Conservation Status of Hudson River Intertidal Plant Species

Hudson River Foundation
2 December 2014

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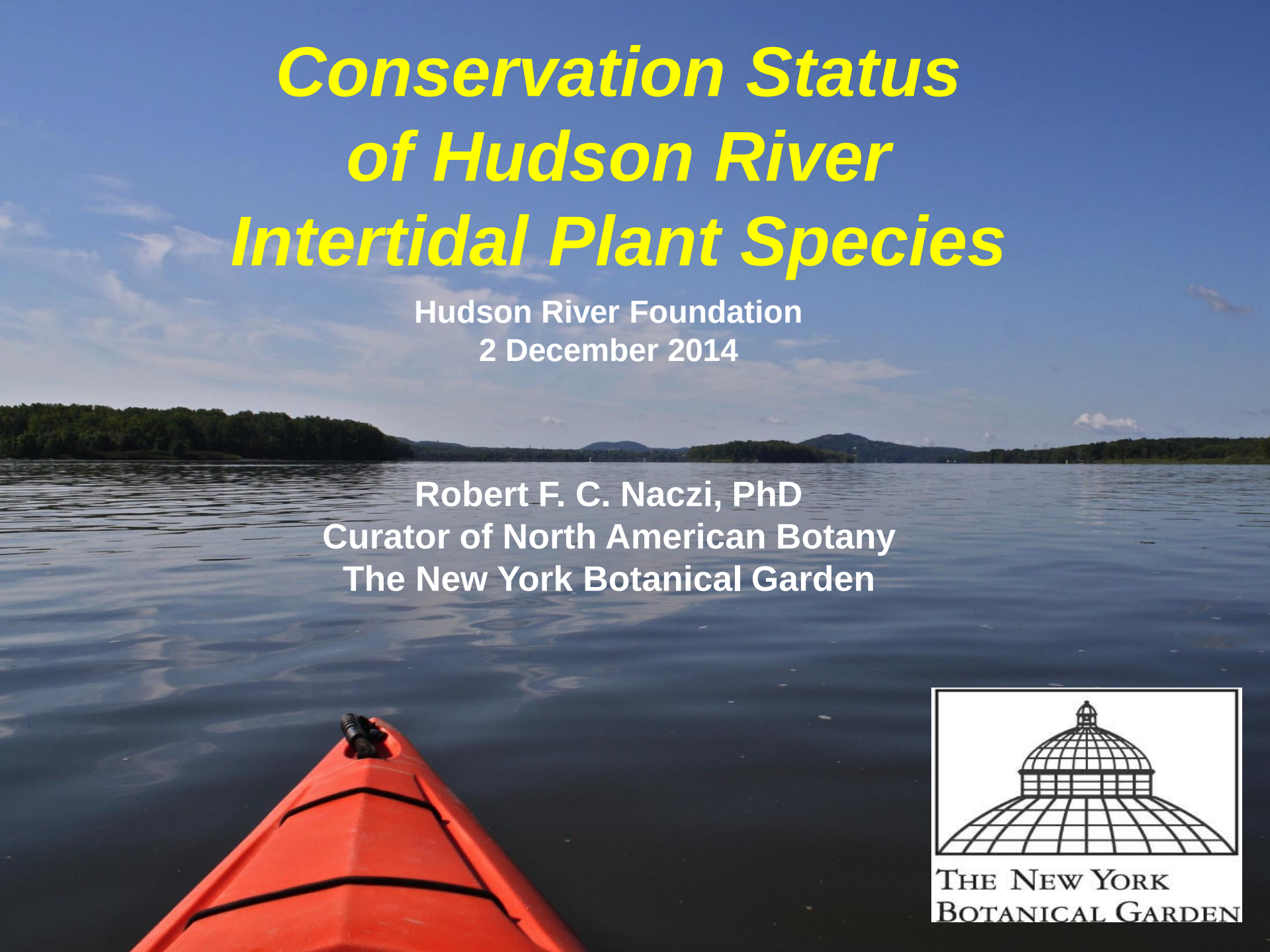
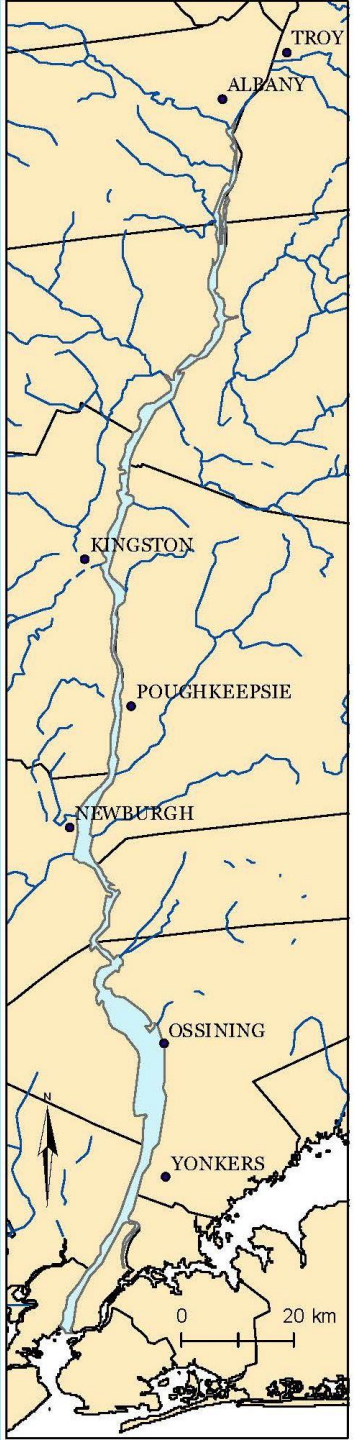


Foot of Storm King Mountain
Thomas Pope, 1880s
New York State Museum


What are
Intertidal Plants?

Estuary Arrowhead
Sagittaria subulata
(Alismataceae)



Hudson River Estuary

- Battery Park (Manhattan) north to Federal Dam at Troy (just north of Albany)
- 153 miles long
  (by comparison, the Delaware Estuary is 130 mi, Potomac is 110 mi, and Connecticut is 60 mi)
- tidal amplitude usually 3--4 feet
- tributaries tidal for only a short distance, if at all

Why Study Intertidal Plants?

- Intertidal plants are poorly known, even among botanists.

Intertidal plants are poorly known, even among botanists.

Informal survey of professional botanists who spend a substantial amount of time in the field in the Mid-Atlantic

"Have you ever seen *Lilaeopsis chinensis* in the field?"

n = 31

Only 32% responded with "Yes."

Most had never heard of the species.

Eastern Grasswort (*Lilaeopsis chinensis*, Apiaceae)

Why Study Intertidal Plants?

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- What we do know reveals at least several species are restricted to the intertidal habitat.

Estuary Bidens

(*Bidens bidentoides*, Asteraceae)

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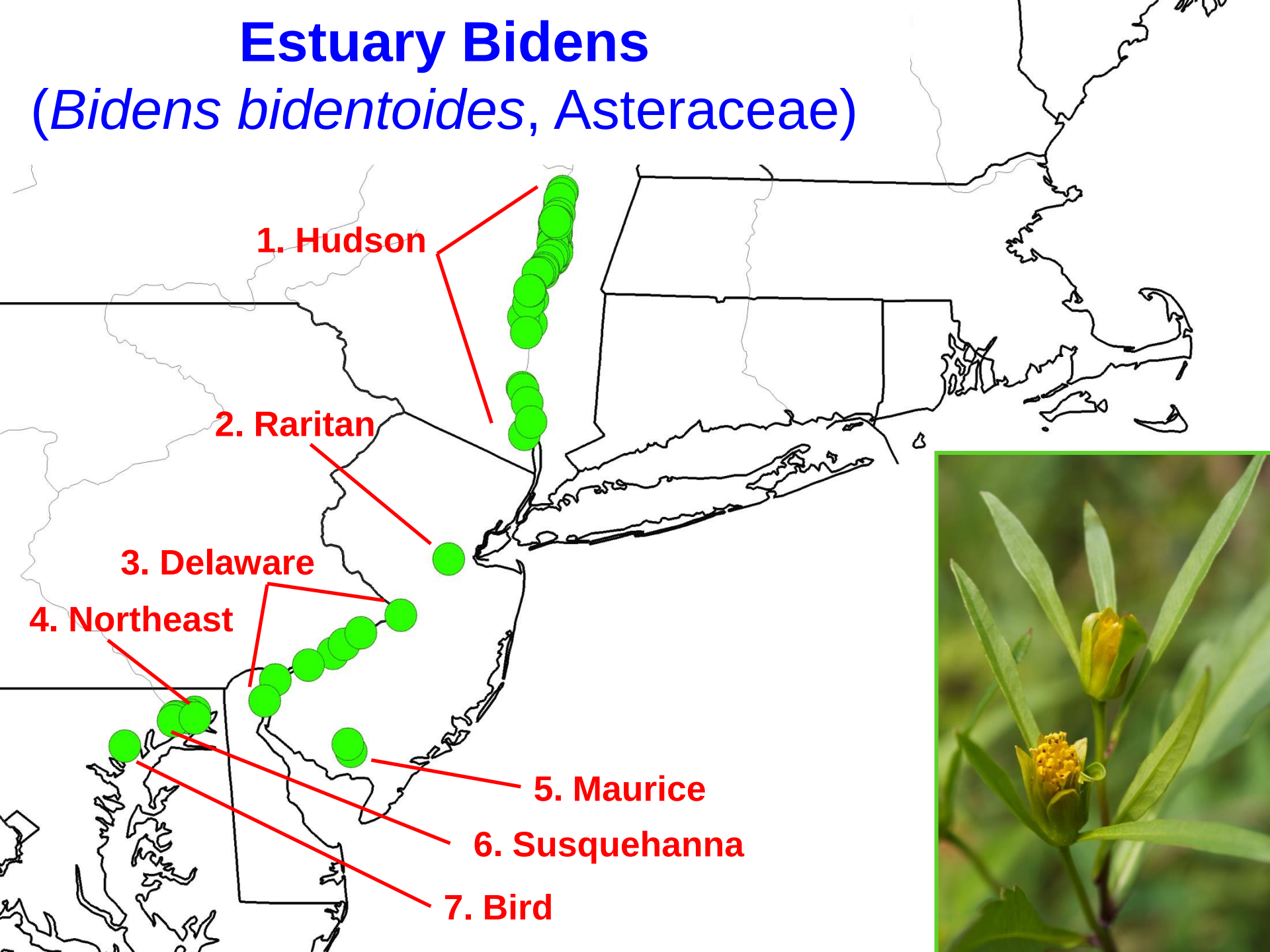

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- The intertidal habitat is quite rare.

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- The intertidal habitat is quite rare.
- The intertidal habitat is extreme.

Intertidal Plants Inhabit Extreme Environments

- high tides inundate plants and low tides expose plants, twice each day
- salinity often fluctuates widely
- turbidity fluctuates widely
- sediment accumulates rapidly
- waves often are strong
- substrate is dynamic

Extreme Environments often Select for Extreme Adaptations

Estuary Arrowhead
(*Sagittaria subulata*, Alismataceae)

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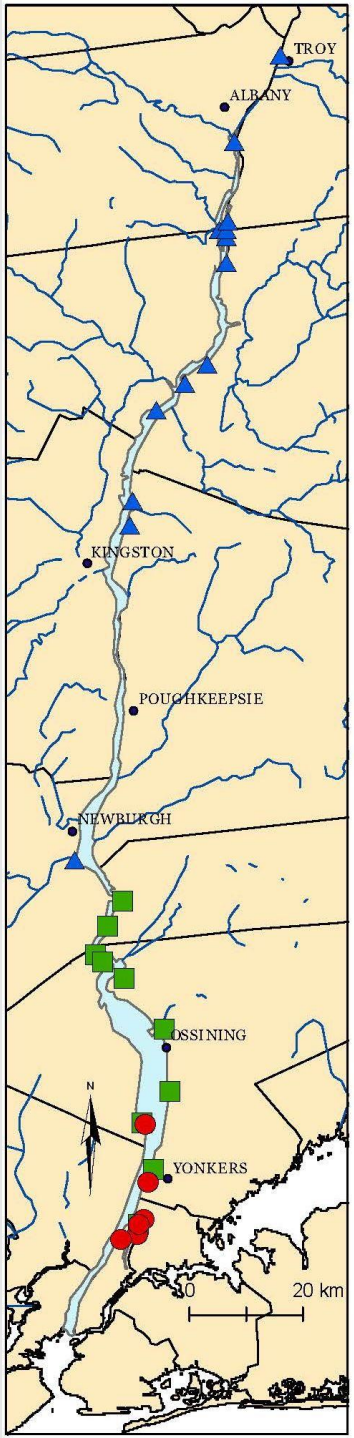
- The intertidal habitat is quite rare.
- The intertidal habitat is extreme.
- Intertidal habitats face multiple threats.



Salinity Matters!

Bolboschoenus robustus

Bolboschoenus novae-angliae

Bolboschoenus fluviatilis

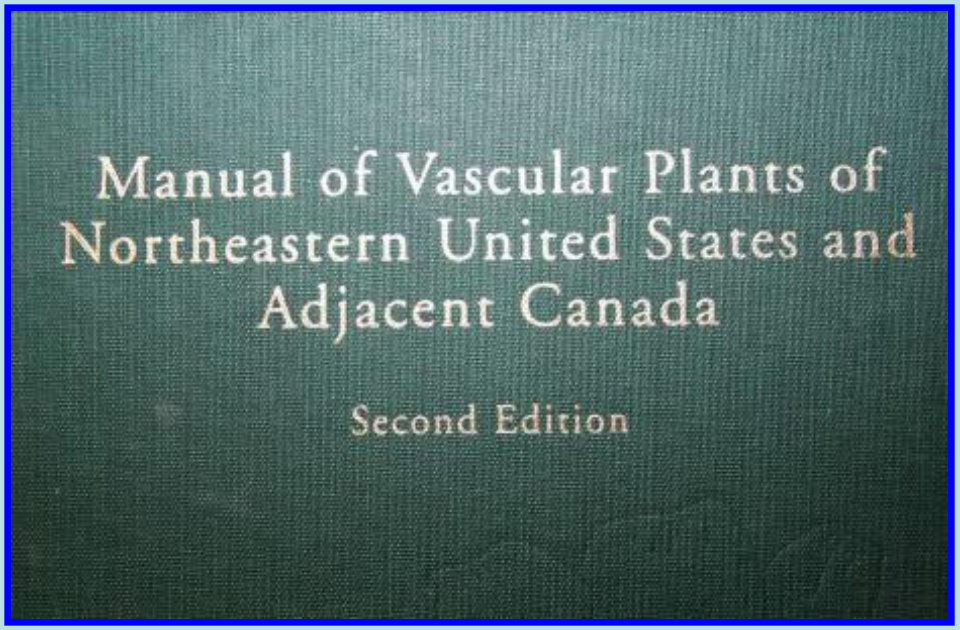
Identification Challenges

Problems detected in 8 species of Hudson River intertidal plants.

Species	Problem
1. *Bidens eatonii* (Asteraceae)	misidentifications
2. *Bidens hyperborea* (Asteraceae)	misidentifications
3. *Cardamine longii* (Brassicaceae)	misidentifications
4. *Crassula aquatica* (Crassulaceae)	taxonomic complexity
5. *Eleocharis olivacea* (Cyperaceae)	misidentifications, taxonomic complexity
6. *Isoetes riparia* (Isoetaceae)	taxonomic complexity
7. *Najas muenscheri* (Hydrocharitaceae)	taxonomic complexity
8. *Sagittaria montevidensis* ssp. *spongiosa* (Alismataceae)	taxonomic complexity

In Preparation: A New Identification Manual for the Northeast

Current Manual: *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*, 2nd edition, by Gleason & Cronquist (NYBG Press, 1991)

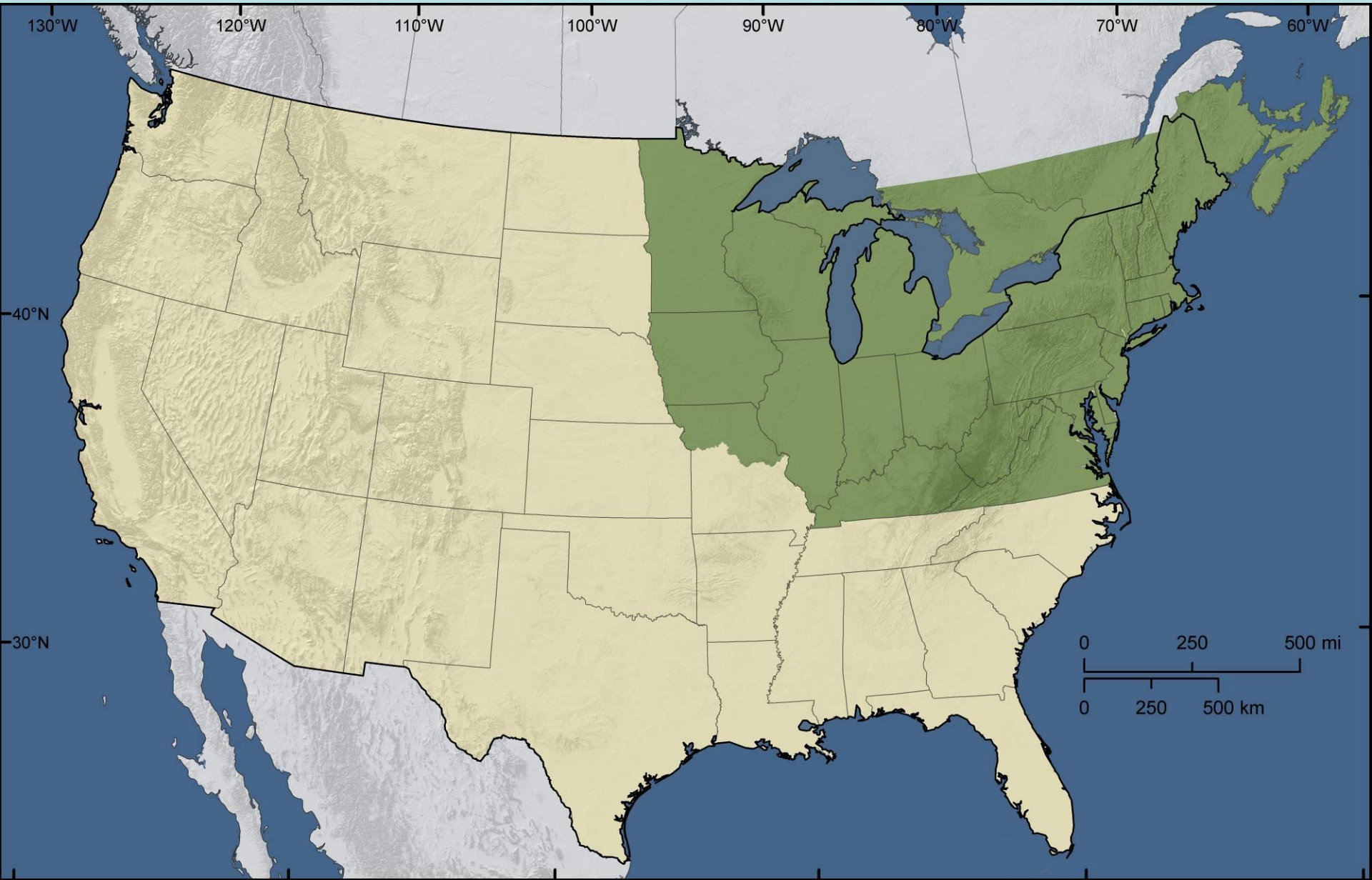


Henry A. Gleason

Arthur Cronquist

Extensive Geographic Coverage

(860,500 mi^2, 22 states, 5 provinces)



One example of taxonomic complexity in intertidal plants: *Najas muenscheri* (Hydrocharitaceae)

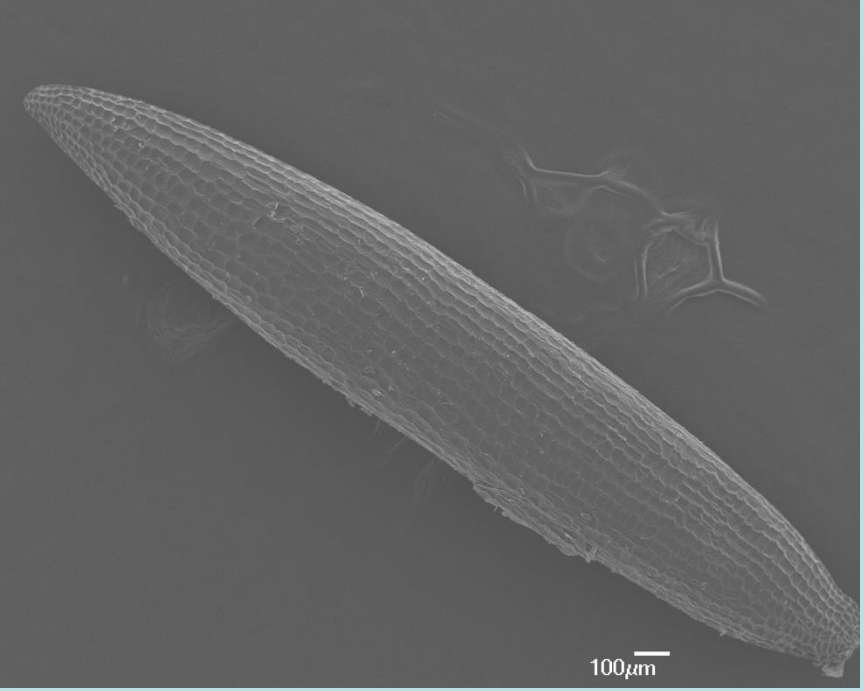
1. NAJAS L. Water-nymph. Characters of the family; vegetatively plastic mop. Counts of lf-teeth in the descriptions do not include those of the sheath.

1 Dioecious; lower side of the midvein of the lvs (and often also the internodes) prickly .....
1 Monoecious; lf-surface and internodes smooth.
2 Lf-teeth multicellular, evident at 10×, 7–15 per side; lvs becoming recurved in late season; seed-coat pitted, the areolae in ca 12–18 ladder-like rows, distinctly wider than long .....
2 Lf-teeth unicellular, minute, 20 or more per side (except in no. 5); lvs spreading or ascending; seed-coat smooth or pitted with areolae in ca 20 or more rows, the areolae about as long as or longer than wide.
3 Seeds pitted, dull, fusiform or nearly cylindric; anthers 1- or 4-locular.
4 Style apical.
5 Anthers 4-locular; seeds mostly 1.2–2.5 mm, with areolae in 20–45 rows; widespread ... 3. *N. g*
5 Anthers unilocular; seeds mostly 3.3–3.8 mm, with areolae in 50–60 rows; Hudson R. .... 4. *N*
4 Style offset from the apex of the fr and seed; anthers unilocuar ..... 5.
3 Seeds smooth, glossy, broadest above the middle; anthers unilocular .....

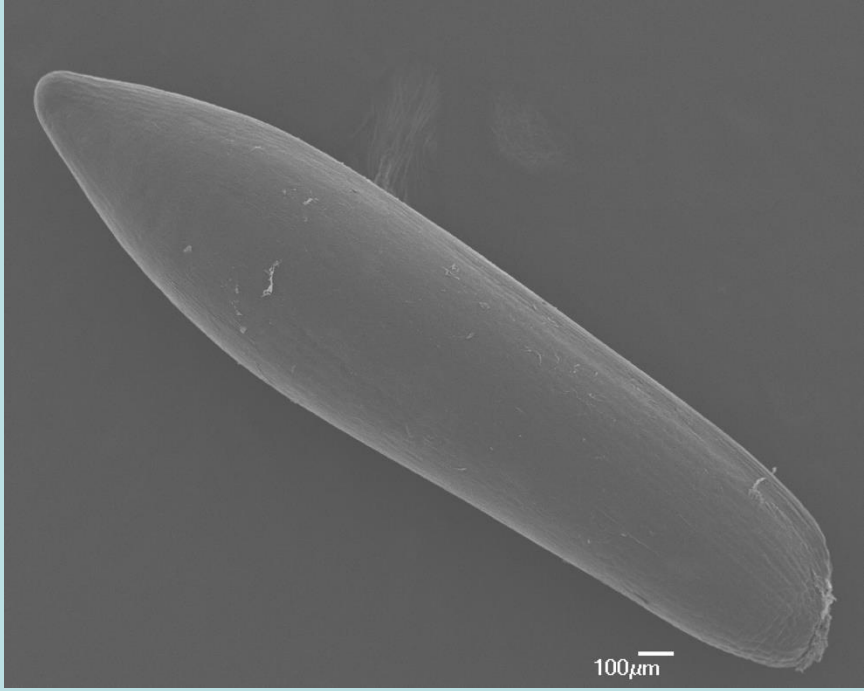
1. Najas marina L. Alkaline w.-n. Dioecious; stems 0.5–4.5 dm, 0.5–4 mm thick, often pric

4. Najas muenscheri R. T. Clausen. Hudson R. w.-n. Monoecious; stems 3–9 dm, ca 1 mm thick; lvs 1–1.5 mm, spreading, minutely serrulate with 50–100 unicellular teeth per side; anthers monothecal and with a single microsporangium; seeds 3.3–3.8 mm, slender, fusiform-cylindric, with 50–60 rows of minute, rectangular areolae. Abundant on tidal mudflats along the Hudson R. (*N. guadelupensis* var. *m.*)

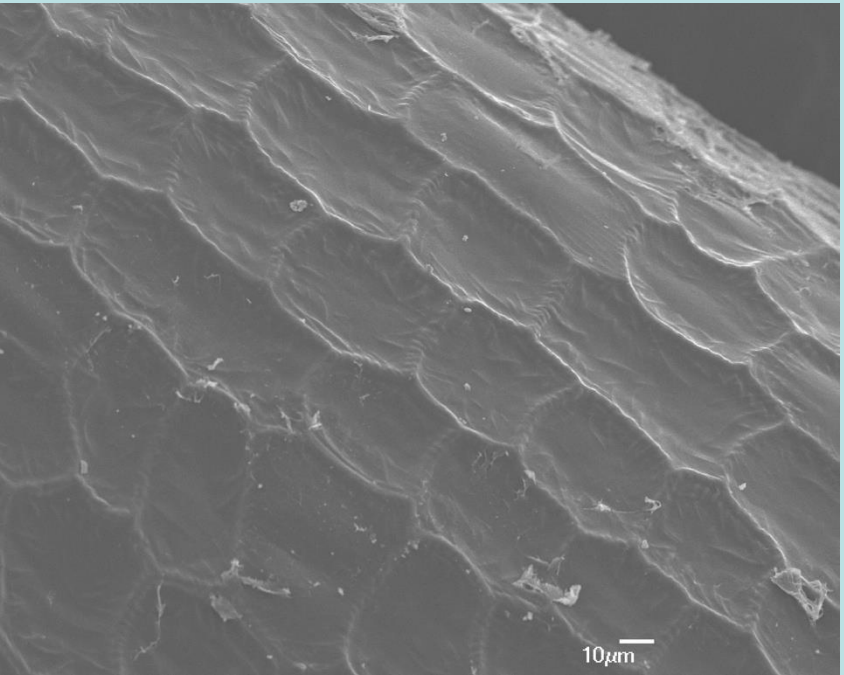
(Gleason & Cronquist 1991: 646)

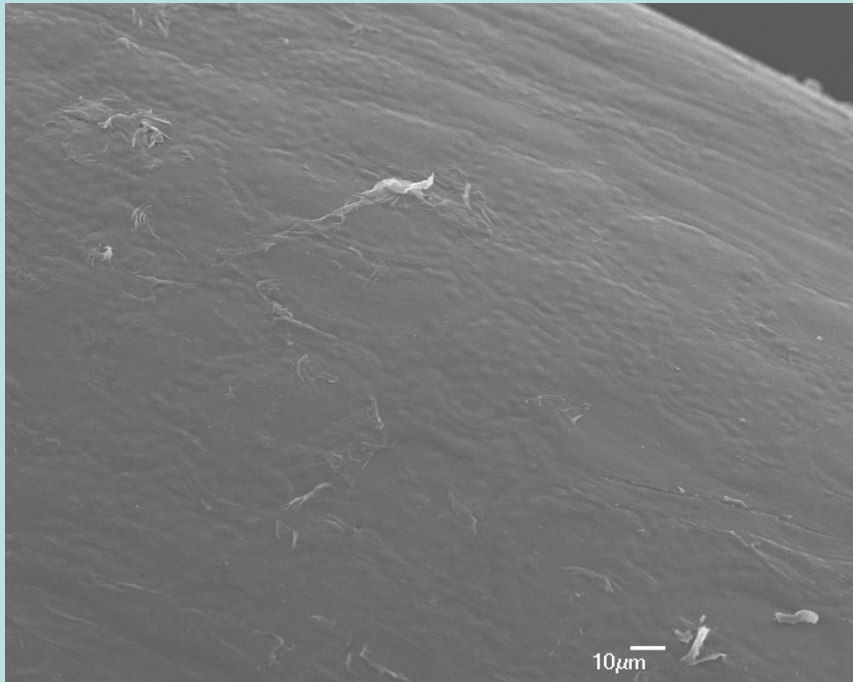


Najas muenscheri



Najas aff. *muenscheri*





Why Study Intertidal Plants?

Given their restrictiveness and the numerous environmental threats they face, intertidal plants are sensitive indicators of environmental health.

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Given their restrictiveness and the numerous environmental threats they face, intertidal plants are sensitive indicators of environmental health.

Intertidal plants should be conservation priorities.

Objective

Conduct conservation assessments of vascular plant species restricted or nearly restricted to intertidal habitats.

Spongy Arrowhead
(*Sagittaria montevidensis* ssp. *spongiosa*, Alismataceae)

Smith's Bulrush
(*Schoenoplectiella smithii*, Cyperaceae)

Methods

1. Documented the diversity of intertidal plants.

Pickerelweed
(*Pontederia cordata*)
Pontederiaceae

Cardinalflower
(*Lobelia cardinalis*)
Campanulaceae

Methods

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    - previous field experiences on other tidal rivers of the Mid-Atlantic (Bohemia, Delaware, Manokin, Manumuskin, Mullica, Nanticoke, Northeast, Sassafras, Susquehanna)
    - literature review

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Discovered 32 species are restricted or nearly restricted to intertidal zones in the Hudson Estuary.

Methods

2. Reviewed herbarium specimens to assemble baseline on historic occurrences.

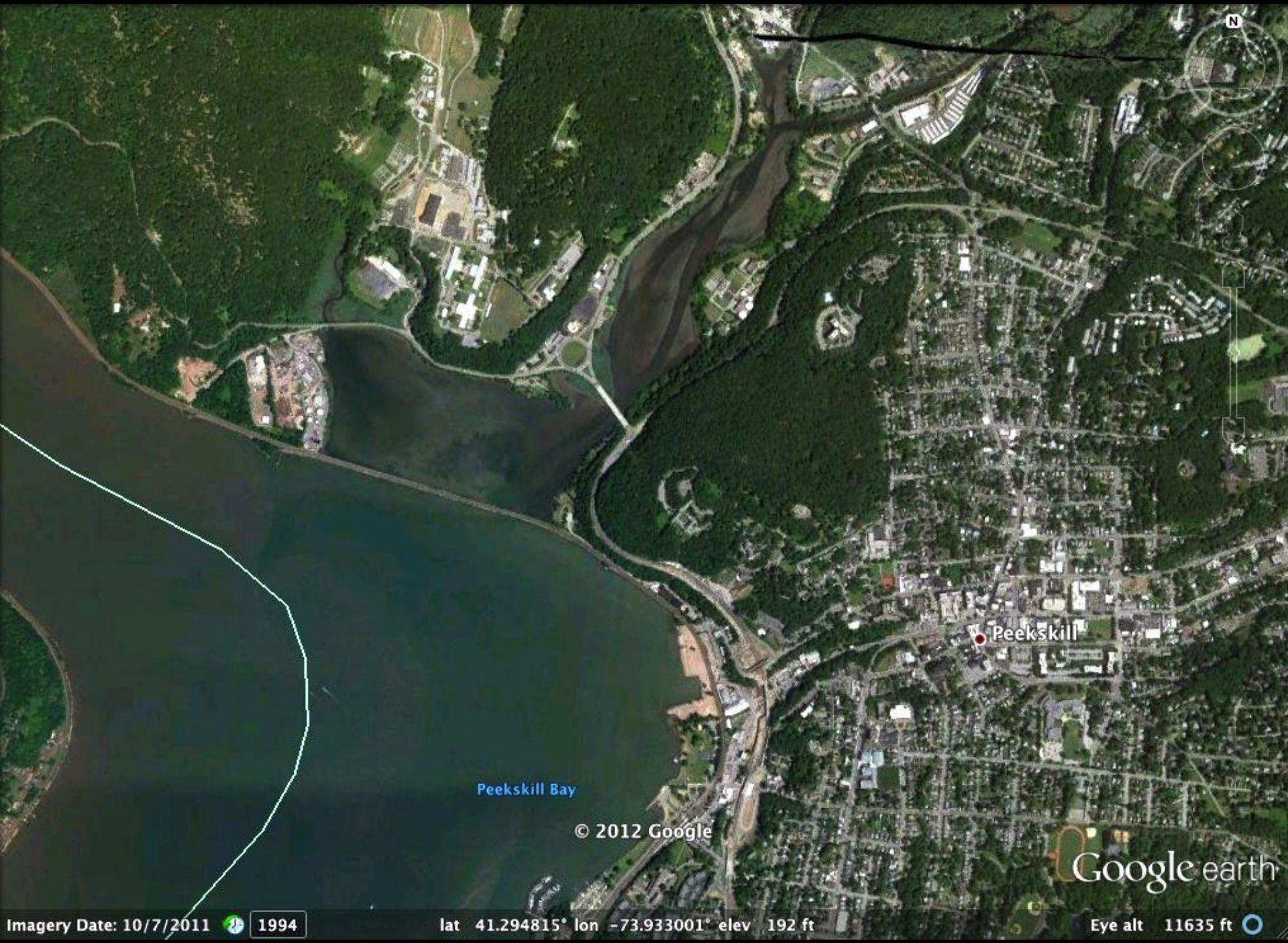
8 herbaria house collections of Hudson intertidal specimens.

850 intertidal specimens located, identified, and georeferenced.

Isoetes riparia, Englm.
High water line.
Mouth of creek, just
above Peeks Kill.
Aug. 1869.
W. H. Leggett legit.

J. Engelmanii ABr
Laah.

I. Tuckermanii ?
" canadensis ?


N
Peekskill
Peekskill Bay
© 2012 Google
Google earth
Imagery Date: 10/7/2011
1994
lat 41.294815° lon -73.933001° elev 192 ft
Eye alt 11635 ft

Methods, cont.

3. Conducted field work.

- explored historic sites as well as many previously unexplored sites
- worked during daily narrow window of opportunity

Hudson River Field Participants

Suneeti Jog,
The Nature Conservancy

Jenna Dorey,
NYBG

Erik Kiviat,
Hudsonia

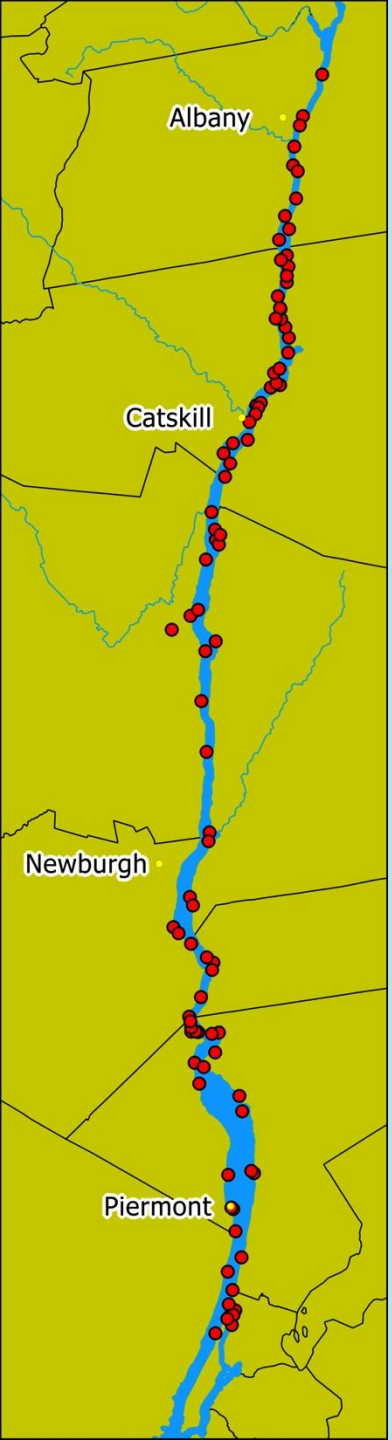
Nava Tabak,
Scenic Hudson

Sarah Walker,
NYBG

David Werier,
N.Y. Flora Assocn.

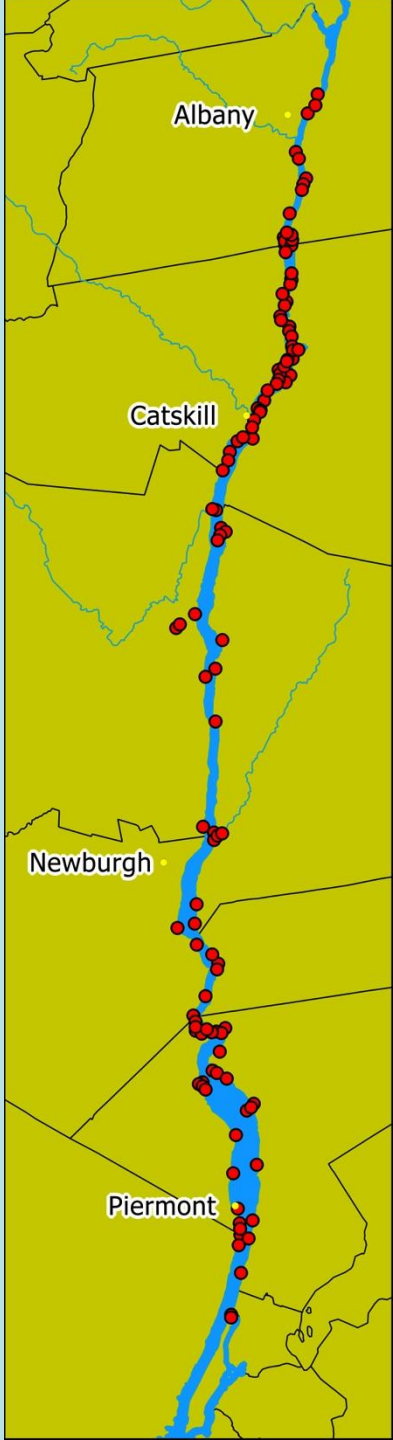
Charlie Zimmerman,
NYBG

Hudson River Estuary Study Sites



Historic
(1825-2003)
92 sites

Current
(2011-2014)
118 sites



What is it like to look for an intertidal plant?

Methods, cont.

4. Analyzing data.

- comparing historic to current occurrences
- investigating patterns of occurrence with GIS (geographic information systems)
- determining conservation status of each species

Methods, cont.

Conservation Status Categories

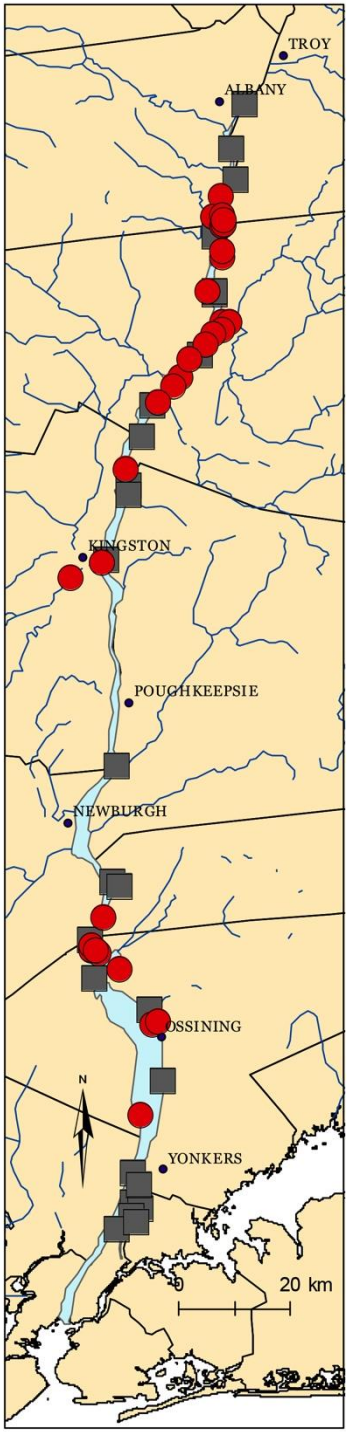
Secure (future is bright): >15 sites; >10,000 plants

Imperiled (future in question)

a. moderately: 5−15 sites and/or 1000−10,000 plants

b. critically: <5 sites; <1000 plants

Extirpated (already gone): historic only



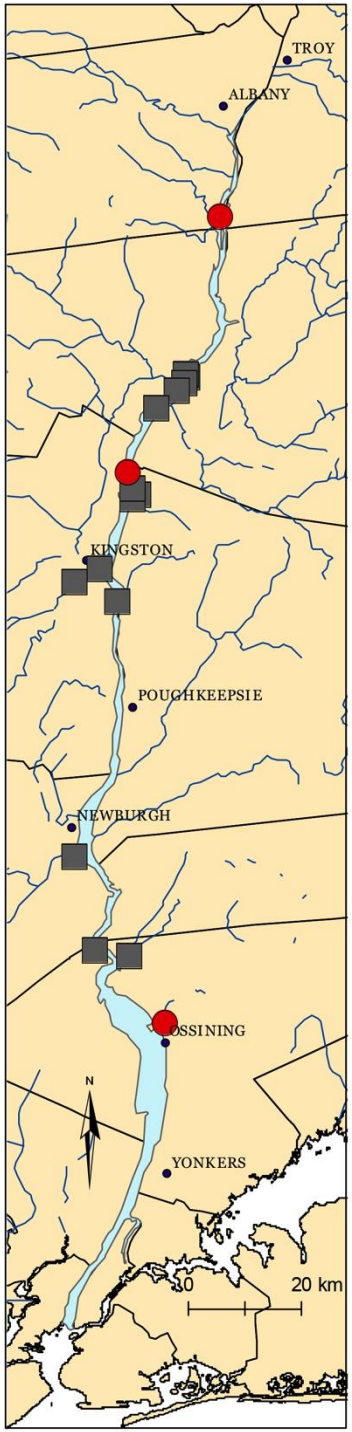
Results: Secure Species

Water Hemp

(*Amaranthus cannabinus*, Amaranthaceae)

34 populations known

historic current



Imperiled Species

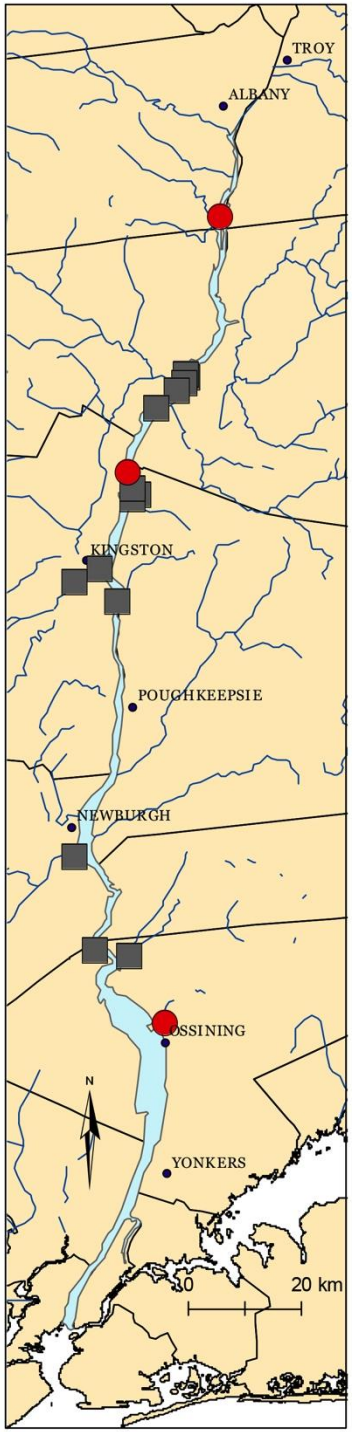
River Quillwort

(*Isoetes riparia*, Isoetaceae)

3 populations known

(129 plants total)

historic current



Imperiled Species

River Quillwort

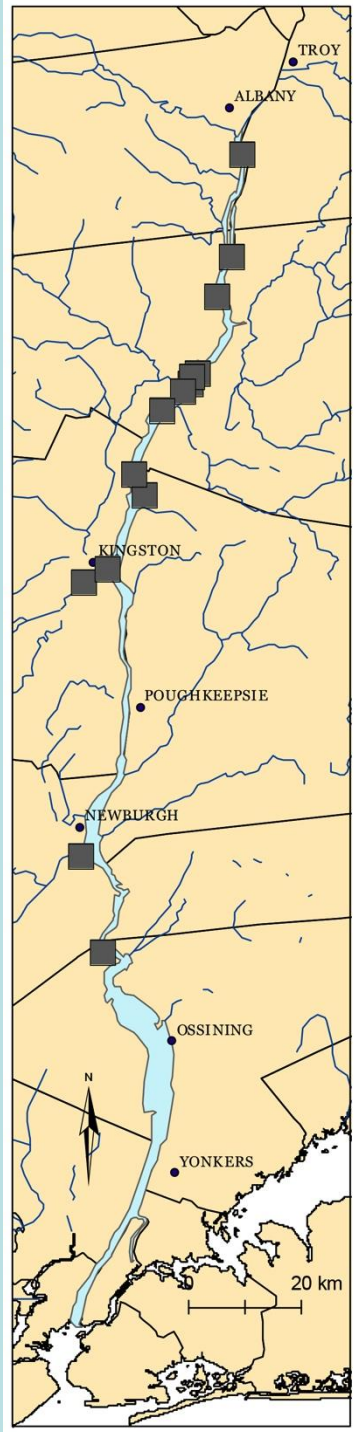
(*Isoetes riparia*, Isoetaceae)

3 populations known

(129 plants total)

First sighting on Hudson since 1941

historic current



Extirpated Species

Parker's Pipewort

(*Eriocaulon parkeri*, Eriocaulaceae)

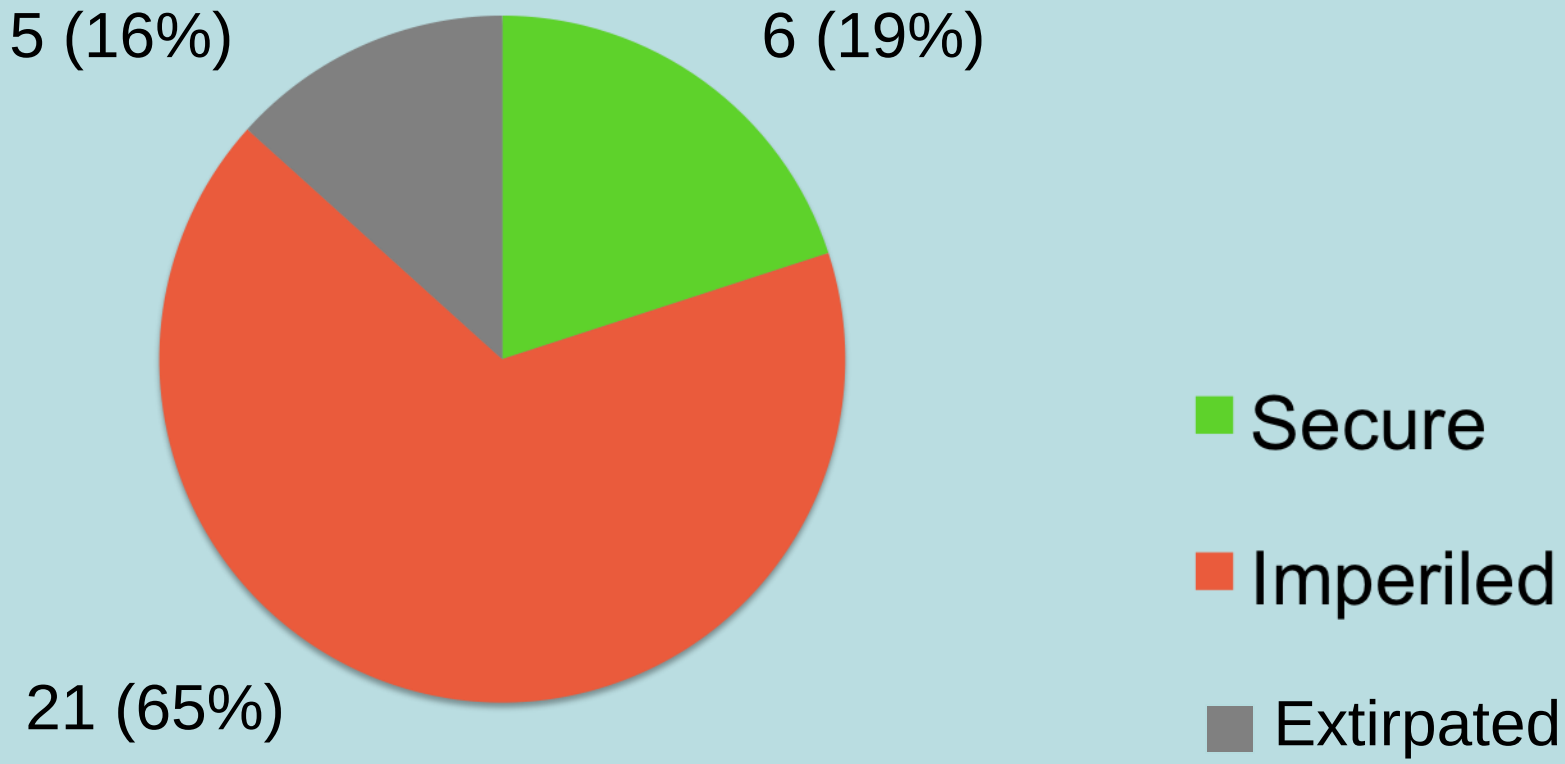
last collection

from Hudson River: 1944

historic current

Summary of Conservation Status for Intertidal Species

(n = 32)



Examples of Declines in Intertidal Plants

River Quillwort (*Isoetes riparia*)

15H, 3C, -80% change; 129 plants currently known

American Waterwort (*Elatine americana*)

11H, 3C, -73% change; 46 plants currently known

Smith's Bulrush (*Schoenoplectiella smithii*)

11H, 5C, -55% change; 38 plants currently known

Pygmy Riverweed (*Crassula aquatica*)

5H, 2C, -60% change; 580 plants currently known

Likely causes of declines

1. Pollution, especially from excess nutrients
2. Competition from invasive species
3. Habitat destruction, esp. from development
4. Erosion, esp. from ship-induced wave action
5. Sedimentation
6. Dredging

Ample Evidence of Eutrophication

A Few of the Invasive Plant Species of Hudson River Intertidal Zones

Phragmites australis
(Poaceae)
present for decades,
continues to invade,
many poplns known

Kyllinga gracillima
(Cyperaceae)
new to Hudson,
2 poplns known

Cyperus fuscus
(Cyperaceae)
new to New York,
3 poplns known

Cyperus diformis
(Cyperaceae)
new to Hudson,
2 poplns known

Reasons for Hope

Application of Conservation Science: Identification of Critical Areas

Site	# intertidal spp.
HISTORIC SITES	
Rogers Island (Columbia Co.)	13
Saugerties (Orange Co.)	12
Stony Creek (Dutchess Co.)	11
Iona Island (Rockland Co.)	10
CURRENT SITES	
Stockport Creek mouth (Columbia Co.)	10
Croton River (Westchester Co.)	9
Saugerties (Ulster Co.)	8
Hannacrois Creek mouth (Albany Co.)	7

Application of Conservation Science: Revision of NYNHP Ranks

S1 = 1--5 sites
S2 = 6--20 sites
S3 = 21--35 sites

Species	NYNHP Listing	Current # Sites	Change Necessary
Bidens hyperborea	S1	NA	remove from list (specimens misidentified)
Cardamine longii	S2	NA	remove from list (specimens misidentified)
Limosella australis	S3	8	**upgrade to S2**
Najas muenscheri	S1	23	**downgrade to S3**
Plantago cordata	S3	17	**upgrade to S2**
Sagittaria montevidensis	S2	28	**downgrade to S3**
Sagittaria subulata	S3	51	**remove from list (too many poplns.)**
Schoenoplectiella smithii	not listed	5	**add to list as S1**

Why It Matters

1. This is the first comprehensive study of the Hudson's intertidal plants.

2. Intertidal plants are worth conserving.
   - unique elements of our shared natural heritage
   - inhabit very few places

3. Intertidal plants provide essential ecosystem services.
   - stabilize shorelines
   - buffer effects of storms
   - provide food and shelter for animals

4. Intertidal plants are indicators of environmental health.

5. Results of this project will inform future restoration projects.

Acknowledgments

Funding: Hudson River Foundation, Anonymous Private Trust, Linde Ostro, Stephan Chenault

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Assistance with microscopy: Charles Zimmerman

Assistance with maps: Becky Hrdy, Michelle Naczi