A New Wetland Map for Tompkins County

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Wetlands

Wetlands exist… *"at the interface between truly [terrestrial] ecosystems and [aquatic] systems, making them inherently different from each other, yet highly dependent on both."*

- Mitsch and Gosselink, 2007

Vernal Pool
Credit: CT Dept of Energy & Environmental Protection

Emergent marsh/ shrub swamp
Credit: NH Division of Forests and Lands

Tidal Marsh
Credit: Maine Natural Areas Program

Mitsch, W.J. and J.G. Gosselink. (2007). Wetlands, 4th edition. Van Nostrand Reinhold, New York, New York and John Wiley & Sons, Inc., Hoboken, New Jersey.

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"…areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

- U.S. Army Corps of Engineers (Corps) and the U.S. EPA accepted definition for regulatory purposes

Jurisdictional Wetland Criteria
1. Flooding or saturation
2. Hydric Soils
3. Hydrophytic vegetation

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Wetlands

Ecological Values

- Support unique plant and animal communities
- High biological diversity
- Critical habitat for many rare and endangered species

Ecosystems goods and services

- Flood abatement
- Groundwater replenishment
- Erosion and sedimentation control
- Water purification
- Nutrient cycling
- Recreation and tourism
- Open spaces

Wetlands

Protection

Federal Law

- Clean Water Act (1972) Section 404 established a program to regulate the discharge of dredge and fill material into waters of the United States including wetlands

    Solid Waste Agency of Northern Cook County (SWANCC) v. U.S. Army Corps of Engineers, 531 U.S. 159 (2001)

    Rapanos v. United States, 547 U.S. 715 (2006)

    Recent events
    May 27, 2015: EPA and ACOE announce final rule defining waters protected by CWA
    October 9, 2015: Federal court blocked the rule's implementation nationwide

State Law

- The Freshwater Wetlands Act, Article 24 of the Environmental Conservation Law, provides DEC and the Adirondack Park Agency with the authority to regulate freshwater wetlands in the state.

Wetlands

Protection – Tompkins County

Wetland Protections in Tompkins County:
Existing Status, Gaps, and Future Needs (2008)

- Field Survey
  - 17.4 miles, 45 wetlands encountered, totaling 605 acres
- Results
  - 19% of wetlands (#) in Tompkins have no protection under state or federal law
  - 70-80% of wetlands (#) not on existing wetland maps
  - 20% of wetland area in survey not included in USFWS NWI wetlands database

WRC Wetlands Committee drafted sample local wetland law

"identify and map all wetlands that are not currently regulated by DEC or the federal government and are therefore vulnerable to disturbance and destruction from development."

- Tompkins County WRC Work Plan

Existing Wetland Maps

National Wetlands Inventory (NWI)

US Fish and Wildlife Service

- Map all wetlands in United States

NYS Article 24 Freshwater Wetland Maps

NYS Department of Environmental Conservation

- Map all NYS jurisdictional wetlands (>12.4 acres) and smaller wetlands of unusual local significance

Existing Wetland Maps

USGS NHAP 1980s – Tompkins County

Existing Wetland Maps

Lansing Example
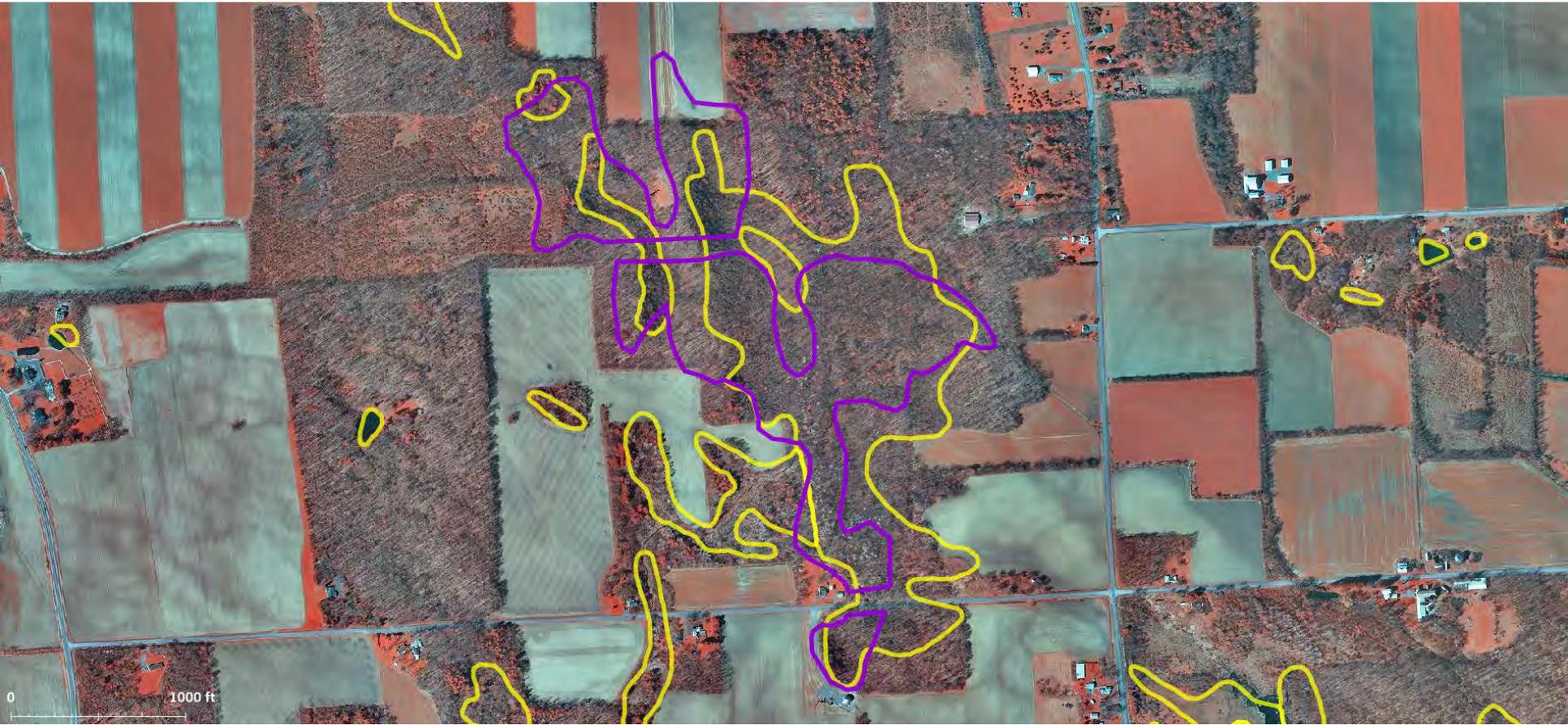
NYSDOP 2012 – Tompkins County

Existing Wetland Maps

Dryden Example
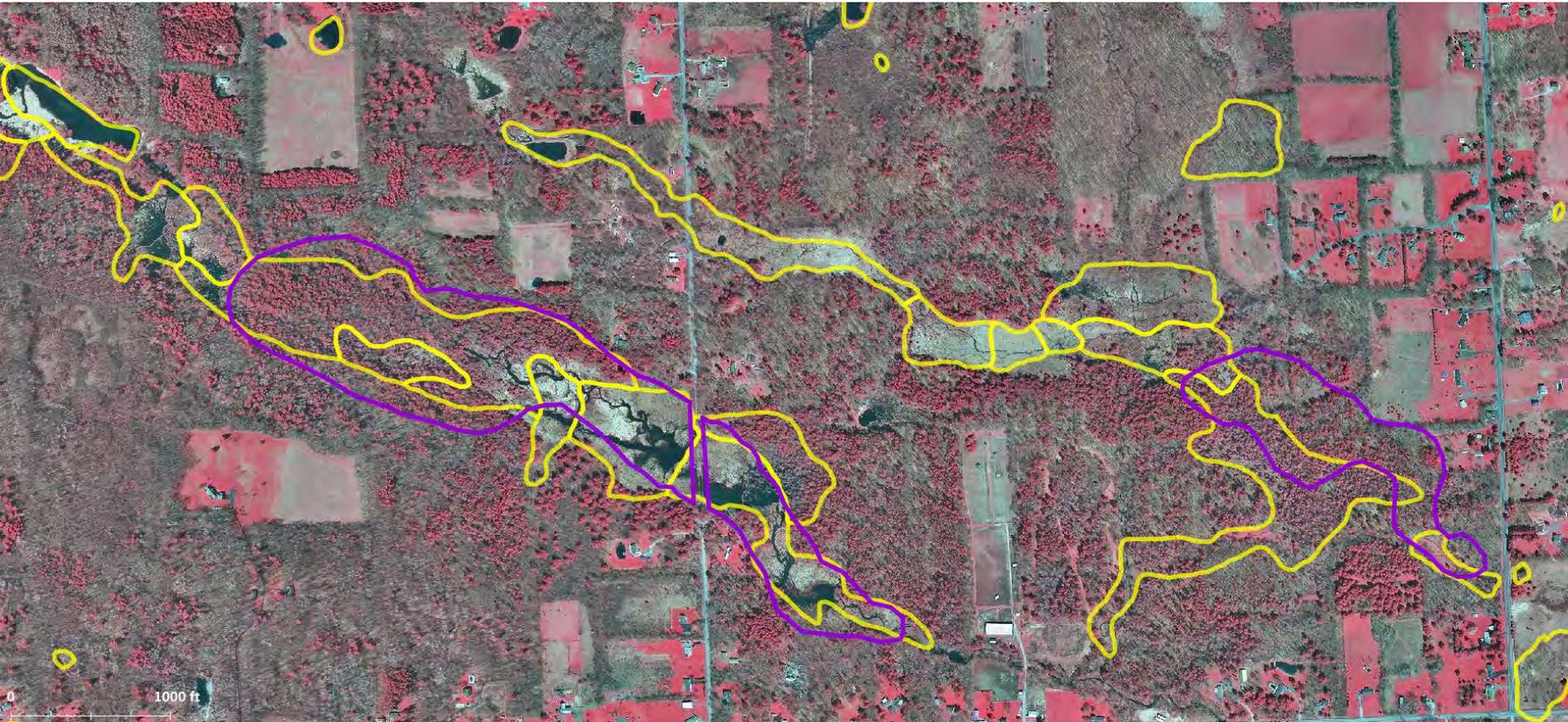
NYSDOP 2012 – Tompkins County

Existing Wetland Maps

Wetland acreage by category

	DEC	NWI
Freshwater Emergent		2,196.4
Freshwater Forested/Shrub		7,329.9
Freshwater Pond		890.1
Unconsolidated shoreline		11.6
Lake		213.4
Riverine		117.6
Total	5,631.9	10,747.5

Existing Wetland Maps

NWI Wetland Mapping Accuracy Variability

58% of wetlands on NWI maps (CA)

Werner, H. W. Accuracy assessment of National Wetland Inventory maps at Sequoia and Kings Canyon National Parks. Park Sci. 23, 19–23 (2004).

22% of wetlands on NWI; 39% of wetland area not in NWI (VT)

Morrissey, L. A. & Sweeney, W. R. Assessment of the National Wetlands Inventory: Implications for wetlands protection. Geogr. Inf. Syst. water Resour. IV AWRA Spring Spec. Conf. Houston, TX. May 8-10, 2006 1–6 (2006).

90% wetlands > 3ac and 70% of wetlands >1ac and <3ac captured by NWI; 100% of NWI wetlands were wetlands (ME)

Nichols, C. Map Accuracy of National Wetlands Inventory Maps for Areas Subject to Maine Land Use Regulation Commission Jurisdiction. Ecological Services report R5–94/6, 14pp. (1994).

93.7% wetlands on NWI Maps; 97% NWI wetlands were wetlands (MI)

Kudray and Gale, 2000. Evaluation of NWI maps in a heavily forested region in the upper Great Lakes. Wetlands, 20(4), 581-587.

10% of 200ac of wetland captured by NWI (VA)

Stolt, M. H. & Baker, J. C. Evaluation of National Wetland Inventory Maps to inventory wetlands in the Southern Blue Ridge of Virginia. Wetlands 15, 346–353 (1995).

NWI maps underestimated wetland area by 61% (Oswego and Onondaga Counties)

McMullen, J. M. & Meacham, P. A. in Wetl. Environ. Gradients, Boundaries, Buffers (Mulamoottil, G., Warner, B. G. & McBean, E. A.) 193–205 (CRC Press LLC, Lewis Publishers, 1996).

New Data Resources

NYS Digital Orthoimagery Program

- 2002 - color-infrared (0.5ft and 1ft pixel resolution)
- 2007 - natural color (0.5ft and 2ft pixel resolution)
- 2012 - 4-band (0.5ft and 2ft pixel resolution)

LiDAR Elevation Data for Tompkins County

- Collected in 2008
- Funded by TCSWCD

Oblique Aerial Imagery

- Pictometry (Rochester, NY)

New Data Resources

Tompkins County 2012 Wetlands Map

Wetland mapping process

Mapping

Visual interpretation
- NYSDOP aerial imagery
  - 2002 CIR and 2012 CIR
- LiDAR derivatives
- Oblique aerial imagery

Scale of delineation = 1:1000 or better

No minimum mapping area

Classification

National Wetland Classification Standard

Additional attributes
- Artificial vs Natural
- Mapping indicators
- Likelihood of wetland
- Wetland Complex Identification

National Wetland Classification Standard

Systems	Class (vegetation)	Hydrologic Regime	Modifiers
Marine	Pond/Lake Bottom	Temporarily Flooded	Beaver activity
Estuarine	Shore	Saturated	Drained/ditched
Riverine	Emergent (grasses)	Seasonally Flooded	Farmed
Lacustrine	Scrub-Shrub	Permanently Flooded	Impounded
Palustrine	Forested	…	Artificial
	…		…

Tompkins County 2012 Wetlands Map

Dryden Example

NYSDOP 2012 – Tompkins County
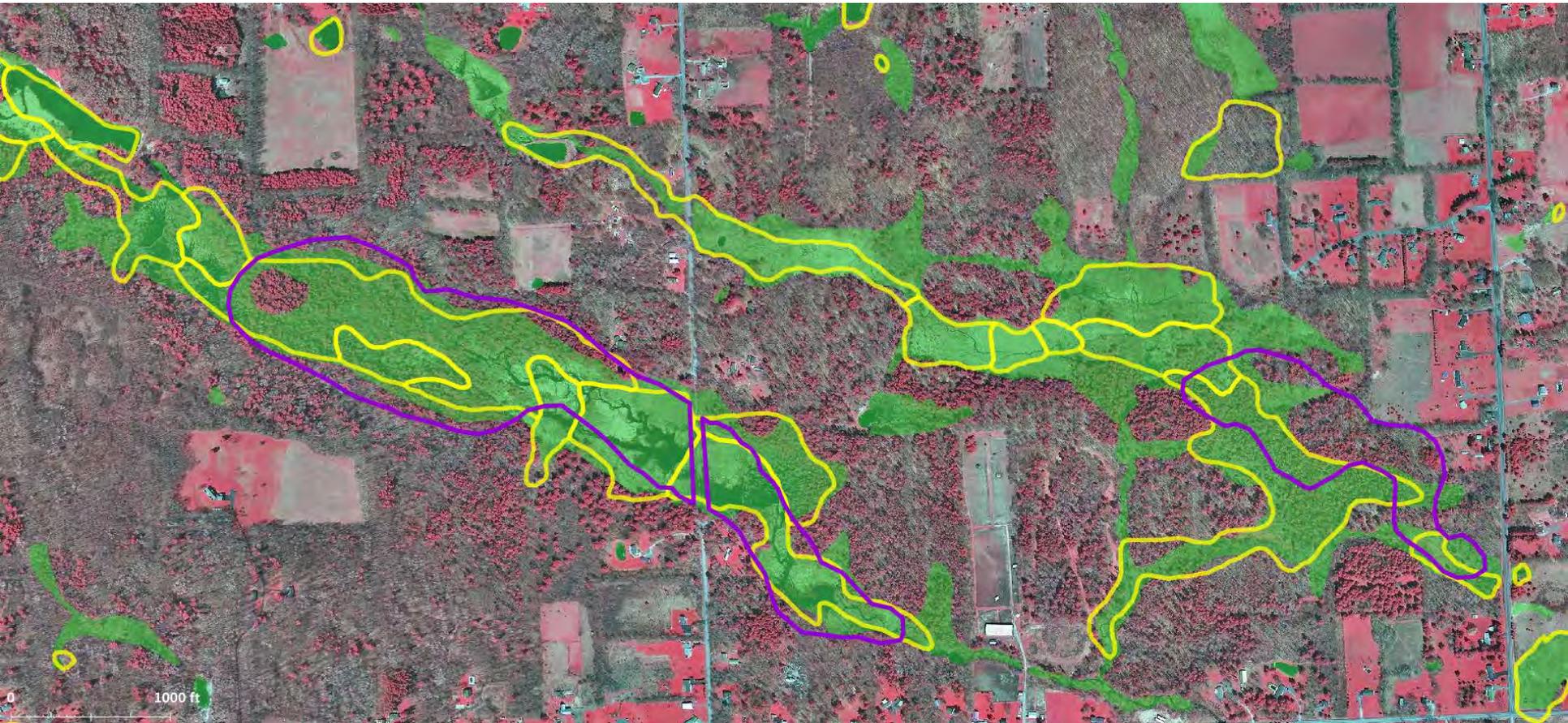
Tompkins County 2012 Wetlands Map

Groton Example
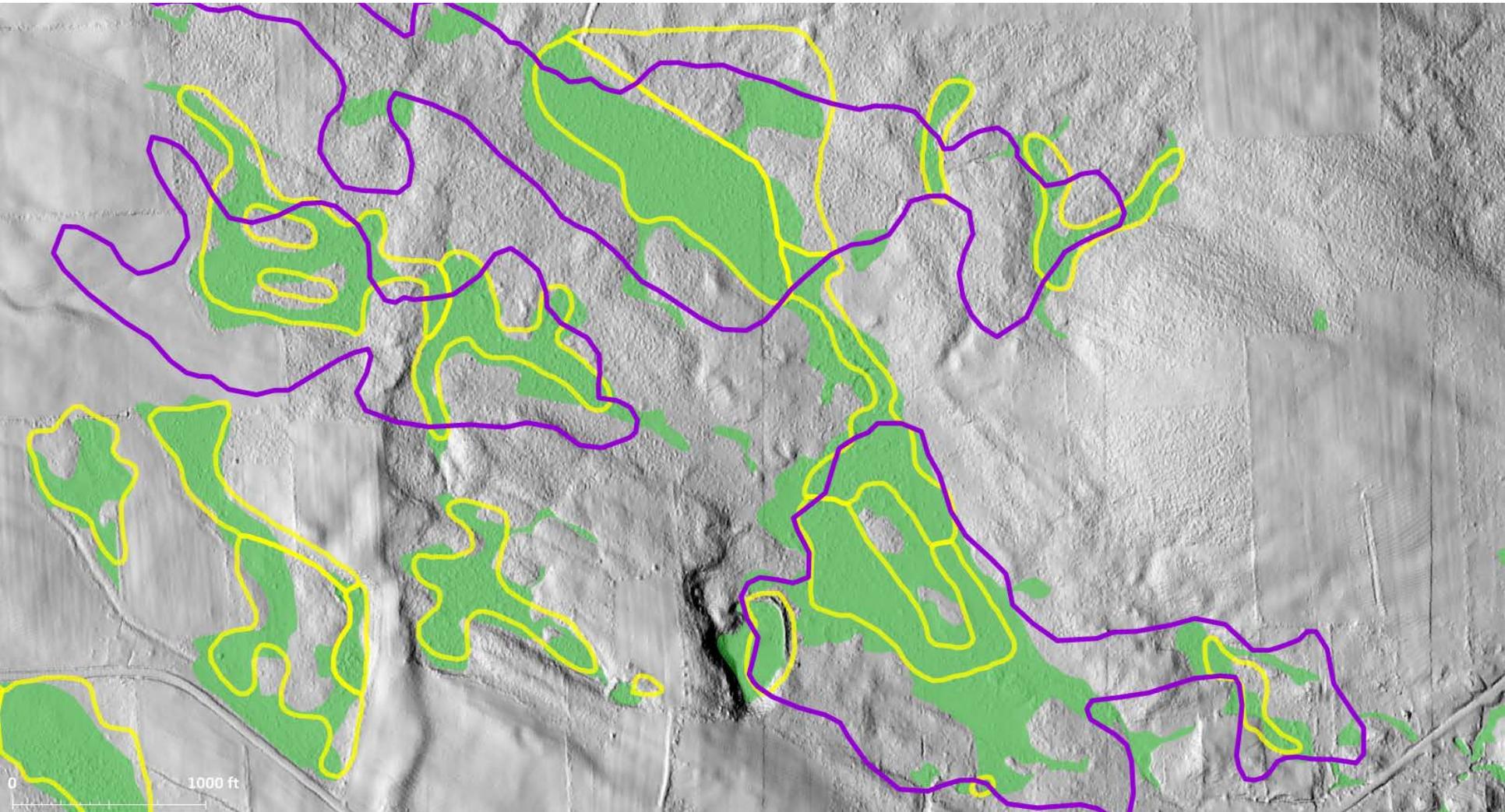
Tompkins County 2012 Wetlands Map

Result: Wetland acreage by category

	DEC	NWI	Tompkins 2012
Freshwater Emergent		2,196.4	4,002.9
Freshwater Forested/Shrub		7,329.9	9,359.7
Freshwater Pond		890.1	1,618.0
Unconsolidated shoreline		11.6	8.2
Lake		213.4	207.9
Riverine		117.6	115.8
Total	5,631.9	10,747.5	15,312.5

Tompkins County 2012 Wetlands Map

Results: Comparison to existing wetland map

Natural Wetlands Only

Size Class	DEC	Tompkins 2012
< 0.5 ac		1,667
0.5 - 1.0 ac		434
1.0 - 2.0 ac		342
2.0 - 12.4 ac	9	525
> 12.4 ac	81	197
Totals	90	3,164

5,632ac

10,205ac

Tompkins County 2012 Wetlands Map

Accuracy Assessment

Measures

1. Omission errors
2. Commission errors
3. Spatial accuracy of wetland boundary
4. NWCS Classification

Field Survey: August – October 2015

- Training and consultation
  - Kerry Thurston
    InFocus Environmental Consulting

- 26 sites total
  - 22 Cornell Plantations' Natural Area
  - 4 CLWN Member Landholdings

Tompkins County 2012 Wetlands Map

Accuracy Assessment

Results

65 wetland areas found in the field

48 mapped in GIS $\longrightarrow$ 74% captured

- Missed wetland median size: 0.2 acres
- 97.5% of wetlands over 0.5 acres successfully mapped

52 wetlands mapped in GIS

4 NOT found in field $\longrightarrow$ 92% of mapped wetlands real

- Falsely mapped wetlands were all floodplain wetlands

Tompkins County 2012 Wetlands Map

Accuracy Assessment

Results

Distance of GPS Field Survey Point to Wetland Boundary

GPS'ed Edge

Mapped Wetland
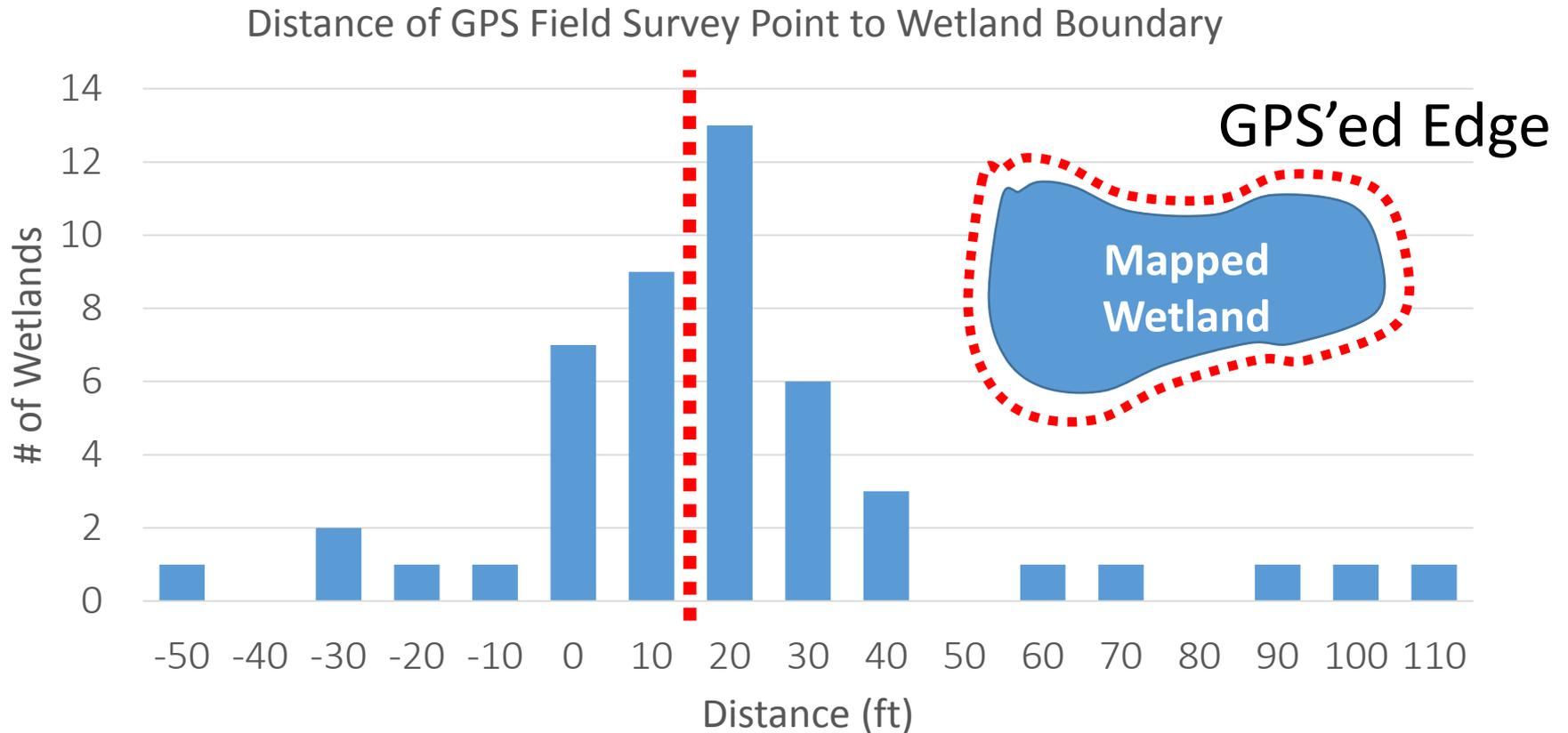
Tompkins County 2012 Wetlands Map

Accuracy Assessment

Concerns

1. Not a random sample

   - Spatial autocorrelation

2. Did not adequately assess NWCS classification

3. Accuracy of areas classified as floodplain wetlands

   - 1,636 acres of palustrine with *temporarily flooded* hydrologic regime

4. Still missing the smallest wetlands

Tompkins County 2012 Wetlands Map

Conclusions

Data Quality

1. New map is not perfect
   - Misses smallest wetlands (<0.5ac)
   - Likely overestimates floodplain wetlands
   - May underestimate wetland size on average

2. New map is more complete and spatially accurate

3. Improve with additional field data

Applications

1. Immediately useful for planning

2. Field delineations to determine whether wetlands are jurisdictional and subject to regulation under state and federal laws

3. Better resource for supporting possible local wetland protection law

Tompkins County 2012 Wetlands Map

Data Availability

Dropbox Folder

- Geospatial data
- Metadata
- Final Report
- PDF Maps
- Presentations

CUGIR (Cornell)

- Geospatial data
- Metadata

Online Map

- Tompkins County Map App
- Cornell Hosted
- CartoDB

Tompkins County 2012 Wetland Map