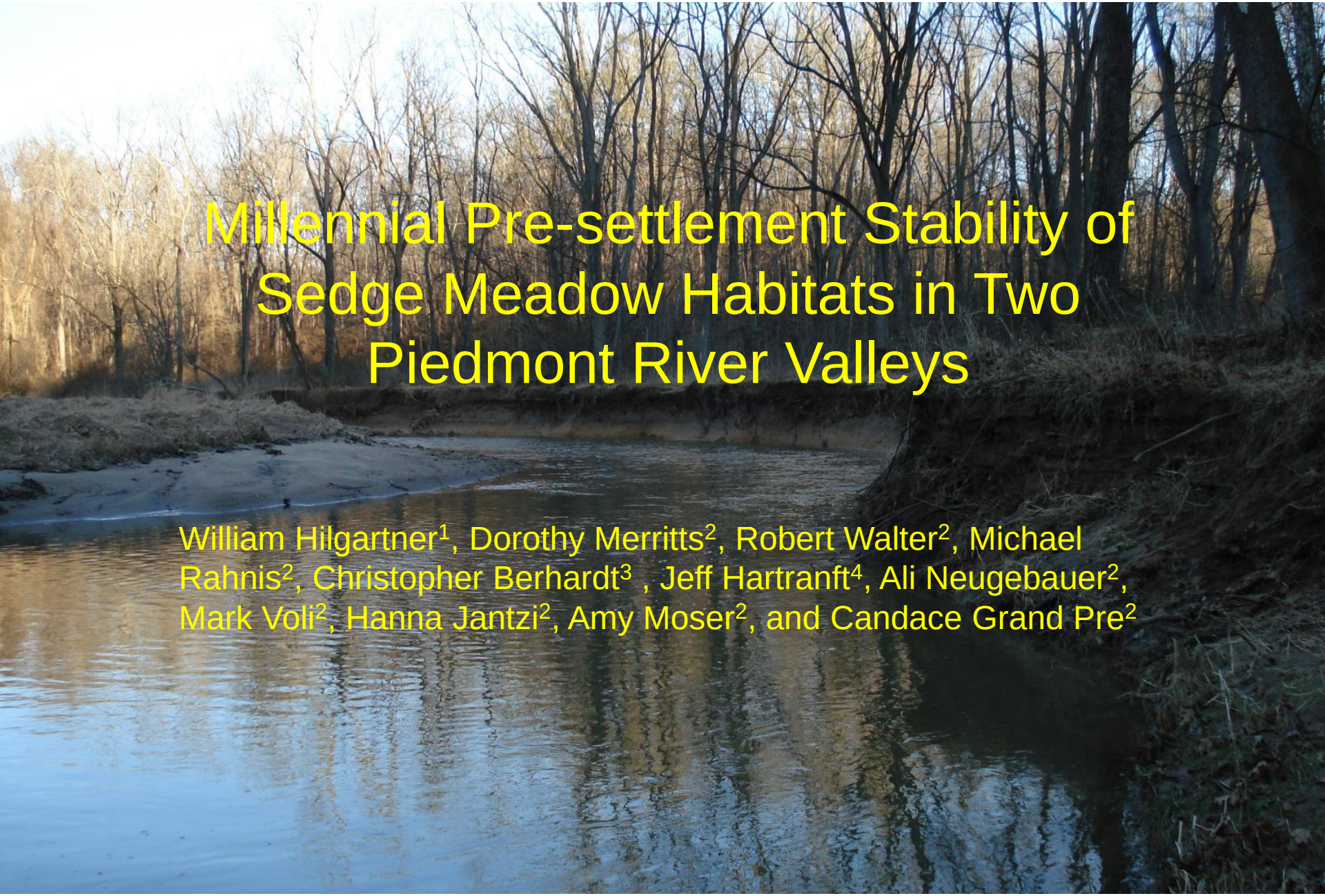
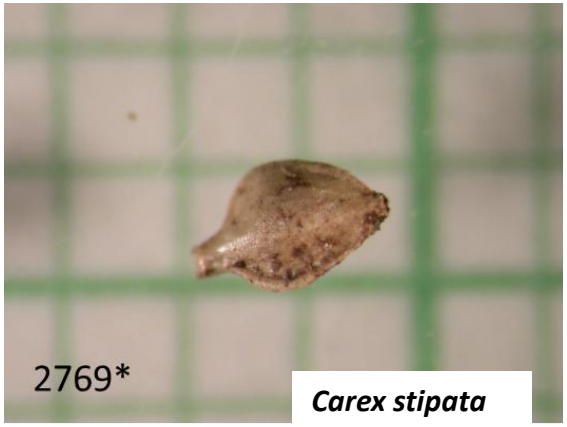
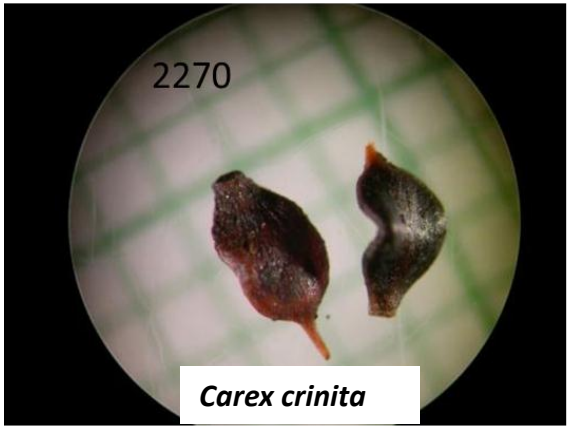


Millennial Pre-settlement Stability of Sedge Meadow Habitats in Two Piedmont River Valleys

William Hilgartner[1], Dorothy Merritts[2], Robert Walter[2], Michael Rahnis[2], Christopher Berhardt[3] , Jeff Hartranft[4], Ali Neugebauer[2], Mark Voli[2], Hanna Jantzi[2], Amy Moser[2], and Candace Grand Pre[2]

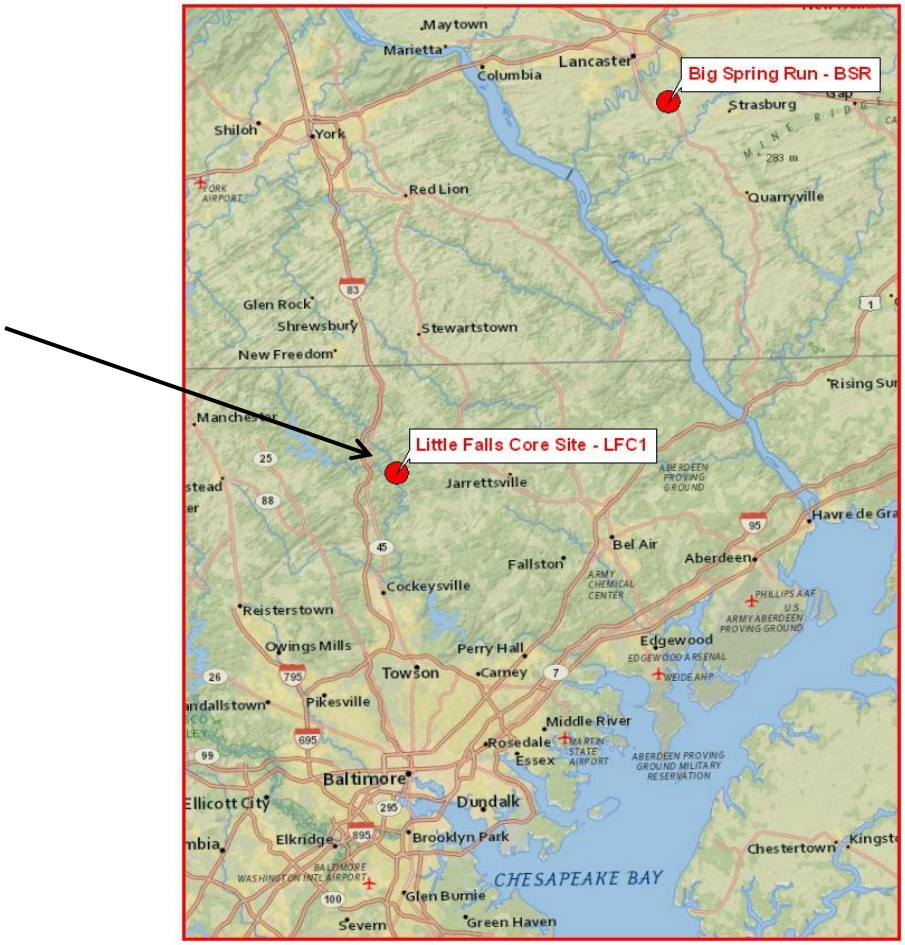
This presentation focuses on a paleoecological analysis of fossil seeds from core and river bank samples, combined with pollen analysis, geomorphic data and land use history of two river sites in Maryland and Pennsylvania

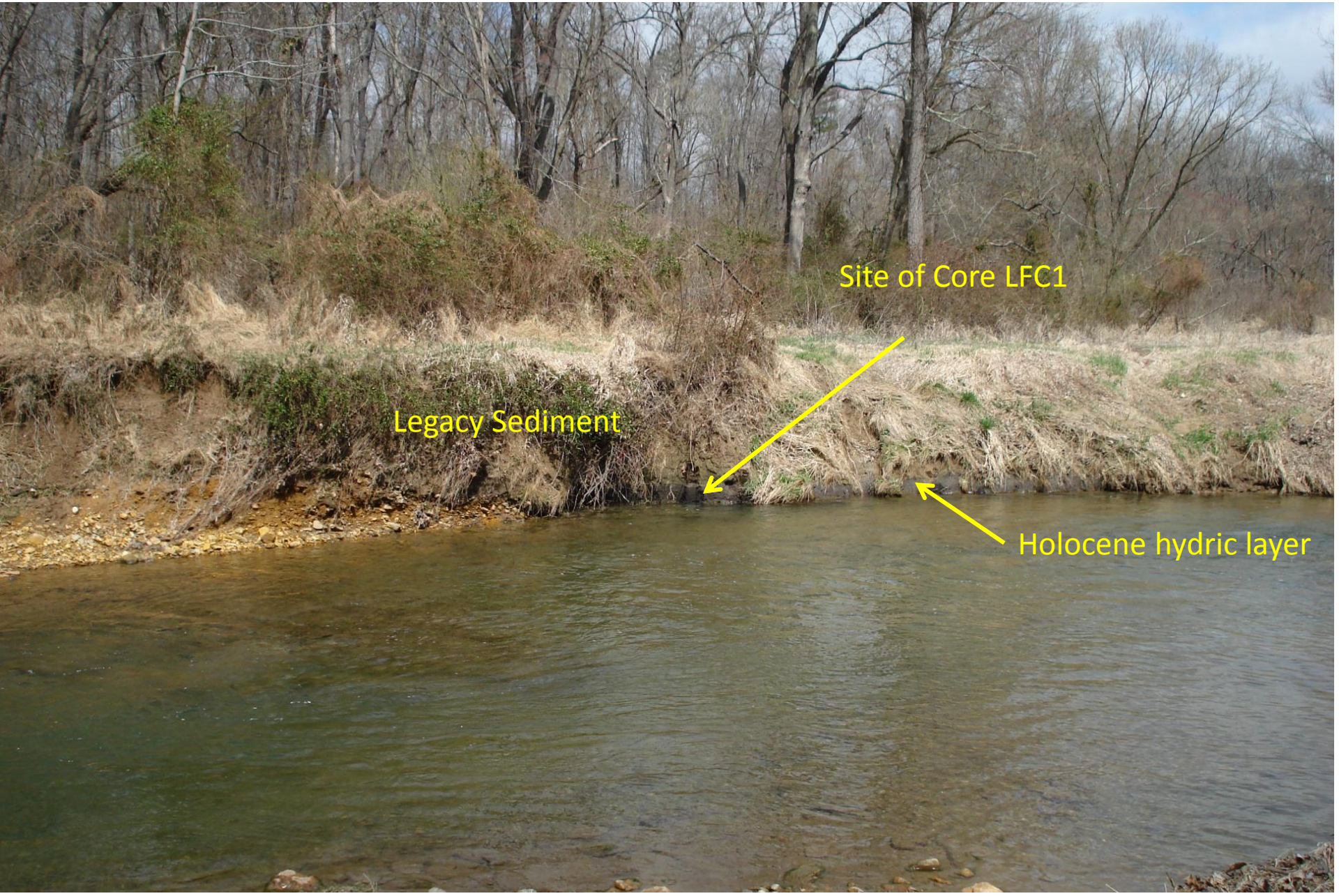




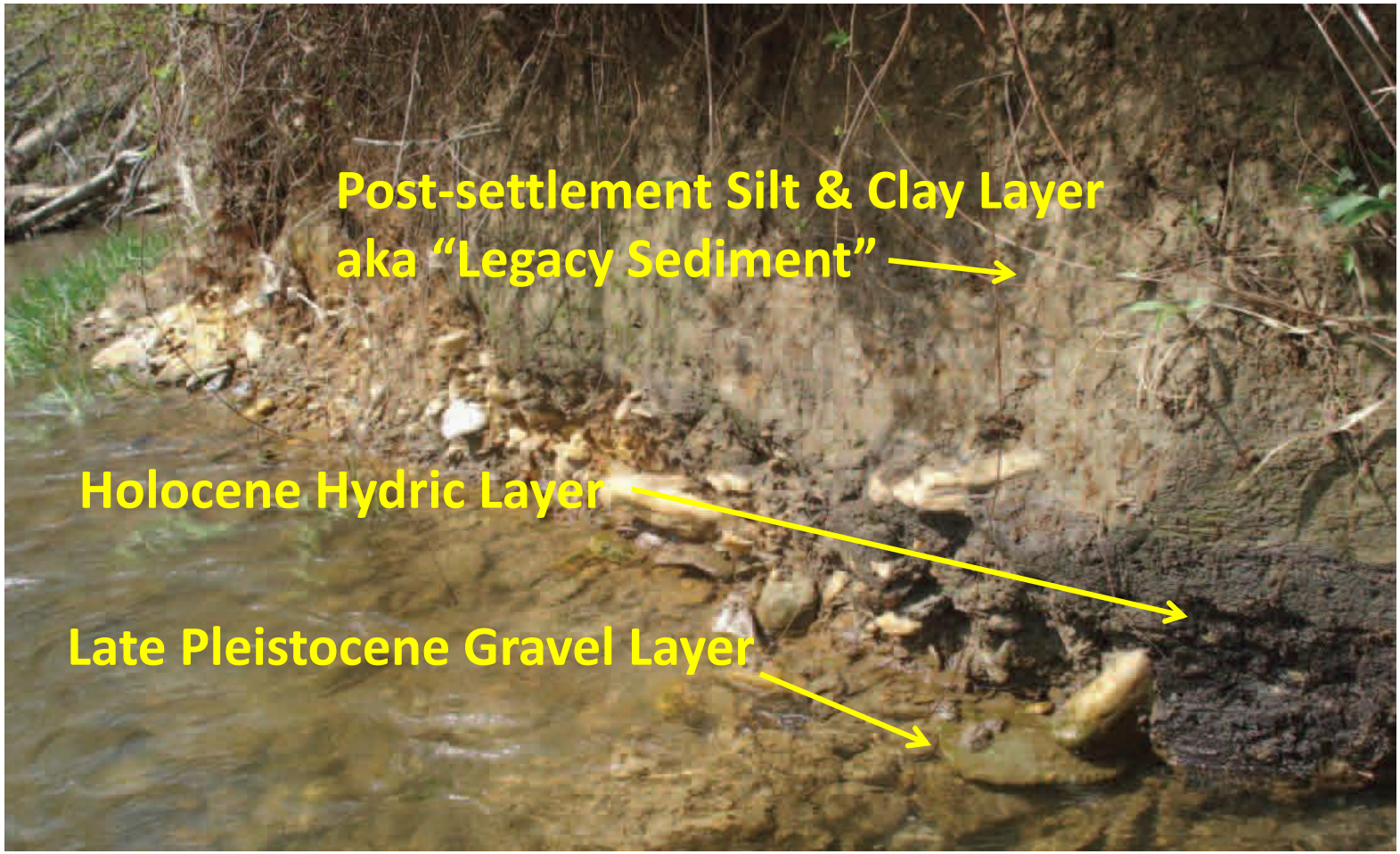
First Site:
Little Falls, northern Baltimore County, Maryland,

Little Falls, Baltimore Co., Maryland




Site of Core LFC1
Legacy Sediment
Holocene hydric layer

River Bank Stratigraphy



Core LFC 1

0 cm

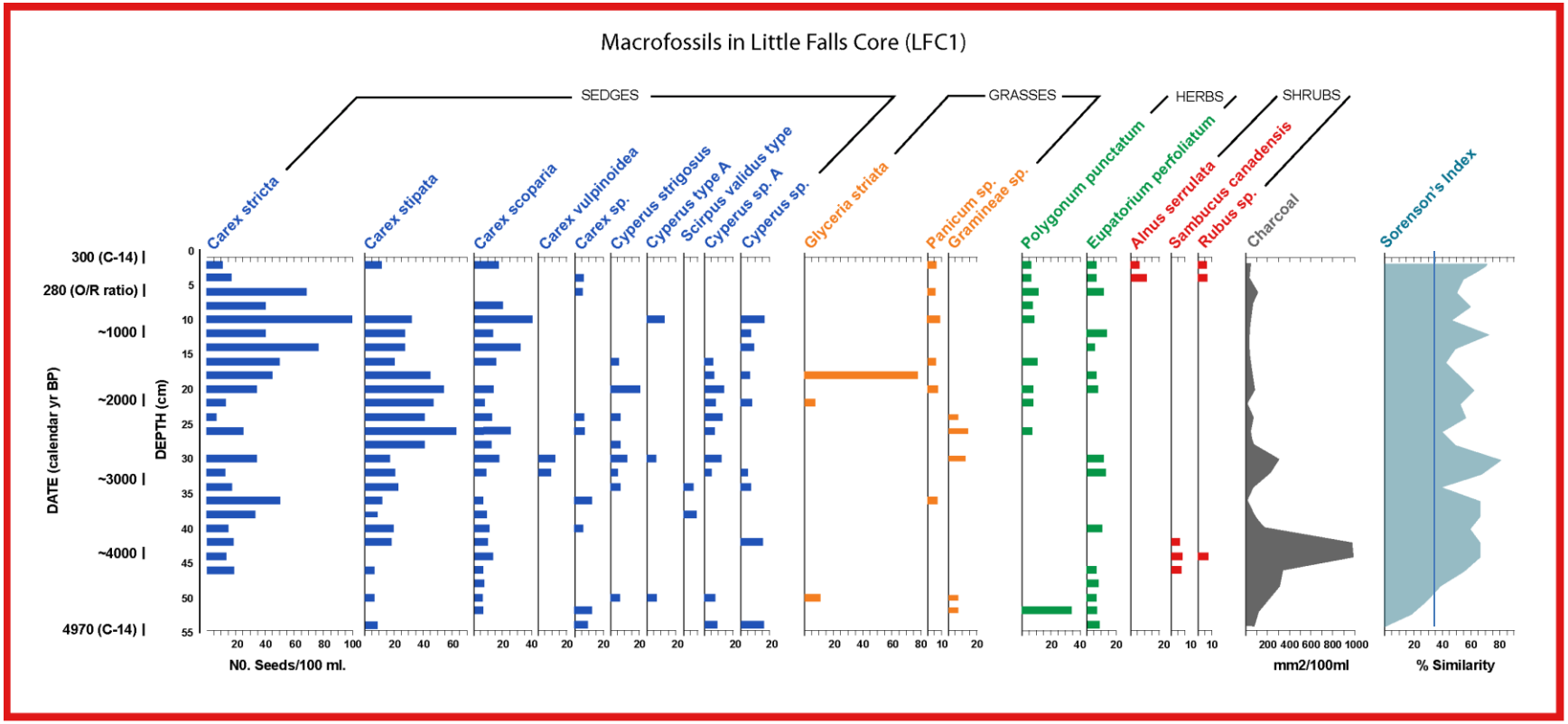
Black clay &
plant fragments
10 YR 2/1

56 cm

C-14 Date Intercept
Age = 300 yr BP

C-14 Date Intercept
Age = 4,970 yr BP

RESULTS: Macrofossil Profile LFC1

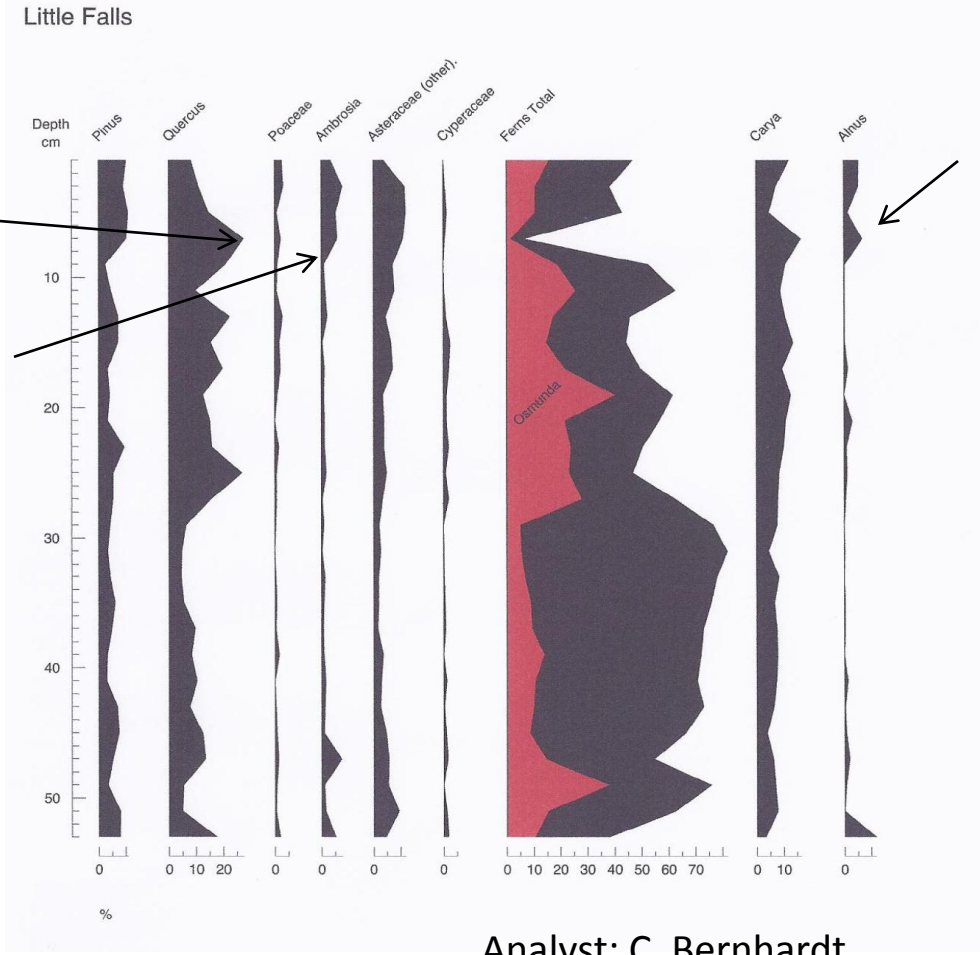


Analyst: W. Hilgartner

Pollen Profile LFC1

Oak decline

Ragweed Increase
ca. A.D. 1730



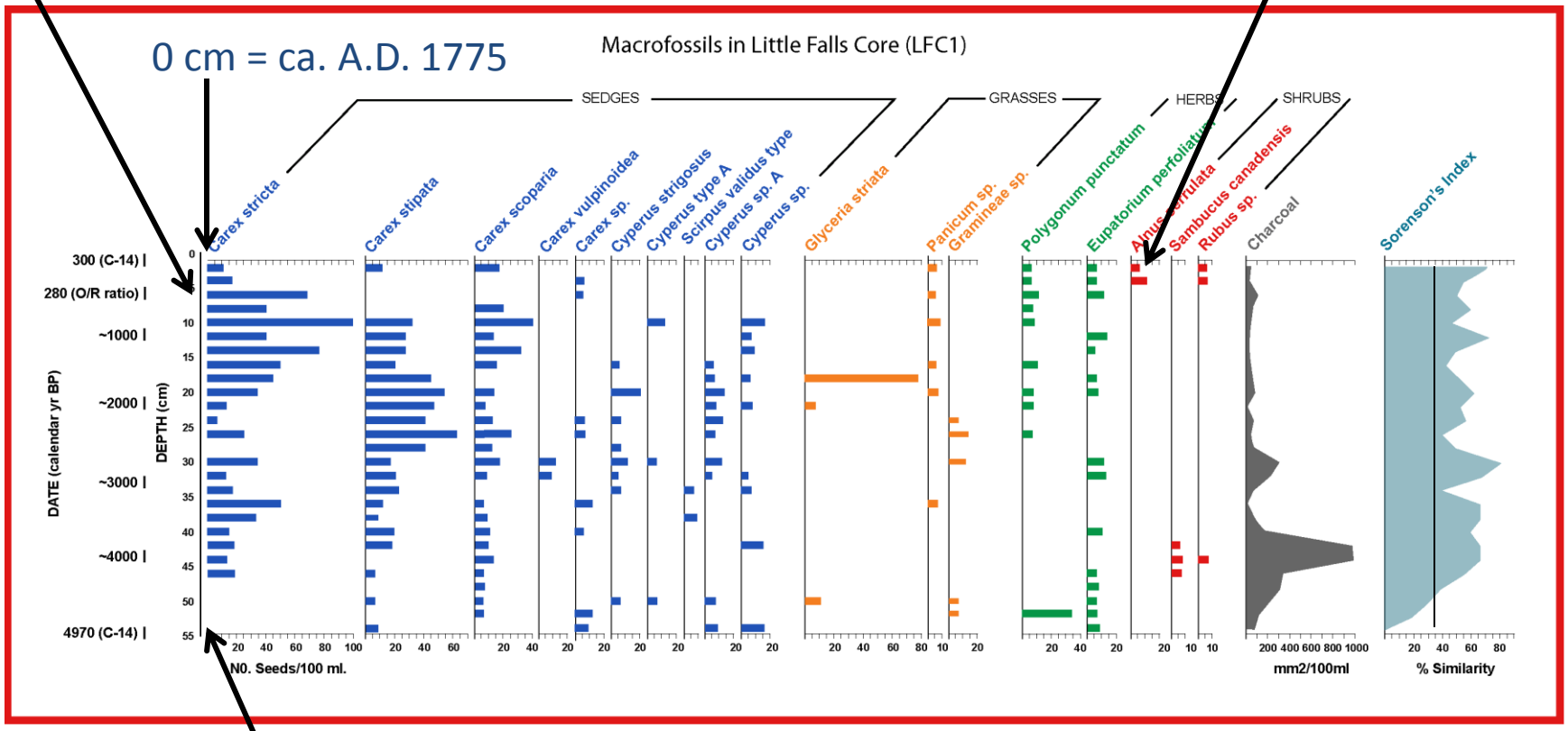
Increase in Alder

Analyst: C. Bernhardt

Ragweed Increase

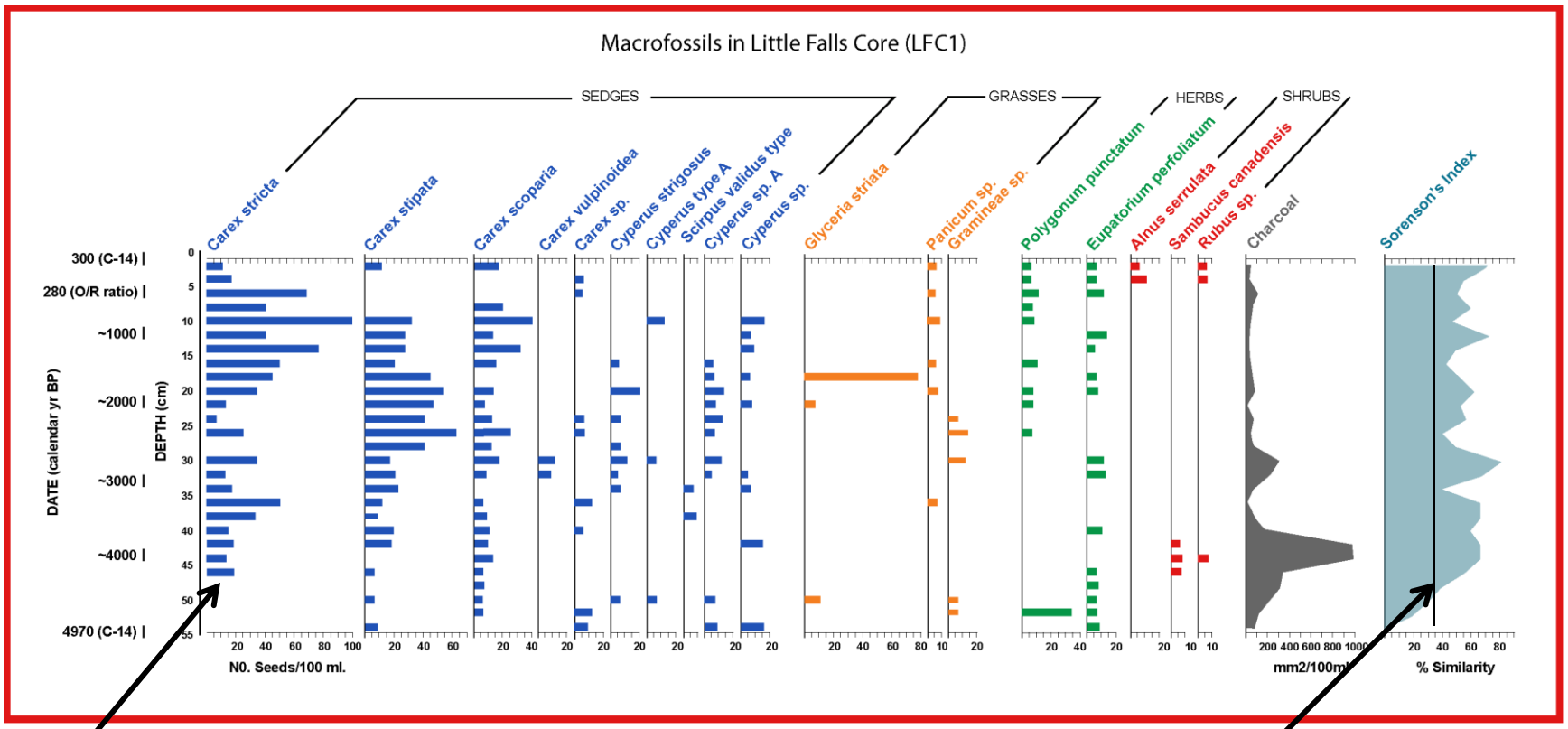
6.0 cm = ca. A.D. 1730

Alder increase



C-14 = 4970 BP

Sorensen's Index of Similarity



Initial establishment of *Carex stricta* ~4300 BP

Note: Consistent indices > 40% from 4300 BP to 1775

Results: A stable tussock sedge wetland persisted from 4300 yr BP until A.D. 1775.

Hydrology of Prehistoric Wetland at Little Falls

…Absence of paleo-channels

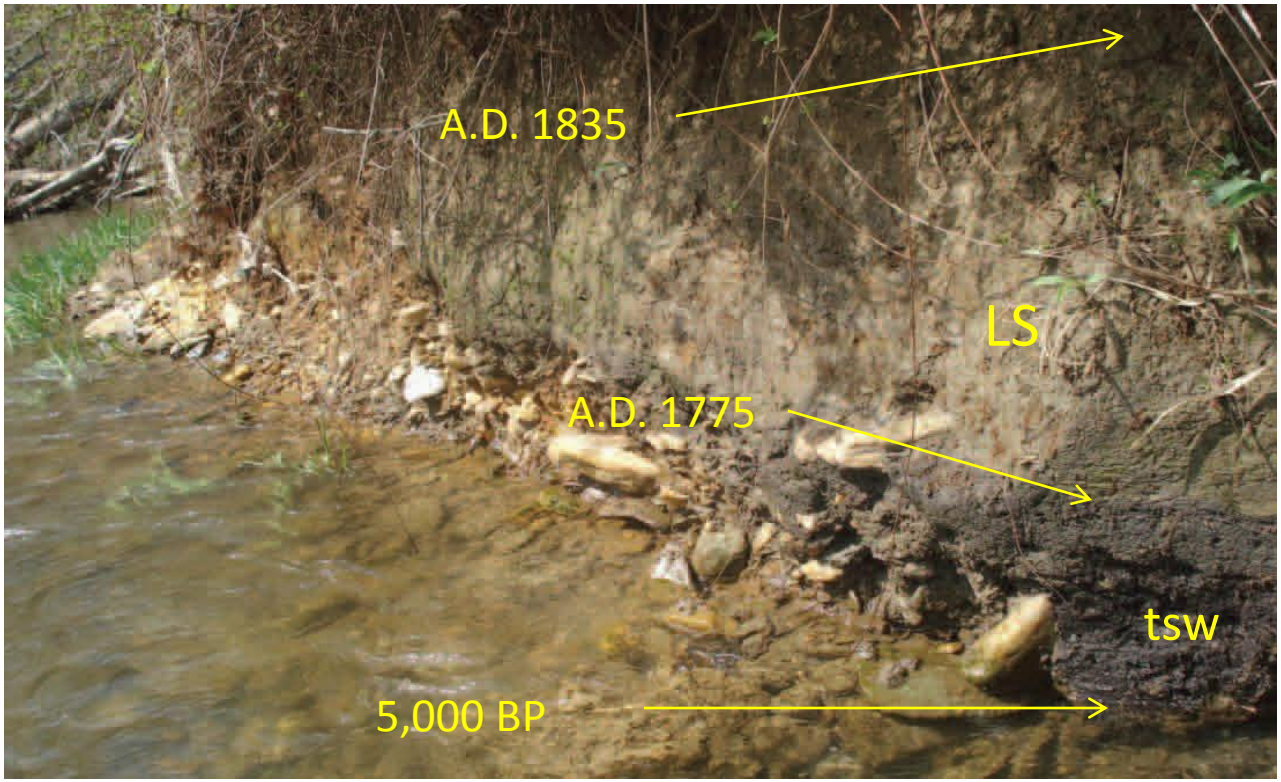
- springs from Valley margin;
- ground water table at 1.0 cm;
- saturated soil

Tussock Sedge Wetland,
Great Marsh, Chester Co., PA

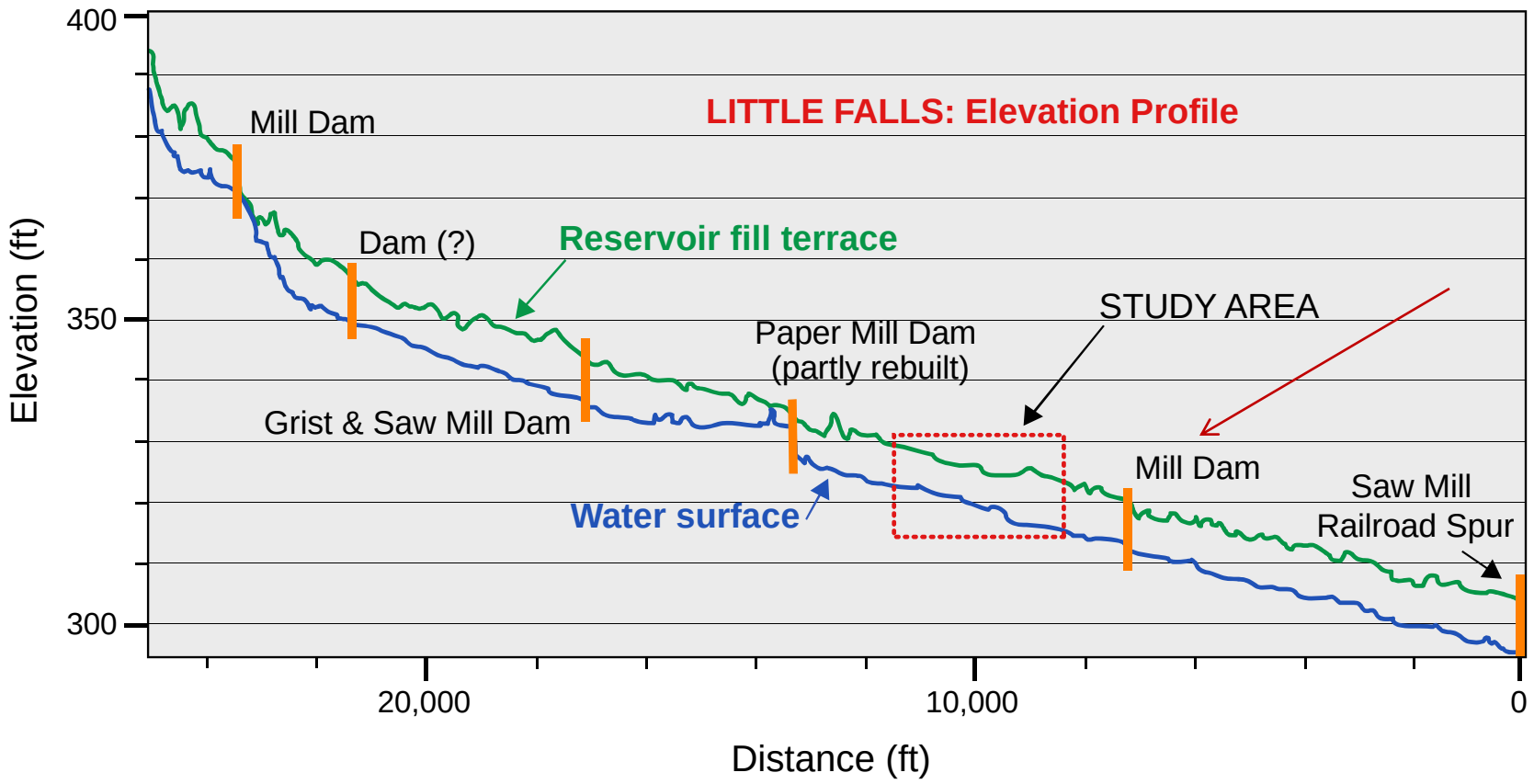
Initial habitat change began ca. A.D. 1730 *when Carex stricta* declined and Alder (*Alnus serrulata*) became established

Burial between 1775 and 1835

The tussock sedge wetland (tsw) was rapidly buried within 60 years between ca. A.D. 1775 and 1835, when 1.0 – 2.0 m of silt and clay sediment (Legacy Sediment - LS) accumulated in a reservoir behind a downstream mill dam.



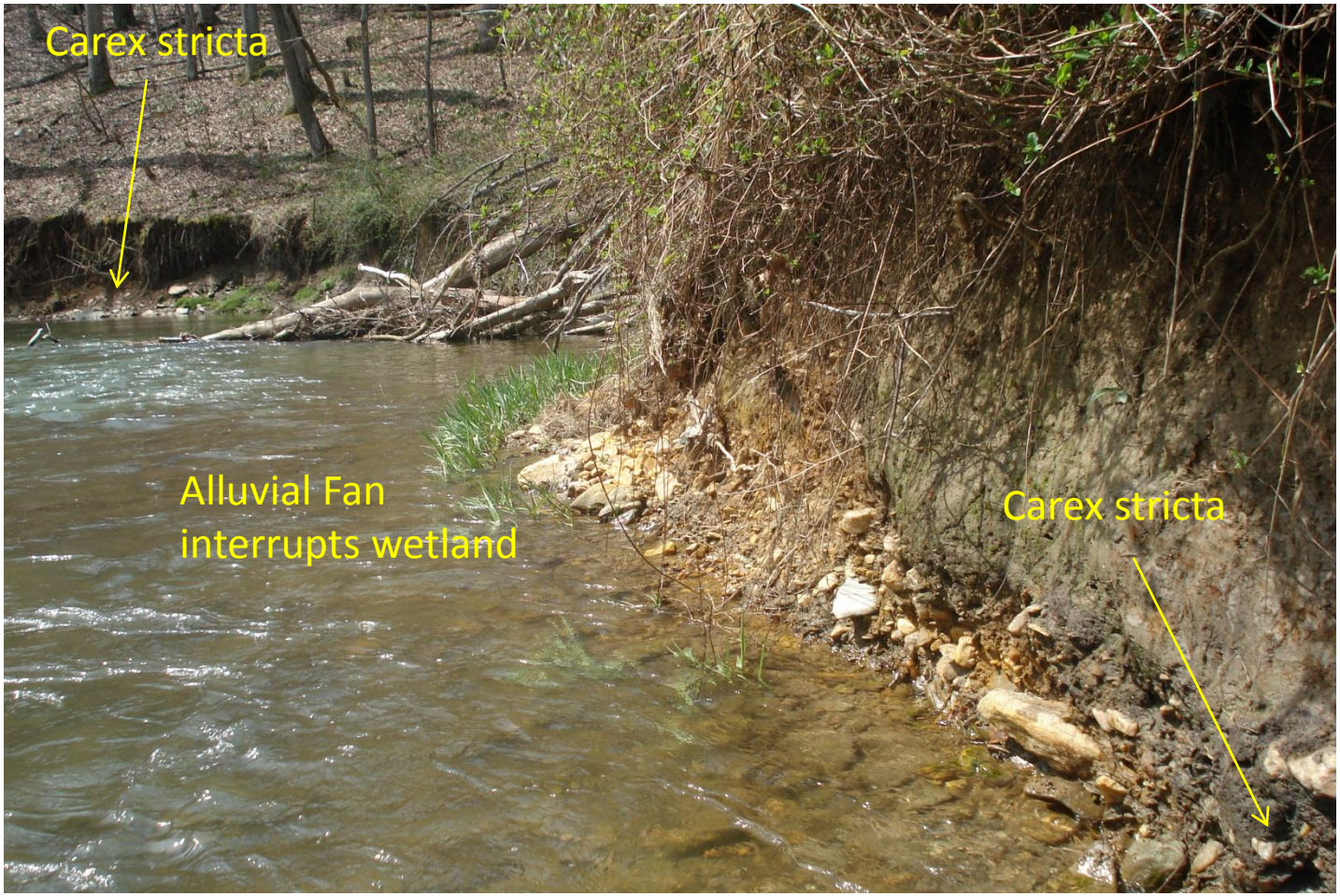
18th to 20th Century Dams at Little Falls



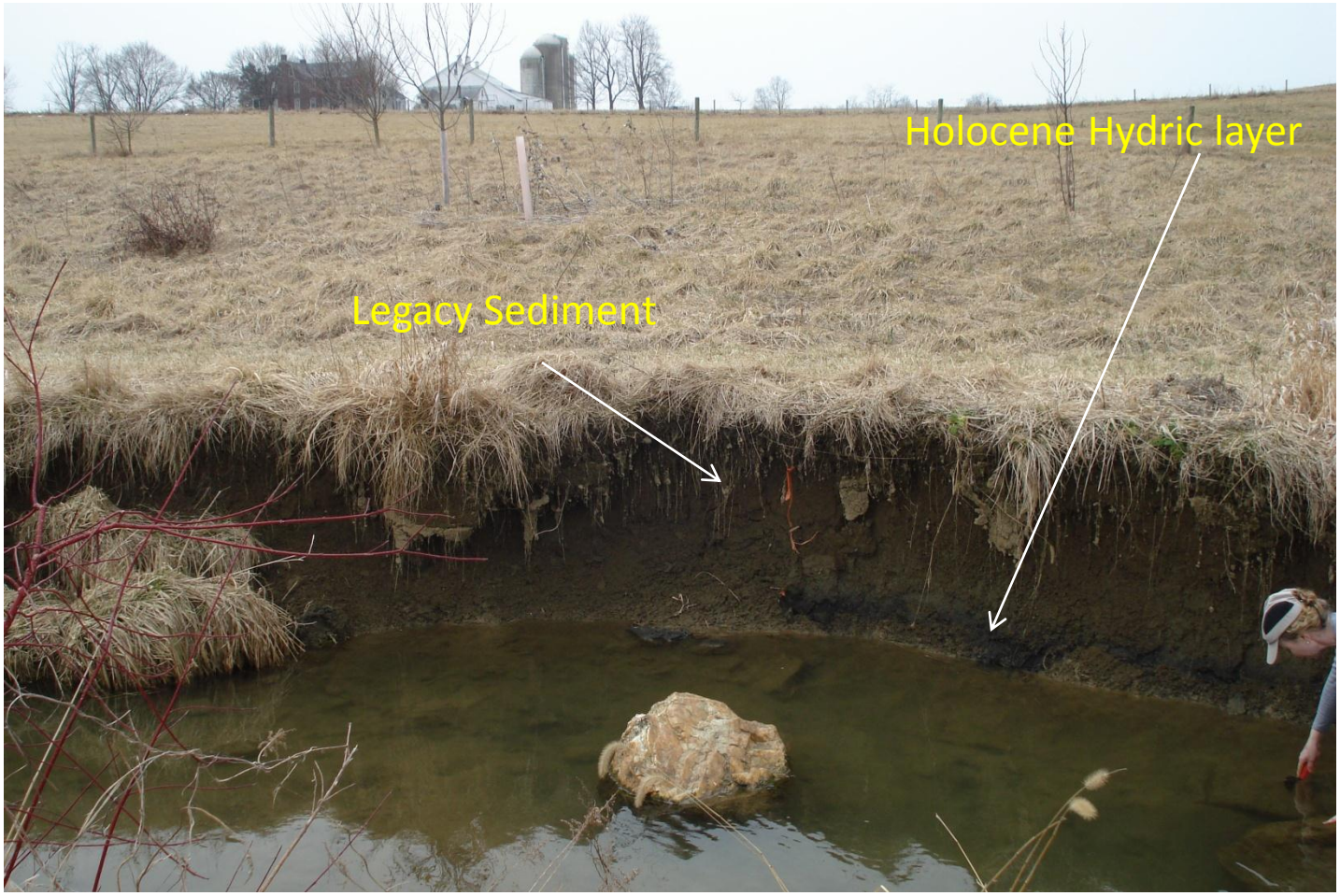
Breach of the mill dam created an incised, high-banked meandering river channel …..

This incision exposed the legacy sediment and underlying prehistoric tussock sedge wetland, periglacial gravel, and bedrock.

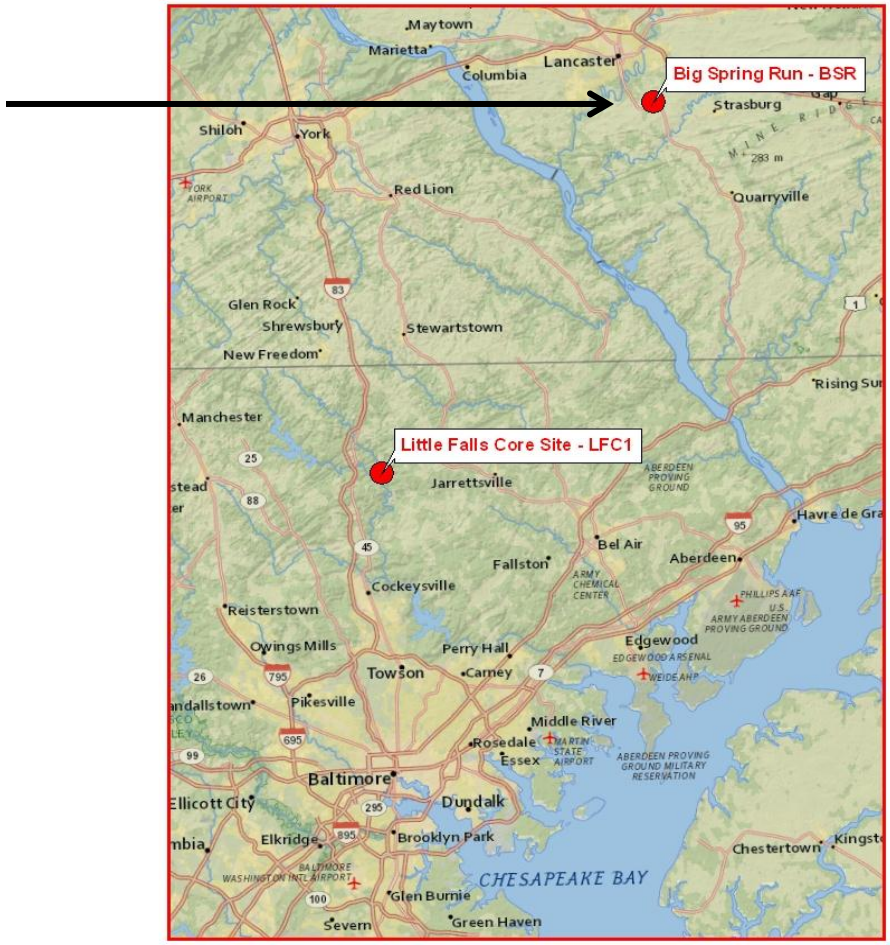
Lateral sediment samples show tussock sedge wetland extent (23 m)



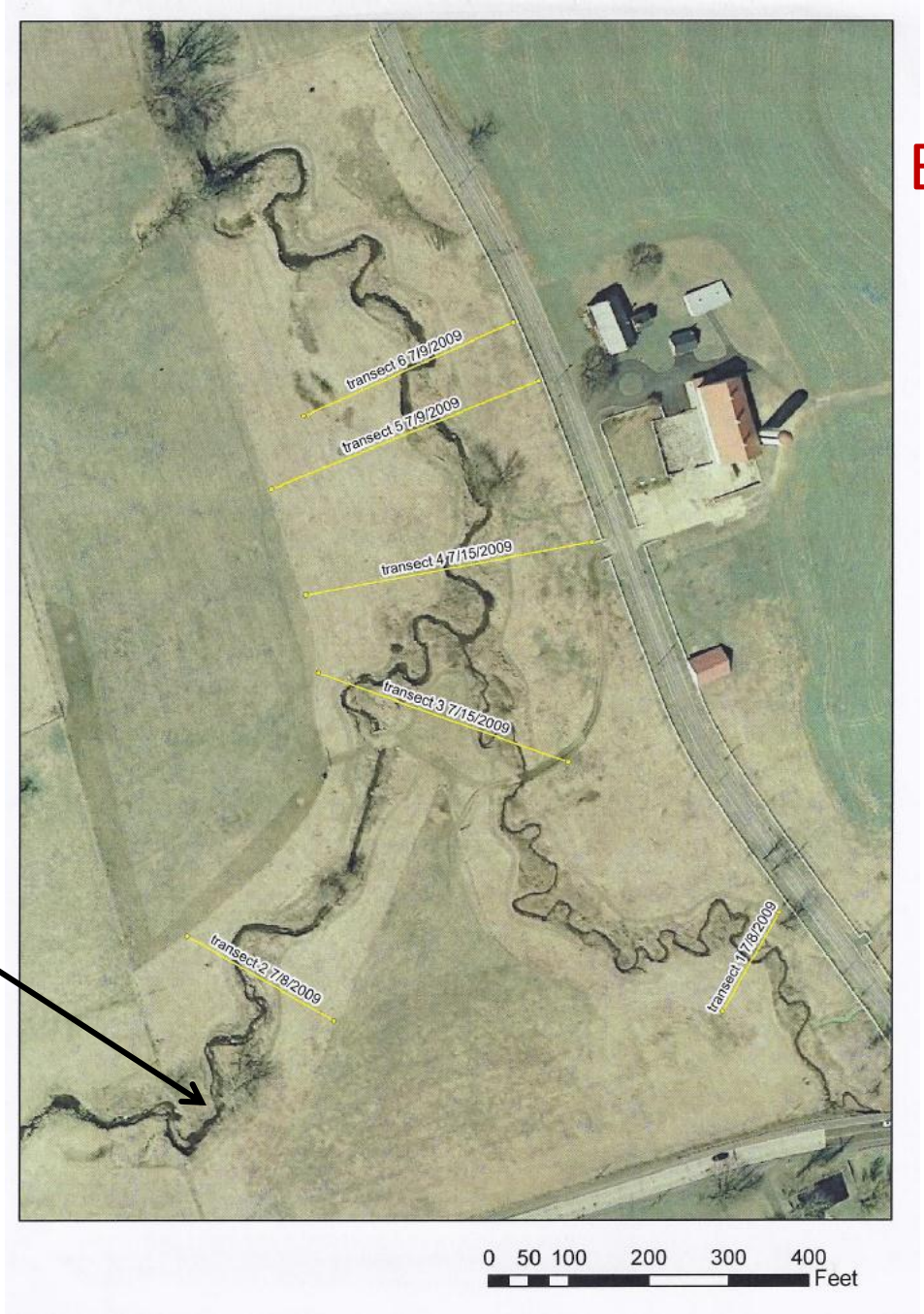
The Second Site:
Big Spring Run, Lancaster Co., PA



Big Spring Run, Lancaster Co., Pennsylvania

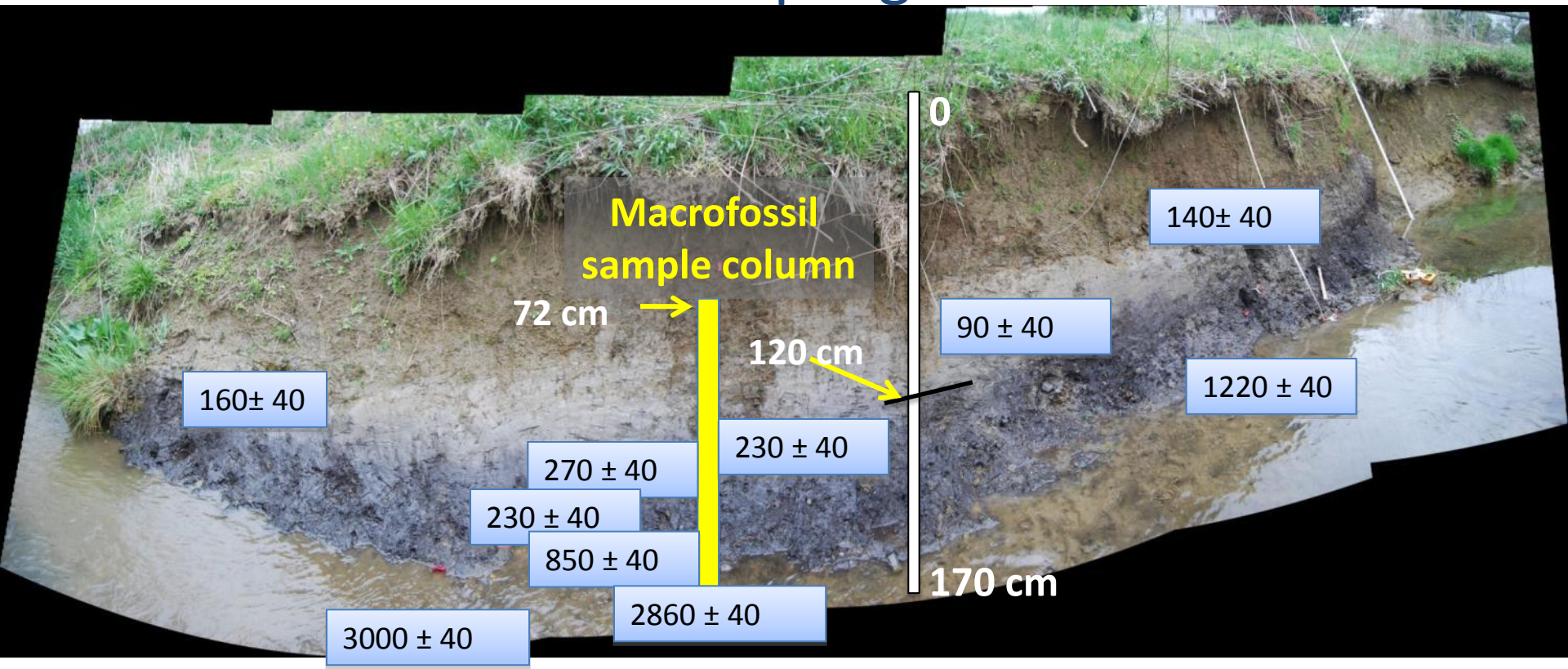


Big Spring Run



Macrofossil Sampling Site

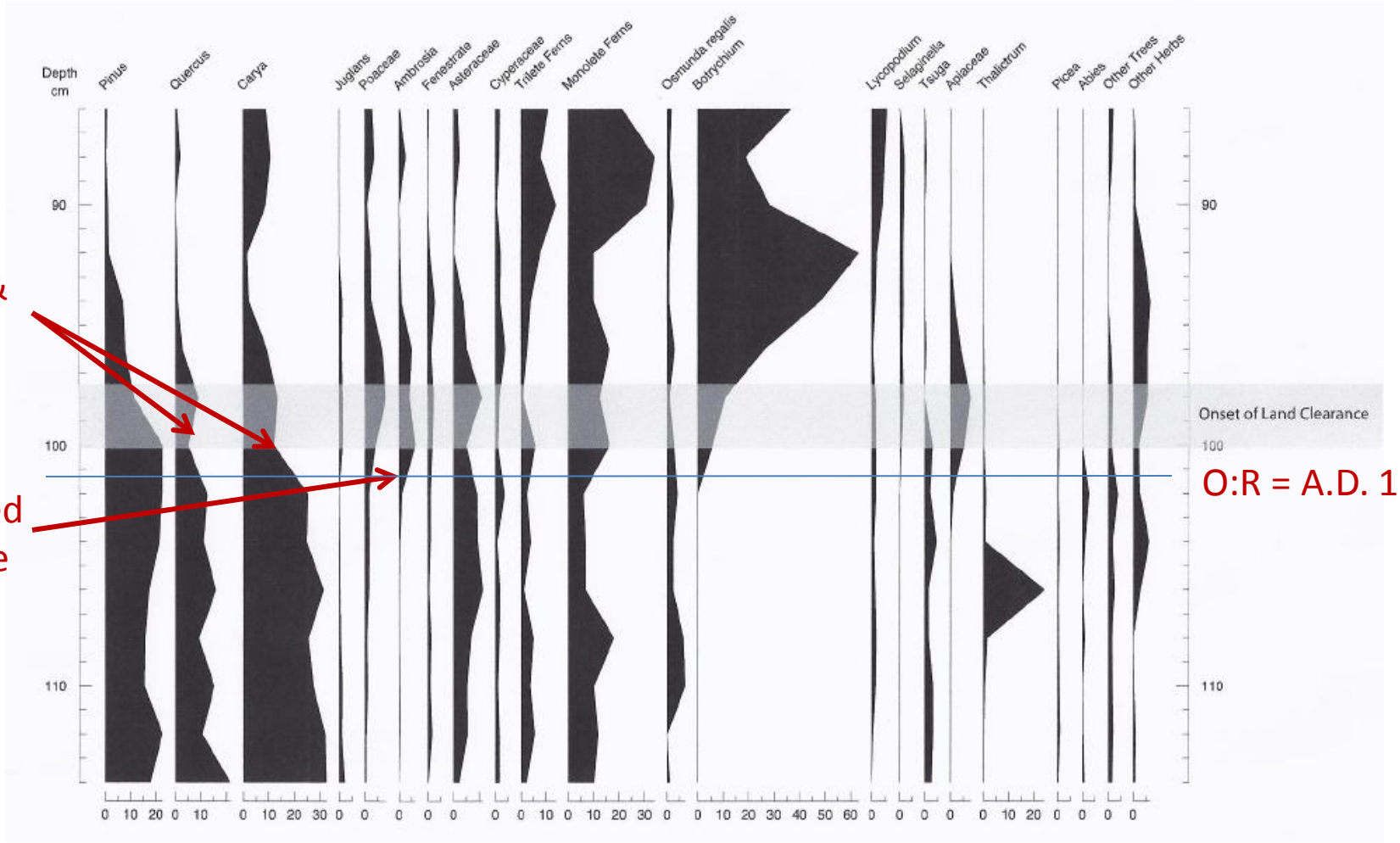
C-14 dates and Depths of the Macrofossil Sampling Site



Pollen in upper layers of the sample column (85 cm – 114 cm)

Decline in oak & hickory

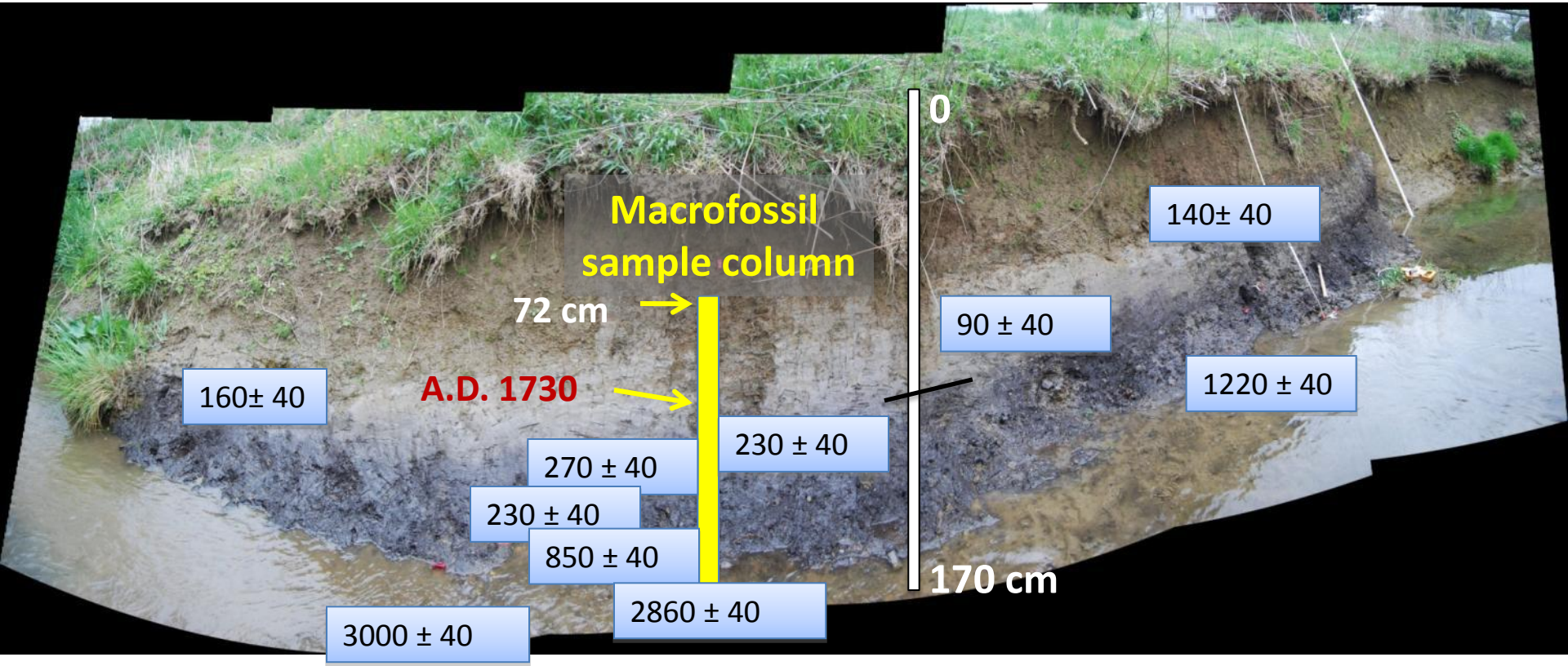
Ragweed increase



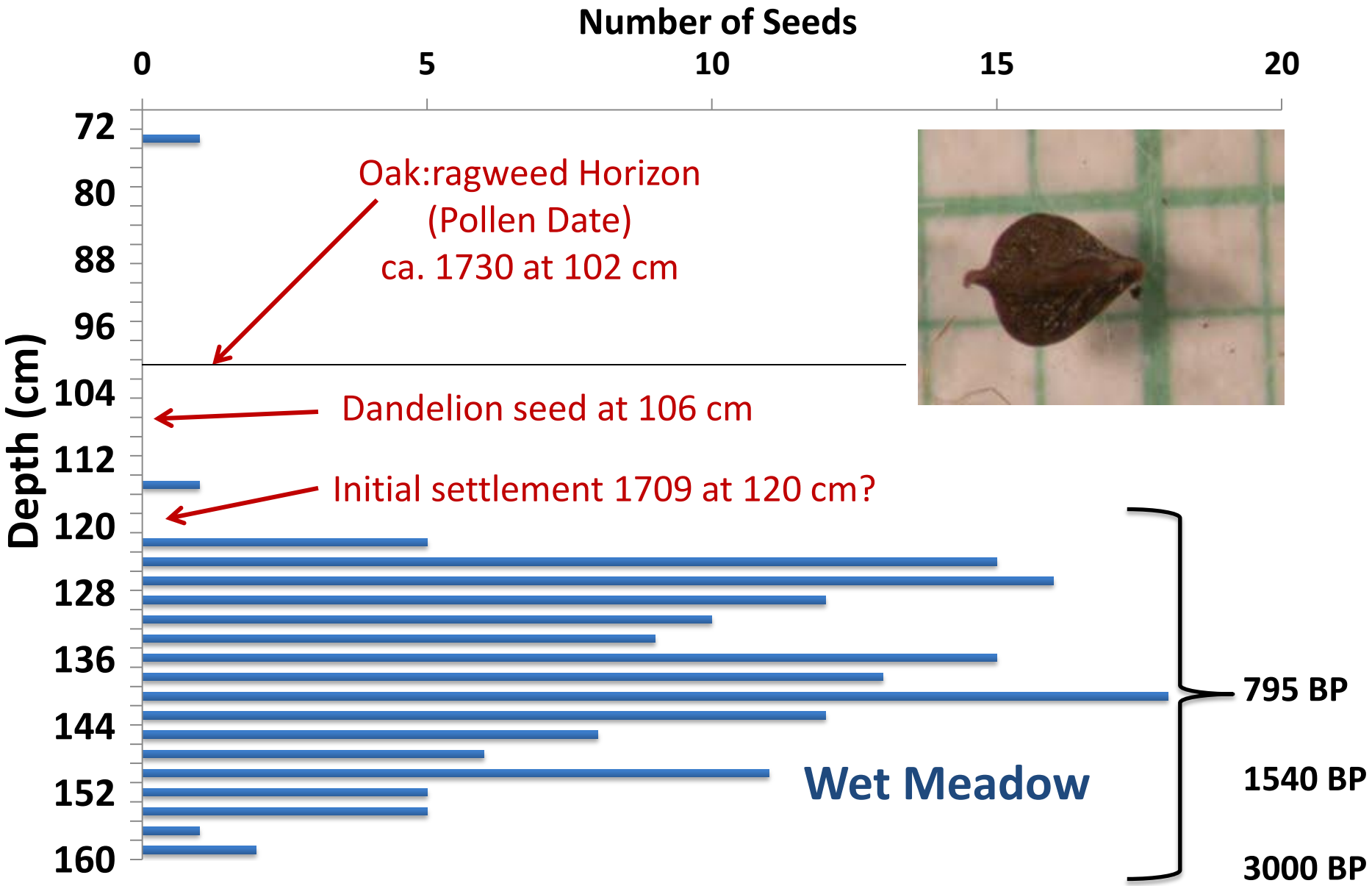
O:R = A.D. 1730

Analyst: C. Bernhardt

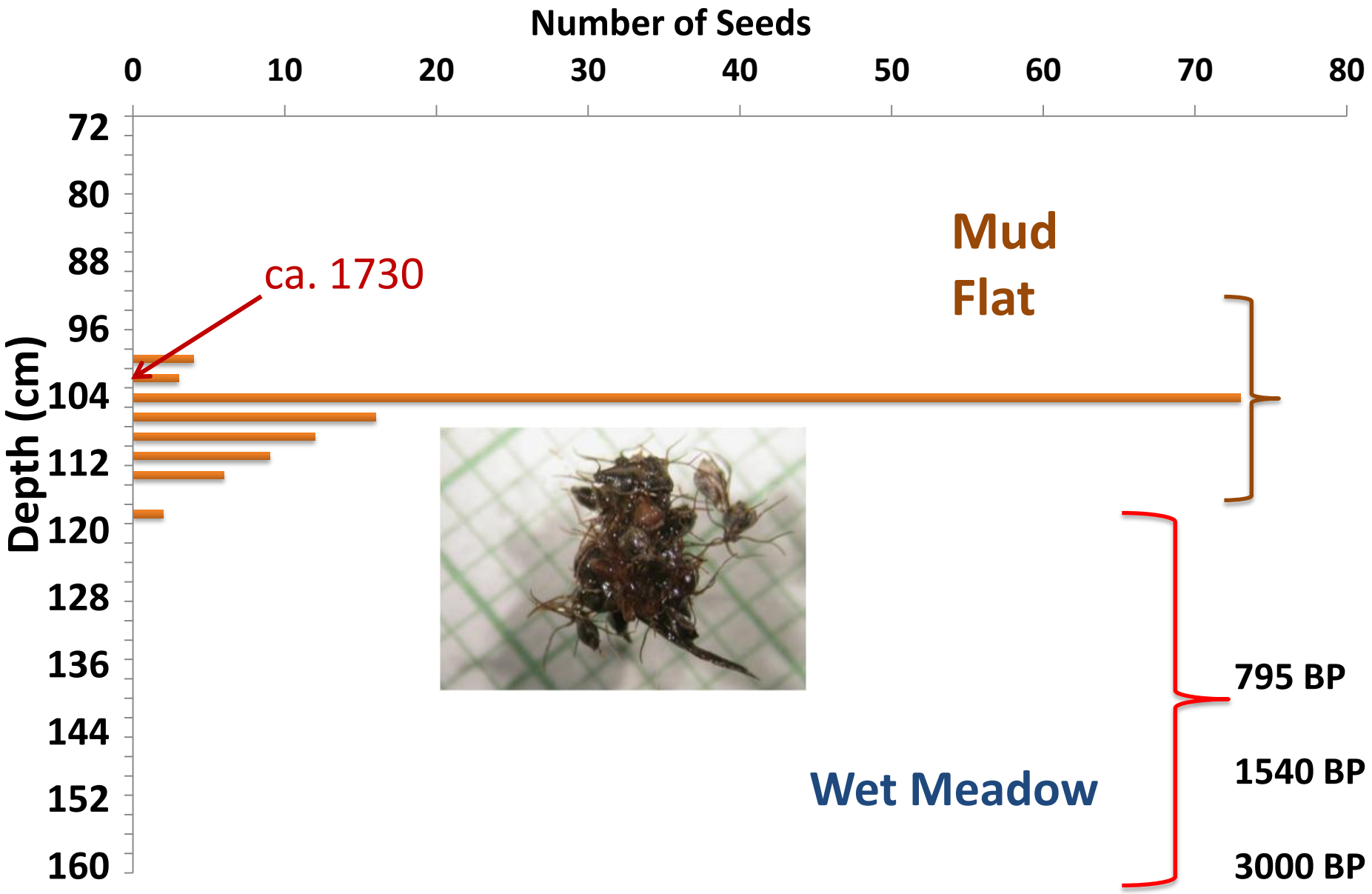
Pollen Date Added (in red)



Carex prasina type (n =165) -drooping sedge
Obligate wetland perennial

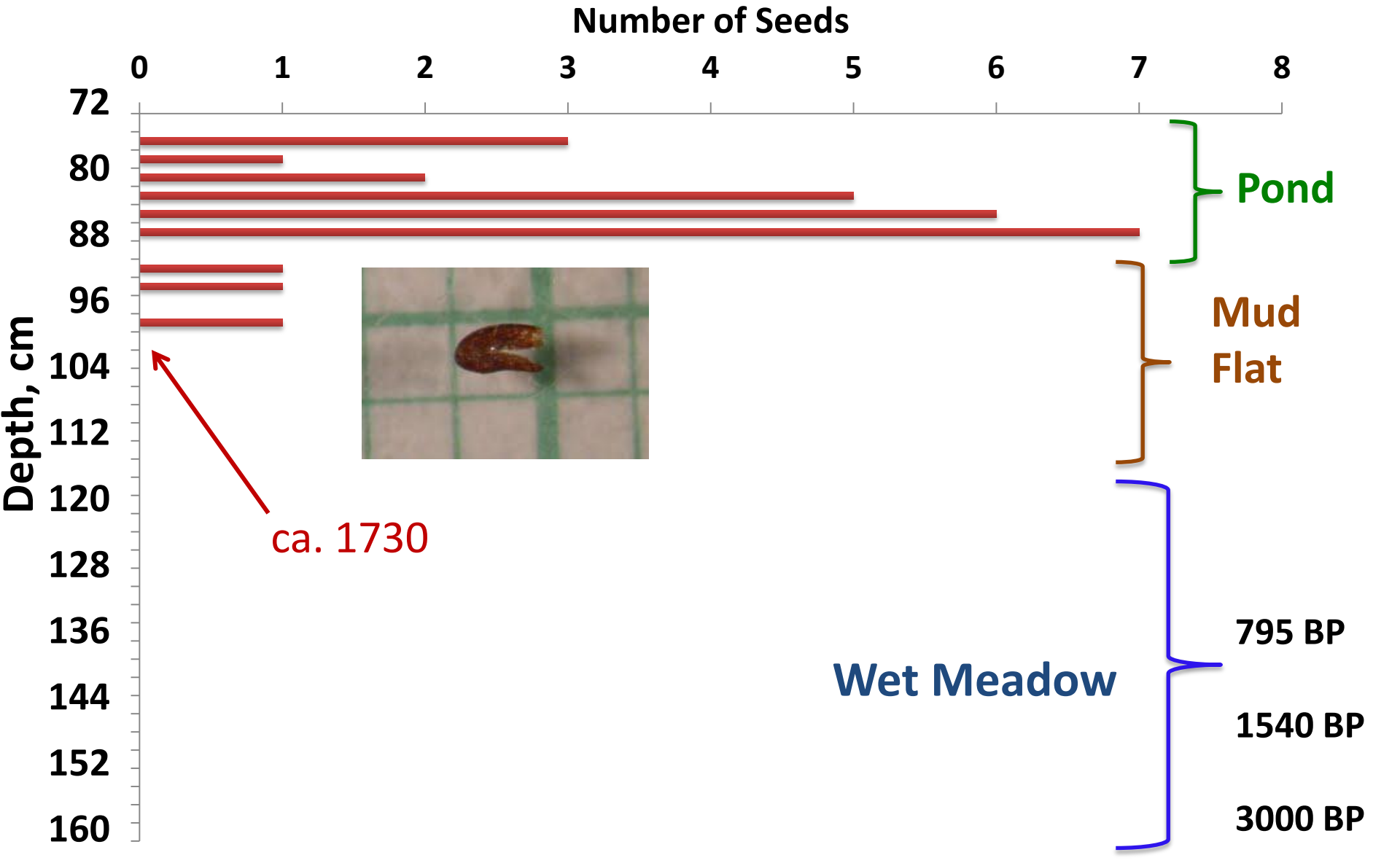


Eleocharis obtusa (n = 125)- blunt spikerush (syn: *E. ovata*)
Obligate wetland perennial

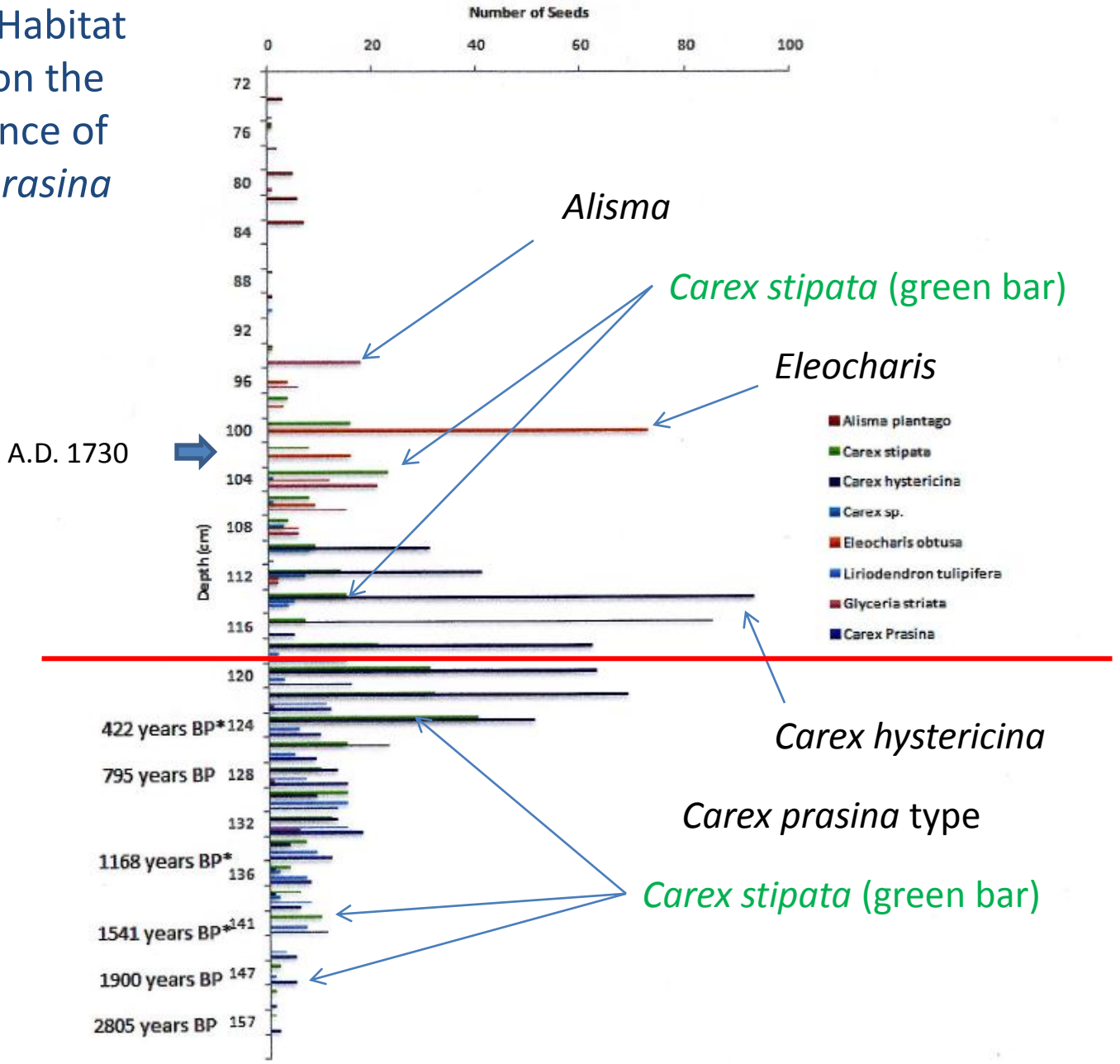


Alisma plantago-aquatica (n =27)- water plantain

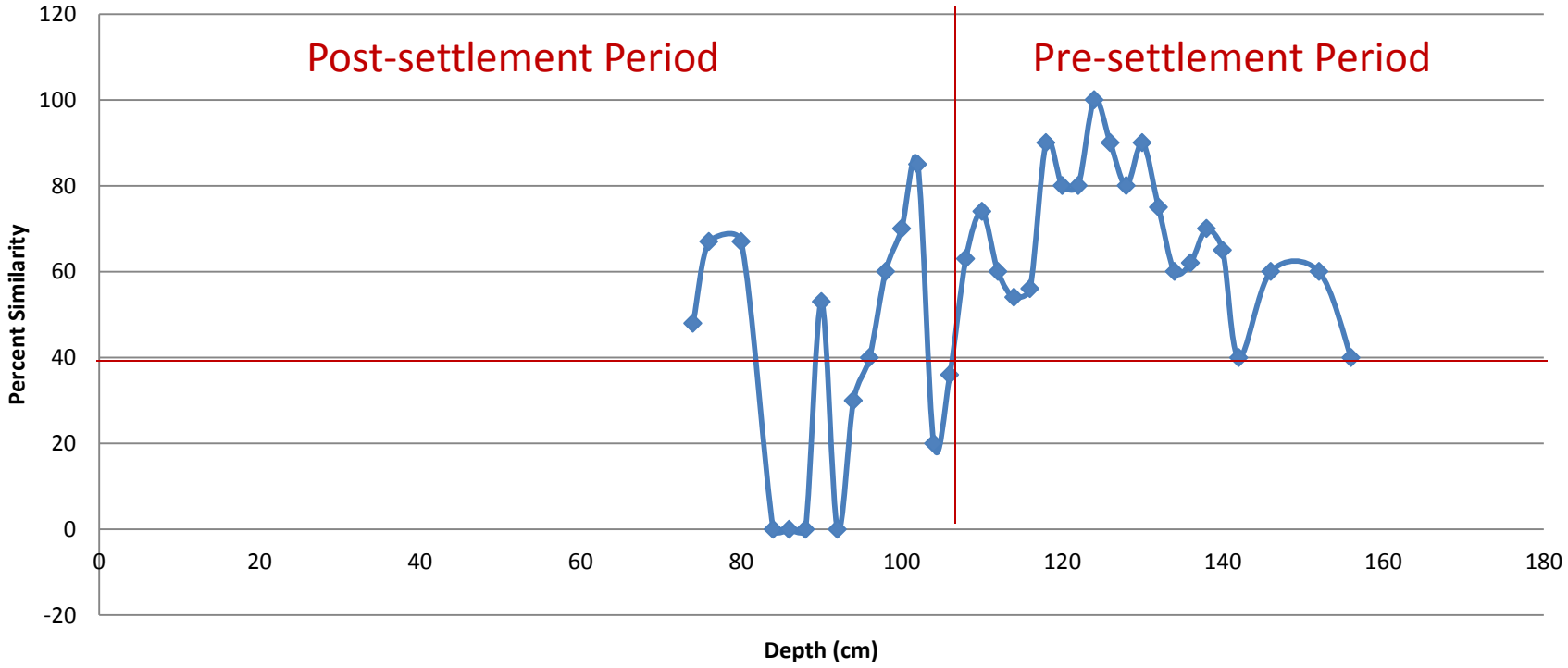
Obligate wetland, aquatic (up to 15-cm water depth)



Pre-settlement Habitat Stability Based on the Continual Presence of *C. stipata & C. prasina*



Sorensen's Similarity - BSR Samples



Summary…..
Pre-settlement Wetland Stability…

…was maintained over millennia despite these disturbances:

- a high charcoal/drought period, ca. 4,000 - 4200 BP,
- presumed high abundance of beaver activity
- tropical storms and flooding events
- prehistoric human disturbance.

This long-term wetland stability indicates…

- a forested watershed (~100% forest cover) acted as a storm and erosion buffer
- low sedimentation rates entered the valley (0.01 cm/yr at both sites)
- constant water table level and stable hydrology
- no ponds from beavers in either valley
- no main channel; instead low flow anastomosing system

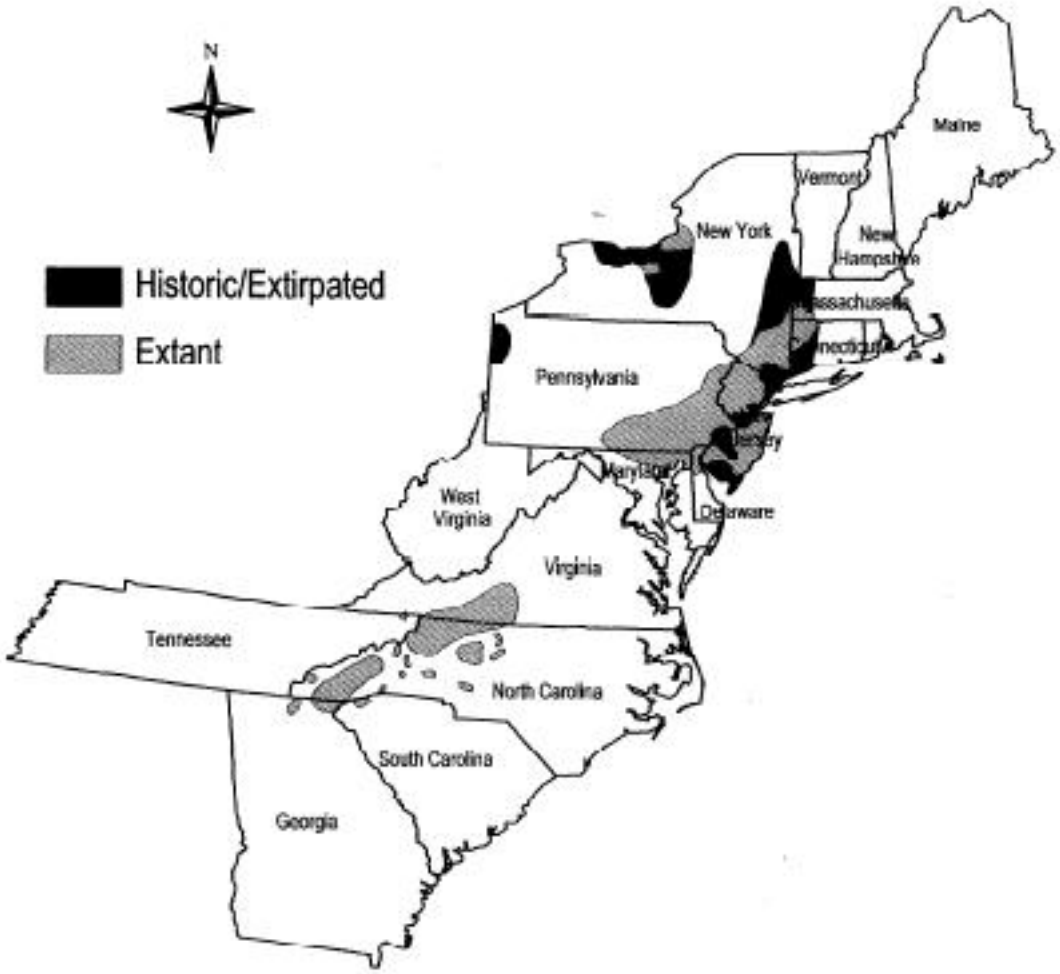
Post-settlement Habitat Change

A sudden period of rapid sedimentation from deforestation combined with multiple mill ponds and dams during the 18th and 19th centuries was the first event in > 4,000 years to produce succession and decline in these wetlands.

Sedge meadow wetlands, especially tussock sedge wetlands are the favored habitat of the endangered bog turtle (*Glyptemys muhlenbergii*) in Maryland and Pennsylvania

Decline of Bog Turtle Habitat

The greater extent of prehistoric sedge meadow wetlands and their subsequent reduction by dams may help explain the modern disjunct distribution and decline of the bog turtle.



One solution to the decline in bog turtle habitat is restoration…removal of the legacy sediment to expose the underlying sedge meadow wetland.

Acknowledgements:

Funding: Franklin and Marshall College, PA Dept of Environmental Protection, PA Chesapeake Bay Commission, EPA, and NSF (MRI and NCALM)

Students of Franklin and Marshall College; John Hart-Smith of Johns Hopkins University

Landowners at Big Spring: Joseph Sweeney (sold property in 2011);
The Kirchner family (current owners)
Great Marsh owners are Jim Moore and family

Affiliations:

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- [2]Franklin and Marshall College, Lancaster, PA.
- [3]U.S. Geological Survey, Reston, VA.
- [4] Department of Environmental Protection, Harrisburg, PA.