

Wetland Functions and Landscape-level Assessment

USING ENHANCED WETLANDS DATA (NWI+ data)
TO PRODUCE REPORTS ON AND MAPS SHOWING
WETLAND FUNCTIONS

Wetland Functions vs. Values

- Functions – value neutral; take place whether or not they are considered important by society
- Values – people's opinion on the worth of a function...can change over time

Wetlands – Holistic View

- Wetlands operate as a holistic, integrated system within a watershed, waterfowl flyway, or ecoregion
- They work together to provide most functions
- Strength is their collective capacity to provide functions
- Value of the system is greater than the sum of its parts

Wetland Functions and Some Values

- Provision of Habitat for Plants and Animals
 - Natural Products
 - Recreation
 - Aesthetics
 - Privacy - increase property value
 - Shoreline Stabilization
- Nutrient Retention and Recycling
 - Water Quality Protection
 - Pollution Abatement
 - Peat Deposits
 - Aquatic Productivity – food chain support, fishing/hunting

Wetland Functions (cont'd)

- Surface Water Detention
 - Floodwater Storage
 - Water Supply
 - Trapping Sediments – water quality protection/pollution abatement
- Bank and Shoreline Stabilization
 - Reduce erosion, protect private property

Wetland Assessment Approaches

- Landscape-level Assessment
 - Using GIS to evaluate all wetlands
 - Field Inspection of Randomly Selected Wetlands
- Rapid Field Assessment (2-4+ hrs/wetland)
- Model-based Field Assessment
 - HGM
 - IBI
- Research

Today's Class Focus

- GIS-based Landscape-level Assessment
- Field verification based on observed indicators of performance of functions
- Not on detailed “rapid assessment techniques” or “condition assessments”

Using Enhanced NWI Data for Desktop Wetland Assessments

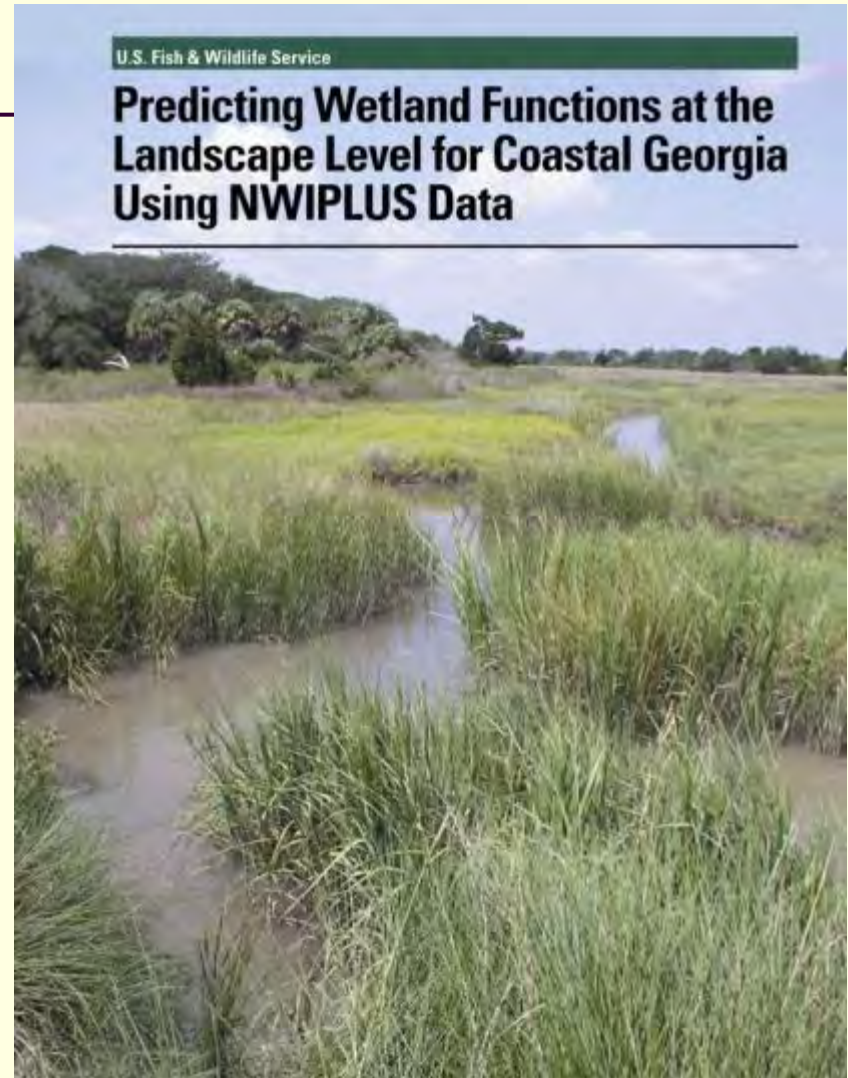
- Standard NWI Map Data
 - **PLUS**
- LLWW Descriptors (Landscape Position, Landform, Water Flow Path, and Waterbody Type)
- Expanded NWI Data can predict wetland functions for geographic areas of variable sizes
- **= NWI+ Data**

Use NWI+ Data (Wetland Classification) to Predict Wetland Functions

Relate characteristics in NWI+ database to various functions of interest

Coordinated Effort To Develop Correlations

- Reviewed literature
- Worked with wetland specialists in the Northeast and others
- Correlation Report (2003) and Tables (2013)
- Should review prior to use in other geographic regions
 - Reviewed/revise for coastal Georgia, Wisconsin, and New Mexico
- User Adaptable (can modify functions of interest)



Preliminary Functional Assessment

- Surface Water Detention (inland wetlands)
- Coastal Storm Surge Detention (coastal wetlands)
- Streamflow Maintenance
- Bank and Shoreline Stabilization
- Nutrient Transformation
- Carbon Sequestration
- Sediment and Other Particulate Retention
- Provision of Fish and Wildlife Habitat
 - Fish and Aquatic Invertebrates
 - Waterfowl and Waterbirds
 - Other Wildlife
- Provision of Habitat for Unique, Uncommon, or Highly Diverse Wetland Plant Communities (formerly Conservation of Biodiversity; *based on mapped types not through field surveys*)

Developing Functional Correlations

- Correlate Functions with Characteristics
 - Some emphasize LLWW descriptors
 - Surface Water Detention
 - Streamflow Maintenance
 - Some only use NWI
 - Nutrient Transformation
 - Habitat for Other Wildlife
 - Others rely on NWI + LLWW
 - Shoreline Stabilization
 - Sediment Retention
 - Habitat for Fish and Shellfish
 - Habitat for Waterfowl and Waterbirds

Surface Water Detention

- High Potential
 - Fringe Wetlands
 - Basin Wetlands
 - Floodplain Wetlands
 - Throughflow Ponds (in-stream)
- Moderate Potential
 - Flats
 - Other Ponds (except sewage treatment ponds and similar waterbodies)



Coastal Storm Surge Detention

- Tidal wetlands
 - Marine Fringe
 - Estuarine Fringe, Basin, Island
 - Lotic Tidal Floodplain, Fringe, Island
- Possibly add Terrene wetlands contiguous with tidal wetlands at least along salt and brackish marshes



Streamflow Maintenance

- High Potential
 - Nonditched Headwater Wetlands (hw)
 - 1st order perennial streams and above
 - 2nd order perennial streams in mountainous/hilly regions
- Moderate Potential
 - Ditched Headwater Wetlands (hw + NWI “d” wetland)
 - Lotic Floodplain Wetlands
 - Throughflow Ponds and associated wetlands
 - Outflow Ponds
 - Terrene Outflow Wetlands (adjacent to streams)

Nutrient Transformation

- High Potential
 - Seasonally Flooded or wetter Vegetated NWI Wetlands
 - Permanently Saturated Vegetated Wetlands (bogs)
- Moderate Potential
 - Seasonally Saturated and Temporarily Flooded Vegetated Wetlands

Carbon Sequestration

- High Potential
 - Bogs and other wetlands on organic soils or with histic epipedons
 - Wetlands with wetter water regimes (E and wetter)
- Moderate Potential
 - Other Wetlands

Retention of Sediments and Other Particulates

■ High Potential

- Vegetated Wetlands (wetter water regimes)
 - Basin, Fringe (exc. Rocky Shore), Island,
- Floodplain Wetlands
- Lotic Basin
- Throughflow and Bidirectional Ponds and associated vegetated wetlands
- Stormwater Treatment Ponds
- Terrene Throughflow Basin Wetlands

■ Moderate Potential

- Nonvegetated Wetlands
- Vegetated Flat Wetlands (excluding bogs)
- Some others...

Bank and Shoreline Stabilization

- High Potential
 - Vegetated (except island types) along waterbodies
 - Lotic and Lentic
- Moderate Potential
 - Terrene Vegetated Wetlands along Ponds



Provision of Fish and Aquatic Invertebrate Habitat

■ High Potential

- Lacustrine Semipermanently Flooded, Littoral Aquatic Bed, Unconsolidated Bottom/Vegetated Wetland, Permanently Flooded Lacustrine Wetland
- Palustrine Semipermanently Flooded (contiguous with permanent waterbody) and associated ponds, Palustrine Unconsolidated Bottom/Vegetated

Fish and Aq. Invert (cont'd)

- Moderate Potential
 - Lentic PEMIE Wetlands including mixes with FO and SS (Northeast)
 - Other Ponds with Fringe Wetlands
 - Excludes industrial, stormwater, and similar ponds in highly disturbed landscapes and ponds with “K” or “F” water regimes

Fish and Aq. Invert (cont'd)

- Important for Stream Shading
 - Lotic Stream Wetlands that are PFO or PSS (including mixes where one of these types predominates, but excluding those along intermittent streams)
 - Excludes streamside shrub bogs
- Locally Significant (area-specific)
 - Seasonally Flooded Lentic Wetlands along Lake Champlain (important spawning habitat)

Provision of Waterfowl and Waterbird Habitat

■ High Potential

■ Similar to Fish Habitat

■ Includes

- PEM1E along streams (probably marshes)
- Beaver Ponds and associated wetlands

■ Ponds associated with P__F wetlands

■ Wood Duck Potential

■ Lotic Wetlands that are FO and SS with “C” and wetter water regimes

■ Some others

Waterfowl and Waterbird Habitat

- Moderate Potential

- Seasonally flooded and wetter Phragmites wetlands
- Lacustrine Littoral Unconsolidated Bottom
- Other Ponds (excluding industrial, commercial, stormwater, sewage treatment and similar ponds)
- PEM wetlands (including mixes with SS) that are Seasonally Flooded and wetter and associated with a waterbody

Provision of Other Wildlife Habitat

■ High Potential

- Large vegetated wetlands \geq 20 acres (excluding open water, nonvegetated wetlands, and pine plantations)
- Small diverse wetlands (10-20 acres with 2 or more covertypes, excluding Phrag and open water types)
- Small permanently or semipermanently flooded palustrine wetlands surrounded by forest and other FO or SS wetlands within 100m of these wetlands

■ Moderate Potential

- Other vegetated wetlands (excluding wetlands associated with dredged material disposal impoundments)

Provision of Habitat for Unique, Uncommon or Highly Diverse Wetland Plant Communities

- Wetland types recognized as important or scarce regionally
 - Oligohaline tidal wetlands
 - Riverine tidal emergent wetlands
 - Palustrine tidal emergent wetlands
 - Palustrine tidal scrub-shrub wetlands
 - Atlantic white cedar swamps
 - Bald cypress swamps (Northeast)
 - Eelgrass beds
 - Calcareous fens
 - Lotic Fringe wetlands
 - Headwater seep wetlands?
 - Forested wetlands in forest complexes >7410 acres

- Locally Significant (possibilities)
 - Urban wetlands
 - Shrub bogs
 - Mussel and oyster reefs
 - Larch swamps
 - Northern white cedar swamps
 - Hemlock swamps
 - Estuarine emergent wetlands
 - Lentic fringe wetlands (EM/AB and AB/EM)
 - Uncommon types based on the inventory
 - e.g. floodplain wetlands in KS and MO?

Limitations of Landscape-level Assessment

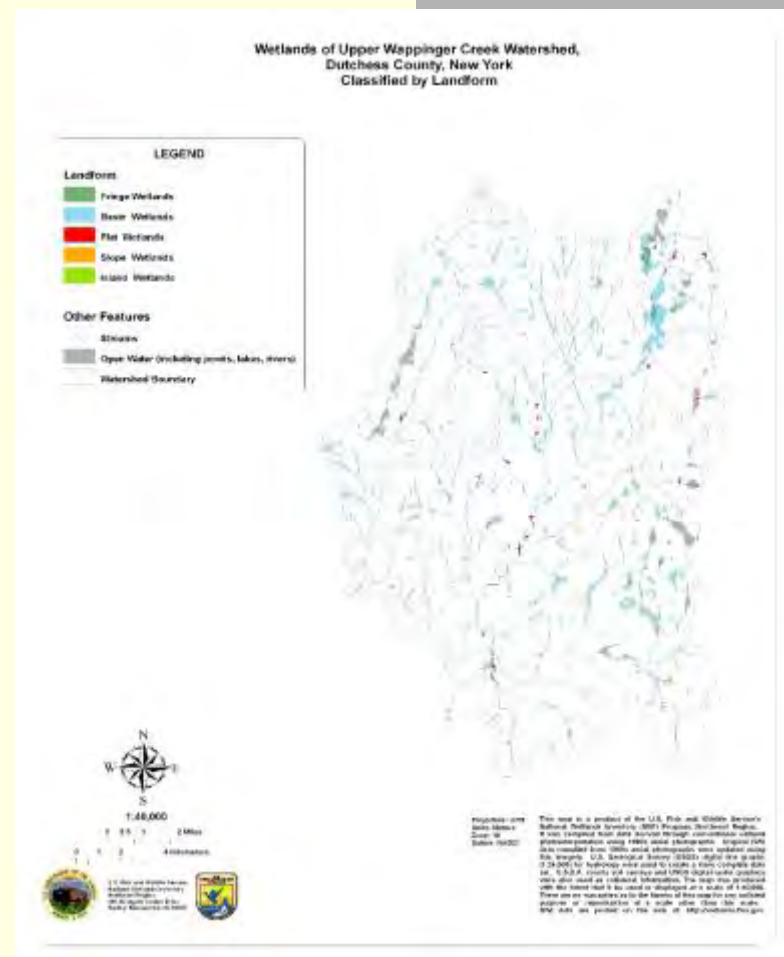
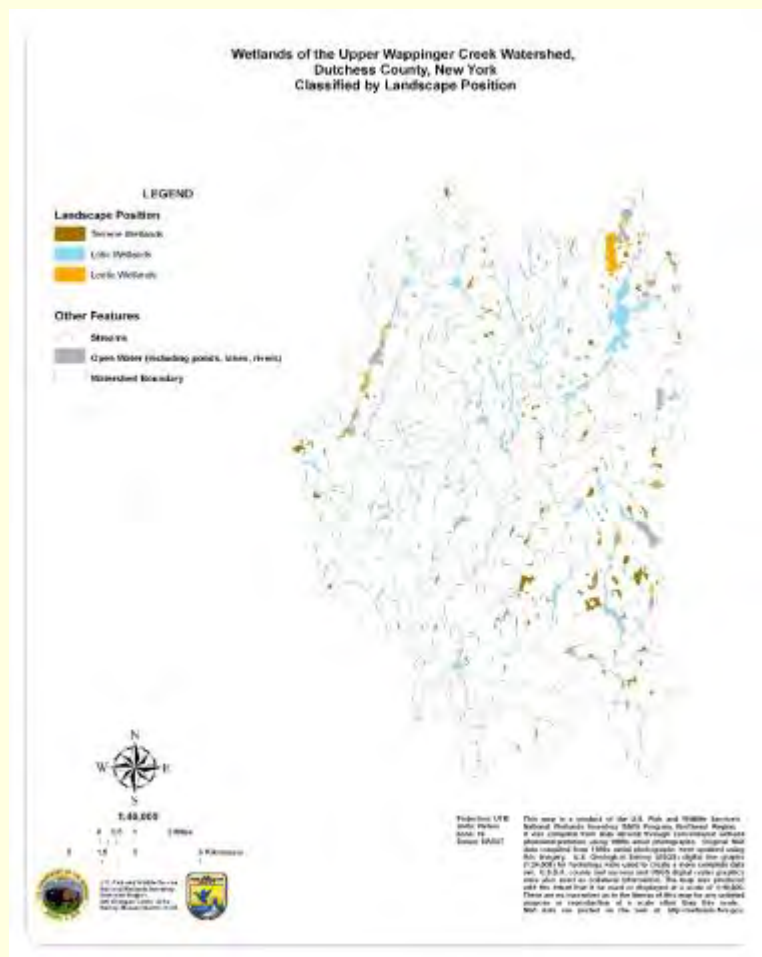
- First approximation
- Source data limitations
 - All wetlands not shown
 - Possible upland inclusions
 - All streams not shown
 - Age of data
- LLWW wetland classifications based largely on map interpretation (field review variable)
- Correlations between functions and characteristics = work in progress (reports available for Northeast US and Coastal Georgia)
- Predicted functions depend on classification



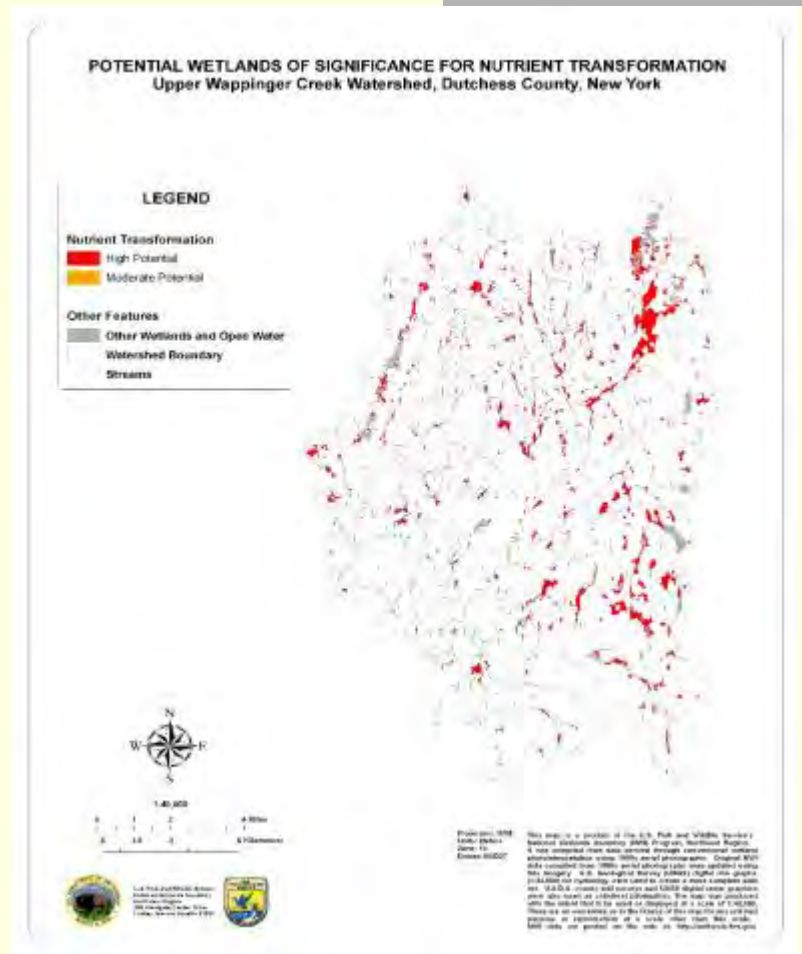
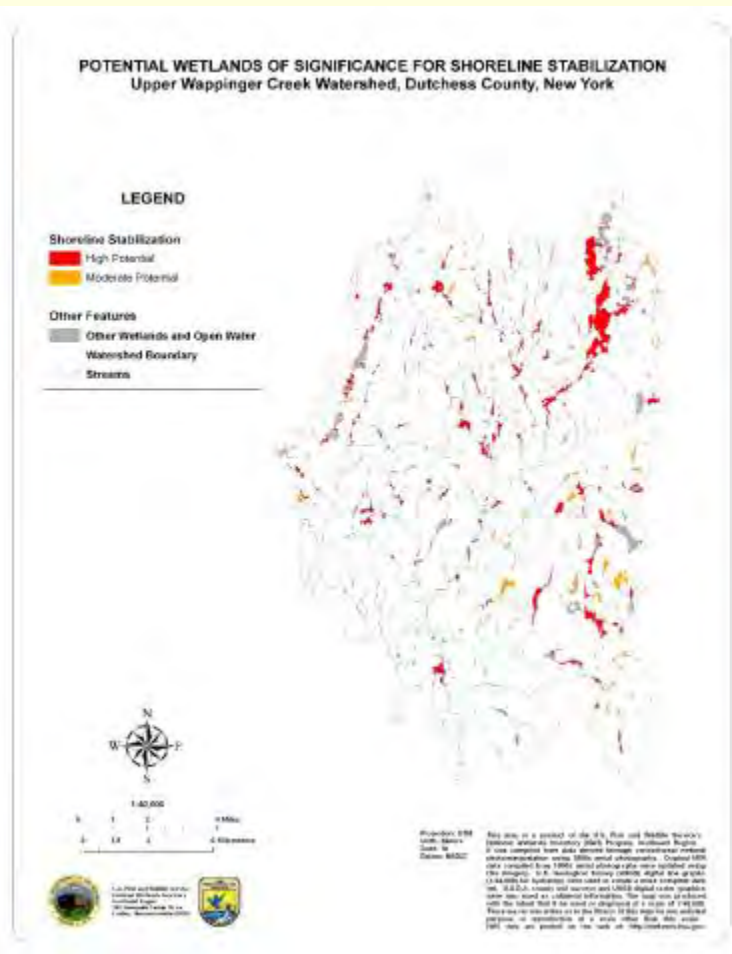
Watershed Assessments

Maps, reports, and geospatial data

Landscape Position and Landform



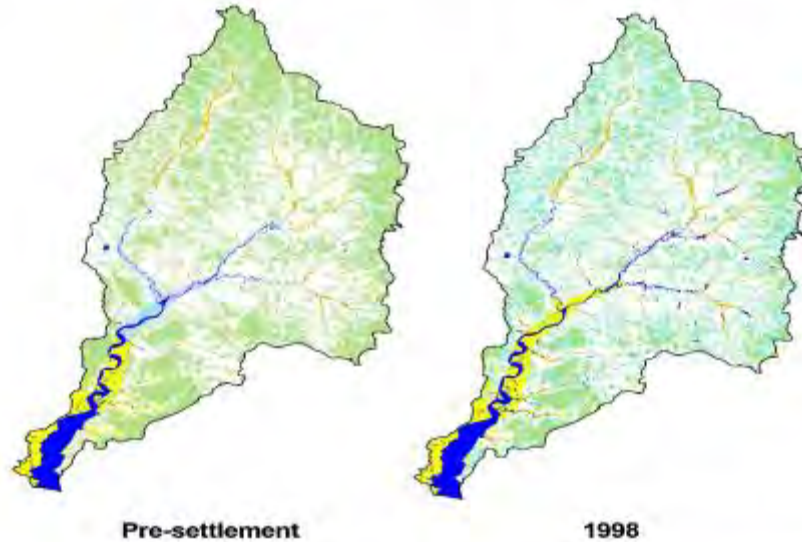
Shoreline Stabilization and Nutrient Transformation



Historical Analysis – Cumulative Impacts

U.S. Fish and Wildlife Service

Historical Analysis of Wetlands and Their Functions for the Nanticoke River Watershed. A Comparison between Pre-settlement and 1998 Conditions.



National Wetlands Inventory
Region 5

November 2003



Pre-settlement vs. 1998

Nanticoke River Watershed

Pre-settlement

- 230,000 acres
- 2,809 wetlands
- 72% = interfluvial outflow wetlands
 - Aver. Size = 433 a

1998

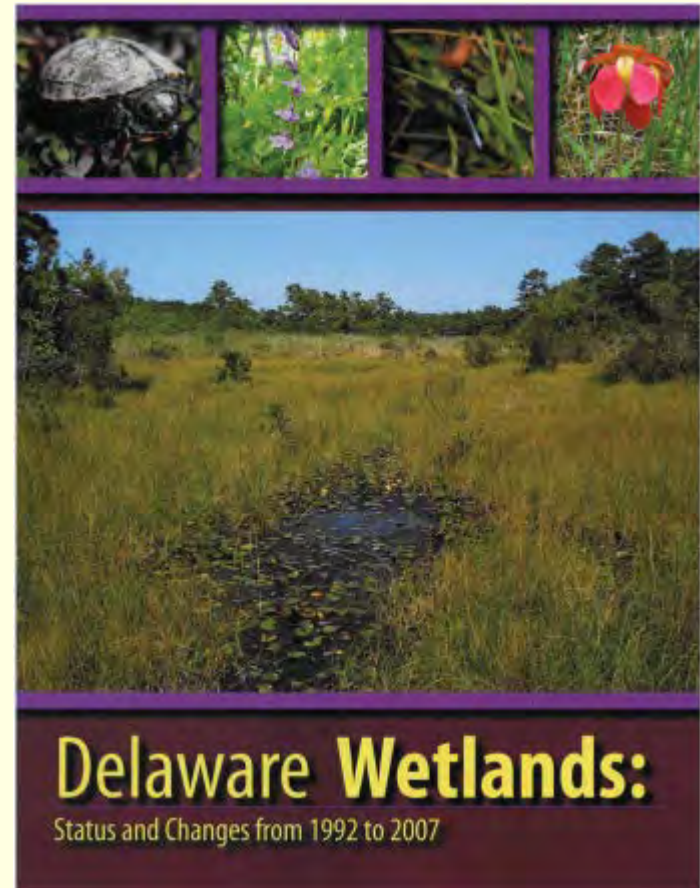
- 142,000 acres (=62%)
- 5,810 wetlands
- 43% decrease in interfluvial outflow type
 - Aver. Size = 44 a
- Palustrine -40%
- Estuarine -28%

Functional Losses for Nanticoke

■ Surface Water Detention	-36%
■ Streamflow Maintenance	-64%
■ Nutrient Transformation	-47%
■ Sediment Retention	-46%
■ Coastal Storm Surge Detention	-23%
■ Fish/Shellfish Habitat	-28%
■ Waterfowl/Waterbird Habitat	-28%
■ Other Wildlife Habitat	-41%

NWI+ Data and Reports Posted Online

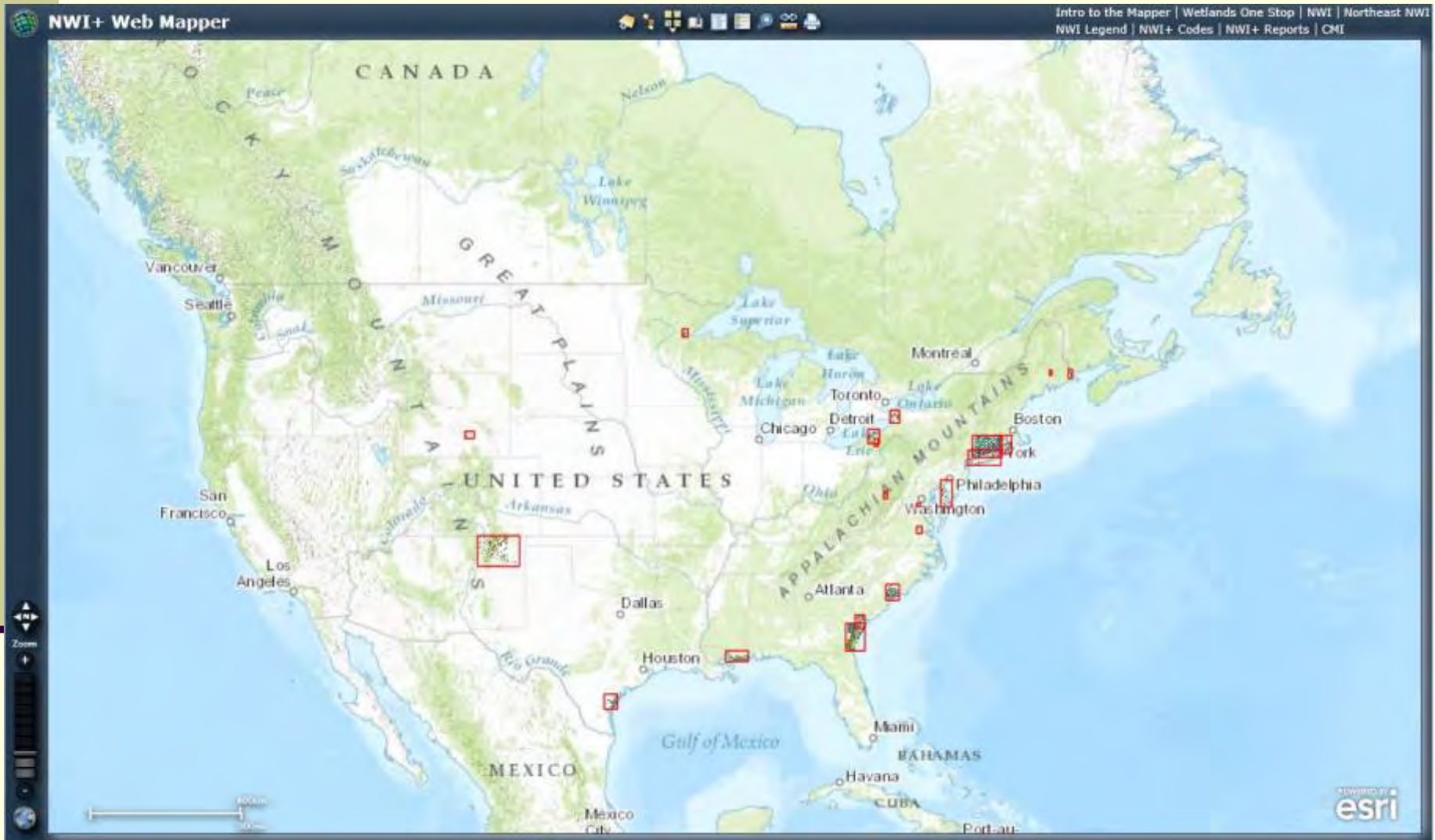
- ASWM's Wetlands One-Stop Mapping
- <http://aswm.org/wetland-science/wetlands-one-stop-mapping>
 - Look under:
 - **NWI+ Mapper** for display of results
 - **NWI+ Reports** for copies of summary reports
- FWS Data and Cooperators



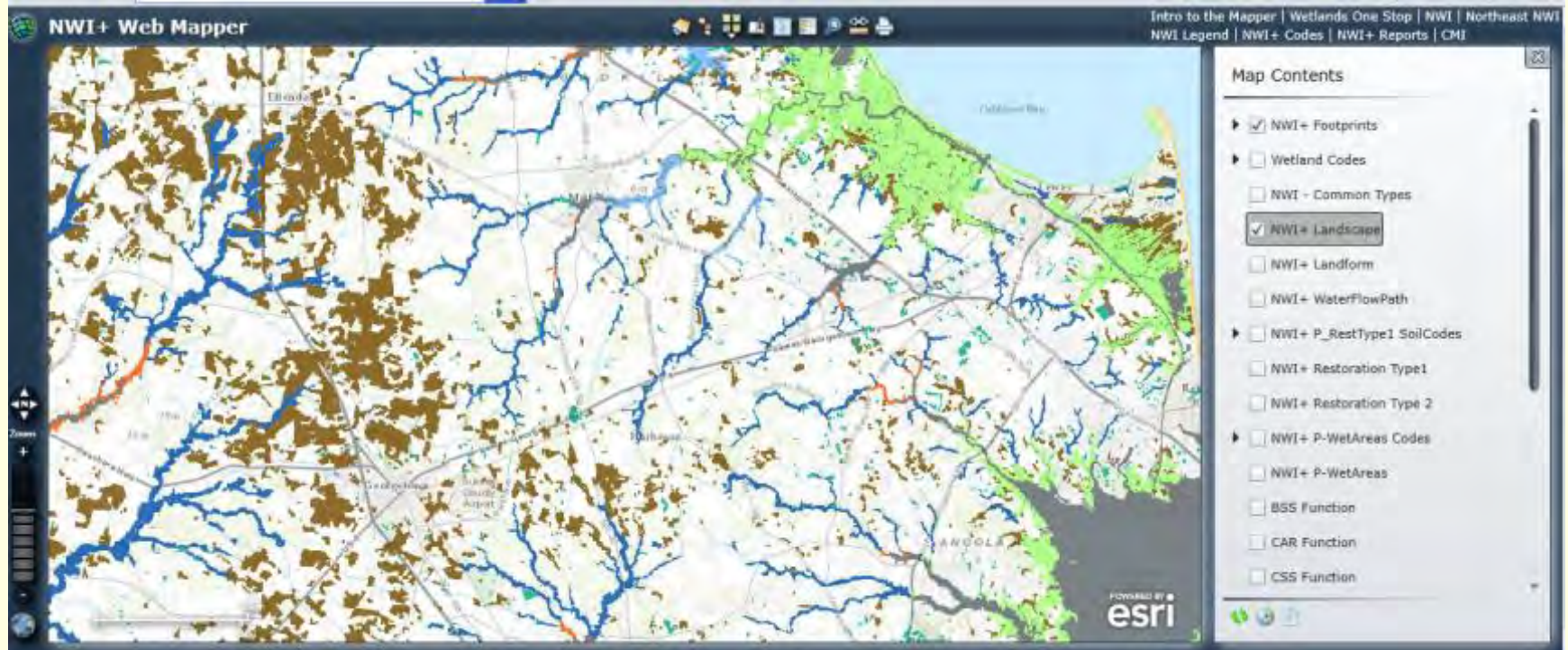
NWI+ Web Mapper - Views

Developed by
Conservation Management Institute, Virginia Tech
Contact: Kevin McGuckin kmcguckn@vt.edu

Opening Page - Footprints of Projects



Landscape Position (Default) with Map Contents Opened



Landscape Position with Map Options



Landscape and “Wetland Code” Table

The screenshot displays the NWI+ Web Mapper interface. The main map area shows a landscape with various wetland types color-coded. A pop-up window titled "PFO1E" is open, displaying the following data:

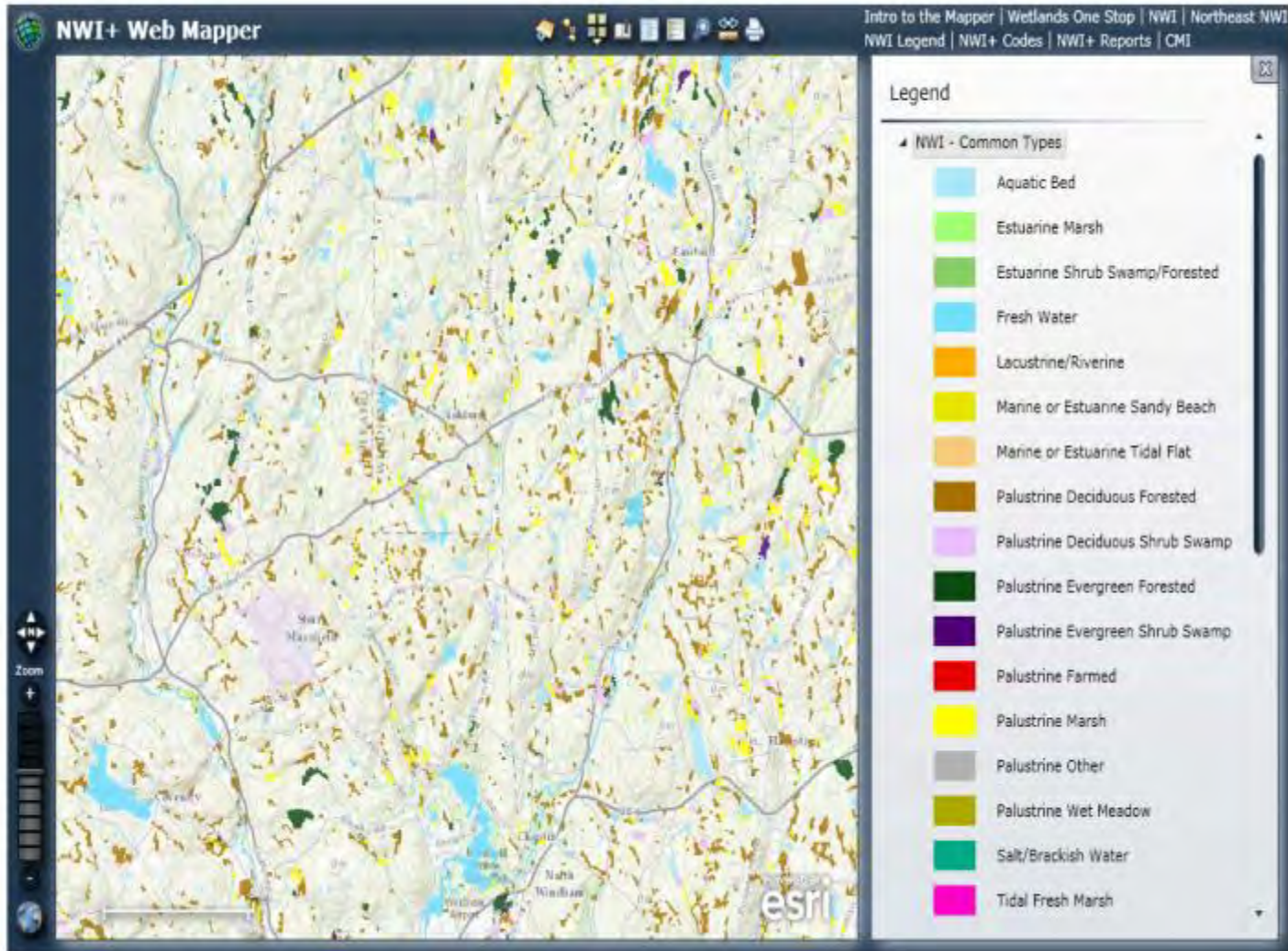
NWI Attribute	PFO1E
Code	PFO1E
LLWW Code	LS18ApdThlw
Acres	51.7781901365653

The right-hand side of the interface features a "Map Contents" legend with the following items:

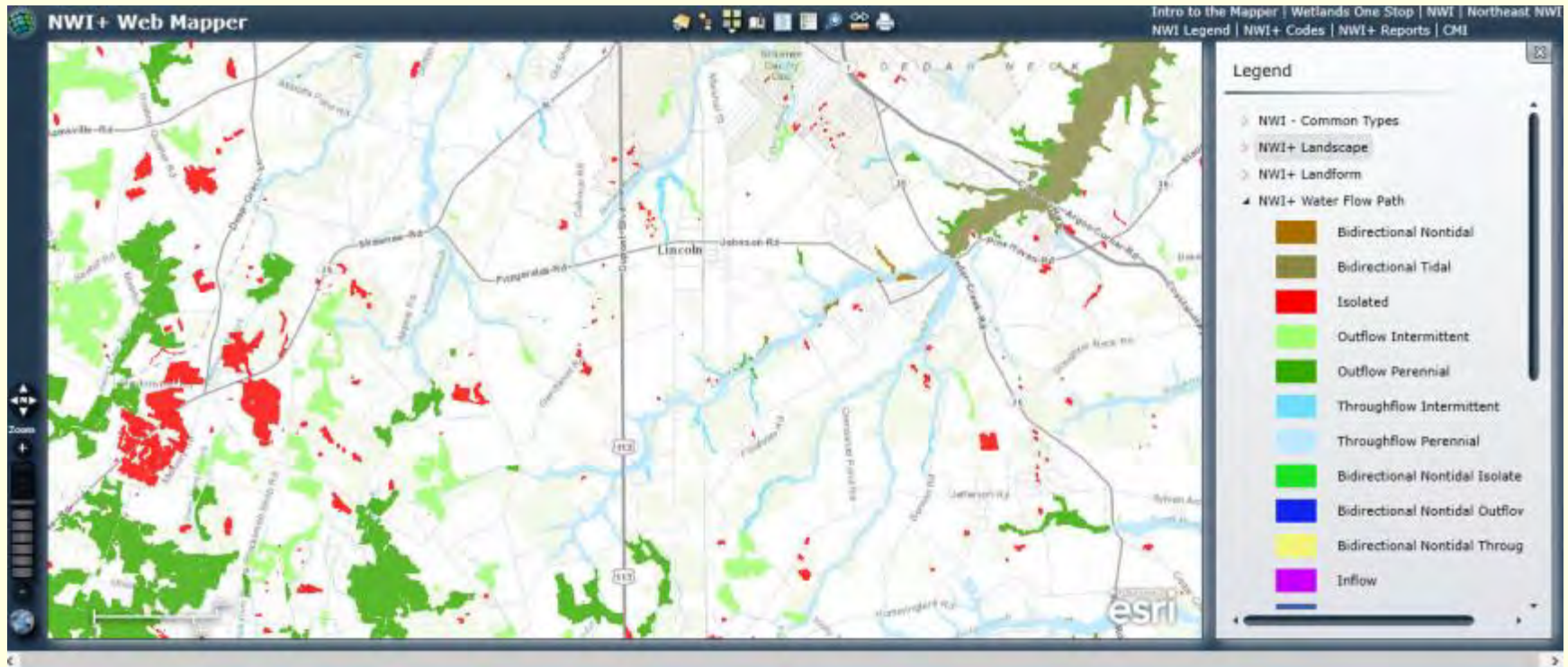
- NWI+ Footprints
- Wetland Codes
- NWI - Common Types
- NWI+ Landscape
- NWI+ Landform
- NWI+ WaterFlowPath
- NWI+ P_RestType1 SoilCodes
- NWI+ Restoration Type1
- NWI+ Restoration Type 2
- NWI+ P-WetAreas Codes
- NWI+ P-WetAreas
- BSS Function
- CAR Function
- CSS Function

The interface includes navigation tools on the left and top, and the Esri logo is visible in the bottom right corner of the map area.

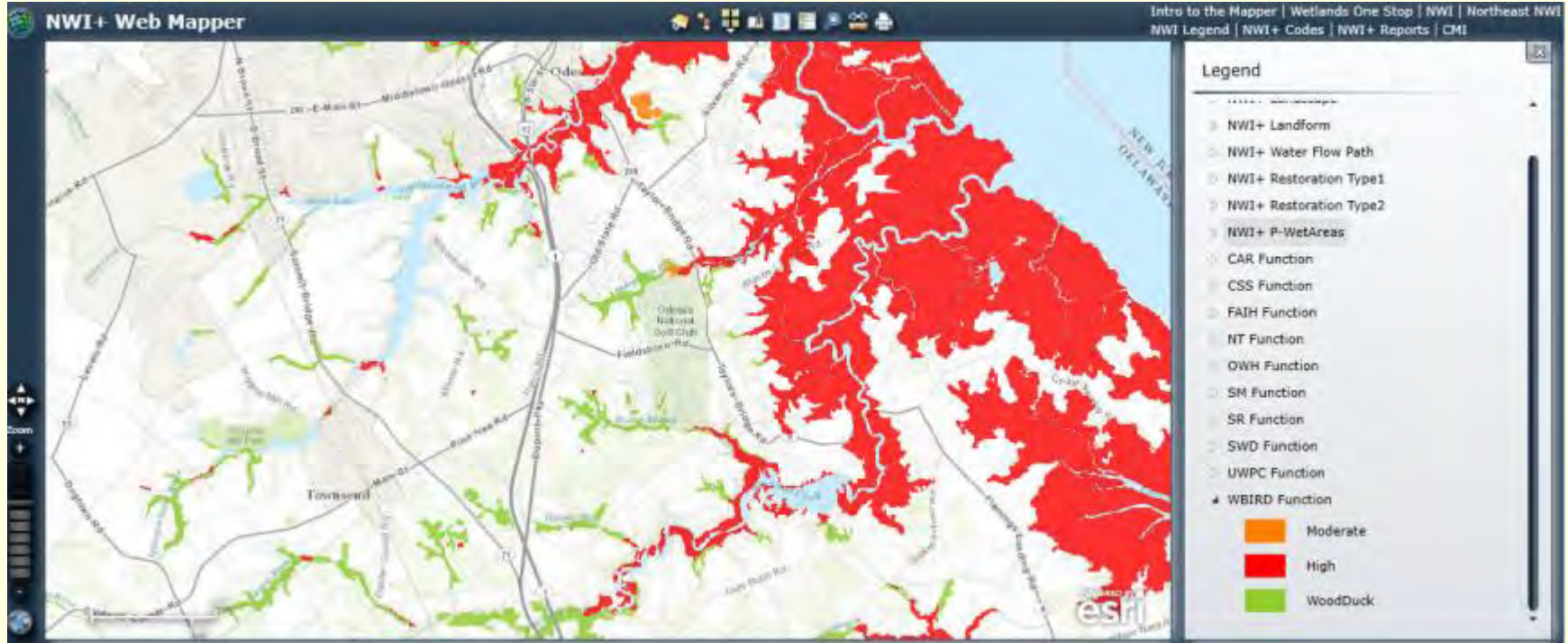
NWI Types with Legend



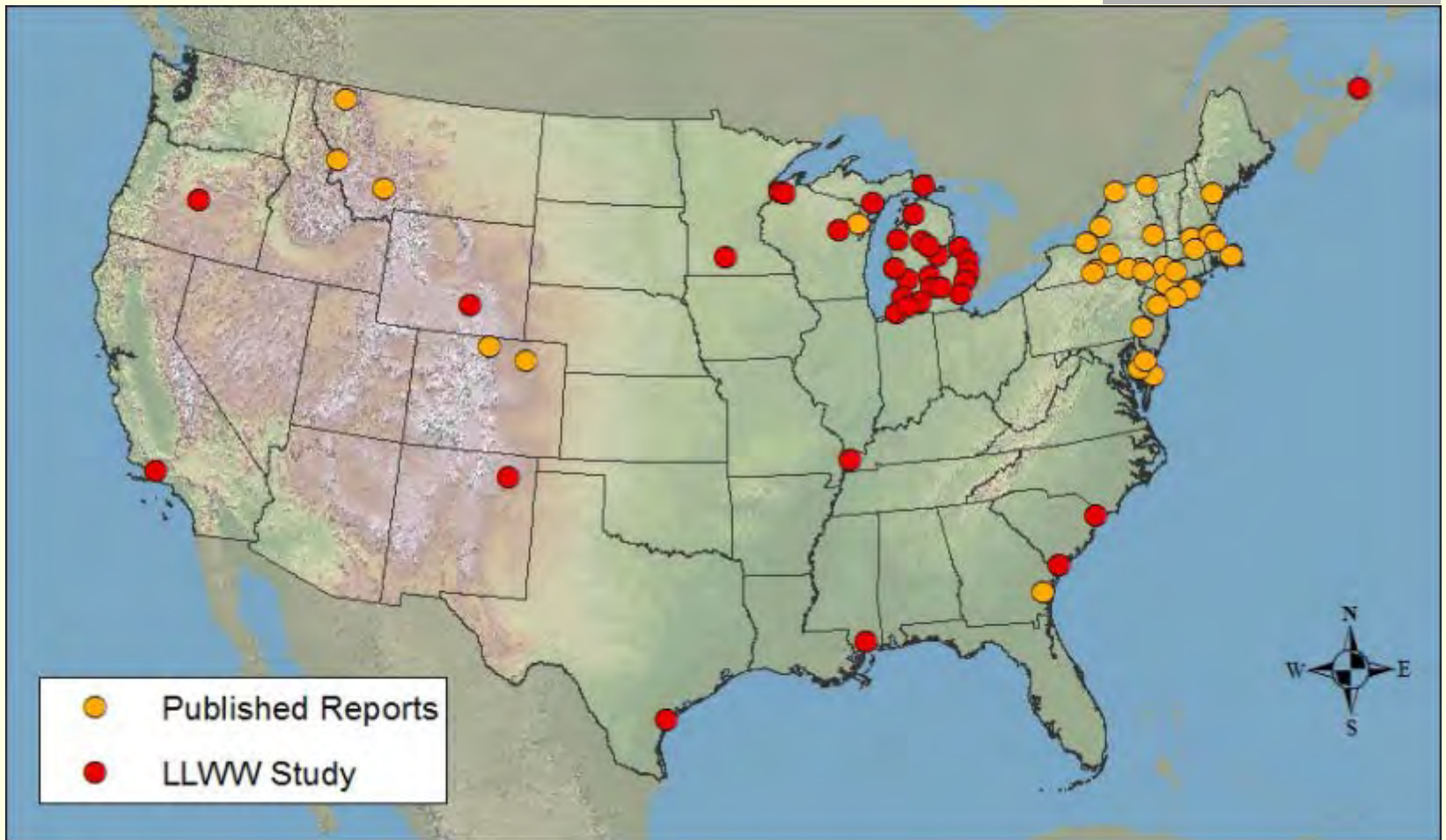
Water Flow Path with Legend



Function Map – Provision of Waterfowl/Waterbird Habitat



NWI+ Applications including Others



Other Wetland Data Layers

- P-wet Areas
 - Undeveloped hydric soil map units that were not mapped as NWI wetlands and in “natural vegetation” (fields, thickets, and woods)
- Potential Wetland Restoration Sites
 - Former wetland areas (based on soils)
 - Impacted existing wetlands (e.g., impounded, partly drained, farmed, tidally restricted)

Uses of Functional Assessments

- Watershed characterization of wetlands
- Landscape-level wetland functional assessments
- Functional loss assessments as part of wetland trend studies
- Restoration planning – target sites to improve certain functions for the watershed

NWI+ = Better Characterization of Wetlands

- Can use for descriptions of wetland types in the area of interest and as aid in selecting sites for monitoring and research
- Shows connectivity among wetlands
- NWI+ doesn't address all the reasons behind unique wetland characteristics (e.g., water chemistry differences due to surficial geology and groundwater connections; Azzolina et al. 2007) but there are provisions through Cowardin et al. and LLWW to include water chemistry (pH, salinity) and groundwater interactions in the classification of individual wetlands

Landscape-level Assessment of Wetland Functions

- Preliminary
 - Current capacity of “area of interest” to provide functions
- Can use to assess possible effect of cumulative losses on wetland functions since and earlier time period
 - Significance of wetland changes on wetland functions between time periods
 - Increase in some types while other types decline will alter performance of certain wetland functions
- When applied to **potential wetland restoration sites** provides perspective on likely functions to be improved