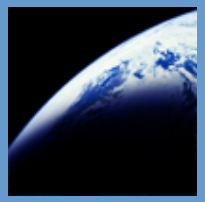


Lamont Doherty Earth Observatory

Goddard Institute for Space Studies
New York, N.Y.

Yameko to JFK - Paleoenvironmental Change from Jamaica Bay Marshes

D. Peteet, NASA/GISS & LDEO

L.Lieberman, LDEO

P. Higgiston, LDEO

S. Sritrairat, LDEO,

T. Kenna, LDEO

NYCDEP
10-28-08

Thanks to National Park Service, Hudson River Foundation, and LDEO Investment Fund

Why are Wetlands Valuable?

Sponges for aquifers

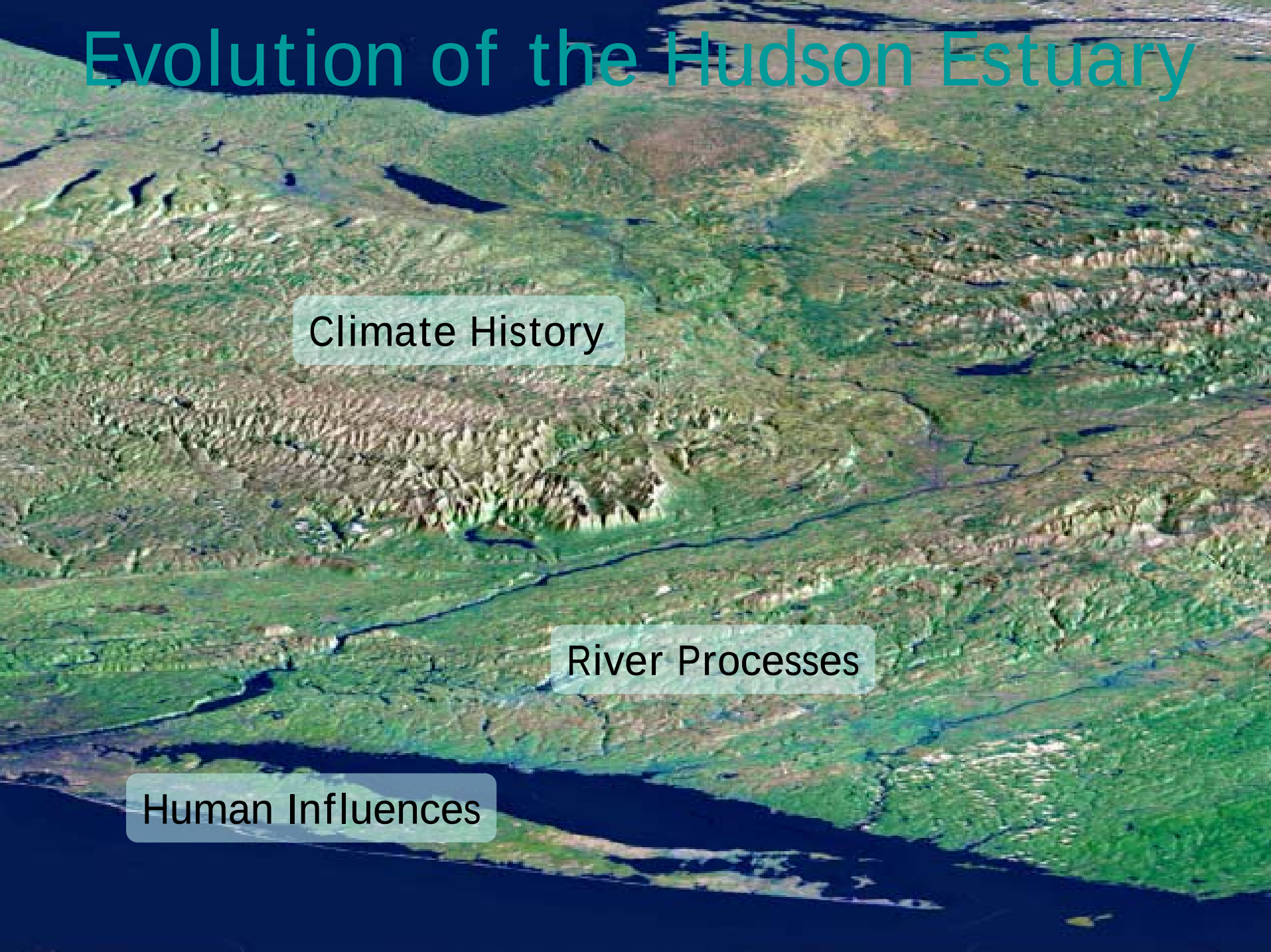
Nurseries for aquatic ecosystems

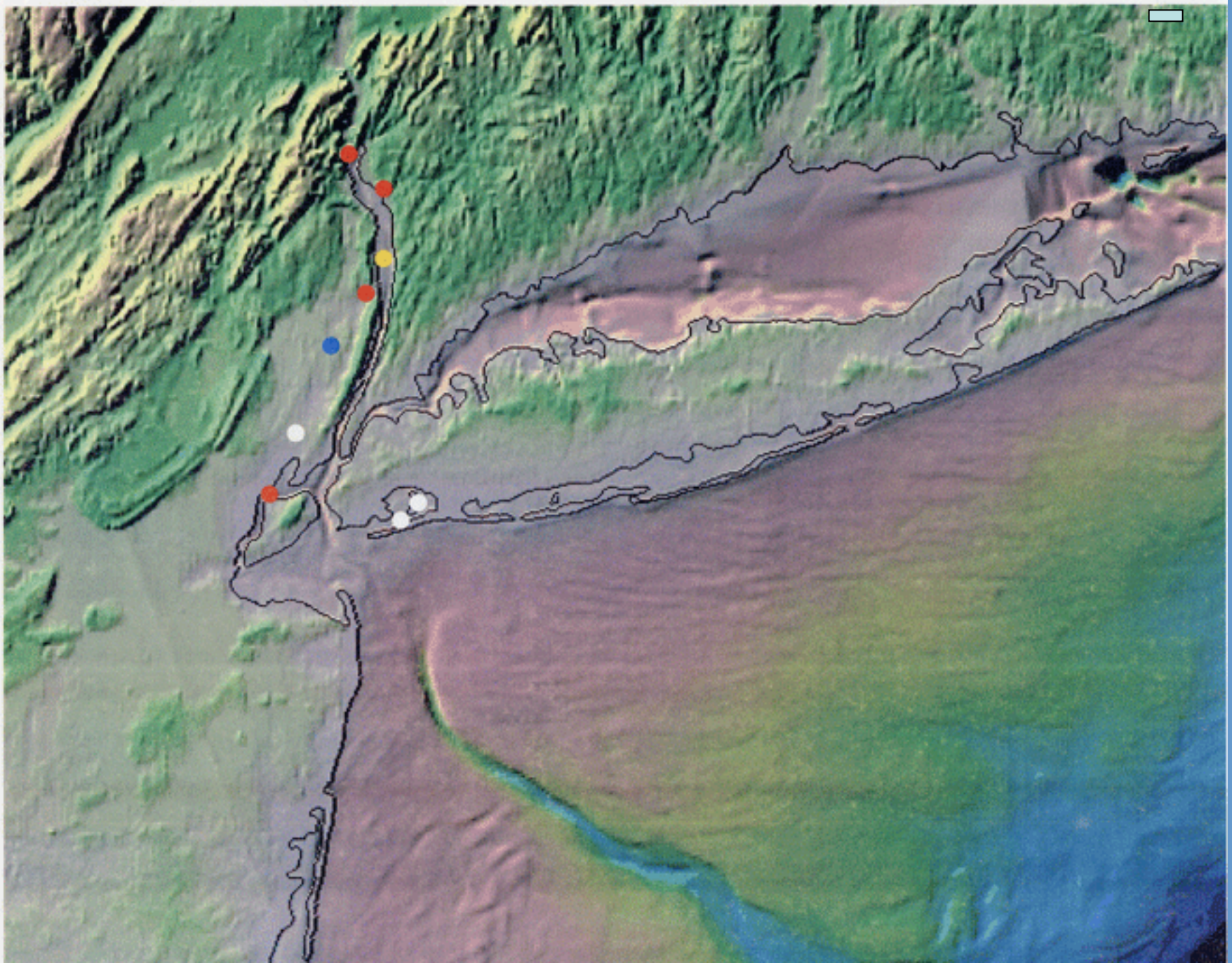
Protection of shorelines

Ecotone between rivers & uplands

****Archives of environmental history**

Evolution of the Hudson Estuary





Marsh Habitat Loss

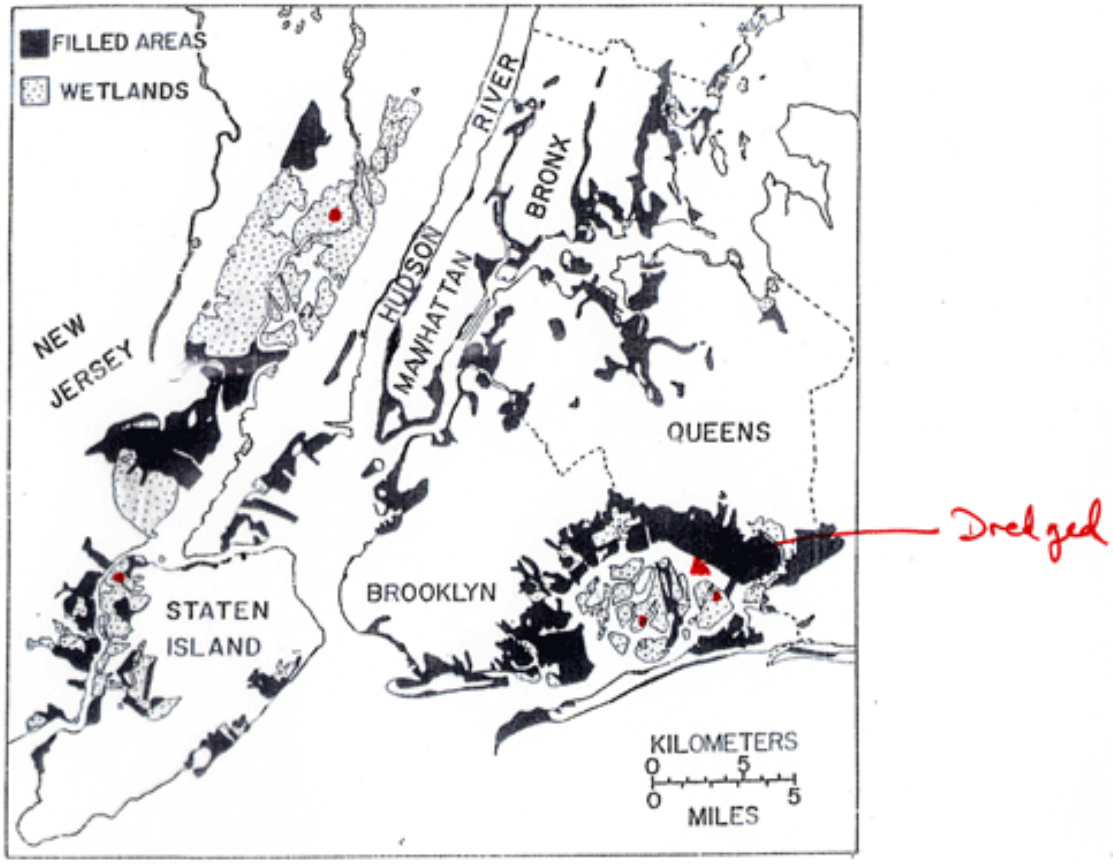
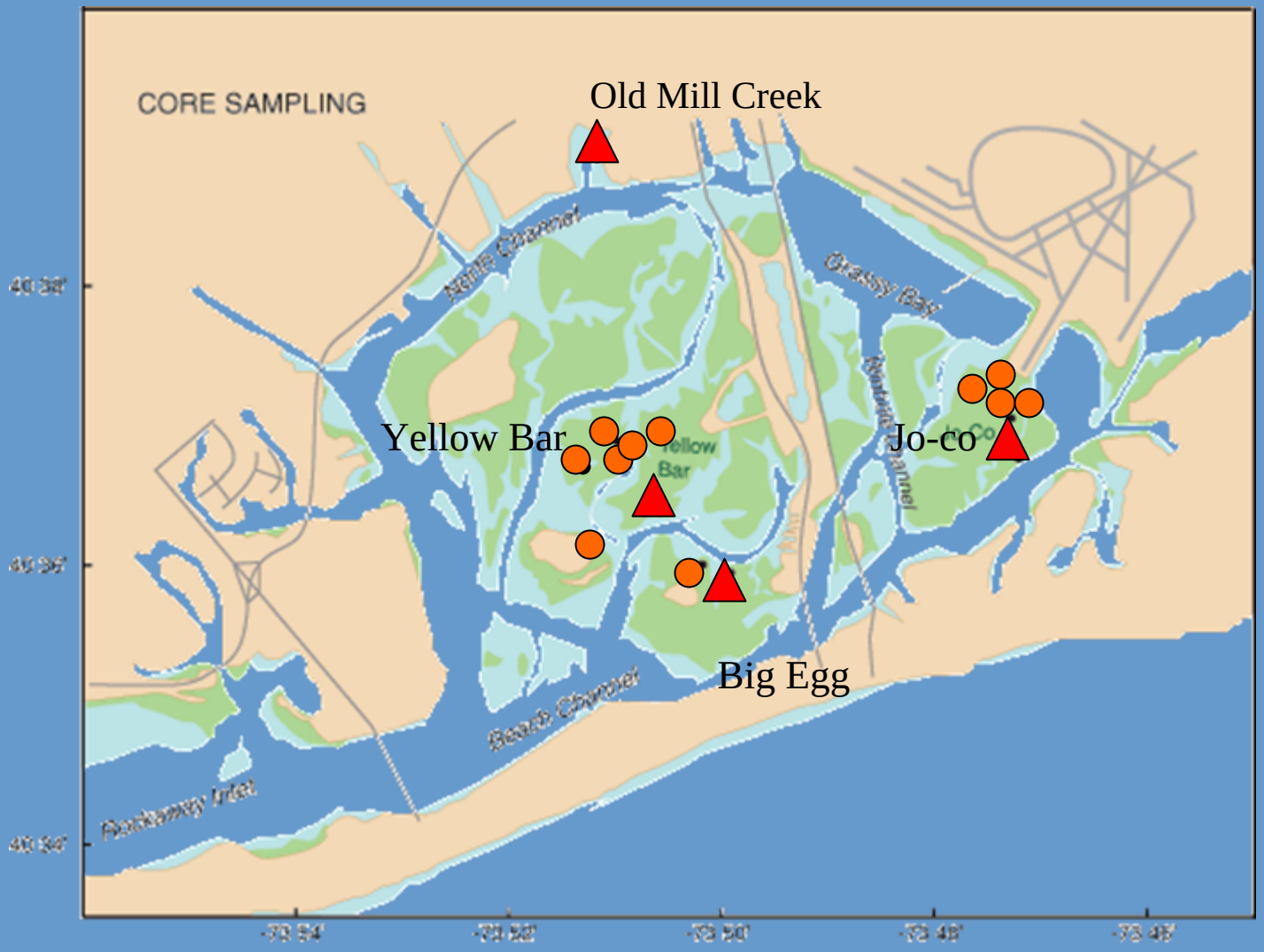


FIGURE 2. Filled land and wetlands remaining in the mid 1960s. (After Bower *et al.*[30]) 1968

from Gross, 1974

Jamaica Bay Core Sites



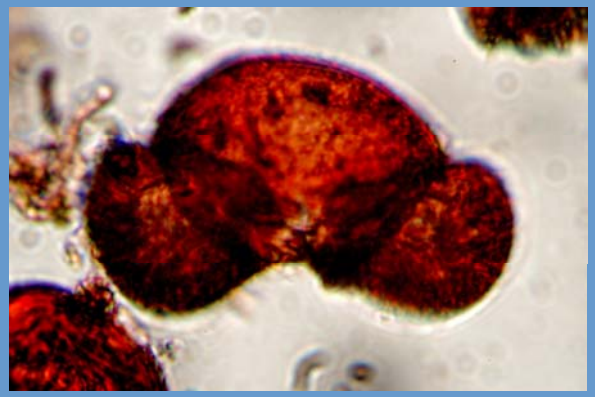
Yellow Bar, Jamaica Bay

Habitat Loss

Spartina alterniflora, **grass**

Coring Piermont Marsh

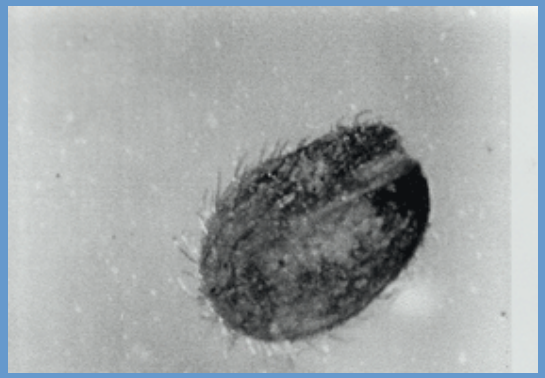
Spartina patens
&
Distichlis grass



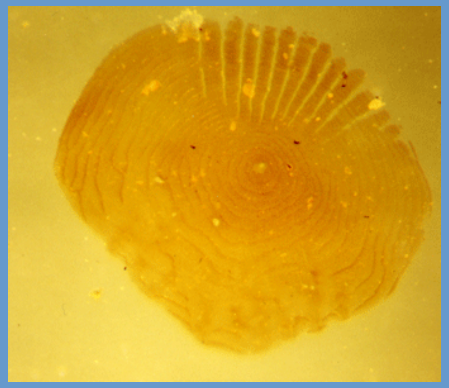
Methods

- Pollen and Spore Analysis
  - 300 grains/sample…regional
- Macrofossil and Charcoal Analysis
  - Species-specific, fire history
- Foraminifera
  - High or low marsh, sea level?……droughts, floods?
- C-14 Dating, Cs
  - AMS on macrofossils
- Sediment stratigraphy
  - Loss-on-ignition…carbon sequestration
  - Inorganic supply
- Trace metals and elements
  - Lead, zinc, cadmium; zinc, titanium, potassium

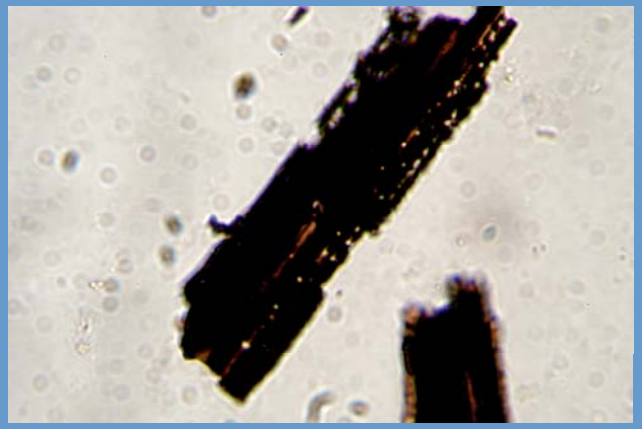
Quercus



Salicornia



Fundulus scale

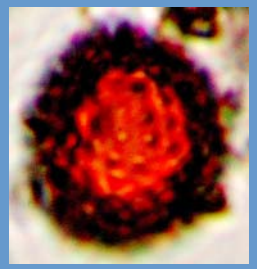


Charcoal

Marsh Chronology

++ Plants take C from air (not water)

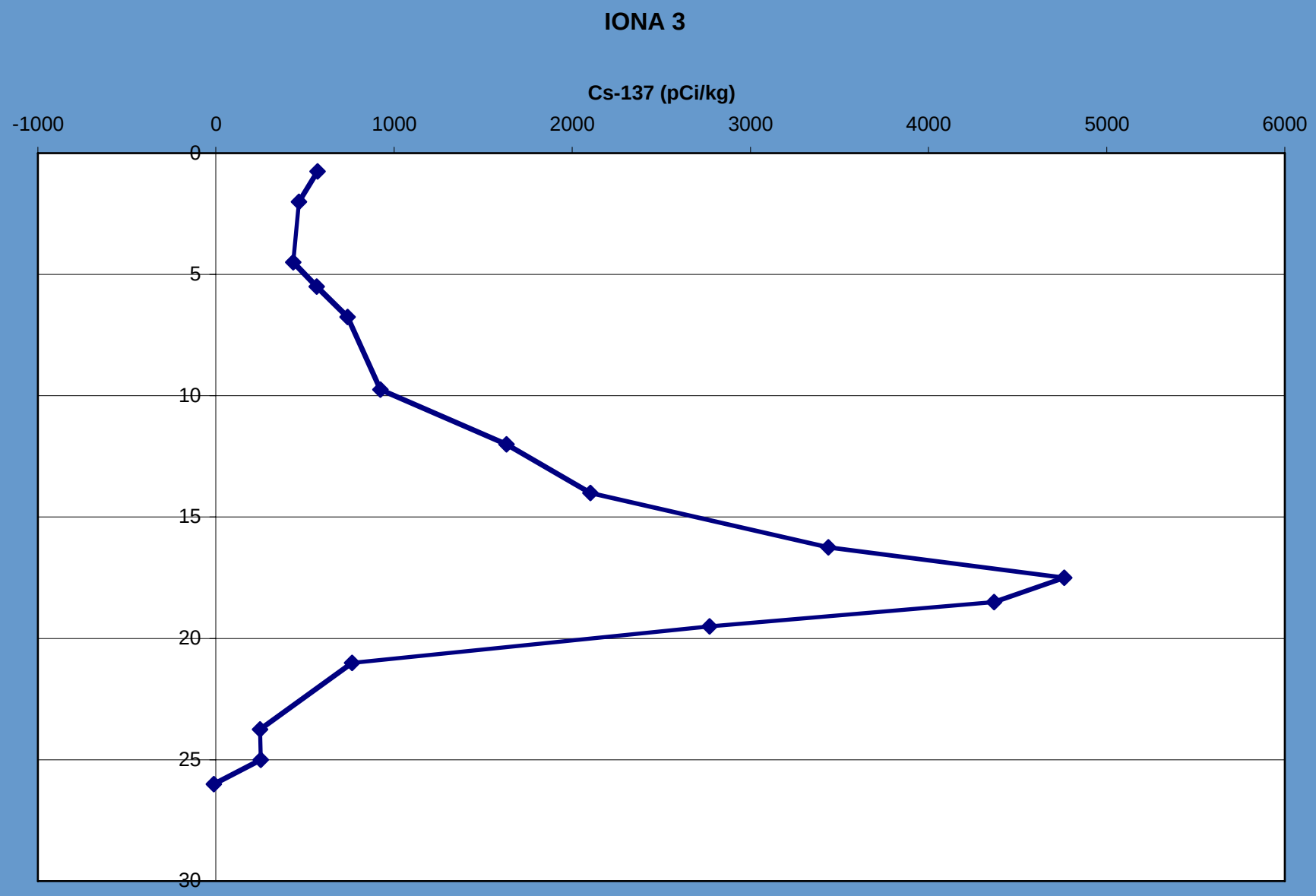
- Problems in C-14 production

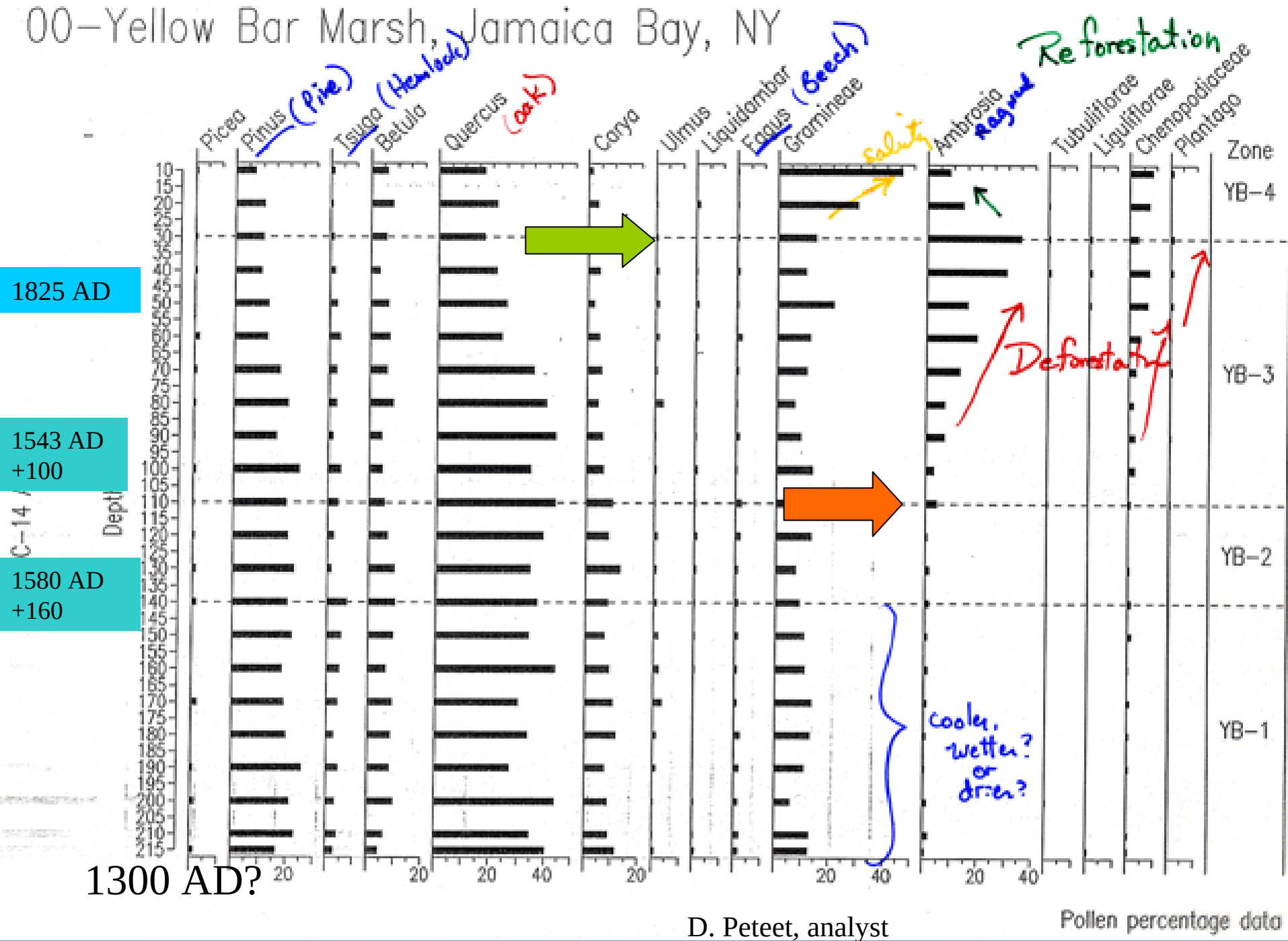


++Importance of *Ambrosia* (ragweed)

++Cs-137 in marshes

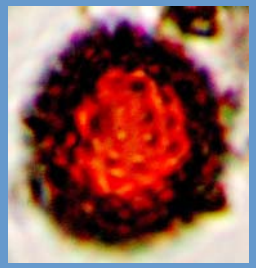
IONA Cs-137

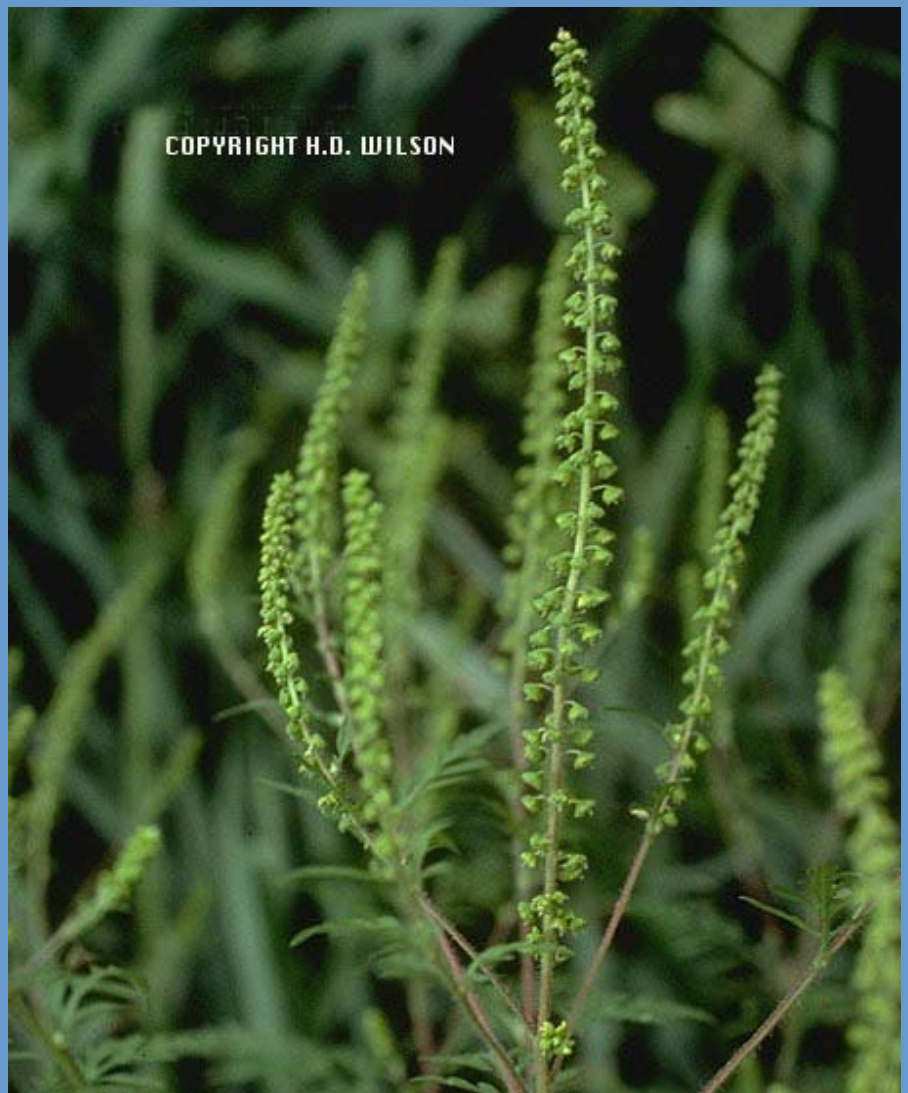

IONA 3
Cs-137 (pCi/kg)
-1000
0
1000
2000
3000
4000
5000
6000
0
5
10
15
20
25
30



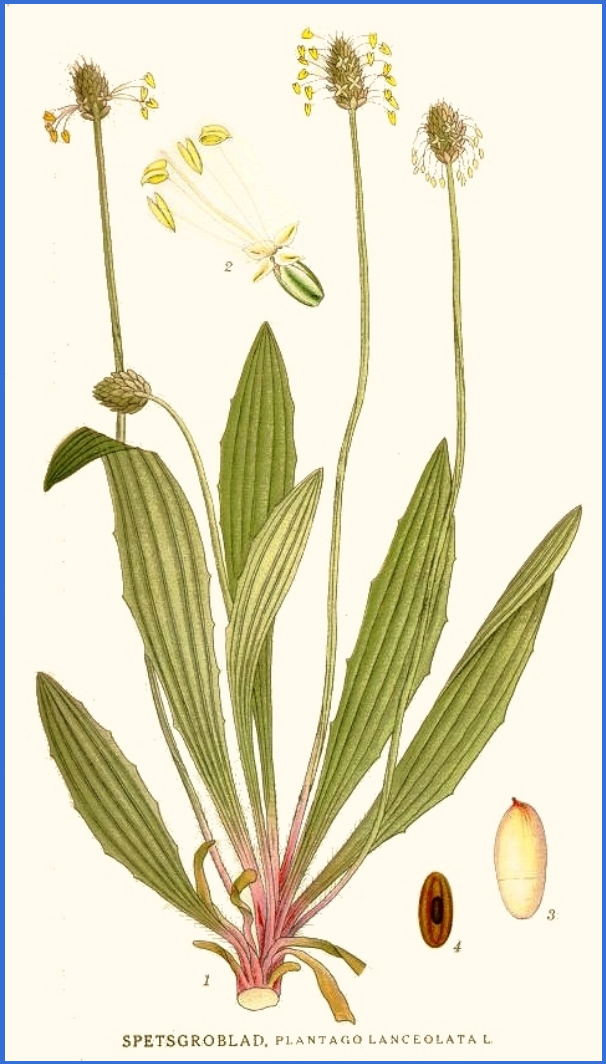
D. Peteet, analyst

Ragweed (*Ambrosia*)



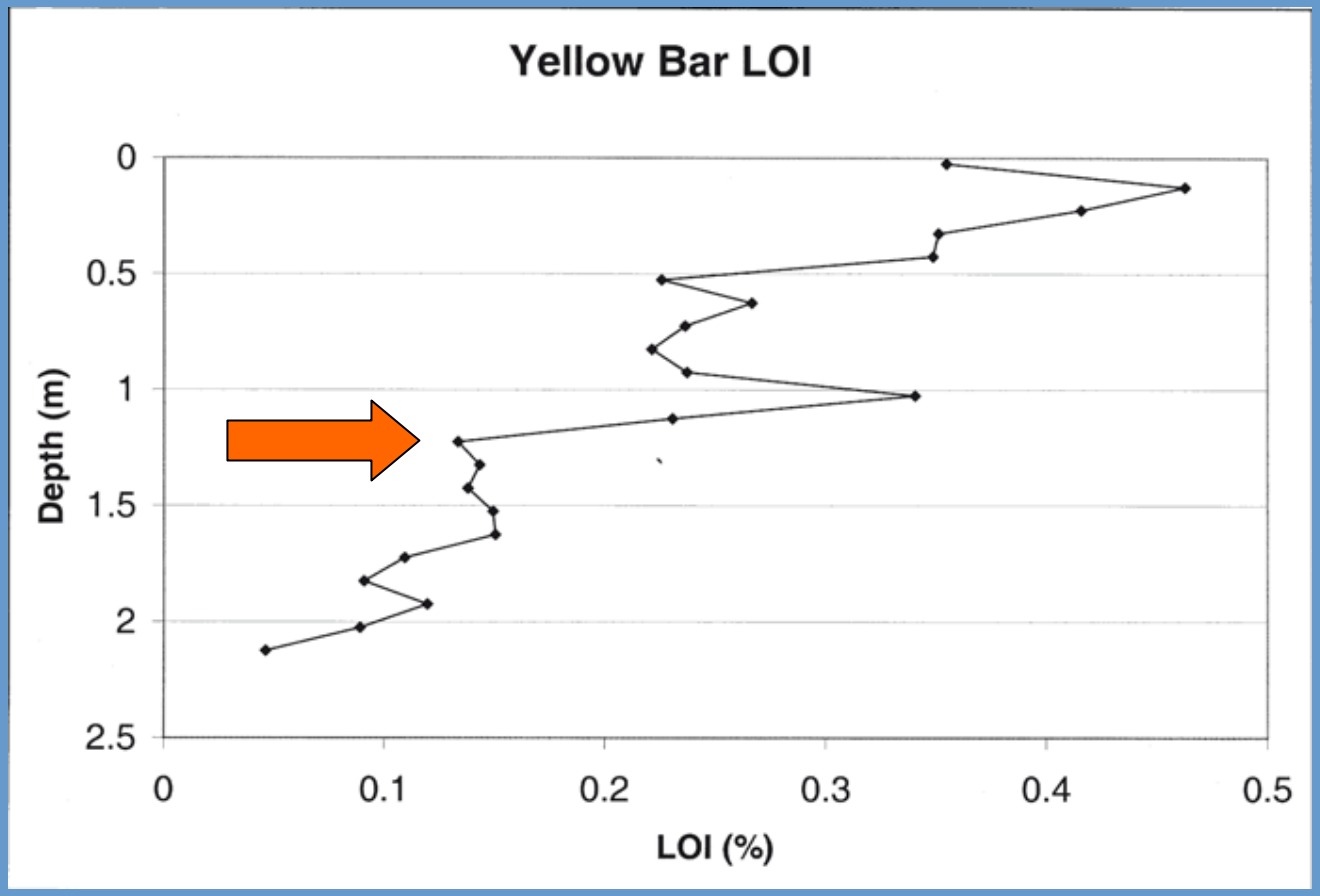


Plantago lanceolata

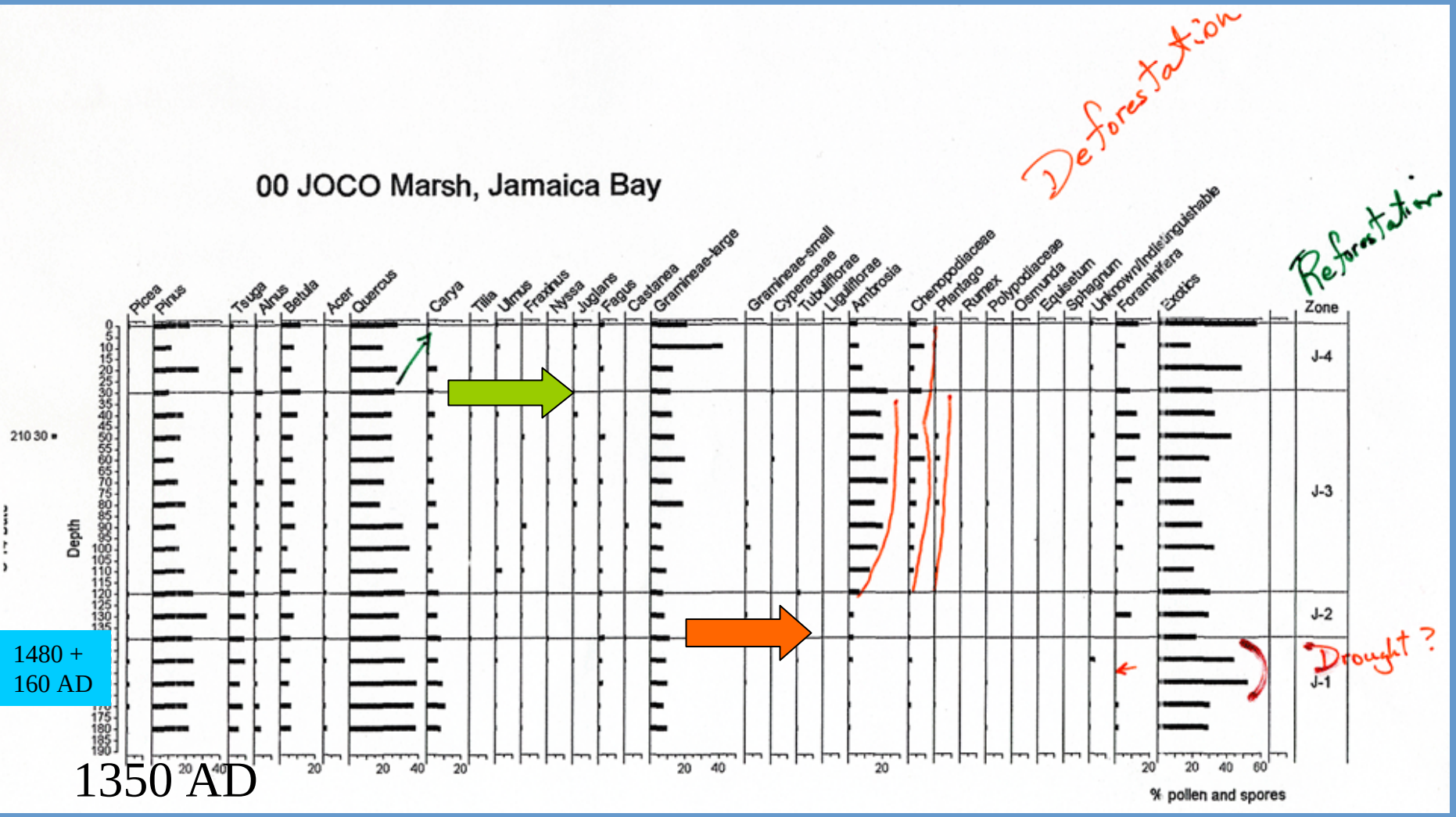


Rumex acetosella

Chenopodium album
(goosefoot)

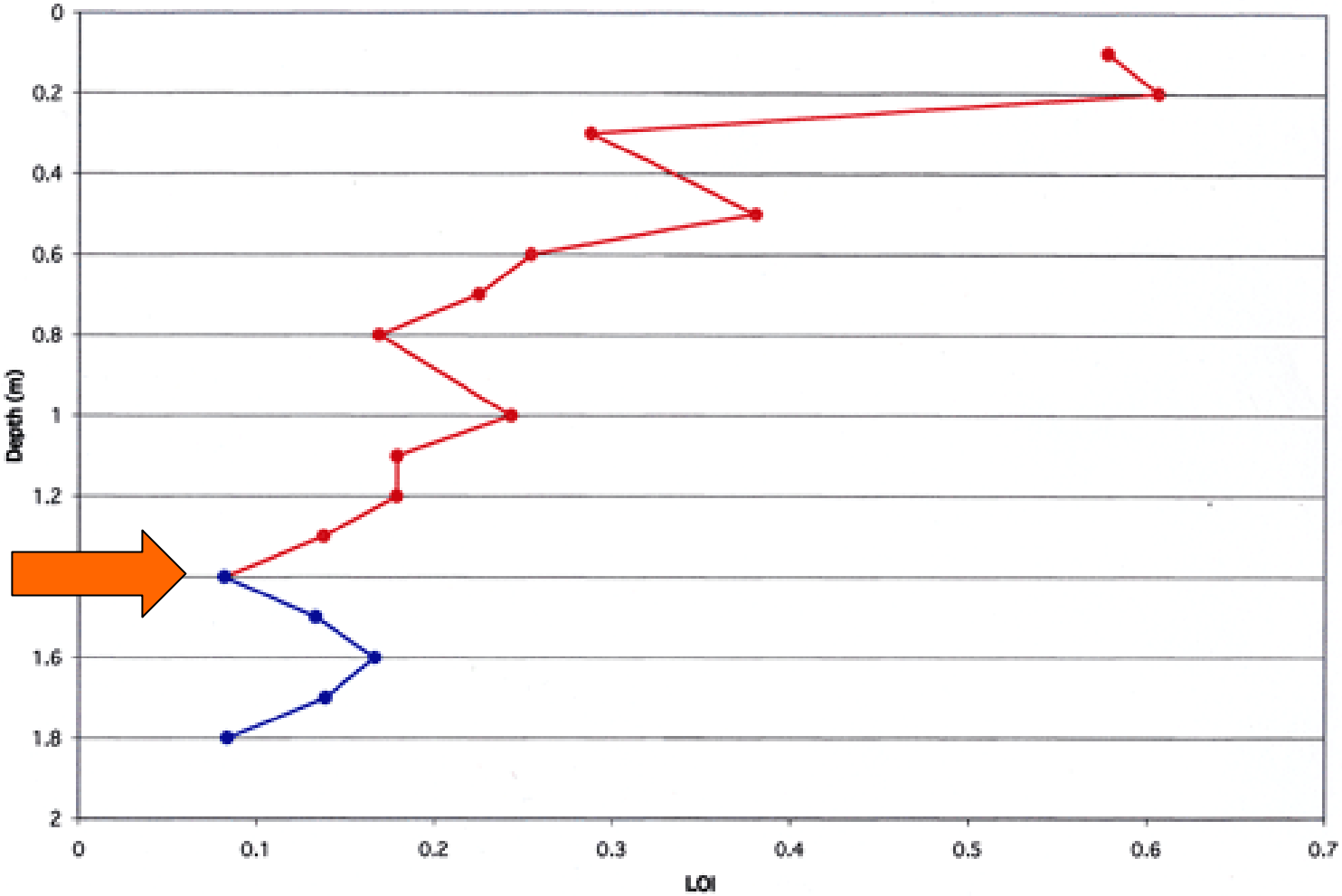


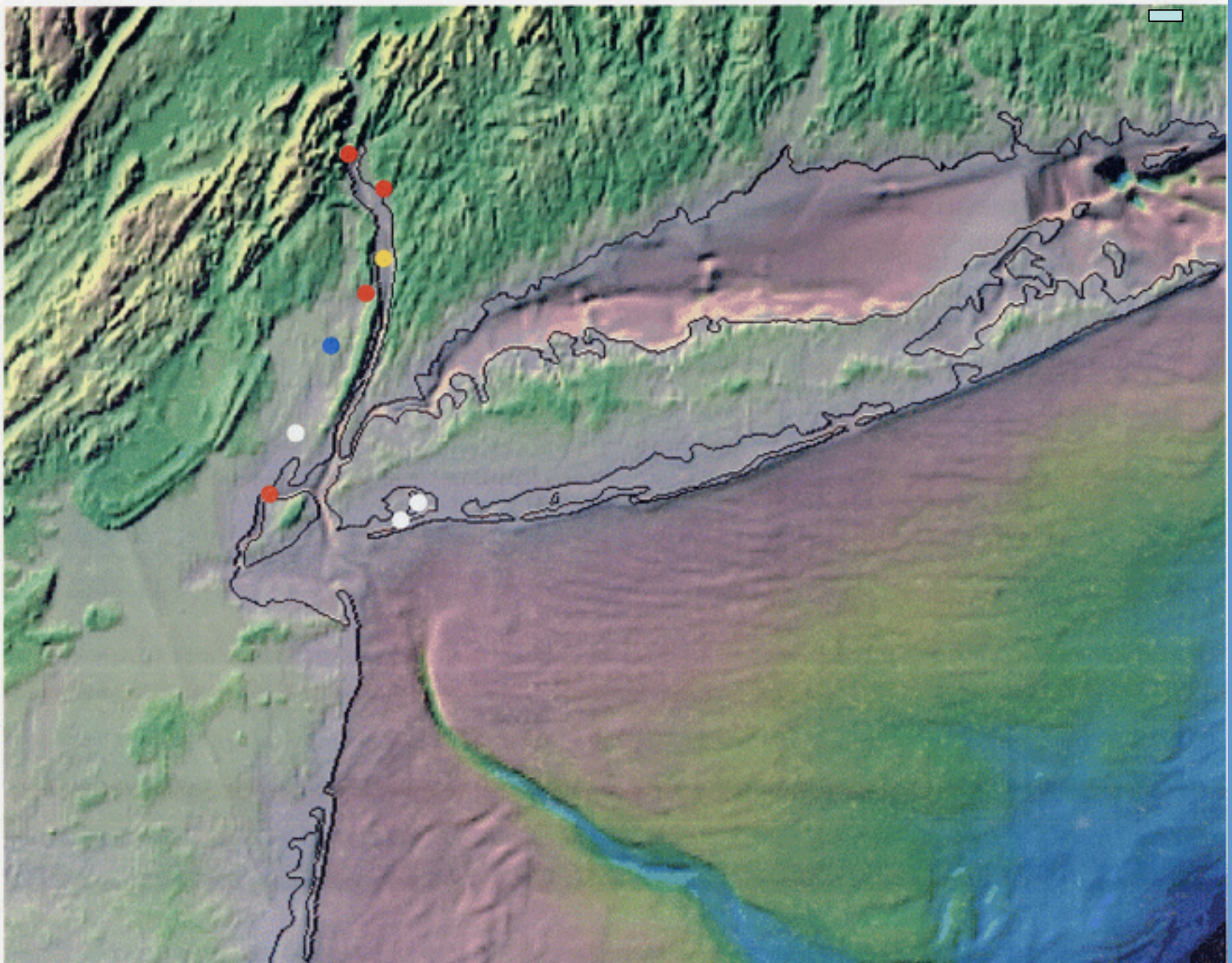
European impact



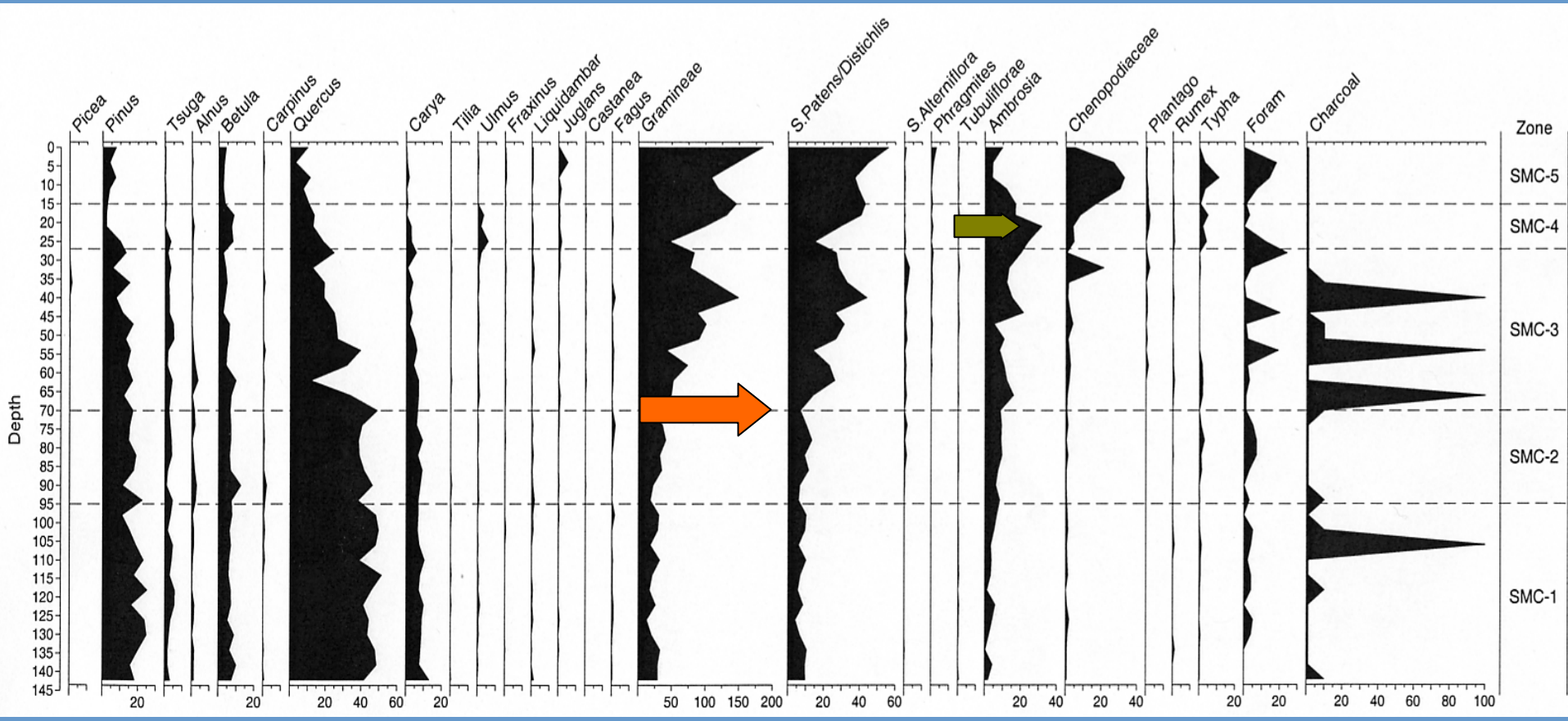
D. Peteet, analyst

Joco





Sawmill Creek, Staten Island

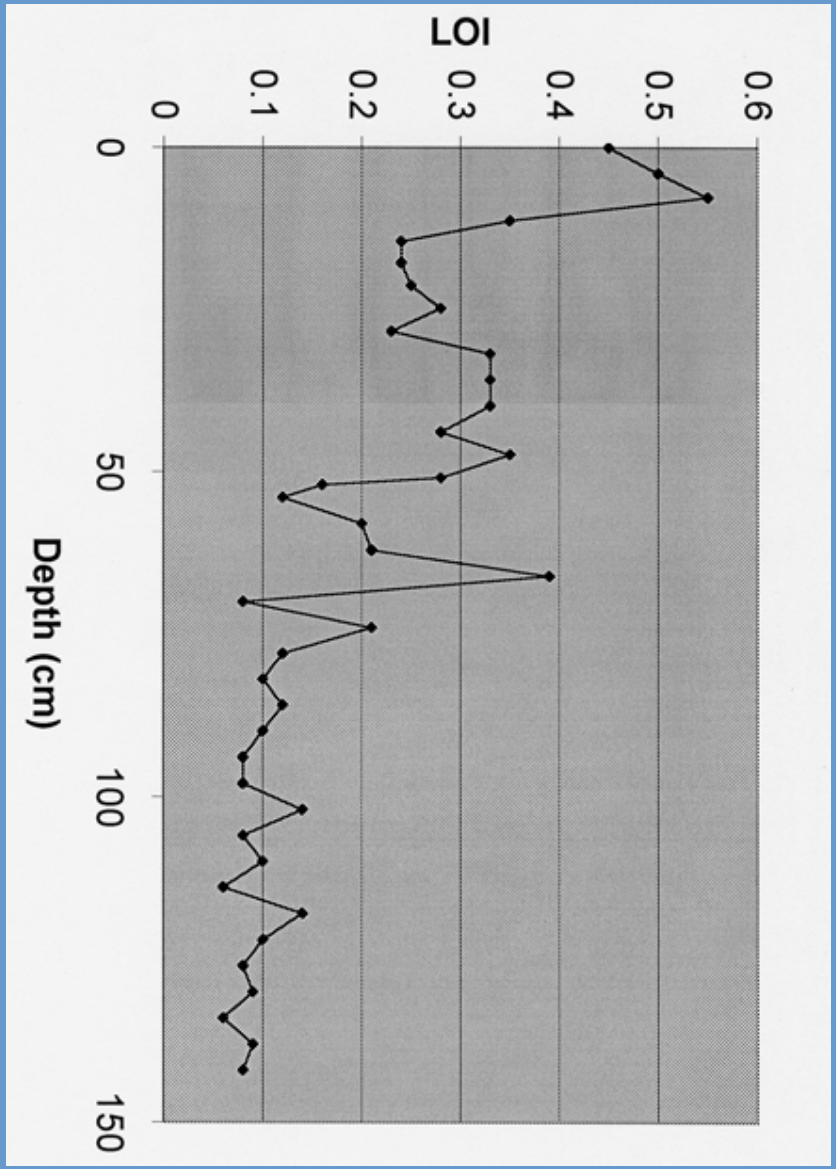


360 + 60 C-14, 1694 calendar

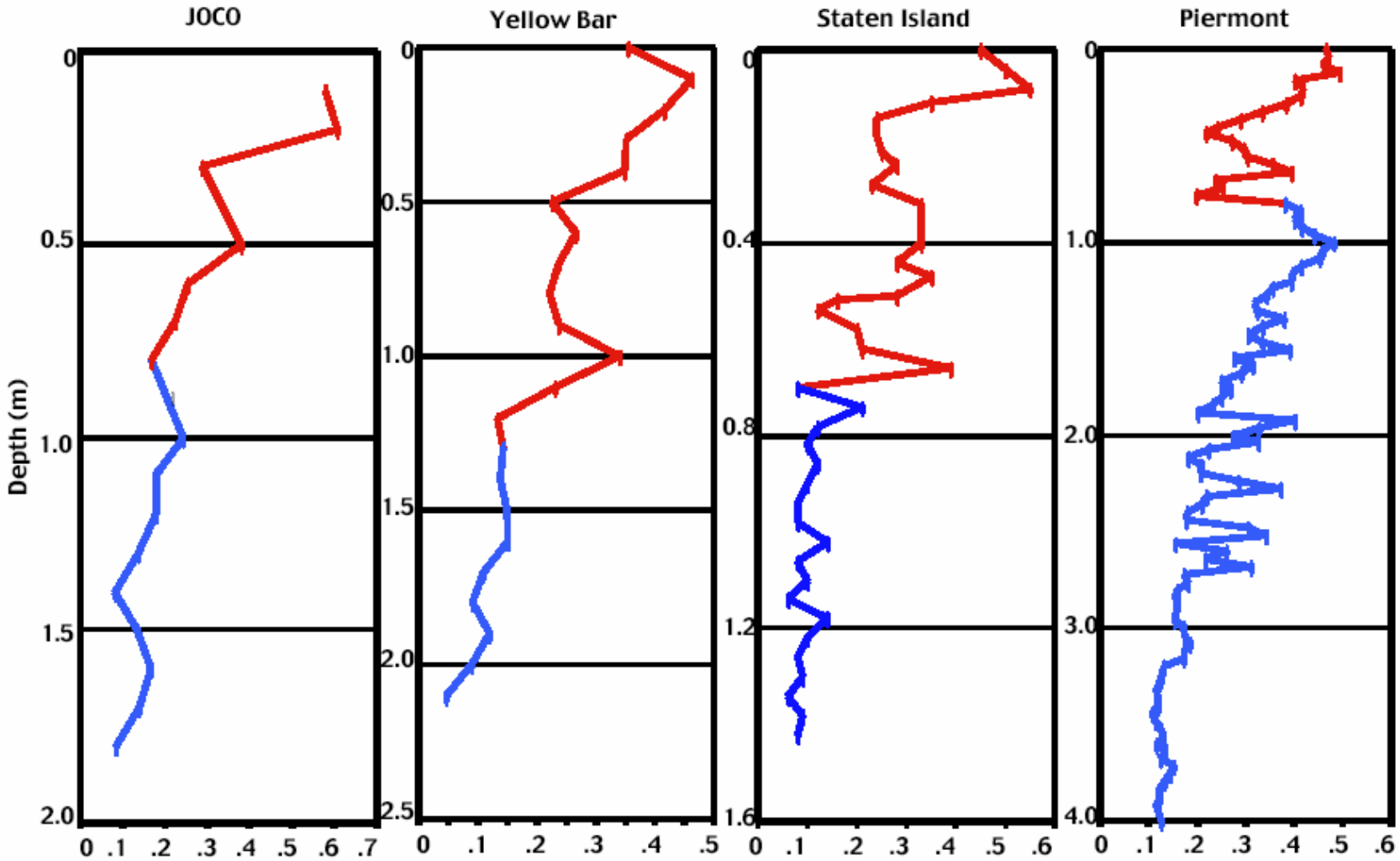
D. Kleinstein, analyst

Sawmill Creek,
Staten Island

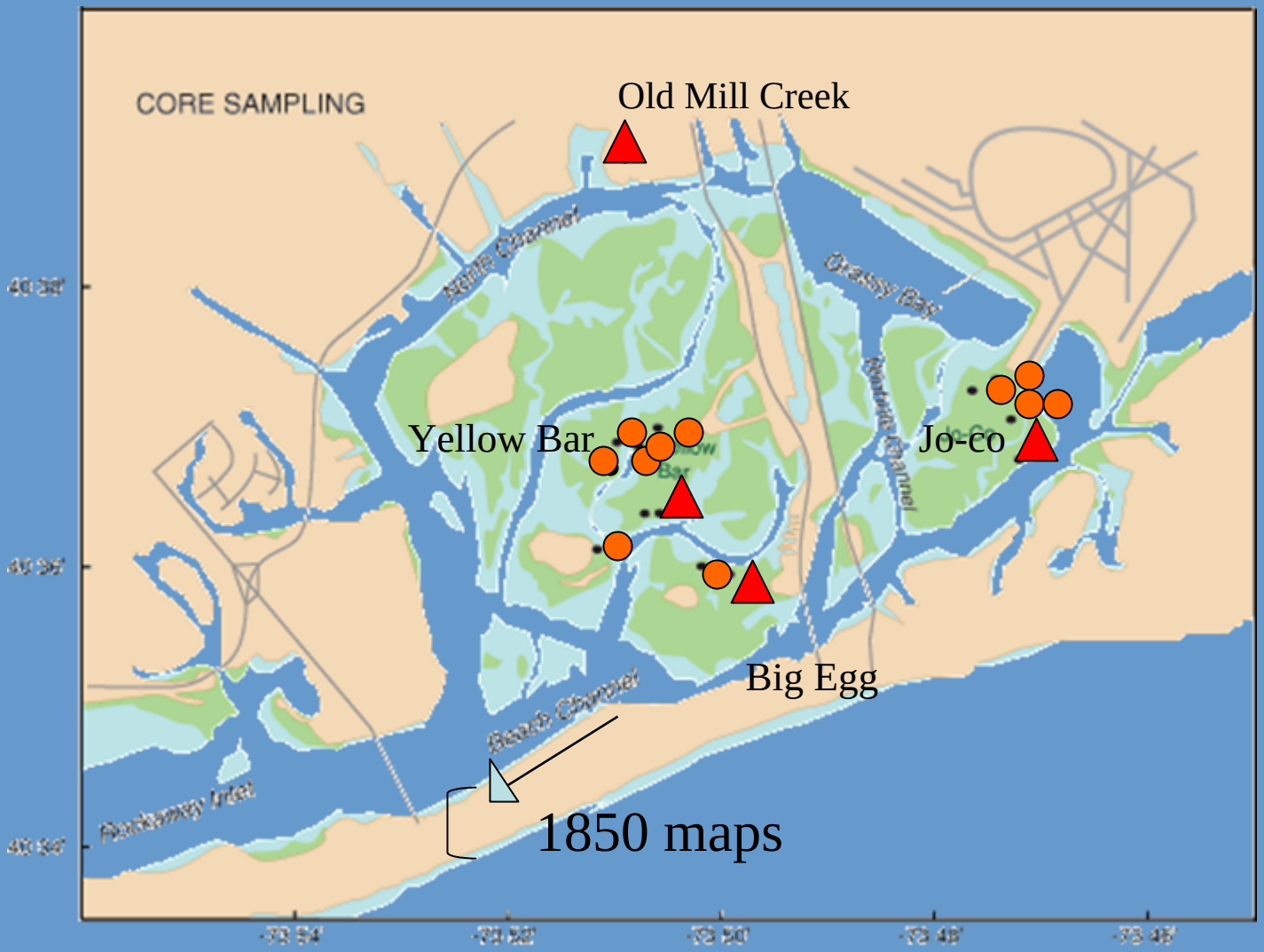
European
Impact



Loss-on-ignition



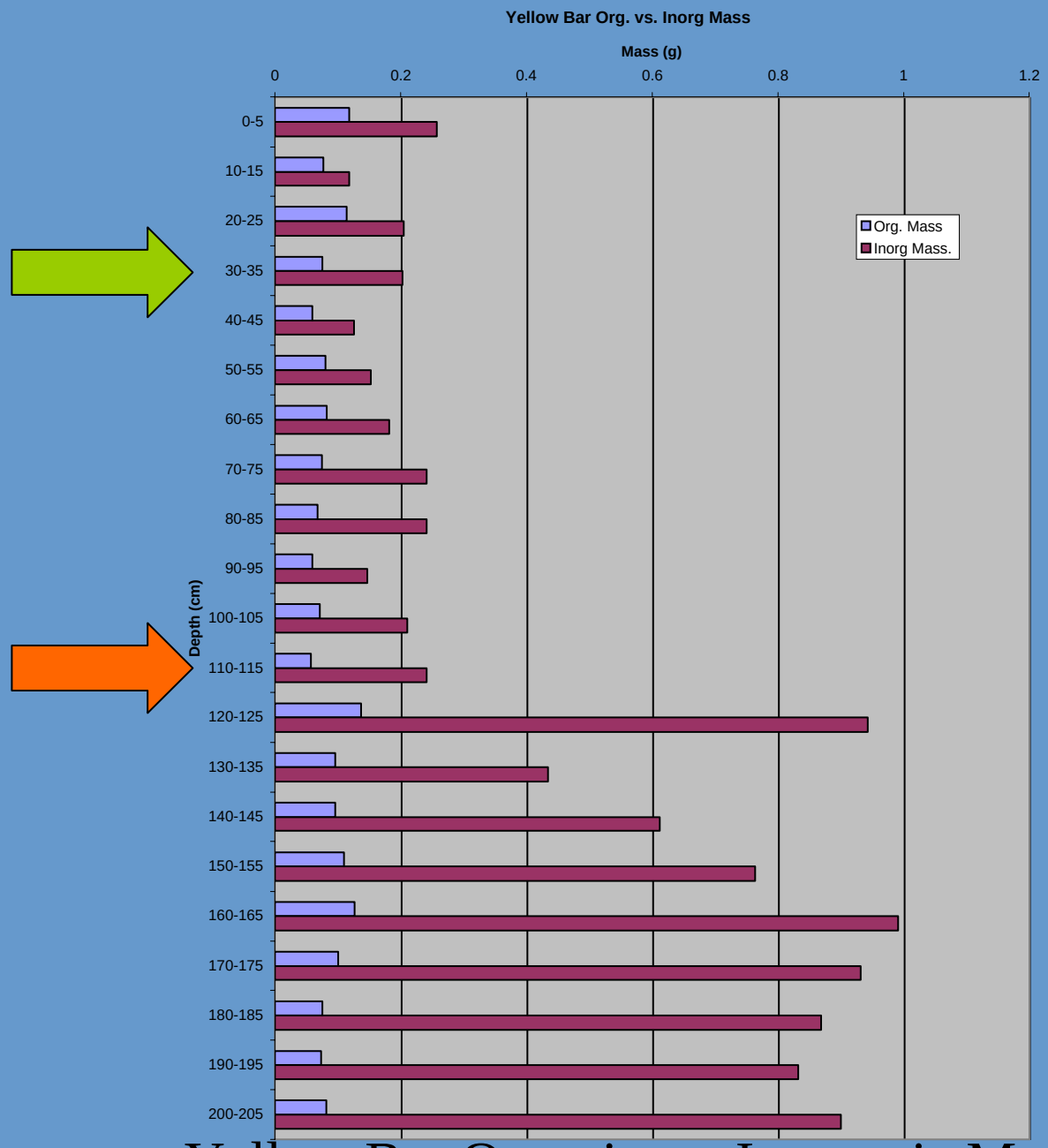
Jamaica Bay Core Sites



Yellow Bar, Jamaica Bay

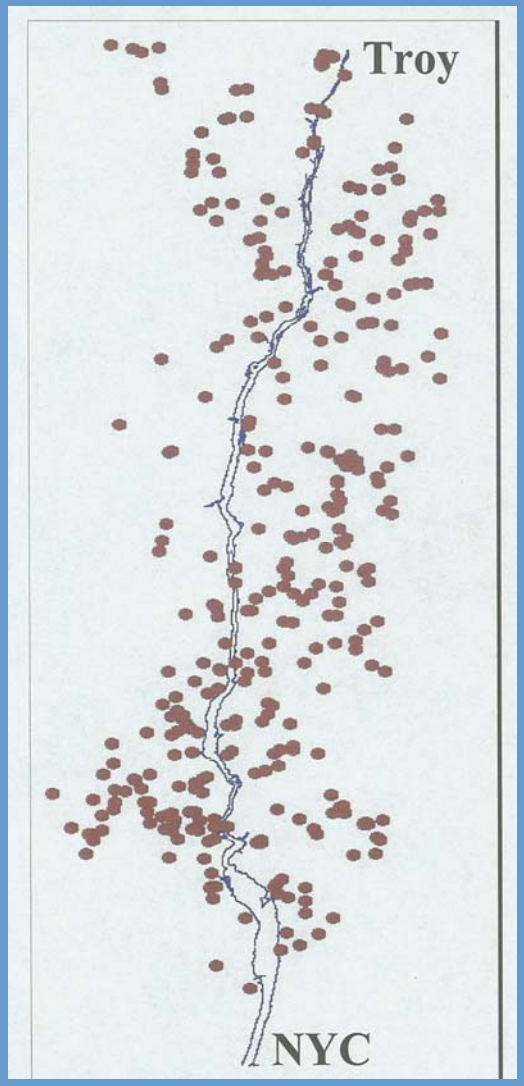
Habitat Loss

Spartina alterniflora, **grass**



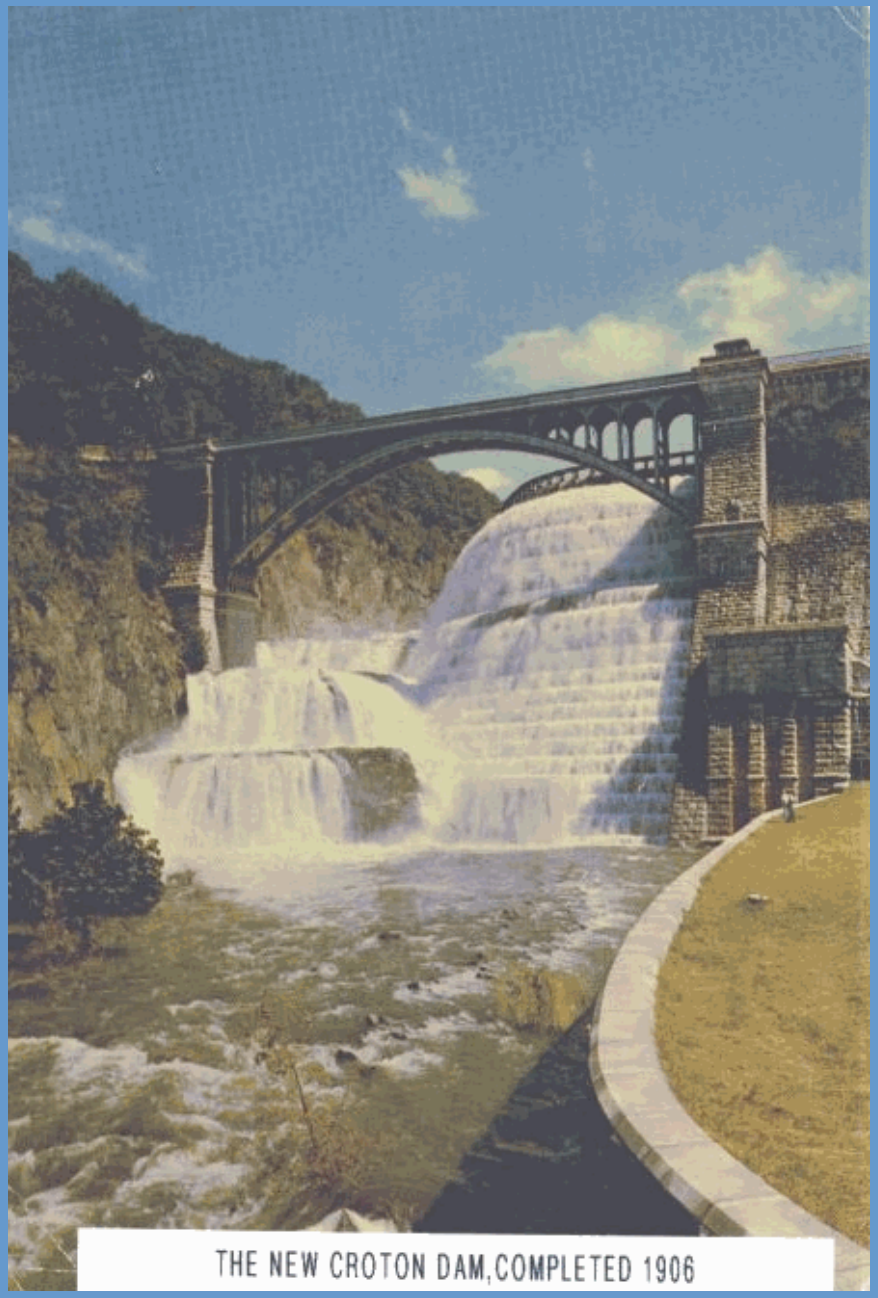
Note range

Yellow Bar Organic vs. Inorganic Mass (g)



Hudson Watershed Dams
2005

Karen Limburg, IES



THE NEW CROTON DAM, COMPLETED 1906

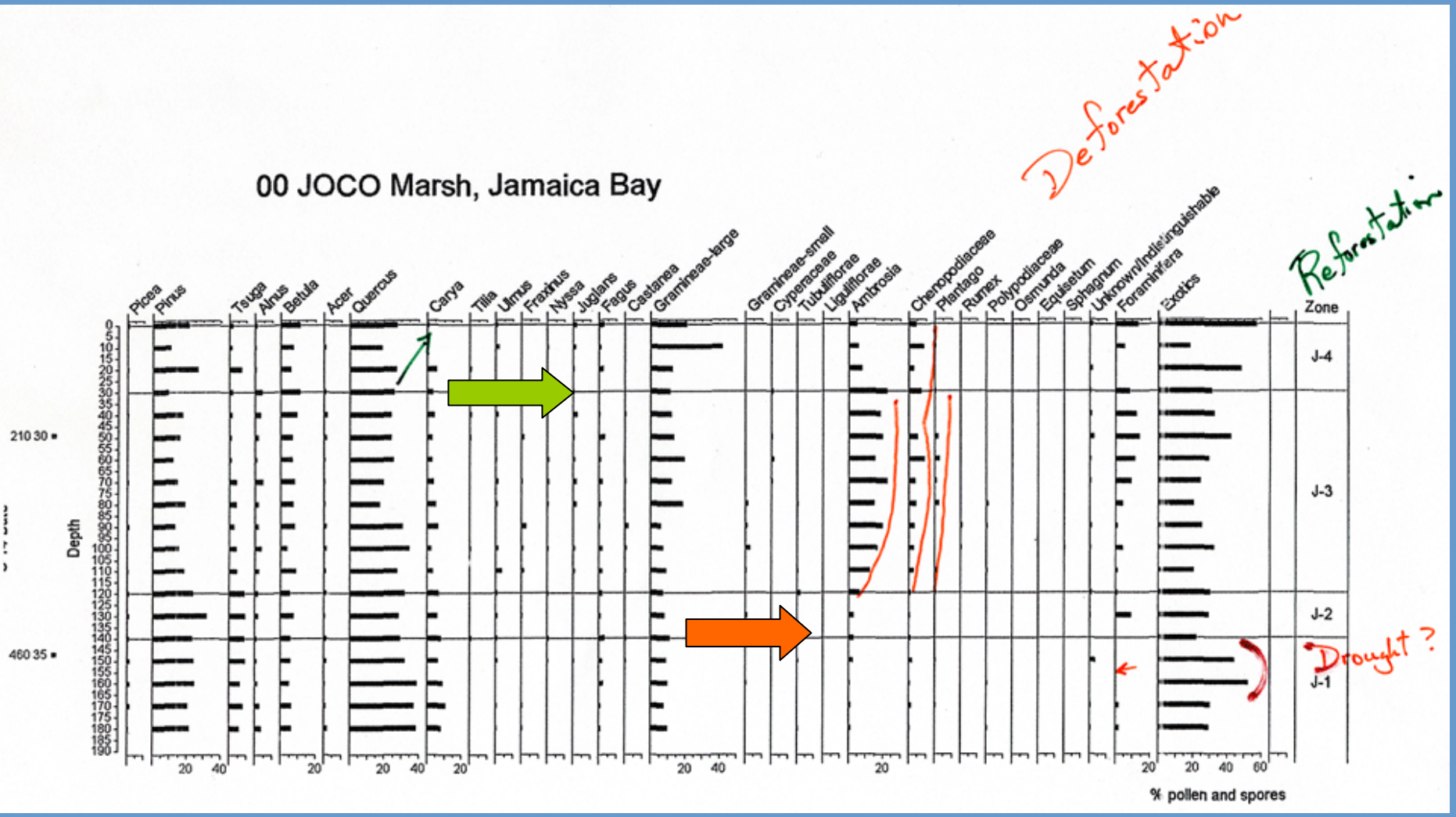
Yellow Bar

A) Inorganic mass declines dramatically with European impact

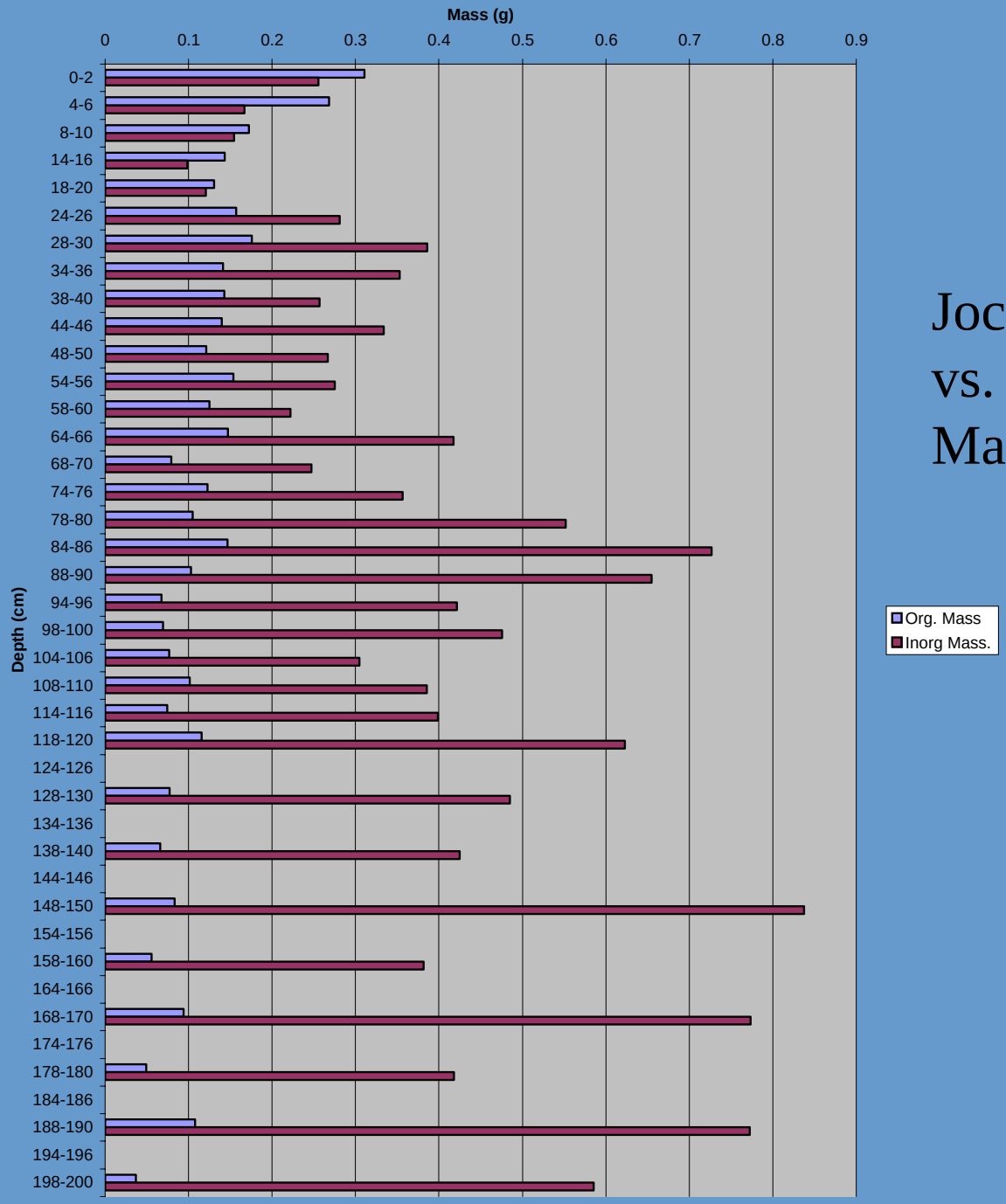
B) Organic mass is slightly higher prior to European impact, then declines

C) 20th Century resumption,

Absence of haying???



D. Peteet, analyst



Joco Organic vs. Inorganic Mass (g)

Note: Inorg. 1/3 -1/2 YB

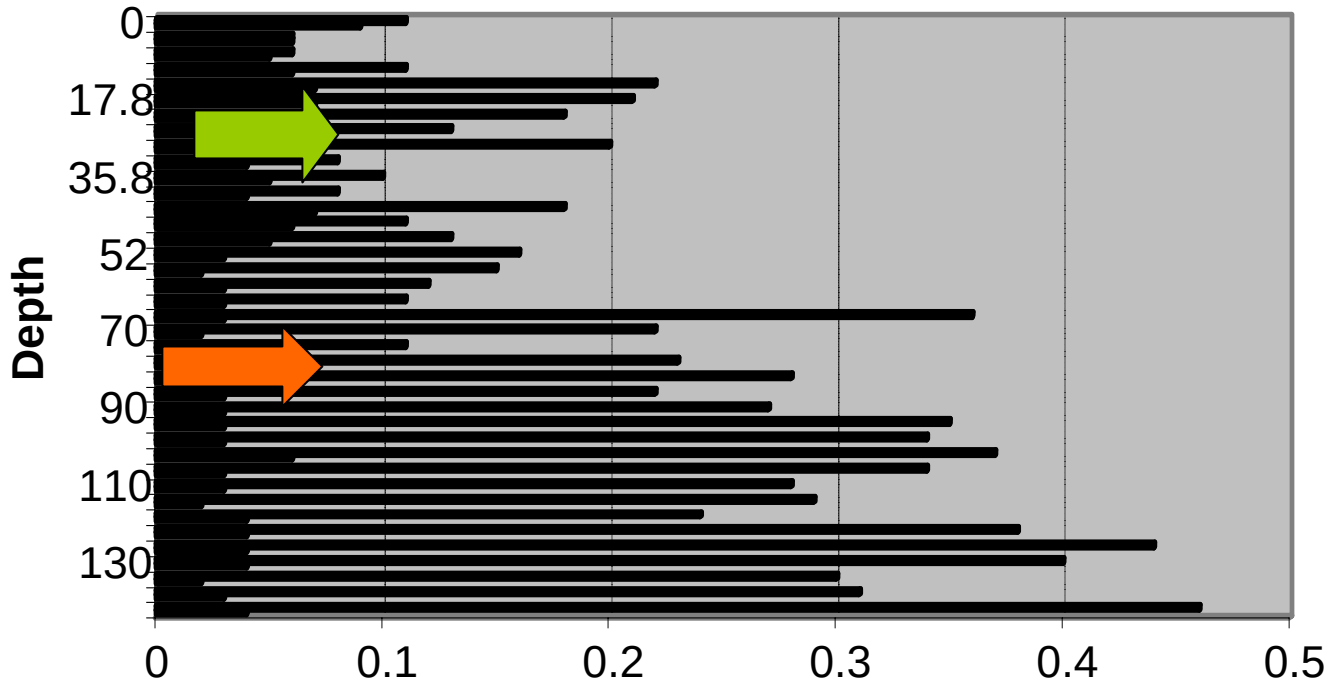
Joco Marsh

A) Major inorganic decline with European impact, but large fluctuations

B) Gradual increase in organic mass over time

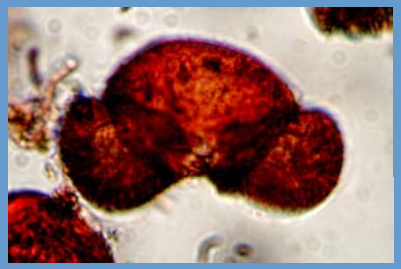
C) Increase in twentieth century

Sawmill Creek, Staten Island



LOI
(g/cc)

Conclusions



Cores from Yellow Bar, JoCo, Big Egg, and Old Mill Creek indicate that Jamaica Bay marshes formed less than a millennium ago, probably due to westward movement of Rockaway Spit that provided protection.

Forests prior to European impact were comprised of more oak, white pine, hickory, and hemlock than today. Minor components were elm, beech, and sweetgum.

Disturbance of the forests and landscape when Europeans arrived is indicated by increases in weedy plants such as ragweed, plantain, and goosefoot.

Conclusions, cont.

Percent of organic matter in the Hudson marshes since European impact increases by a factor of five, probably caused by the sharp decline in upland inorganics. Reasons include dams, millponds.

Significant variability in organic/inorganic composition between YB and Joco over centuries reflects high marsh/low marsh environments

0-1m, Saw Mill Creek, SI

Ongoing Questions

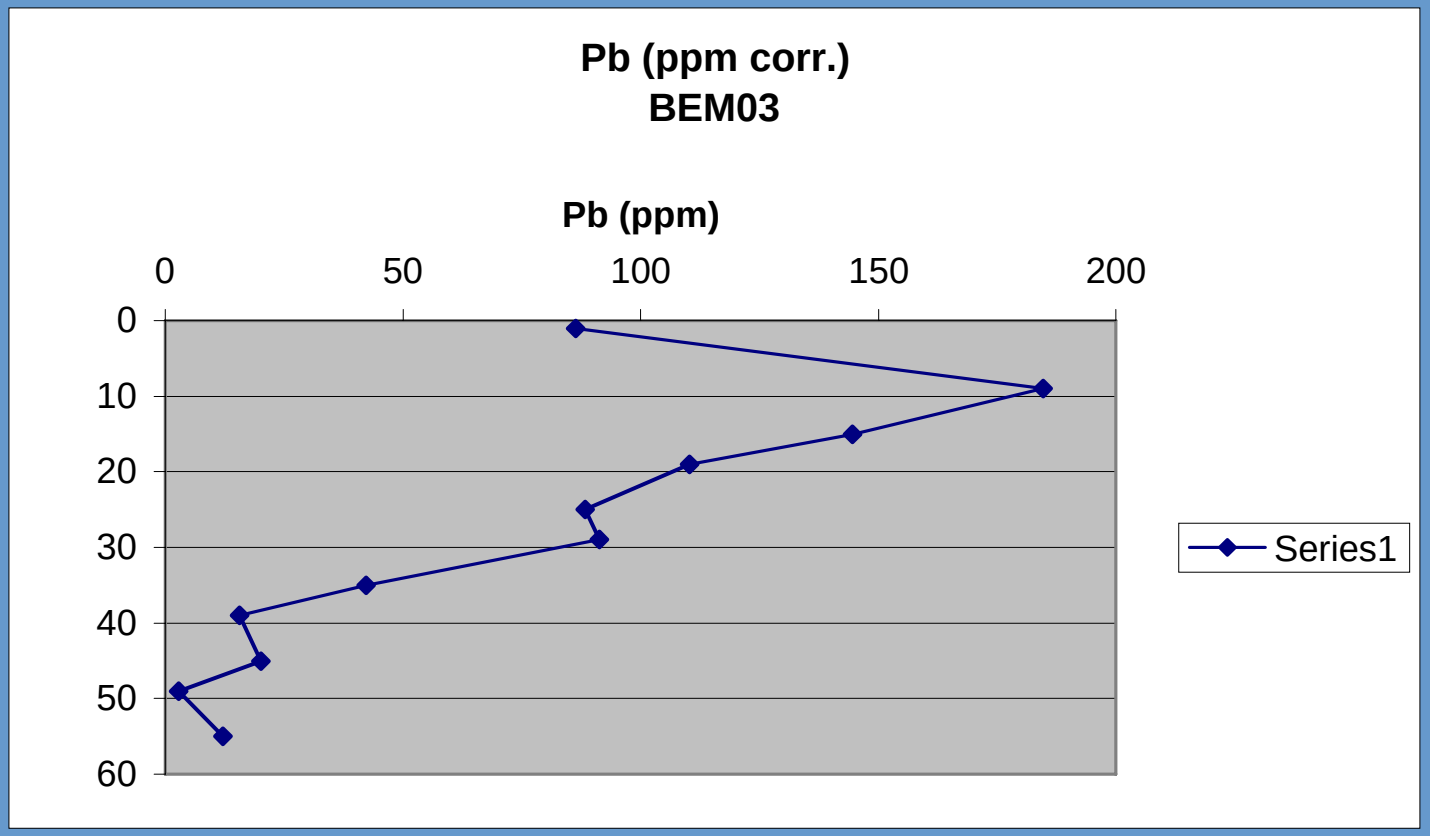
Isotopes - C-13, N-15

Elements & Metals

C/N ratios

C sequestration

Other sites - Big Egg, Old Mill Creek



Pb in Big Egg Marsh, showing pollution in upper portion of marsh

1626 Engraving

THE FIRST KNOWN PICTURE OF NEW AMSTERDAM, MADE AROUND 1626 BY CYRN FREDERICKSZ FOR THE DUTCH WEST INDIA COMPANY. THE PICTURE IS REVERSED BECAUSE THE ORIGINAL ENGRAVING WAS PROBABLY MADE WITH THE AID OF A *CAMERA OBSCURA*, WHICH PRODUCED AN INVERTED IMAGE. THE CORRECT VIEW WITH GOVERNORS ISLAND AT THE LEFT AND THE MILL ON THE WEST SHORE OF MANATTAN IS OBTAINED BY LOOKING AT THE PICTURE IN A MIRROR. *PHOTOGRAPH COURTESY OF THE J. CLARENCE DAVIES COLLECTION, THE MUSEUM OF THE CITY OF NEW YORK*

Bolton, 1934