes that connect with people at relatable natural and socio-economic scales.

4) **Iowa Watershed Approach: A vision for a more resilient Iowa** – Larry Weber, Edwin B Green Chair of Hydraulics, University of Iowa

The Iowa Flood Center (IFC) led the successful proposal development for the Iowa Watershed Approach for Urban and Rural Resilience (IWA) that was awarded $96,887,177 to the state of Iowa from the U.S. Department of Housing and Urban Development's National Disaster Resilience Competition. The IWA is working in nine watersheds across the state to help reduce flood impacts, improve water quality, and increase community flood resilience. The program represents a vision for Iowa's future that voluntarily engages urban and rural stakeholders throughout the watershed to work together to achieve common goals. The IWA will improve flood resilience during major storm events by strategically placing flood mitigation projects in sub-watersheds to increase storage and water retention during heavy rainfall. Community flood resilience engagement activities will help communities prepare for, respond to, recover from, and adapt to floods. The expertise and scientific and technological advances developed by IIHR—Hydroscience & Engineering and the Iowa Flood Center served as a significant source of leverage to bring the IWA project to the state of Iowa. In five years, Iowa will have a well-refined, replicable program, and all participating watersheds will have an established watershed management coalition, a hydrologic assessment and watershed plan to guide them into a sustainable future, and experience working with private landowners to adopt conservation practices that reduce the impacts of flooding during intense rainfall and improve water quality year round. The success of the IWA depends on collaborative partnerships among many statewide organizations and local stakeholders who together are carrying out the work necessary to achieve the goals of the IWA to improve Iowa's future watershed resiliency.

Larry Weber, University of Iowa

GROUP DISCUSSIONS

Group discussion unpacked some of the information shared in the presentations and provided the participants a chance to identify gaps, needs and next steps. Three discussion topics were included and are summarized below.

1) Identifying datasets, databases, models, and approaches that are applicable to each level of the pyramid and levels of agency/organizational involvement.

We rely heavily on LIDAR data, but we also need to understand erosional and depositional processes – we need lower more granular data as well to ground truth remote sensing data. However, not all processes can be captured in fine scale either,

e.g., SPARROW. Some coarse scale data can capture processes, but some cannot. The group discussed how they define large/coarse scale versus small/fine scale. One suggestion was that coarse scale would be 500 meters, medium would be 30 meters and fine would be 1 meter. Another suggested that GIS is course scale while physics based delineations are fine scale. A lot of work is done at the landscape level – sometimes using 6-inch resolution LIDAR data. At mid-level it is a rapid reconnaissance level. Wetland delineation is at the fine scale level. Sometimes, lower resolution coarser scale is fine and will save a lot of money – it depends on what the need/purpose is.

We also need to include temporal considerations. Temporal work could show forested land with a clay layer with micro depressions when a forest is cleared and leveled for farming, the volume of water added to the stream channels impacting erosion head cuttings, etc. LandSAT can be used for a 40 -year time span versus shorter term differentials. How do these different layers work together and how can they be integrated? Building locations are also important to include in order to identify constraints for floodplain and wetland restoration – a data set is under development using census data and building footprints in LIDAR.

How do we utilize national level data sets for various levels of application, especially when they often have different naming conventions? There are many definitions for "riparian" among federal agencies and just within the USFS alone. Federal agencies such as the USFS are working on some of this. The solution may be a multi-scale approach. For example, with USGS stream gauge data – how do we determine correct water heights? Is it an ecological definition? A hazard management definition? USGS is looking at developing a common nomenclature. NOAA is also looking at developing some common naming conventions. There needs to be greater opportunity for federal agencies to review protocols and to share updates, data and naming conventions/definitions.

2) Identifying Priority Functions for Assessment and Methods for Quantifying/Scoring Function Provision

The group discussed which floodplain functions are the low hanging fruit and which are harder to restore - there is a physical, chemical and biological gradients to consider. Biogeochemistry is a new frontier, but it is harder to get to then water storage. Nutrient storage and exchange are harder to get to partly because land use data is often confidential. Physical functions are easier to document than chemical

and biological. Human health and safety functions are easier to rally around – to get stakeholder and public responses, however, habitat and biological functions get less immediate response. Functions of the floodplain can vary throughout the watershed – having functions available at the right place at the right time is important, as the location of functions don't always correlate with the need. Priority functions depend on what the purpose is for the functional assessment, e.g., policy, implementation, etc. For example – FEMA funds should be provided for wetland restoration to reduce flood risk. But how can you produce data through assessments that help elevate nature-based solutions over other practices?

The group discussed challenges in making the transition from functions to ecosystem valuation. We need to be aware that some of the functions we are seeking to protect and enhance have markets and are well recognized as having a "value" that people can generally understand (i.e., some functions are easier to monetize than others such as disasters and water supply). Many others have more nebulous non-marketed values that are often discounted by the public, politicians and policymakers. We need much more research and education on how to better value and characterize these non-market attributes and to involve them in decision-making processes. Benefit transfer is the most commonly used approach, but it has been heavily criticized because the data is from a different location and can be outdated. Our challenge is to find localized data that can be used to develop locally specific monetary values – but it is often prohibitively expensive to do so. The Society of Ecological Economics is working to develop a dataset based on peer reviewed data. Priority could be based on feasibility and impact. In many cases, the economic analysis will mean the difference between gaining support for a project or not.

We have used both qualitative and quantitative approaches – the quantitative is much harder to get at. Scores for different functions are created separately and can be hard to compare, but this type of comparison is important. Condition of a floodplain or wetland doesn't necessarily define its importance to a community, i.e. urban streams and wetlands may be degraded but provide significant value, qualitatively and/or quantitatively, for those communities. What is the social investment and how do the functions attract the social investors? The importance/value of functions is context dependent. It was suggested that we take business leaders into upper watershed to show investors the value of lowering flooding a foot or two.

The discussion turned to communicating the value of nature-based solutions beyond the economic value. How do we get people to care? It's a "secret sauce" of multiple benefits – you want to maximize solutions – stacking benefits that are more esoteric with more tangible benefits. When you have a market its easy to figure out the values – our challenge is to figure out how to value non-market values. People want to see a difference. If people can't see it, they don't believe it (i.e., numbers don't matter to people – however, floods, rivers on fire, etc., do). We believed that if we had the right science, that we'd get the best policy but that hasn't necessarily worked out. What is the purpose of environmental protection? To improve the quality of our lives – this is where we need to focus our messaging.

Survey after survey, water quality (clean drinkable, swimmable water) has won out as the most important issue to people, but value is context dependent. Maybe the approach is to focus on the functions that are "sellable" and visible to people, e.g., drinking water in the arid West, salmon in the Pacific Northwest. But we need to strike while the iron is hot – timing is key (i.e., river erosion isn't important to people until after a flood). Some of our role is to draw the connection between people and things that matter to them. We need to build a better understanding among the public of natural functions. Society is becoming more detached from the natural world as we move toward urban centers – we need to work harder to connect people to the landscape that supports them. Systems thinkers are more likely to adopt BMPs and nature-based approaches – systems thinking is a skill that can be taught. Citizen science can help with buy-in as well.

3) Identifying Key Agencies/Organizations and Others for Implementation and Useful Resources, Publications and Projects.

Key agencies and organizations:

Kyle Magyera, Wisconsin Wetlands Association and Dave Fowler,, Association of State Floodplain Managers

We need to engage more with USDA/NRCS. Floodplains and wetlands have substantial capacity to capture excess nutrients. We need to find better ways to incentivize good practices within the agricultural community. We need to highlight the role of agricultural practices and drainage, but we need to be clear about the component of the agricultural community we are targeting – there is a significant difference between industrial row cropping and small family farms. We need to be clear that we are not targeting agriculture, but agricultural practices. Improving the science will be important in this effort. Some of the most impactful conservation efforts in the agricultural community have come from the Farm Bill. Incentivizing

better practices is key. However, the Farm Bill often focuses on short-term maintenance of practices. We need to create incentives for long-term maintenance, i.e., farmers who put land into the Conservation Reserve Easement Program (CREP) don't always maintain the land after the monitoring time limits. Participation is voluntary, and the contract period is typically only 10–15 years. Many properties that were in the Wetland Reserve Program (WRP) are now static systems, not being maintained and are becoming overrun with invasive species. Sometimes they are good for nitrogen and phosphors removal, but biologically they are essentially dead. How can we incentivize process-based conservation?

Some of the other agencies we need to engage more with include FEMA, HUD, USACE, FHWA, NOAA. We also need to engage more with states and local communities. States can sometimes provide matching funds and enable good local programs. States also have a public trust responsibility that could be leveraged in these discussions. Other organizations we should engage with include realtors to get assistance with outreach to home builders and others in the development community. ASFPM has developed No Adverse Impact "how-to" guides that could be useful for these conversations.

Data gaps and needs:

- We need to invest in maintaining and updating the NWI dataset to be able to show land cover change over time. However, we also need to improve existing data. Ideally, we would improve the NWI by including forested and headwater wetlands. The technology is there, just not the resources.
- There is a lack of hydrologic data – in Iowa they increased the number of stream gauges but there is still a lack of water quality data.
- We need better data on percentage of land in different floodplains – 5-year, 10-year, 25-year, 100-year and 500-year. This could be done by state or by watershed.
- We need better FEMA maps – 40% of FEMA maps are in hard copy only and many streams are not mapped at all.
- We need to create an inundation map that can be made available to everyone. FEMA maps are regulatory, so they are not comprehensive. We need to know where in the floodplain the functions are occurring – this is where we need to focus, not on regulatory.
- We need better data on wetland and floodplain functional lift that is quantifiable so functional lift can be monetized.

Next Steps:

- Make a list of states that have done successful work with nature-based state-wide efforts to reduce flood risk to share lessons learned with others.
    - We could take these cases studies on a "road show" to ASFPM state chapter meetings.
    - We could coordinate regional workshops to bring states together to teach each other.

    - Illinois is a true success story – years of work, strong code enforcement, and rapid damage assessments to provide information to the public on post flood options.
    - North Carolina is a leader in floodplain mapping – there is dedicated funding from fees on titles/deeds.
- Audit the federal agencies for various disincentives for floodplain conservation – where is money being put into the ground that is working against our conservation goals?
    - The FWS Ecological Services Field offices used a major DOI report on Effects of Federal Programs on Wetlands that resulted in actions to address many issues, but it hasn't been updated in a few decades.
- Do some demonstration and educational projects – field components are helpful for education and support.
    - Pennsylvania Amish farmers collectively worked to restore an entire lost floodplain – local education efforts are valuable. Chesapeake Bay has been a motivation for many.
    - Host charettes to identify community values and motivations – identify best practices, distill stories and share with stakeholders, the general public and decision-makers.
    - Reach out to the Agricultural Research Service to inventory related existing programs and demonstration projects.
- Create a publicly available flood inundation map that pulls from various data sources in order to show various floodplain benefits and make it available to everyone.
- Reach out to TMAC – they have just got a quorum and new leadership that might entertain these suggestions (Jeff Sparrow and Doug Bellamo are now leading). TMAC has brought up the need for non-regulatory layers to the FEMA flood maps in the past but the Council keeps talking themselves out of making recommendations for expanding the non-regulatory layers. They haven't set their agenda yet, so there is a good opportunity to help guide direction now.
- Put all of the workshop participants on the NFFA contact list for future participation in these efforts