

Geoarchaeology of Jefferson's Monticello Plantation

Fraser D. Neiman, Monticello

Sara Bob-Harper, Highland

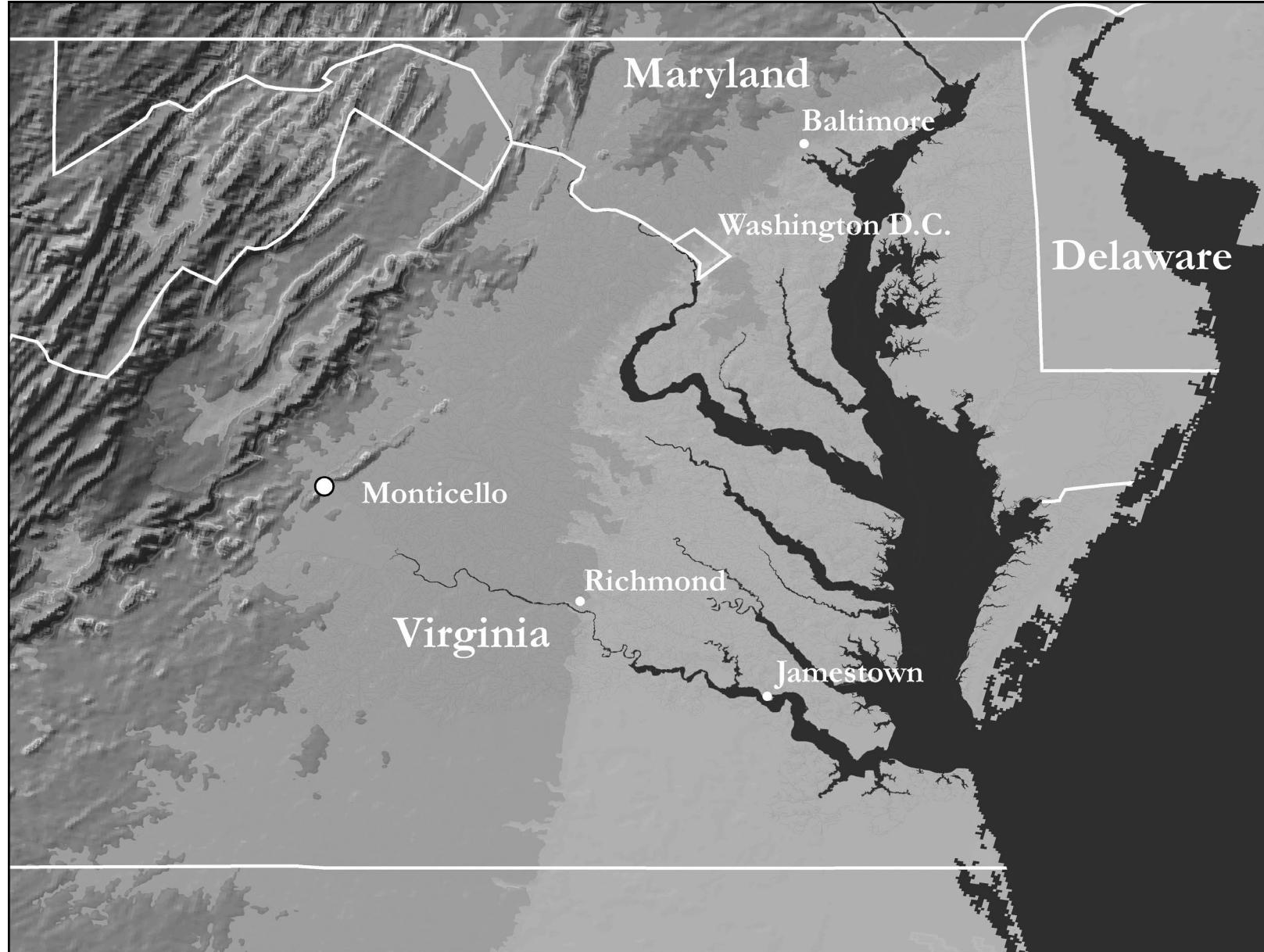
Derek Wheeler, Monticello

John G. Jones, Archaeological Consulting Services, Ltd.

James Burton, University of Wisconsin

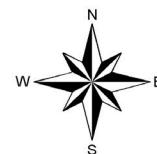
James Feathers, University of Washington

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



0 50 100 Miles

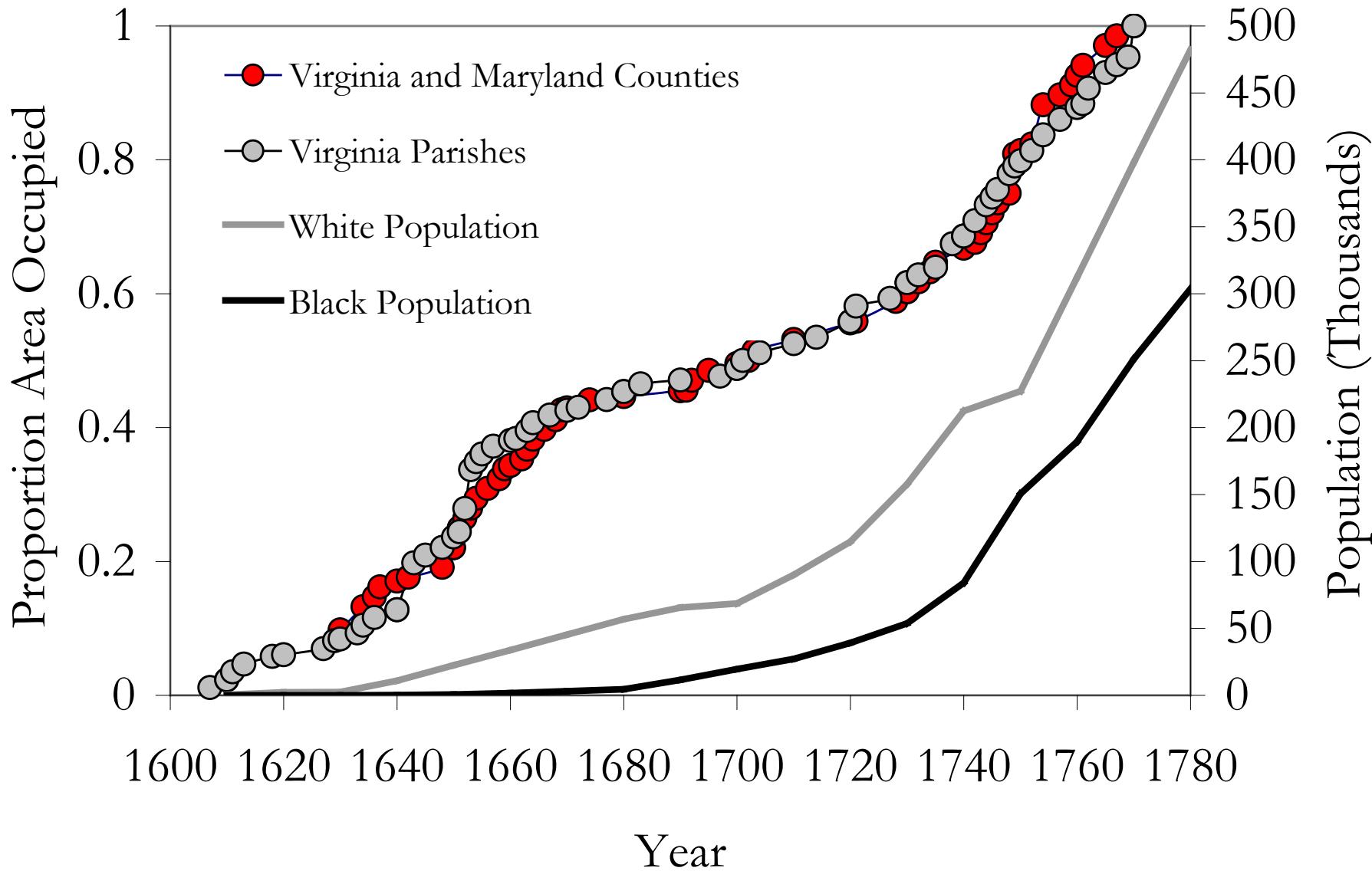
0 100



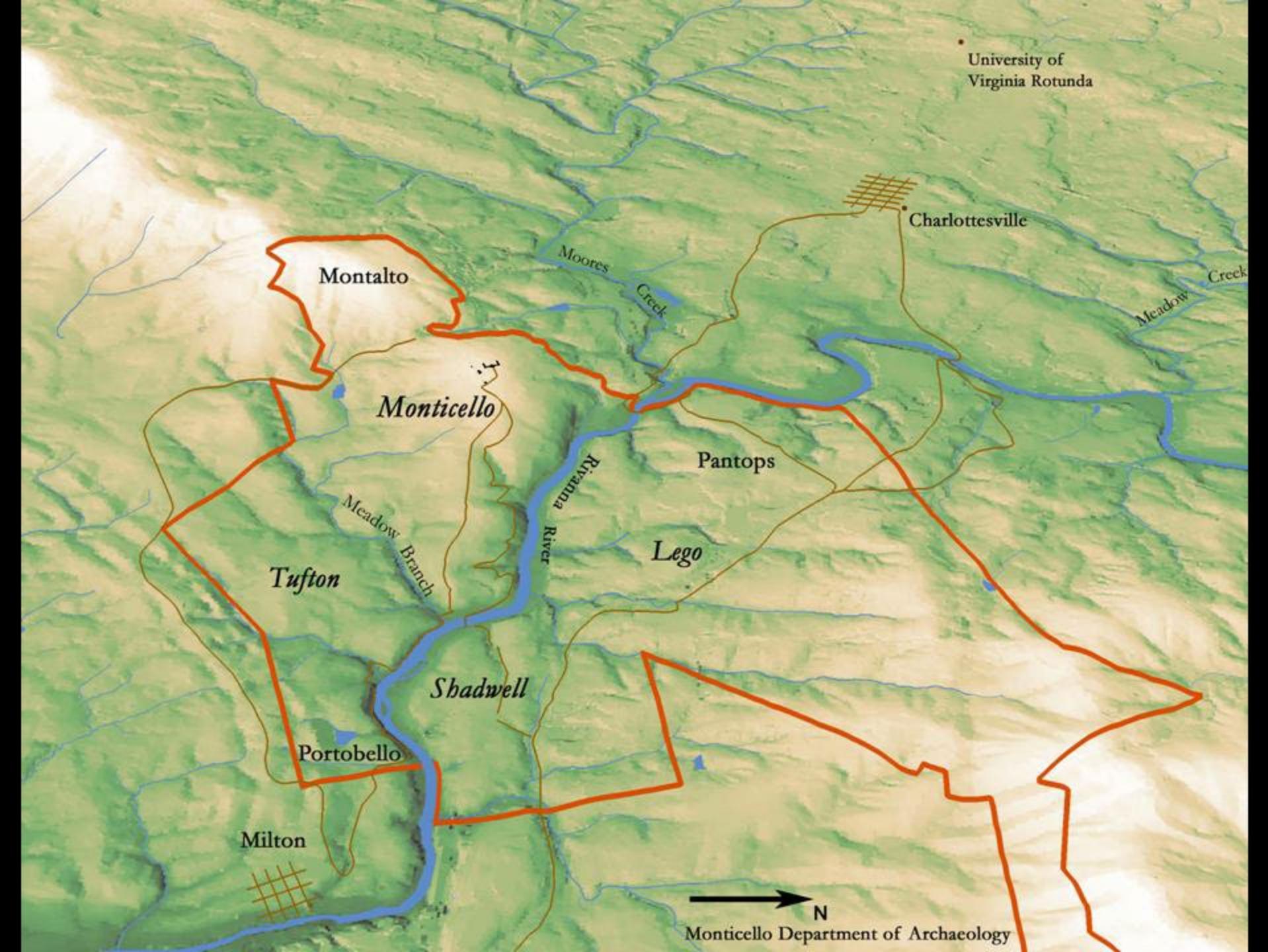
200 Kilometers

0

Demographic Expansion



University of
Virginia Rotunda





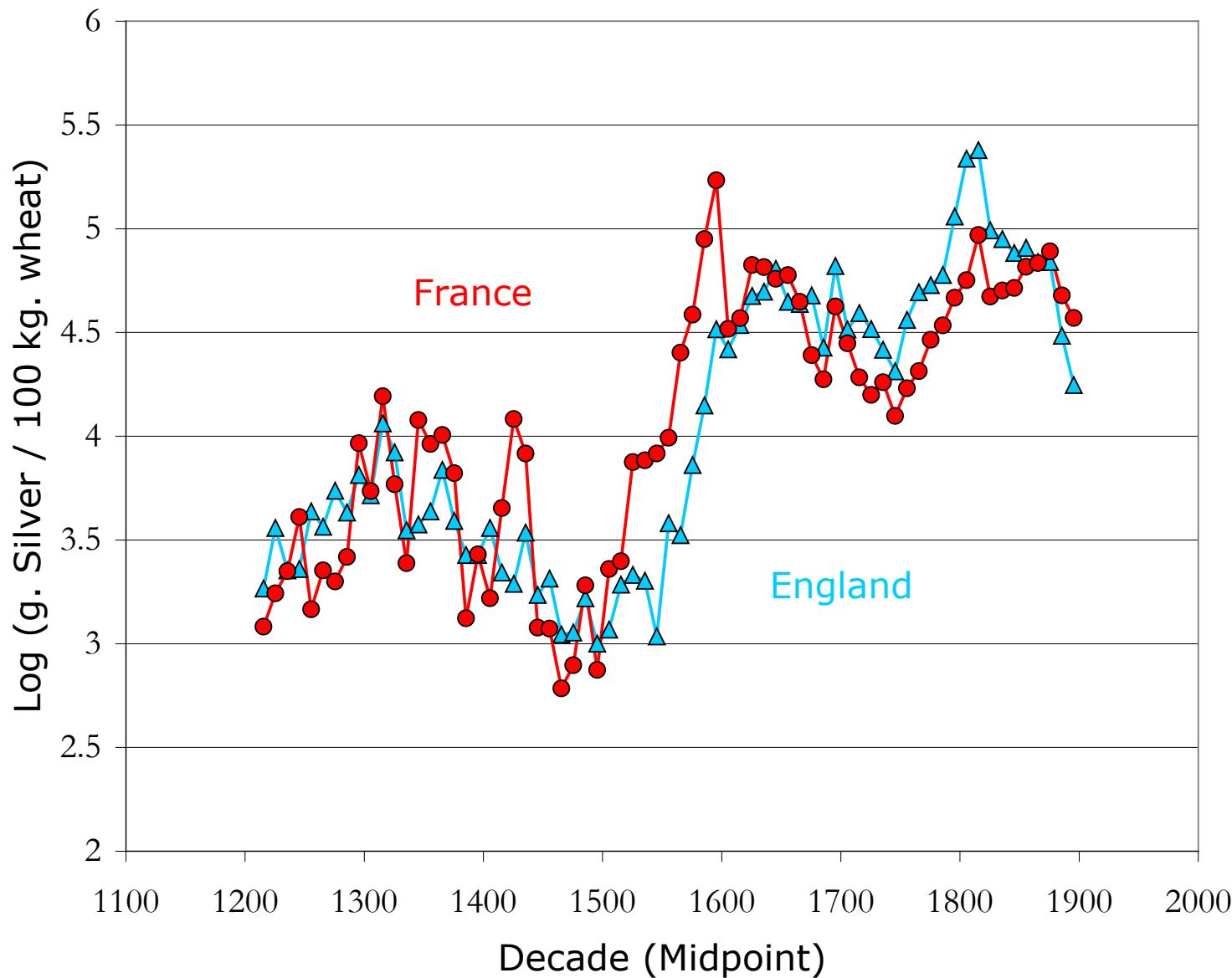
Tobacco

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

Wheat

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

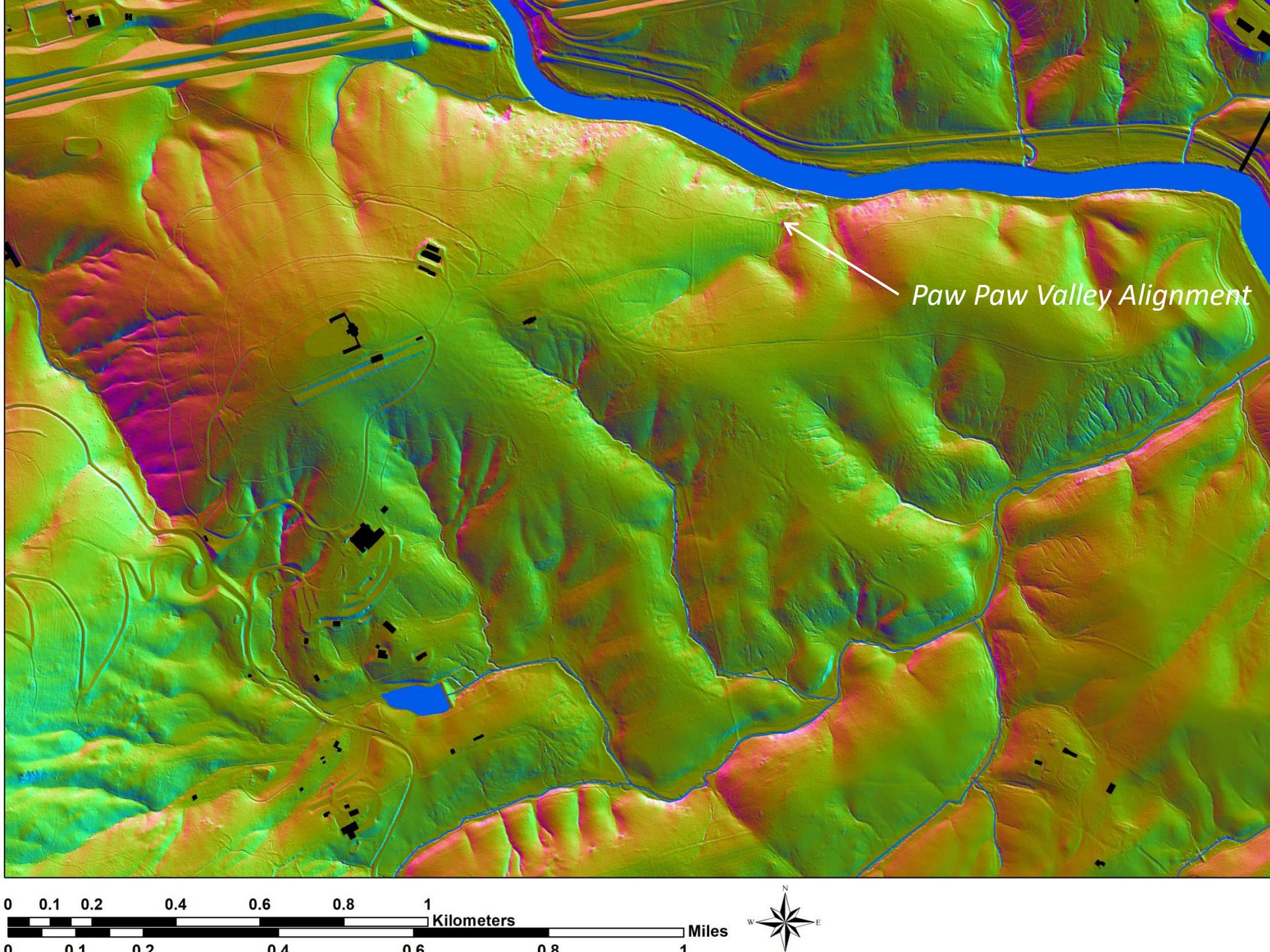
European Wheat Prices



*"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



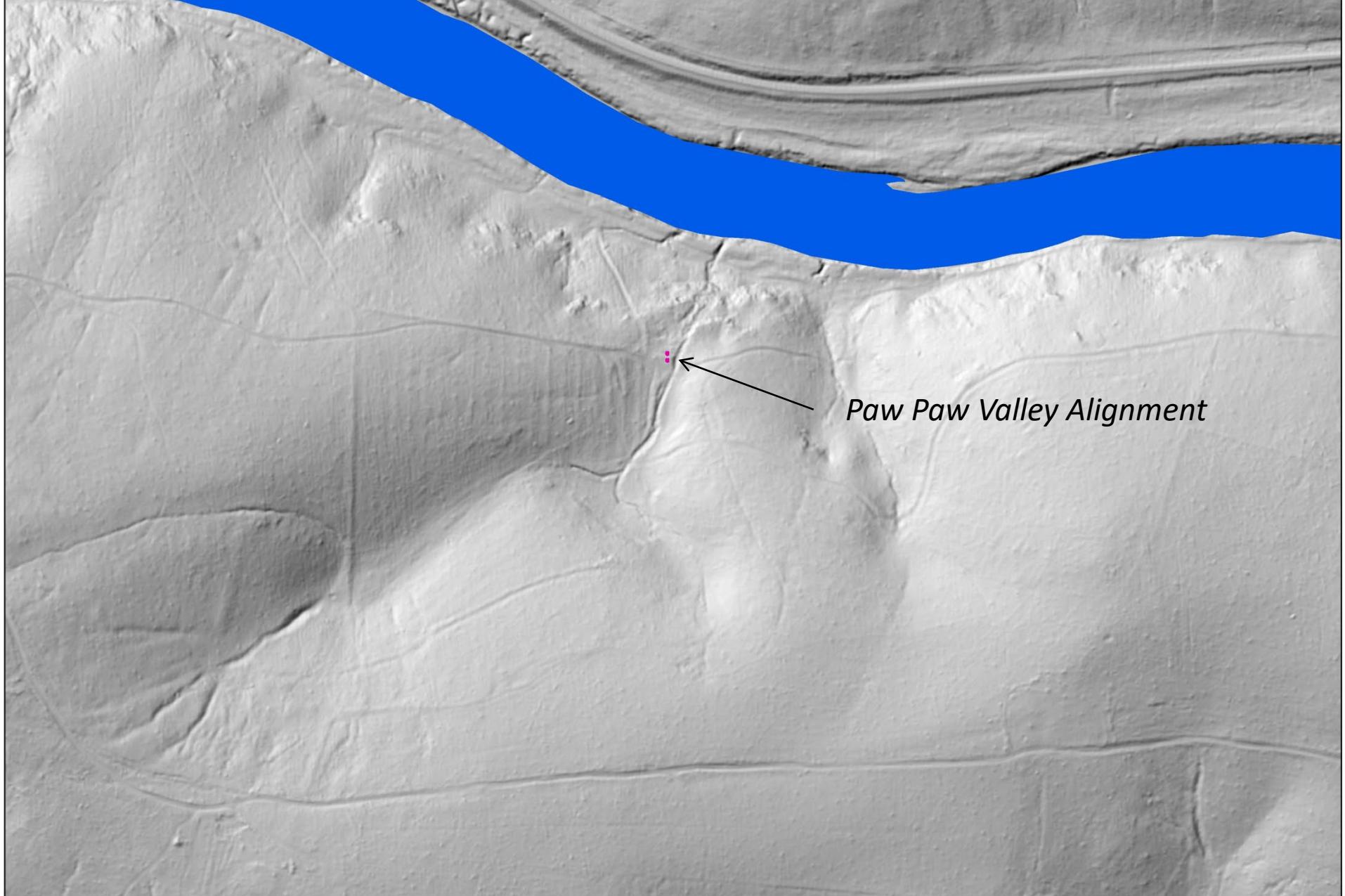


Paw Paw Valley Alignment

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





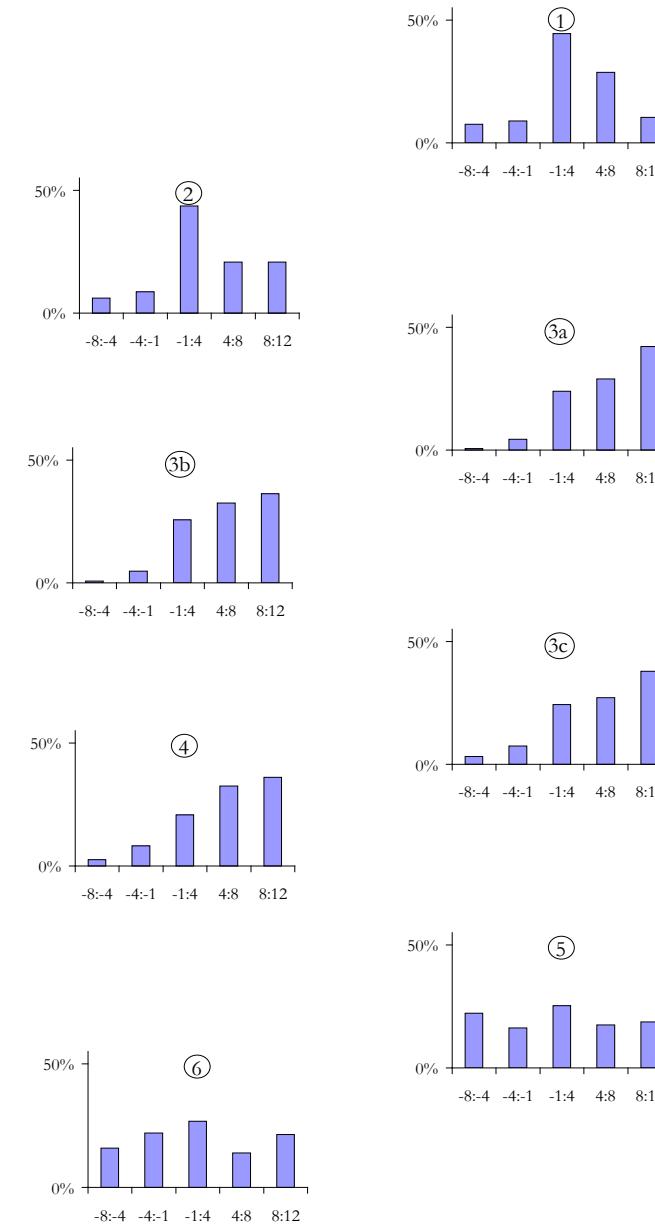
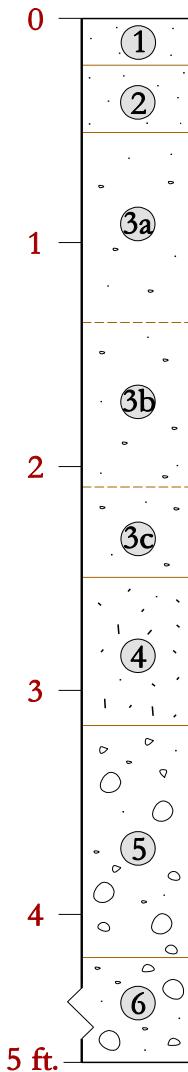




Paw Paw Valley: Unit 1

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

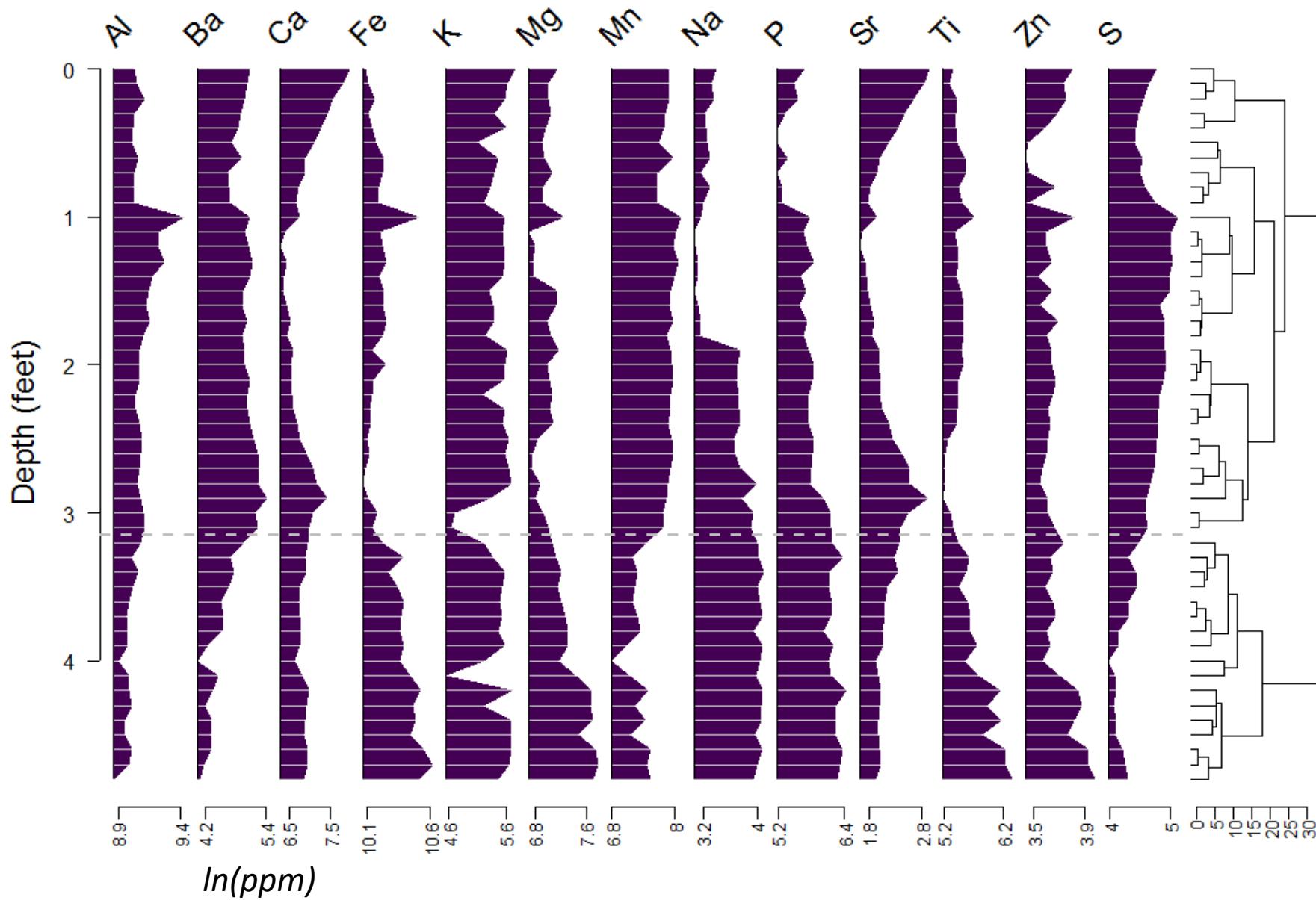


Cobbles-Pebbles-Sand-Silt-Clay

Phi

Paw Paw Valley: Unit 1

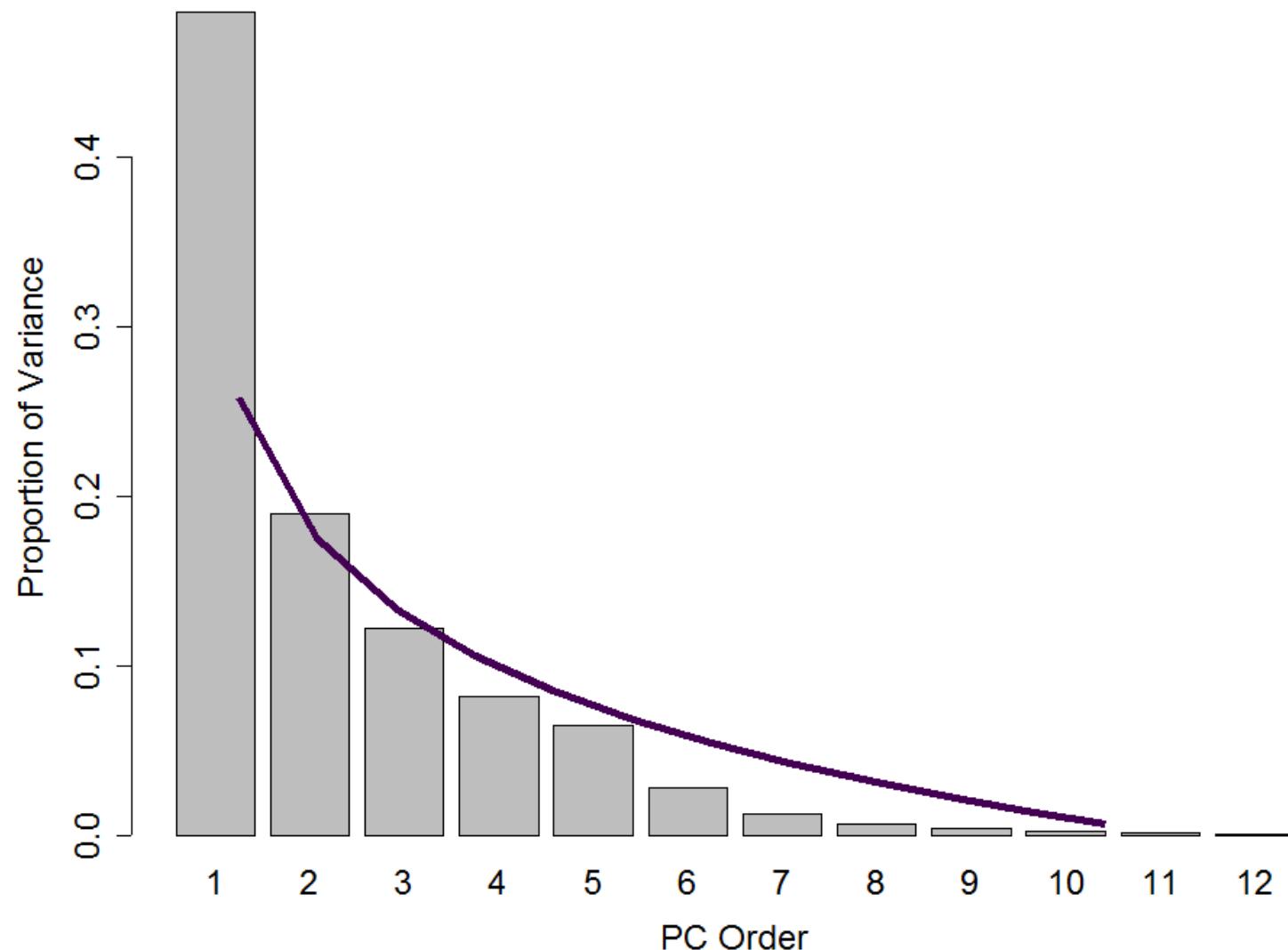
Sediment Chemistry



Paw Paw Valley: Unit 1

Sediment Chemistry

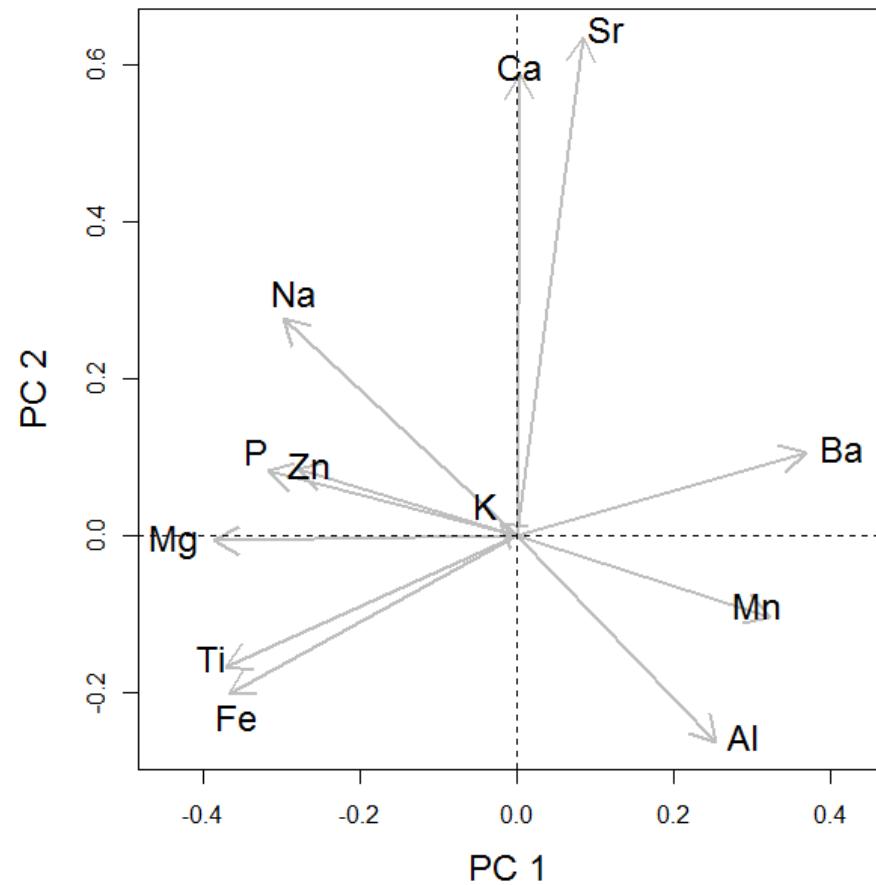
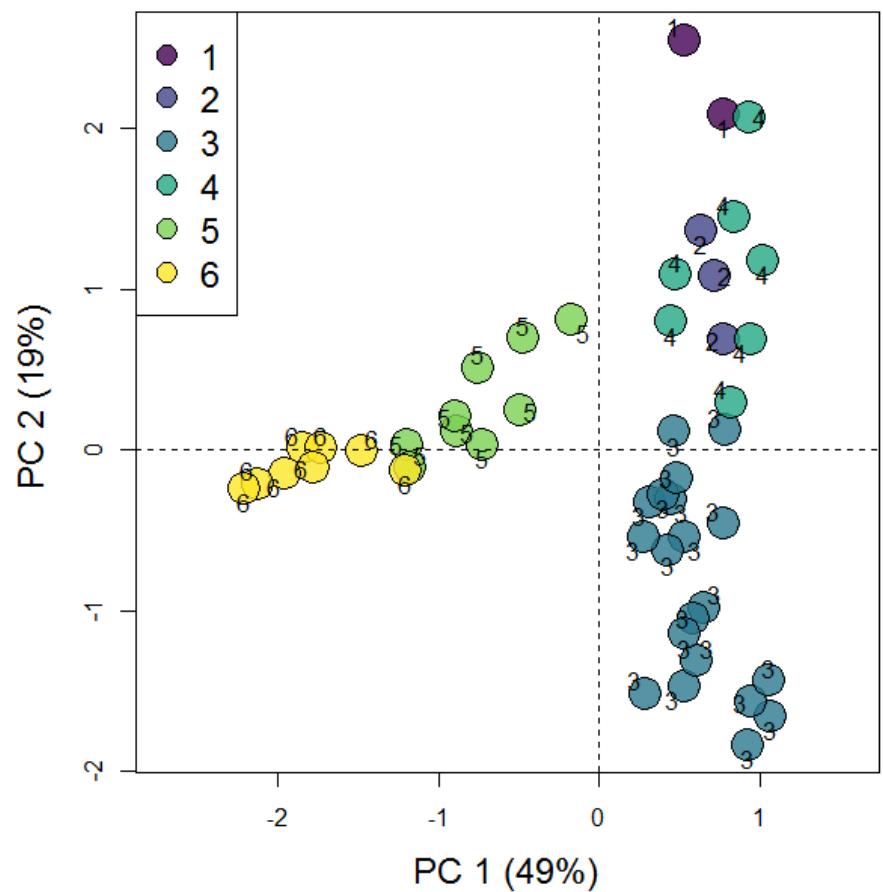
PCA



Paw Paw Valley: Unit 1

Sediment Chemistry

PCA



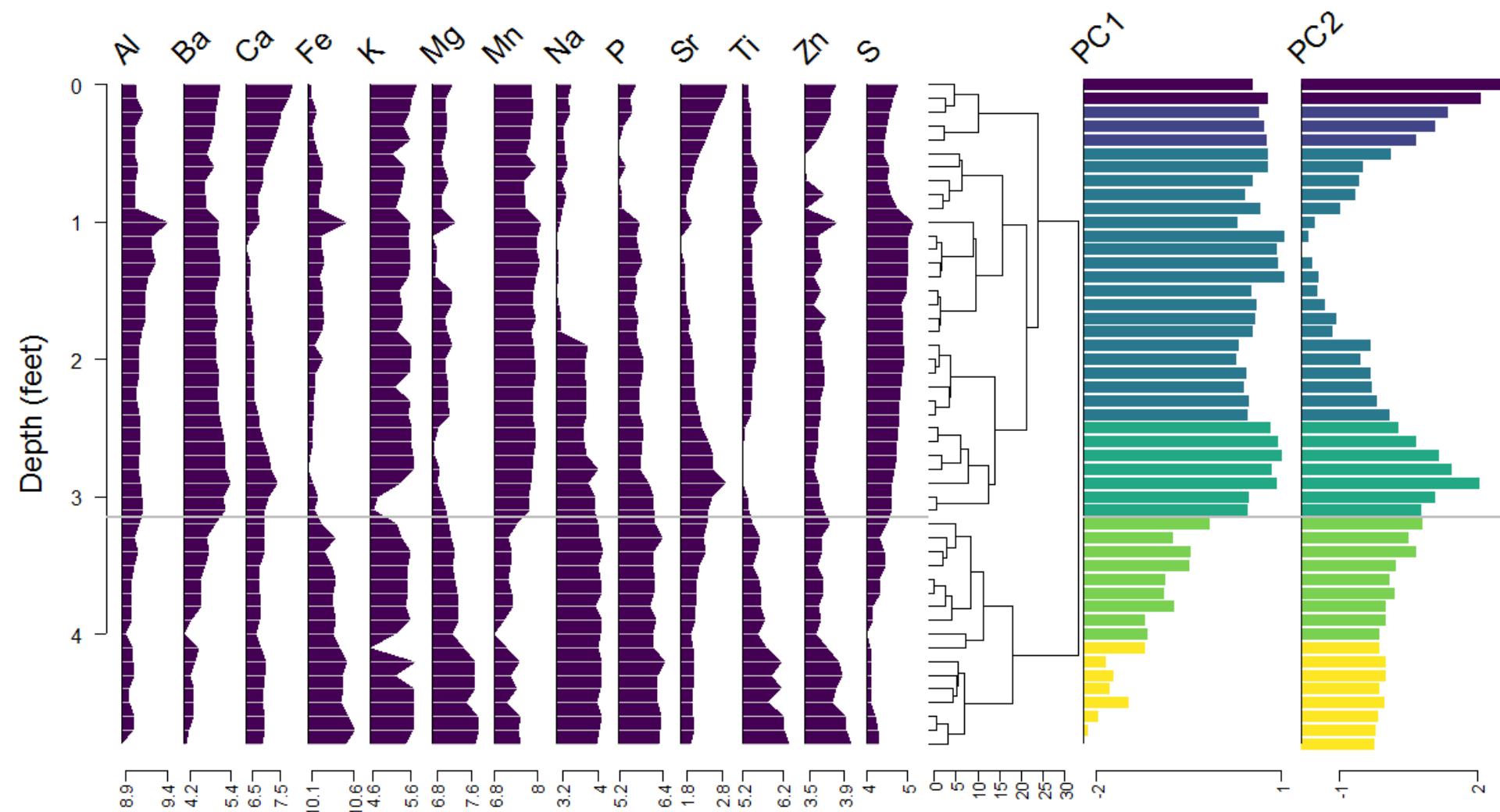
Paw Paw Valley: Unit 1

Sediment Chemistry

PCA

weathering

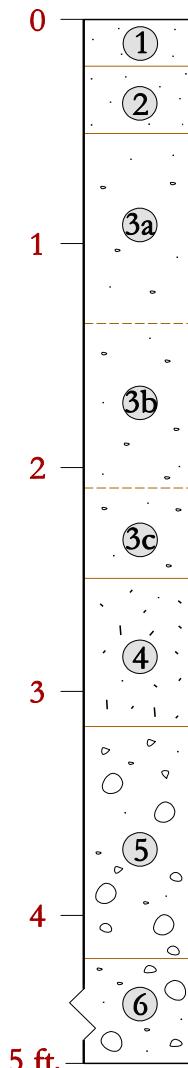
*O-horizon
inputs*



Paw Paw Valley: Unit 1

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1-2.

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

3.

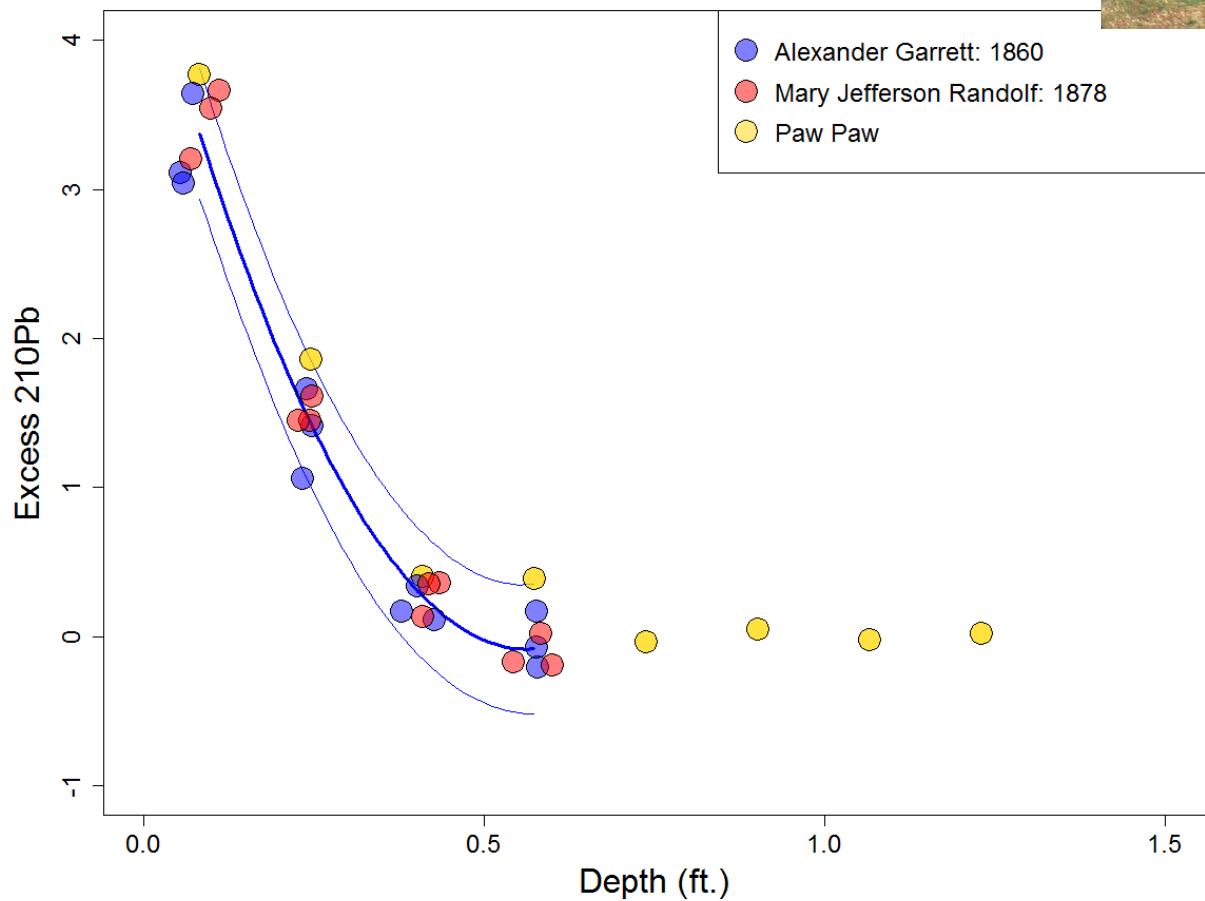
4.

5-6.

- A horizon **transported** from upslope
- 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

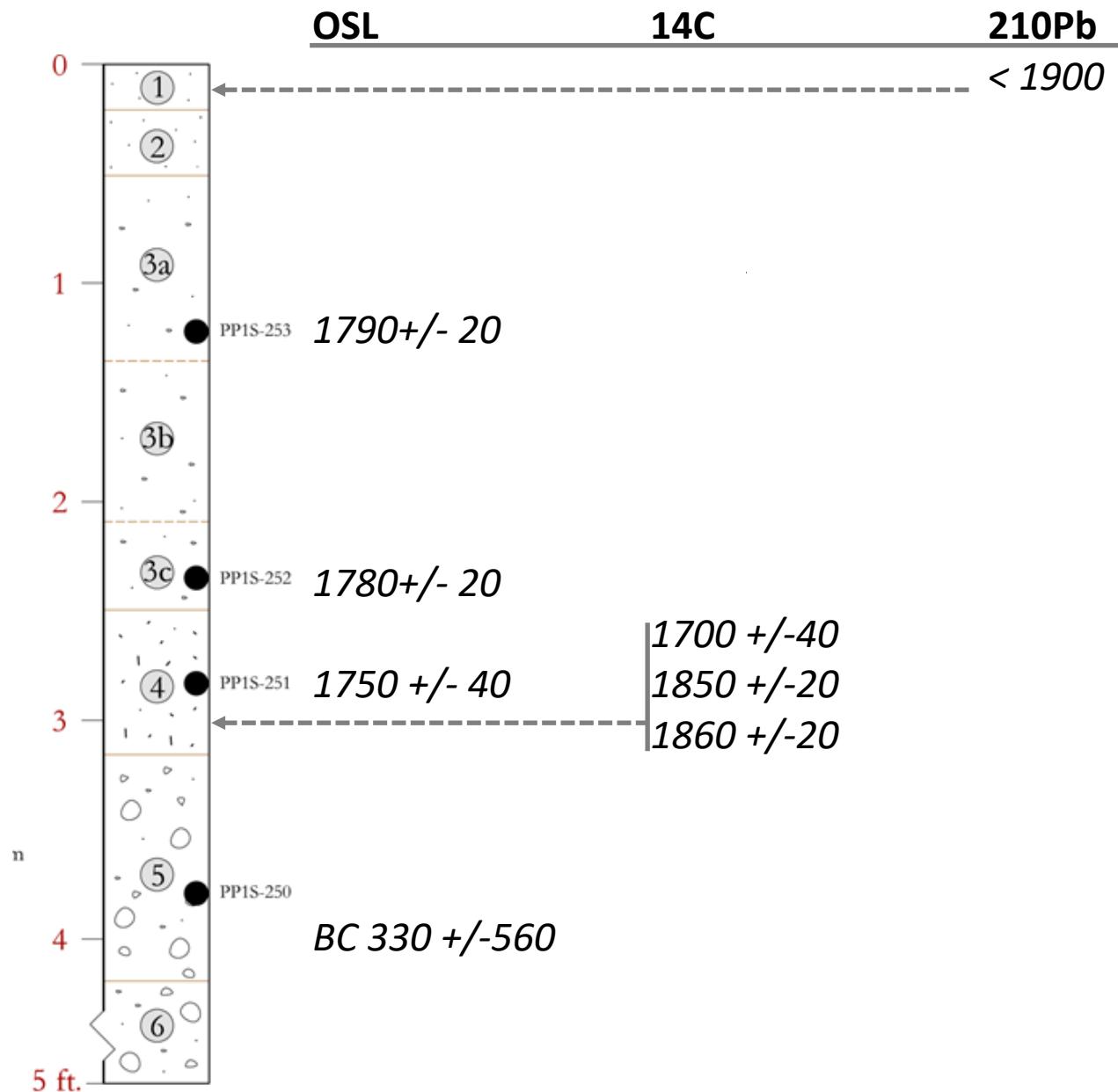
Dating: ^{210}Pb



Paw Paw Valley: Unit 1

Dating: OSL, 14C, 210Pb

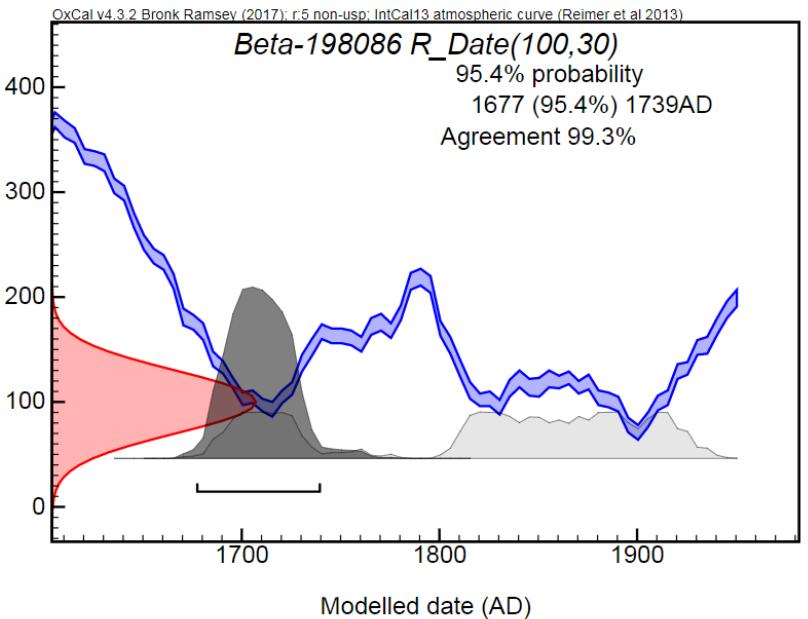
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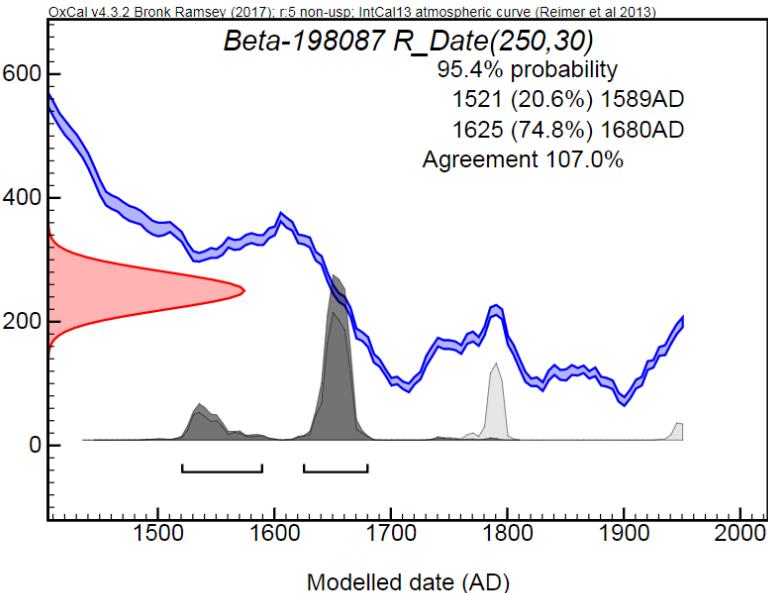
Paw Paw Valley: Unit 1

Dating: 14C

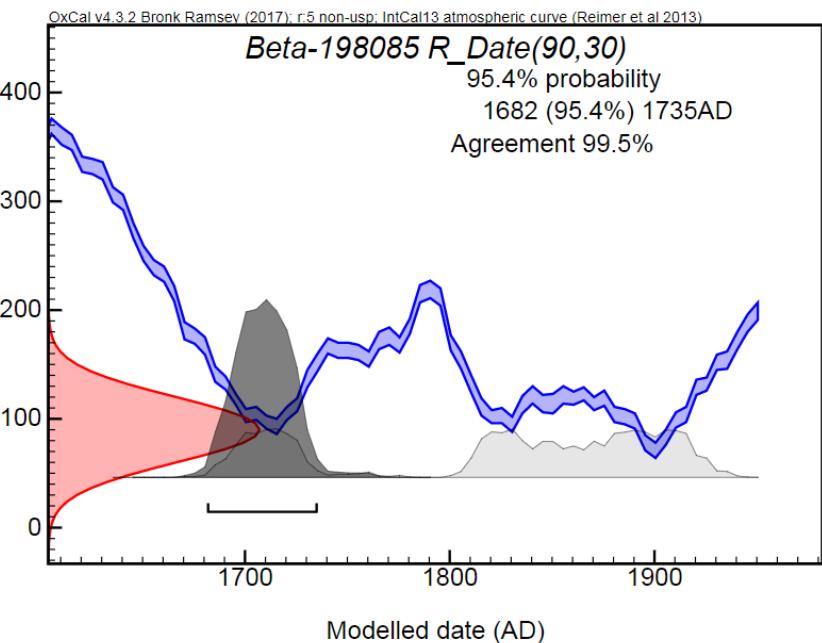
Radiocarbon determination (BP)



Radiocarbon determination (BP)



Radiocarbon determination (BP)



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*”.

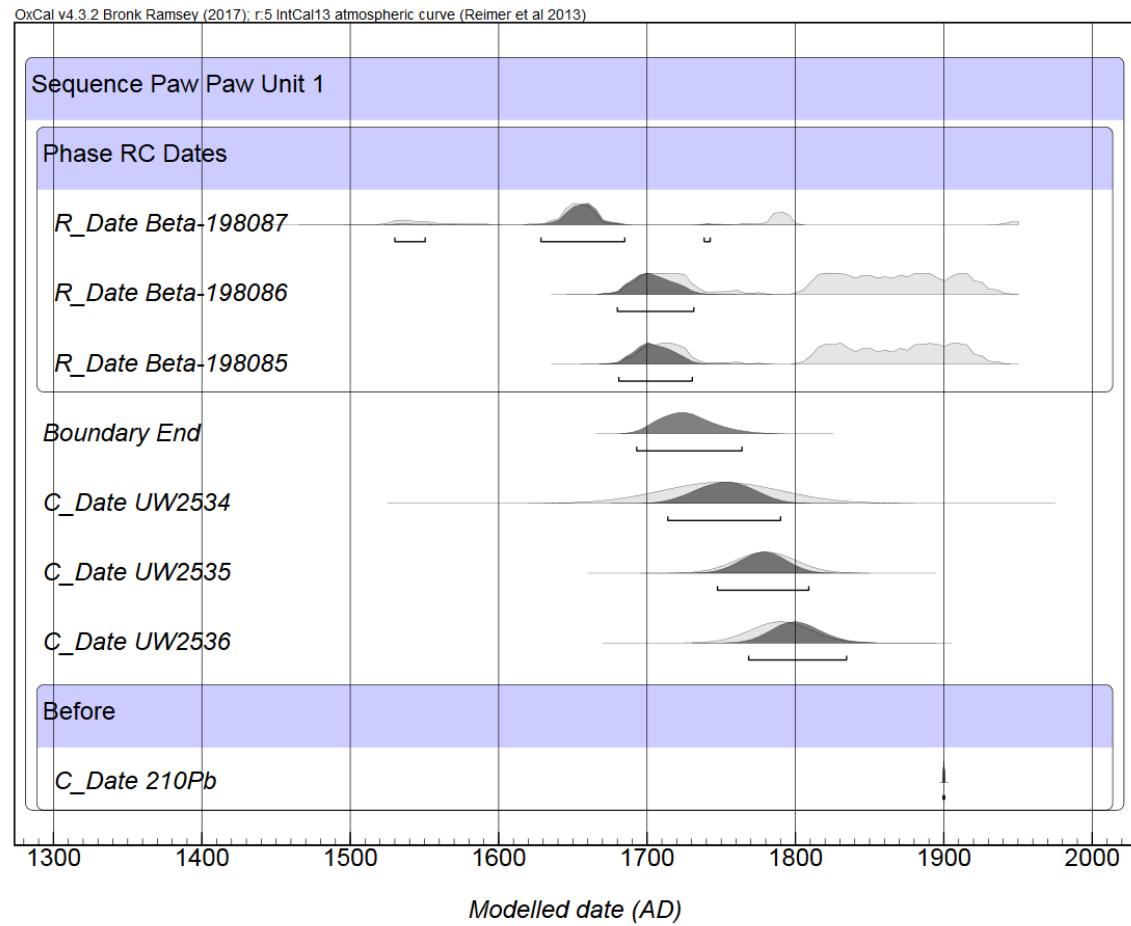
$$\textit{Posterior} \quad \textit{Probability that event } E \textit{ happened in year } Y, \textit{ given our data.} \propto \textit{Likelihood} \quad \textit{Probability of getting our data, given that event } E \textit{ happened in year } Y. \times \textit{Prior} \quad \textit{Prior probability that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

Paw Paw Valley: Unit 1

Posterior Estimates from the Bayesian Chronological Model

Mean **(95% credible interval)**

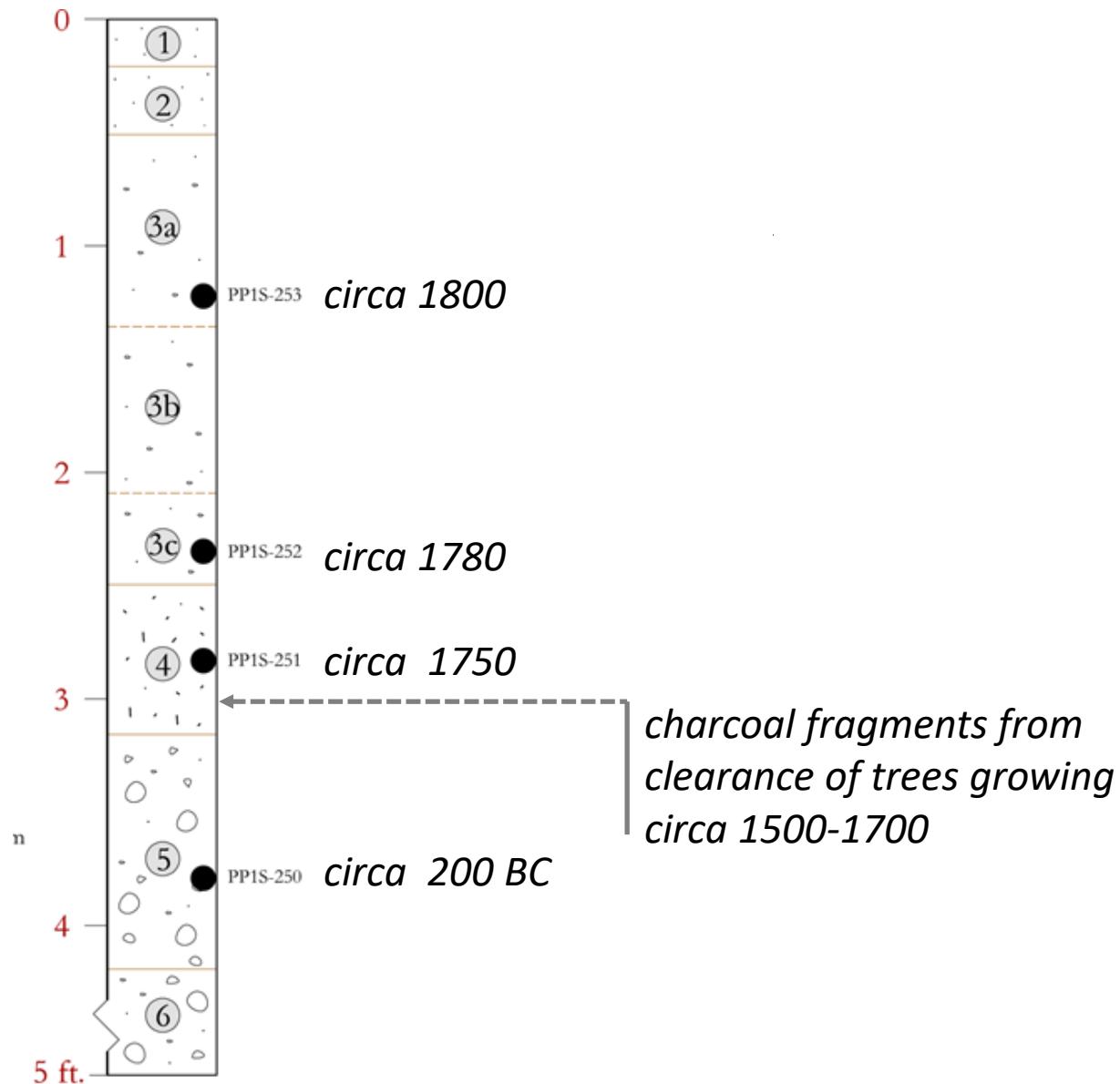
14C: 1636	(1530 – 1742)
14C: 1706	(1680 – 1731)
14C: 1706	(1681 – 1730)
1728	(1693 – 1764)
OSL: 1752	(1714 – 1790)
OSL: 1778	(1747 – 1809)
OSL: 1801	(1768 – 1834)
210Pb: < 1900	



Paw Paw Valley: Unit 1

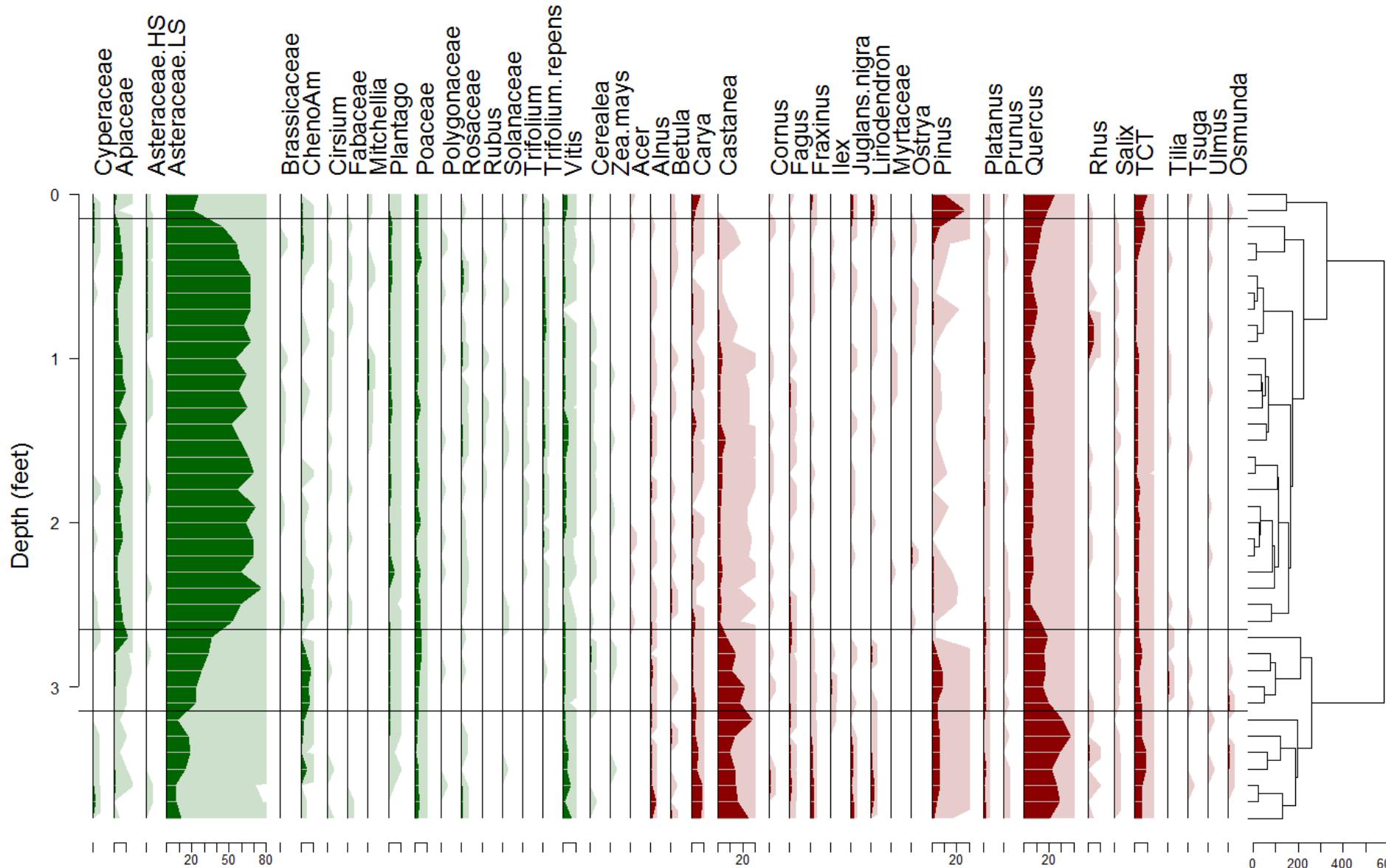
Proposed Chronology

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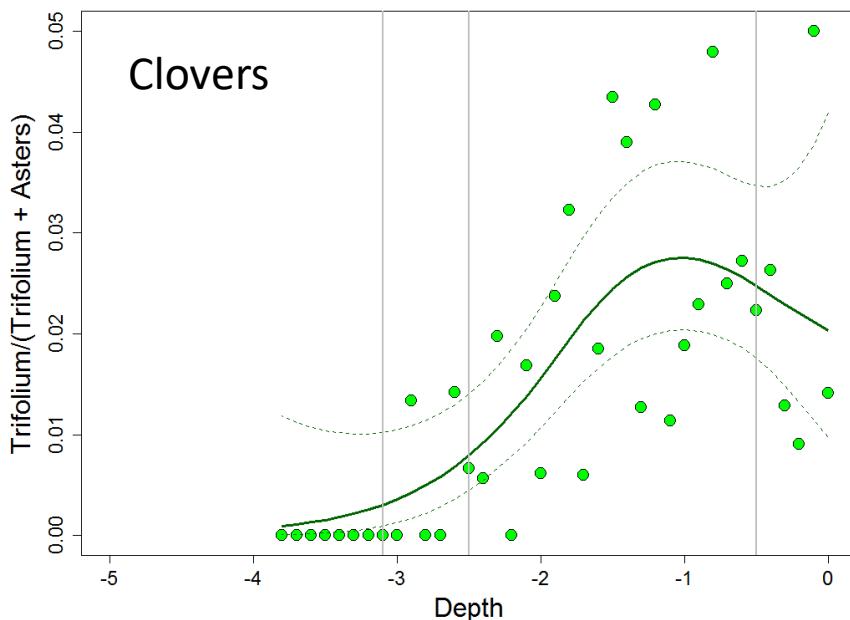
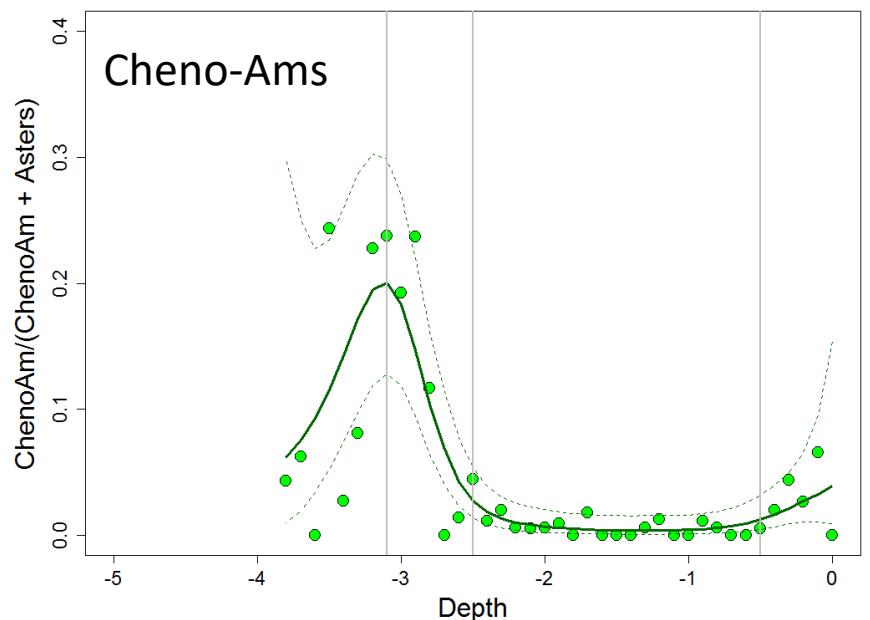
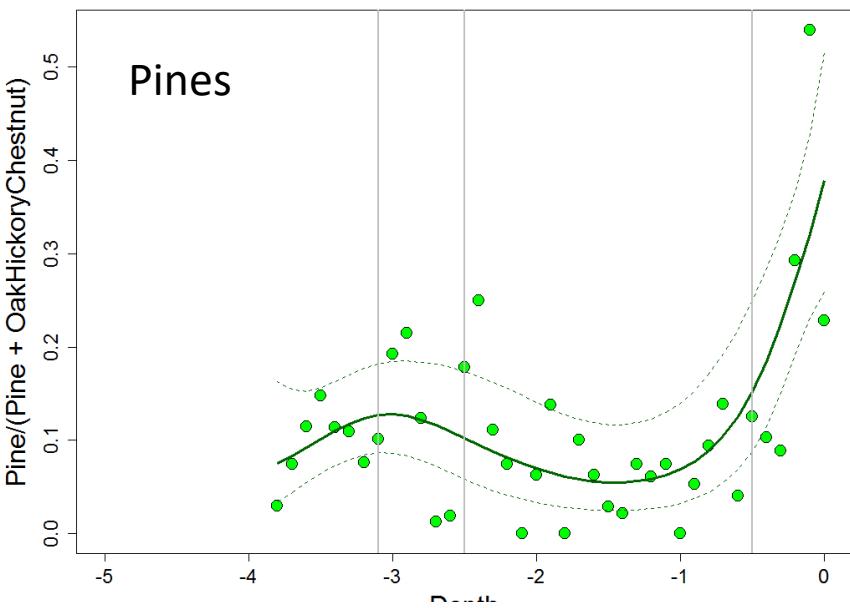
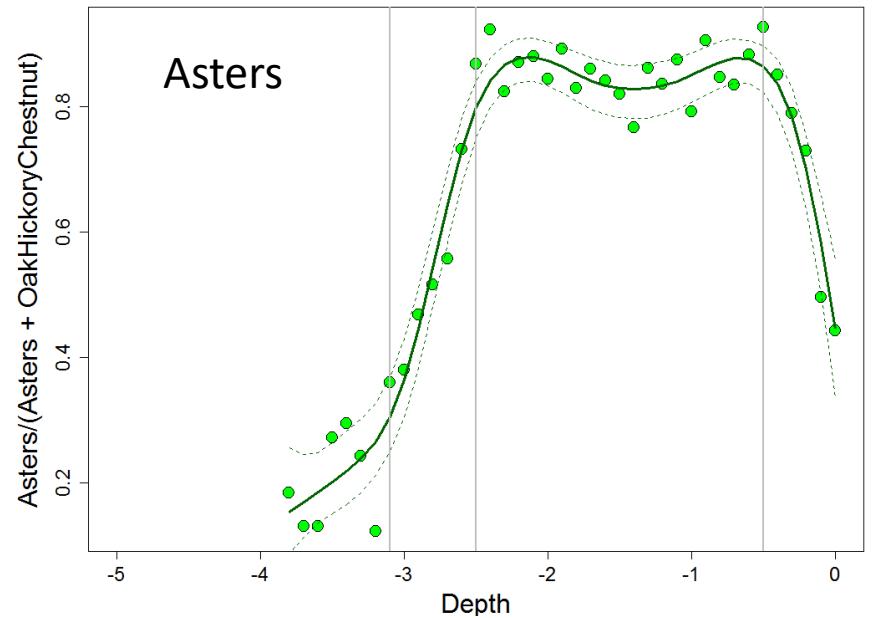
Paw Paw Valley: Unit 1

Pollen



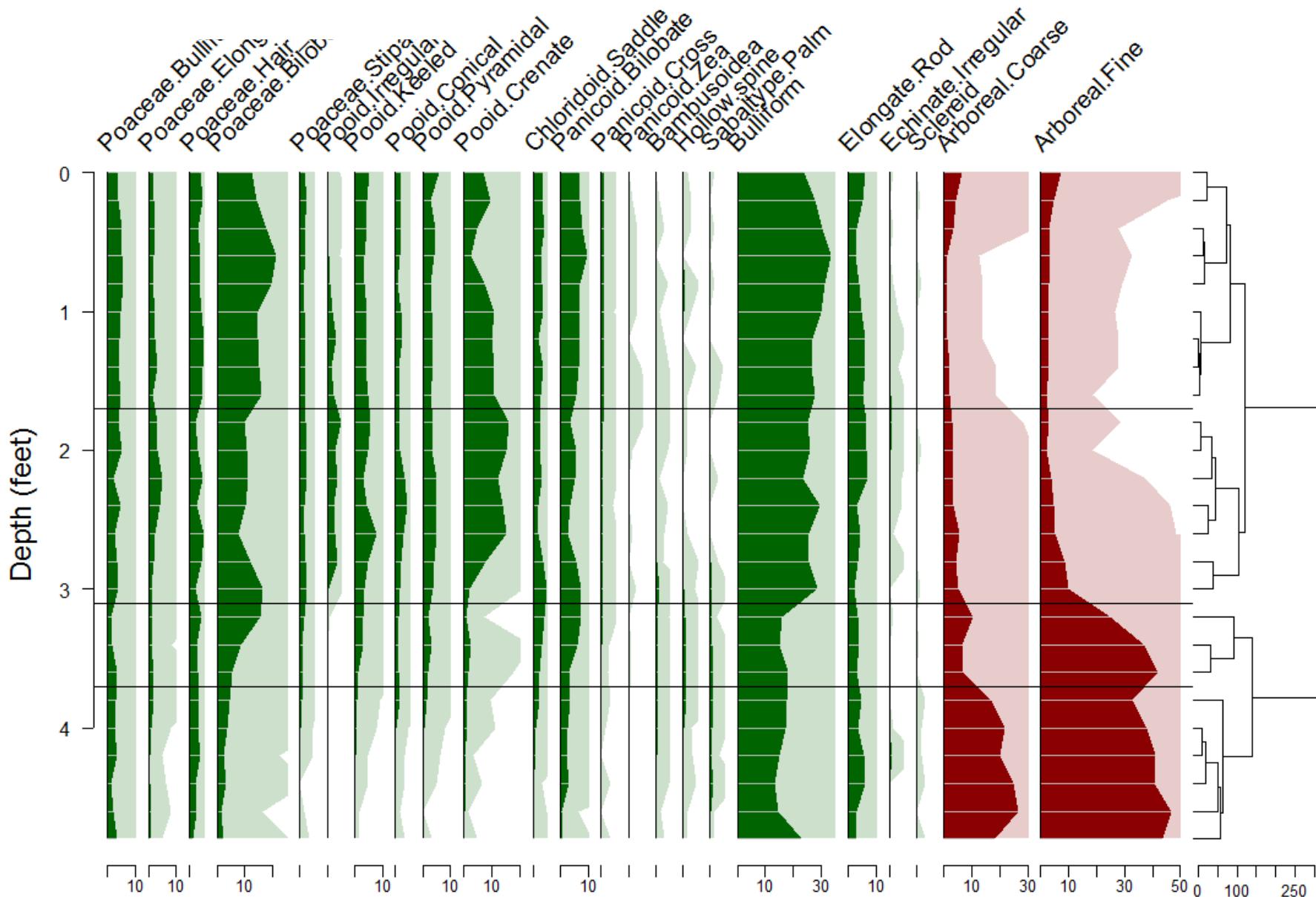
Paw Paw Valley: Unit 1

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



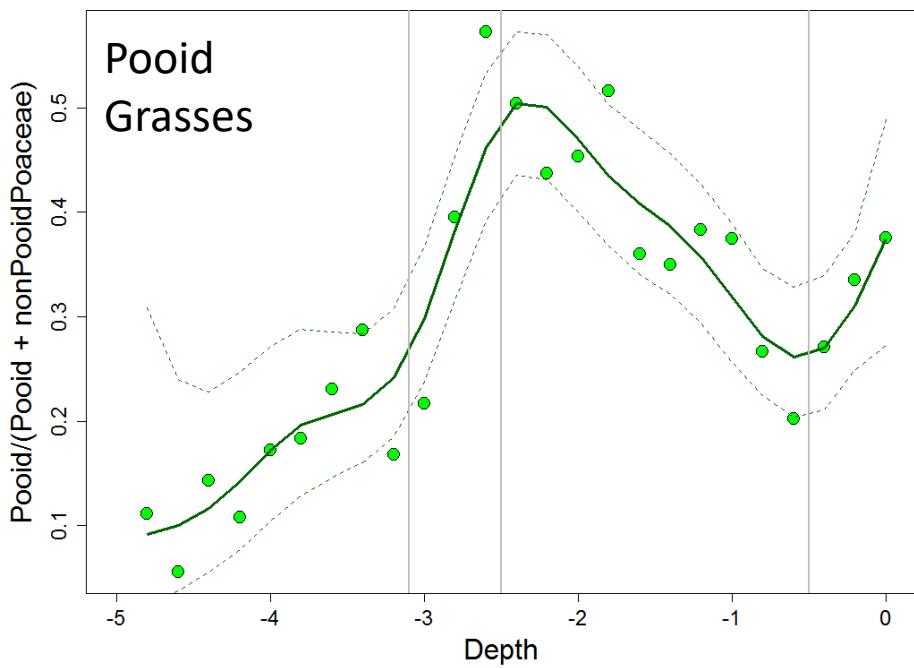
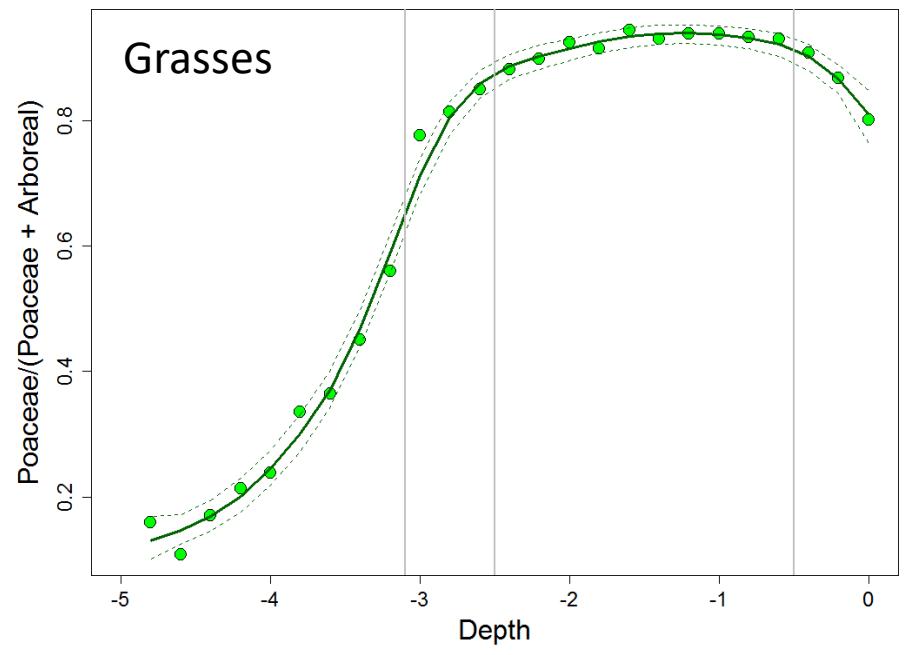
Paw Paw Valley: Unit 1

Phytoliths



Paw Paw Valley: Unit 1

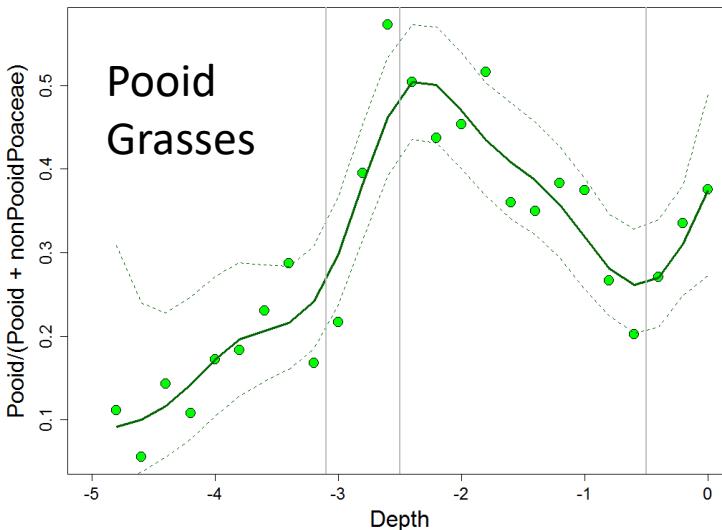
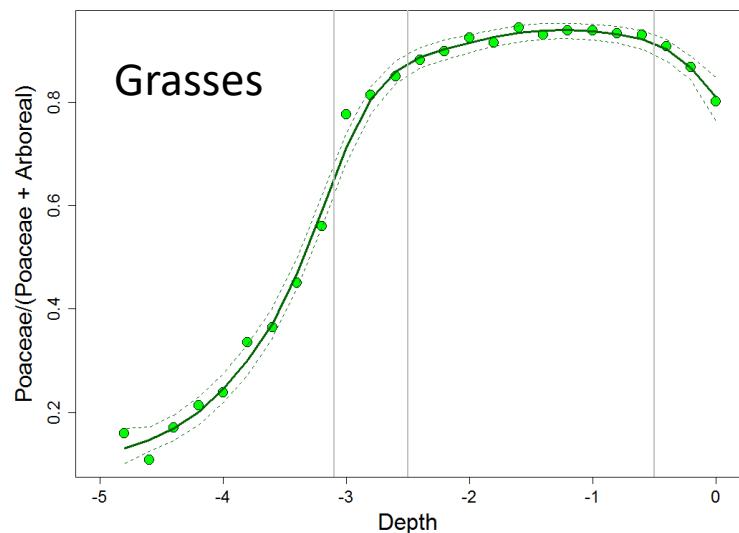
GAMs for Select Phytolith Taxa: Logistic link, quasi-binomial errors



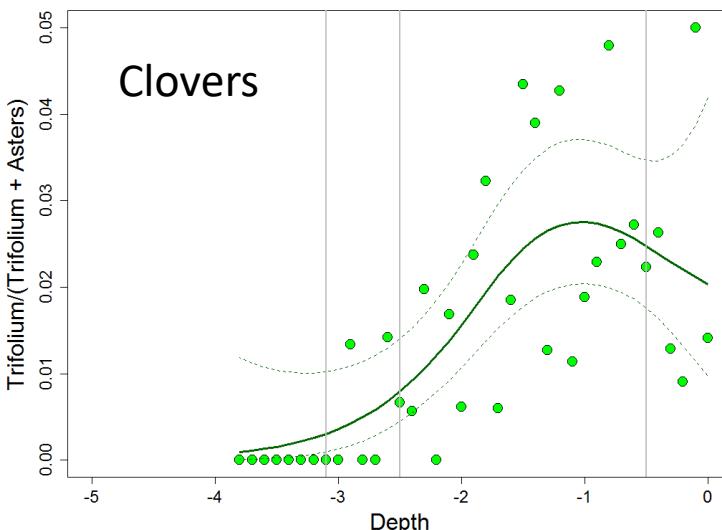
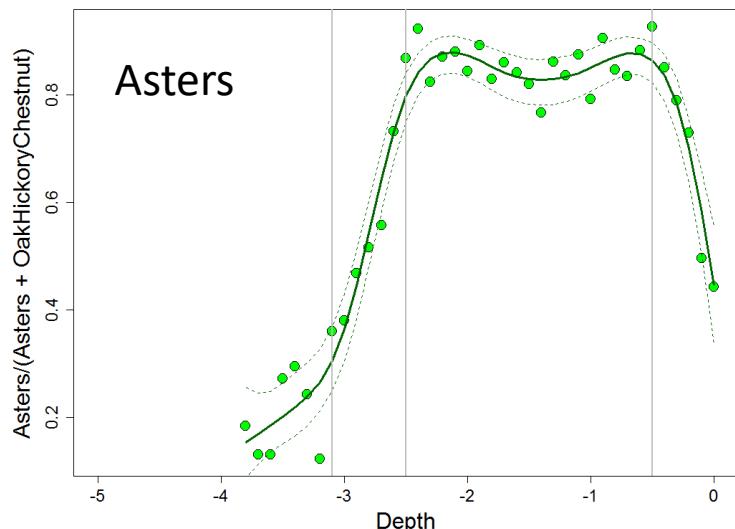
Paw Paw Valley: Unit 1

GAMs for Phytolith versus Pollen Taxa

Phytoliths

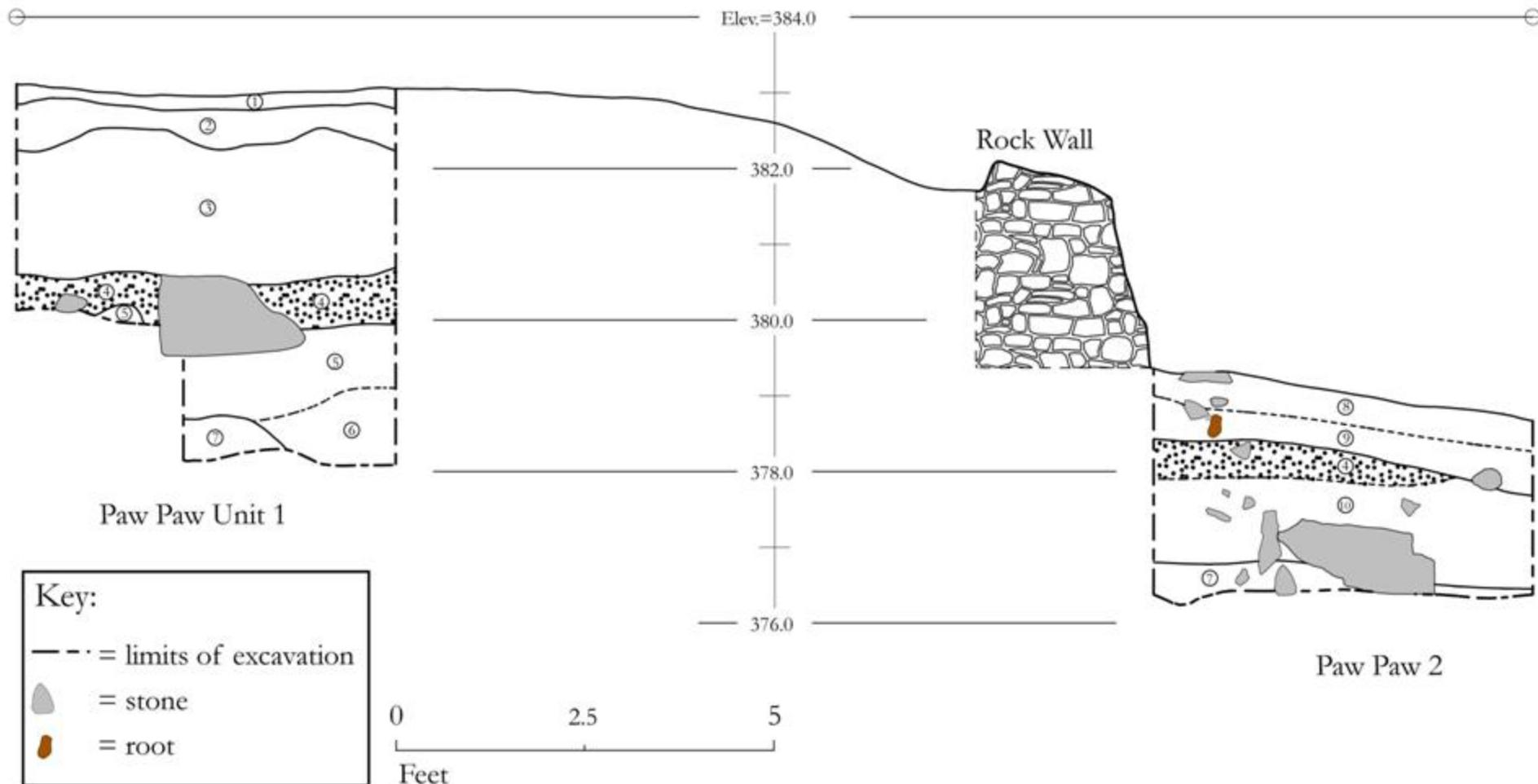


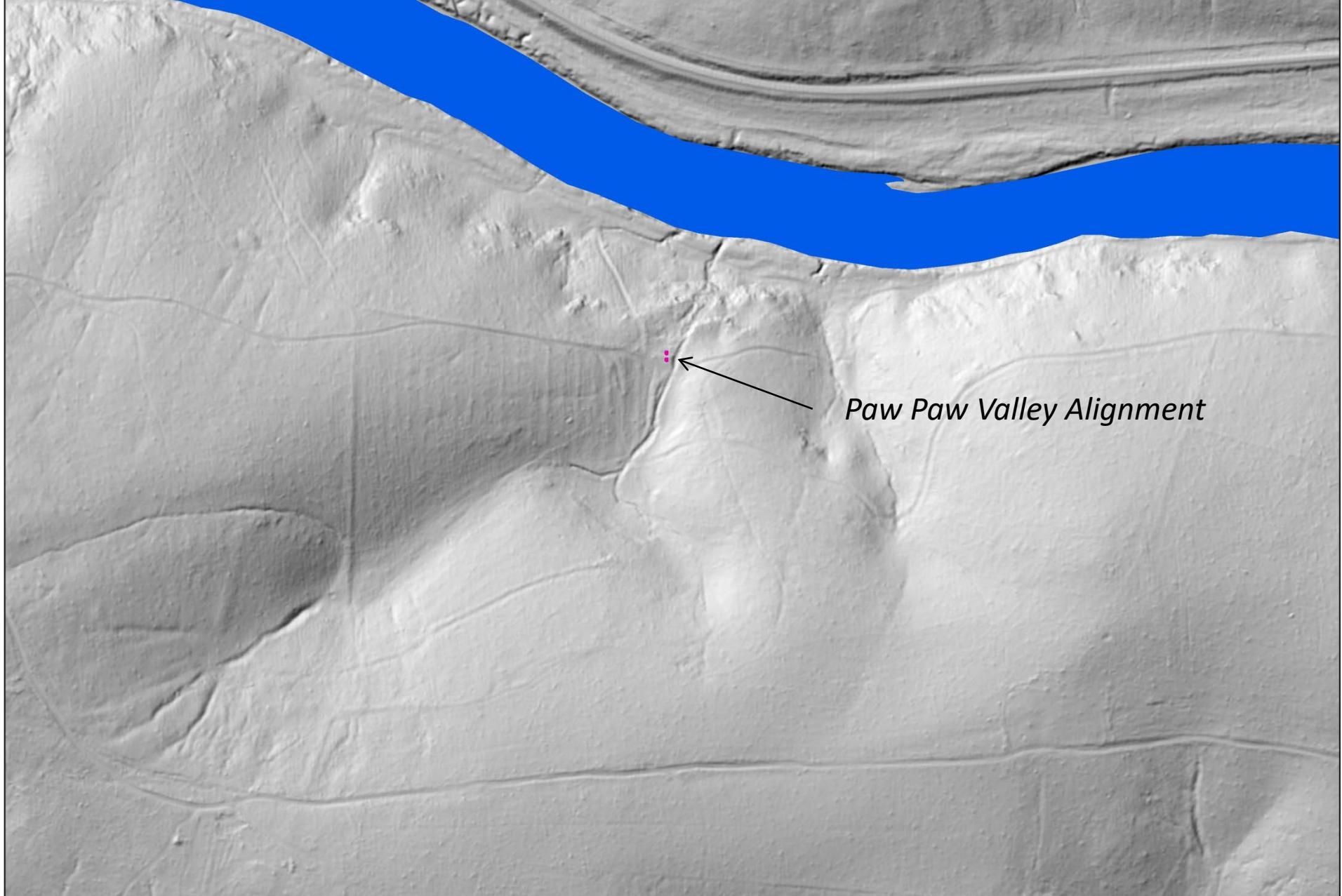
Pollen

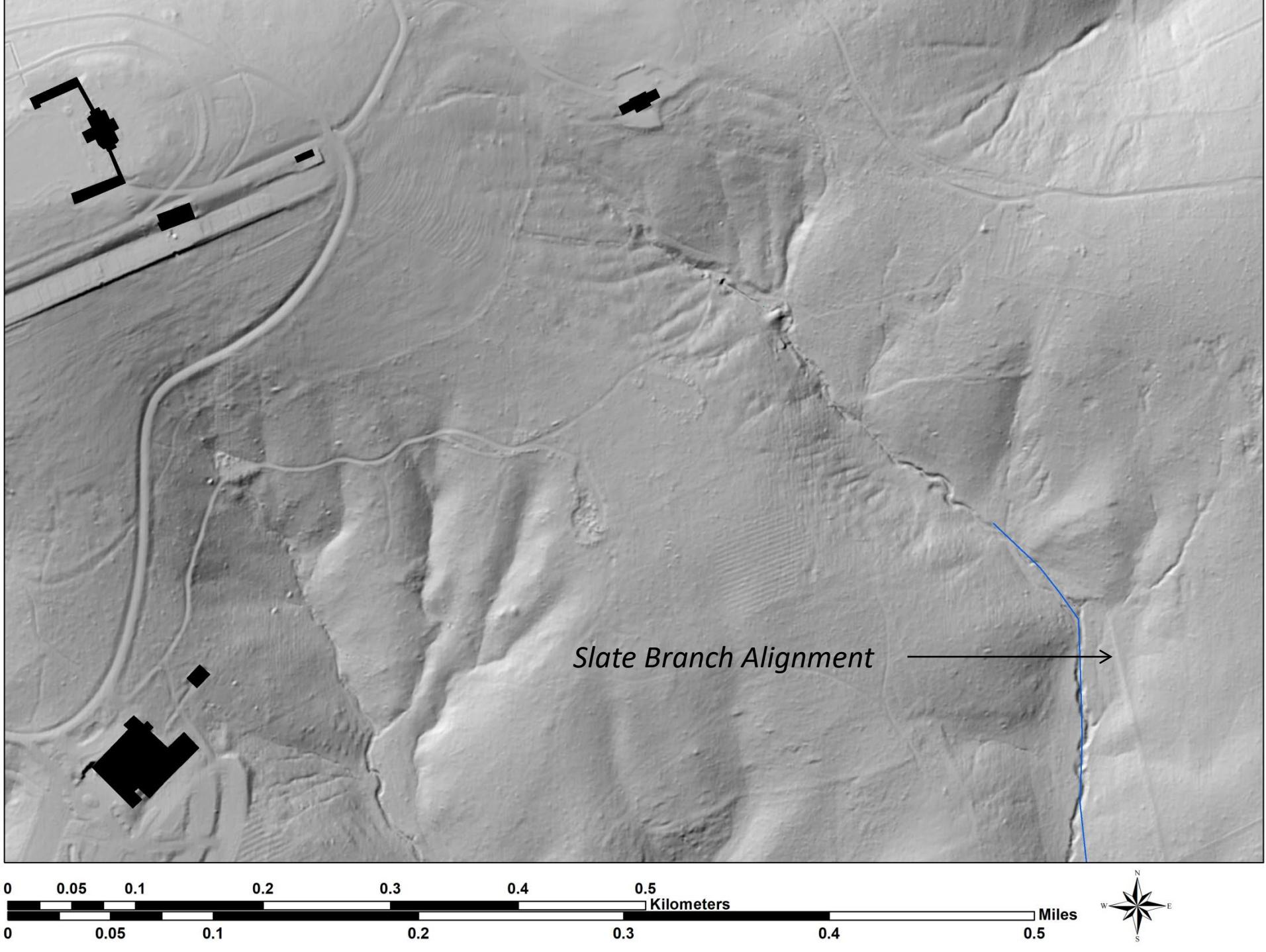




Paw Paw Valley, Units 1 & 2, West Profile

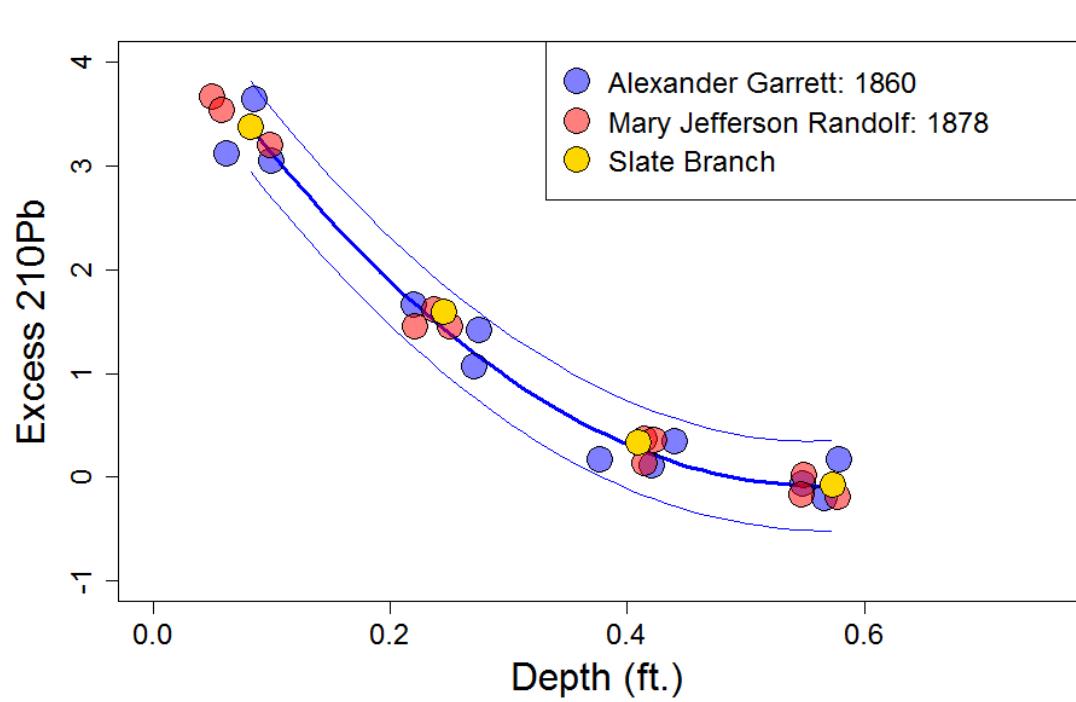






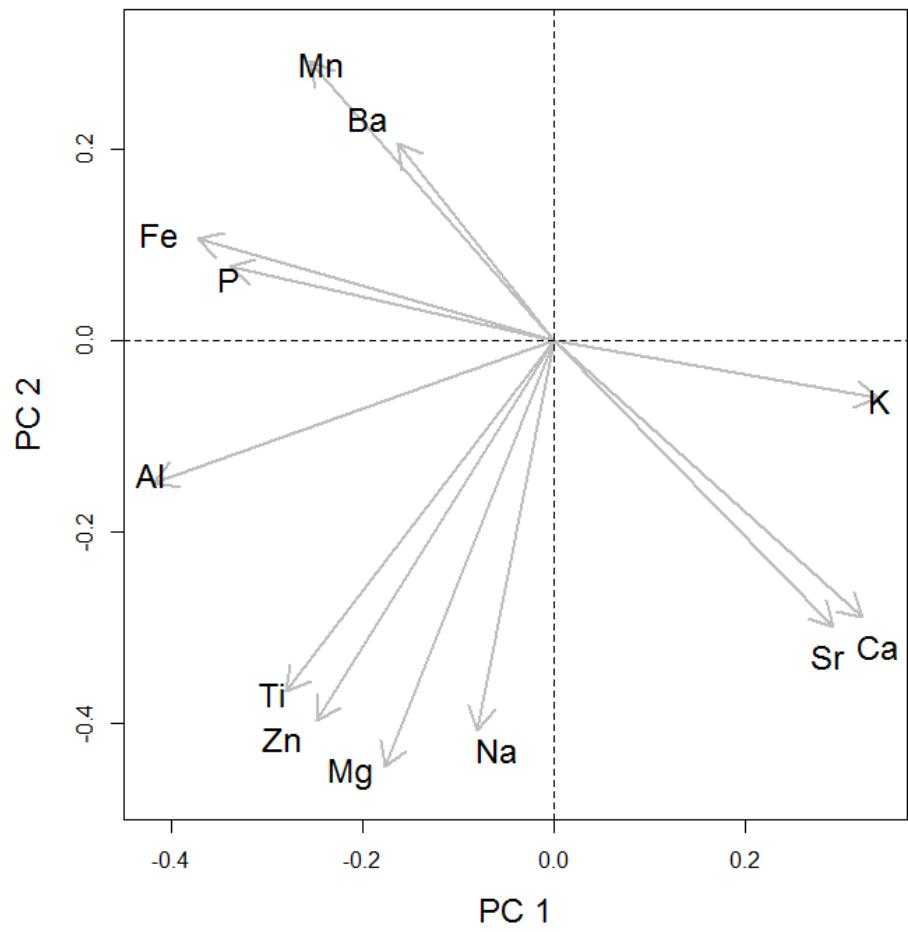
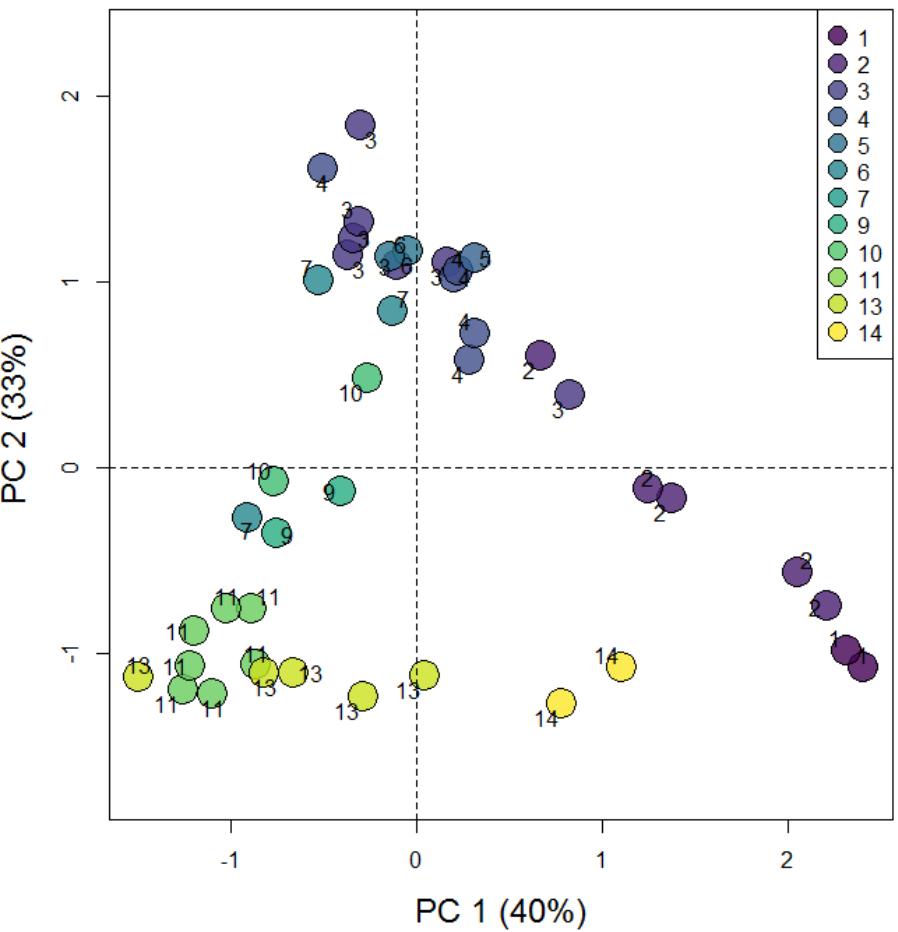
Slate Branch: Alignment: Unit 2

Dating: 210 Pb



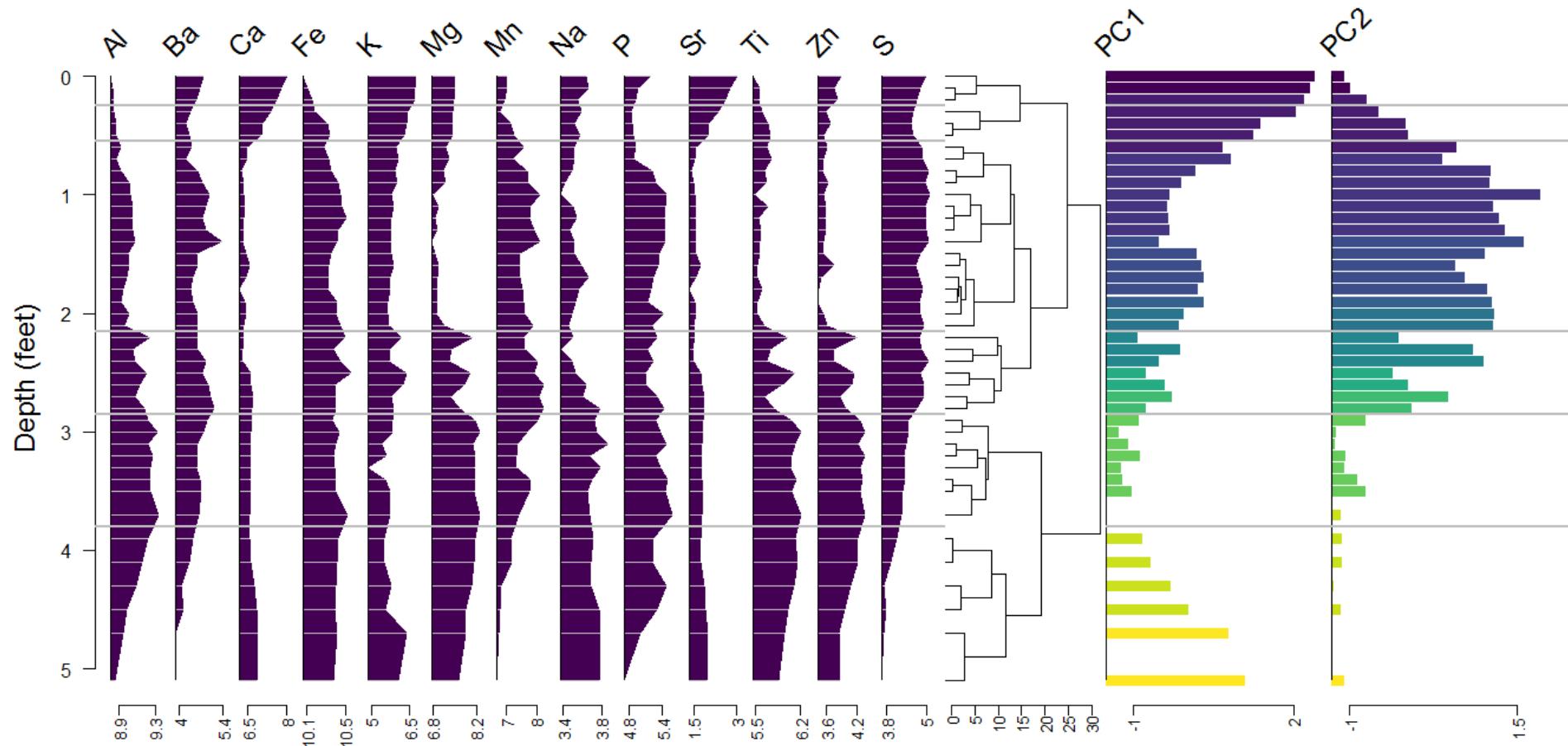
Slate Branch: Unit 2

Sediment Chemistry



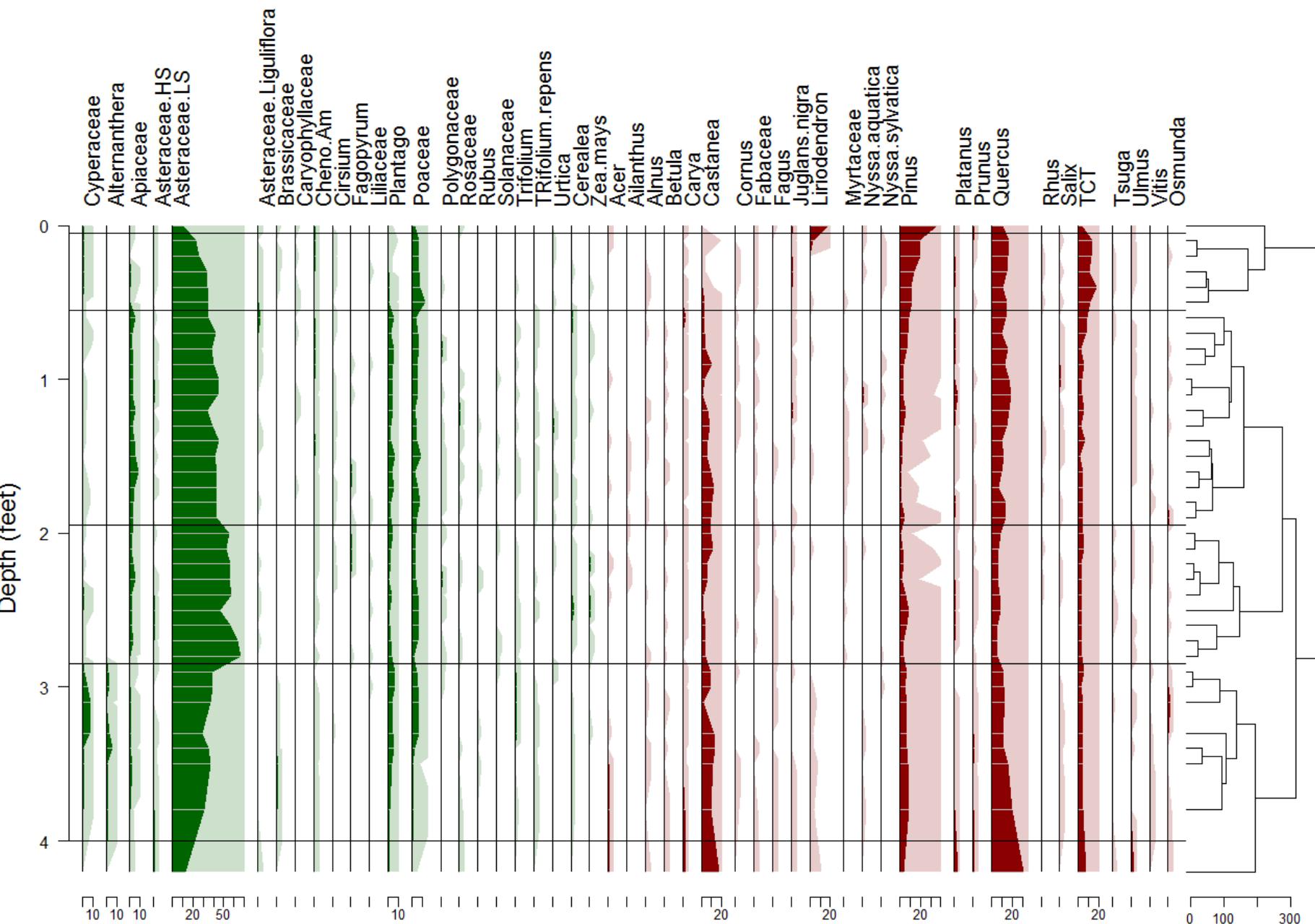
Slate Branch: Unit 2

Sediment Chemistry



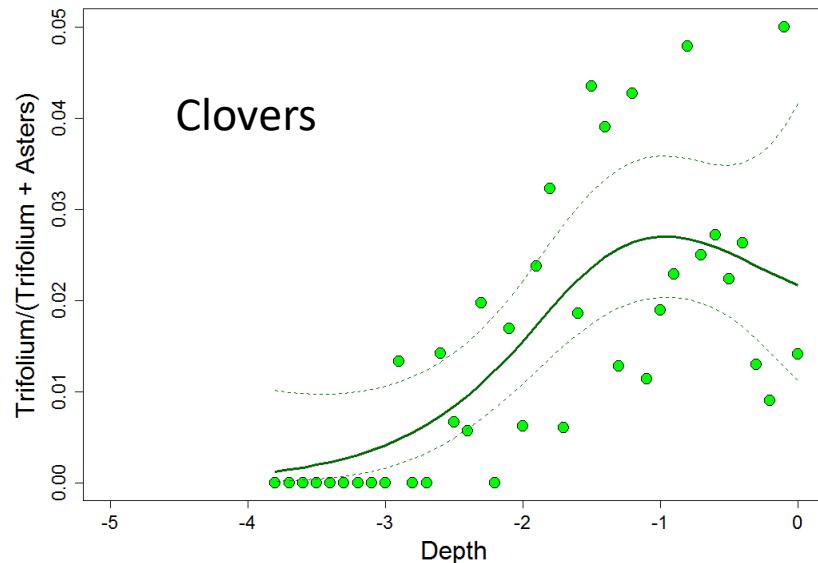
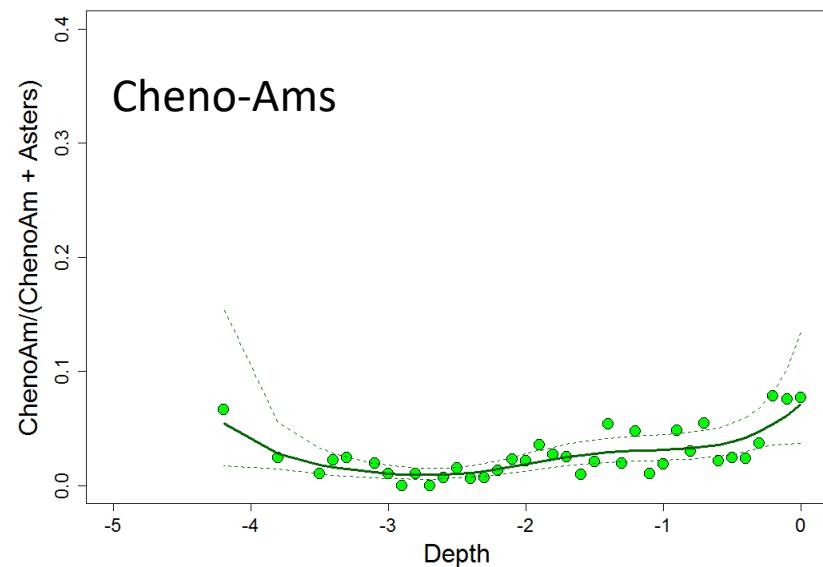
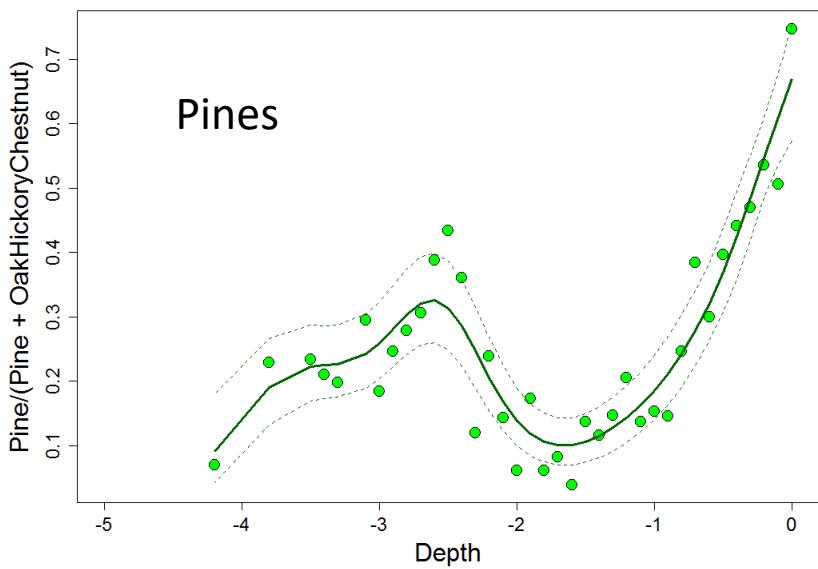
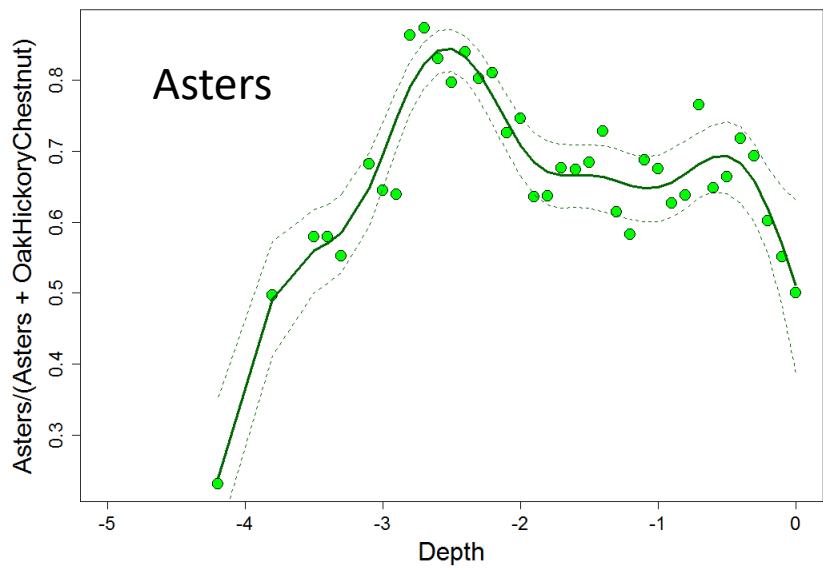
Slate Branch: Unit 2

Pollen



Slate Branch: Unit 2

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

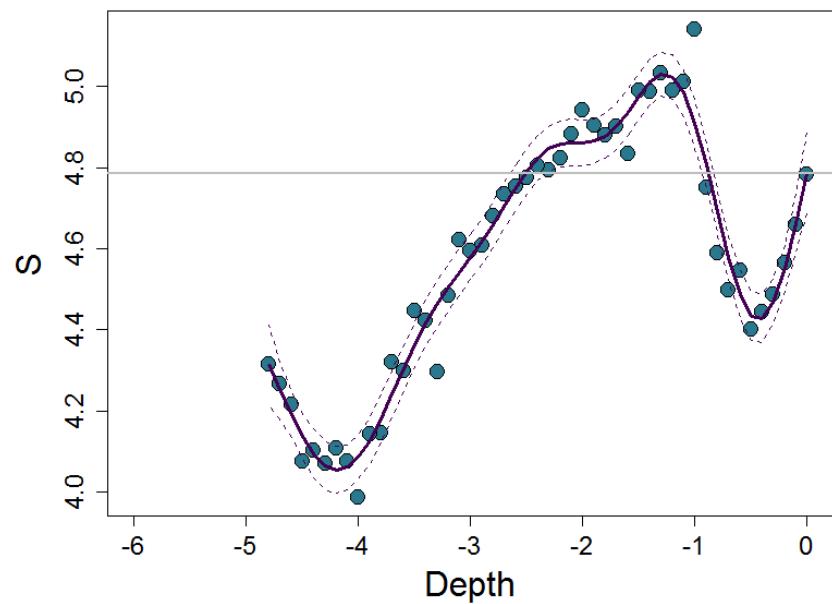


Fertilizer: Gypsum

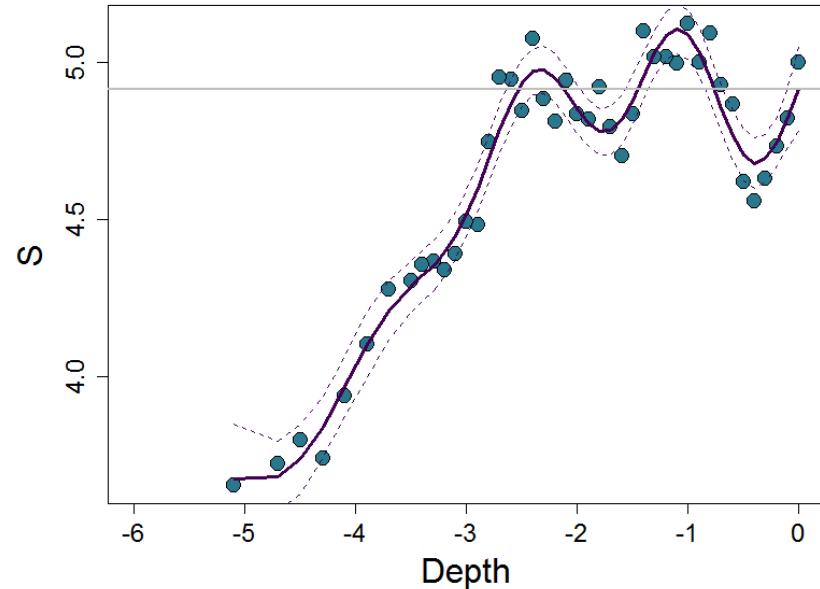
GAMs for Sulfur: identity link, Gaussian errors

Gypsum (?)

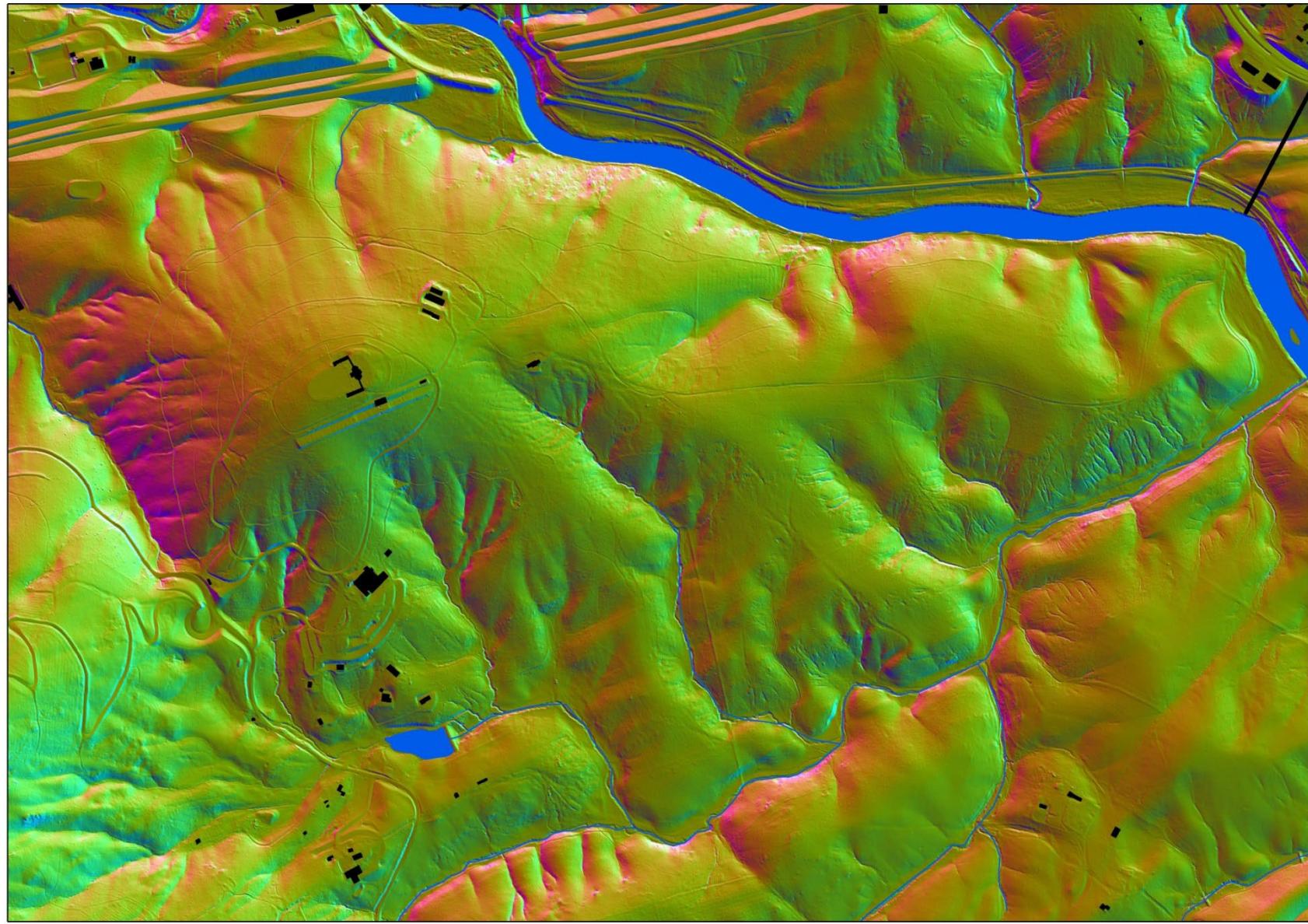
Paw Paw, Unit 1



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

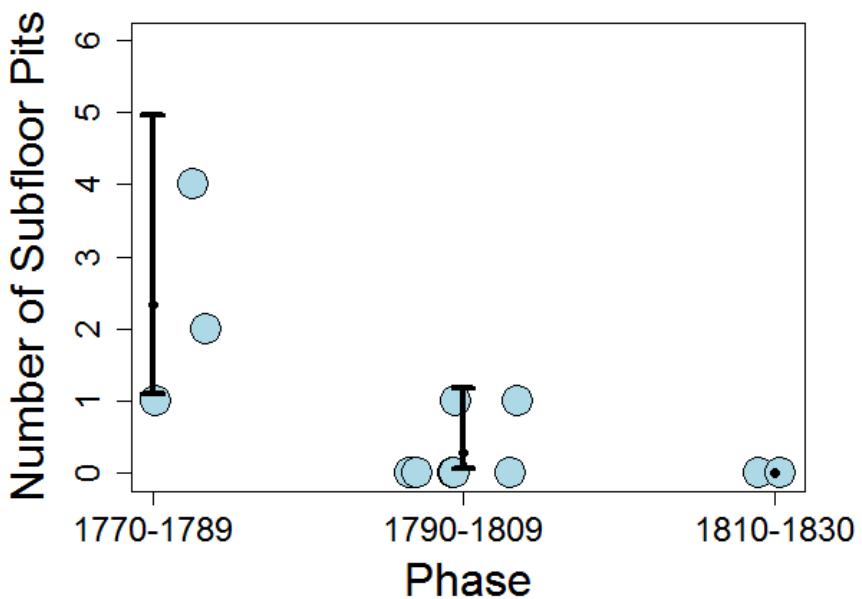
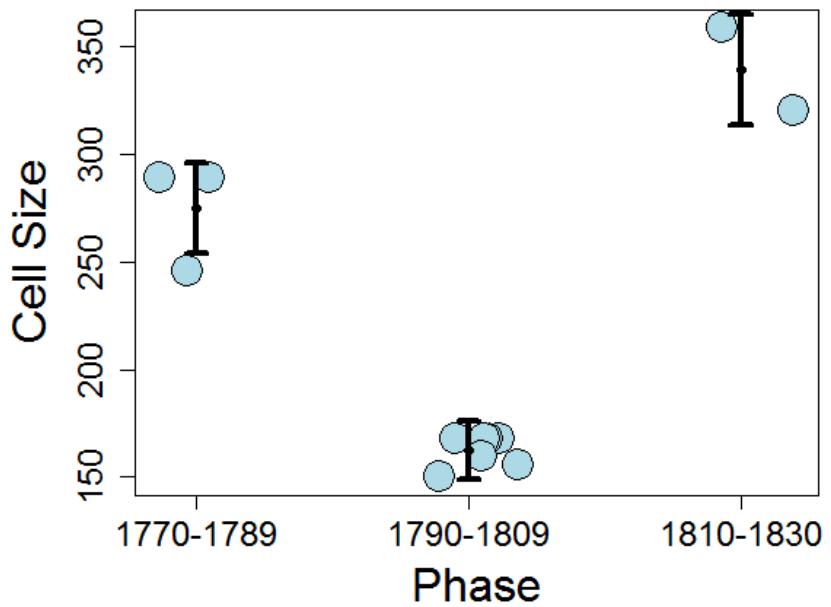
Implications

- 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.



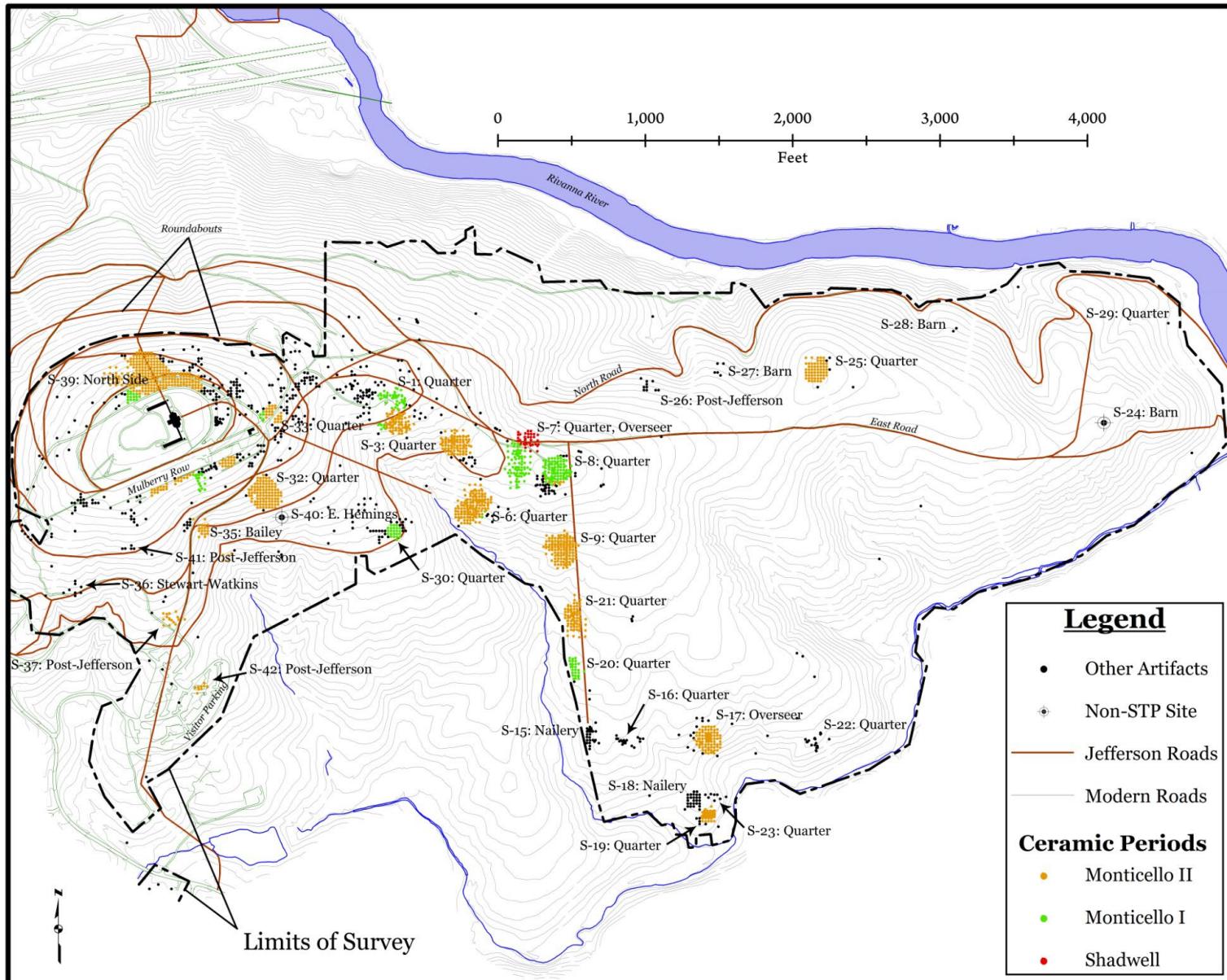
Slave Houses on Mulberry Row

Size vs. Number of Subfloor Pits

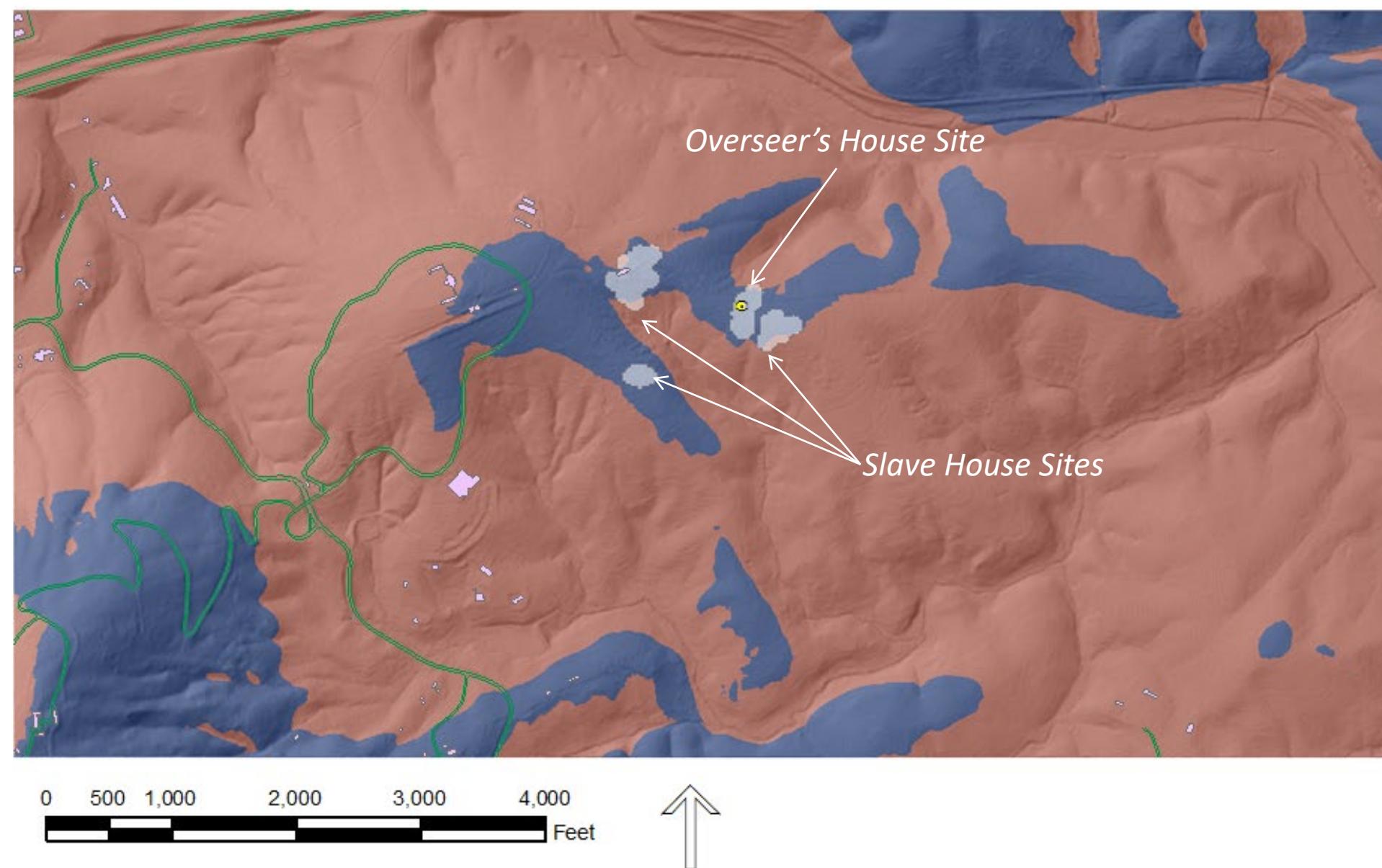


Monticello Plantation Archaeological Survey

Domestic Site Locations



Viewshed from Tobacco-Period Overseer's House



Viewshed from Wheat-Period Overseer's House

