Elevation, Inundation, and Vegetation: Implications for Restoration

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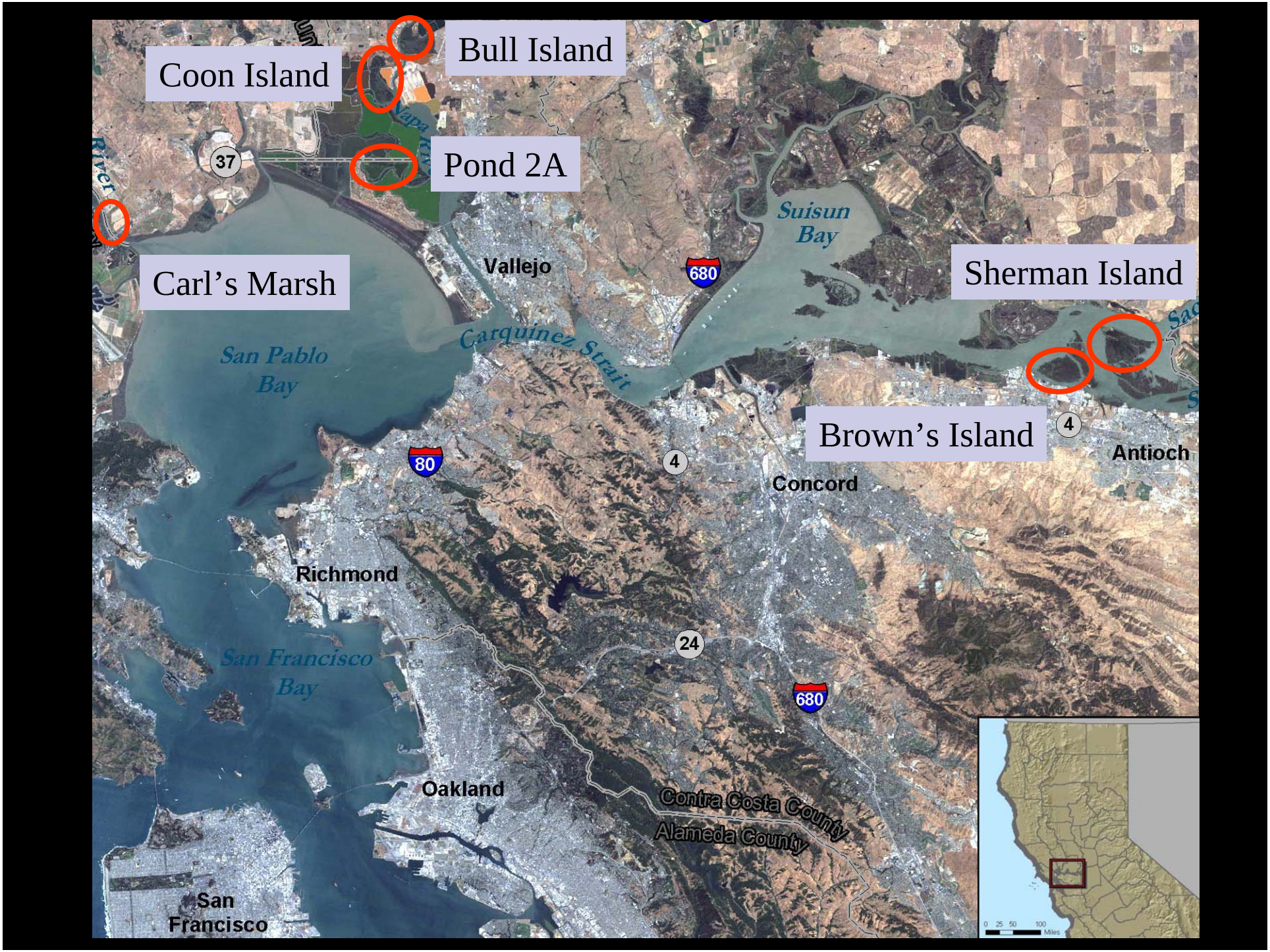
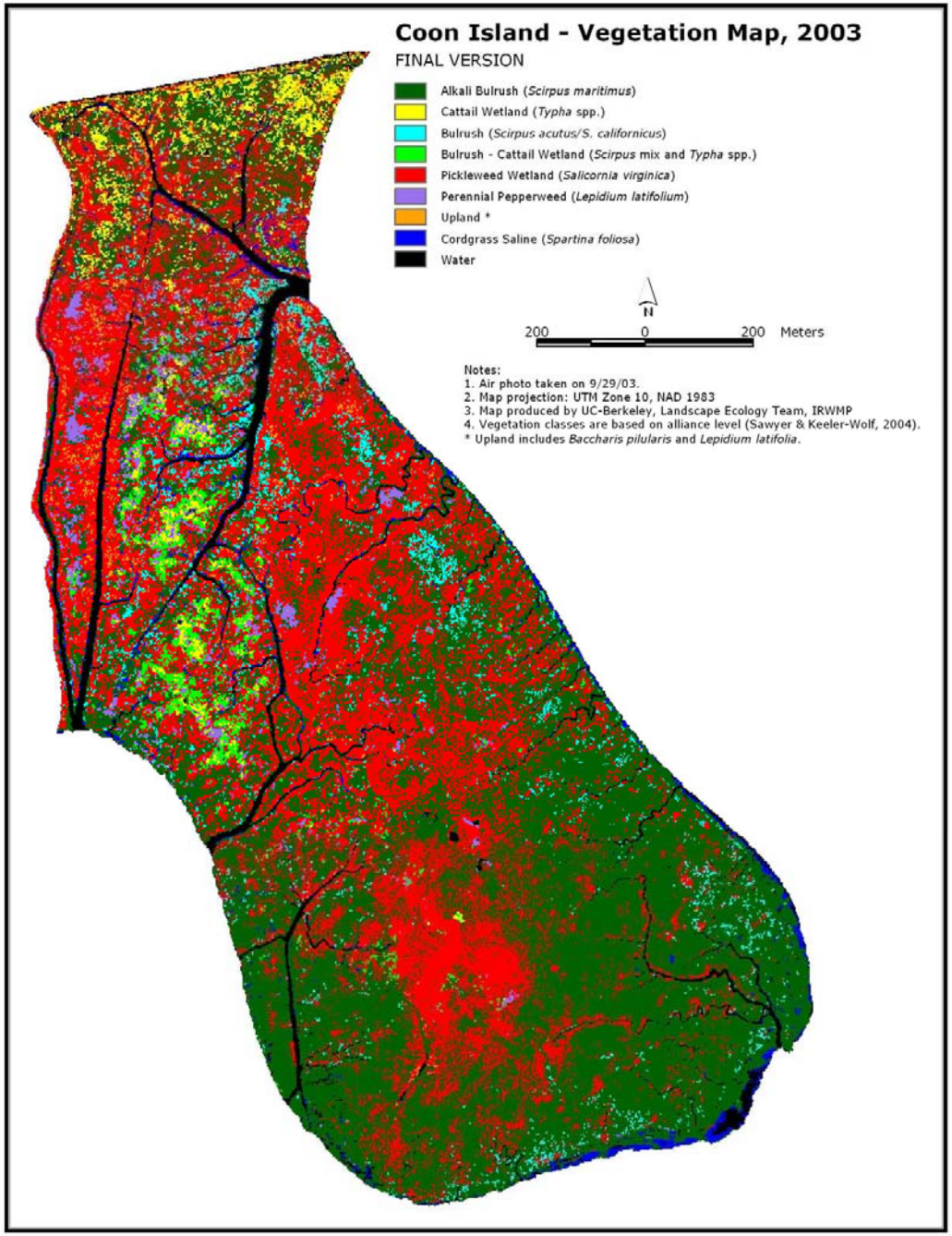
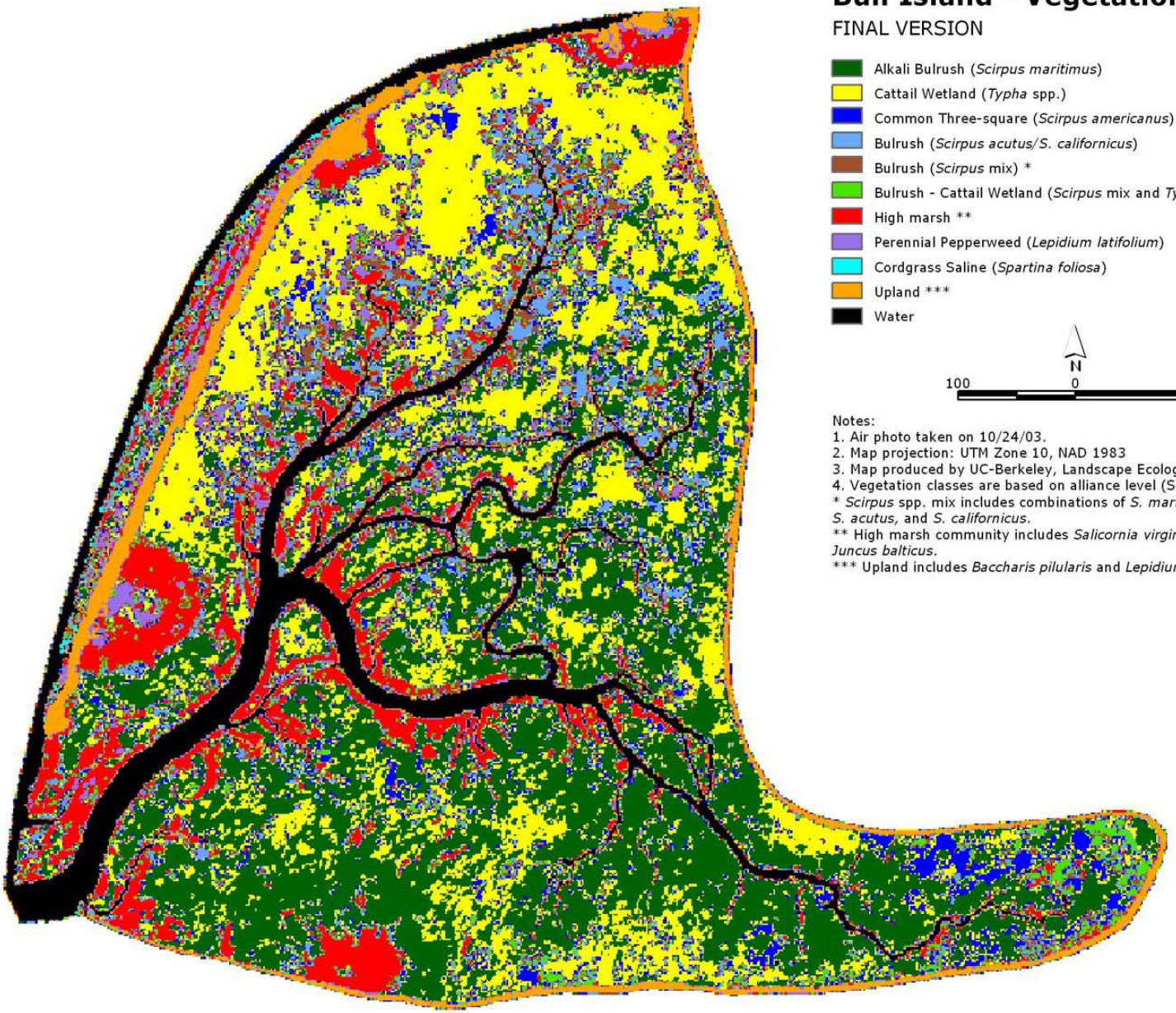

Coon Island
Bull Island
Pond 2A
Carl's Marsh
Sherman Island
Brown's Island
Suisun Bay
Carquinez Strait
San Pablo Bay
San Francisco Bay
Vallejo
Concord
Antioch
Richmond
Oakland
San Francisco
Contra Costa County
Alameda County
37
680
80
4
24


Coon Island - Vegetation Map, 2003
FINAL VERSION
Alkali Bulrush (Scirpus maritimus)
Cattail Wetland (Typha spp.)
Bulrush (Scirpus acutus/S. californicus)
Bulrush - Cattail Wetland (Scirpus mix and Typha spp.)
Pickleweed Wetland (Salicornia virginica)
Perennial Pepperweed (Lepidium latifolium)
Upland *
Cordgrass Saline (Spartina foliosa)
Water
N
200 0 200 Meters
Notes:
1. Air photo taken on 9/29/03.
2. Map projection: UTM Zone 10, NAD 1983
3. Map produced by UC-Berkeley, Landscape Ecology Team, IRWMP
4. Vegetation classes are based on alliance level (Sawyer & Keeler-Wolf, 2004).
* Upland includes Baccharis pilularis and Lepidium latifolia.



Bull Island - Vegetation Map, 2003

FINAL VERSION

- Alkali Bulrush (*Scirpus maritimus*)
- Cattail Wetland (*Typha* spp.)
- Common Three-square (*Scirpus americanus*)
- Bulrush (*Scirpus acutus/S. californicus*)
- Bulrush (*Scirpus* mix) *
- Bulrush - Cattail Wetland (*Scirpus* mix and *Typha* spp.)
- High marsh **
- Perennial Pepperweed (*Lepidium latifolium*)
- Cordgrass Saline (*Spartina foliosa*)
- Upland ***
- Water

N

100 0 100 Meters

Notes:
1. Air photo taken on 10/24/03.
2. Map projection: UTM Zone 10, NAD 1983
3. Map produced by UC-Berkeley, Landscape Ecology Team, IRWMP
4. Vegetation classes are based on alliance level (Sawyer & Keeler-Wolf, 2004).

* *Scirpus* spp. mix includes combinations of *S. maritimus, S. americanus, S. acutus,* and *S. californicus*.

** High marsh community includes *Salicornia virginica, Distichlis spicata,* and *Juncus balticus*.

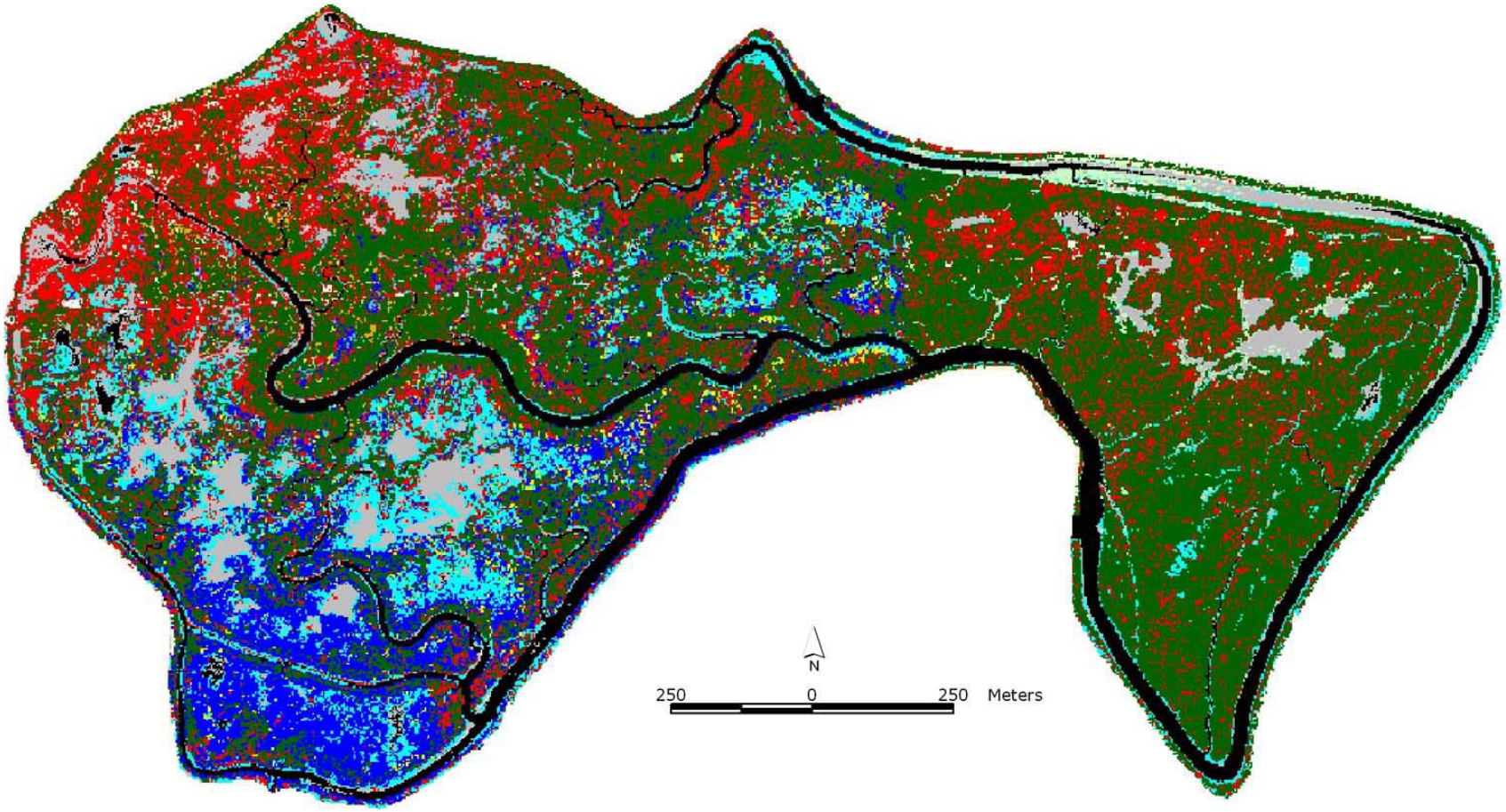
*** Upland includes *Baccharis pilularis* and *Lepidium latifolia*.

Pond 2A - Vegetation Map, 2003

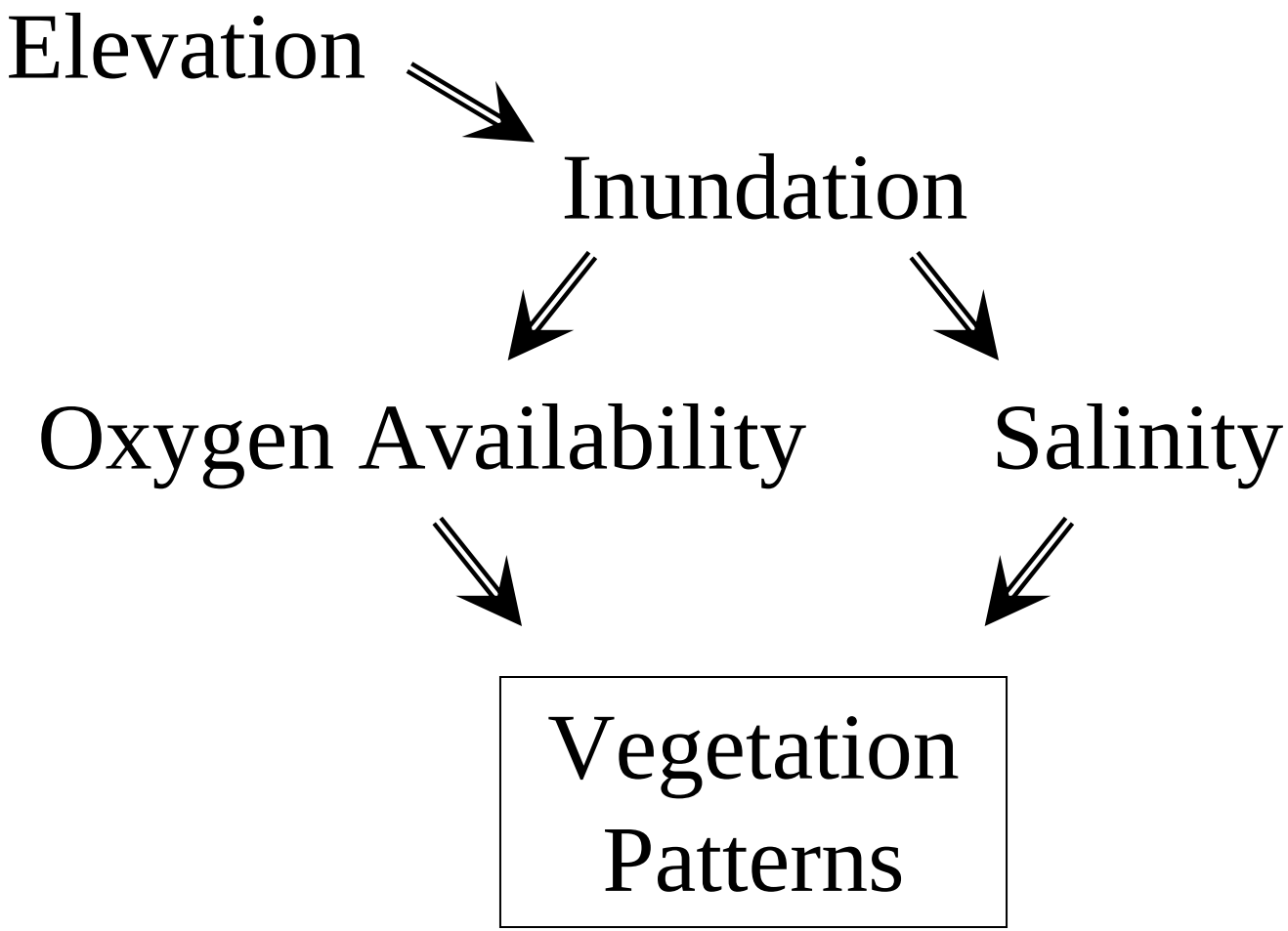
FINAL VERSION

- Alkali Bulrush (*Scirpus maritimus*)
- Pickleweed Wetland (*Salicornia virginica*)
- Cordgrass Saline (*Spartina foliosa*)
- Bulrush (*Scirpus acutus/S. californicus*)
- Cattail Wetland (*Typha* spp.)
- Common Three-square (*Scirpus americanus*)
- Alkali Common Reed (*Phragmites australis*)
- Gumplant (*Grindelia stricta* var. *stricta*
- Giant Reed (*Arundo donax*)
- Bare
- Water

Notes:
1. Air photo taken on 9/29/03.
2. Map projection: UTM Zone 10, NAD 1983
3. Map produced by UC-Berkeley, Landscape Ecology Team, IRWMP
4. Vegetation classes are based on alliance level (Sawyer & Keeler-Wolf, 2004).



Factors Affecting Vegetation

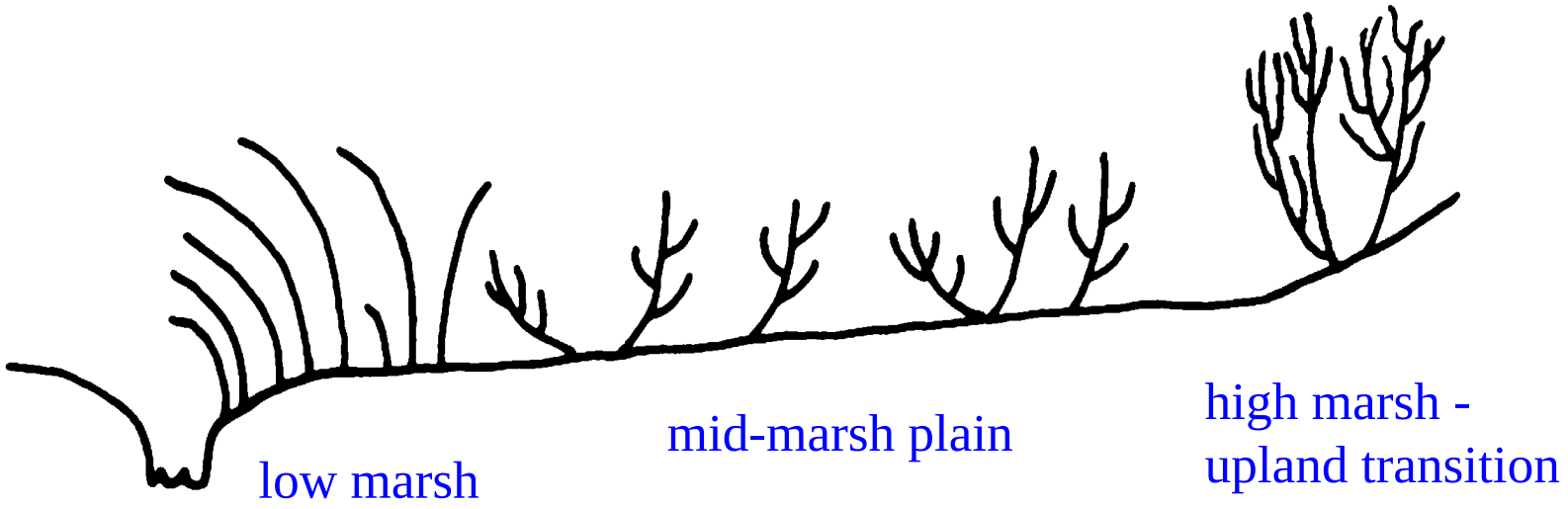


Spatial Variation Across Wetland

frequently inundated ← rarely inundated

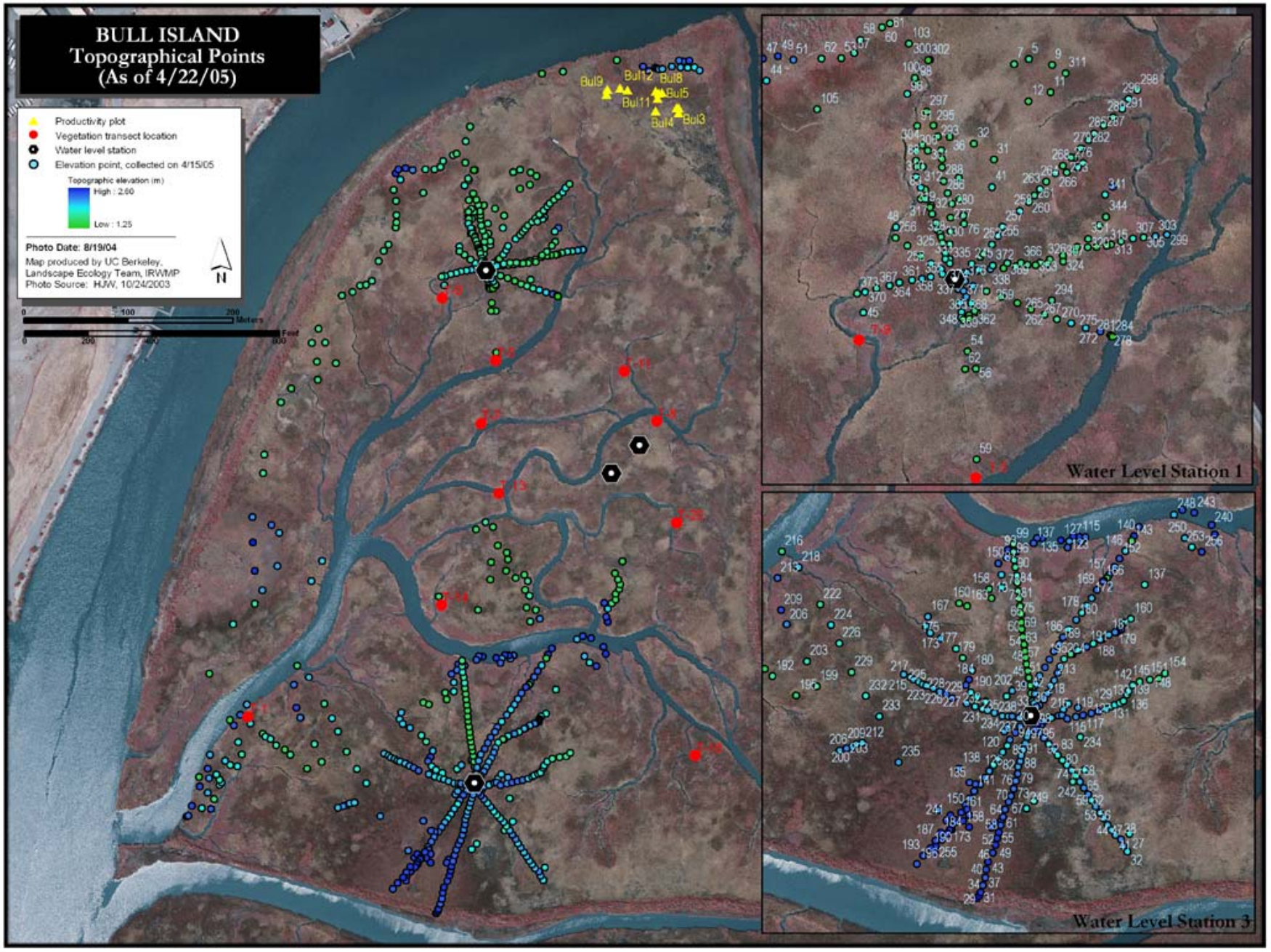
greater oxygen stress ← less oxygen stress

less salt stress → greater salt stress

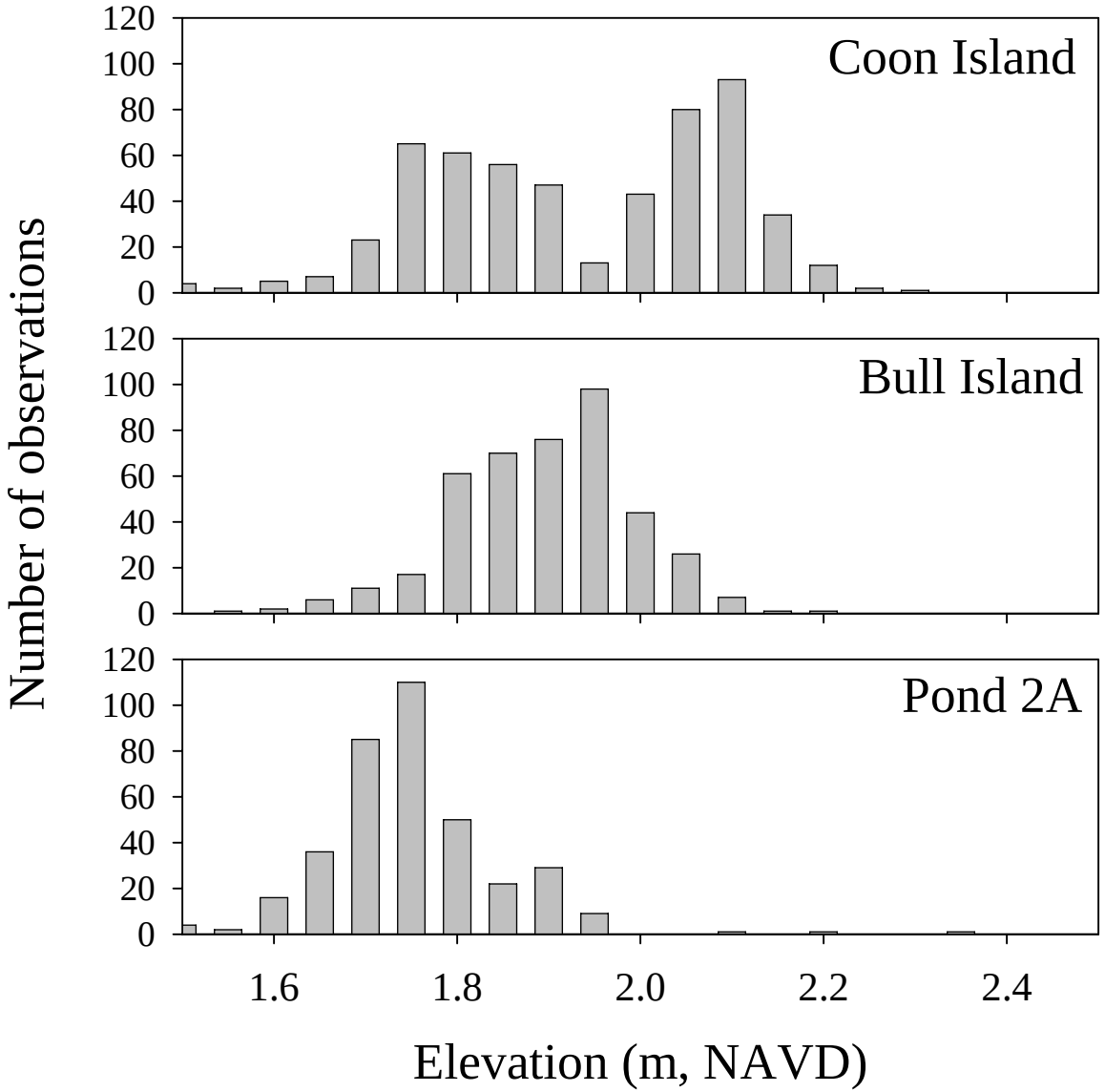


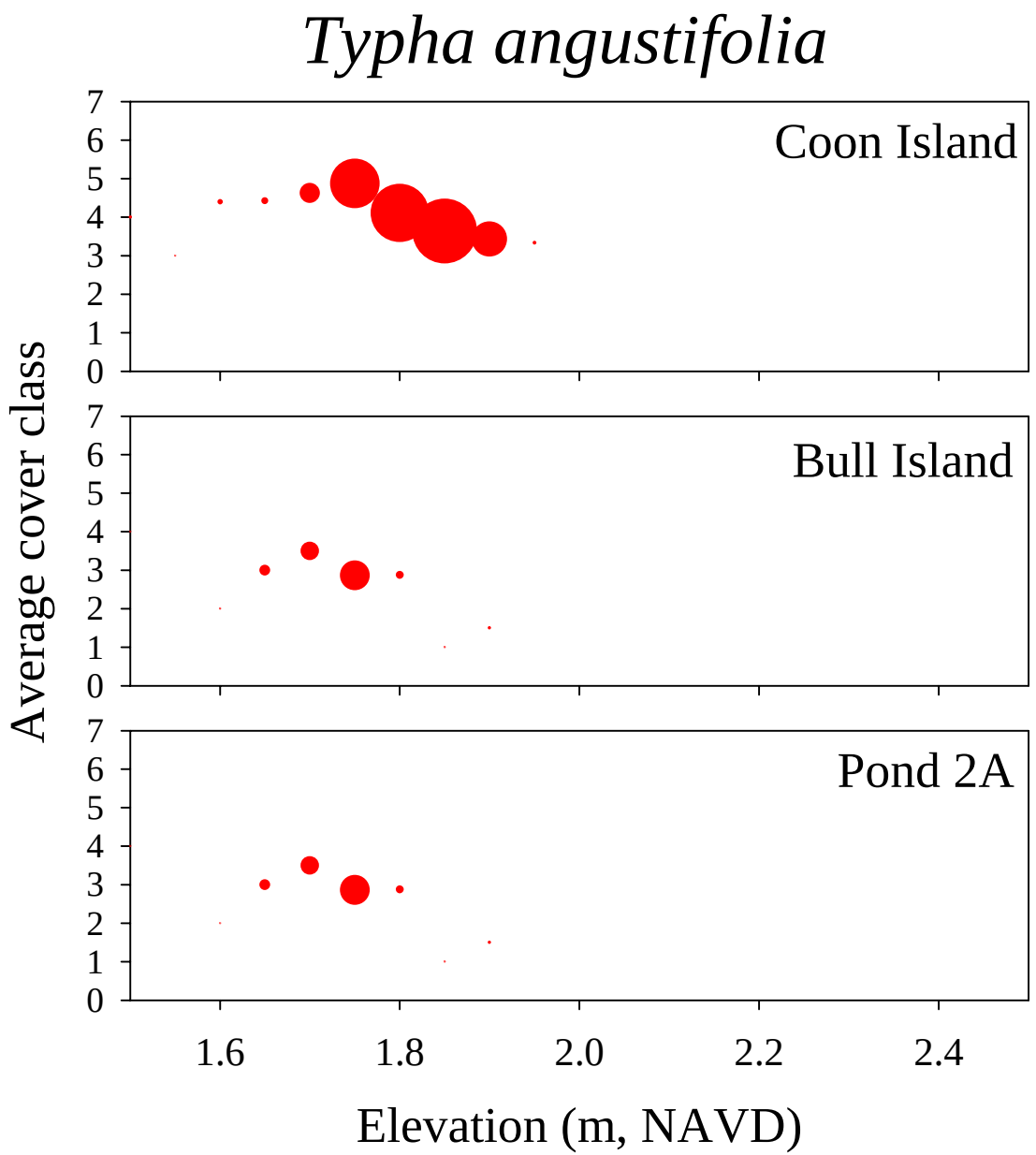
Research Questions

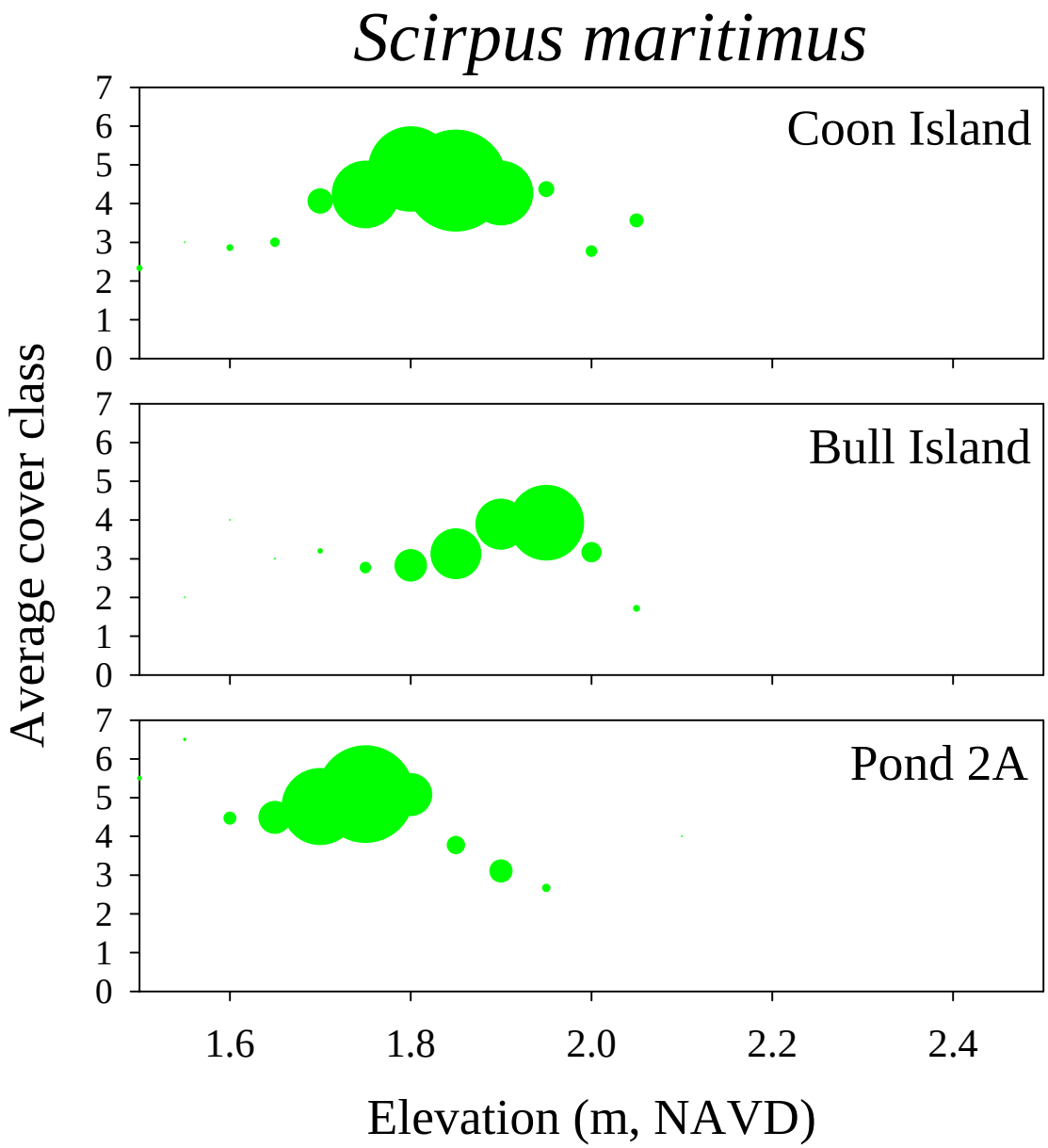
- Is elevation a good predictor of plant distributions in tidal wetlands?
- Is inundation regime a good predictor of plant distributions in tidal wetlands?
- How does plant diversity vary across elevations with tidal wetlands?

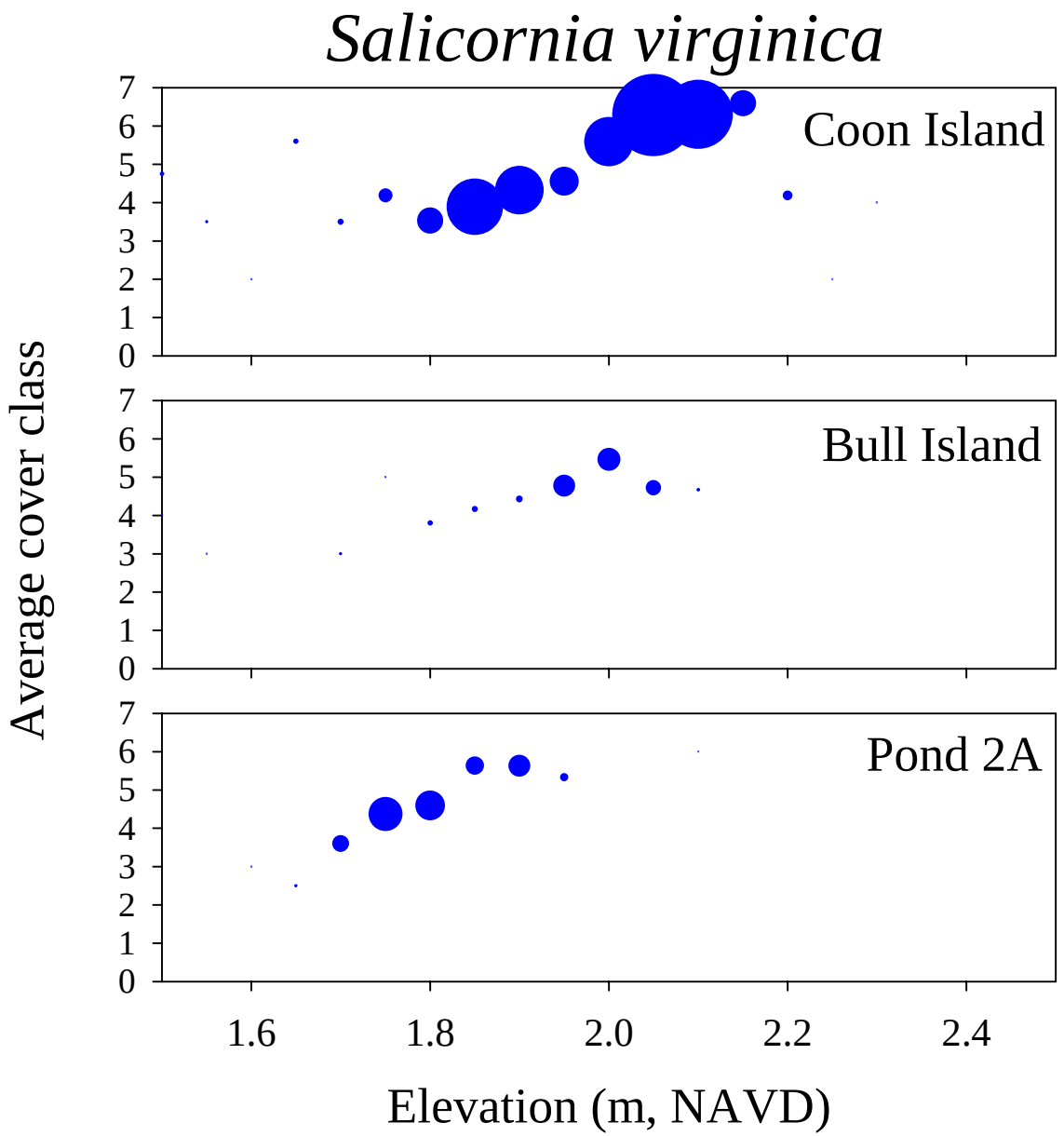

BULL ISLAND
Topographical Points
(As of 4/22/05)
Productivity plot
Vegetation transect location
Water level station
Elevation point, collected on 4/15/05
Topographic elevation (m)
High : 2.60
Low : 1.25
Photo Date: 8/19/04
Map produced by UC Berkeley,
Landscape Ecology Team, IRWMP
Photo Source: HJW, 10/24/2003
N
0 100 200 Meters
0 200 400 600 Feet
Bul9
Bul12
Bul8
Bul5
Bul11
Bul4
Bul3
Water Level Station 1
Water Level Station 3

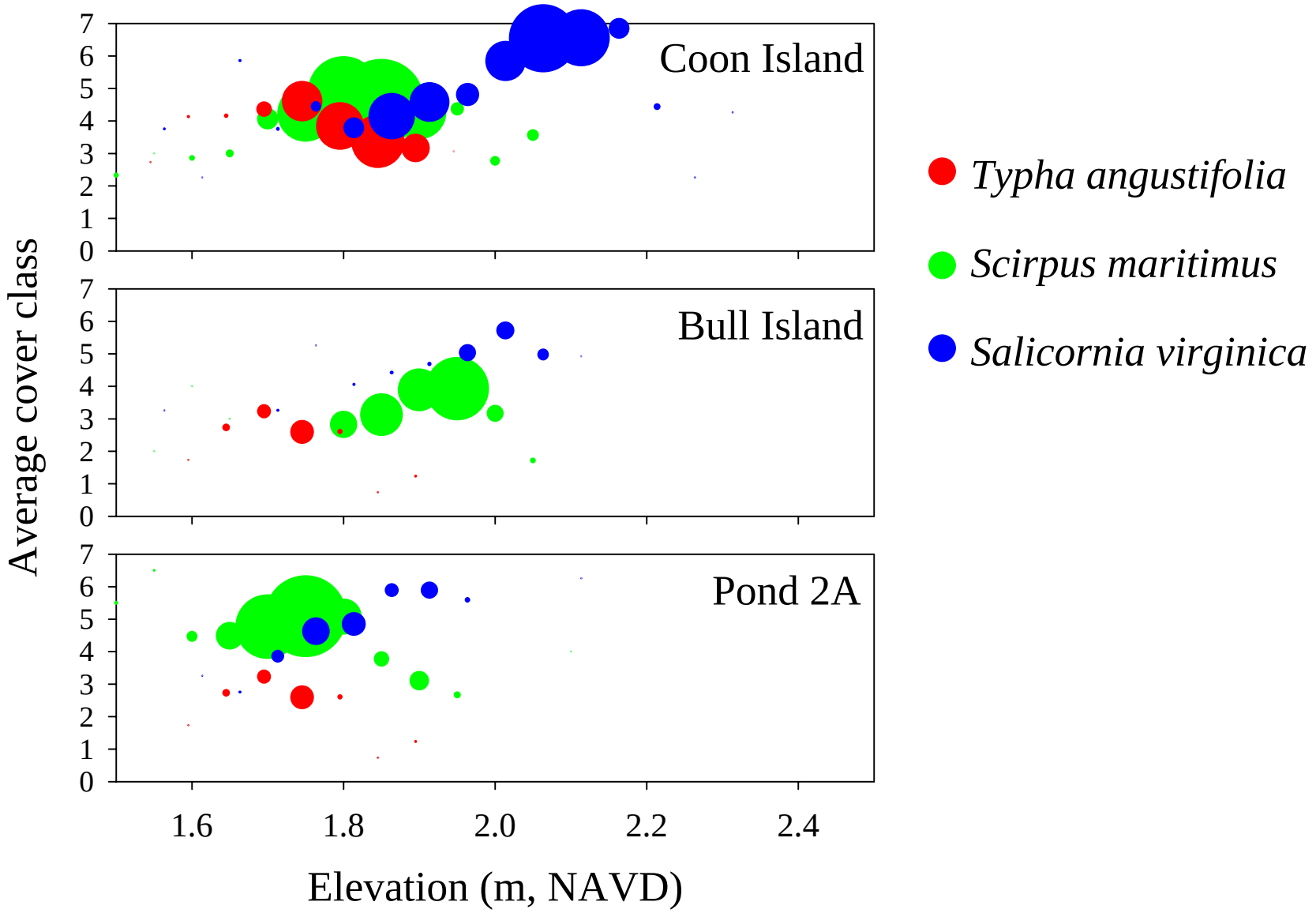
Marsh Surface Elevations




Typha angustifolia
Coon Island
Bull Island
Pond 2A
Average cover class
0
1
2
3
4
5
6
7
1.6
1.8
2.0
2.2
2.4
Elevation (m, NAVD)


Scirpus maritimus
Coon Island
Bull Island
Pond 2A
Average cover class
0
1
2
3
4
5
6
7
1.6
1.8
2.0
2.2
2.4
Elevation (m, NAVD)


Salicornia virginica
Coon Island
Bull Island
Pond 2A
Average cover class
0
1
2
3
4
5
6
7
1.6
1.8
2.0
2.2
2.4
Elevation (m, NAVD)

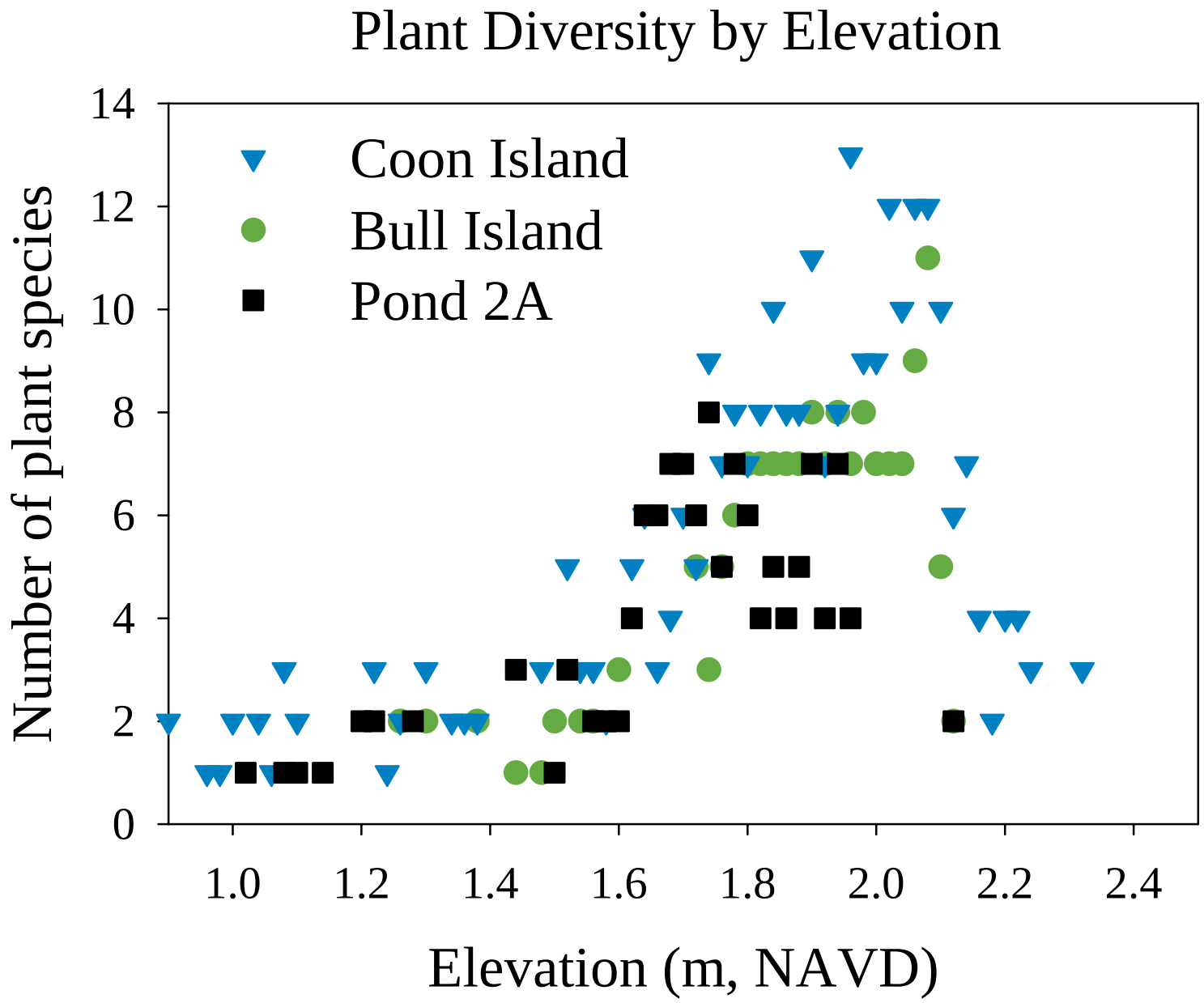

Coon Island
Bull Island
Pond 2A
Average cover class
Elevation (m, NAVD)
0
1
2
3
4
5
6
7
1.6
1.8
2.0
2.2
2.4
Typha angustifolia
Scirpus maritimus
Salicornia virginica

Elevational Distributions

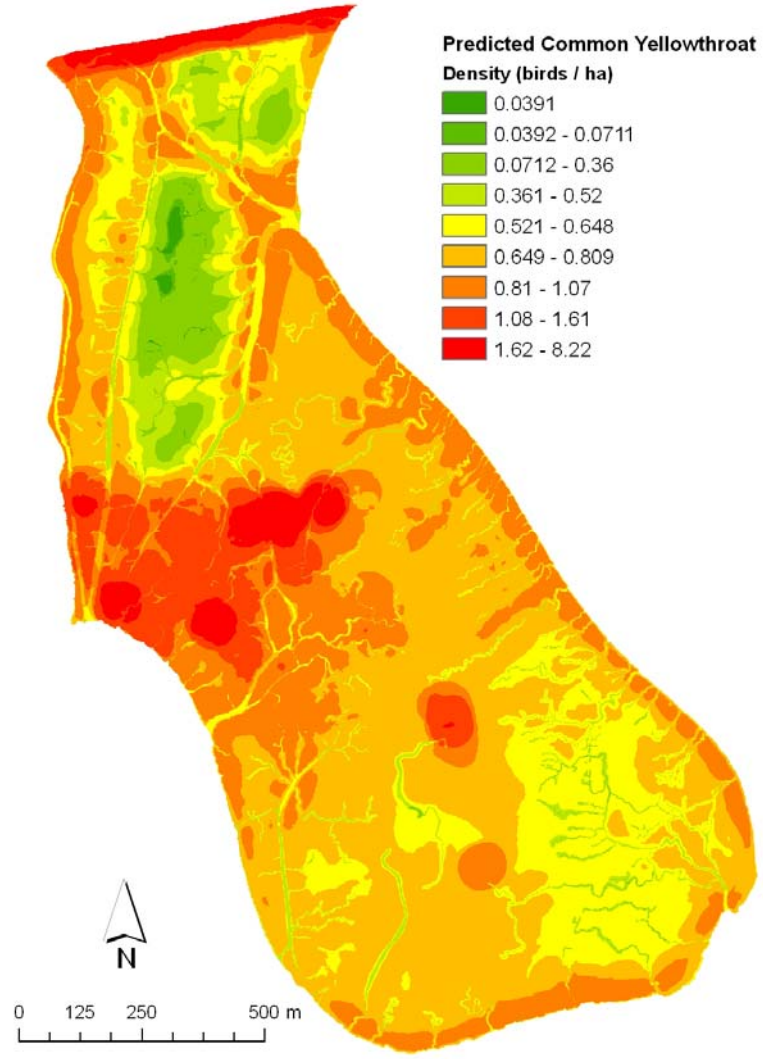
- Elevation important in determining plant distributions, but …
- No critical thresholds among species
- More than just elevation driving distributions
- Pond 2A: predominantly low elevations
- Coon Island: higher elevations are dominated by *Salicornia virginica*

Inundation Effects on Vegetation?

- Hypothesize that inundation regime is a better predictor of plant distributions than elevation
- Need additional analysis to complete this component


Plant Diversity by Elevation
Coon Island
Bull Island
Pond 2A
Number of plant species
0
2
4
6
8
10
12
14
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
Elevation (m, NAVD)

Predictions of Bird Densities



(From PRBO)

Conclusions

- Elevation is important, but other factors also affect plant distributions
- More analysis needed to evaluate the relationship of inundation and plant distributions
- Plant diversity increases with elevation up to MHHW (2 m NAVD) in Napa River wetlands
- Plant distributions along with physical factors can be good predictors of wildlife use of tidal wetlands
- These relationships give valuable insight into restoration design for tidal wetlands

Acknowledgments

- IRWM Collaborators, especially Landscape Ecology Team for vegetation maps, Bird Team for maps of predicted bird density, and Physical Processes Team for inundation data,
- CALFED Science Program for funding