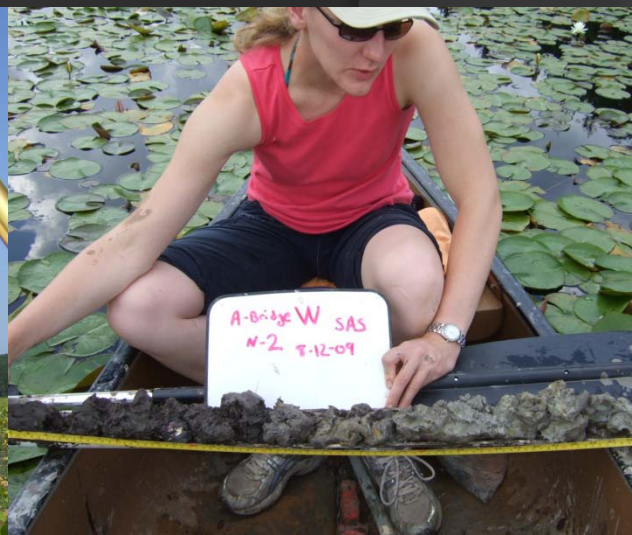
USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

PENNSTATE
1855
College of Agricultural Sciences

Highlights from Pennsylvania

FRESHWATER SUBAQUEOUS SOILS

Patrick Drohan, Emilie Erich, Mary Kay Lupton



Acknowledgements

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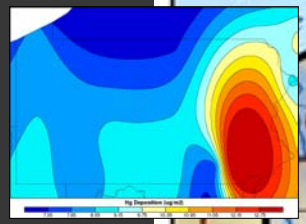
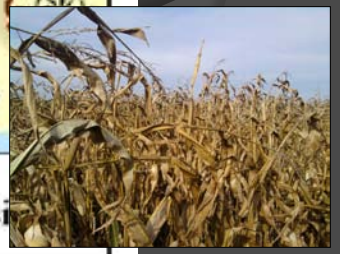
- USDA-NRCS: Ed White and Jim Doolittle
- NRCS staff in CT and RI: Debbie Surabian and Jim Turenne respectively
- URI, Mark Stolt, Mike Bradley and Maggie Payne
- Lupton and Krasinski family

PA's freshwater resources

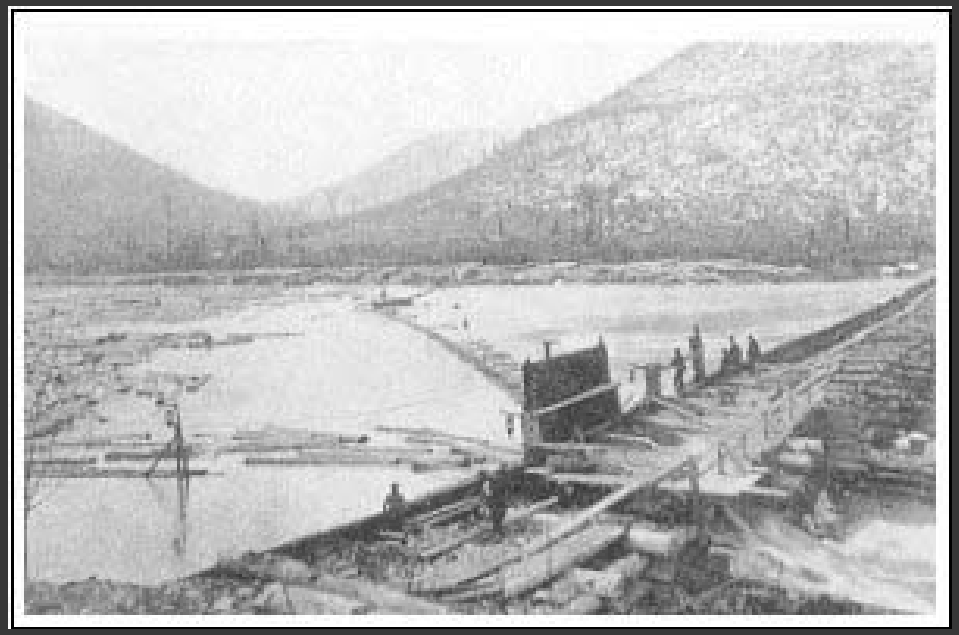


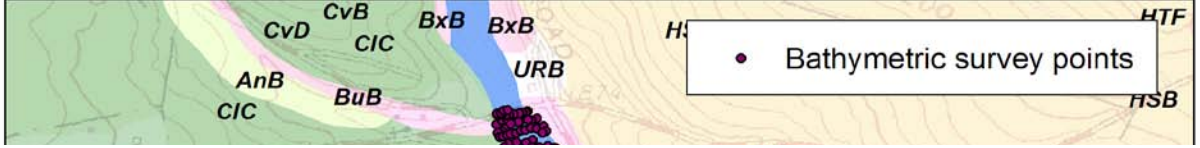


Our objectives are to:

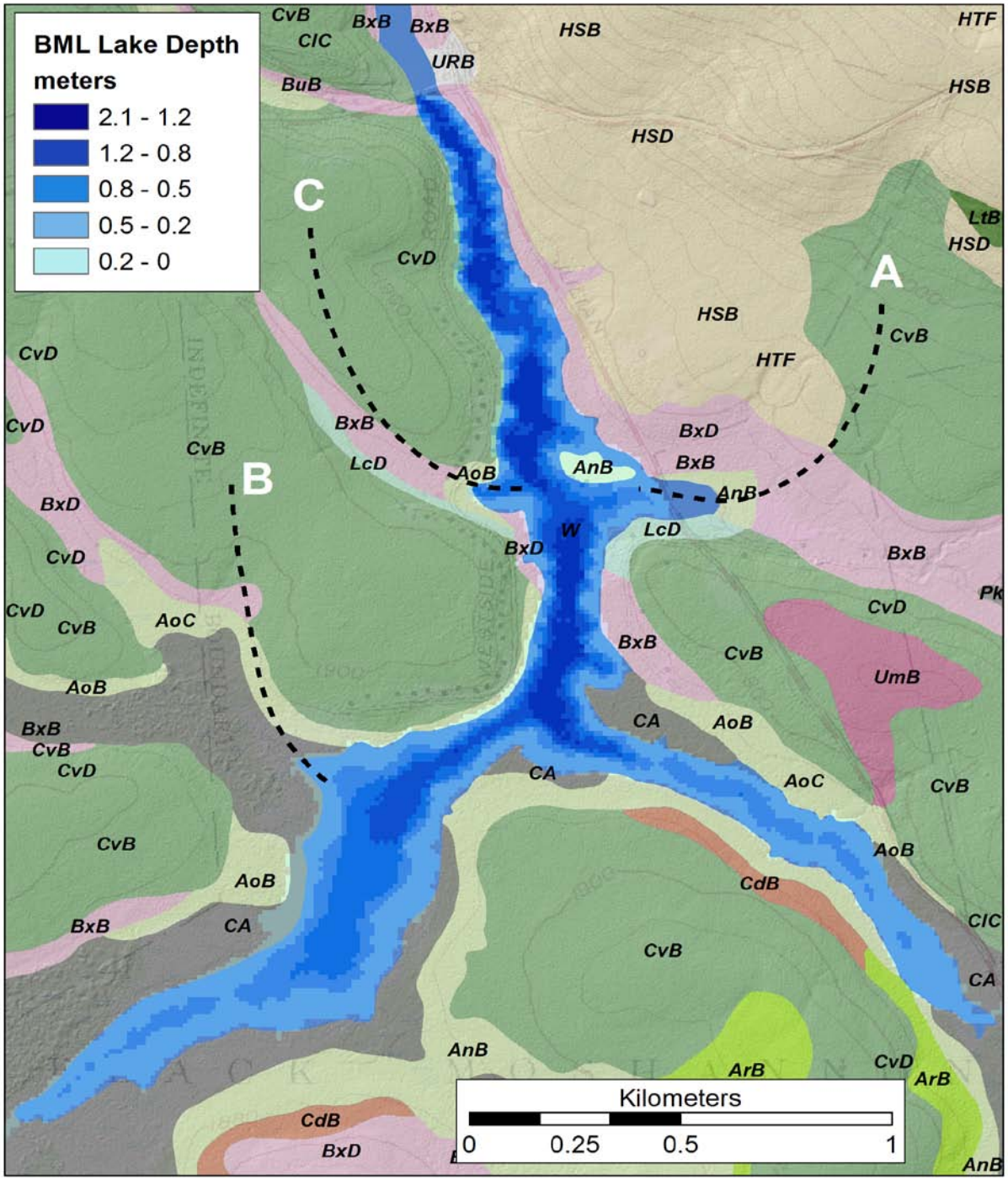
- Quantify and describe the genesis of subaqueous soils in an Appalachian Plateau impoundment;
- identify pedogenic dependent fate and transport relationships for Hg-T in subaerial and subaqueous soils; and
- quantify C sequestration since impoundment.

Moshannon State Forest & Lake




CvB
CvD
CIC
BxB
BxB
AnB
CIC
BuB
URB
HTF
HSB
Bathymetric survey points


1 m
Typic Hapludult
Aquic Fragiudults
Typic Fragiaquults


BML Lake Depth
meters
2.1 - 1.2
1.2 - 0.8
0.8 - 0.5
0.5 - 0.2
0.2 - 0
A
B
C
Kilometers
0
0.25
0.5
1
CvB
CIC
BxB
URB
BuB
HSB
HTF
HSD
LtB
CvD
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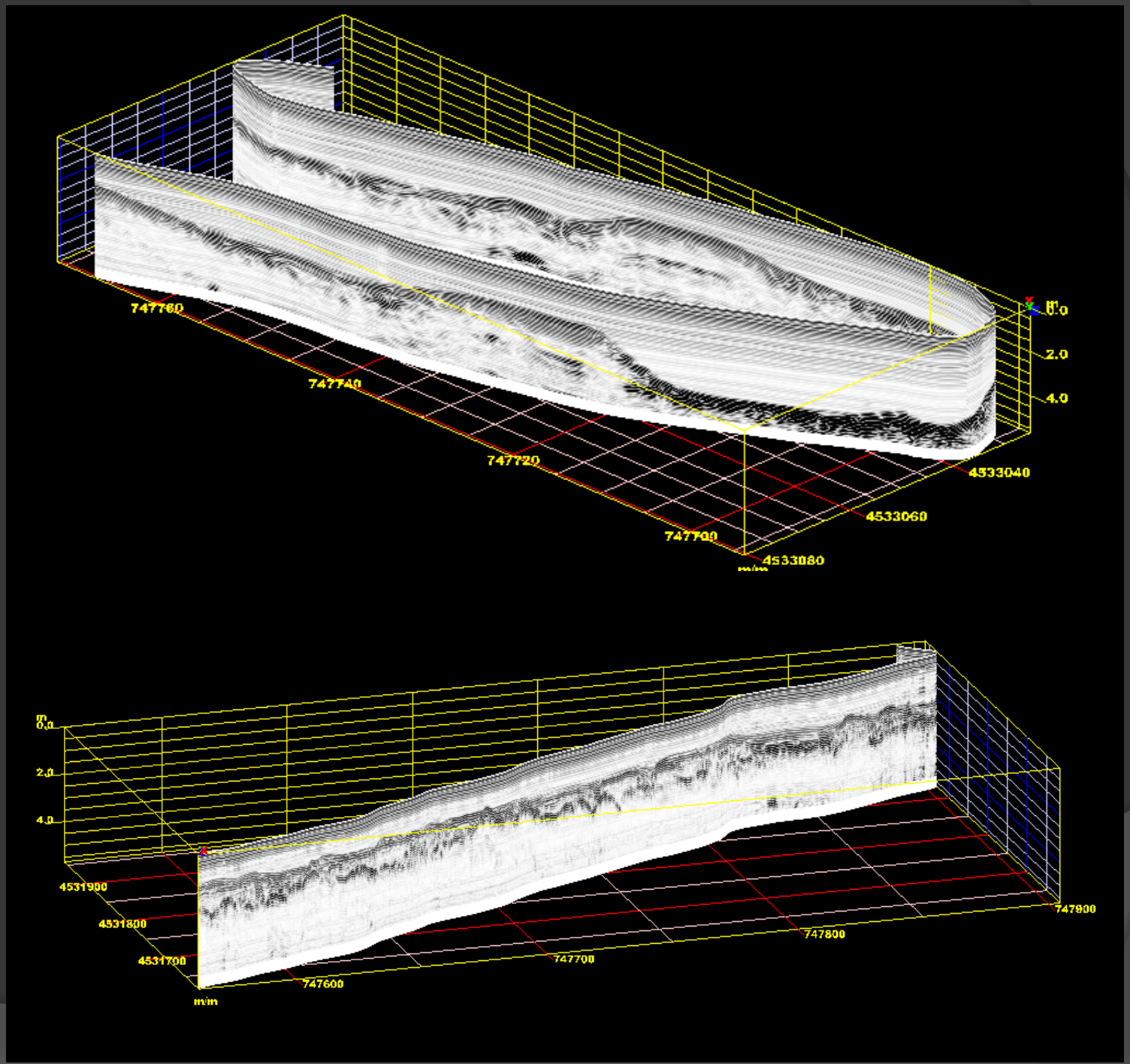
LcD
AoB
AnB
W
AoC
CA
UmB
Pk
CdB
ArB


747760
747740
747720
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0.0
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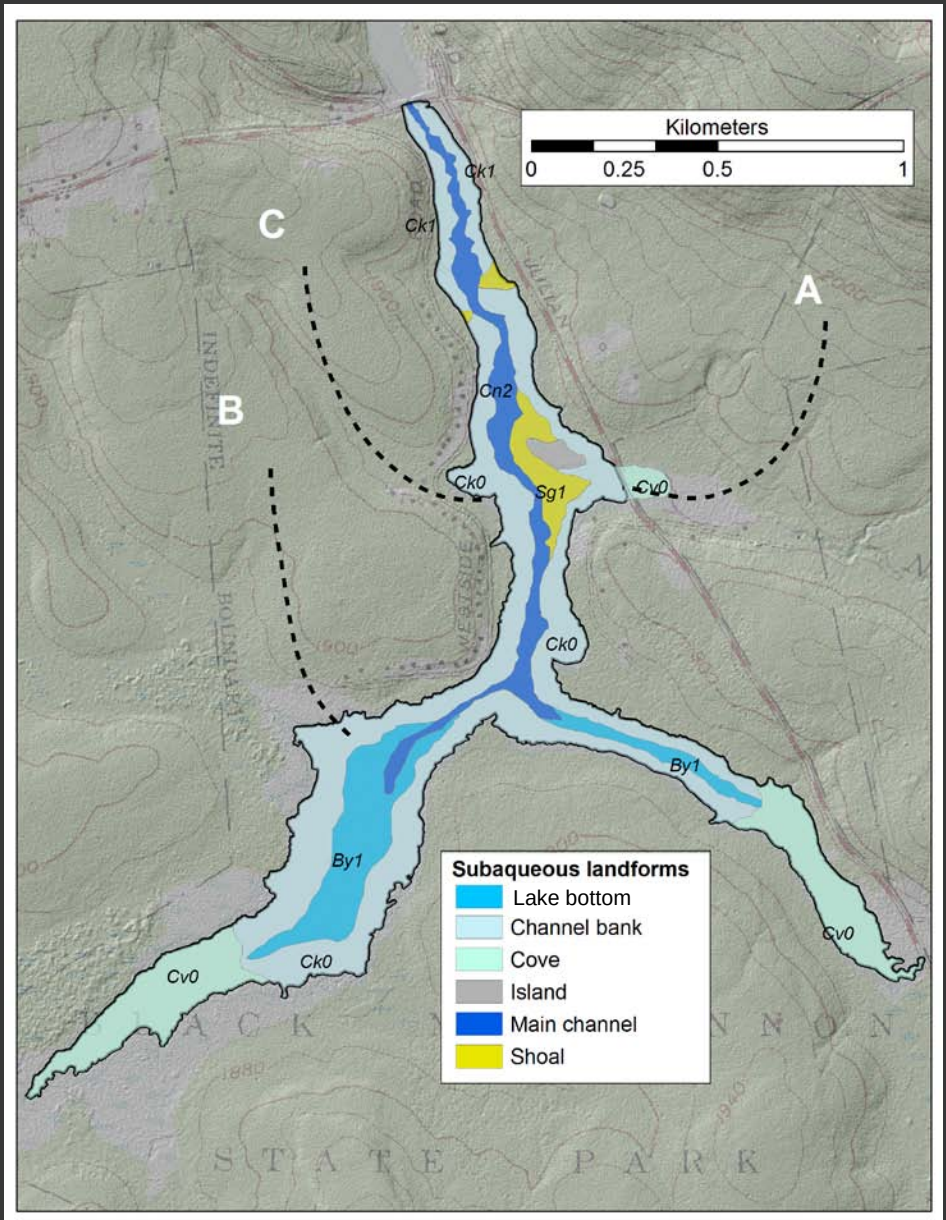
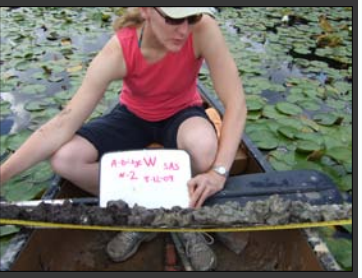
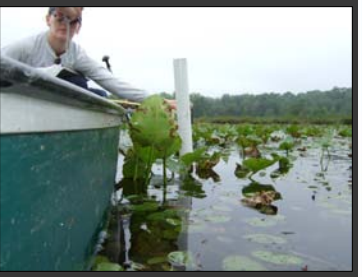
m/m

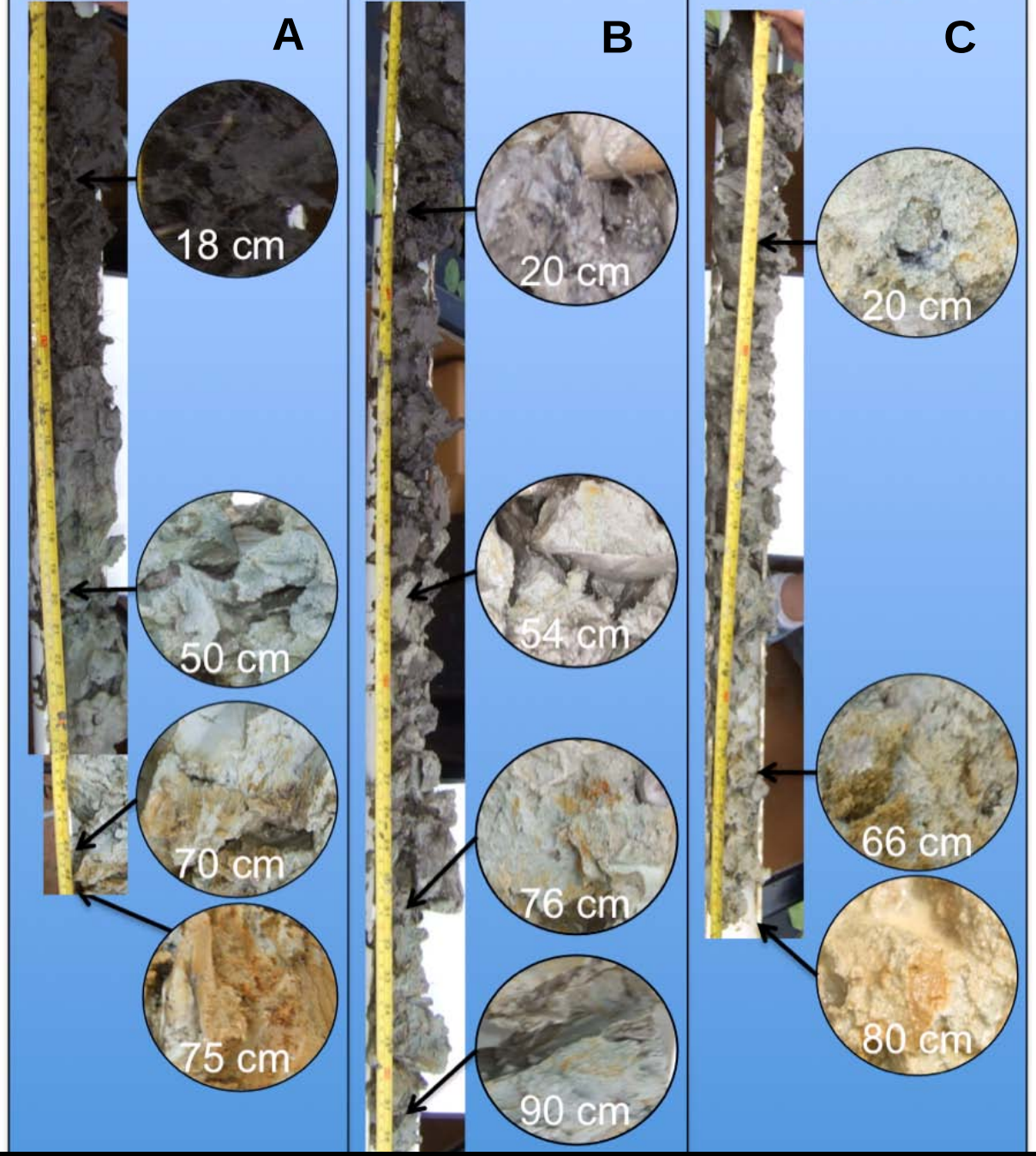


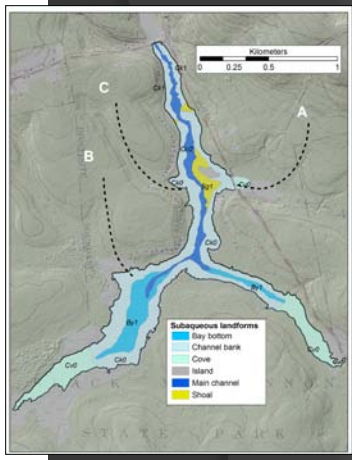
Landform	Landscape Unit	Landscape Unit Description	Soil Subgroup Classification
Main channel	Cn2	Deep water, elongate, steeply sloping units that occur in channels generally central to a bay that have been carved out by water movement (Oakley and Boothroyd, 2006). Water depth 2-3 m.	NA
Channel bank	Ck0	Sloping region of channel abutting shoreline or other landform. Water depth 0-1 m.	Fragic Hydrowassult -Typic Hydrowassult complex
	Ck1	Sloping region of channel abutting shoreline or other landform. Water depth 1-2 m.	Fragic Hydrowassult -Typic Hydrowassult complex
Lake bottom	By1	Nearly level or slightly undulating central portion of a submerged, low-energy, depositional embayment characterized by relatively deep water (Stolt, 2005). Water depth 1-2 m.	Fragic Hydrowassult
Cove	Cv0	Small, shallow to moderately deep shletered bays of recesses (Payne, 2007). Water depth 0-1 m.	Fragic Hydrowassult -Histic Hydrowassult complex
Shoal	Sg1	Moderately shallow gently sloping ridge or bar in central bay or cove, rising above the bottom (Payne, 2007). Water depth 1-2 m.	Histic Hydrowassult

Clay and bucket auger



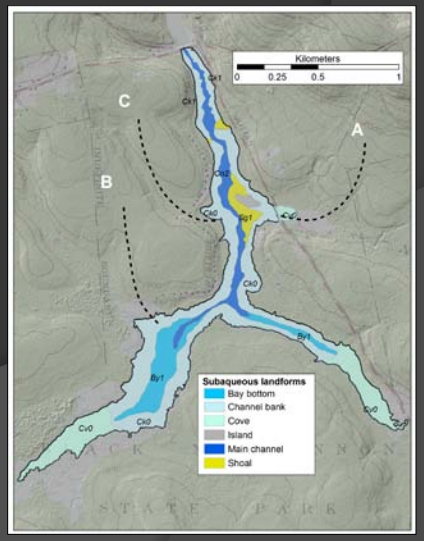




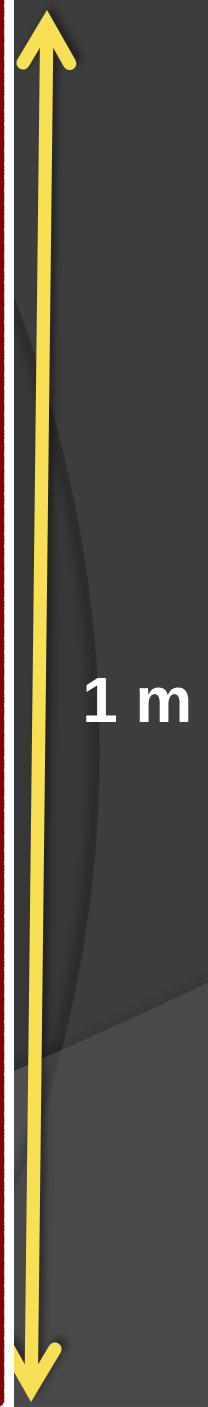


Histic Hydrowassult Typic Hydrowassult Fragic Hydrowassult

Vibracores



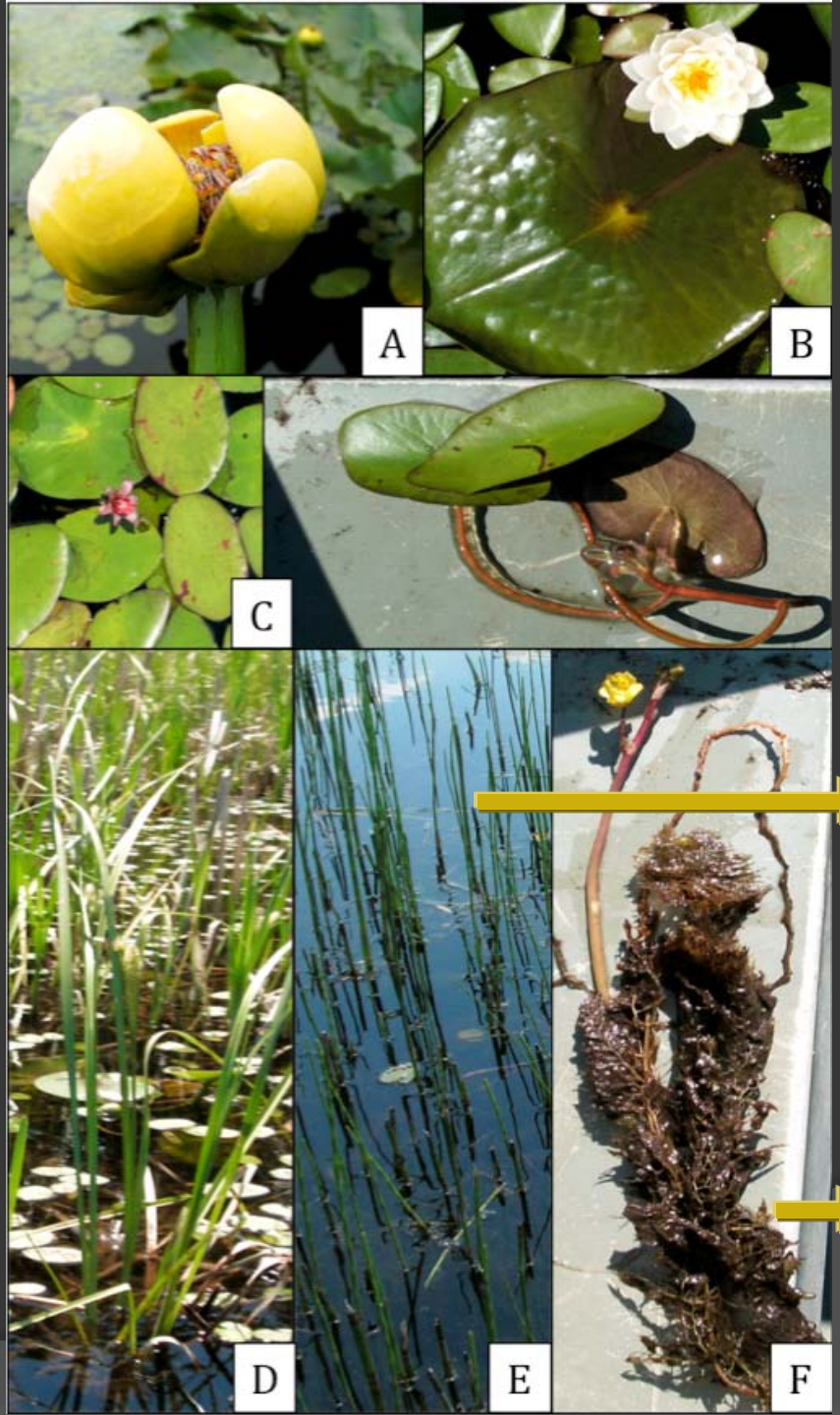
Histic Hydrowassult Typic Hydrowassult Fragic Hydrowassult


1 m

Yellow pond lily

Watershield

Threeway sedge

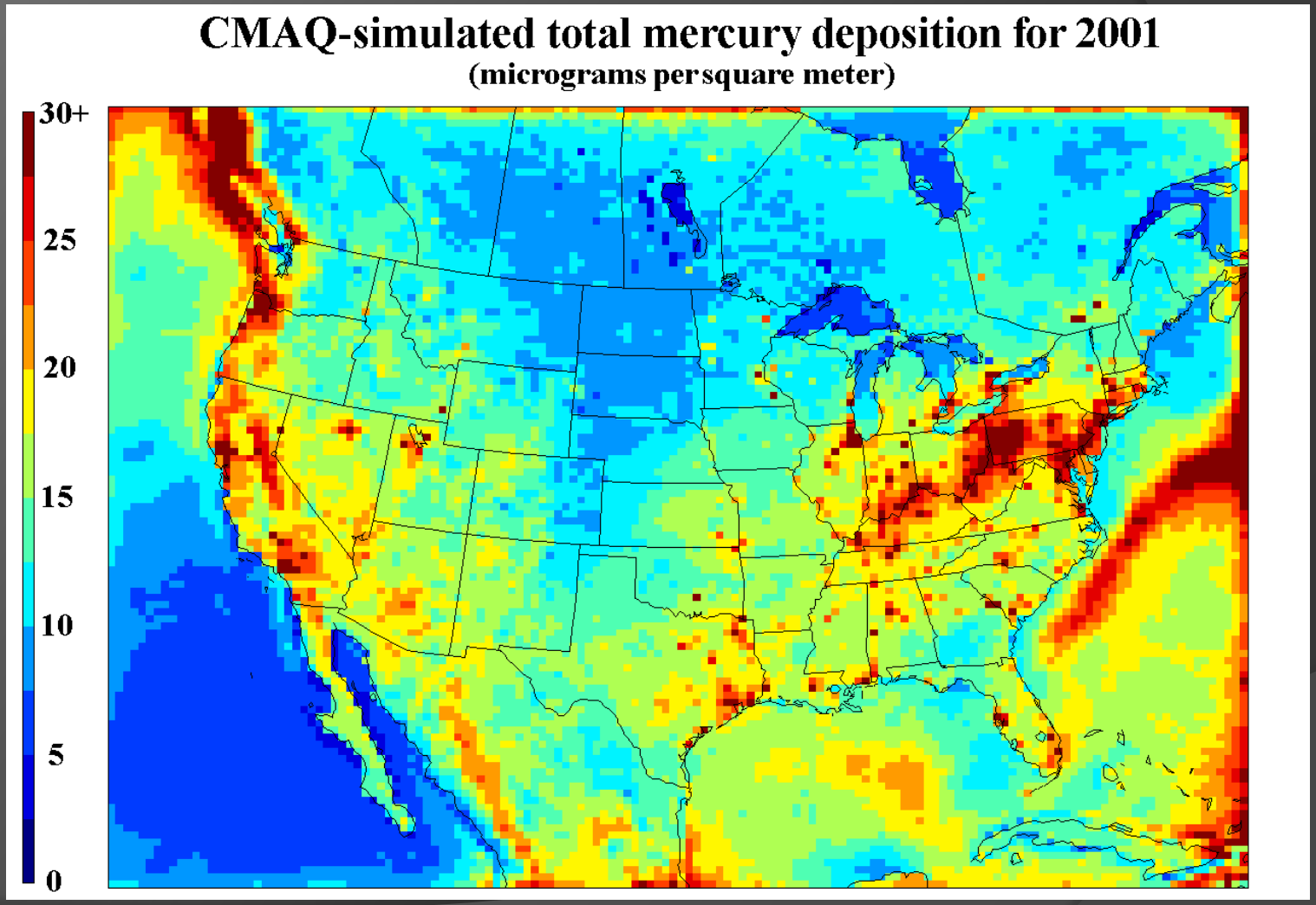


American white water lily

Needle spikerush

Creeping or humped bladderwort

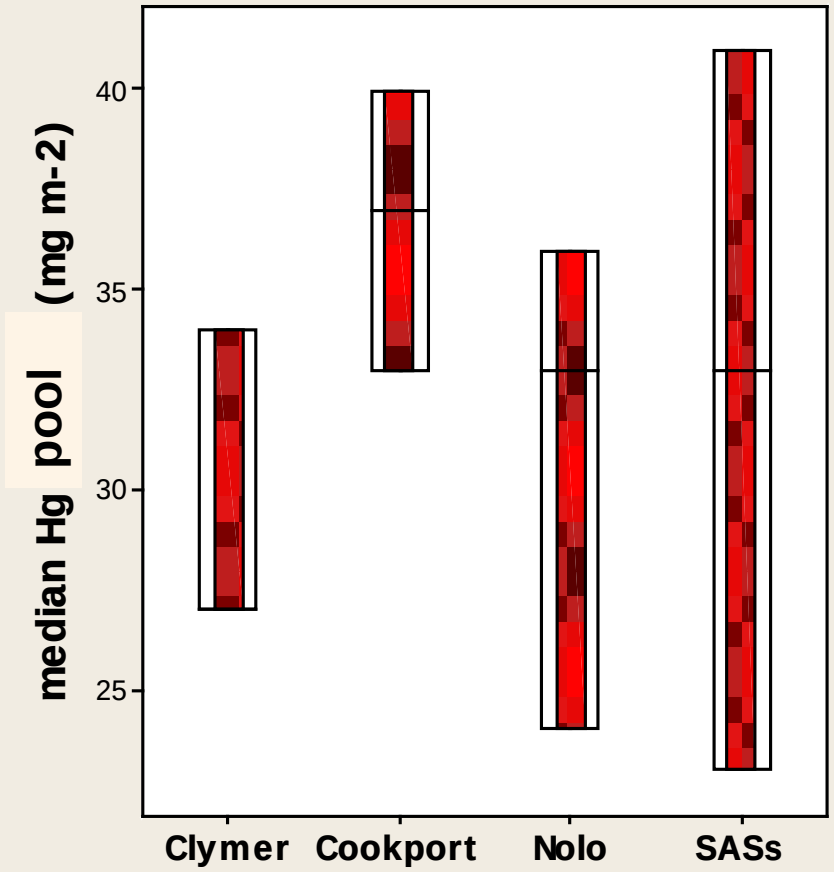
Modeled total (wet+dry) total Hg deposition in 2001.



Multiple Comparisons Chart

Boxplots with Sign Confidence Intervals

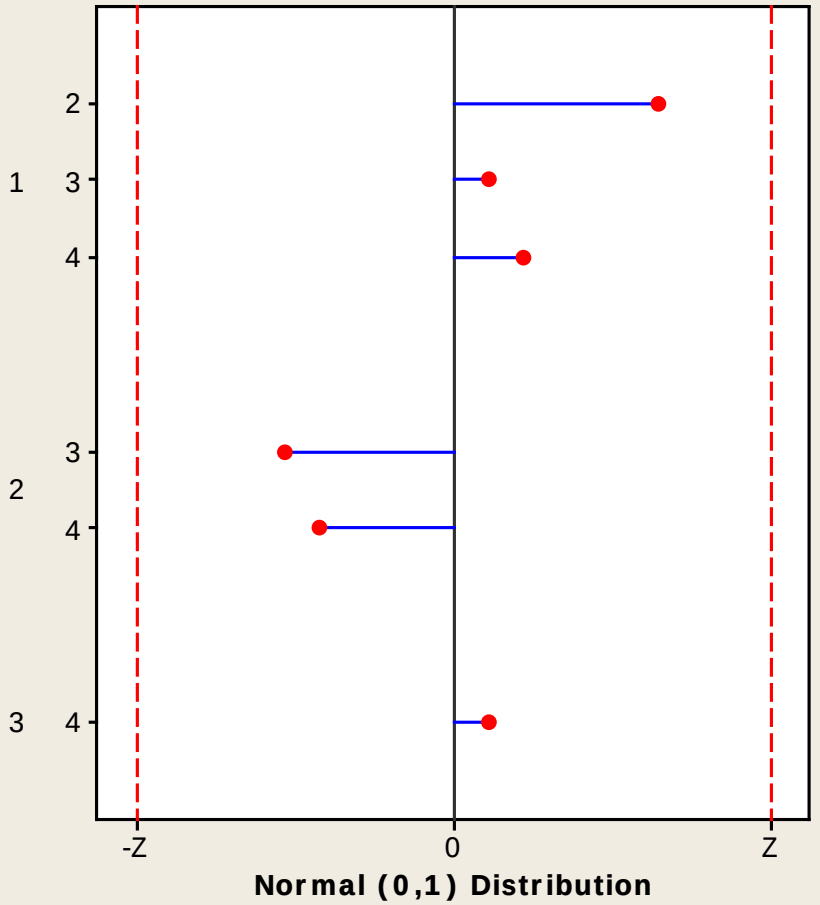
Desired Confidence: 86.761



Family Alpha: 0.2
Bonferroni Individual Alpha: 0.033

Pairwise Comparisons

Comparisons: 6

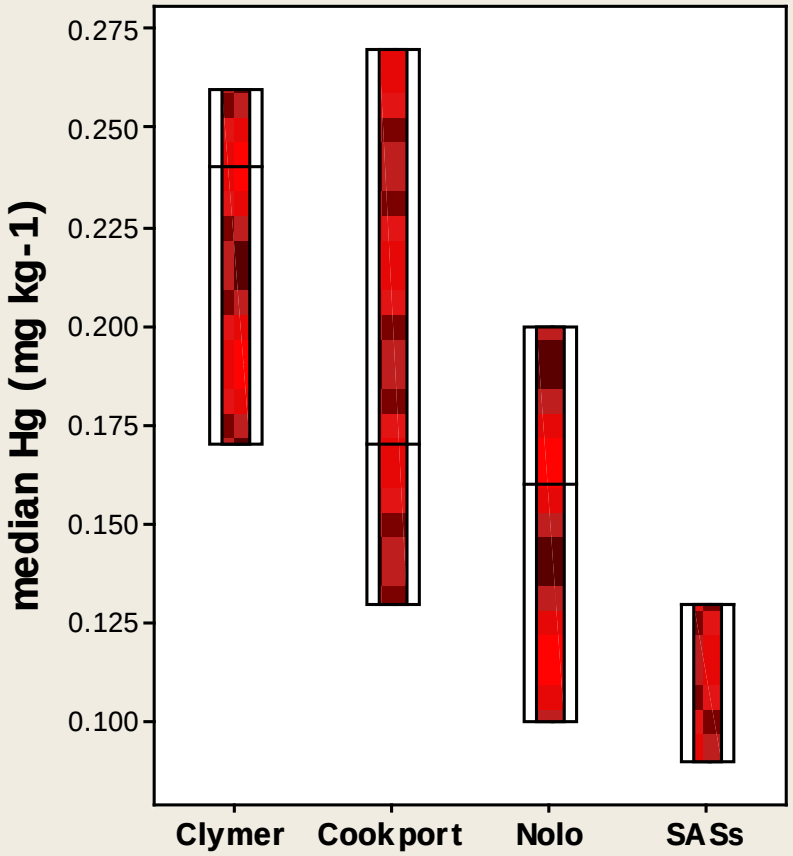


|Bonferroni Z-value|: 2.128

Multiple Comparisons Chart

Boxplots with Sign Confidence Intervals

Desired Confidence: 86.761



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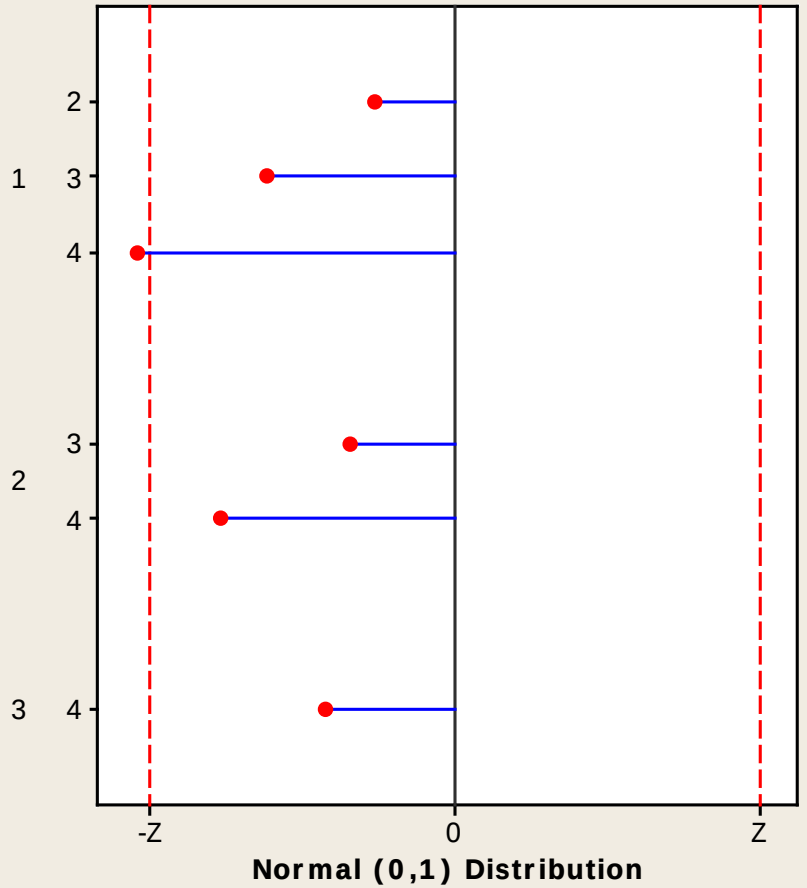
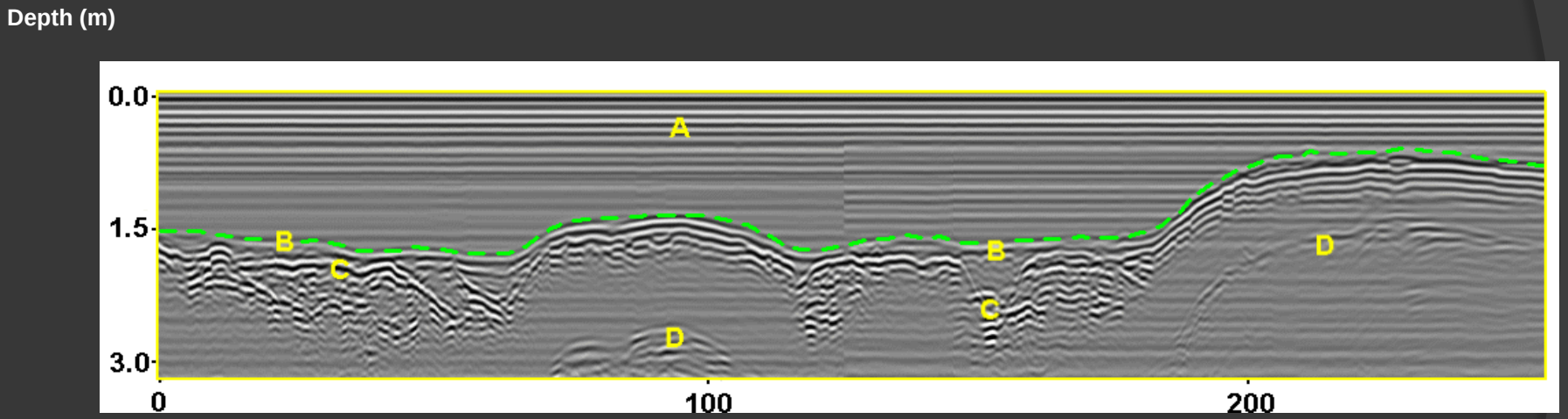
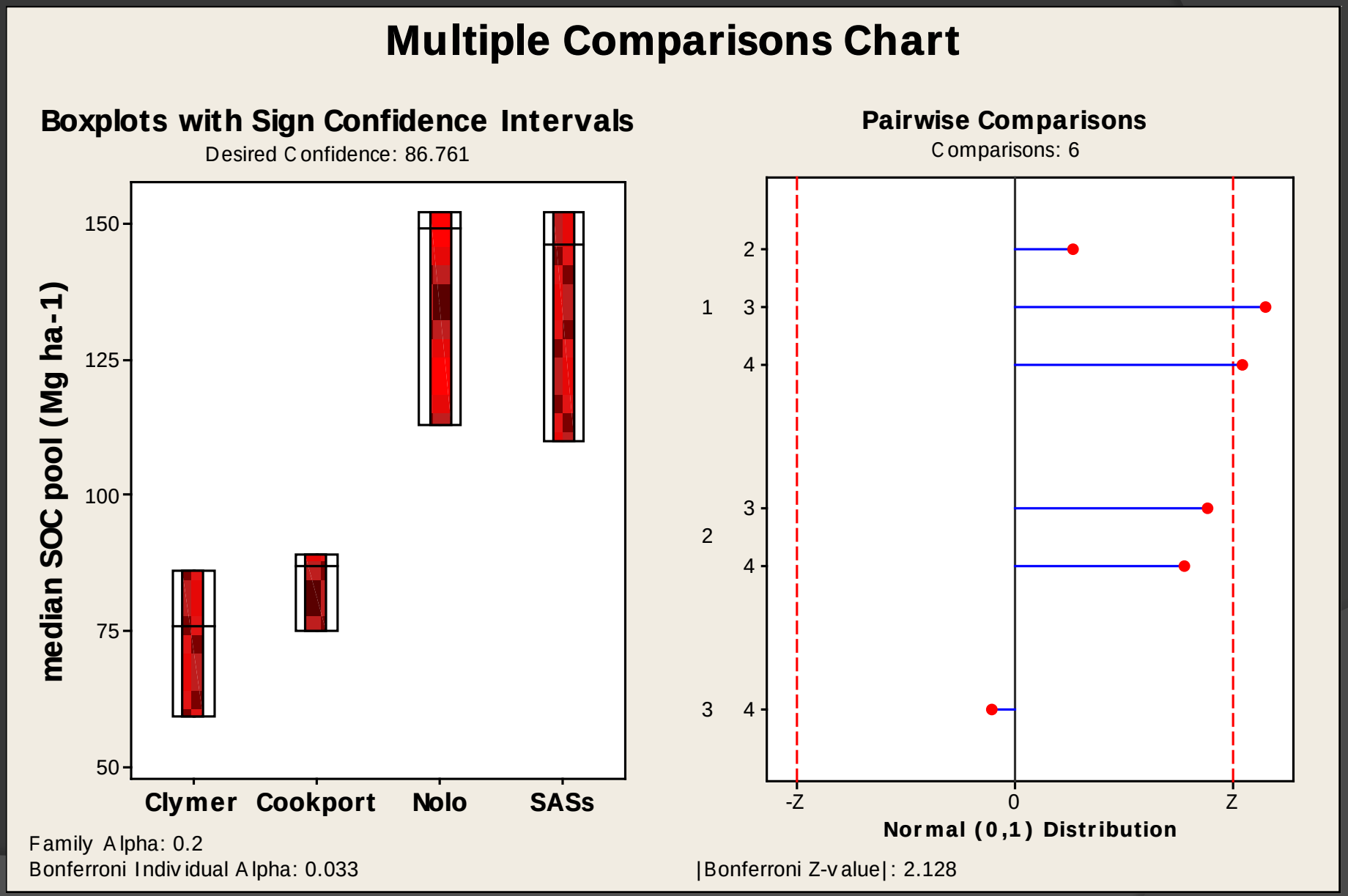


|Bonferroni Z-value|: 2.128

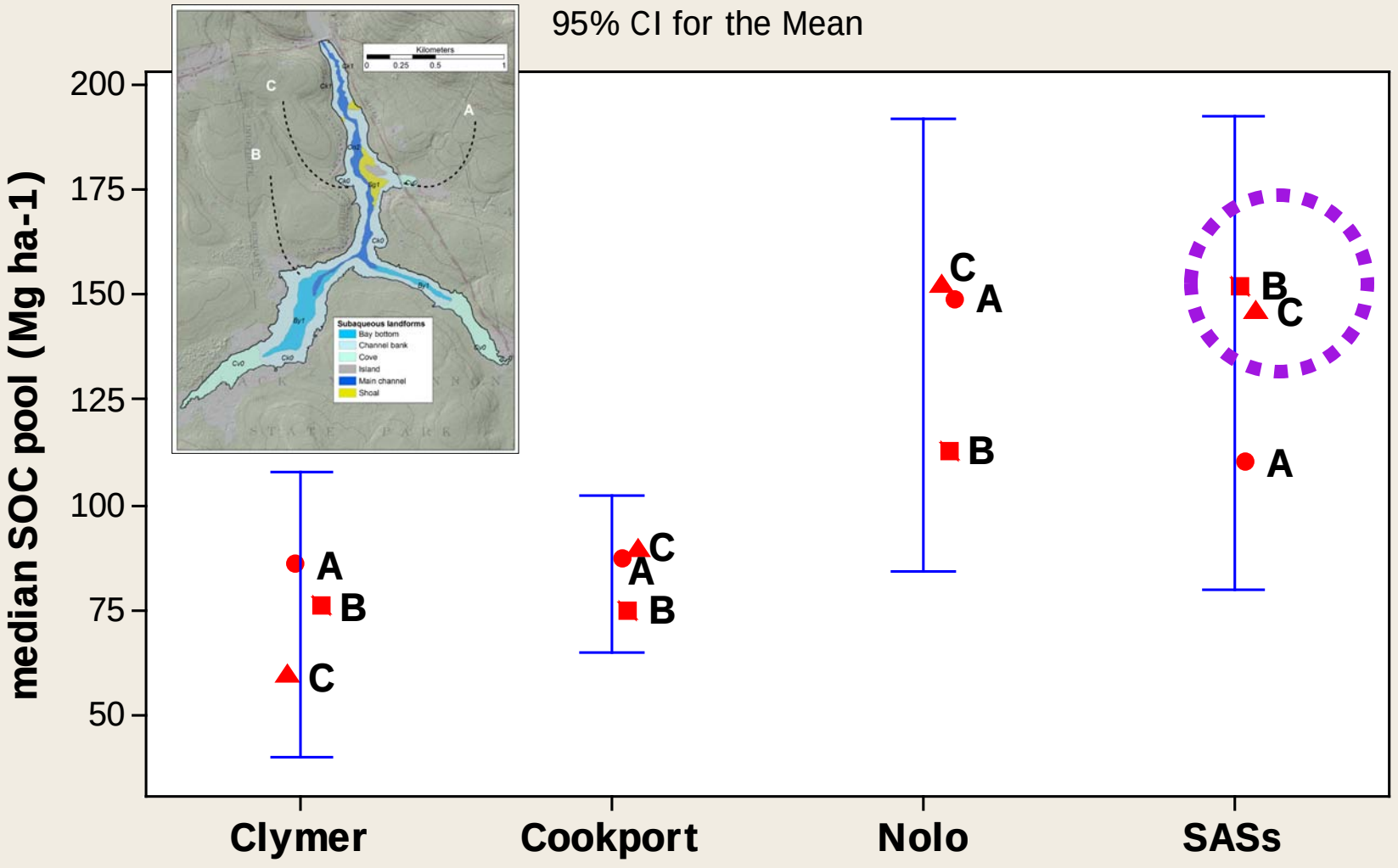
C sequestration since flooding



Soil carbon pools



Pre-flood imprinting on carbon



Interpretations

- Emergent aquatic vegetation,
- Moorings,
- Fish, bog turtle, goshawk habitat,
- Heavy metal accumulation.

In-Lake BMP's, PALMS

Practice	Objectives
Aeration (artificial circulation and hypolimnetic aeration)	Increase dissolved oxygen concentrations in order to improve water quality for aquatic life including fish. Possibly reduce nutrient releases from in-lake sediments, decease phytoplankton levels and improve water clarity.
Liming	Increase pH and alkalinity. Improve water quality for aquatic life including fish.
Alum Treatment (nutrient precipitation and inactivation)	Improve water clarity. Physically settle out phytoplankton. Precipitation of in-lake phosphorus. Reduce nutrient releases from lake sediments.
Chemical Algal Control BMPs	Improve water clarity by killing or inhibiting the growth and reproduction of algae.
Macrophyte Control BMPs	Improve lake uses by reducing nuisance stands of aquatic vegetation.
Shoreline Stabilization	Reduce sediment and nutrient inputs to lakes. Improve aesthetics and public safety.
Dredging	Remove nutrient-laden sediments. Reduce internal release of nutrients from in-lake sediments. Remove aquatic macrophytes along with their seeds and roots. May improve dissolved oxygen levels in the lake.
Fishery Management	Improve overall quality of recreational fisheries.
Nuisance Wildlife Control	Improve shoreline aesthetics. Improve water quality for contact recreational activities. Remove source of nutrient loading.
Boat Operation & Maintenance	Reduce lake user conflicts. Reduce water pollution.
Aquatic Invasive Species Management	Reduce or eliminate exotic and invasive species that compete against more desirable species.

Aquatic Invasive Species of Pennsylvania

For more information and teacher resources, please visit www.behrend.psu.edu/seagrant/ais

The Aquatic Nuisance Species on this poster represent current or future threats to the watersheds of Pennsylvania.

Photos courtesy of Michigan Sea Grant. Additional courtesies: Flathead catfish, ©Shedd[illegible]heries Commission; Nutria, courtesy of Rob Curtis; Phragmites, courtesy of Larry Allain @USDA-NRCS PLAN[illegible]

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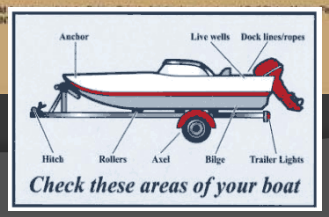
CLEAN YOUR GEAR
Check
Drain
Clean
Dry



Invasive spp. control via herbicides

Summary of Commonly Used Aquatic Herbicides In PA
(Prepared by PA Fish and Boat Commission)

Submerged Aquatic Plants

Aquatic Herbicide	Active Ingredient	Aquatic Species Controlled	Application Rate
Aquathol-K	Endothall	pondweed, naid,milfoil, coontail	0.6 to 1.9 gal/acre ft
Reward or Diquat	Diquat (35.3%)	pondweed, naid,milfoil, coontail	1 to 2 gal/acre
Weedtrine-D	Diquat (8.53%)	bladderwort, coontail, elodea, naiad, pondweed, milfoil	5-10 gal/acre
Hydrothol 191	Endothall (53%)	naiad,elodea,coontail,pondweed,milfoil	0.7 to 3.4 gal/acre ft
Sonar SRP	Fluridone (5%)	bladderwort,coontail, elodea, naiad, pondweed, milfoil	0.54 to 1.08 lbs/ acre
Komeen	Copper (8%)	milfoil, elodea, pondweed, coontail (NOT an Algaecide)	1.7 to 3.3 gal/acre ft

Emergent and Floating Plants

Aquatic Herbicide	Active Ingredient	Aquatic Species Controlled	Application Rate
Rodeo	Glyphosphate (53.8%)	cattail, water lily, arrowhead, spatterdock, watershield, purple loosestrife, common reed (Phragmites)	0.75 gal/acre
Sonar A.S.	fluridone (41.7%)	duckweed, watermeal, spatterdock, water lily also coontail, elodea, pondweed, milfoil	< 5 feet 0.16 to 1.25 qt/ acre ft > 5 feet 1.0 to 1.5 qt/ acre ft
Aqua-Kleen Aquacide Navigate	2,4-D (20%-27.6%)	water lily, spatterdock, watershield also milfoil, bladderwort	150 to 200 lbs/acre 100 to 150 lbs/acre

Adapted from PALMS, Table 1.6-3

Invasive spp. control via drawdown

Permitted activity in Pennsylvania, PAF&B

Drawdown Effect	Plant Species	Common Name
Decrease	*Cabomba caroliniana*	Fanwort
	Ceratophyllum demersum	Coontail
	Myriophyllum spp.	Milfoil - most species
	Potamogeton robbinsii	Robbin's pondweed
	Nuphar spp.	Yellow waterlily - most species
	Utricularia spp.	Bladderwort
No change or variable	*Chara spp.*	Muskgrass - most species
	Elodea Canadensis	Elodea
	Typha latifolia	Broad-leaf Cattail
	Valisneria americana	Tapegrass
Increase	*Potamogeton spp.*	Pondweed - most species
	Najas flexilis	Bushy pondweed

PALMS, NYSDEC 1990

Invasive spp. control via harvesting

Current work

1. Expansion of lake sampling (state agencies)
2. Quantifying pedogenesis in created wetlands
3. PA Sea Grant collaboration

http://www.youtube.com/watch?v=pQ8nyZW9TSk

Questions?