

Landscape-level Wetland Functional Assessment Using Enhanced Wetland Geospatial Data

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Landscape-level Wetland Functional Assessment

- Using maps, digital geospatial data, and remotely sensed data
- Develop inventory of wetlands
 - With attributes needed to relate to wetland functions
- Use GIS technology and manual review to produce preliminary assessment of wetland functions for a large geographic area (e.g., watershed, county, province, state, etc.)

Data Needs for Landscape-level Wetland Functional Assessment

- Wetlands Inventory
- Plant community (general types)
- Hydrology
- Streams and other waterbodies
- Relationship between wetlands and waters

U.S. Data

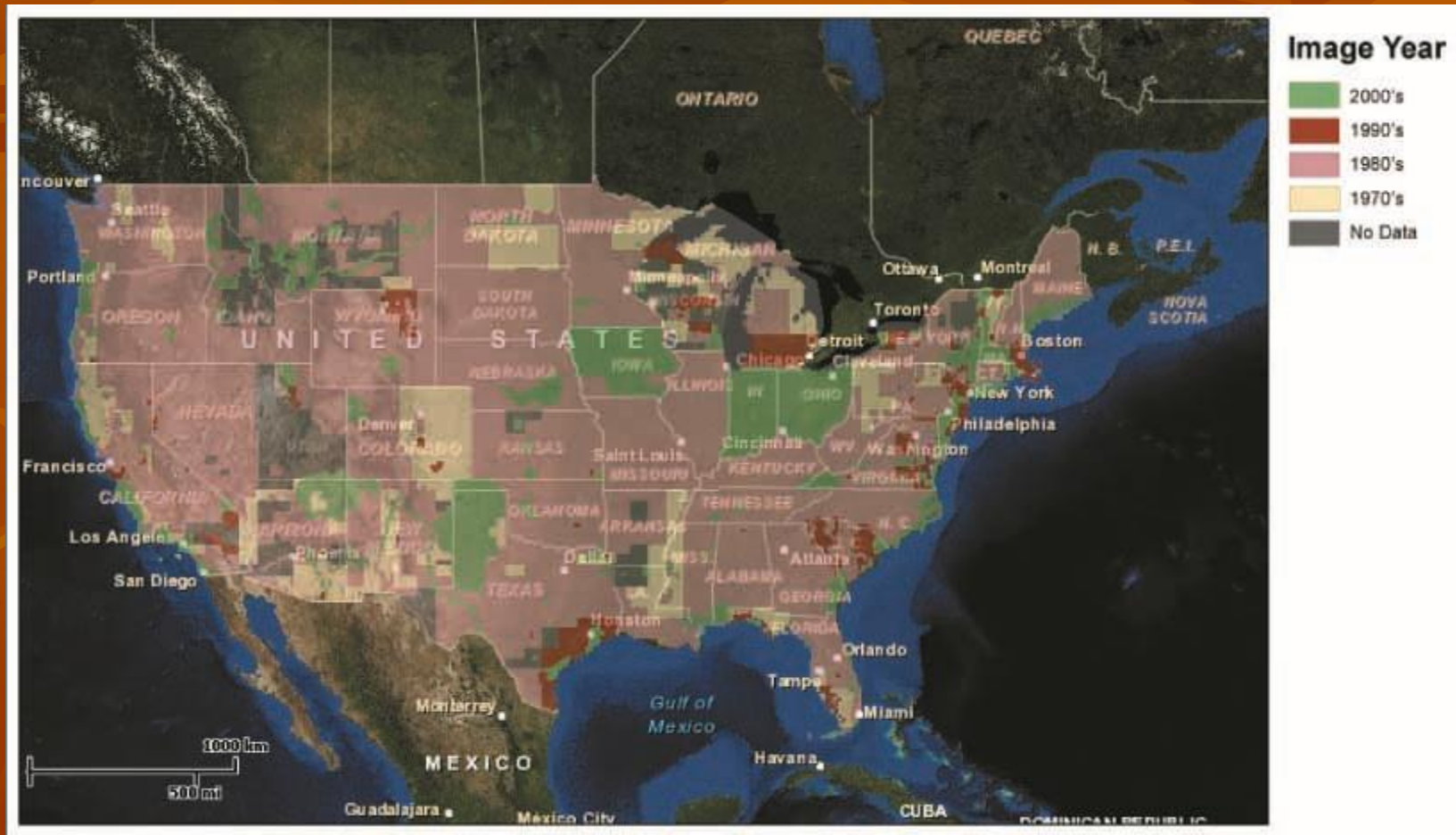
- Start with National Wetlands Inventory (U.S. Fish and Wildlife Service)
- Add other attributes to address properties not in the database that can be readily extracted from maps, aerial imagery, or geospatial databases
- Can also do in other countries where fairly comprehensive wetland inventories have been or are conducted

Inventory Data Considerations and Limitations

- Completeness
 - Wetlands
 - Waterbodies (e.g., streams)
- Currentness
 - May need to update data
- Accuracy of Classifications
- Recognize Limitations
 - Not all wetlands and streams
 - Possible classification issues (esp. hydrology)

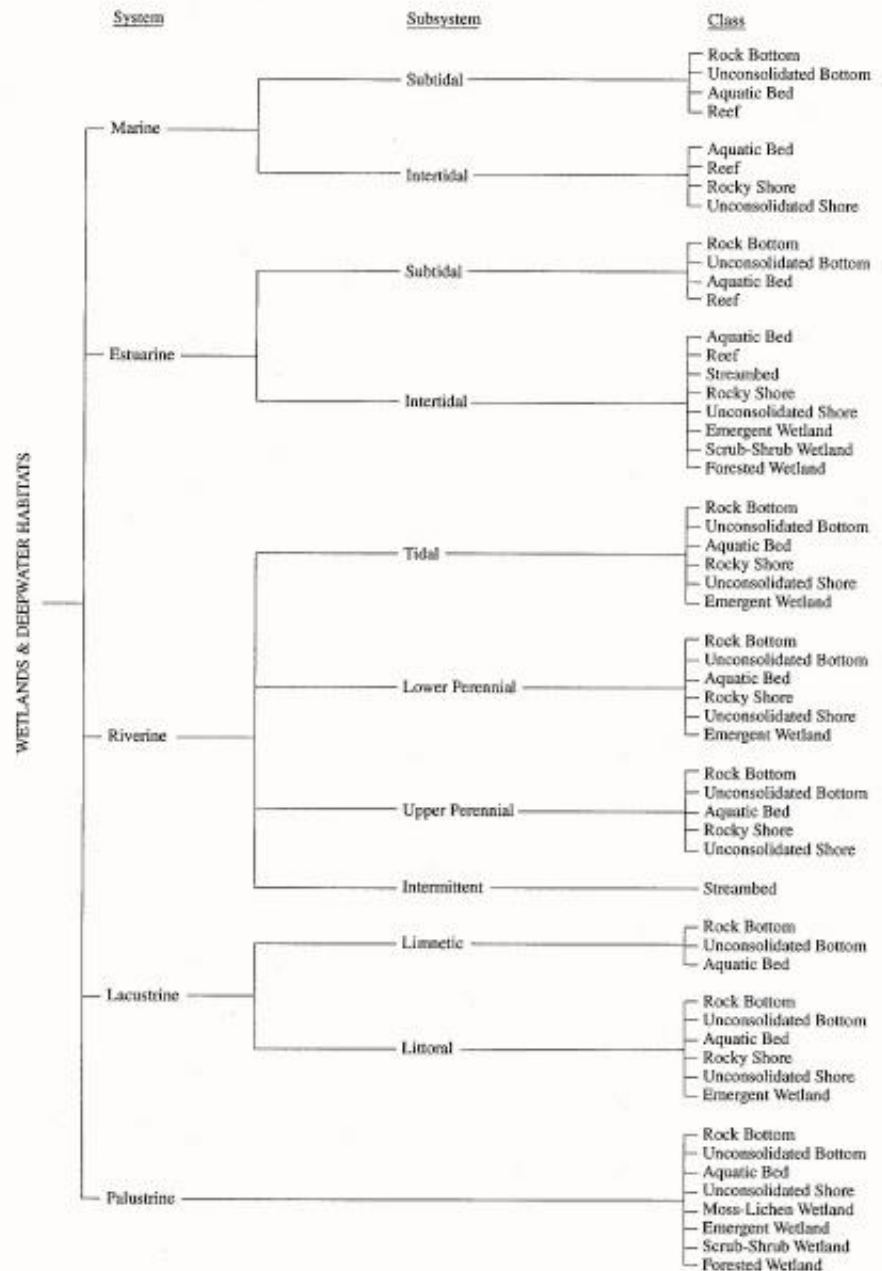
Wetland Geospatial Data

■ National Wetlands Inventory Data



Wetland Classification

- Cowardin et al. 1979
- Ecological System/Subsystem
 - M, E, P, R, and L
- Class
 - AB, EM, SS, FO, US, UB
- Water Regime
- Special Modifiers

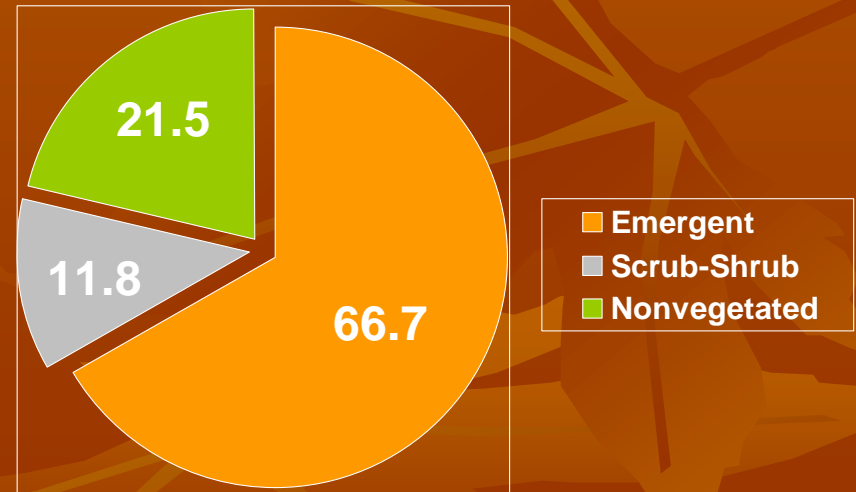
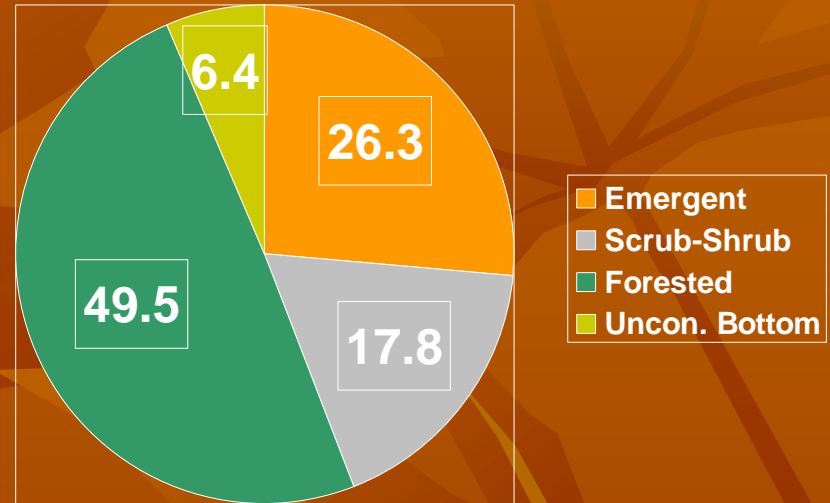


Common Types

- **Marine Intertidal**
 - Unconsolidated Shore, Rocky Shore
- **Estuarine Intertidal**
 - Emergent Wetland, Scrub-Shrub Wetland, Unconsolidated Shore
- **Palustrine**
 - Unconsolidated Bottom, Aquatic Bed, Emergent Wetland, Scrub-Shrub, Forested Wetland
- **Lacustrine**
 - Unconsolidated Bottom or Shore, Aquatic Bed
- **Riverine**
 - Unconsolidated Shore, Aquatic Bed

Nation's Wetlands

- **Conterminous US**
 - 95% are freshwater types
 - 50% = forested
 - 5% are saline tidal types
 - 67% = estuarine emergent



Need more information for landscape-level functional assessment

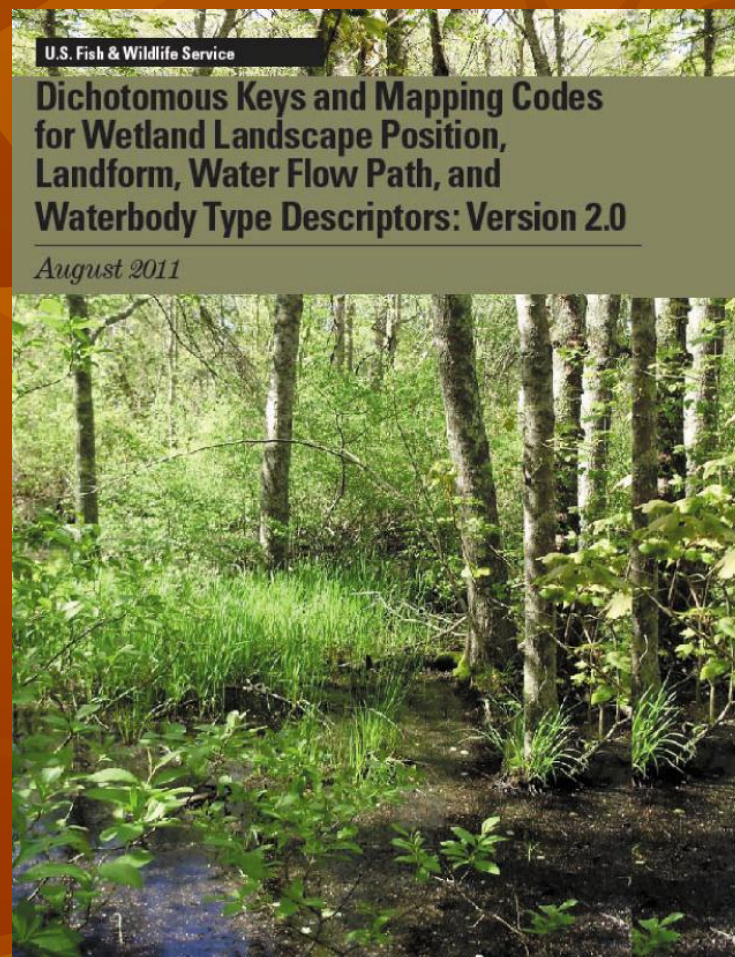
- Especially for freshwater types
- Some important questions:
 - Association with a waterbody (“landscape position”)
 - Is wetland a depression, flat, slope, floodplain, or island (“landform”)
 - Connection to other wetlands and waters (“water flow path”)
 - Headwater location
- For tidal wetlands
 - How many have restricted tidal flow?

LLWW Descriptors

- Add to NWI digital database
 - Landscape position
 - Landform
 - Water flow path
 - Waterbody type
- Then use all attributes to help predict wetland functions for the geographic area of interest

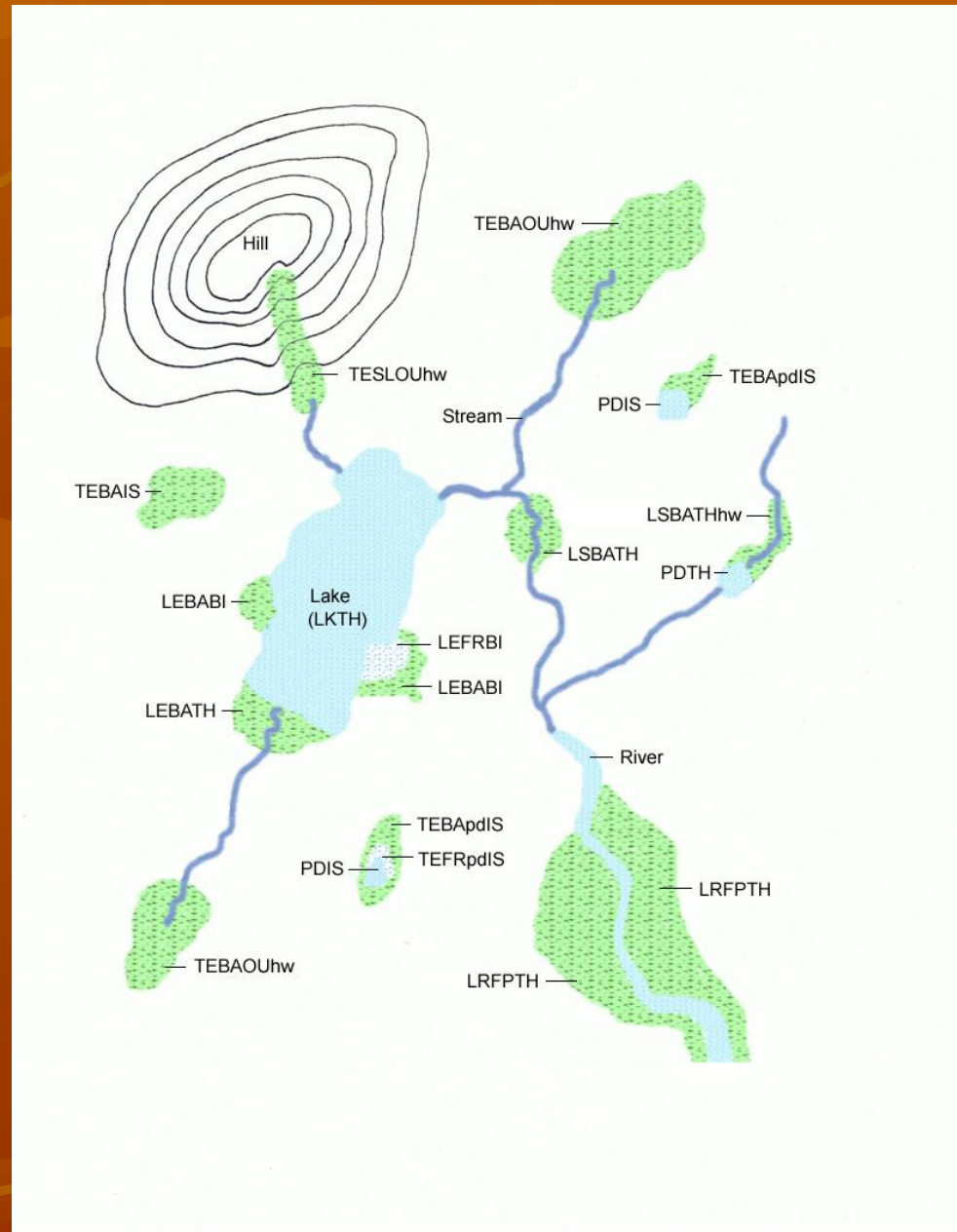
Dichotomous Keys and Mapping Codes

- Detailed Keys and Mapping Codes
 - Landscape Position
 - MA, ES, LS, LR, LE, TE
 - Landform
 - BA, FL, FP, IL, SL, FR
 - Water Flow Path
 - BT, BI, OU, TH, IN, IS, etc.
 - Waterbody Type
 - Other descriptors
 - hw, dd, ed, tr, td, etc.
- Simplified Keys



Enhancing NWI Data

- Adding LLWW descriptors to NWI databases
- Automation/Manual Review (VTech)
- This plus existing NWI data = NWI+ database



NWI+ Database

- **Increases functionality of NWI database for:**
 - Improved characterization of wetlands
 - Associations with waterbodies via the landscape position descriptor
 - Separates depressional wetlands from flat, floodplain, fringe, island and slope wetlands via the landform descriptor
 - Connectivity to other wetlands via the water flow path descriptor
 - Adds more specific waterbody types – e.g., farmed ponds, vernal pools, playas, Carolina bays, etc.
 - Use expanded database to predict wetland functions
- **Not a standard NWI product** –
 - User-funded or
 - May be part of NWI updates depending on available funding and regional priorities

Watershed Reports

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Acknowledgments

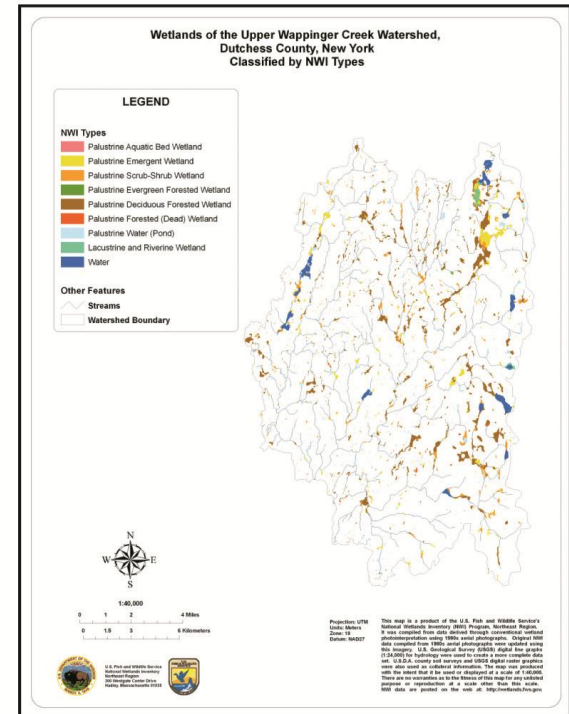
References

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U.S. Fish & Wildlife Service

Wetlands of the Upper Wappinger Creek Watershed *Dutchess County, New York*



Data for Improved Wetland Characterization

Traditional NWI Data

- Acres of wetland types by
 - System (Marine, Estuarine, Riverine, Palustrine, Lacustrine)
 - Class (Emergent, Scrub-Shrub, Forested, Unconsol. Shore, Aquatic Bed)
 - Water Regime (e.g., Seasonally flooded, Temporarily flooded, Saturated, Regularly flooded, Irregularly flooded)
 - Other modifiers (e.g., water chemistry, farmed, beaver, diked, partly drained)

Expanded Data – More Descriptive

- Acres of wetlands by:
 - Landscape Position (Marine, Estuarine, Lentic, Lotic River, Lotic Stream, Terrene)
 - Landform (Fringe, Island, Floodplain, Basin, Flat, Slope)
 - Water Flow Path (e.g., Inflow, Outflow, Throughflow, Isolated, Bidirectional-nontidal, Bidirectional-tidal)
 - Other descriptors (e.g., headwater, estuarine-discharge, tidally restricted, drainage-divide, pond-associated)
- Different pond types

NWI vs. LLWW Acreages

Table 4. Wetlands classified by NWI type for the Upper Wappinger Creek watershed.

System	Class, Subclass	Acreage
Lacustrine (L2)	Aquatic Bed (AB)	21.33
	Emergent (EM)	70.08
	(Subtotal Lacustrine)	91.41
Palustrine (P)	Aquatic Bed (AB)	6.30
	(Subtotal)	6.30
	Emergent (EM)	621.67
	Emergent (EM) / Forested (FO)	3.23
	Emergent (EM) / Scrub-Shrub (SS)	123.05
	(Subtotal)	747.94
	Forested, Broad-leaved Deciduous (FO1)	2357.49
	Forested, Needle-leaved Evergreen (FO4)	7.10
	Forested, Dead (FO5)	29.84
	(Subtotal)	2394.44
	Scrub-Shrub, Broad-leaved Deciduous (SS1)	742.46
	Scrub-Shrub, Needle-leaved Evergreen (SS4)	0.53
	(Subtotal)	742.99
	Unconsolidated Bottom (UB)	695.97
	(Subtotal)	695.97
	(Subtotal Palustrine)	4587.65
Riverine (R)	Unconsolidated Shore (US)	1.47
	(subtotal Riverine)	1.47
	GRAND TOTAL	4680.53

Table 5. Wetlands classified by LLWW type for the Upper Wappinger Creek watershed.

Landscape Position	Landform	Water Flow Path	Acreage	
Lentic (LE)	Basin (BA)	Bidirectional (BI)	116.51	
		Throughflow (TH)	165.00	
		(Subtotal)	281.51	
		Flat (FL)	Bidirectional (BI)	2.74
			(Subtotal)	2.74
		Fringe (FR)	Bidirectional (BI)	116.70
			(Subtotal)	116.70
		Island (IL)	Bidirectional (BI)	2.20
			(Subtotal)	2.20
		(Subtotal Lentic)		403.14
Lotic Stream (LS)	Basin (BA)	Throughflow (TH)	1874.25	
		Throughflow- Intermittent (TI)	10.61	
		(subtotal)	1884.86	
		Flat (FL)	Throughflow (TH)	92.20
			(subtotal)	92.20
		Fringe (FR)	Throughflow (TH)	97.72
			(subtotal)	97.72
		(Subtotal Lotic Stream)		2074.79
	Terrene (TE)	Basin (BA)	Inflow (IN)	1.08
			Isolated (IS)	671.78
Outflow (OU)			603.77	
			Outflow Intermittent (OI)	12.73
			Throughflow (TH)	17.26
			(subtotal)	1306.63
		Flat (FL)	Isolated (IS)	29.43
			Outflow Intermittent (OI)	4.96
			Outflow (OU)	15.21
			Inflow (IN)	0.85
			(subtotal)	50.45
		Fringe (FR)	Outflow (OU)	7.55
			(subtotal)	7.55
		Slope (SL)	Isolated (IS)	59.56
			Outflow (OU)	78.00
		(subtotal)	137.56	
	(Subtotal Terrene)		1502.19	
	GRAND TOTAL		3980.12	

Examples of Maps

NWI Types

Landscape Position

Wetlands of the Upper Wappinger Creek Watershed,
Dutchess County, New York
Classified by NWI Types

Wetlands of the Upper Wappinger Creek Watershed,
Dutchess County, New York
Classified by Landscape Position

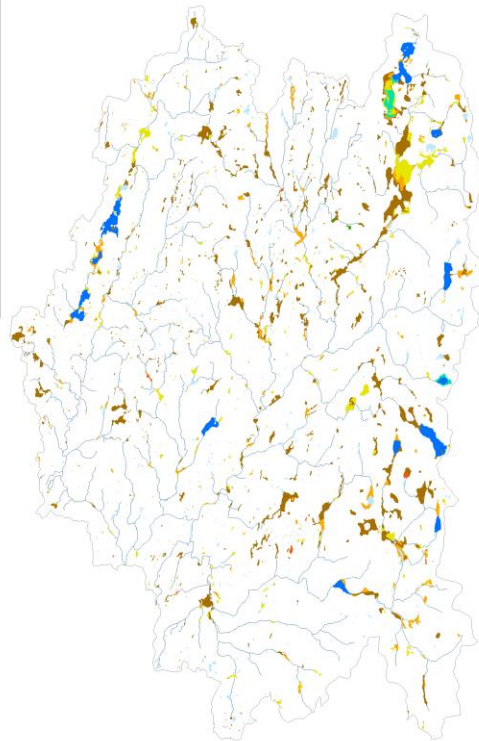
LEGEND

NWI Types

- Palustrine Aquatic Bed Wetland
- Palustrine Emergent Wetland
- Palustrine Scrub-Shrub Wetland
- Palustrine Evergreen Forested Wetland
- Palustrine Deciduous Forested Wetland
- Palustrine Forested (Dead) Wetland
- Palustrine Water (Pond)
- Lacustrine and Riverine Wetland
- Water

Other Features

- Streams
- Watershed Boundary



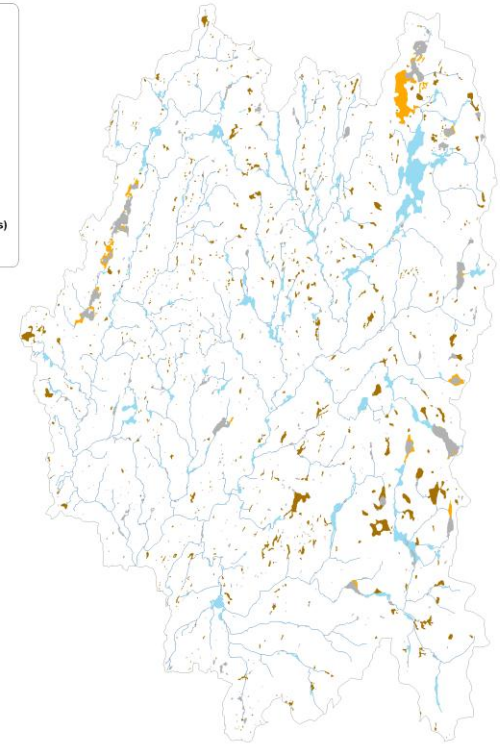
LEGEND

Landscape Position

- Terrene Wetlands
- Lotic Wetlands
- Lentic Wetlands

Other Features

- Streams
- Open Water (including ponds, lakes, rivers)
- Watershed Boundary



Use NWI+ Database to Predict Wetland Functions

- Identify key variables related to wetland functions
- Have done for 11 functions:
 - Surface water detention
 - Coastal storm surge detention
 - Streamflow maintenance
 - Nutrient cycling
 - Carbon sequestration
 - Bank and shoreline stabilization
 - Sediment/particulate retention
 - Provision of habitat for:
 - Fish/aquatic invertebrates
 - Waterfowl/waterbirds
 - Other wildlife
 - Unique, uncommon, or highly diverse plant communities

Relationships between Characteristics and Functions

- 2003 Report
 - Focus on Northeastern U.S.
 - General literature review
 - Peer review
- Regional Reports
 - Start with 2003 Report
 - Modify for new Region
 - Workshop
 - GA
 - WI

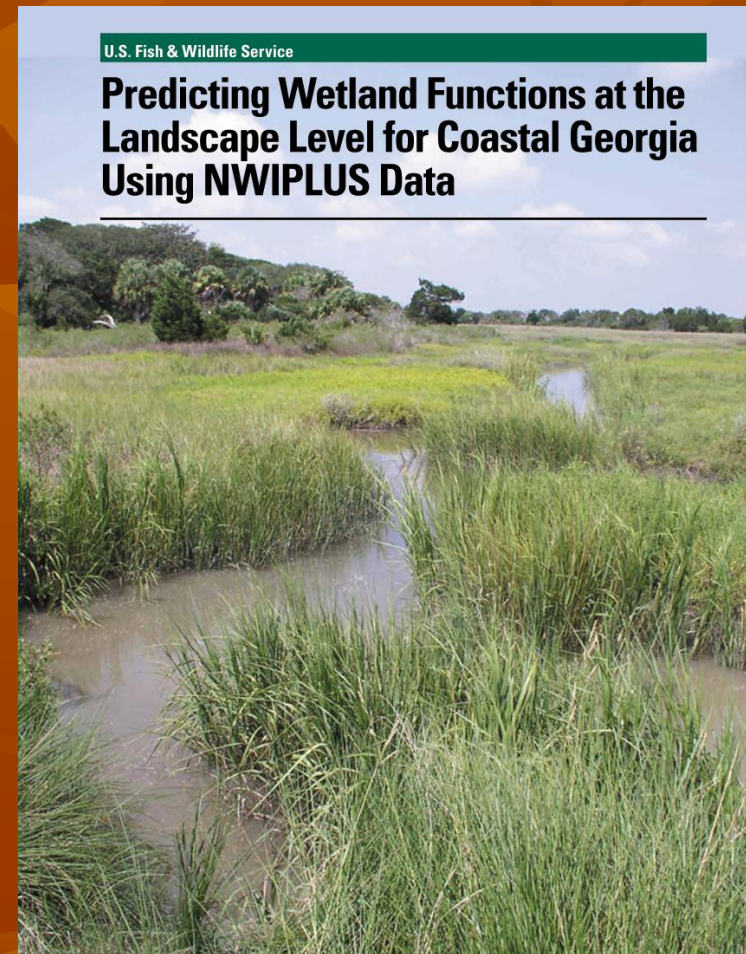


Table – Function: Characteristics

EXAMPLE: Bank and Shoreline Stabilization

- High E2__ (AB, EM, SS, FO and mixes; not IL), E2RS (not ESIL), E2US_P, M2RS(not MAIL), M2AB1N (not IL), LR_ (AB, EM, SS, FO and mixes; not LRIL and not “fm”), LS_ (AB, EM, SS, FO and mixes and not “fm”), LE__ (AB, EM, SS, FO and mixes; not LEIL and not “fm”), R_RS, L2RS
- Moderate E2US_N or M (not IL), M2US (not IL), TE__pd (AB, EM, SS, FO and mixes), TE__OUhw (AB, EM, SS, FO and mixes), E2RF (when occur along a shoreline), M2RF (when occur along a shoreline)

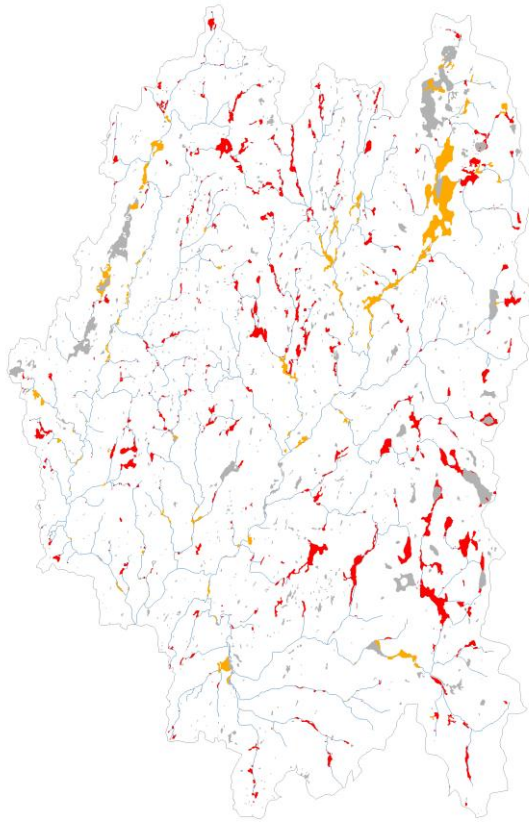
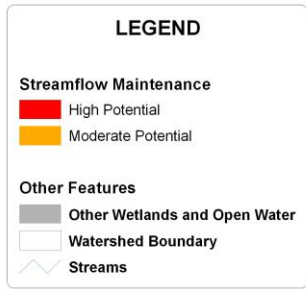
Wetland Function Summary for Watershed Report

Table 6. Preliminary wetland functional assessment findings for the watershed.

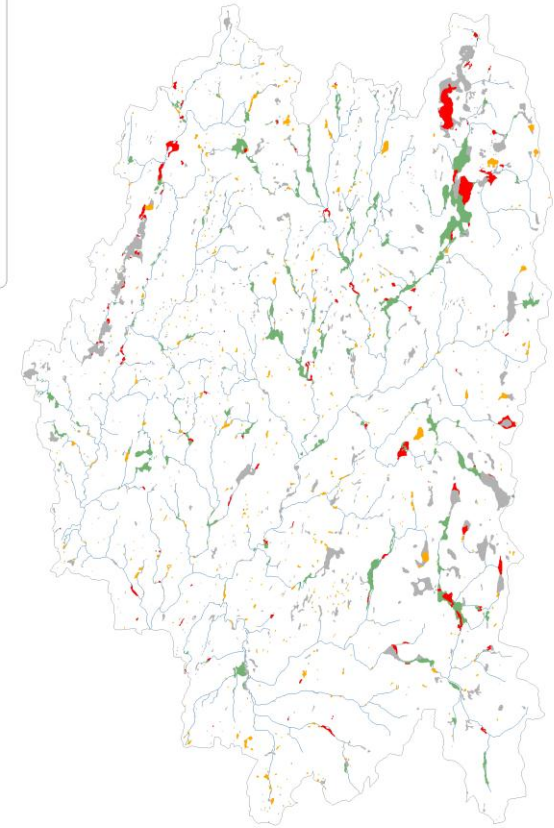
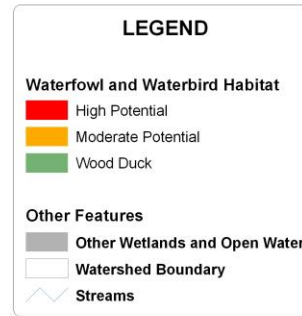
Function/Significance Level	Acres
Surface Water Detention	
High (H)	2624.12
Moderate (M)	1873.37
<i>(Total SWD)</i>	4497.49
Streamflow Maintenance	
High (H)	2364.74
Moderate (M)	1077.23
<i>(Total SM)</i>	3441.97
Nutrient Transformation	
High (H)	3781.28
Moderate (M)	110.4
<i>(Total NT)</i>	3891.68
Sediment and Other Particulate Retention	
High (H)	2624.12
Moderate (M)	1872.3
<i>(Total SR)</i>	4496.42
Shoreline Stabilization	
High (H)	2464.2
Moderate (M)	731.95
<i>(Total SS)</i>	3196.15
Fish and Shellfish Habitat	
High (H)	172.97
Moderate (M)	1034.05
<i>(Total FISH)</i>	1207.02
Shade	
Stream Shading (SS)	1607.47
<i>(Total SHADE)</i>	1607.47
Waterfowl and Waterbird Habitat	
High (H)	616.59
Moderate (M)	671.03
Wood Duck (D)	1544.71
<i>(Total PBIRD)</i>	2832.33
Other Wildlife Habitat	
High (H)	1880.12
Moderate (M)	2121.02
<i>(Total PWILD)</i>	4001.14

Maps Highlighting Wetland Functions

POTENTIAL WETLANDS OF SIGNIFICANCE FOR STREAMFLOW MAINTENANCE
Upper Wappinger Creek Watershed, Dutchess County, New York



POTENTIAL WETLANDS OF SIGNIFICANCE FOR WATERFOWL AND WATERBIRD HABITAT
Upper Wappinger Creek Watershed, Dutchess County, New York



NWI+ Databases for US – Special Projects

Northeast Region (over 500 quads or 30,000 sq. miles) to date:

- **Maine**
 - Casco Bay watershed (state funded)
- **Massachusetts**
 - Cape Cod and the Islands
 - Boston Harbor Islands (NPS funded)
- **Connecticut**
 - Entire state (state funded)
- **New York**
 - 12 small watersheds (state funded)
 - New York City water supply watersheds (city funded)
 - Long Island
- **Pennsylvania**
 - Coastal Zone (state funded)

- **New Jersey**
 - Hackensack River watershed (field office funded)
- **Delaware**
 - Entire state (1/2 state funded)
- **Maryland**
 - Nanticoke watershed, MD/DE (state funded)
 - Coastal Bays watershed (state funded)

Other Regions

- Ventura watershed, CA
- Shirley Basin, WY
- Corpus Christi region, TX
- Horry and Jasper Counties, SC
- Coastal Mississippi
- Anchorage area, AK

Functional Assessment in Progress

■ **Northeast**

- New Jersey (entire state)
- Rhode Island (entire state)
- Connecticut (entire state)
- Massachusetts (entire state)

■ **Southeast**

- Horry/Jasper Counties, SC
- Mississippi Coast

■ **Elsewhere**

- Shirley Basin, WY
- Fond du Lac reservation, MN
- Corpus Christi region, TX
- Anchorage, AK

■ ***Planned for 2013***

- Pennsylvania's Lake Erie watershed (state funded)
- Chesapeake Bay tidewater MD
- James River mainstem, VA
- New York's Lake Ontario watershed (portion)

■ **Post data on website**

- Wetlands One-Stop (Virginia Tech)
 - Geospatial data
 - Maps/reports
 - Links to other wetland geospatial data and gov't websites

www.cmiweb.org/WetlandsOneStop/Default.aspx

NWI+ by State Agencies

- Delaware – entire state (jointly w/FWS)
- Georgia – coastal counties
- Michigan – selected watersheds
- Minnesota – entire state
- Wisconsin – selected watersheds
- New Mexico – pilot area
- Montana – selected watersheds

Uses of Findings

- **Better characterization of wetlands**
 - Link wetlands to waterbodies
 - How much of the wetland resource is isolated
 - More information on ponds and lakes
- **Preliminary landscape-level assessment for conservation planning**
 - Recommended for use in watershed planning
 - Center for Watershed Protection's wetlands-at-risk protection tool
 - Prioritization of sites for acquisition/easement
 - Likely functions of potential wetland restoration sites
 - Match improved functions with watershed deficits
- **View wetlands of interest and their functions in landscape context**
- **Inform landowners and general public on the significance of wetlands for performing various functions**

Questions



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