Post-Glacial Stratigraphy and Human Impacts in Upper Bolton Lake, Eastern Connecticut: Implications for an Atlantic White Cedar Stand

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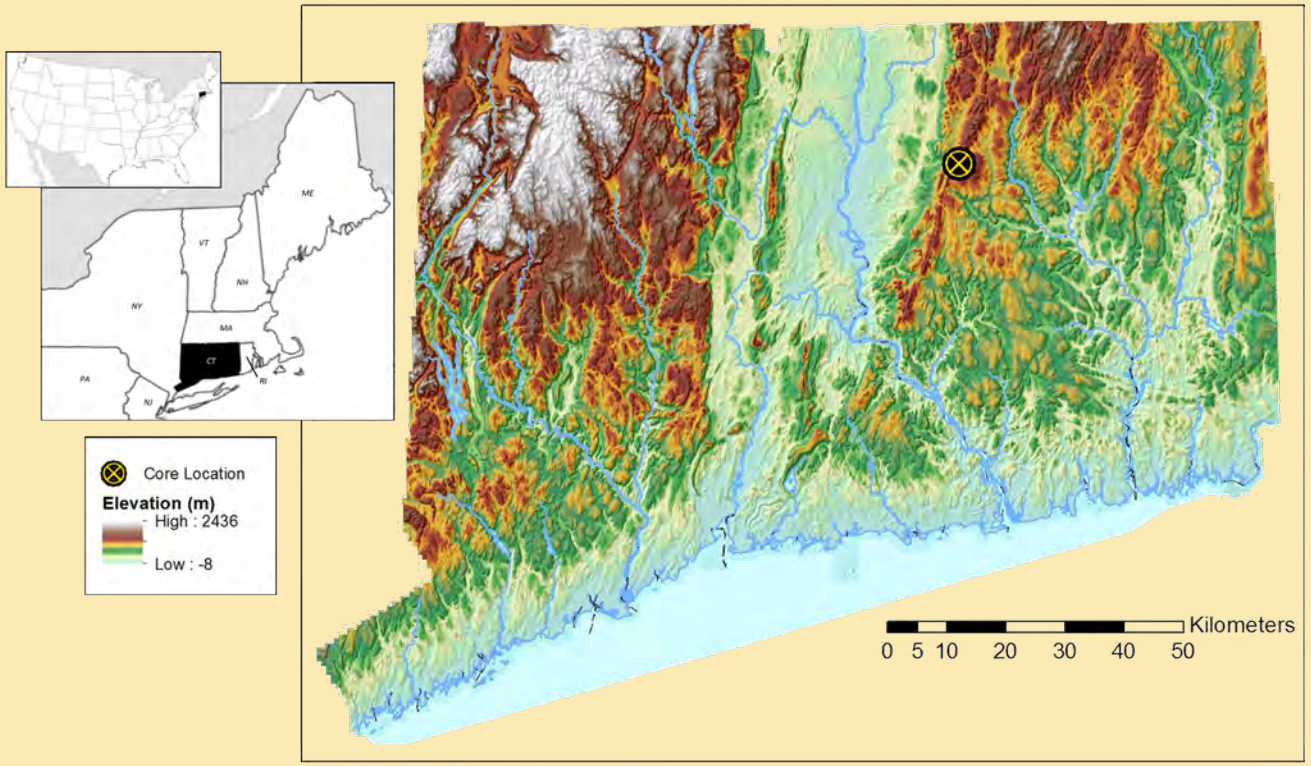
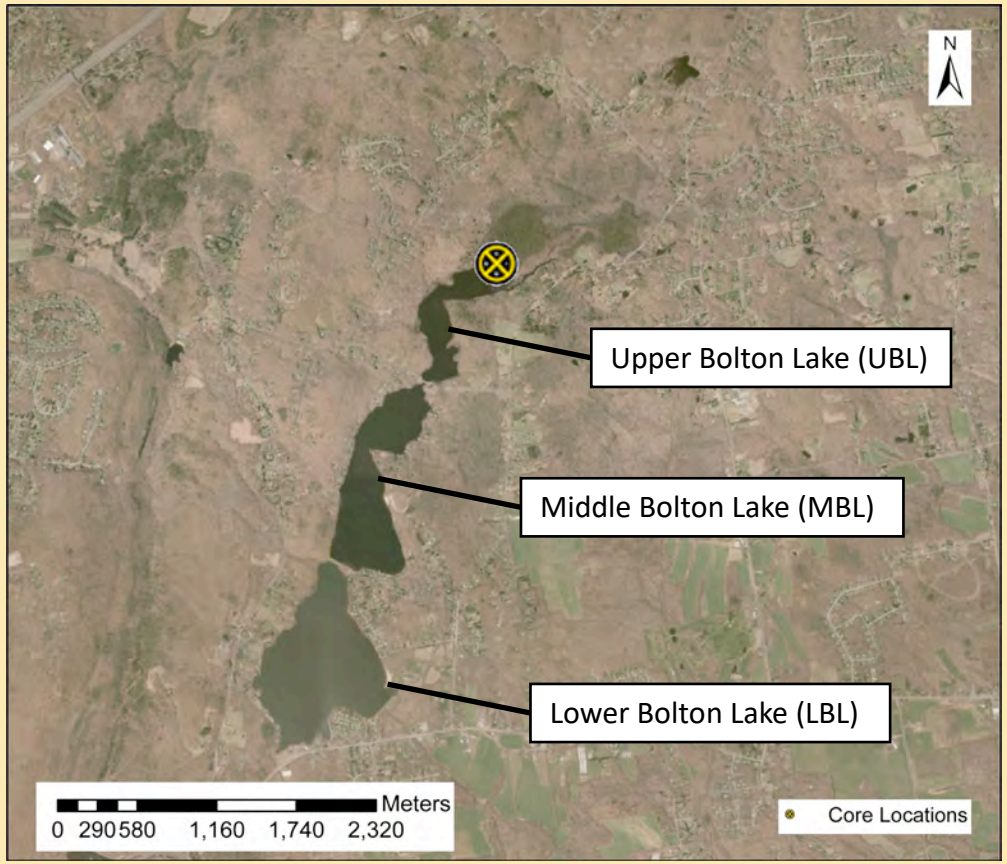
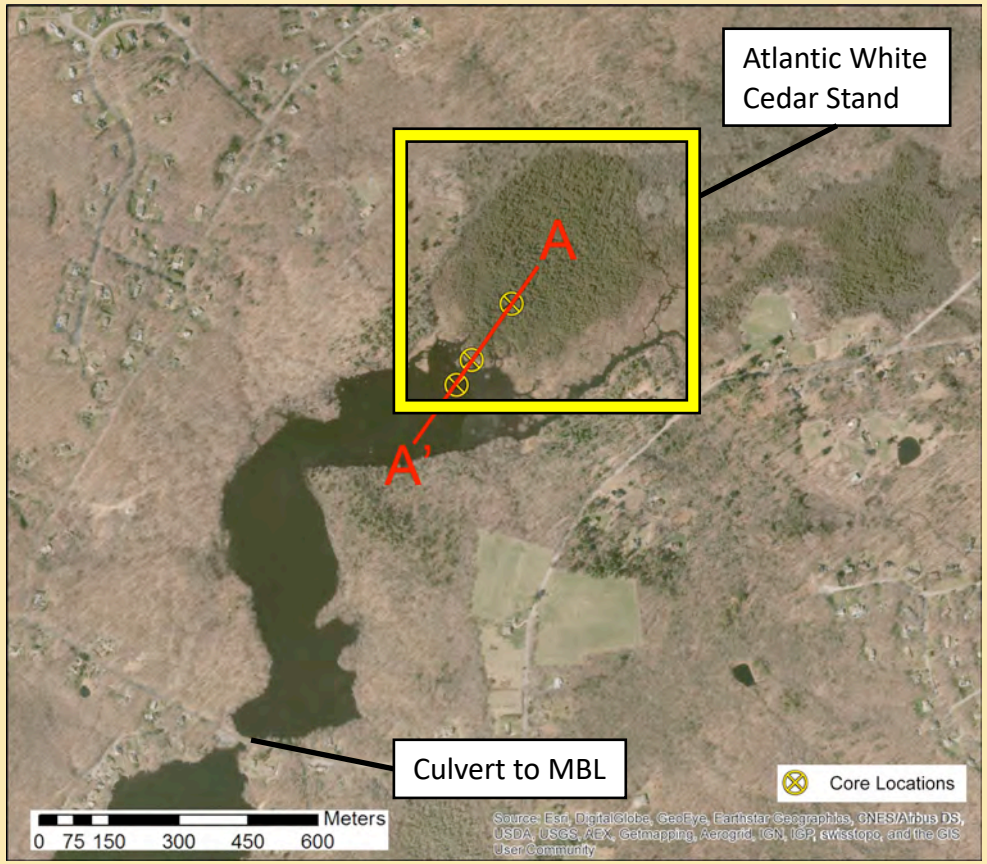
Department of Geosciences

The Bolton Lakes are a small, modified lake system in Tolland County, CT. Upper Bolton Lake (UBL) is the northernmost and smallest of the lakes.





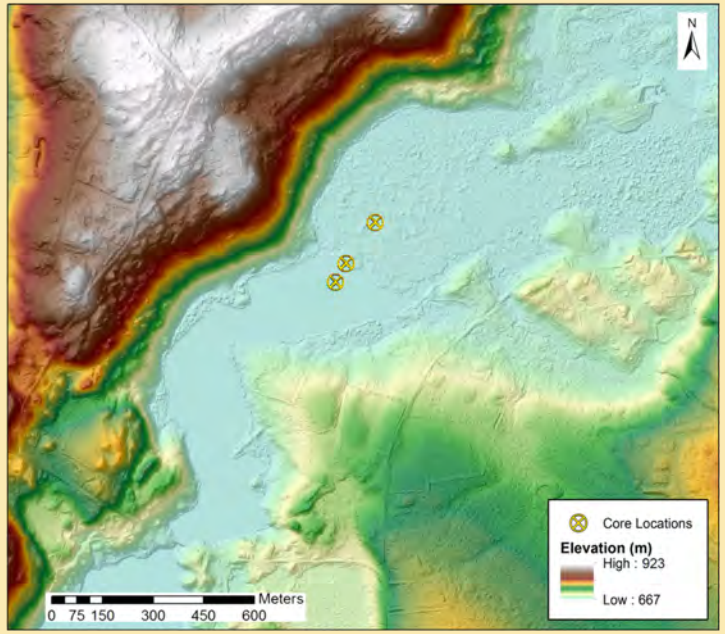
A stand of Atlantic White Cedar trees in the northeast is of high interest to community. Insight on its history may inform future policy decisions.



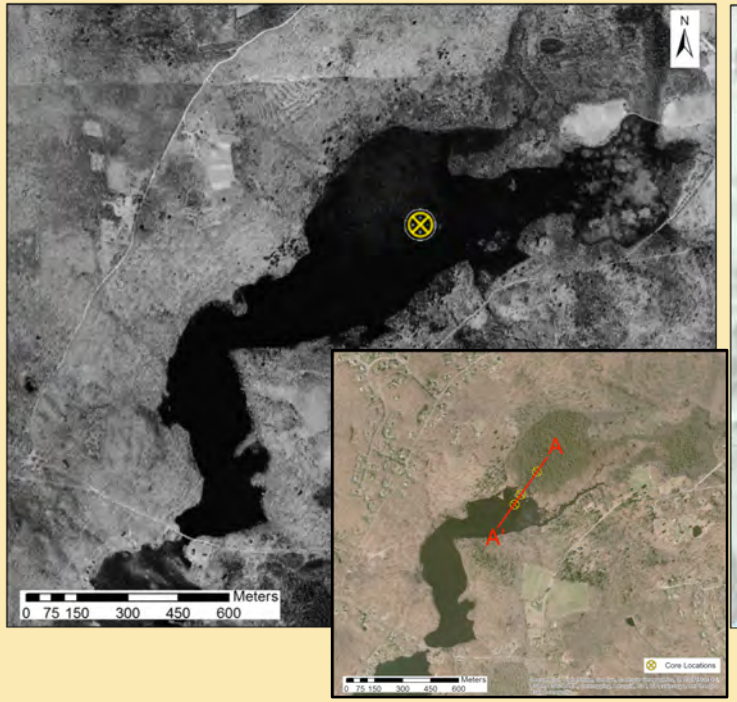
Background Research

Initial imagery indicates that UBL may be within a post-glacial depression; little to no change visible since 1934.

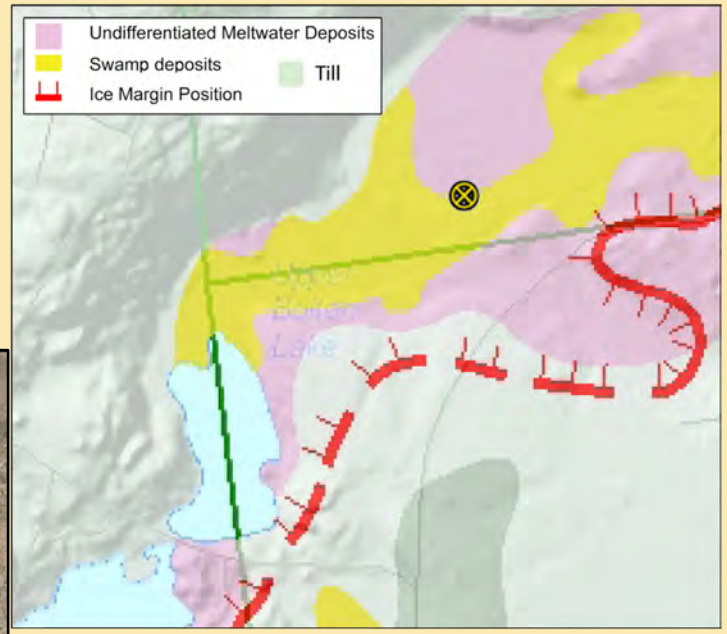
DEM on Hillshade (LiDAR)



1934 Imagery

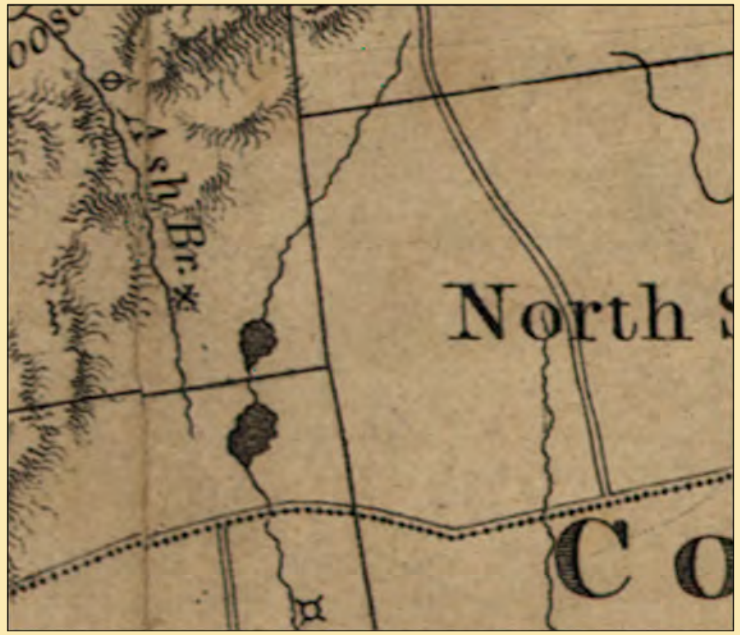


Quaternary Geology

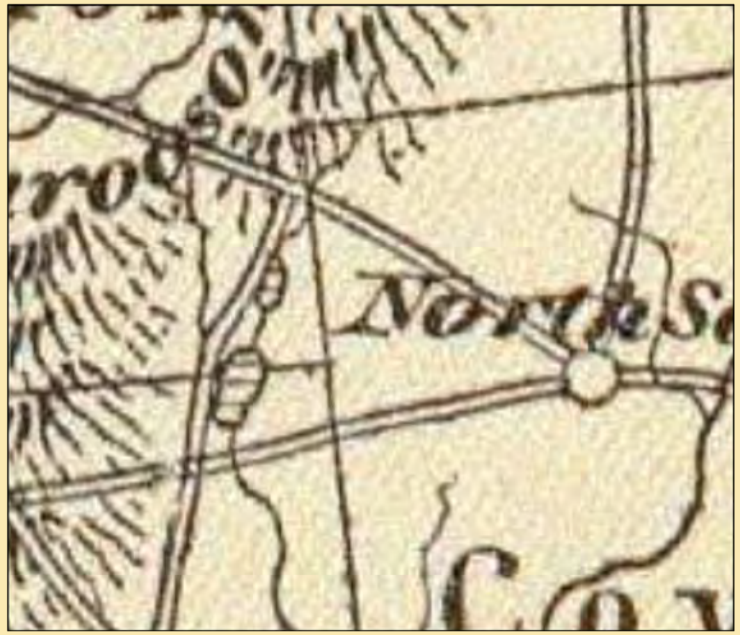


Was Upper Bolton Lake created in the nineteenth century?

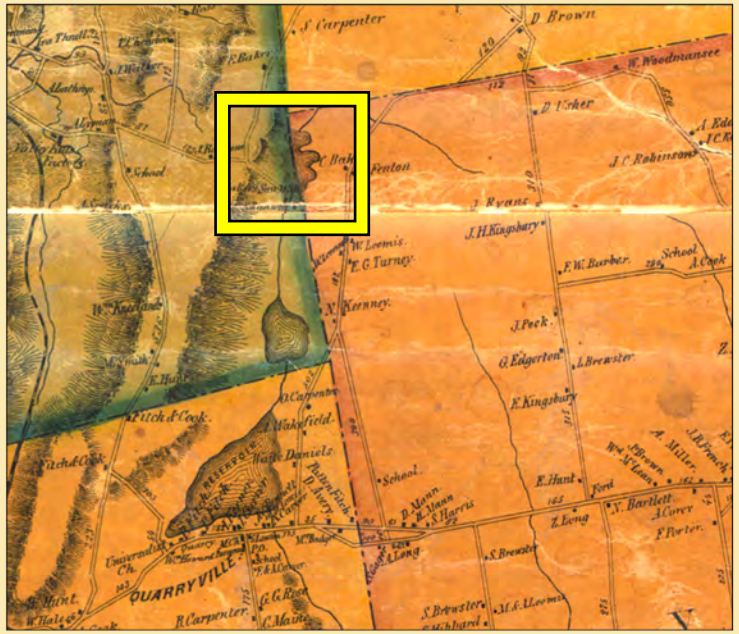
1811 Map



1845 Map



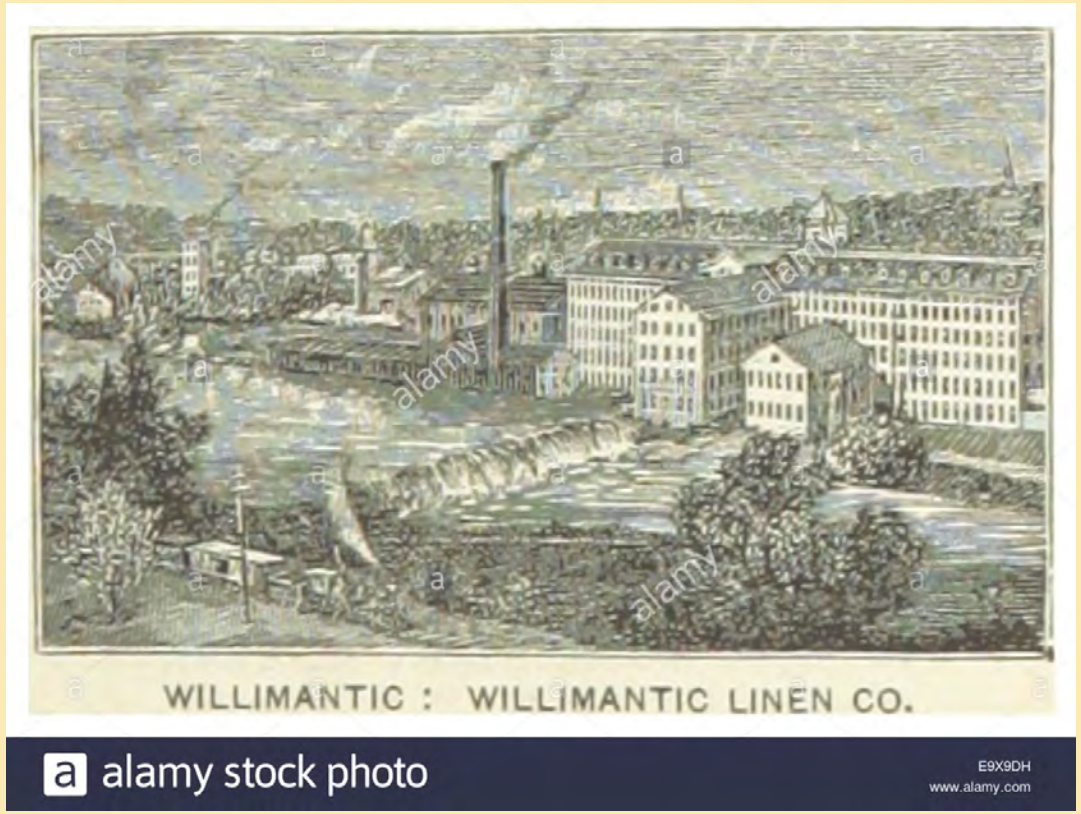
1857 Map



Atlantic White Cedar was known to be harvested at least by the 1700s.

- Cedar is light-weight, resistant to rot.
- Swedish Botanist Pehr Kalm describes unsustainable AWC harvesting in Philadelphia, 1748.

Historical documents indicate the Bolton Lakes were first dammed for mill use in 1832. They were not used on a large scale until the early 1850s.

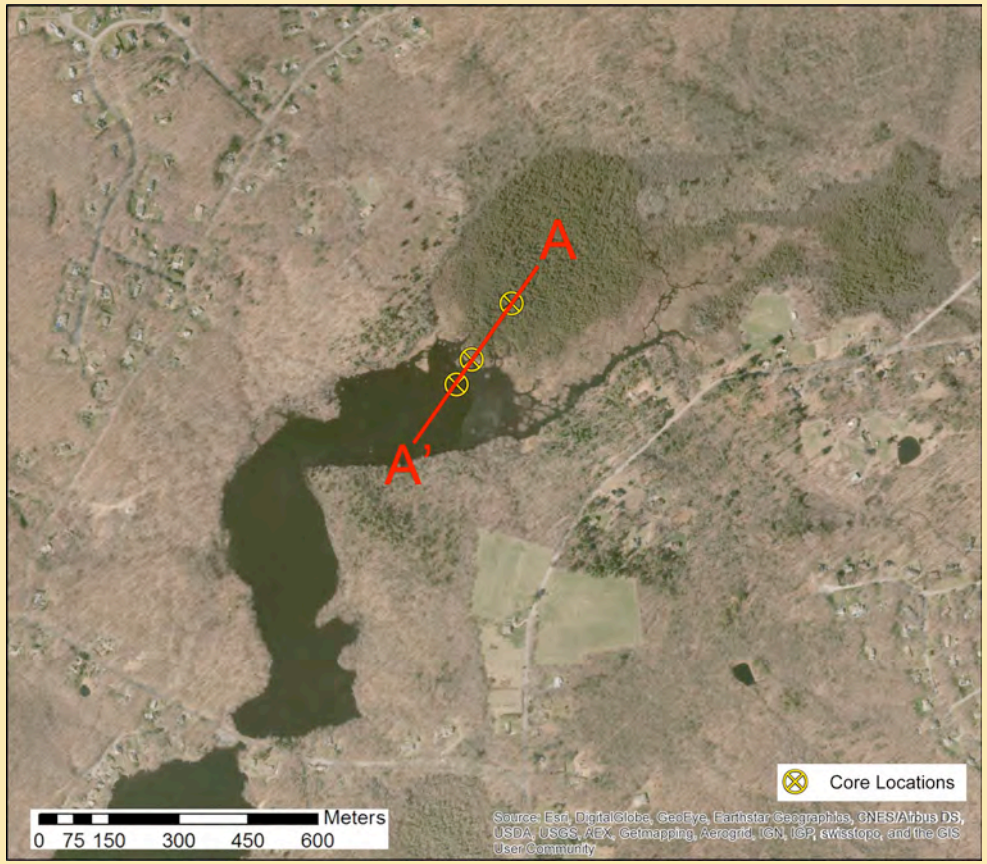


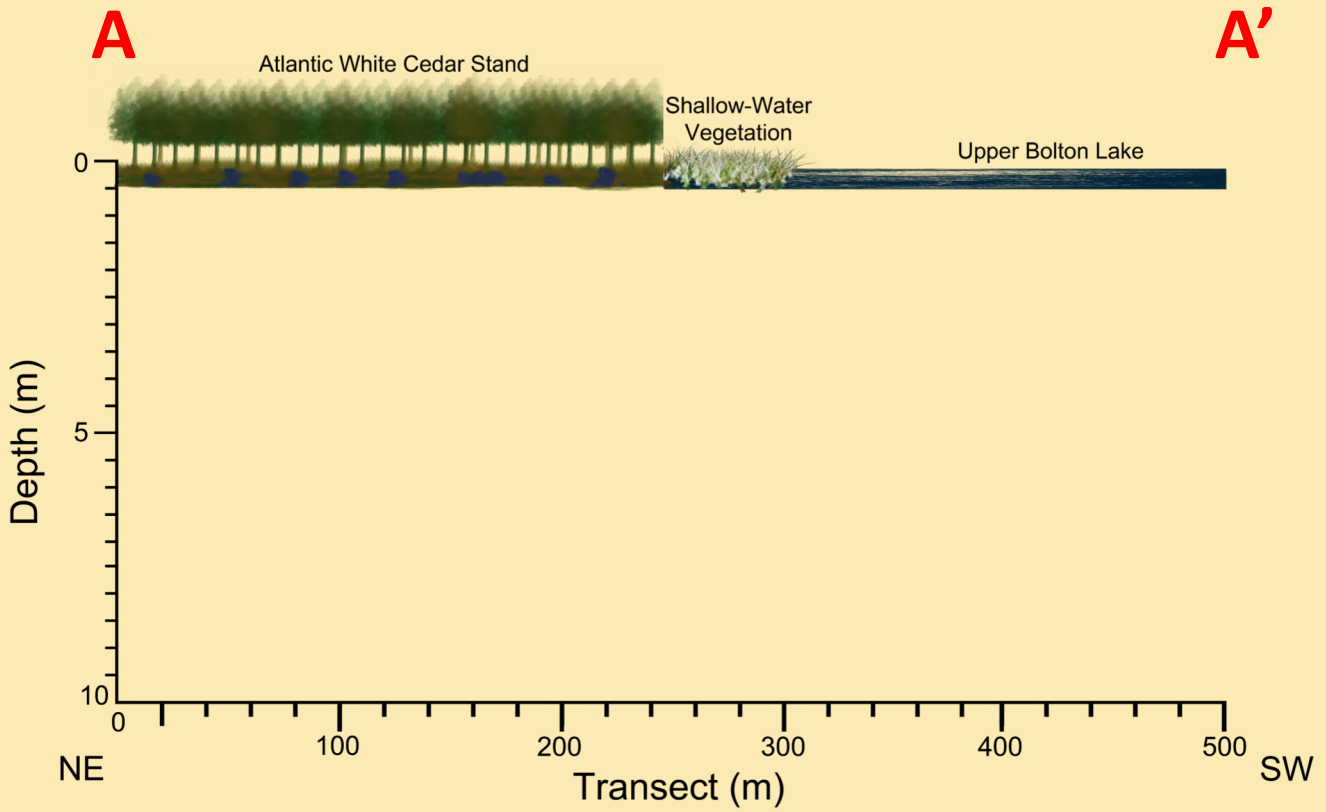
Industrial influence may have created Upper Bolton Lake.

Willimantic River upstream of the cotton mills. At first, there were two Bolton ponds (or lakes), and then in the early 20th century, when the American Thread Company controlled the water in the ponds and the Hop River, a third pond was made out of what had theretofore been a swamp (Figure 7).

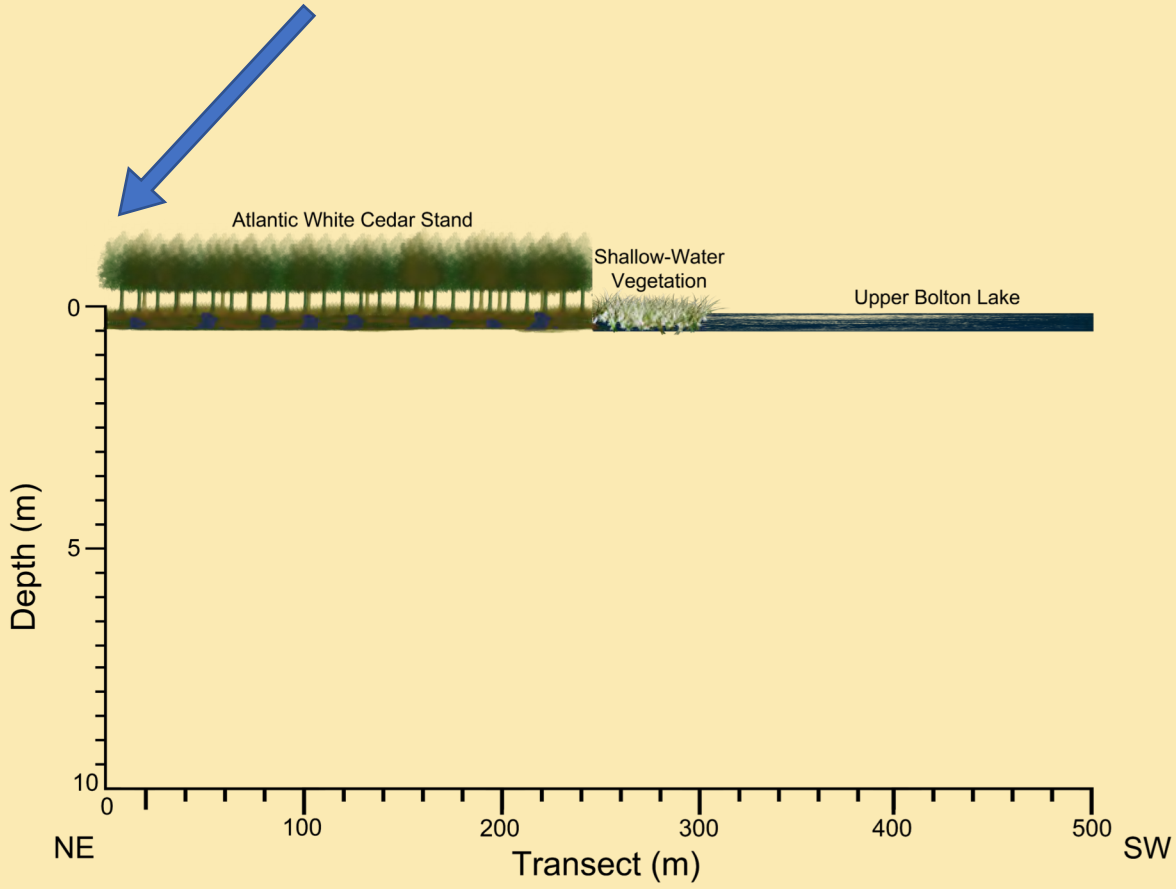
Methods & Results

Sub-surface sampling was key to contextualizing site history.



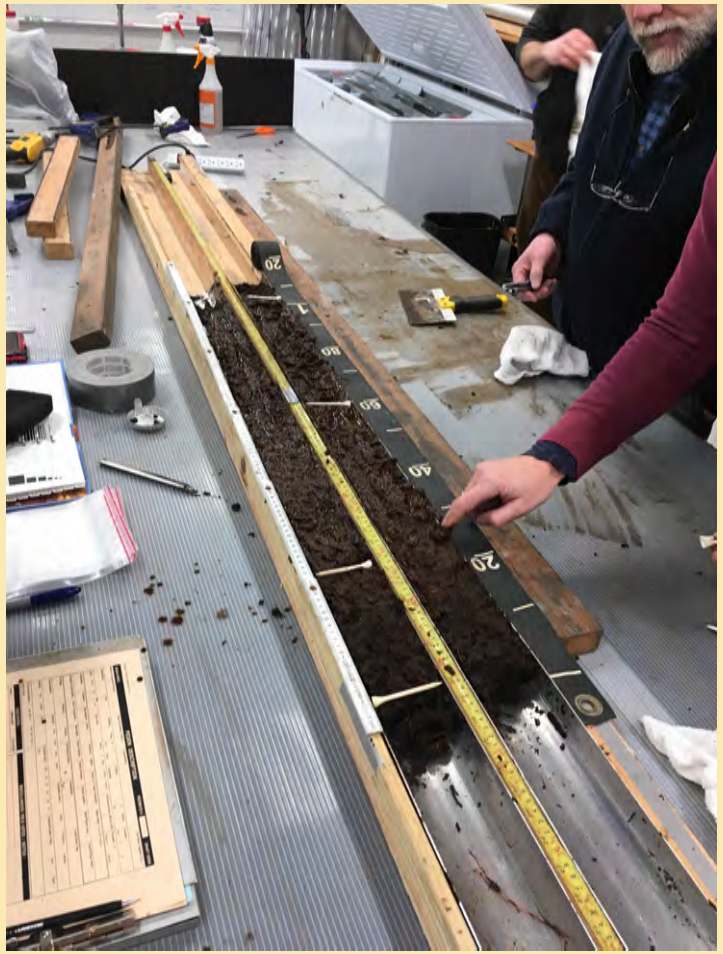


The sampling attempts began with push coring.

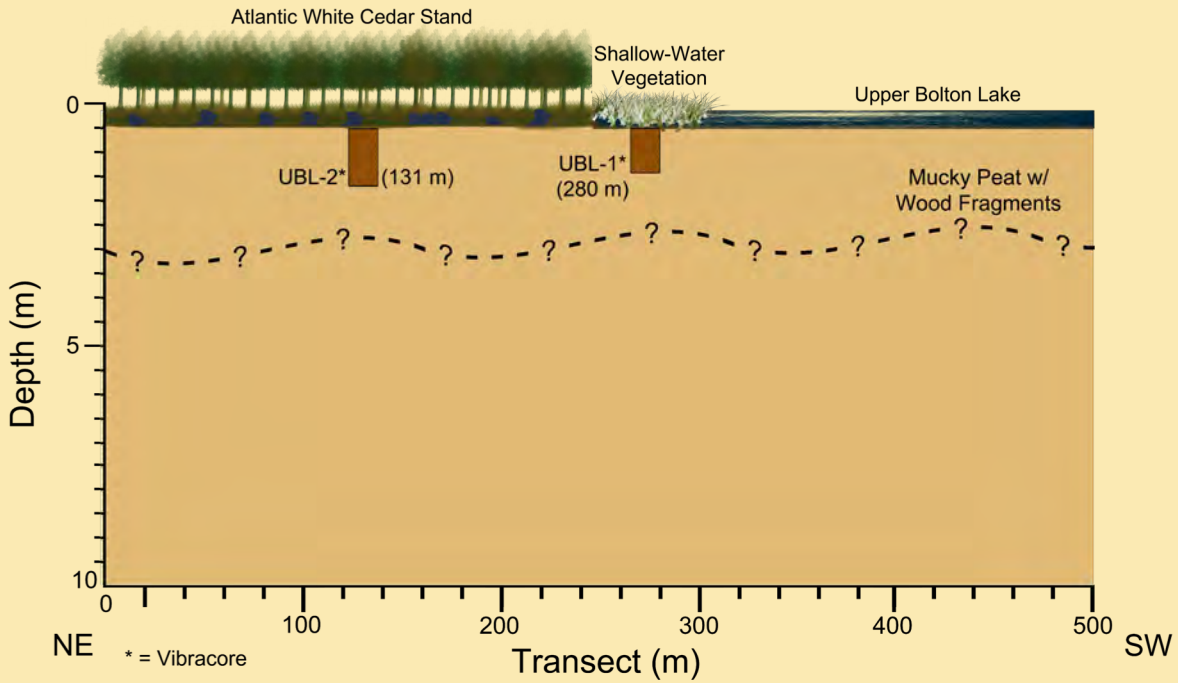


A second attempt was made with vibracoring. This involves pushing a vibrating tube into the ground to collect a continuous record of stratigraphy.

Despite bringing 20 ft core tubes, we were only able to recover ~1 m of material in each core.

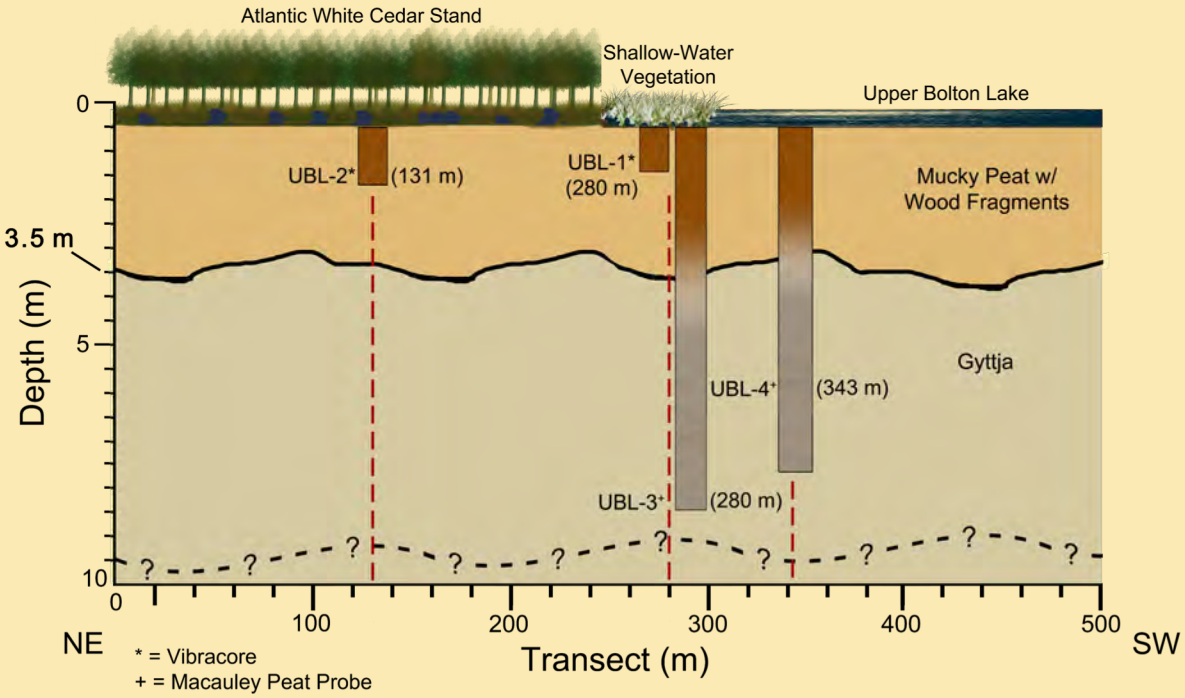


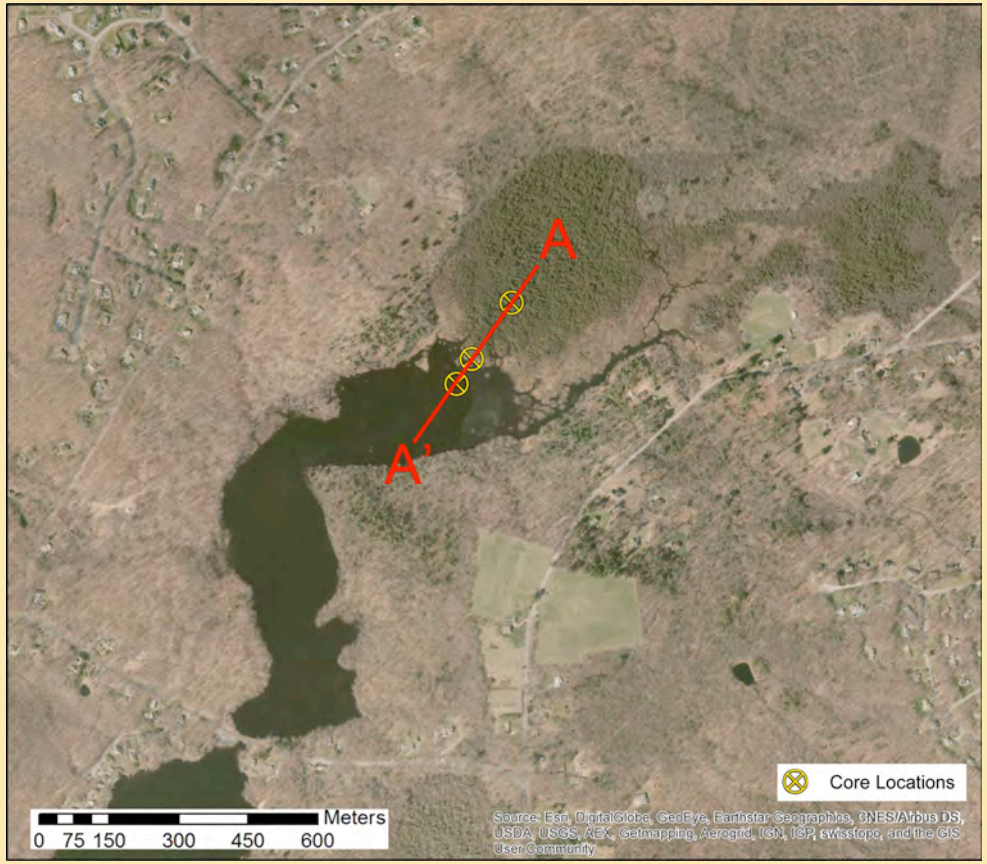
It was better than nothing, but provided little help in telling the story of this site.

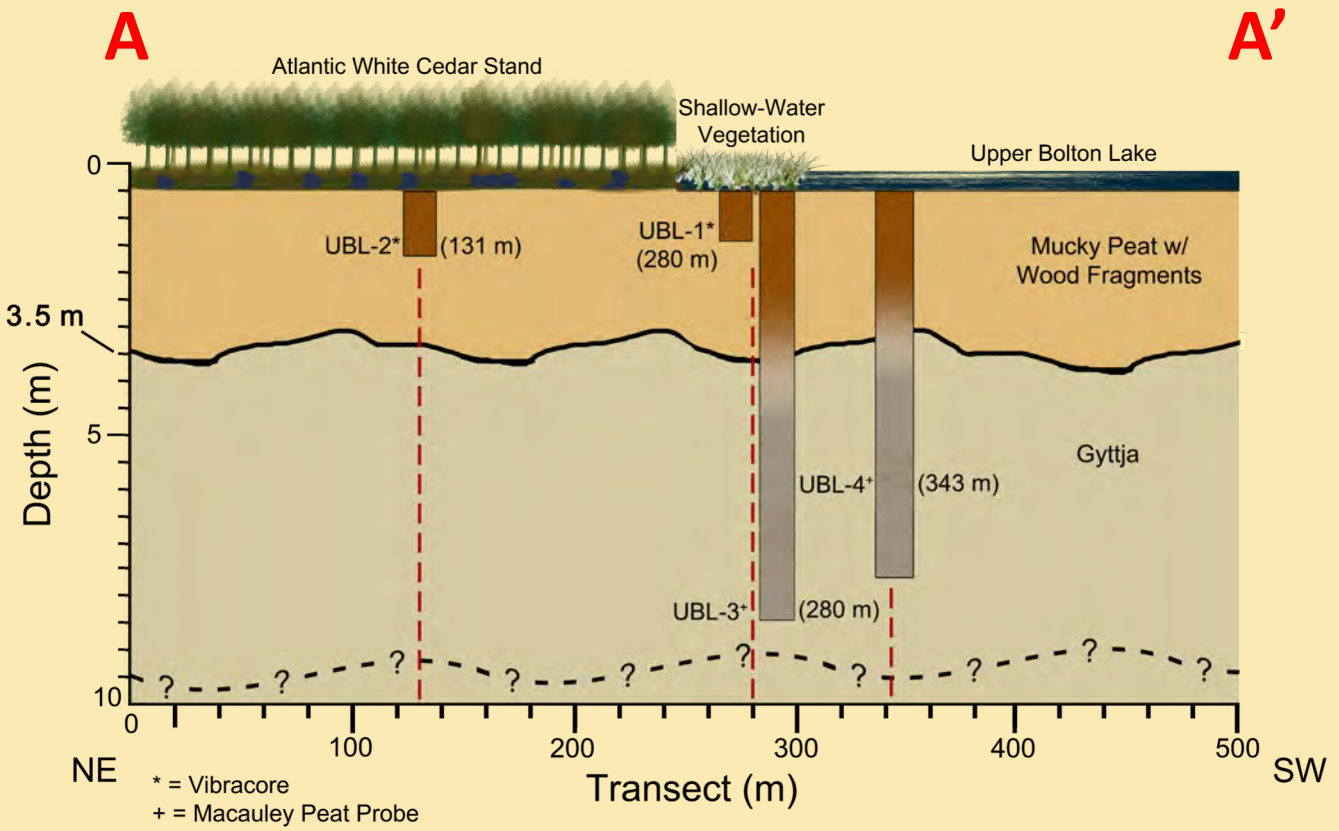


The final attempt utilized the macaulay peat probe. This is a discontinuous sampling method in which you add extensions to get deeper samples.

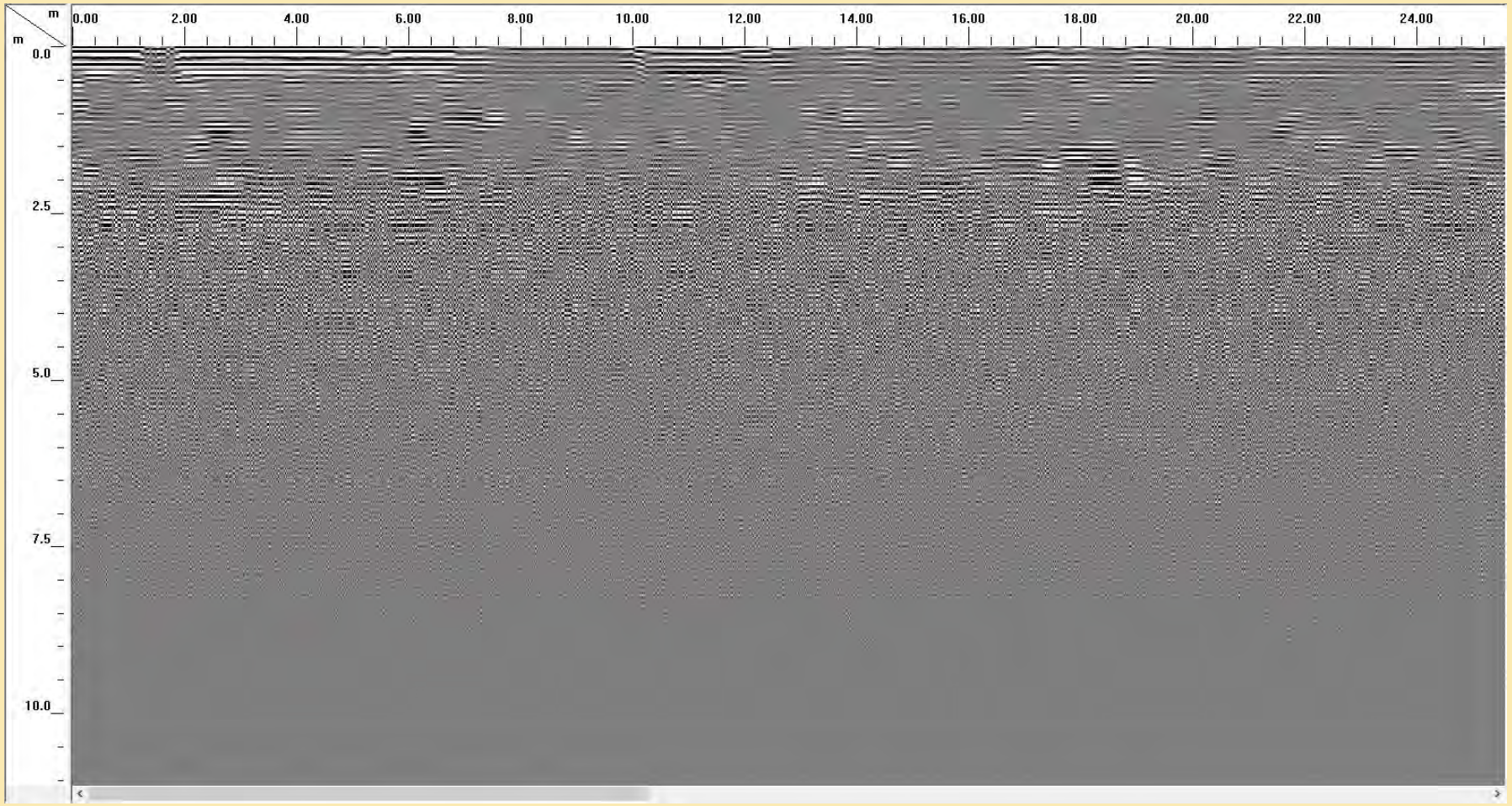
The macaulay peat probe allowed sampling to 8 m below surface. A transition at about 3.5 m from swamp deposits to deeper-lake clay gyttja below.



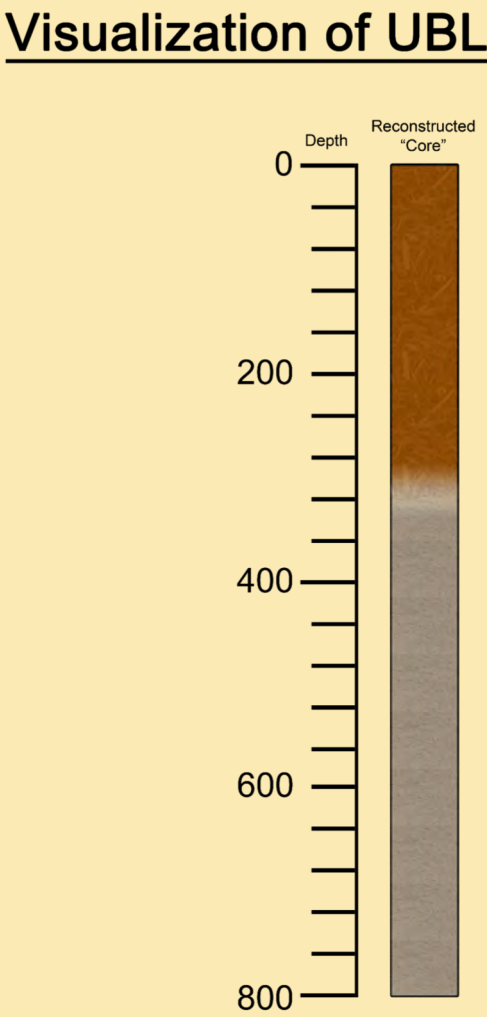

A
A'
Core Locations
Meters
0 75 150 300 450 600
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


A
A'
Atlantic White Cedar Stand
Shallow-Water Vegetation
Upper Bolton Lake
Mucky Peat w/ Wood Fragments
Gyttja
UBL-2* (131 m)
UBL-1* (280 m)
UBL-4+ (343 m)
UBL-3+ (280 m)
3.5 m
Depth (m)
0
5
10
0
100
200
300
400
500
NE
SW
Transect (m)
* = Vibracore
+ = Macauley Peat Probe

Ground Penetrating Radar was used along the transect outside of the stand. The data does not contradict sampling results.



“Core” Reconstruction



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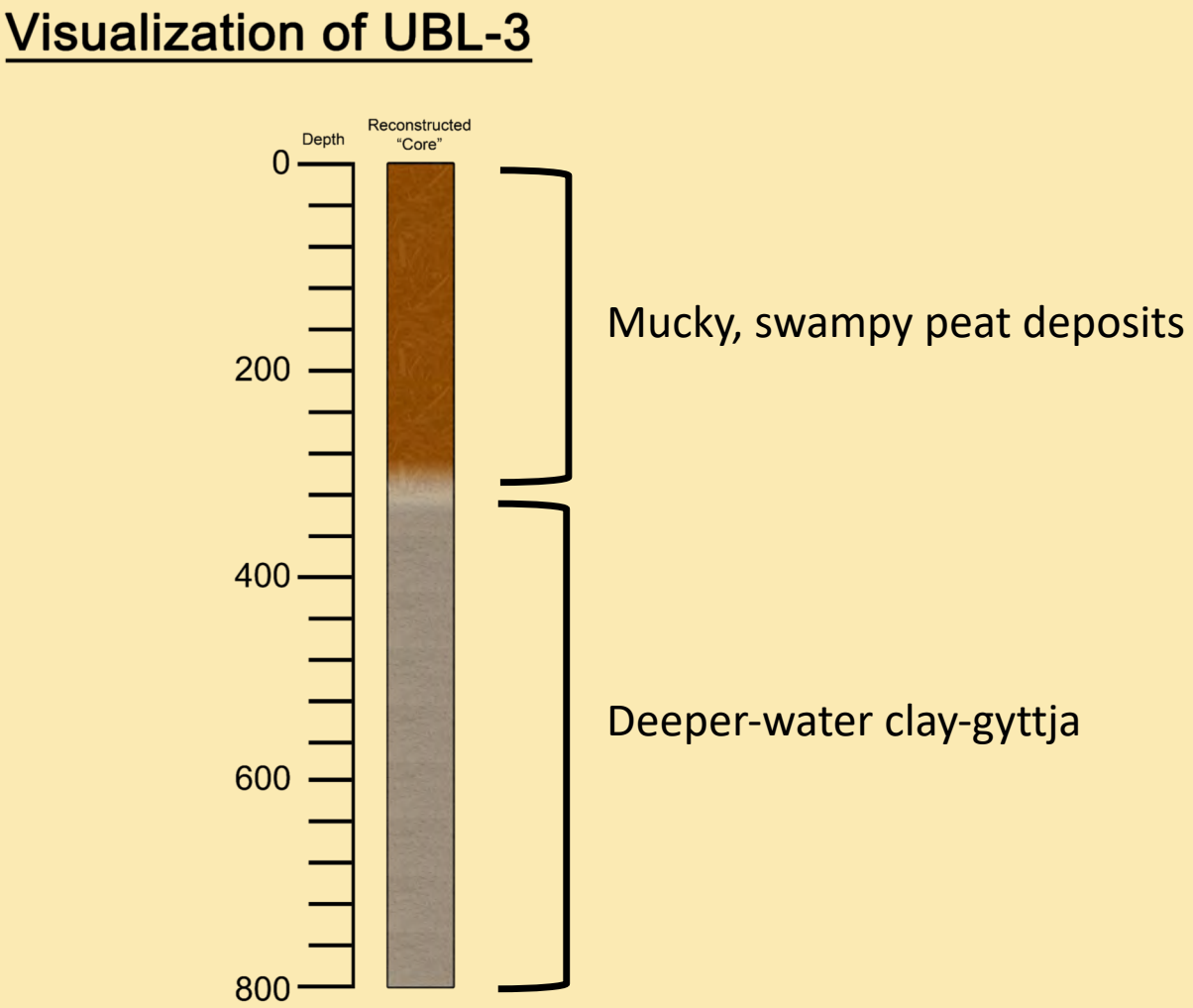
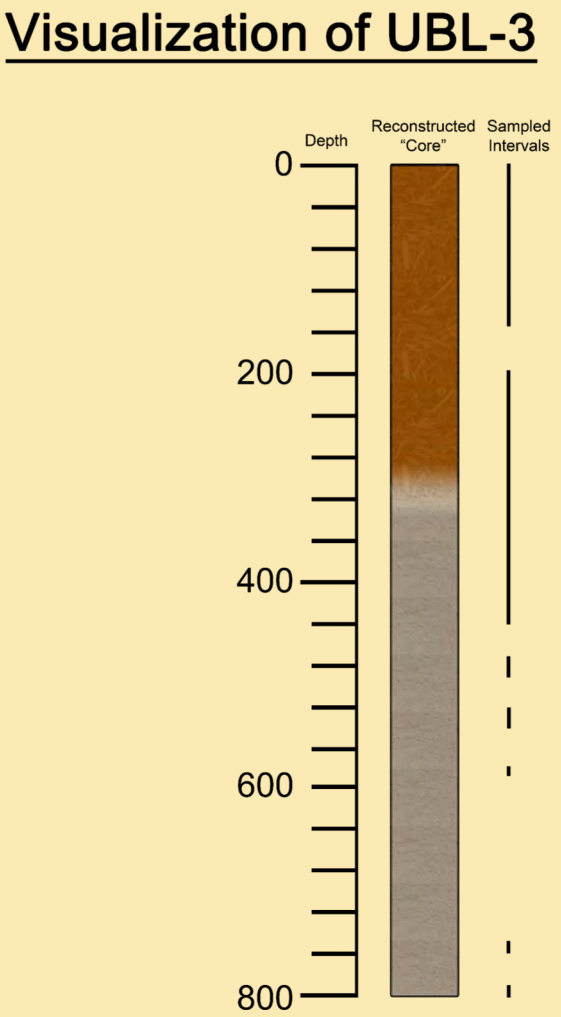
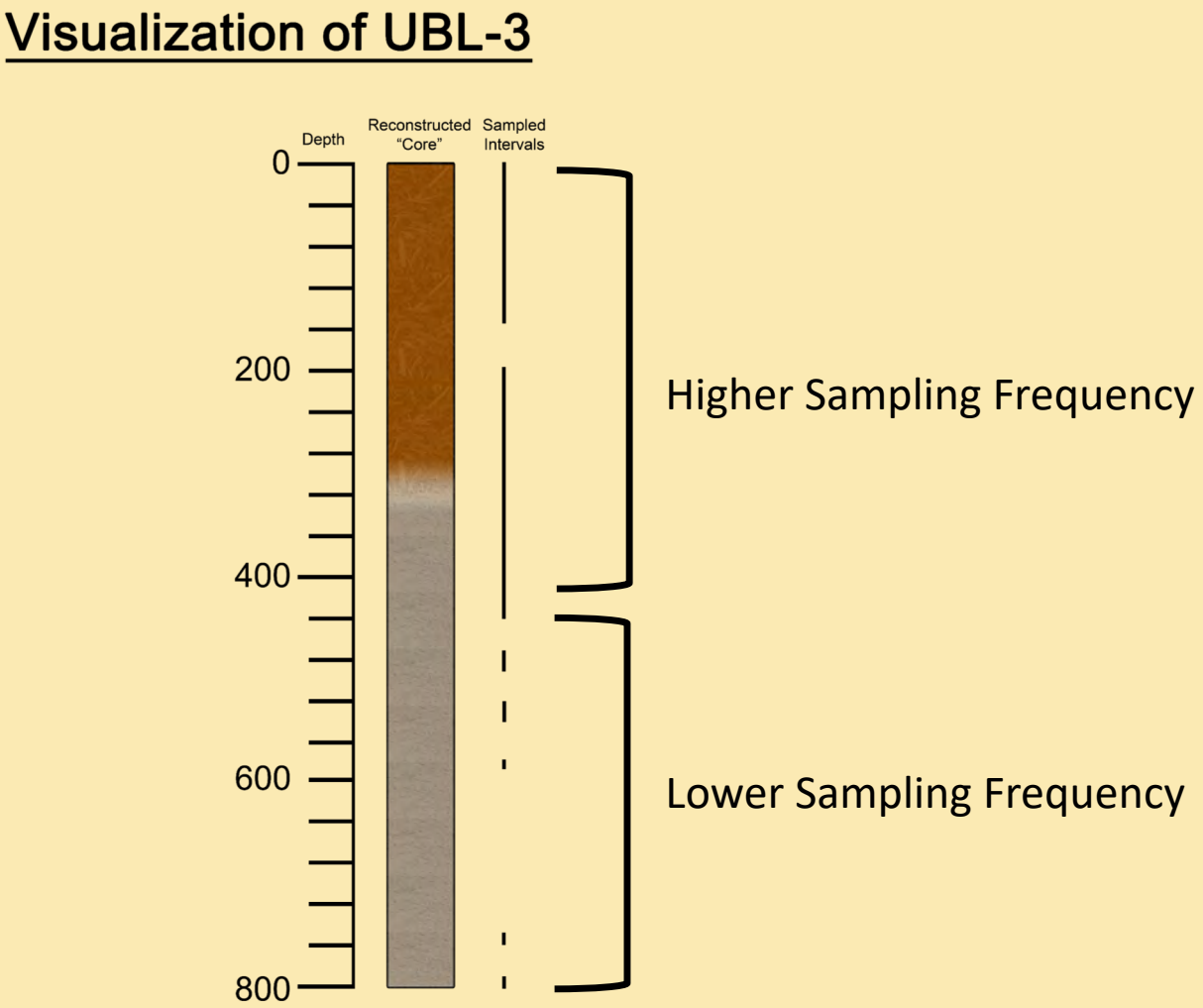


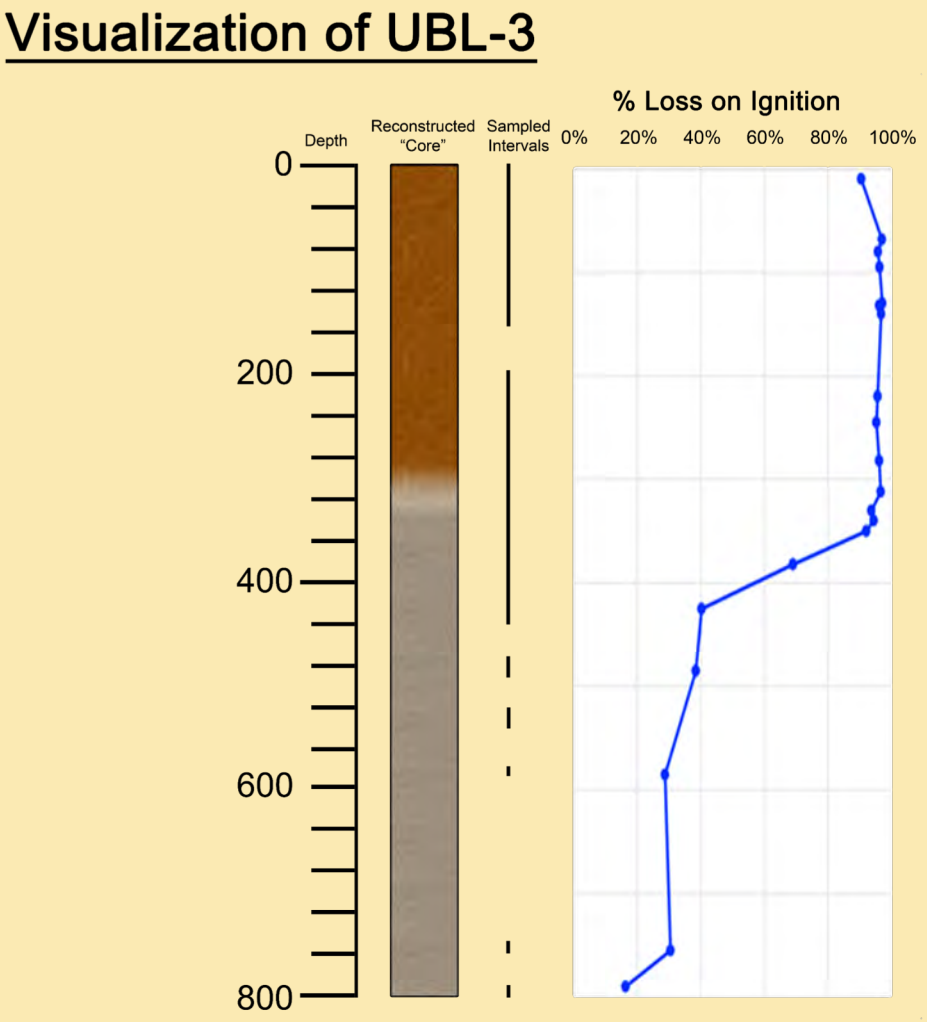
Sampled Intervals



Sampled Intervals



% Loss on Ignition + Core



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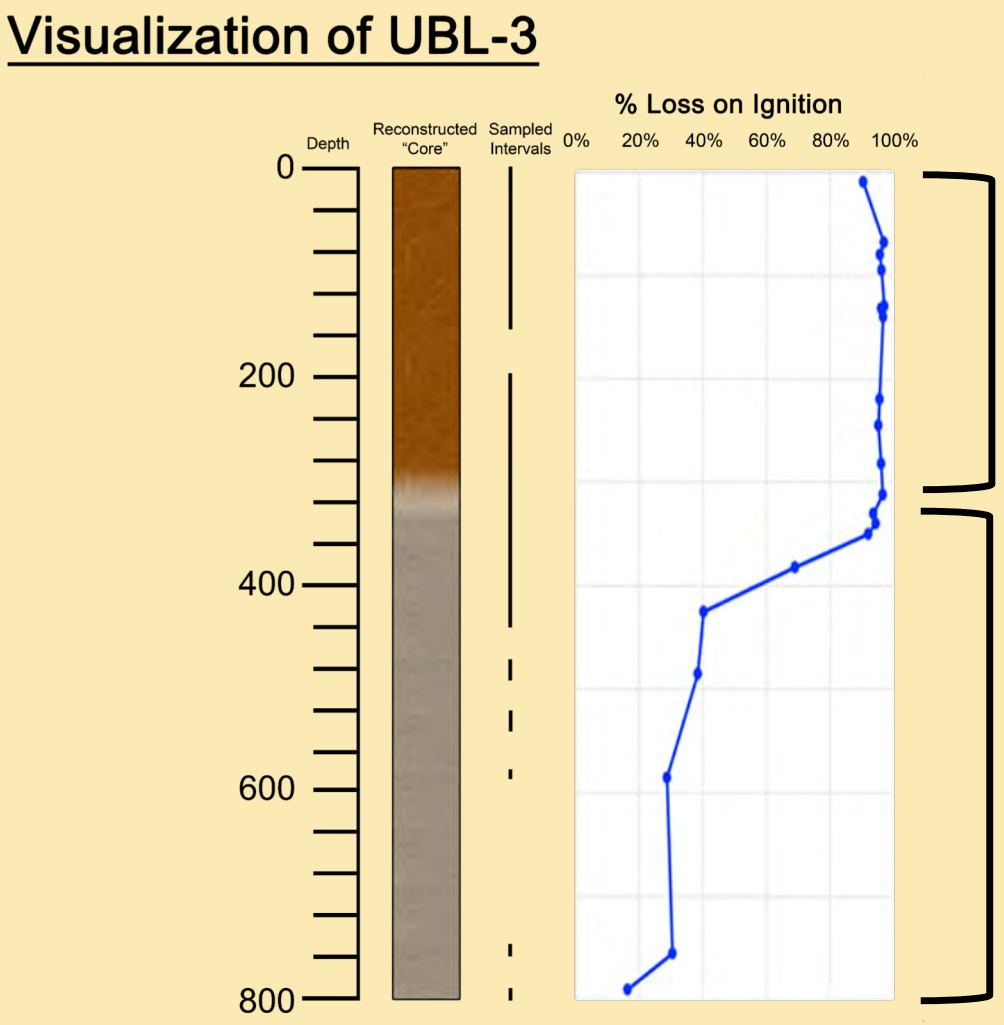
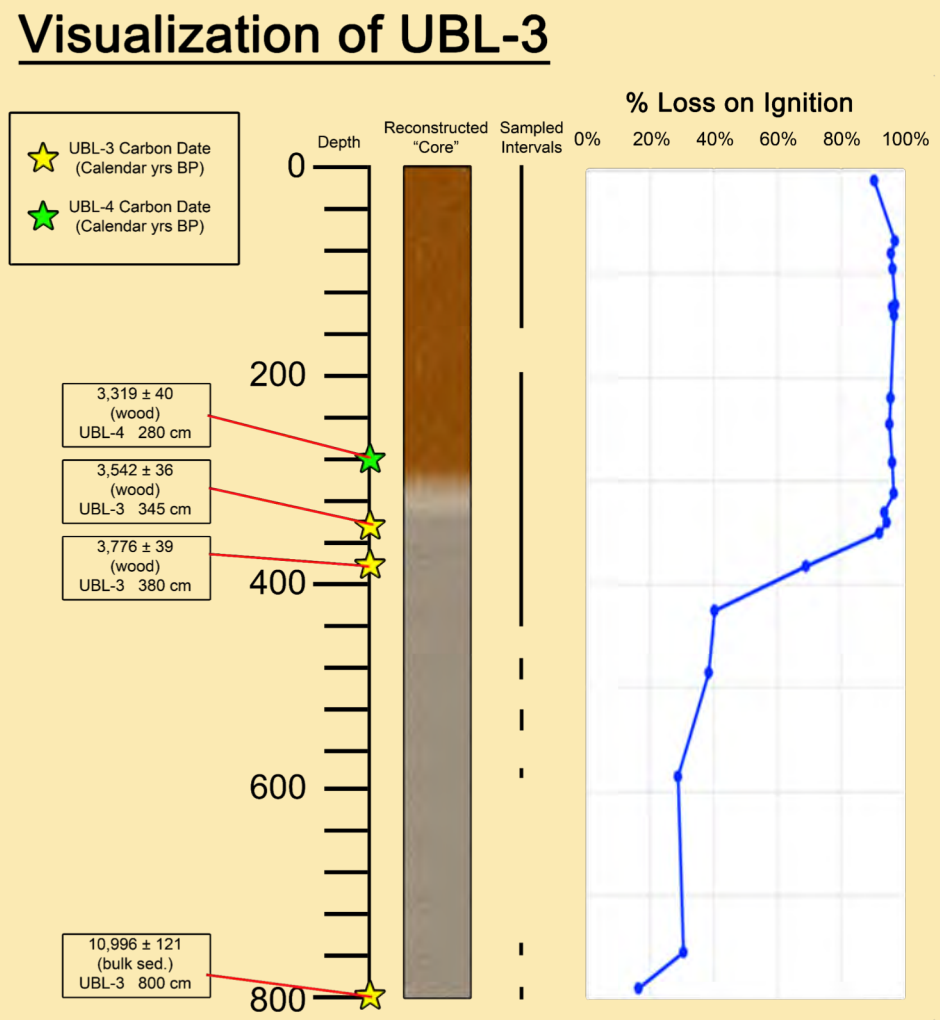


More organics, more loss on ignition

Less organics, less loss on ignition

Radiometric Dating (14C)



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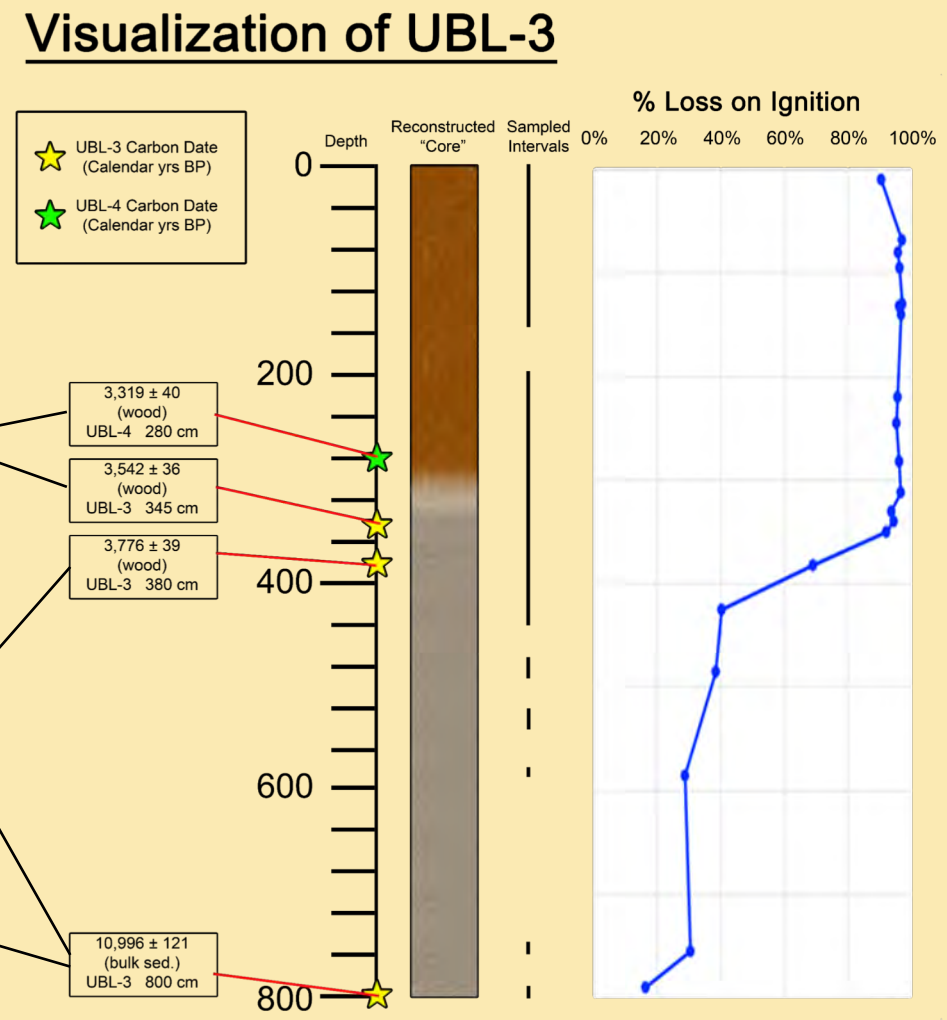

3.5-3.3 Ka
~200 yr transition implies slow change, no pause in deposition

11-3.5 Ka
Continuous deposition over thousands of years

11 Ka
Bottom age. Glacial retreat here began ~16Ka

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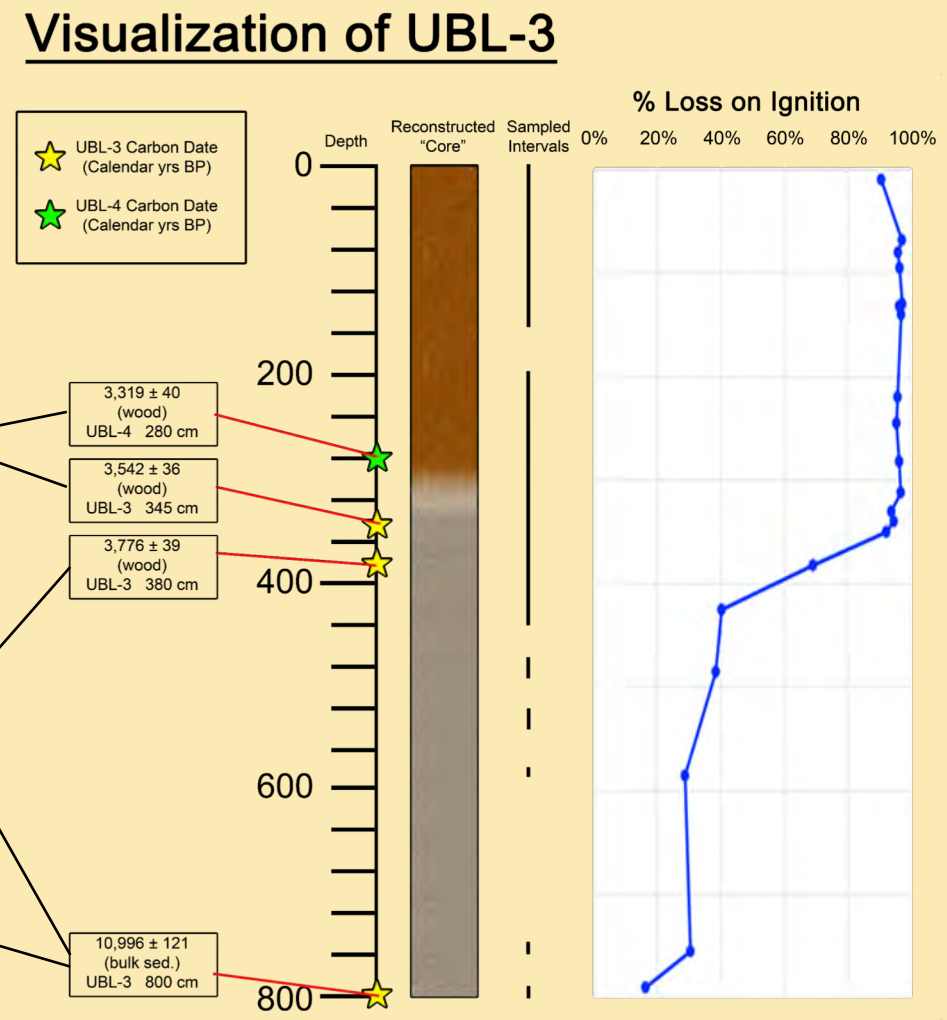

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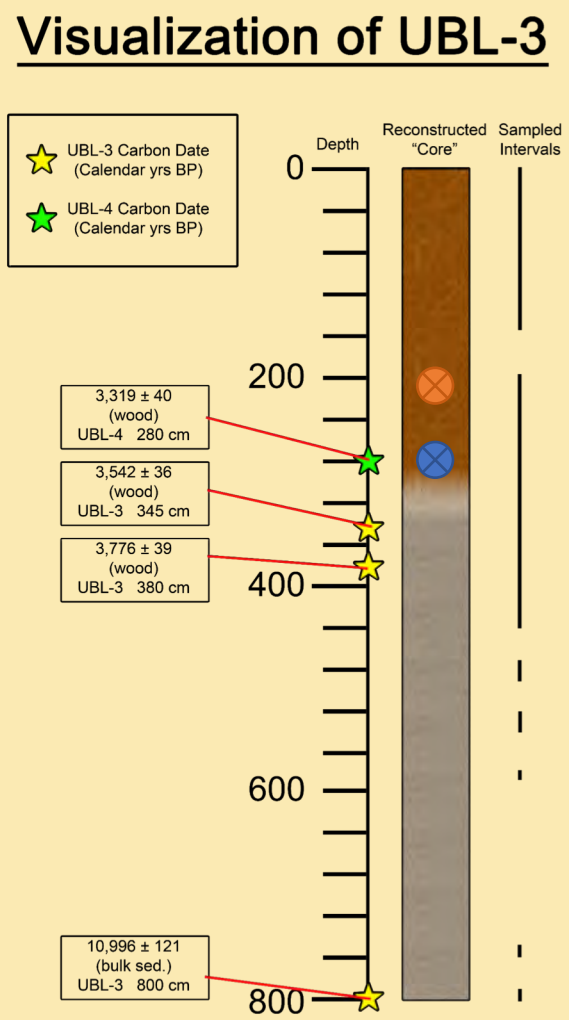
A legacy of Atlantic White Cedar?

The state of New Hampshire has documented AWC swamps with a legacy of 4,000 years.

• Inland Atlantic white cedar swamp (S1)

GENERAL DESCRIPTION: This type occurs in inland basins that are more than 30 miles from the coast and >500 ft. elevation. It is characterized by the presence of numerous northern species that are not found in other *Chamaecyparis thyoides* (Atlantic white cedar)* communities, and by the absence of several coastal and southern species. Swamps in the Sunapee Uplands subsection range in elevation from 890-1040 ft.; a single swamp in the Sebago-Ossipee subsection occurs at 520 ft. elevation. Atlantic white cedar is documented from the pollen record at one site from 4,000 years ago through the present, implying that Atlantic white cedar has long-term persistence in some locations. Hummock and hollow topography is pronounced and hollows are often wet throughout the growing season. Soil pH ranges from superacid to mediacid [3.4-4.8 (average 4.1, n=12)].

Wood Identification

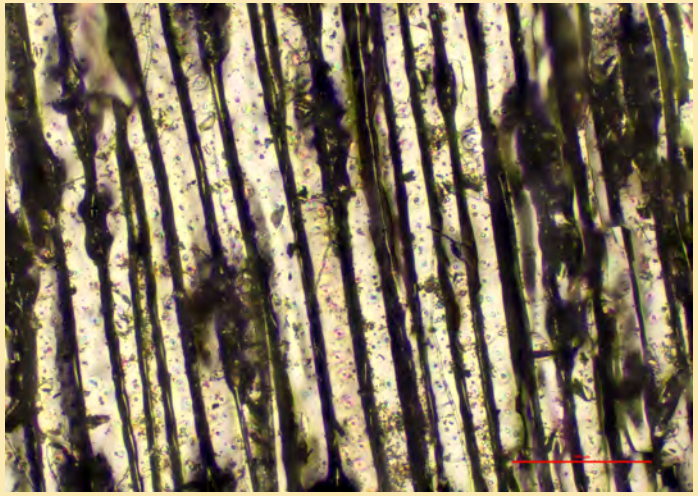


UBL3 – 210 cm

1 carbonized fragment

Identification:

Tsuga canadensis **(Eastern Hemlock)**

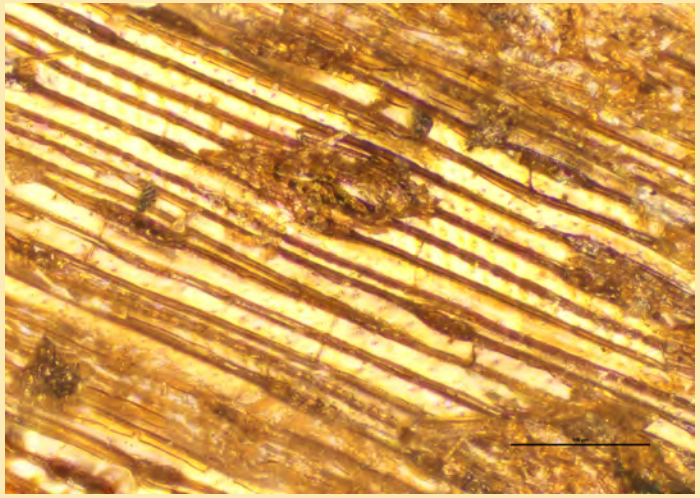


UBL4 – 280 cm

1 uncarbonized fragment

Identification:

Thuja occidentalis **(Northern White Cedar) OR**
Chamaecyparis thyoides **(Atlantic White Cedar)**



Conclusions

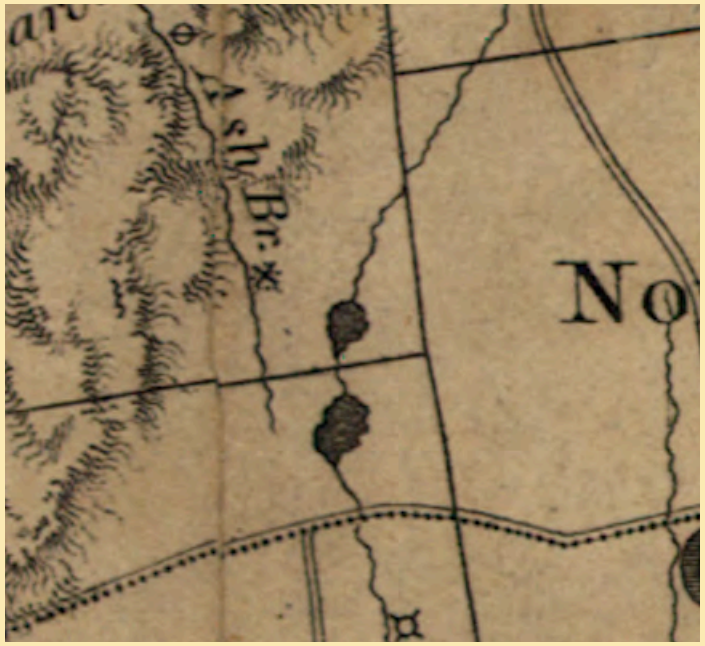
Timeline

- **11 Ka+:** A deep, post-glacial lake sits on this site. This is represented by the clay-gyttja deposits.

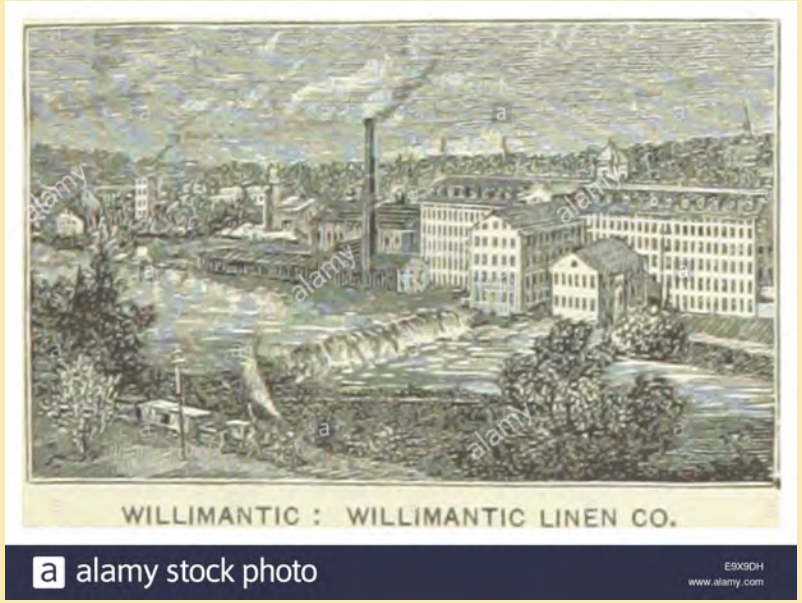
- **3.54-3.32 Ka:** The lake transitions to a shallower, swampy environment. It supports trees, eventually including cedar.

Timeline

- **1673:** European settlement in Bolton; perhaps routine harvesting of cedar



- **1850s:** Full industrial use of Bolton Lakes begins. UBL is formed by the flooding of the cedar swamp.
  - The cedar swamp shrinks until industrial use stops in the 1930s.



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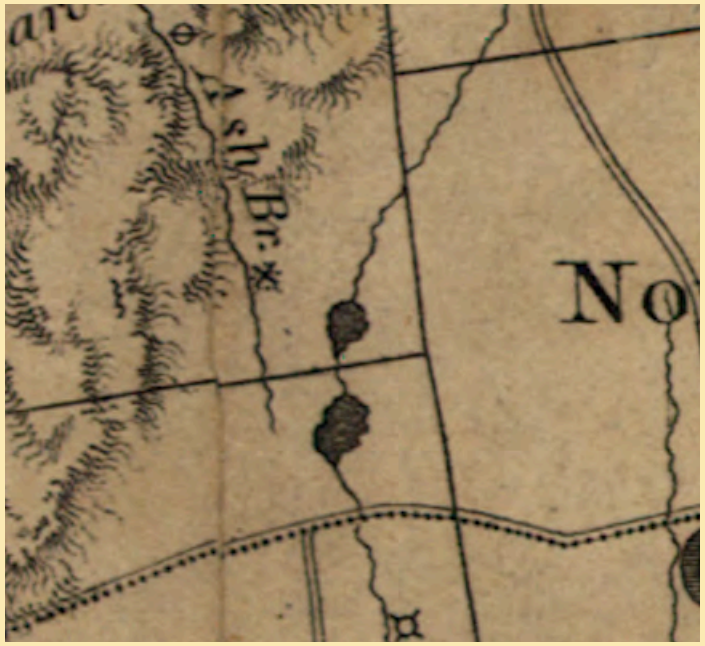

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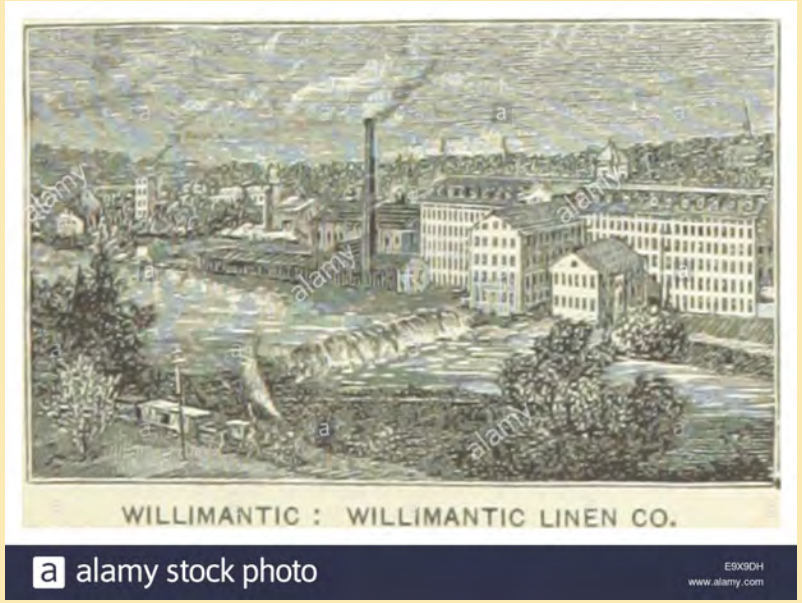

Potential Mechanism of Shrinking

Bolton Historical Society
Bolton, Connecticut

BOLTON'S MYSTERIOUS ROVING ISLANDS
by Hans DePold, town historian

(Published in the Bolton Community News, June 2004)

On Monday, Feb. 28, 1955, on page 4 of The Bridgeport Telegram, there appeared an article titled "Crane, Bulldozer Tear Apart Roving Island in Bolton Lakes." The action was taken under the supervision of the State Board of Fisheries and Game. The floating island had measured 125 feet long, 75 feet wide, and 7 feet thick. It had supported cedar trees (one 8 yards tall) that served as masts and sails to drive the island around Bolton Lake. It had become a favorite private spot for young Bolton boaters, explorers and lovers.

Bolton Lake was created in the mid-1800s as part of a system to provide waterpower to the mills of Willimantic before electricity, internal combustion motors, or even steam power. The prehistoric Mohegan tool-making site at Bolton's Cedar Swamp was submerged when the lake was created.

As darkness descended, factories would close shop and the lake outlet was closed, raising the water level. Then as daylight approached, the lake sluice gates would be opened, doubling the normal flow rate in the rivers powering Connecticut's industrial revolution. That was known as Connecticut ingenuity.

Takeaways

- Water level change from upcoming culvert renovation may affect the Atlantic White Cedar stand.
  - The “natural state” on a recent timescale is a larger cedar swamp.
- Geologic story contextualizes treasured community resource for local residents.
- Geologic and anthropogenic story contributes to literature on Holocene change.

Acknowledgements

- Advisors: William Ouimet, Robert Thorson
- Field/Lab:
  - Samantha Dow, C. Peter Van Dine, Jillian Lenti, Cameron Mitchel, Kelly Flannery, Ben Van Dine
  - USDA-NRCS: Debbie Surabian, Jacob Isleib, Donald Parizek

Email connor.mitchel@uconn.edu for questions on works cited and other resources.