

Geoarchaeology of Jefferson's Monticello Plantation

Fraser D. Neiman, Monticello

Sara Bob-Harper, Highland

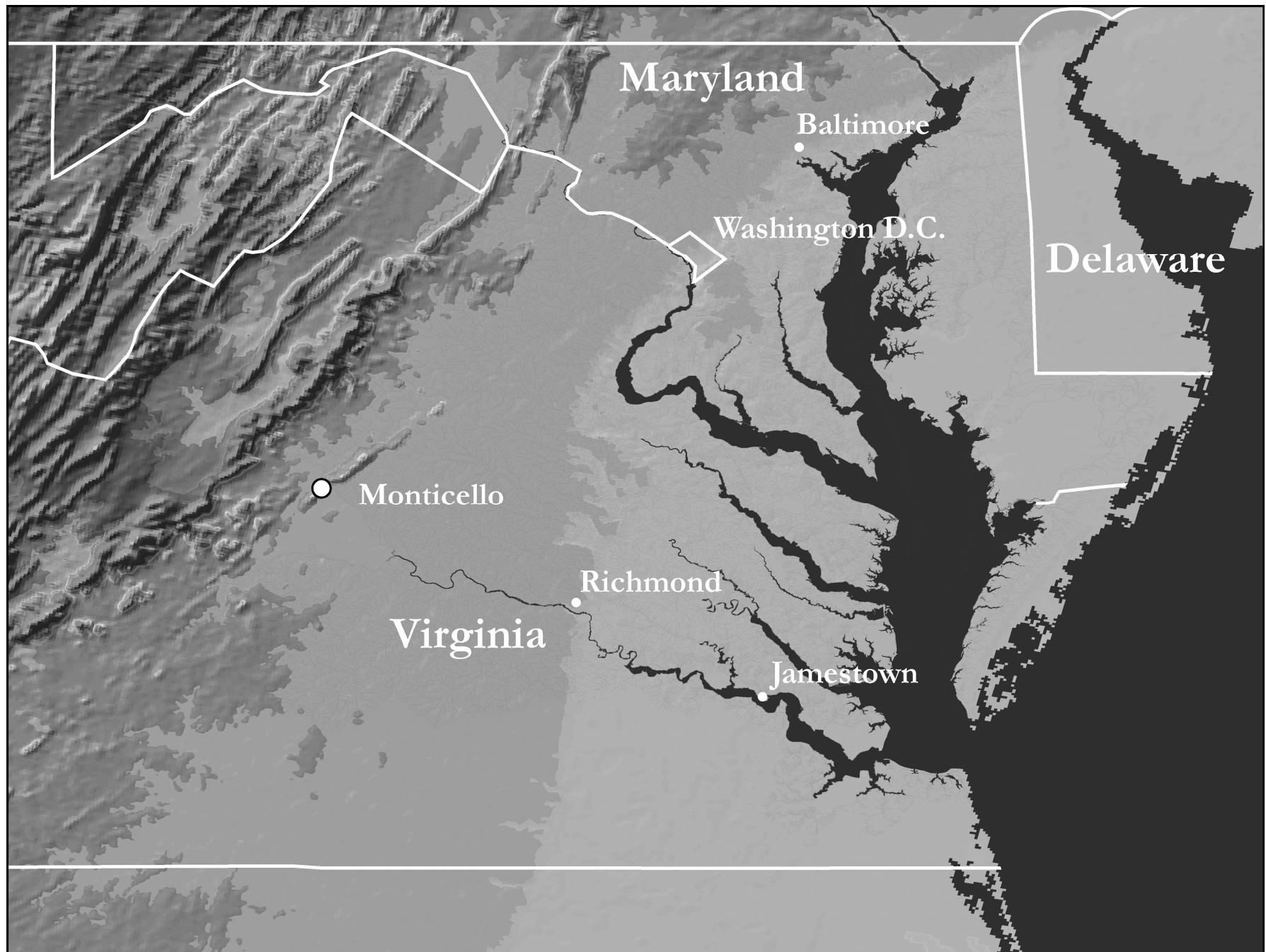
Derek Wheeler, Monticello

John G. Jones, Archaeological Consulting Services, Ltd.

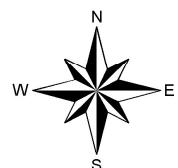
James Burton, University of Wisconsin

James Feathers, University of Washington

<https://github.com/fneiman/MonticelloGeoArchy>



0 50 100 Miles

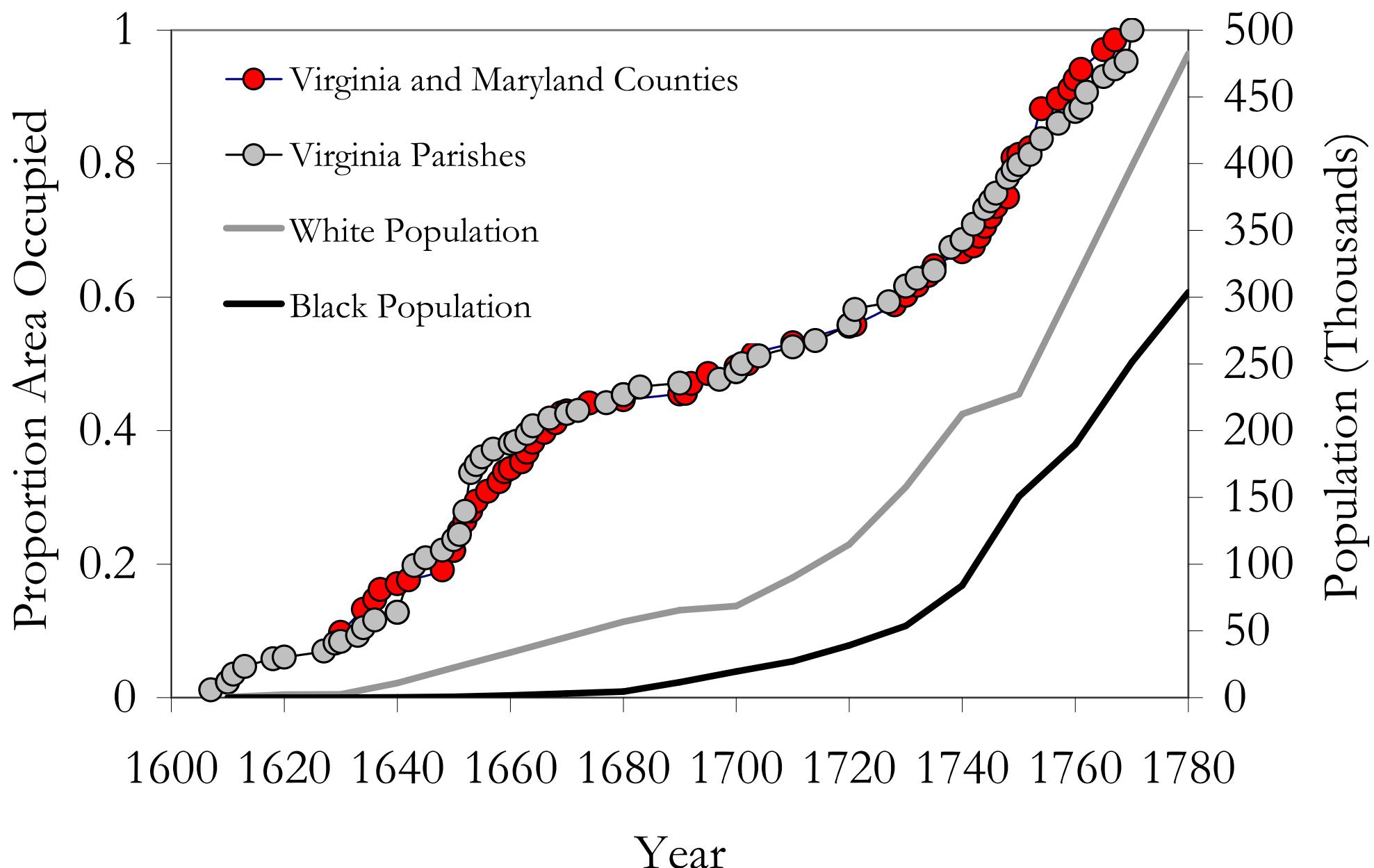


200 Kilometers

0 100



Demographic Expansion



University of
Virginia Rotunda

Montalto

Monticello

Tufton

Portobello

Milton

Moores
Creek

Creek

Rivanna
River

Pantops

Lego

Shadwell

N

Monticello Department of Archaeology



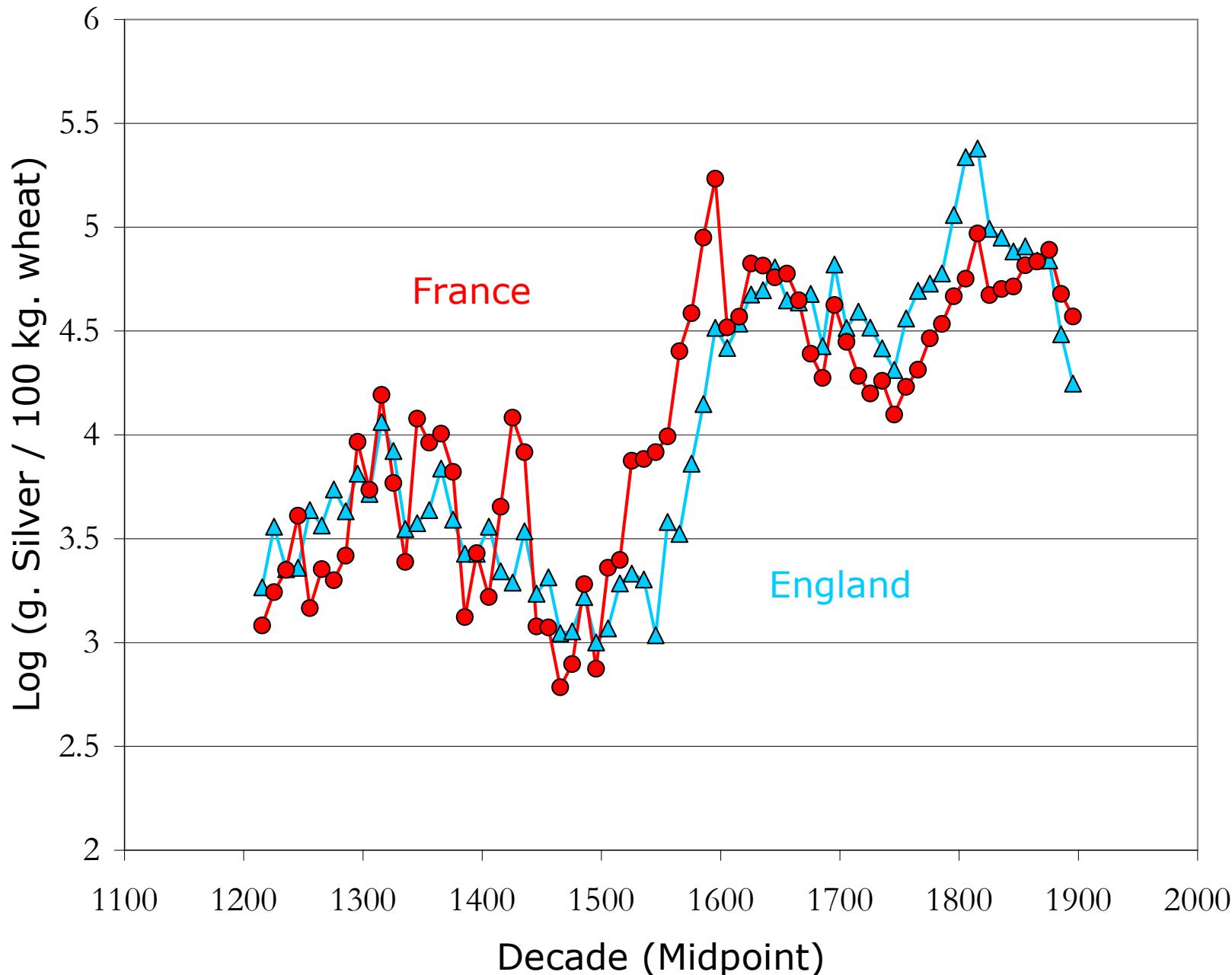
Tobacco

- Hoes
- Stumps
- Field rotation
- Long fallows for sustainability
- Locally evolved

Wheat

- Plows
- No stumps!
- Permanent fields
- Crop rotations and fertilizers for sustainability
- European handbooks

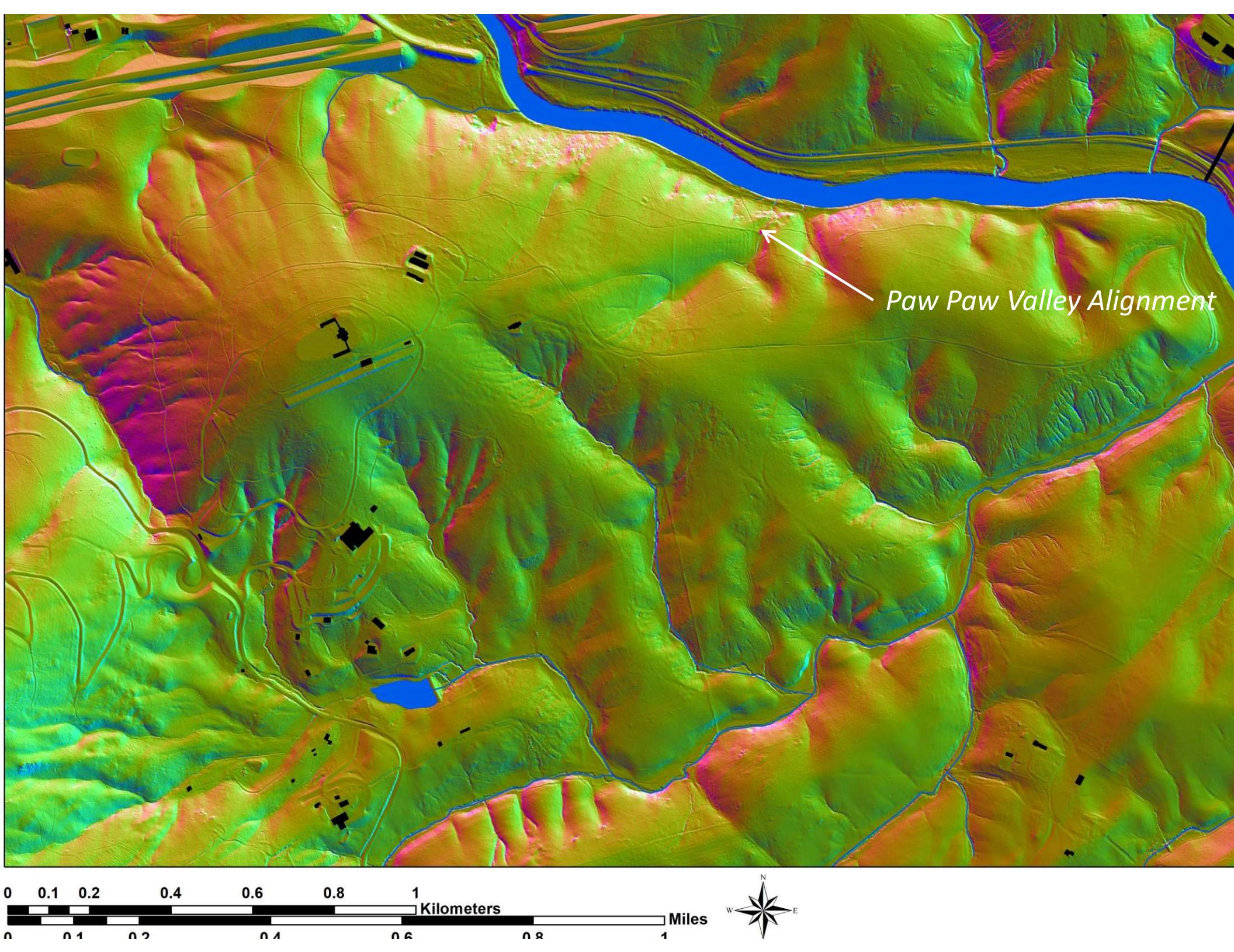
European Wheat Prices

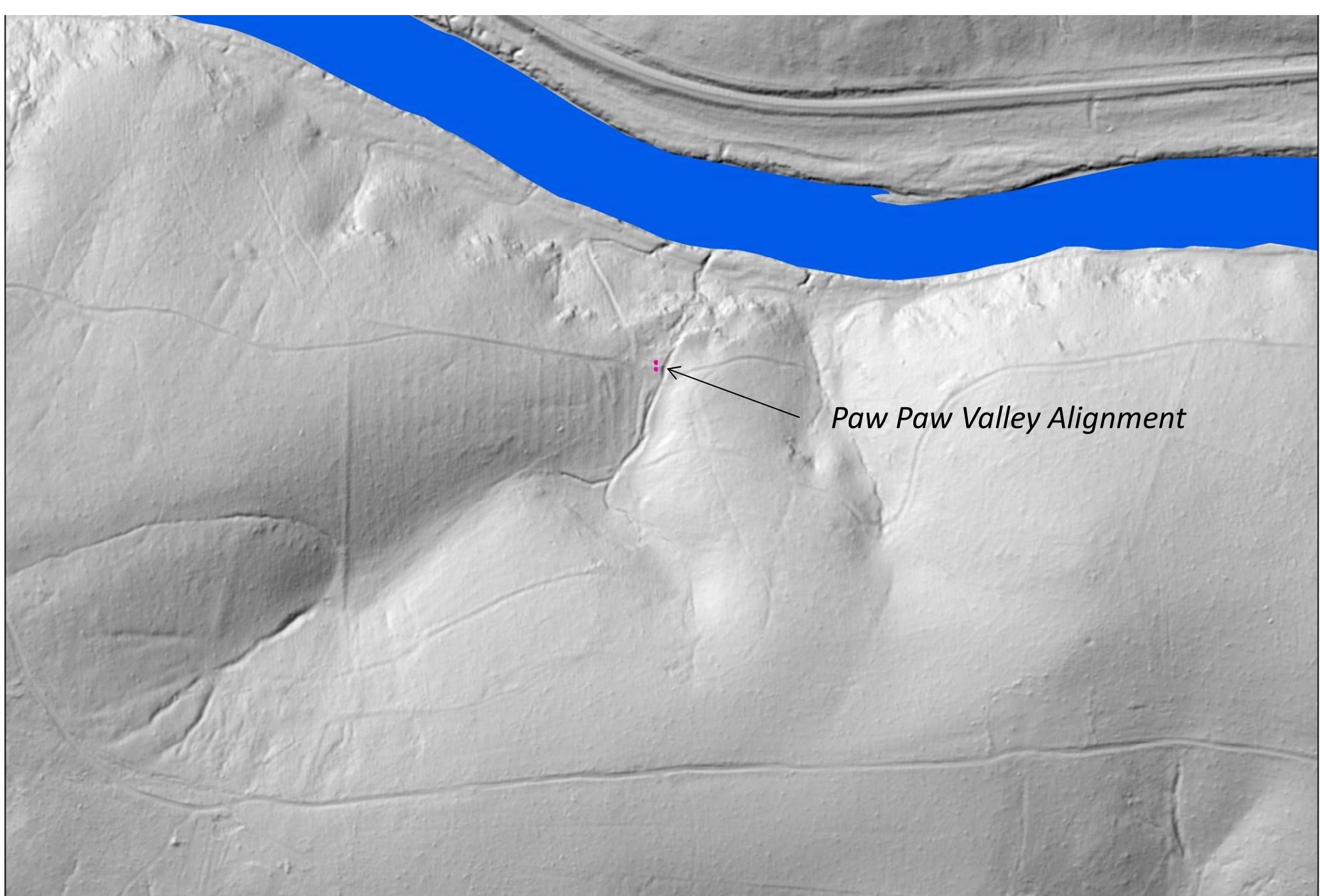


*"There is reason to expect a rupture has taken place between Spain and England. If so, it will involve France and so render the present war of Europe almost universal there. I hope they will see it their interest to let us make bread for them in peace, and to give us a good price for it. **We have every moral certainty that wheat will be high for years to come.** I cannot therefore, my dear Sir, omit to press, for myself, the going into that culture as much as you think practicable. In Albemarle I presume we may lay aside tobacco entirely; and in Bedford the more we can lay it aside, the happier I shall be."*

Thomas Jefferson to Nicholas Lewis
July 4, 1790







0 0.05 0.1

0.2

0.3

0.4

0.5

Kilometers

0 0.05

0.1

0.2

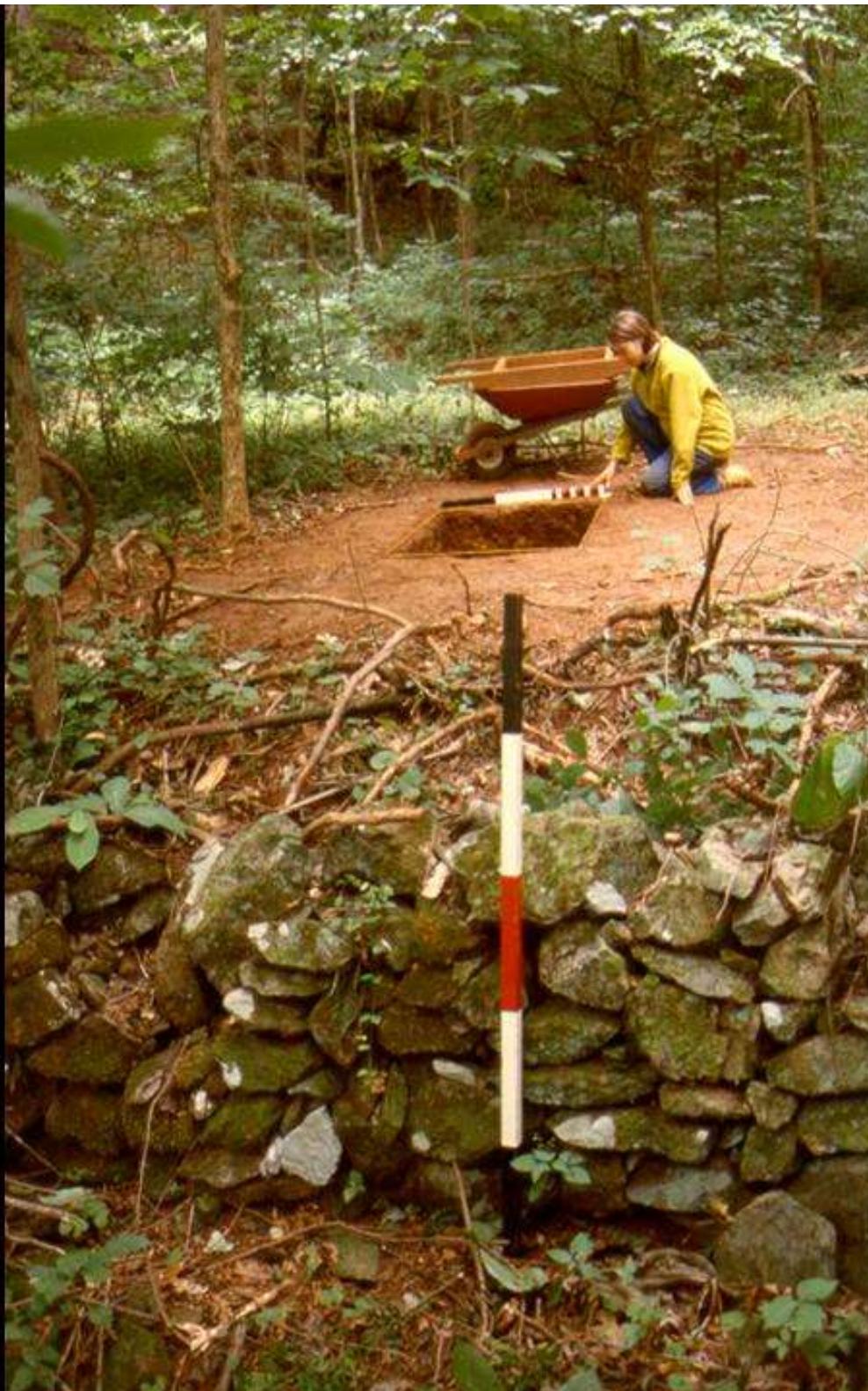
0.3

0.4

0.5

Miles



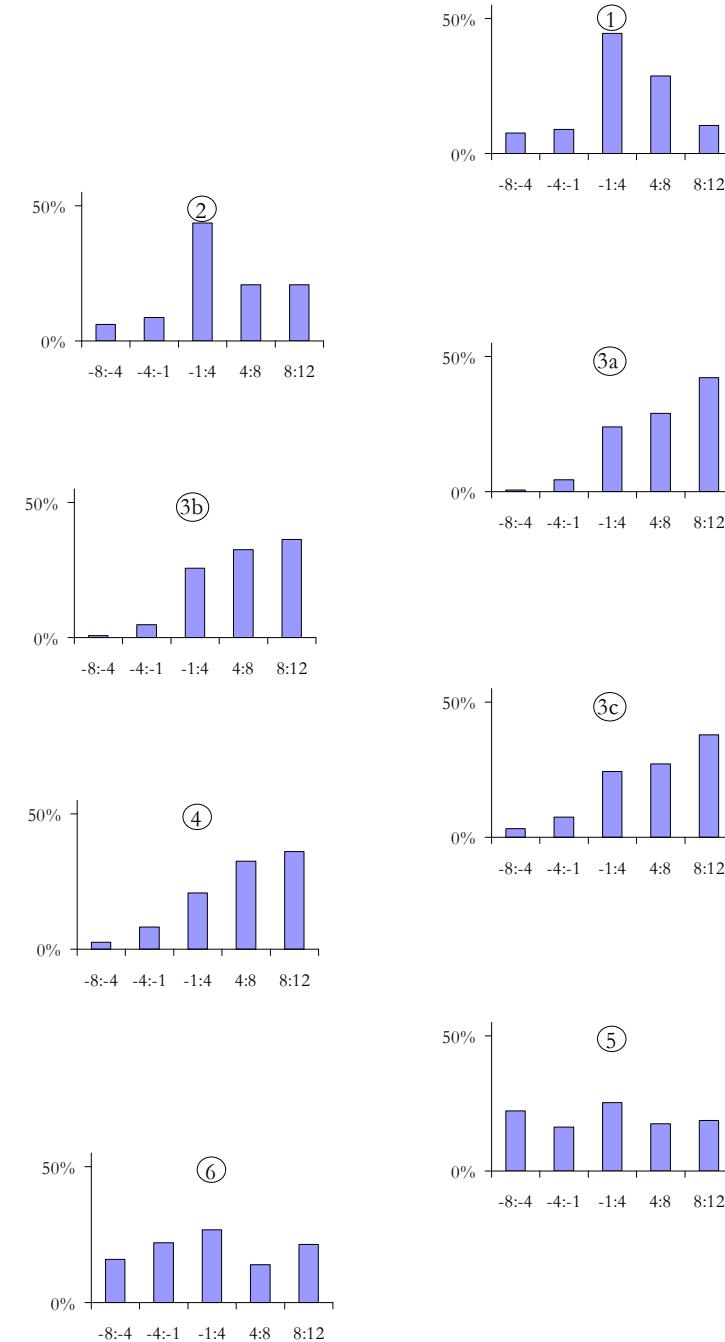
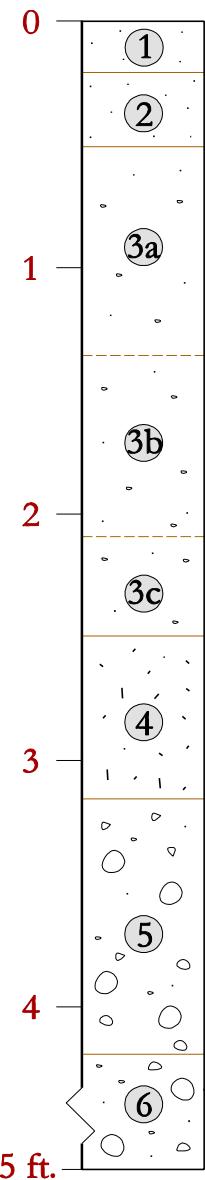




Paw Paw Valley: Unit 1

Lithostratigraphy and Grain Size

1. Reddish brown sandy loam.
2. Red sandy clay loam.
- 3a. Red clay with < 5% weathered greenstone pebbles.
- 3b. Red clay loam with < 5% weathered greenstone pebbles.
- 3c. Red clay with < 5% weathered greenstone pebbles.
4. Reddish brown clay with < 5% pebble-sized charcoal flecks.
5. Yellowish red clay loam with 25% pebbles and cobbles.
6. Strong brown clay loam with 10% weathered greenstone gravel and cobbles

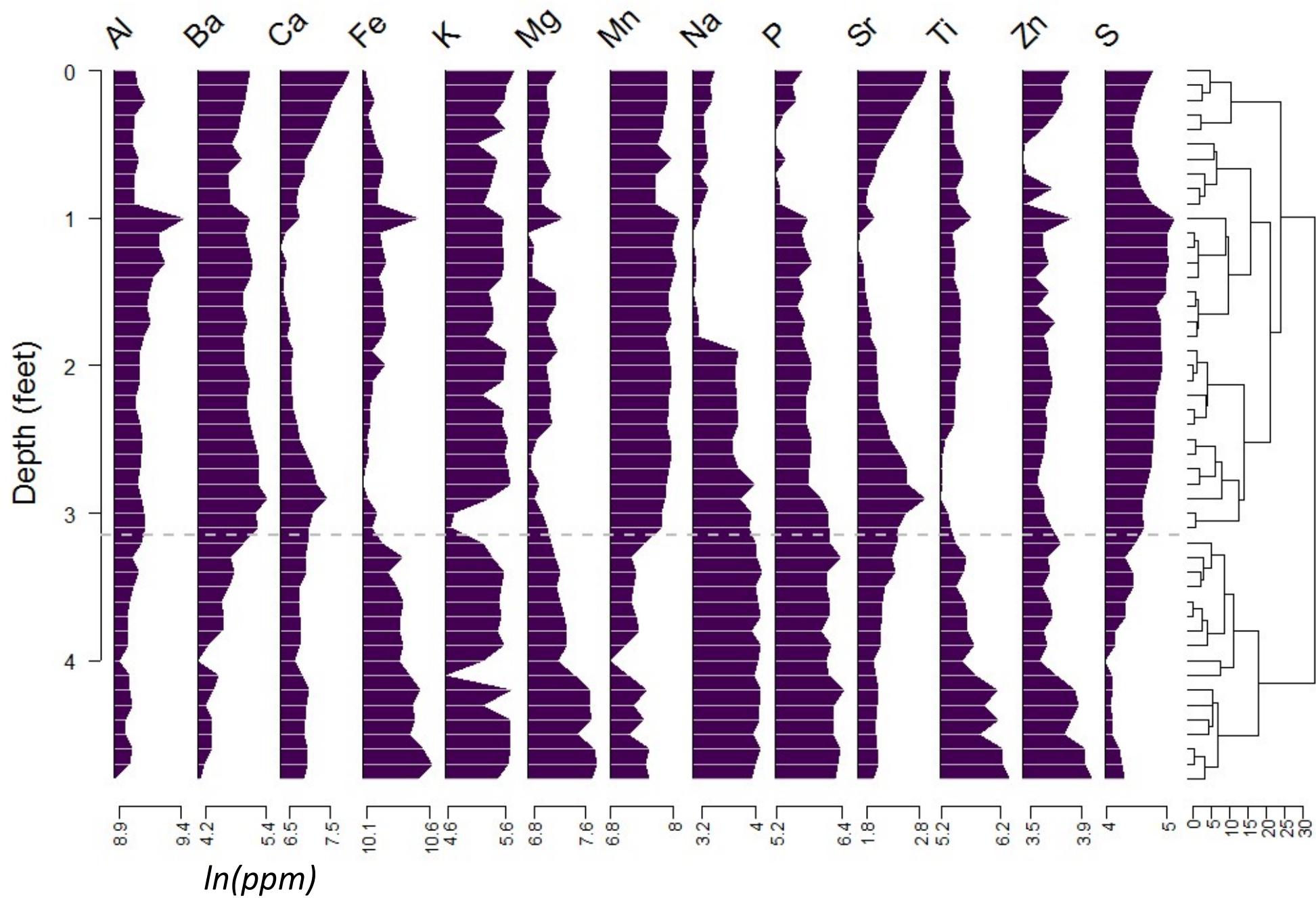


Cobbles-Pebbles-Sand-Silt-Clay

Phi

Paw Paw Valley: Unit 1

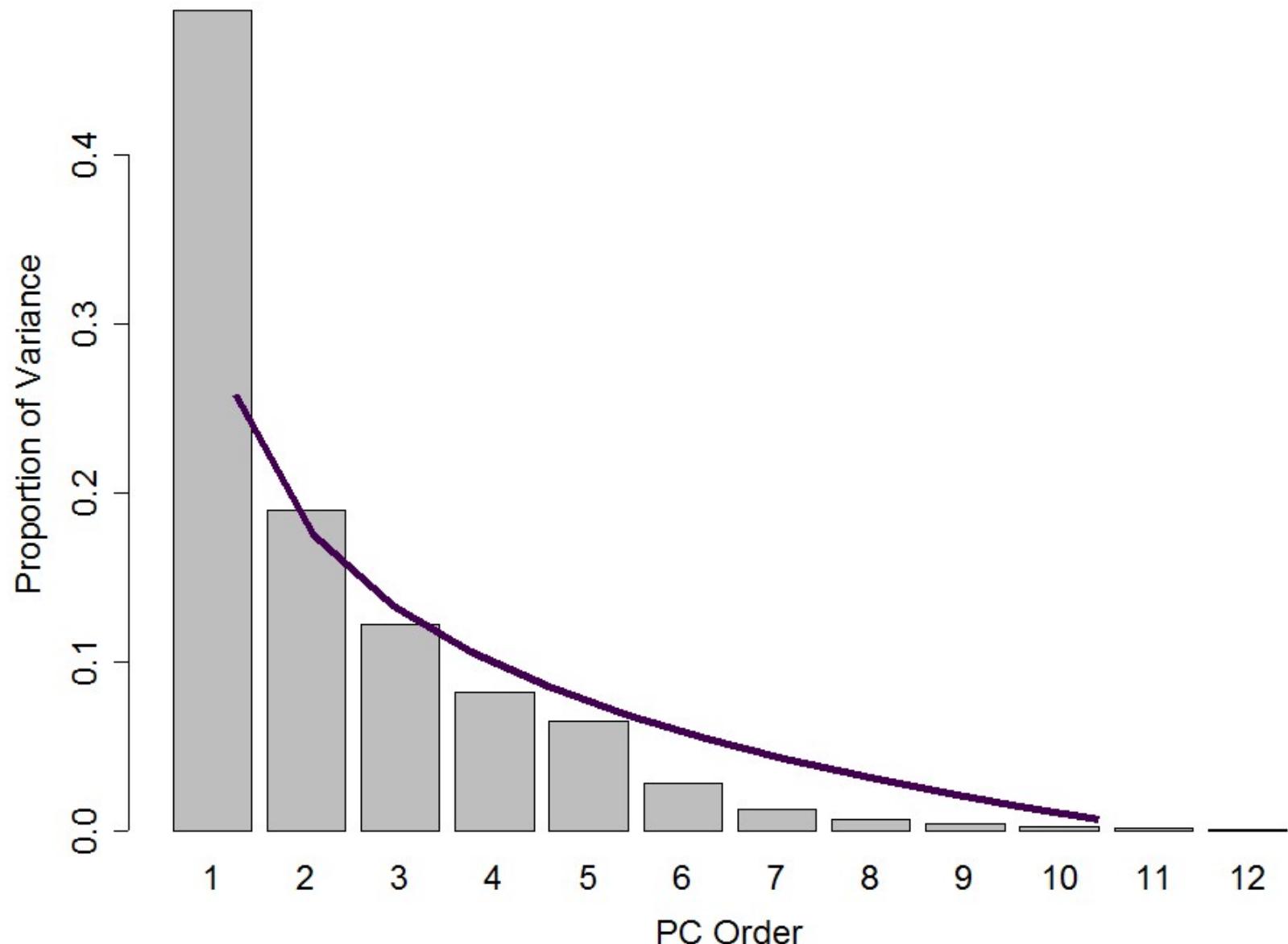
Sediment Chemistry



Paw Paw Valley: Unit 1

Sediment Chemistry

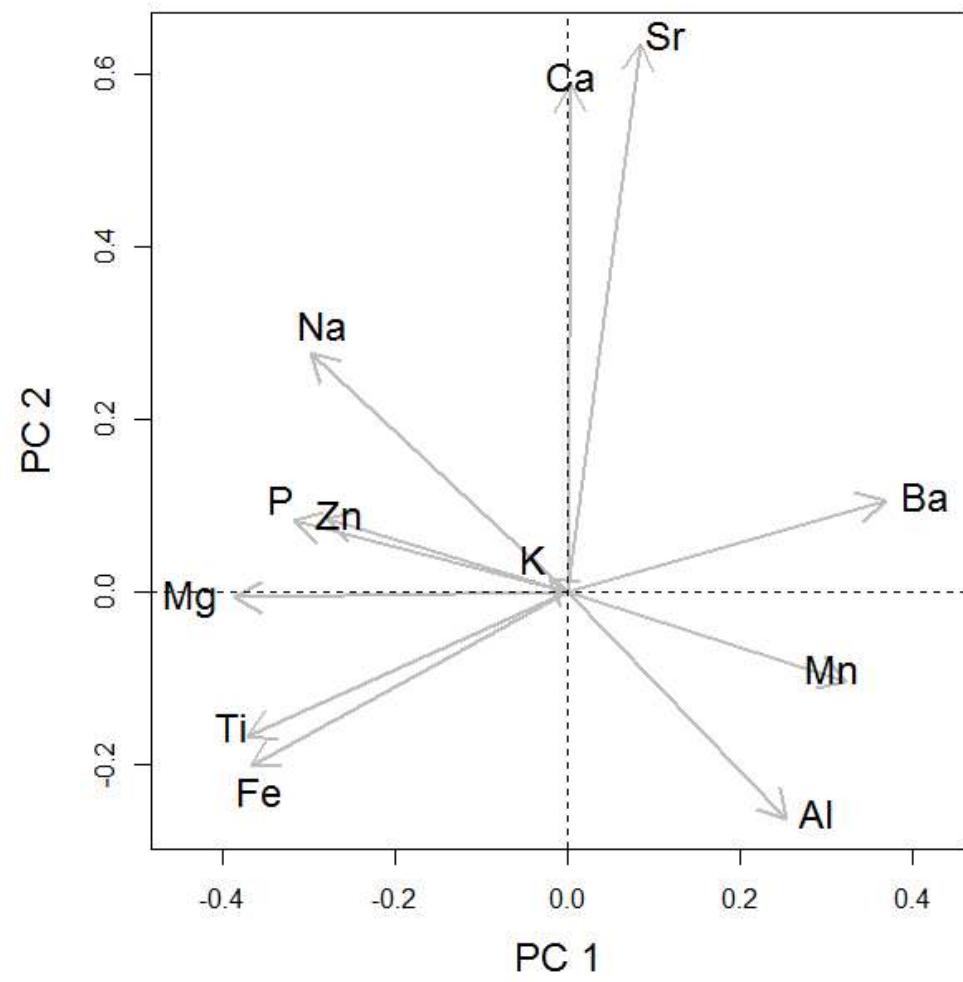
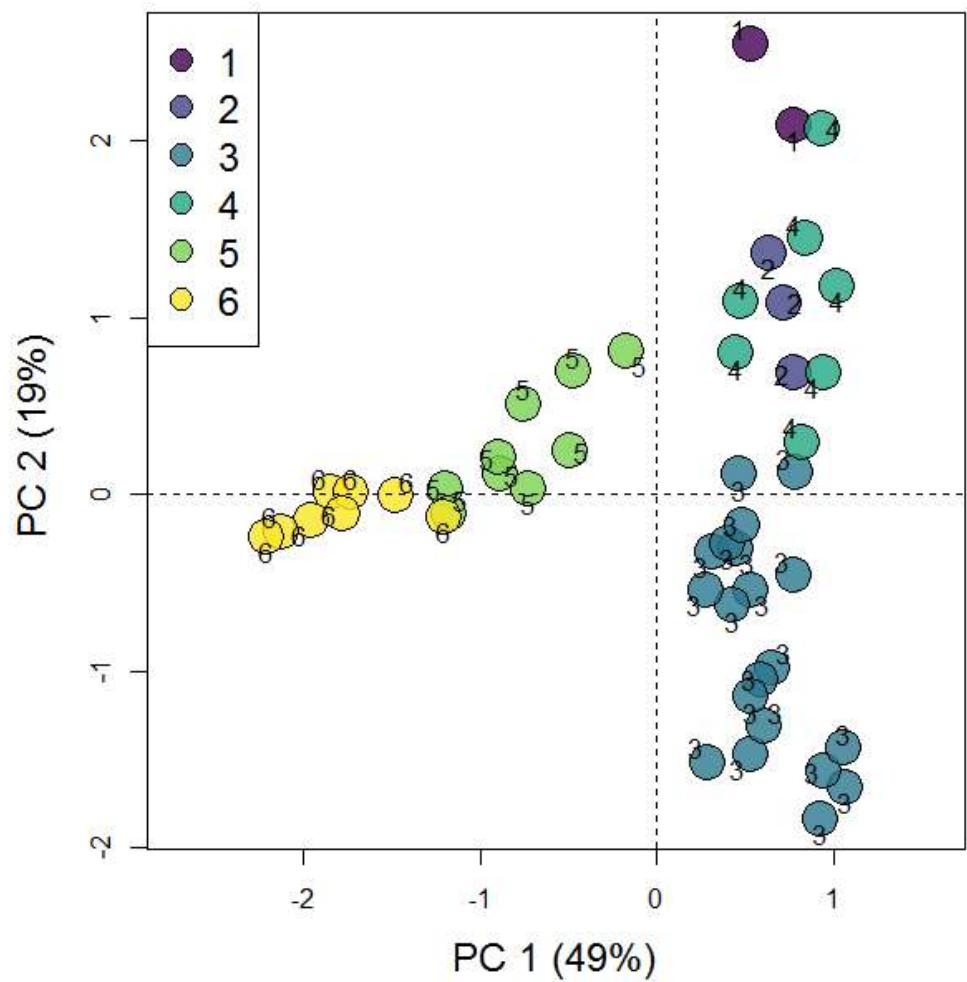
PCA



Paw Paw Valley: Unit 1

Sediment Chemistry

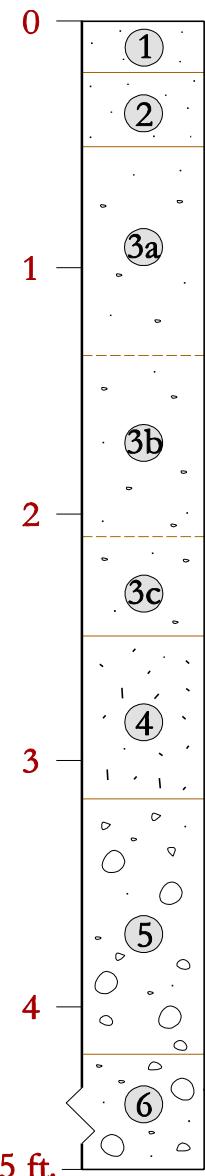
PCA



Paw Paw Valley: Unit 1

Lithostratigraphy and Grain Size

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6. Strong brown clay loam with 10% weathered greenstone gravel and cobbles



1-2.

- Colluvium reaches the top pf the wall.
- Incipient A horizon development
- Illuviation of O-horizon inputs
- Sand deposited from decelerating runoff

3.

- B horizon transported from upslope

4.

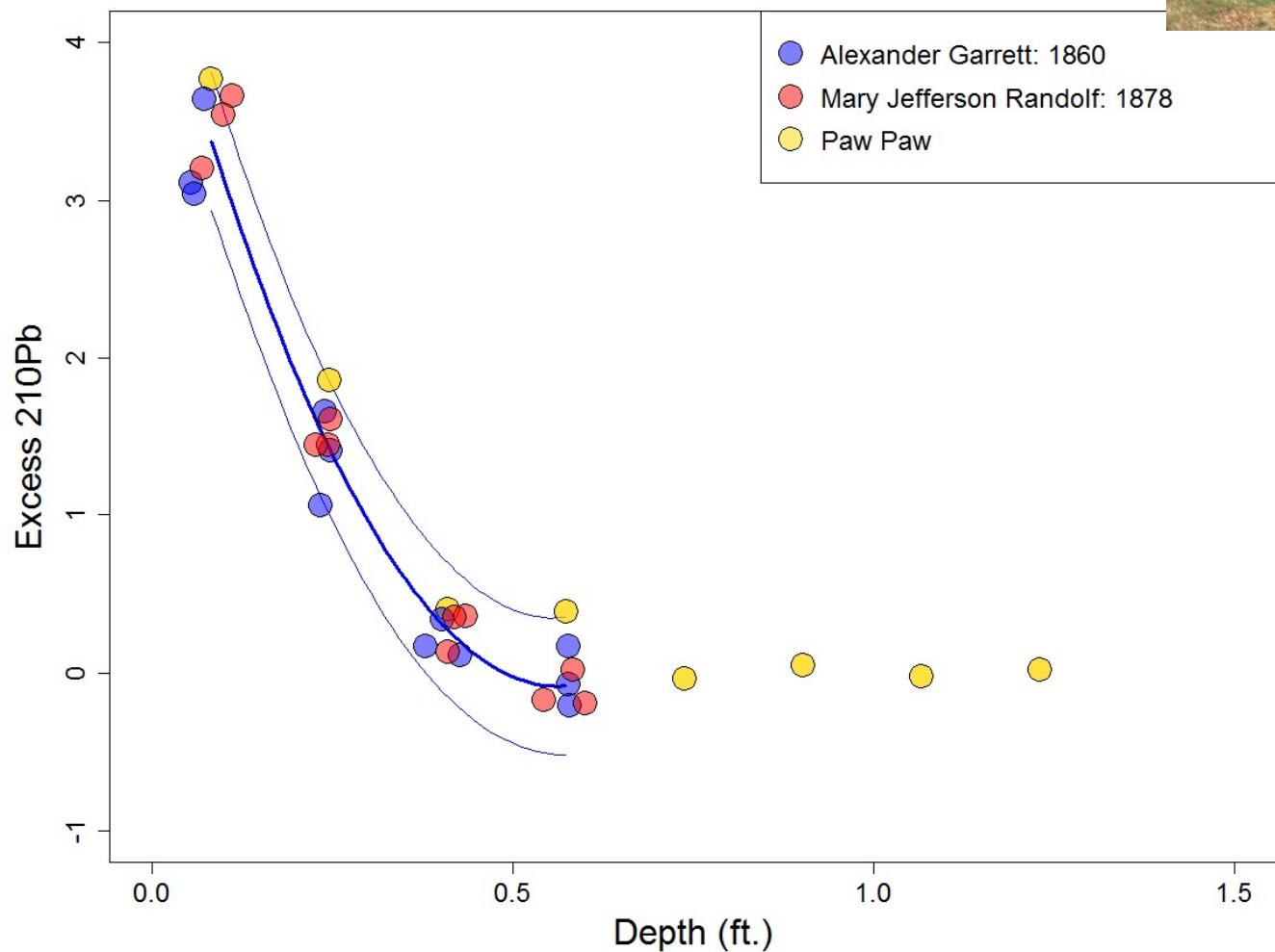
- A horizon transported from upslope

5-6.

- Massive debris flow.
- Weathering gradient.
- Stream bed, hence missing A-horizon .
- Some Illuviation of O-horizon inputs from stream flow.

Paw Paw Valley: Unit 1

Dating: 210 Pb



Paw Paw Valley: Unit 1

Dating: OSL, 14C, 210Pb

1. Reddish brown sandy loam.
2. Red sandy clay loam.

3a. Red clay with < 5% weathered greenstone pebbles.

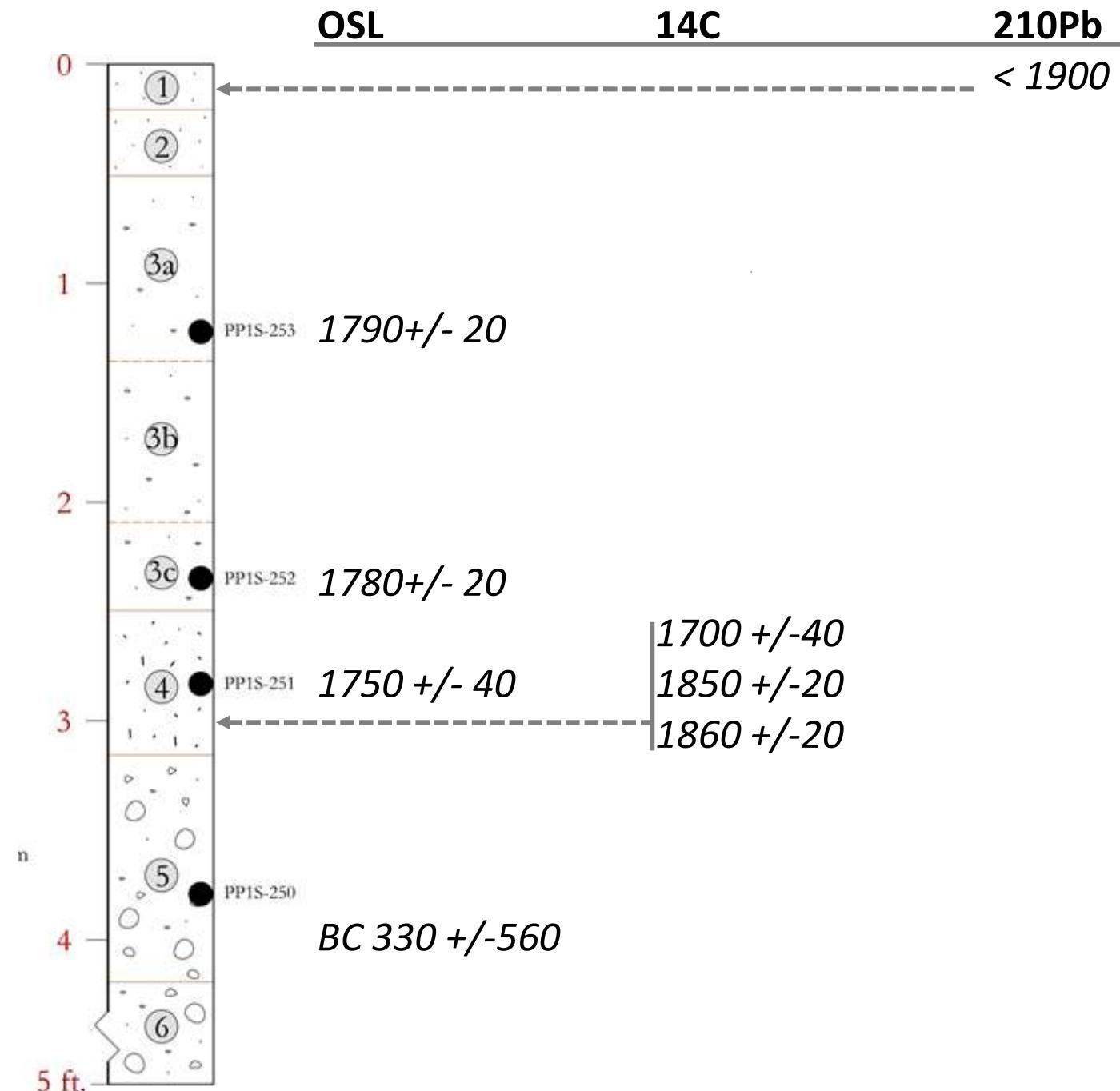
3b. Red clay loam with < 5% weathered greenstone pebbles.

3c. Red clay with < 5% weathered greenstone pebbles.

4. Reddish brown clay with < 5% pebble-sized charcoal flecks.

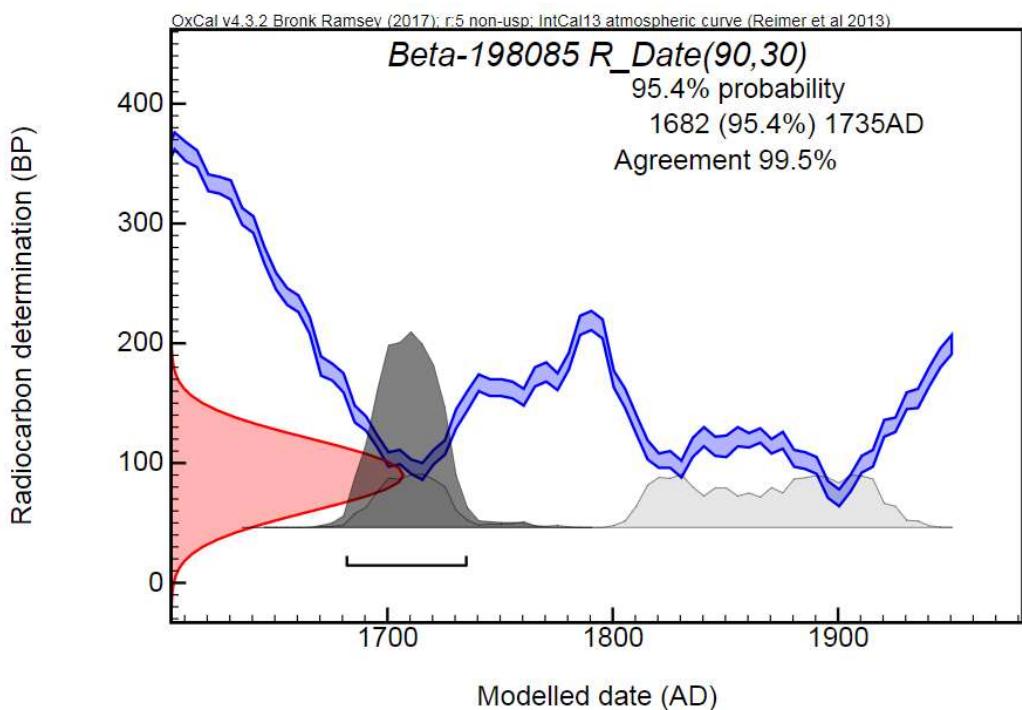
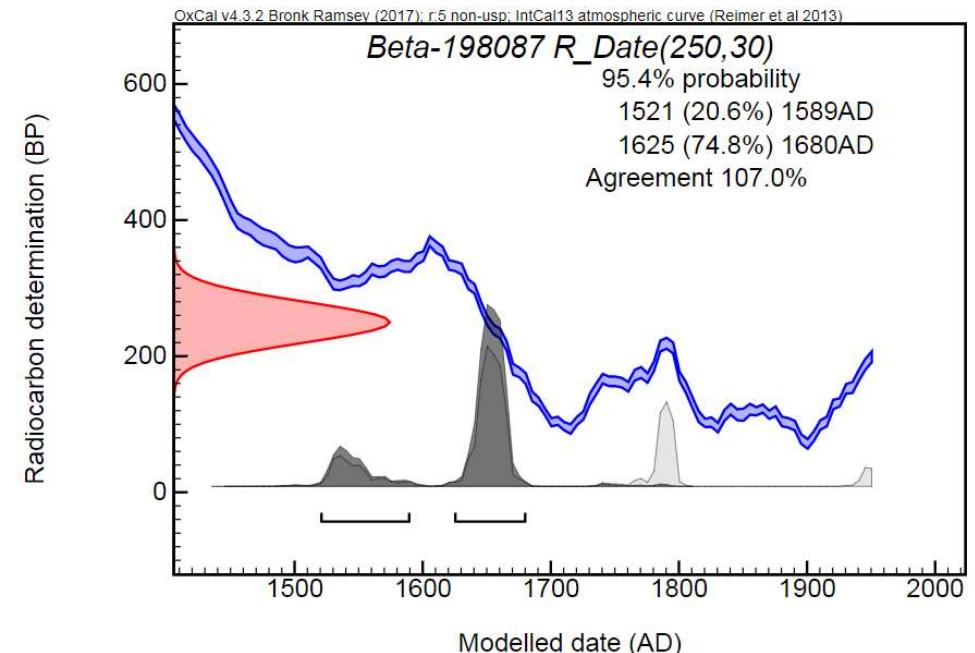
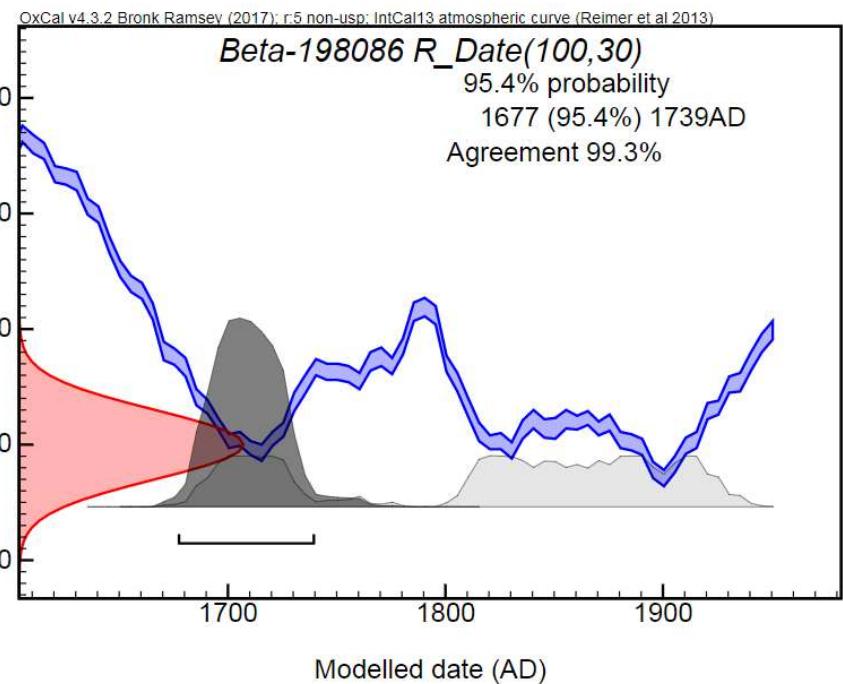
5. Yellowish red clay loam with 25% pebbles and cobbles.

6. Strong brown clay loam with 10% weathered greenstone gravel and cobbles



Paw Paw Valley: Unit 1

Dating: 14C



Paw Paw Valley: Unit 1

Bayesian Chronological Model

1. We have some good data on dates, but with some uncertainty – the *likelihood*.
2. We also have some good *prior* information about what date are likely. *E.g.* from stratigraphic relationships among the dates

We want away to combine 1 and 2 to come up with...

3. More accurate estimates of dates with LESS uncertainty – the “*posterior estimate*”.

$$\textit{Posterior} \quad \textit{Probability that event } E \textit{ happened in year } Y, \textit{ given our data.} \propto \textit{Likelihood} \quad \textit{Probability of getting our data, given that event } E \textit{ happened in year } Y. \times \textit{Prior} \quad \textit{Prior probability that event } E \textit{ happened in year } Y.$$

Paw Paw Valley: Unit 1

Posterior Estimates from the Bayesian Chronological Model

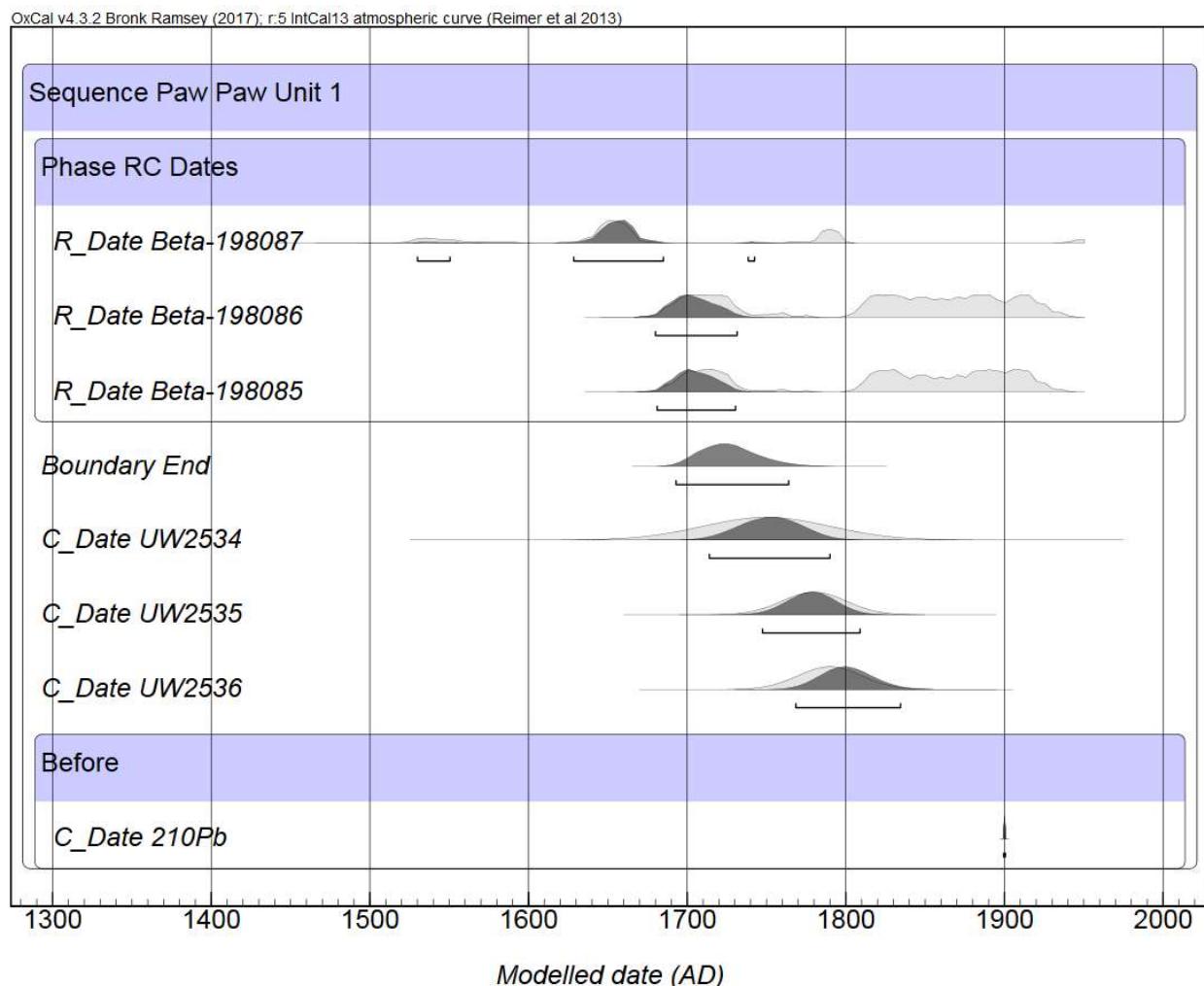
Mean (95% credible interval)

14C: 1636 (*1530 – 1742*)
14C: 1706 (*1680 – 1731*)
14C: 1706 (*1681 – 1730*)

1728 (1693 – 1764)

OSL: 1752 (1714 – 1790)
OSL: 1778 (1747 – 1809)
OSL: 1801 (1768 – 1834)

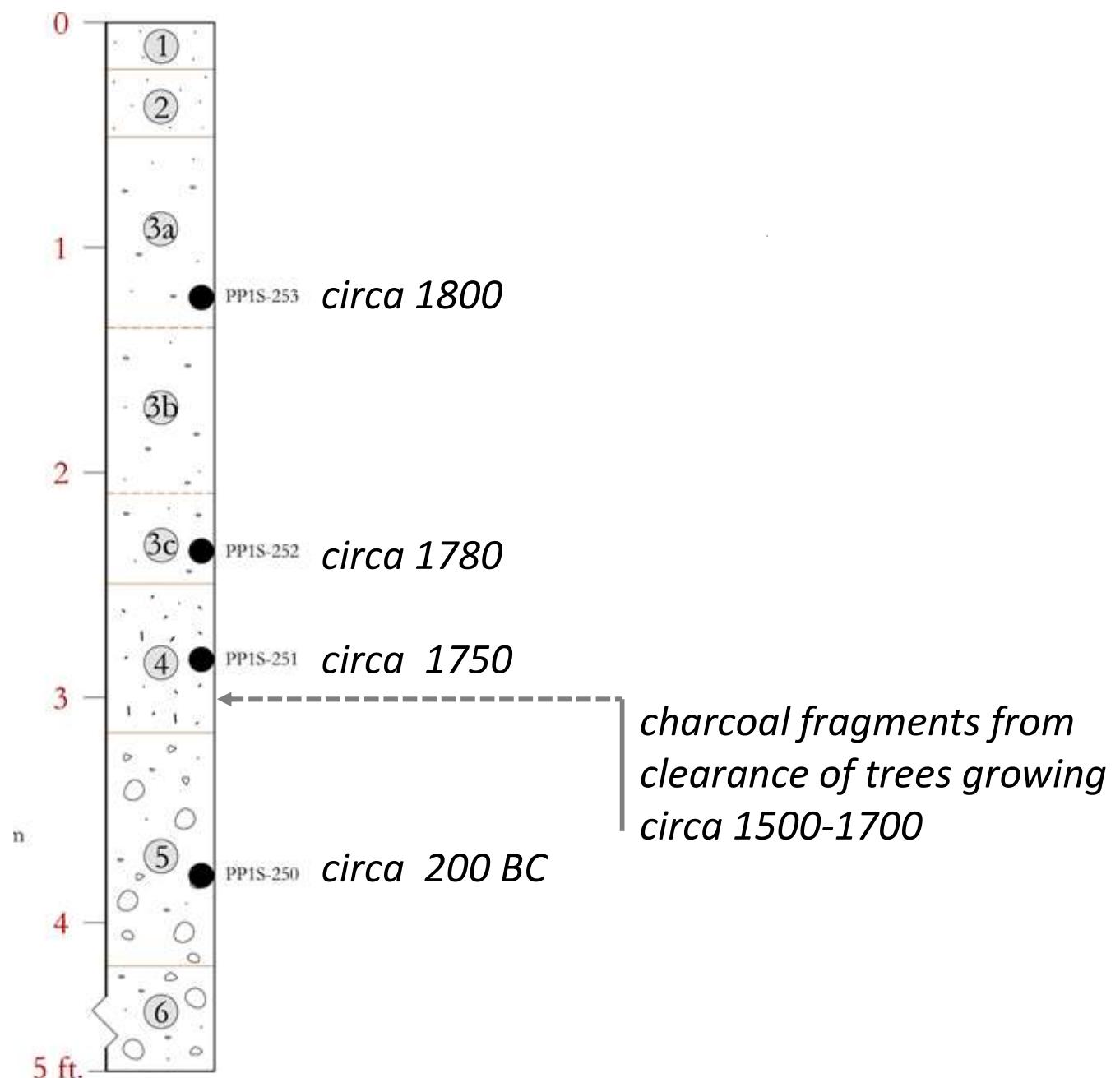
^{210}Pb ; < 1900



Paw Paw Valley: Unit 1

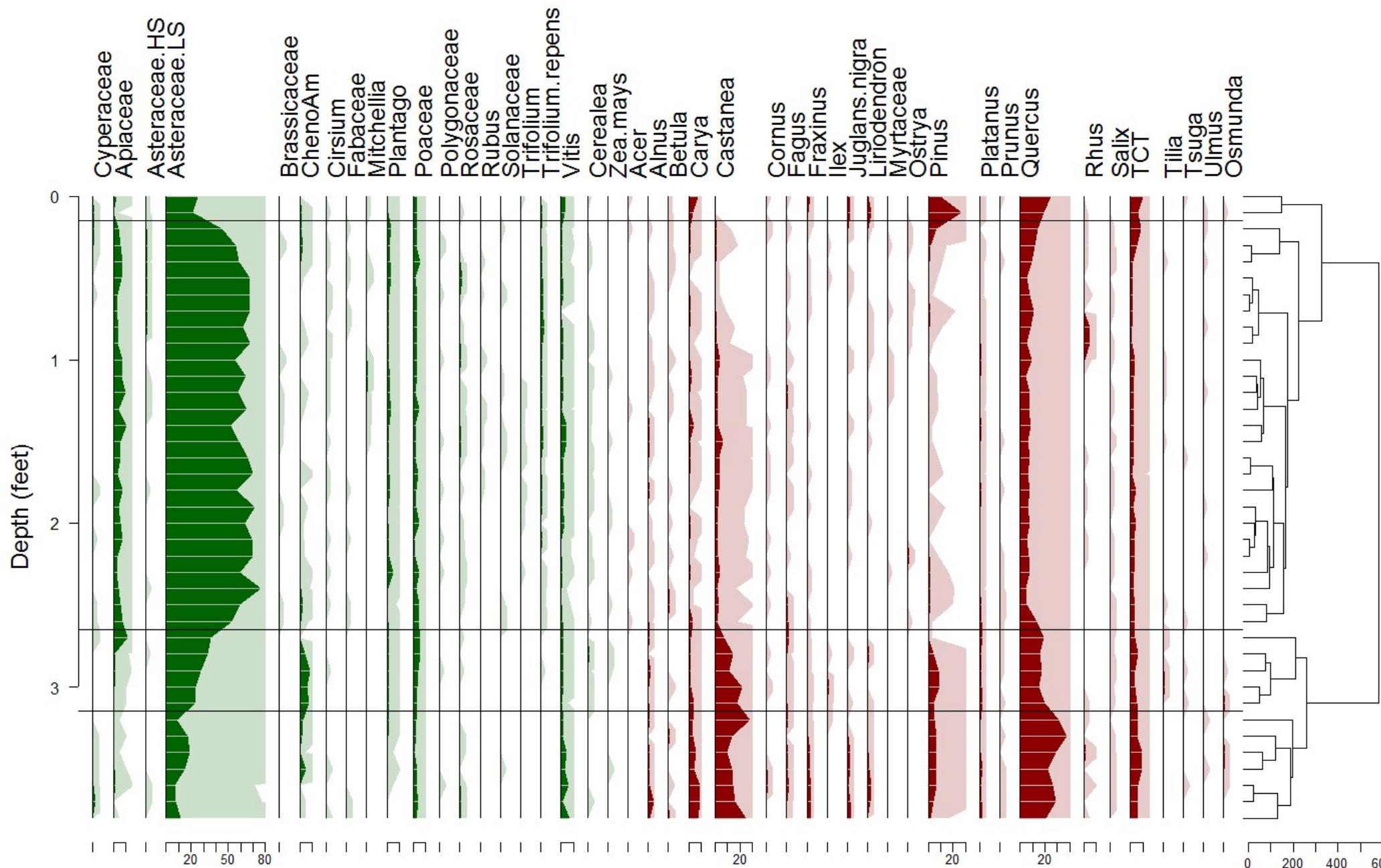
Proposed Chronology

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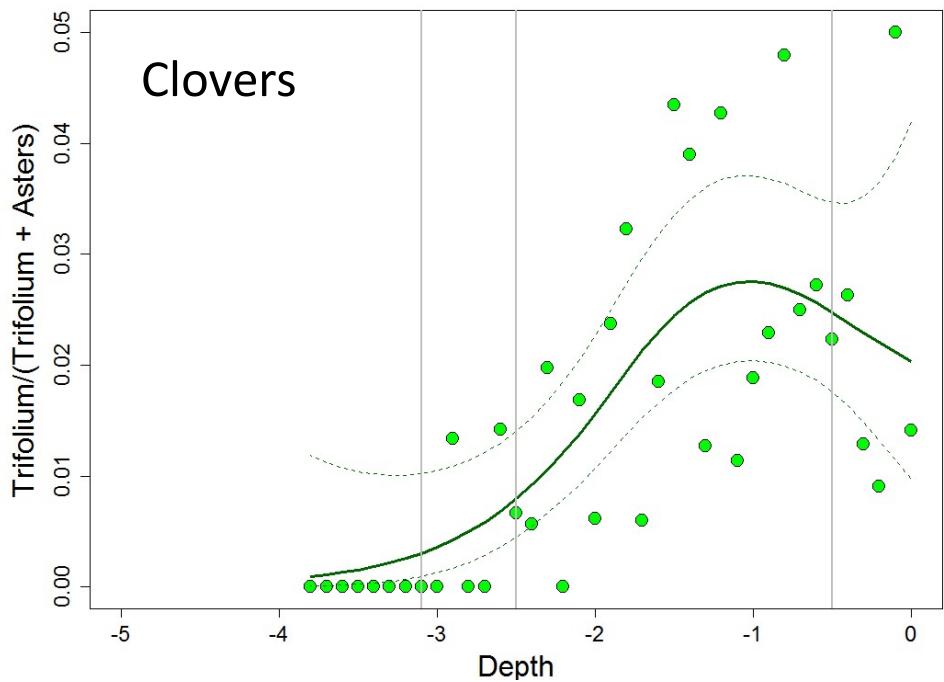
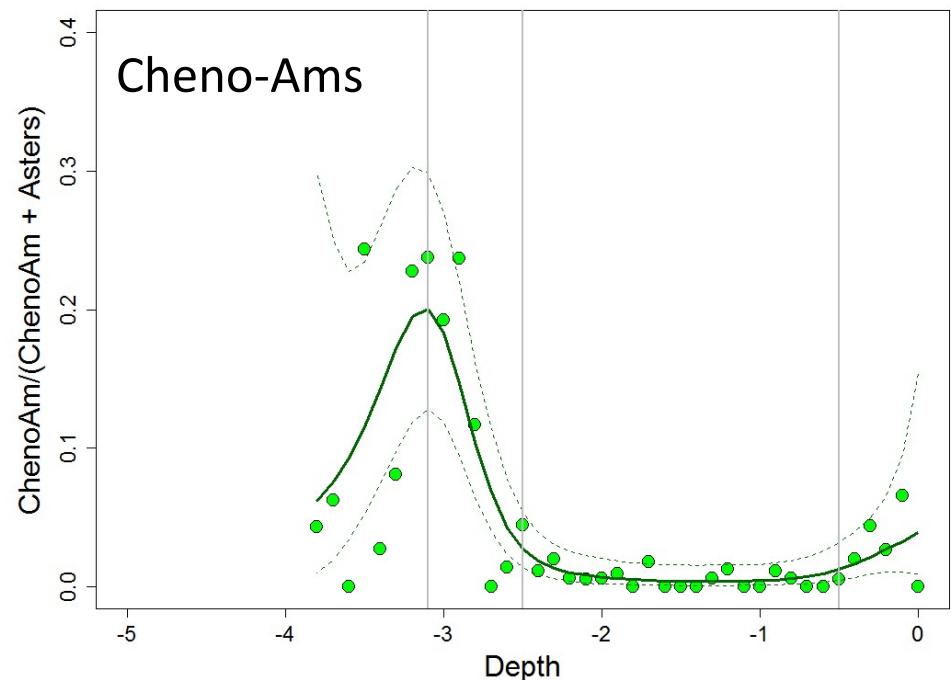
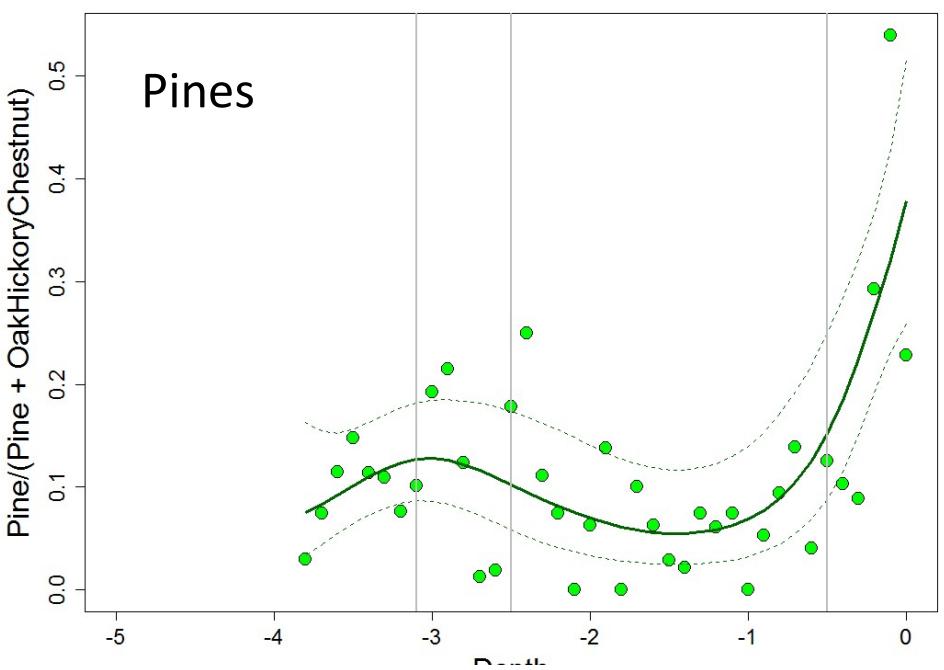
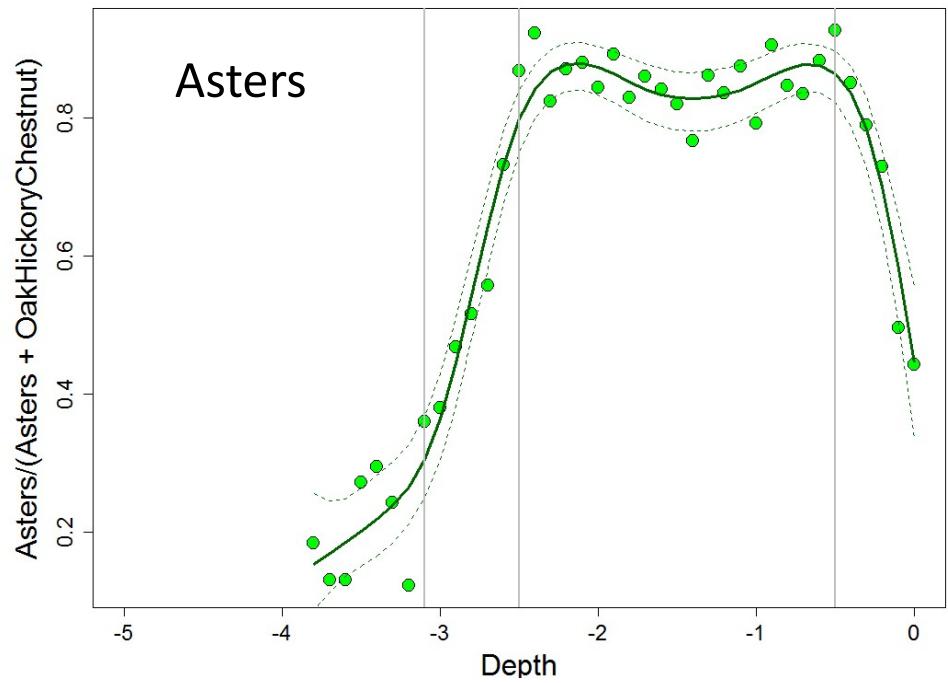
Paw Paw Valley: Unit 1

Pollen



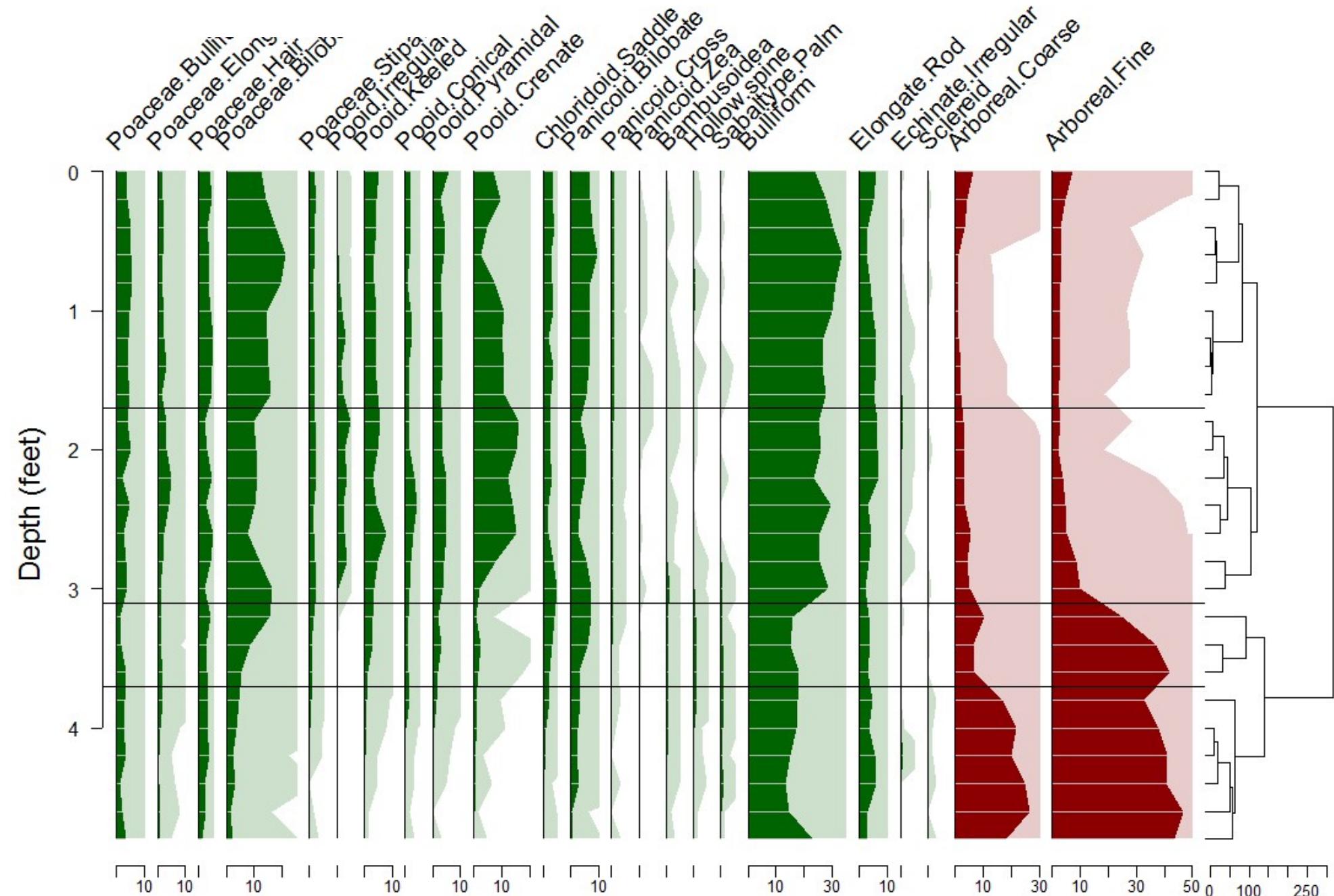
Paw Paw Valley: Unit 1

GAMs for Select Pollen Taxa: Logistic link, quasi-binomial errors



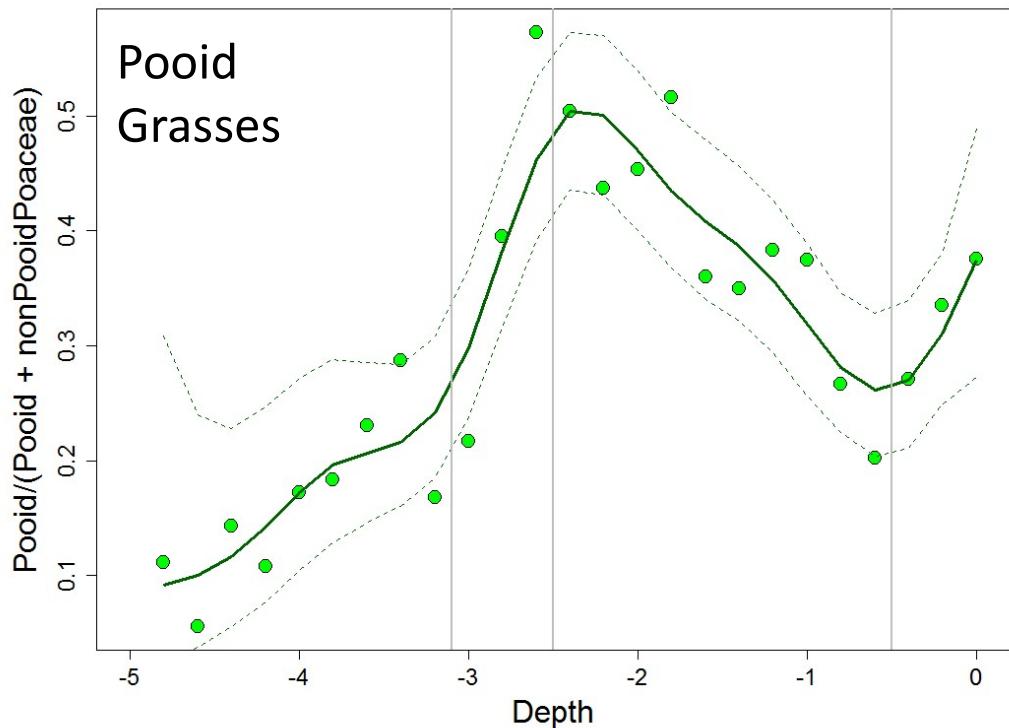
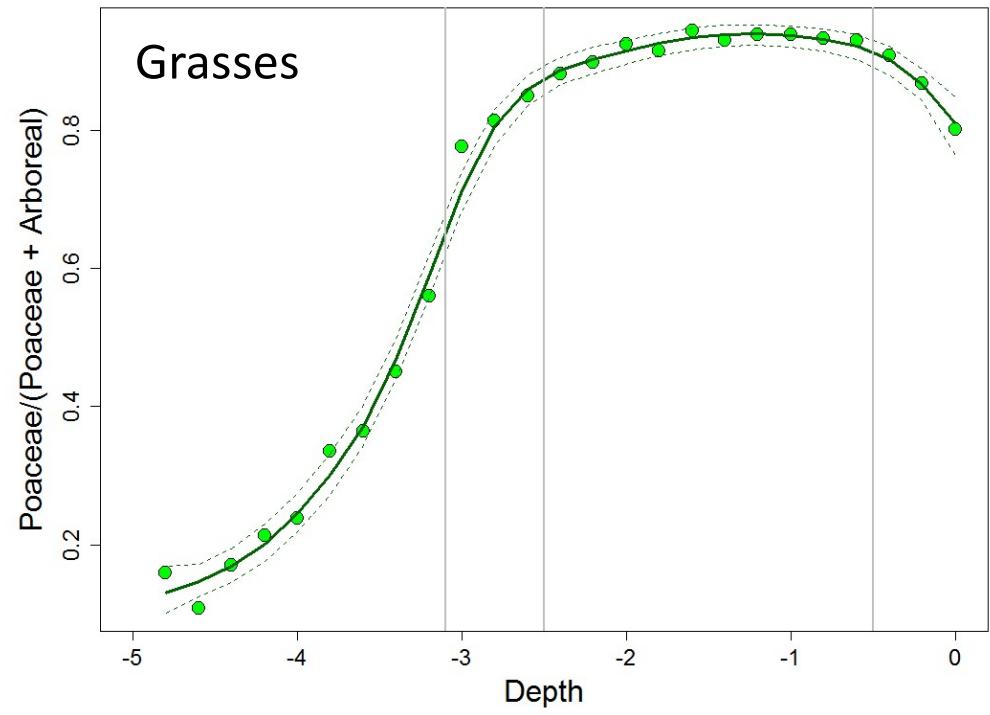
Paw Paw Valley: Unit 1

Phytoliths



Paw Paw Valley: Unit 1

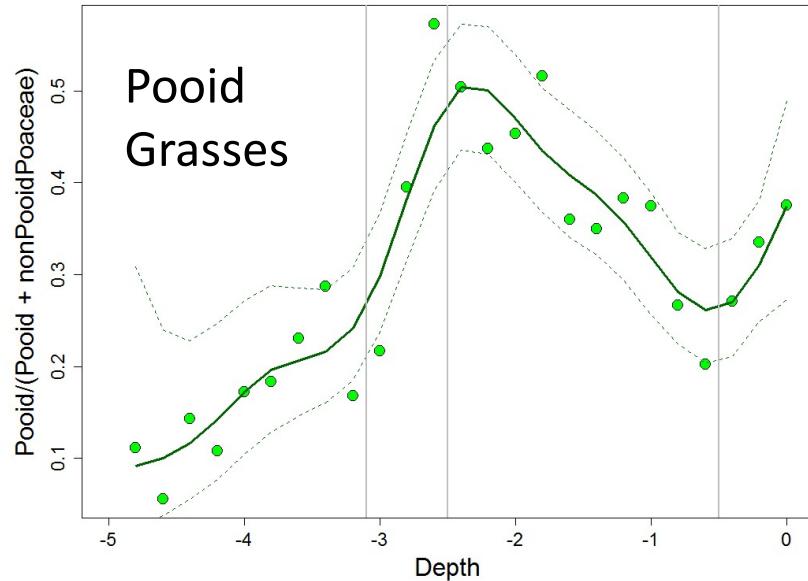
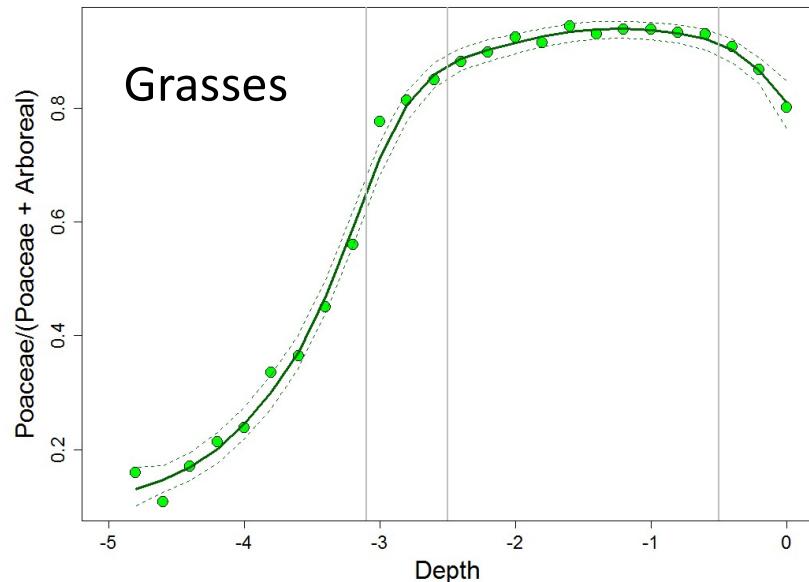
GAMs for Select Phytolith Taxa: Logistic link, quasi-binomial errors



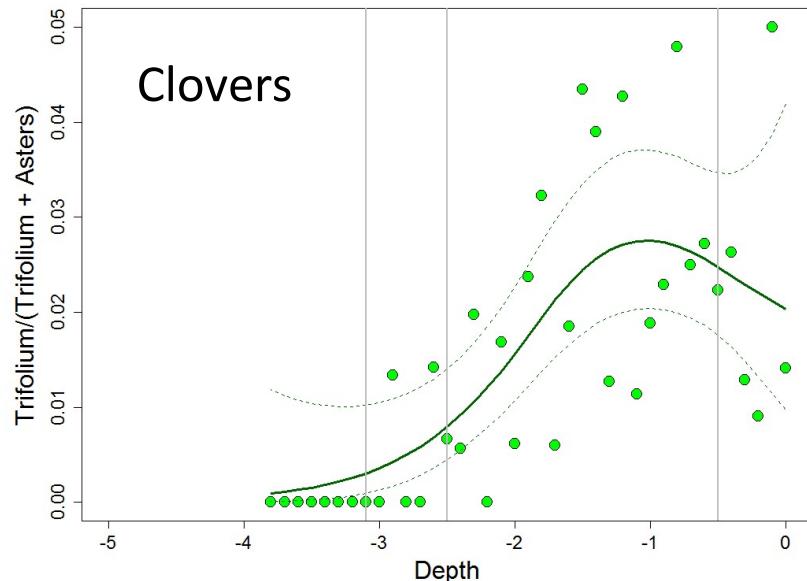
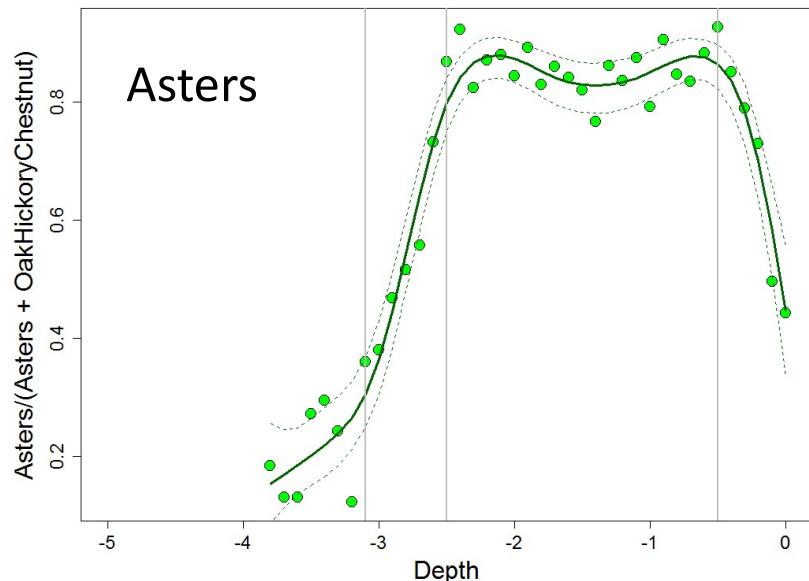
Paw Paw Valley: Unit 1

GAMs for Phytolith *versus* Pollen Taxa

Phytoliths

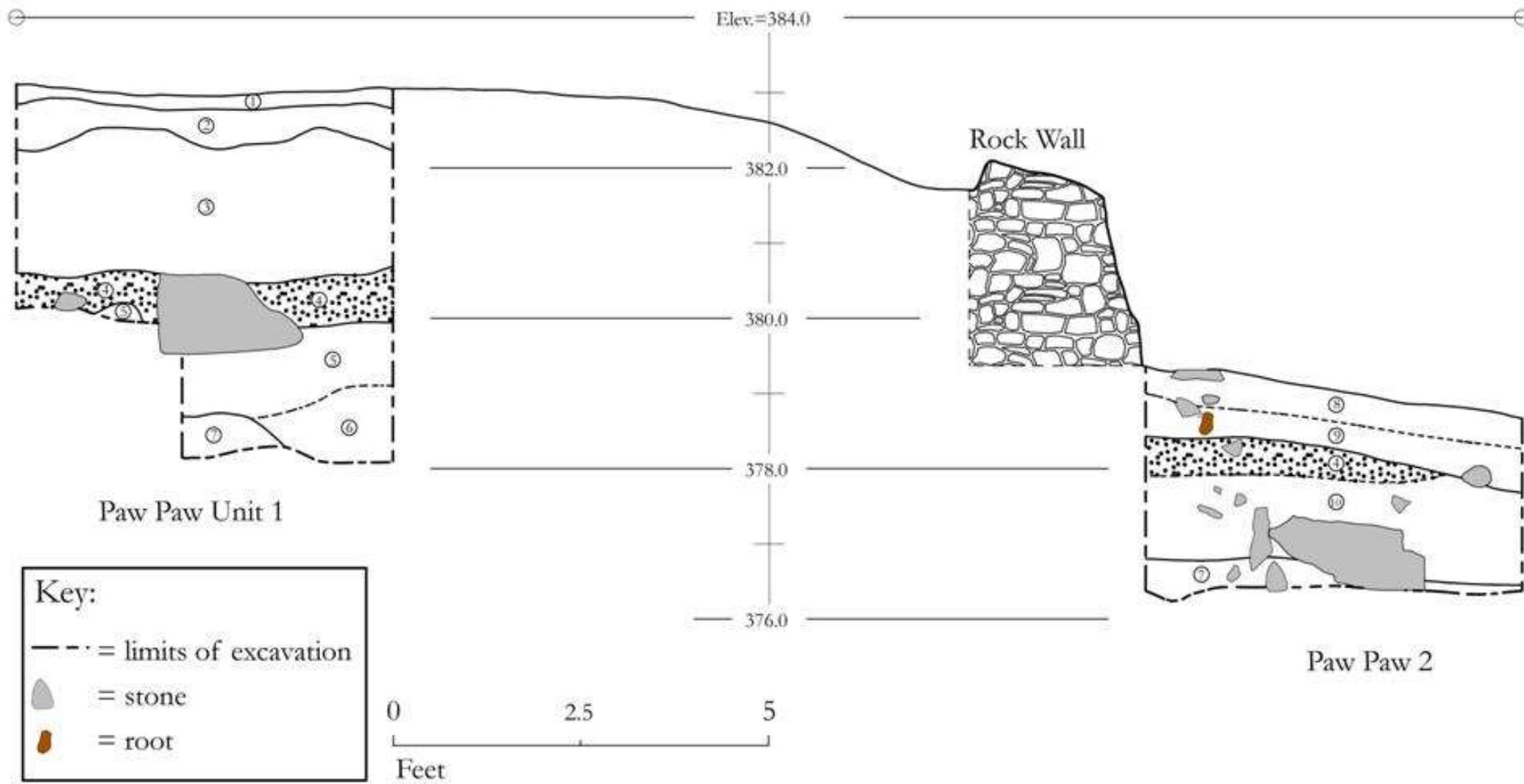


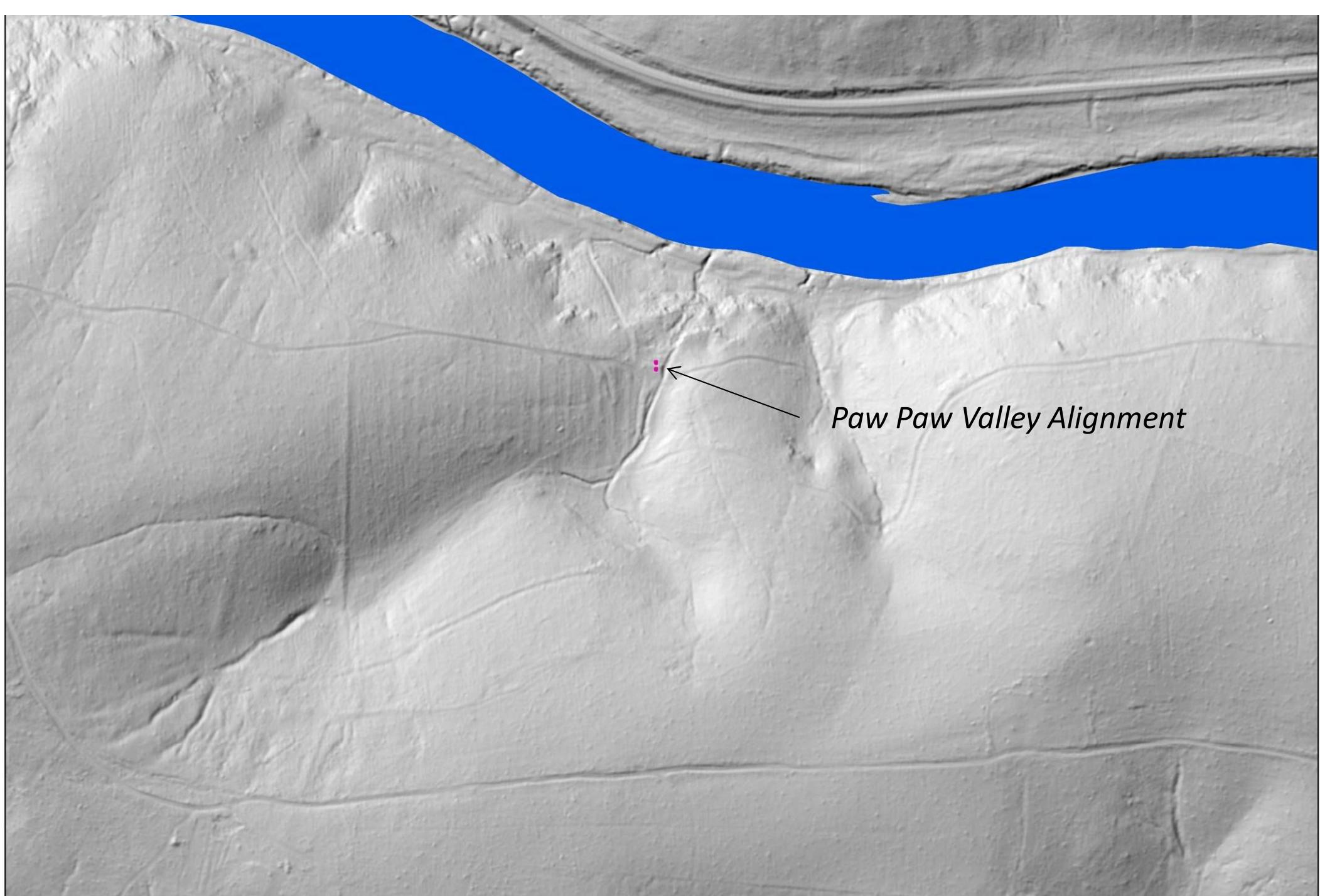
Pollen





Paw Paw Valley, Units 1 & 2, West Profile





0 0.05 0.1

0.2

0.3

0.4

0.5

Kilometers

0 0.05

0.1

0.2

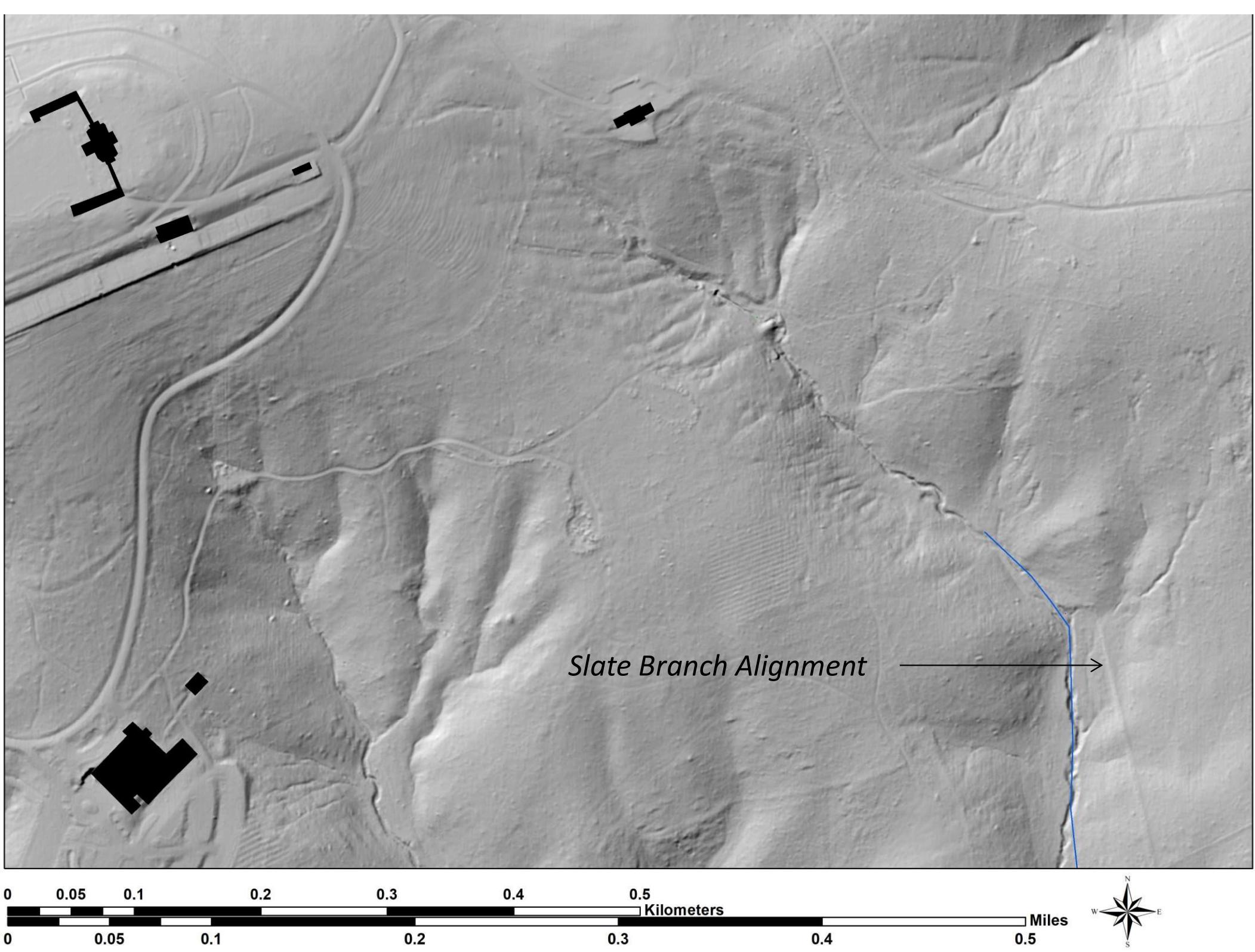
0.3

0.4

0.5

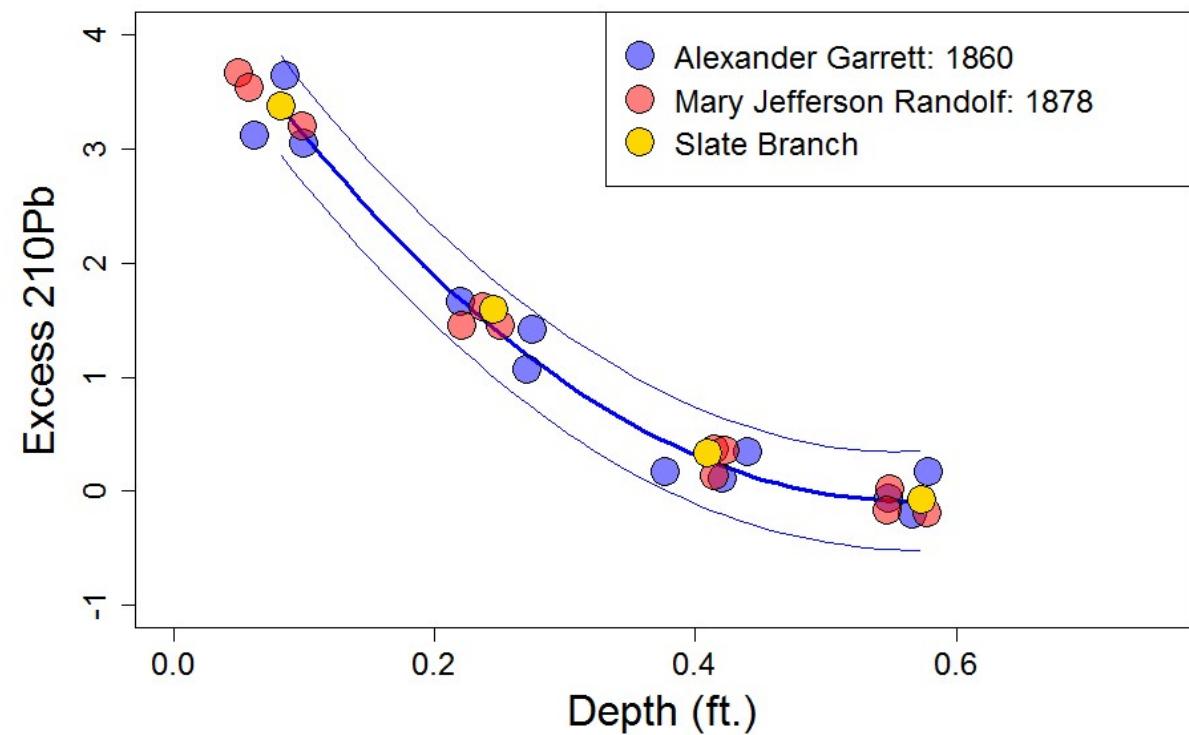
Miles





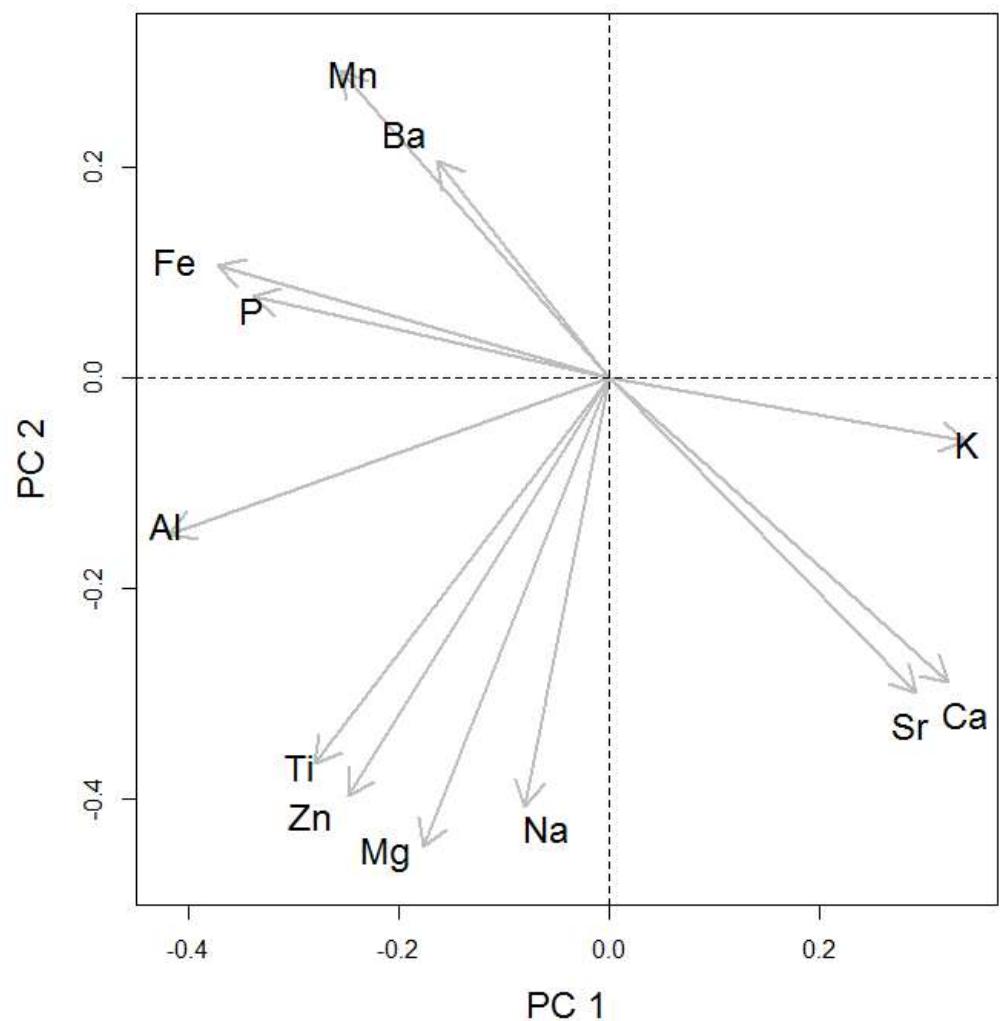
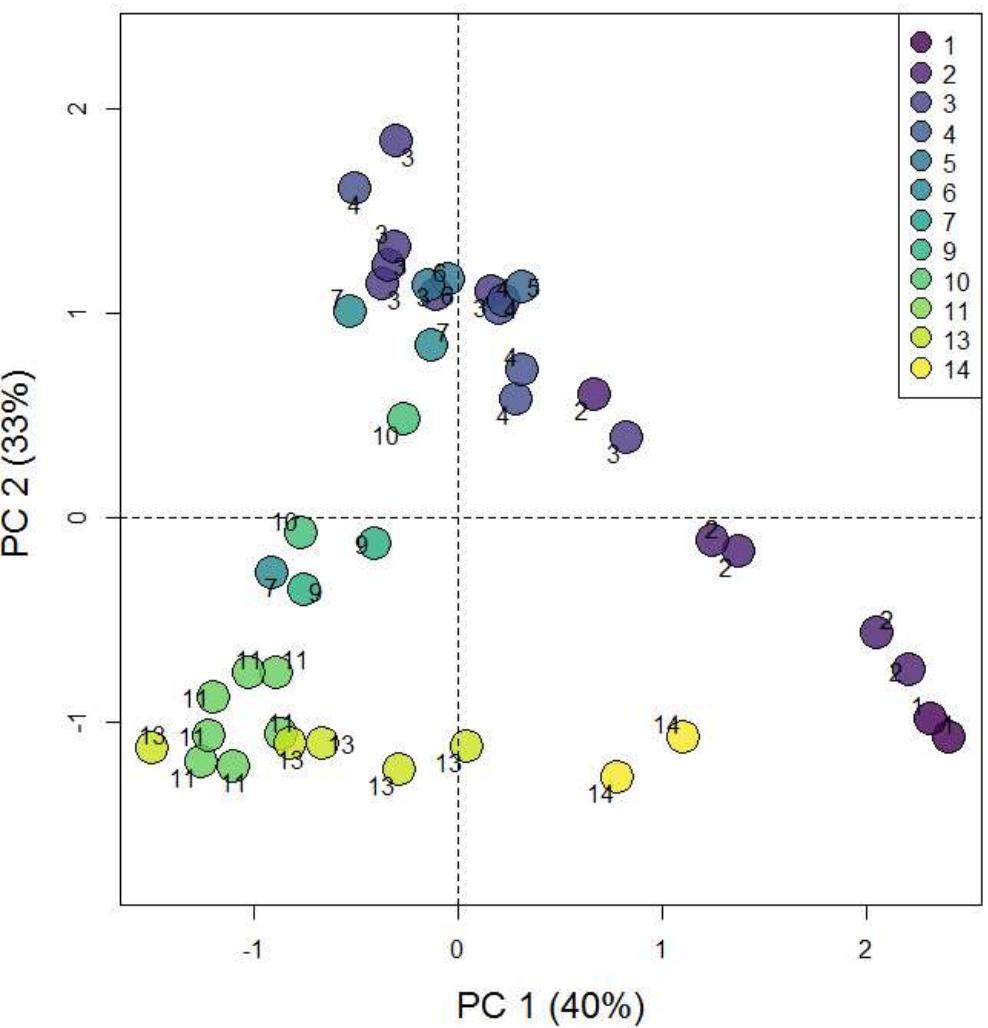
Slate Branch: Alignment: Unit 2

Dating: 210 Pb



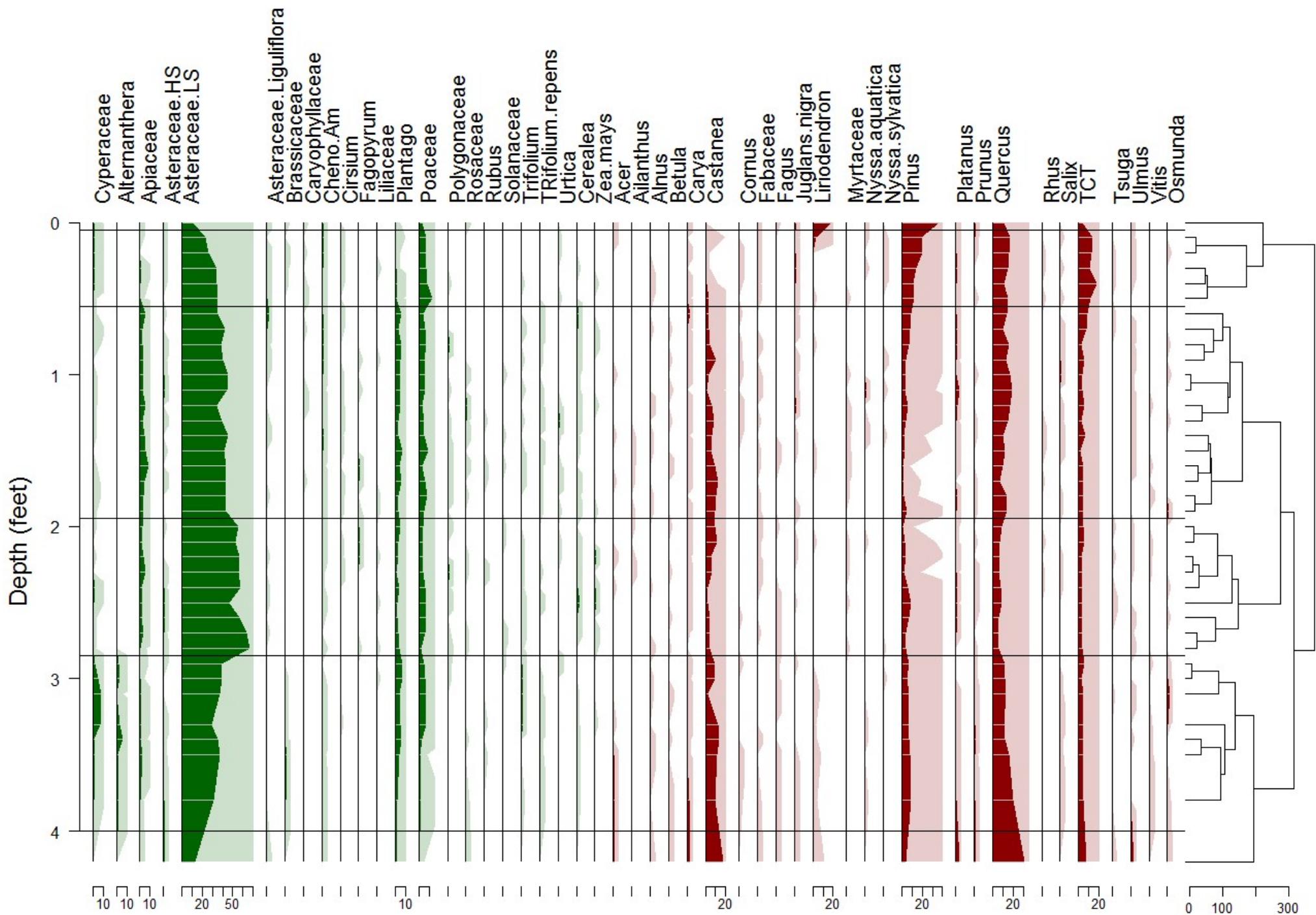
Slate Branch: Unit 2

Sediment Chemistry



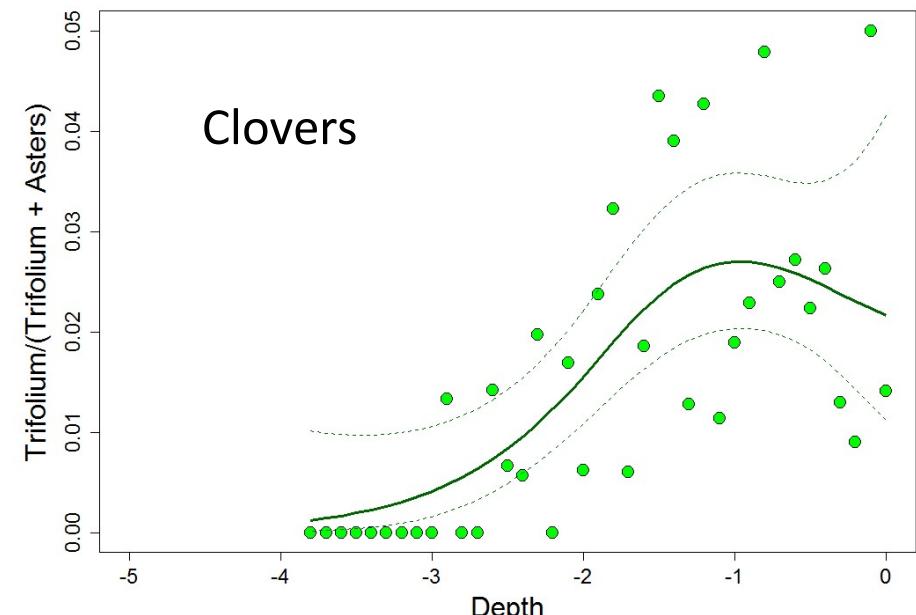
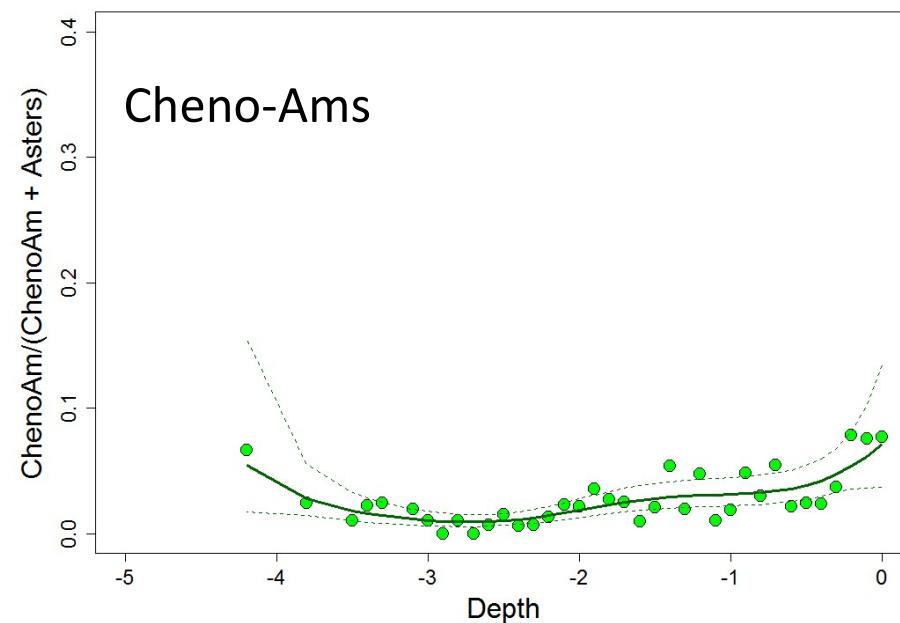
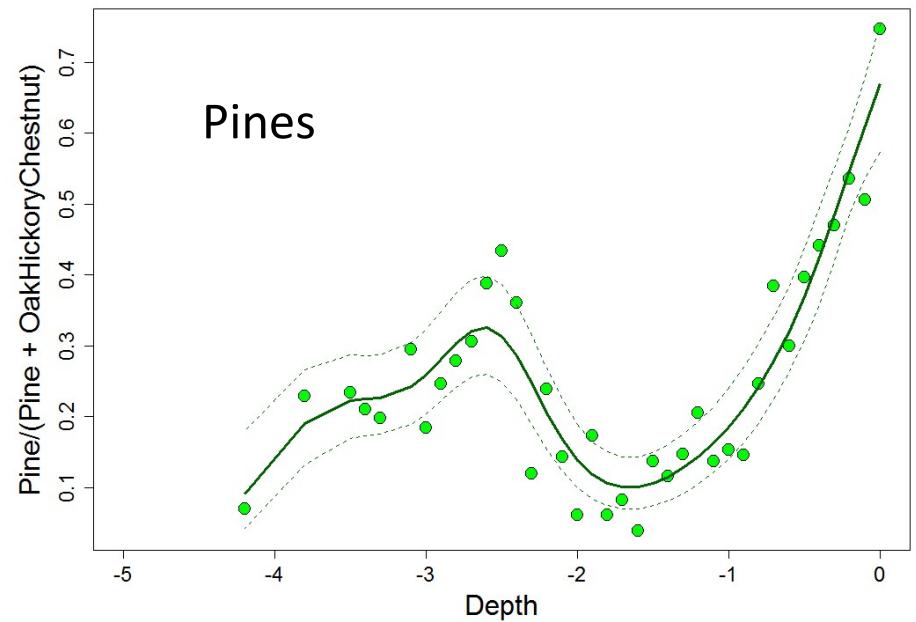
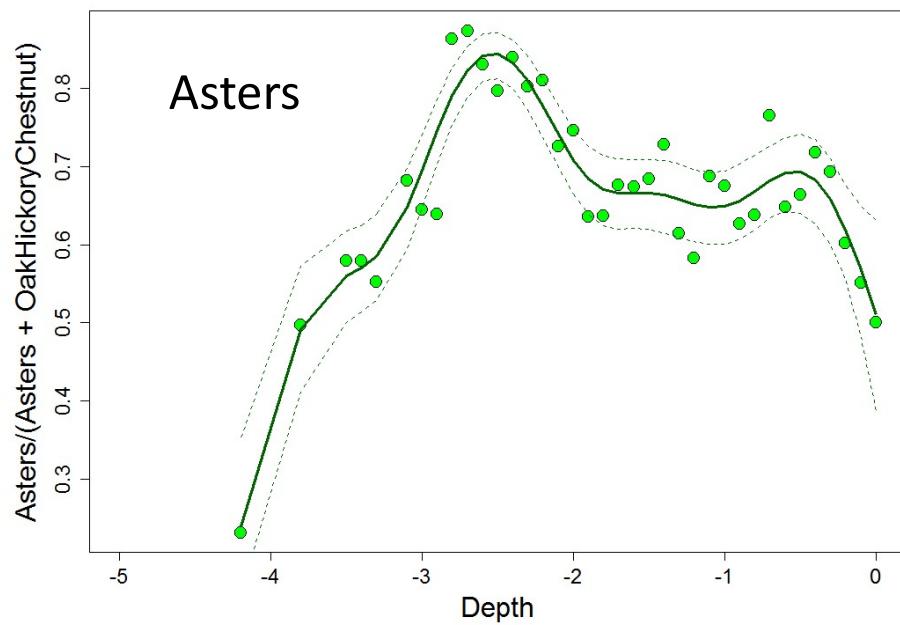
Slate Branch: Unit 2

Pollen



Slate Branch: Unit 2

GAMs for Select Pollen Taxa: Logistic link, quasi-binomial errors

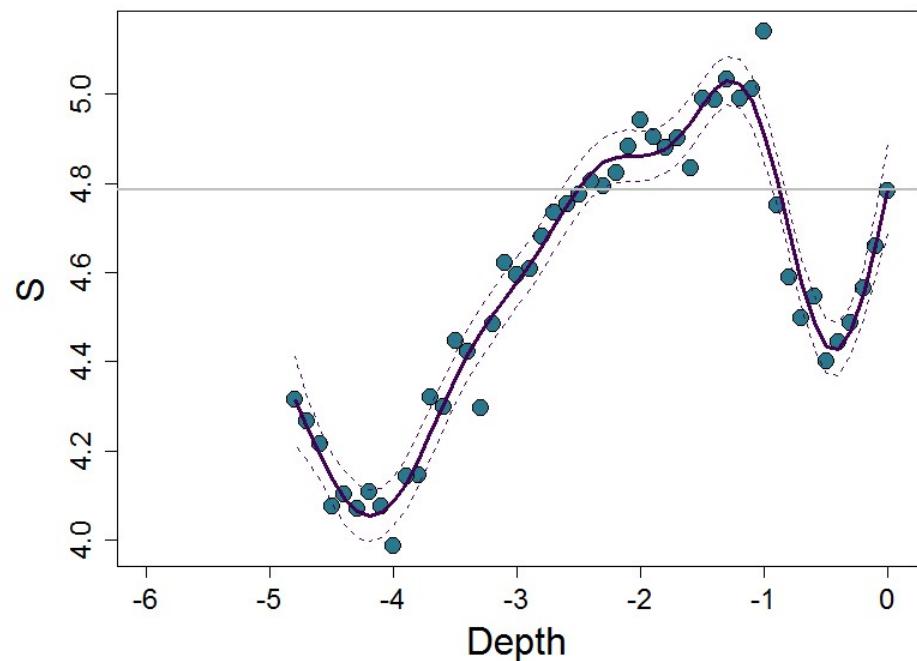


Fertilizer: Gypsum

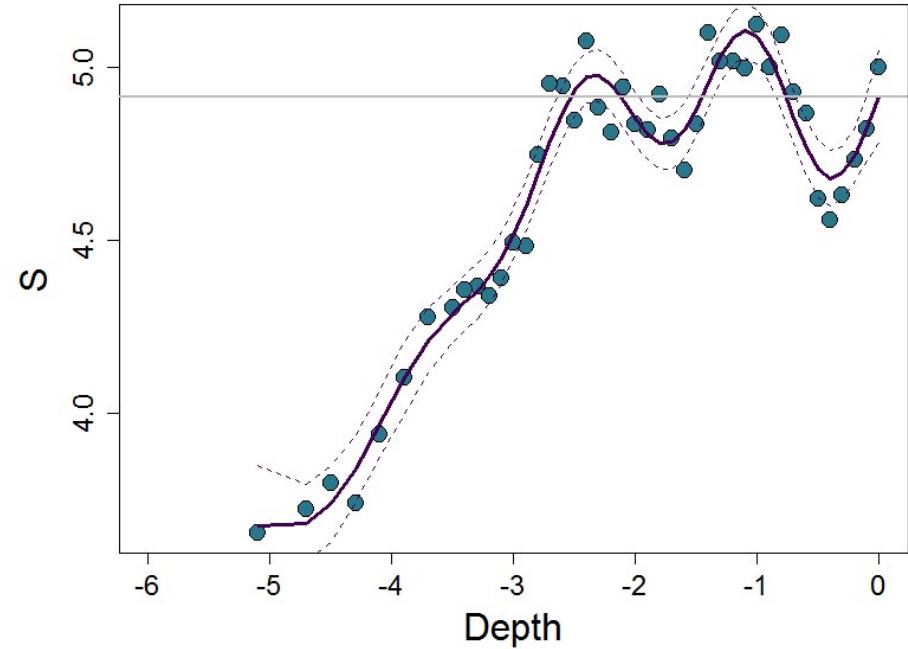
GAMs for Sulfur: identity link, Gaussian errors

Gypsum (?)

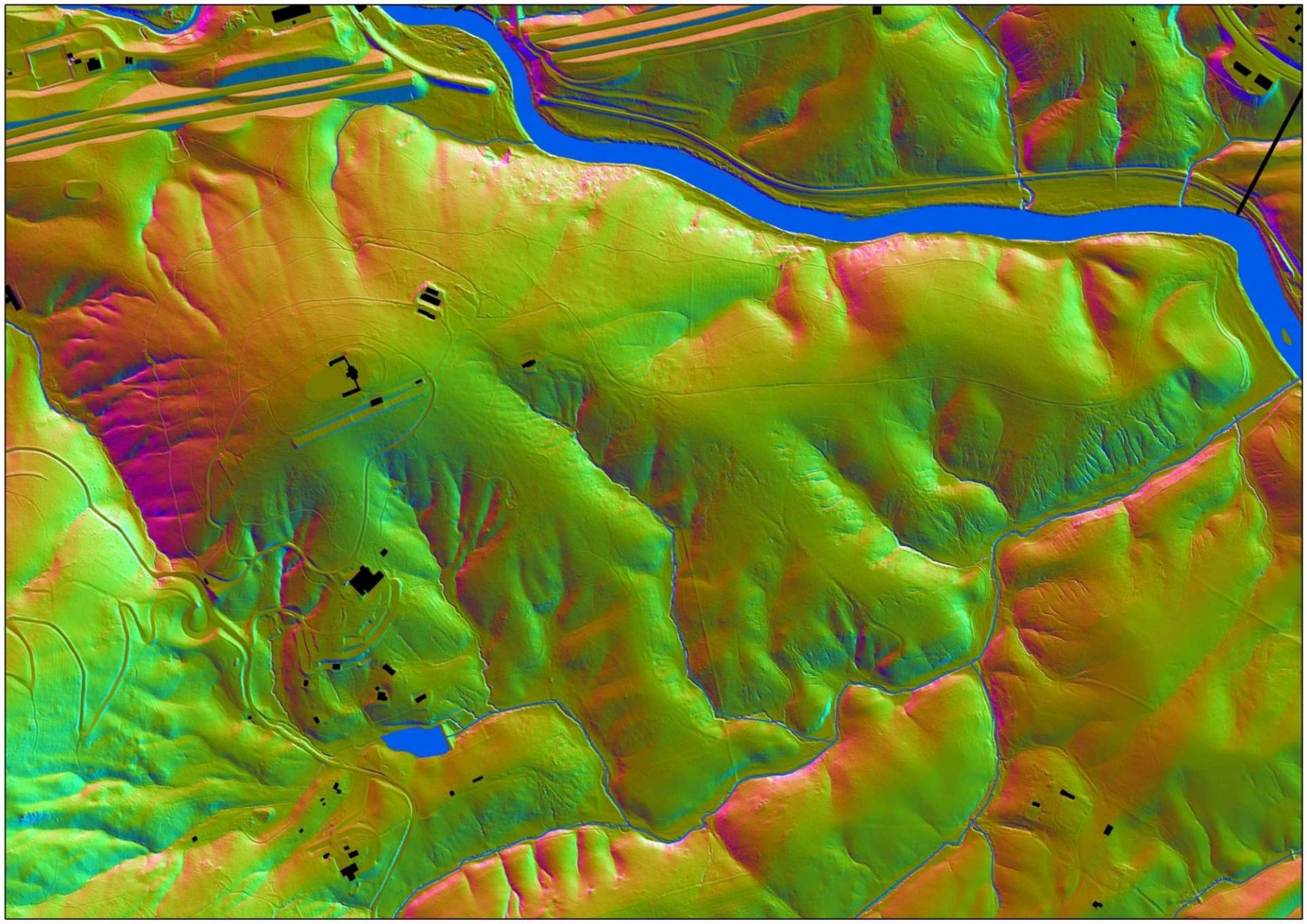
Paw Paw, Unit 1



Slate Branch, Unit 2



Gullies



0 0.1 0.2 0.4 0.6 0.8 1 Kilometers

0 0.1 0.2 0.4 0.6 0.8 1 Miles





Tobacco

- Hoes
- Stumps
- Field rotation
- Long fallows for sustainability
- Locally evolved



Whea

- Plows
- No stumps!
- Permanent fields
- Crop rotations and fertilizer
- European handbooks

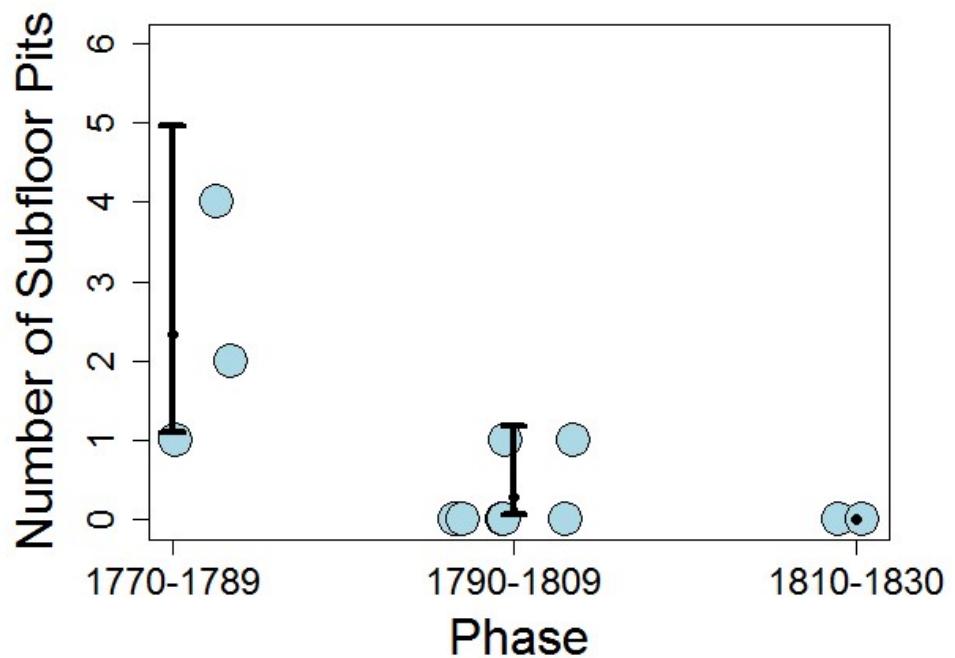
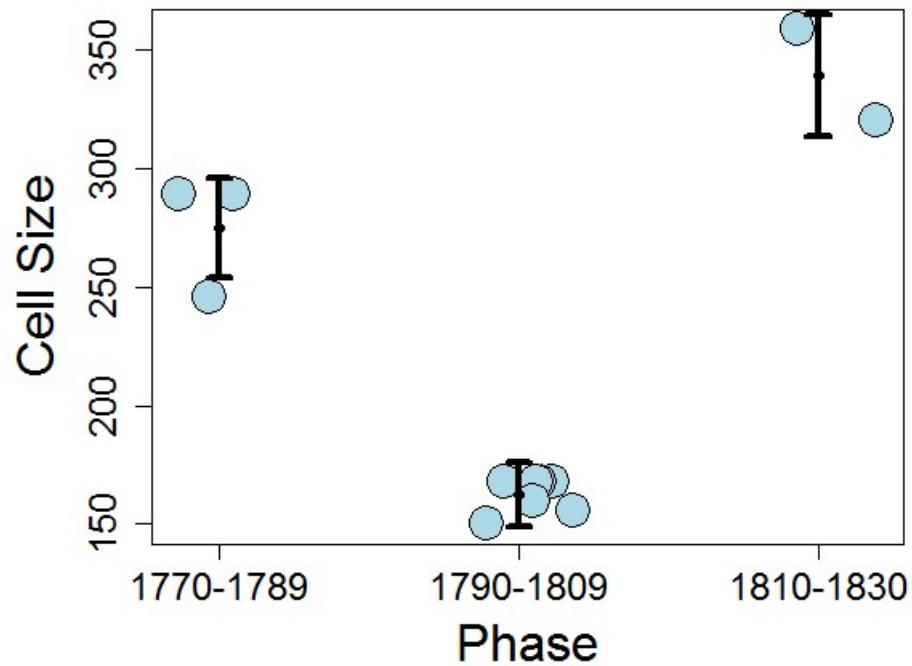
Implications

- Evidence for erosion during the tobacco period.
- But alignments built **after** the transition
- Fallow swiddens initially retained across the transition: wheat grown in newly cleared fields
- Physical traces of different kinds of labor!
- Hoe gangs vs. task groups.



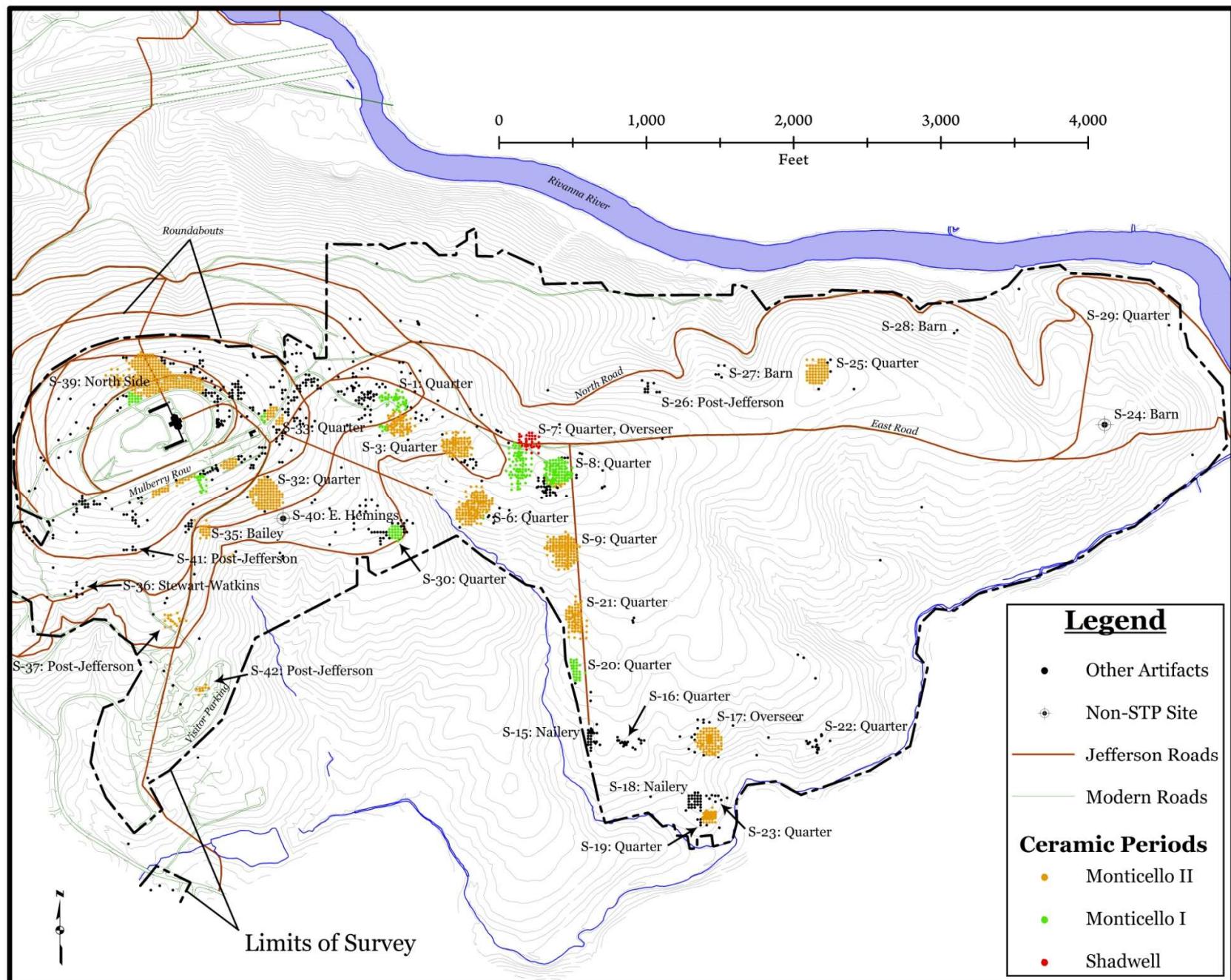
Slave Houses on Mulberry Row

Size vs. Number of Subfloor Pits

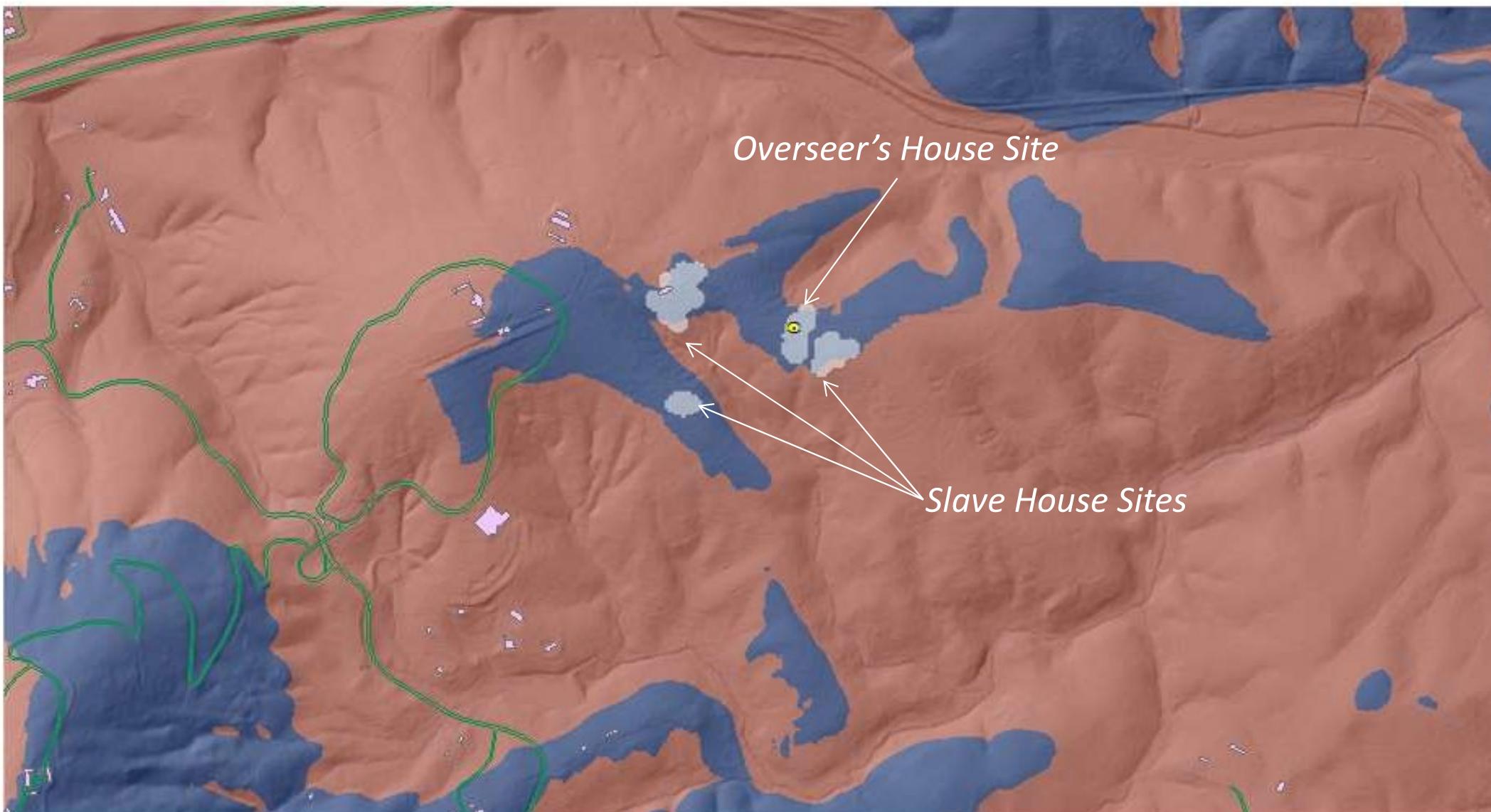


Monticello Plantation Archaeological Survey

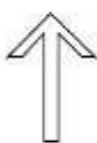
Domestic Site Locations



Viewshed from Tobacco-Period Overseer's House



0 500 1,000 2,000 3,000 4,000
Feet



Viewshed from Wheat-Period Overseer's House

