

# *Historical Archaeological Ecology of Jefferson's Monticello Plantation*

Fraser D. Neiman, Monticello

Sara Bob-Harper, Highland

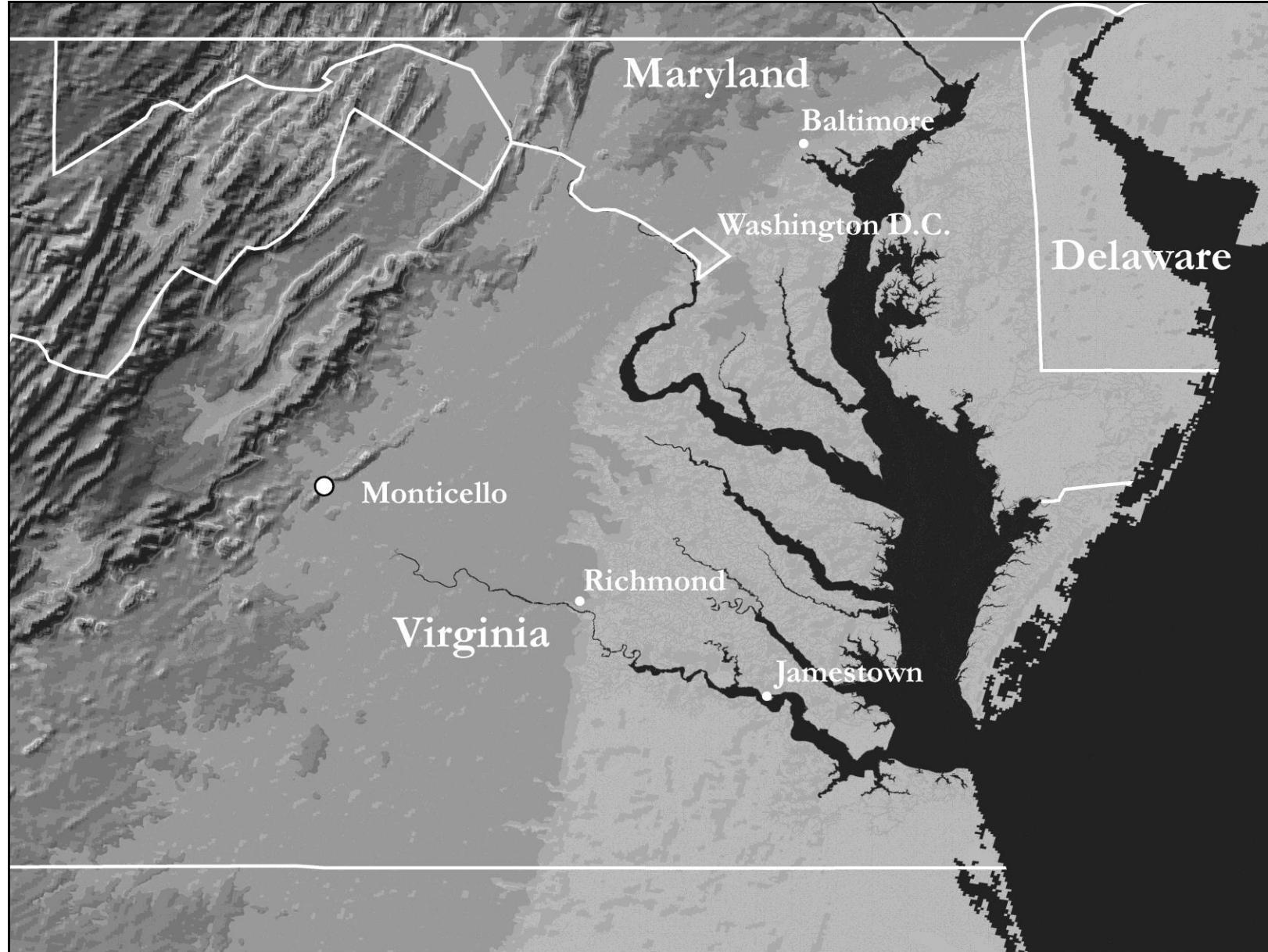
Derek Wheeler, Monticello

John G. Jones, Archaeological Consulting Services, Ltd.

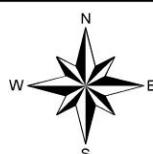
James Burton, University of Wisconsin

James Feathers, University of Washington

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

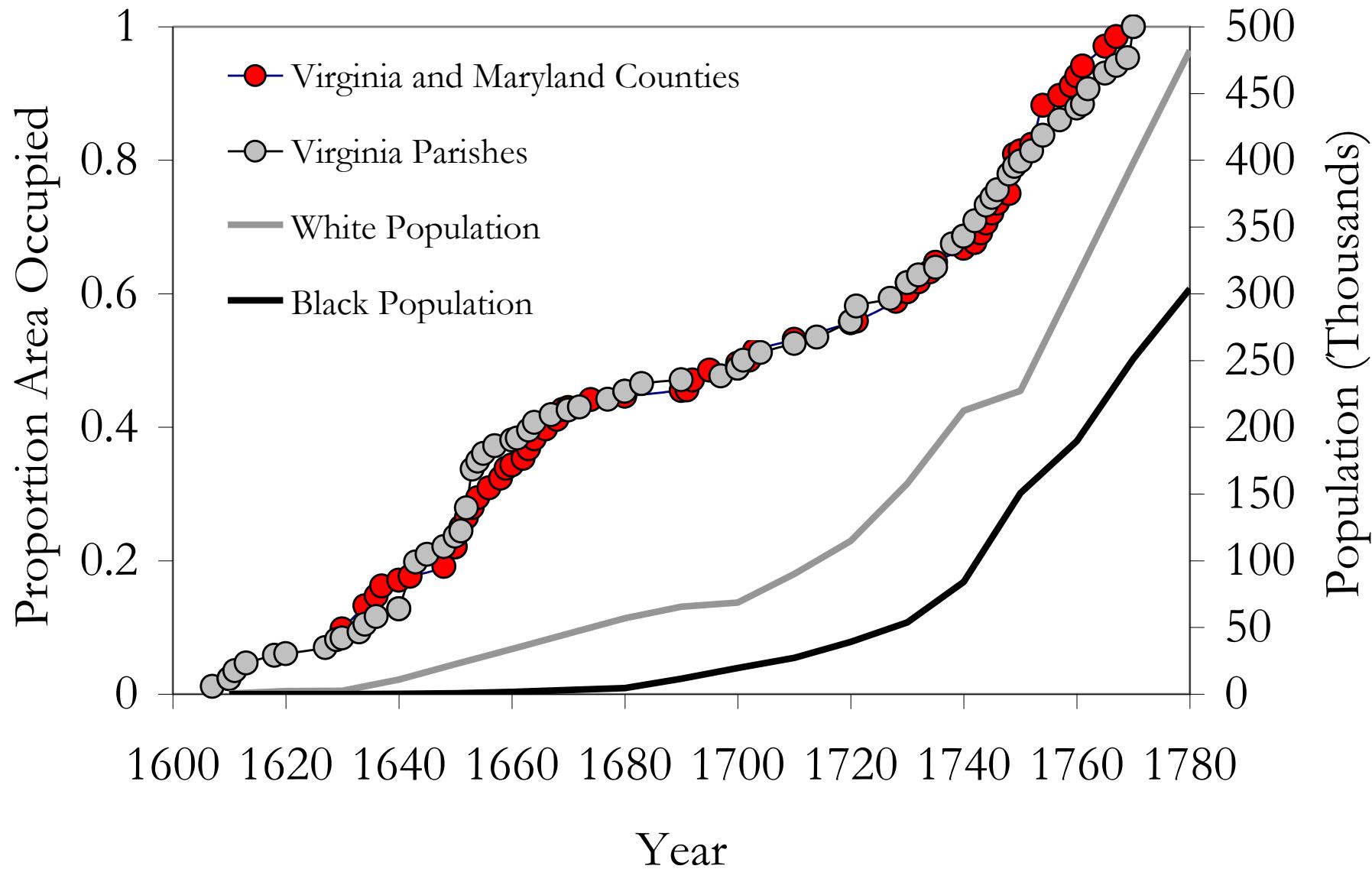


0                  50                  100 Miles



0                  100                  200 Kilometers

## Demographic Expansion



University of  
Virginia Rotunda





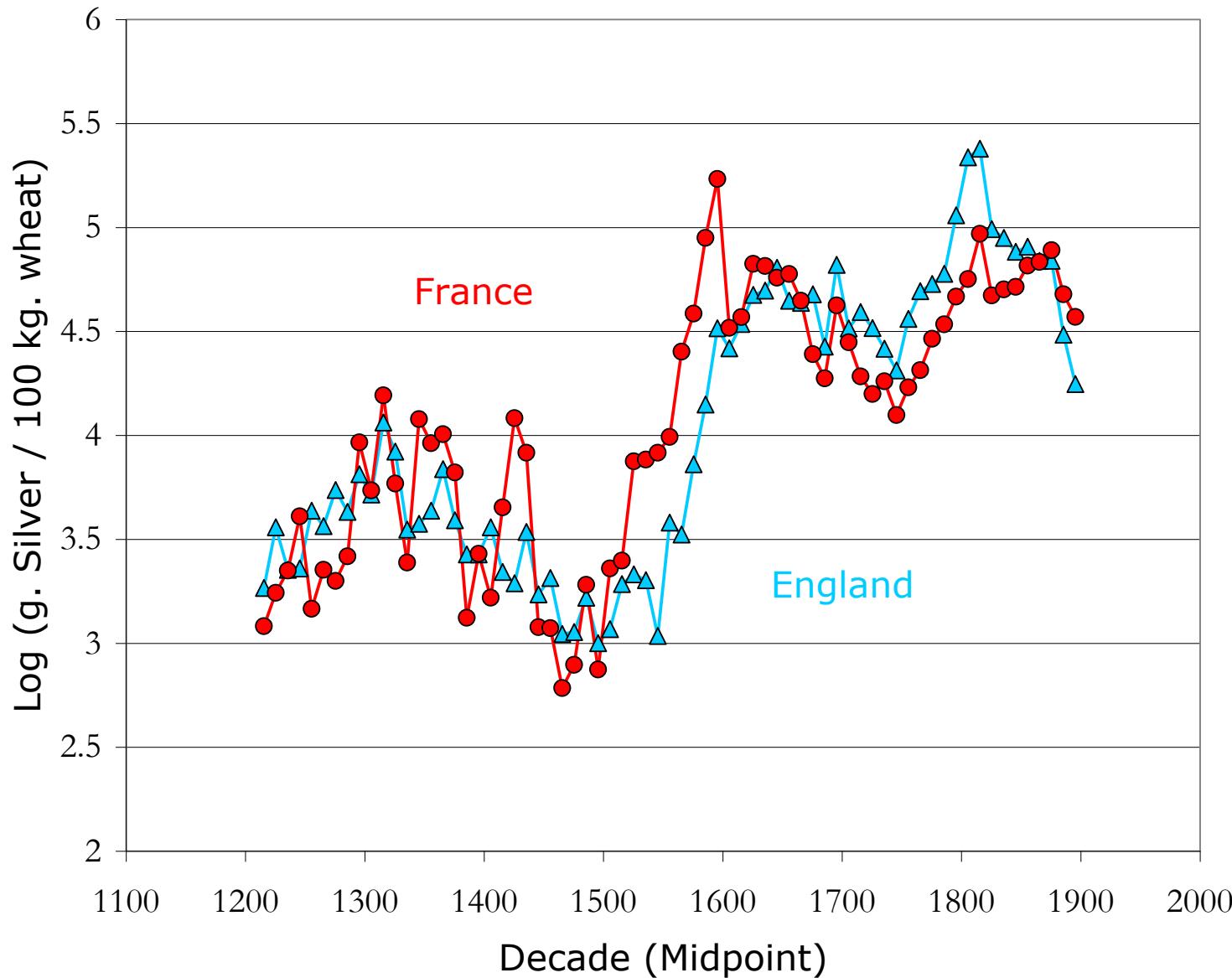
## Tobacco

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

## Wheat

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

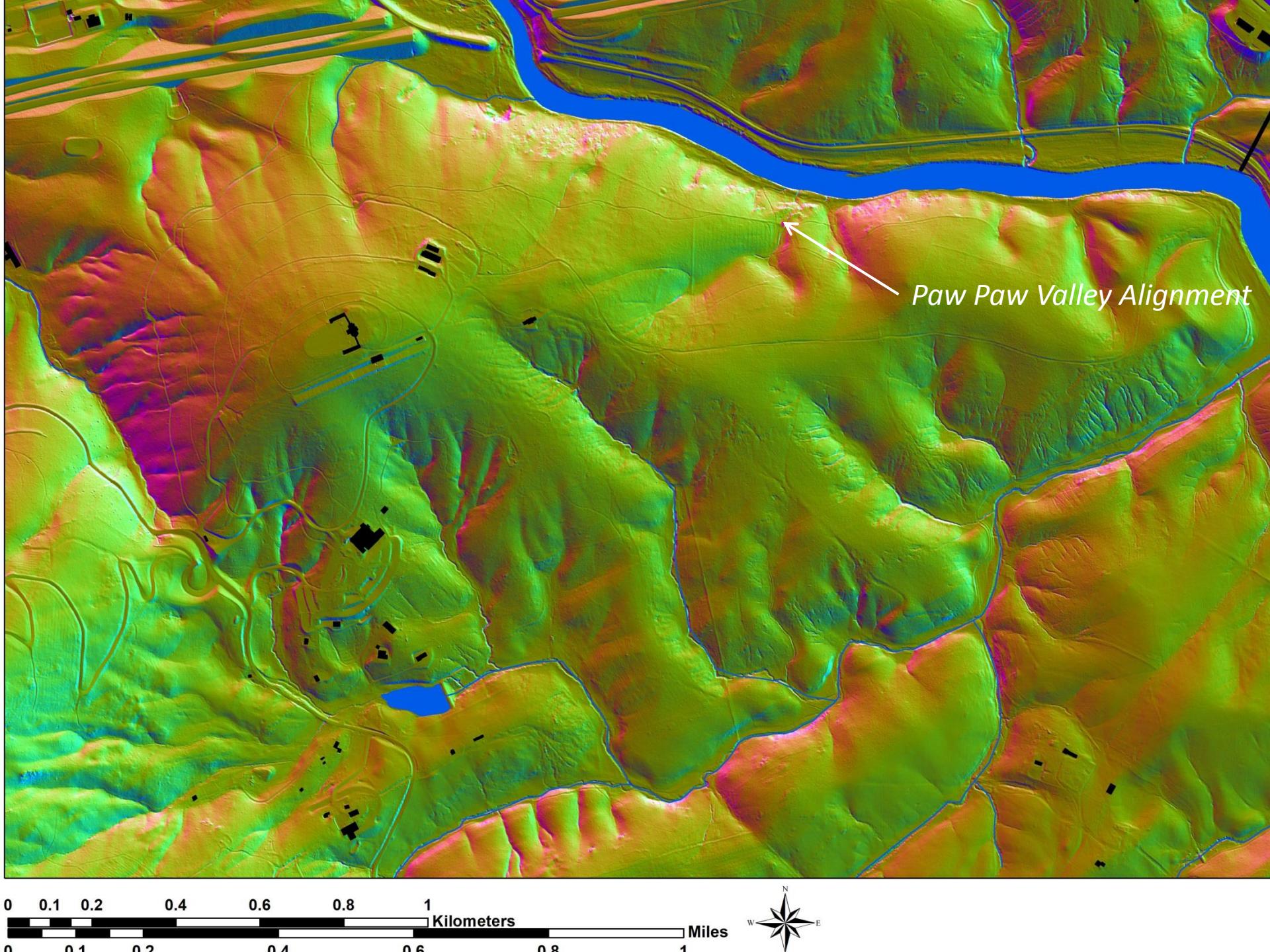
# European Wheat Prices



*"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



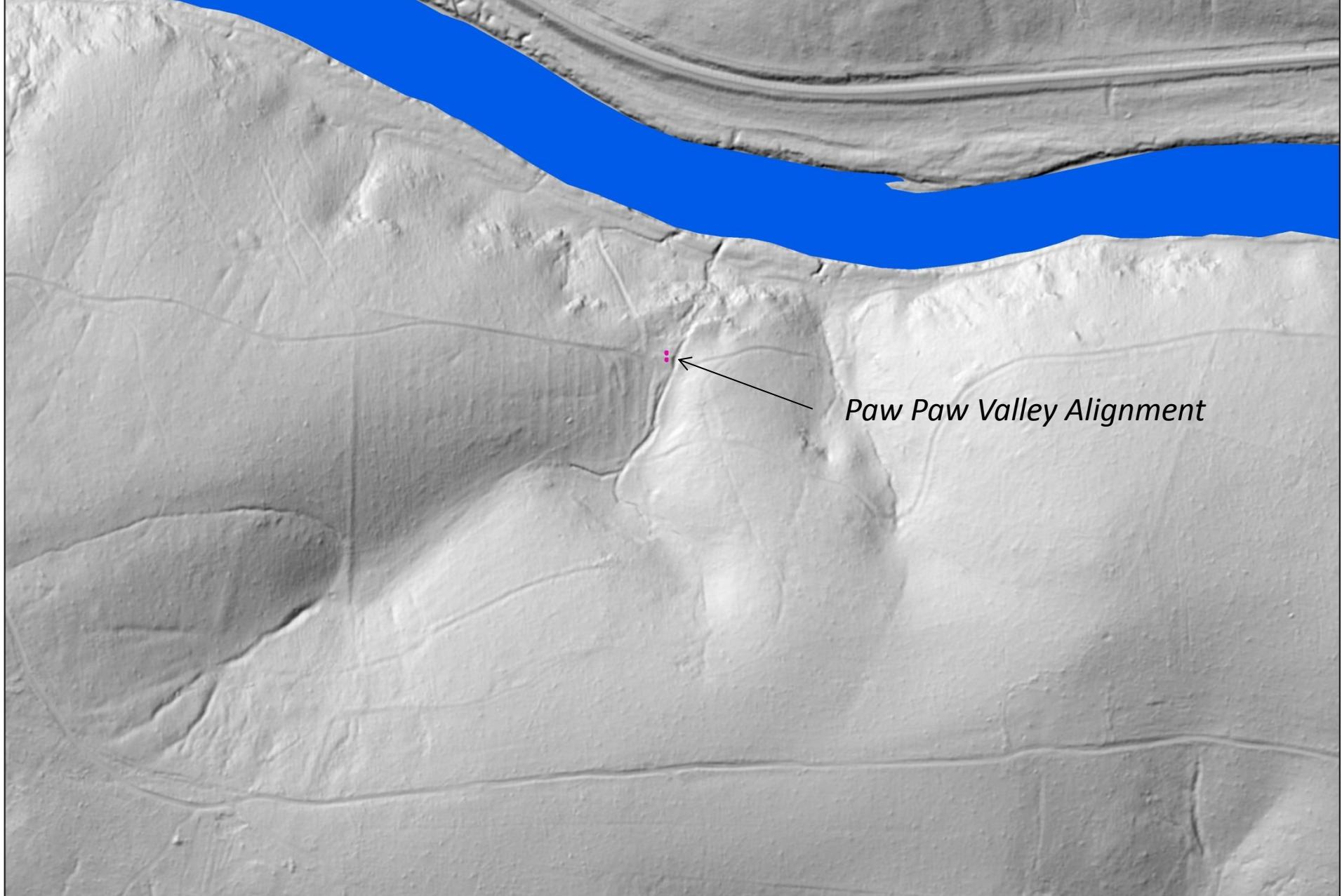


*Paw Paw Valley Alignment*

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





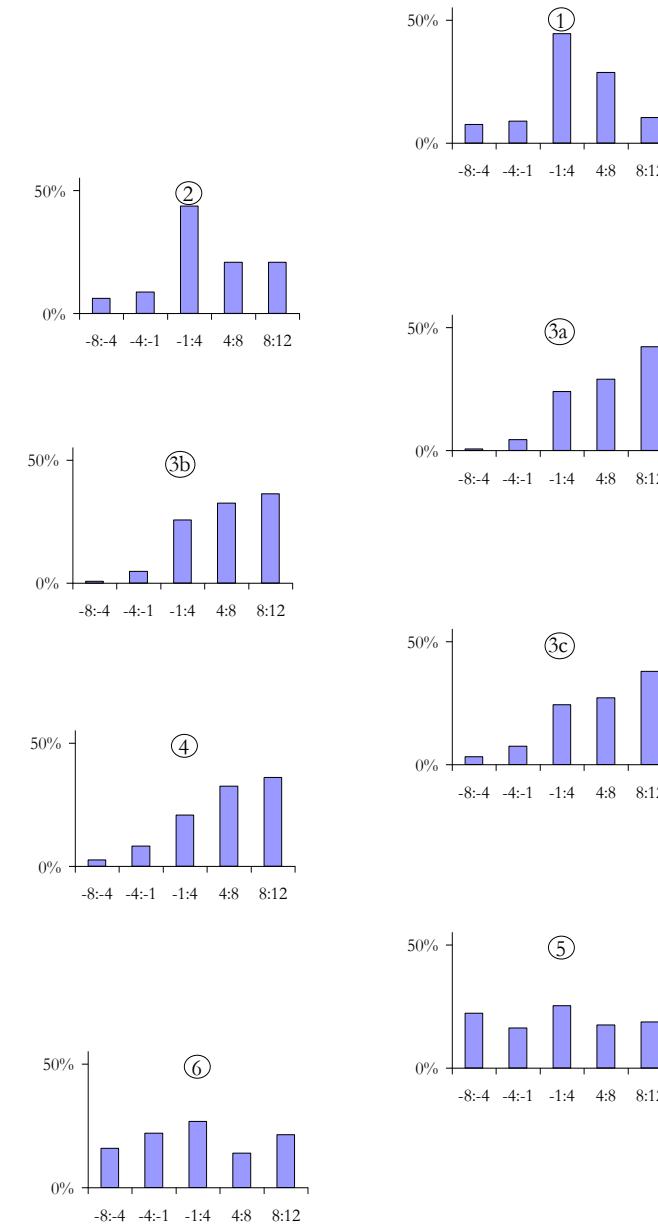
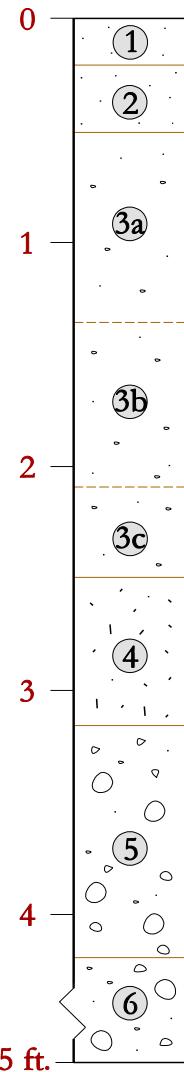




# Paw Paw Valley: Unit 1

## Lithostratigraphy and Grain Size

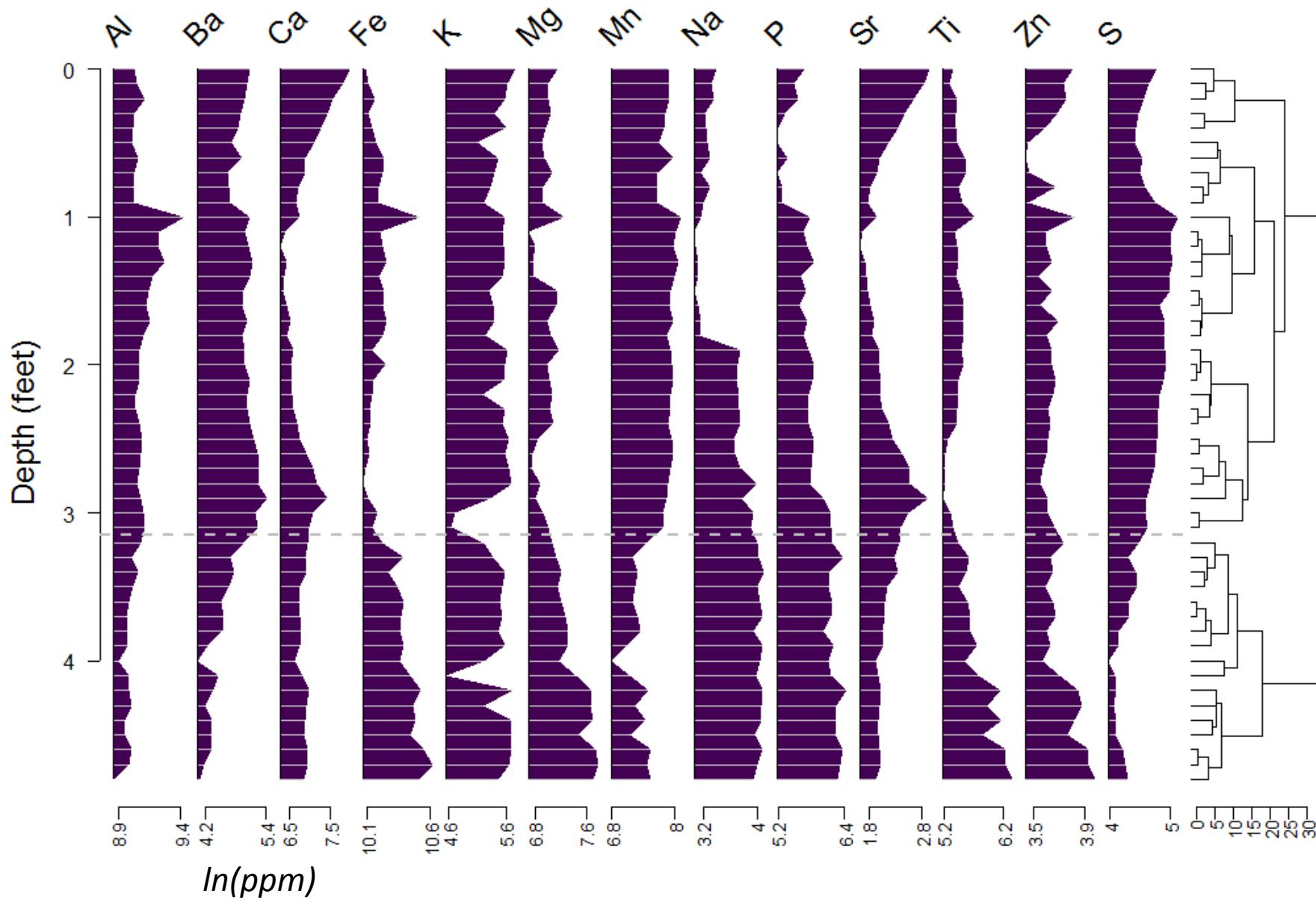
1. Reddish brown sandy loam.
  2. Red sandy clay loam.
  - 3a. Red clay with < 5% weathered greenstone pebbles.
  - 3b. Red clay loam with < 5% weathered greenstone pebbles.
  - 3c. Red clay with < 5% weathered greenstone pebbles.
  4. Reddish brown clay with < 5% pebble-sized charcoal flecks.
  5. Yellowish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



Cobbles-Pebbles-Sand-Silt-Clay  
Phi

# Paw Paw Valley: Unit 1

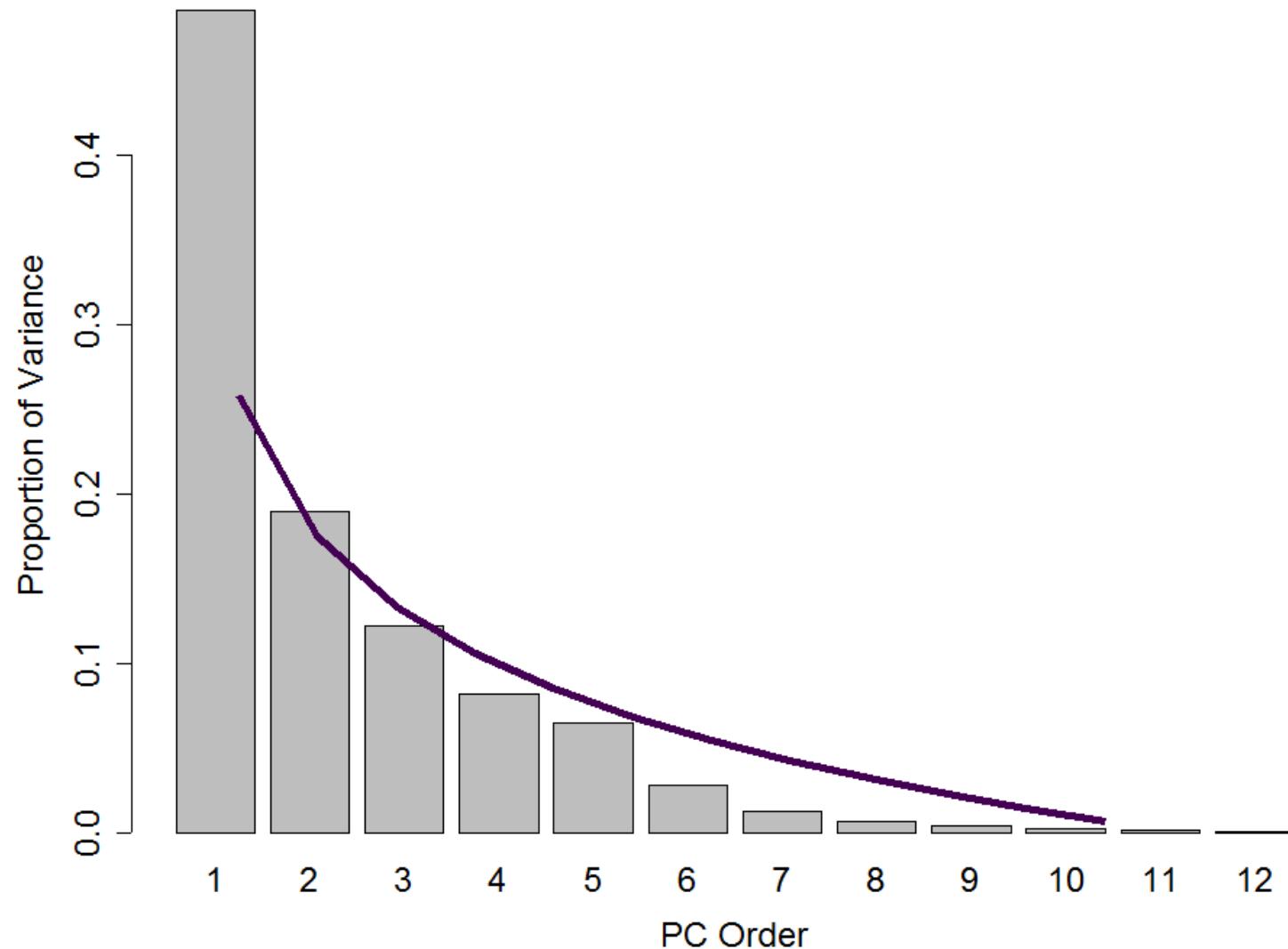
## Sediment Chemistry



# Paw Paw Valley: Unit 1

## Sediment Chemistry

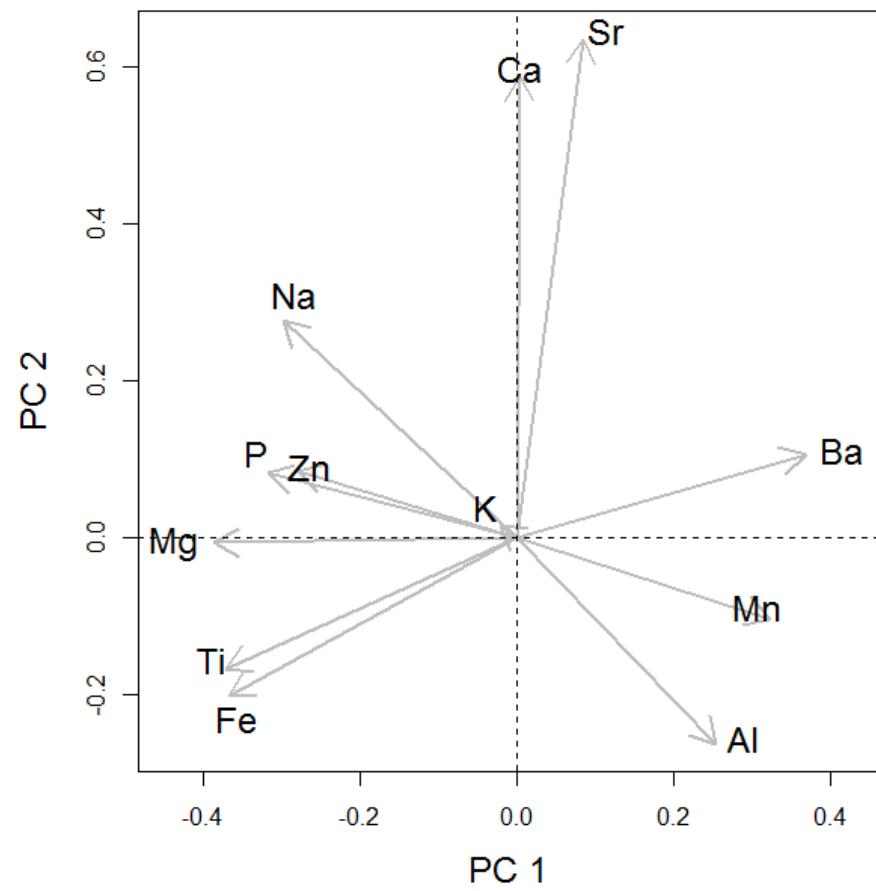
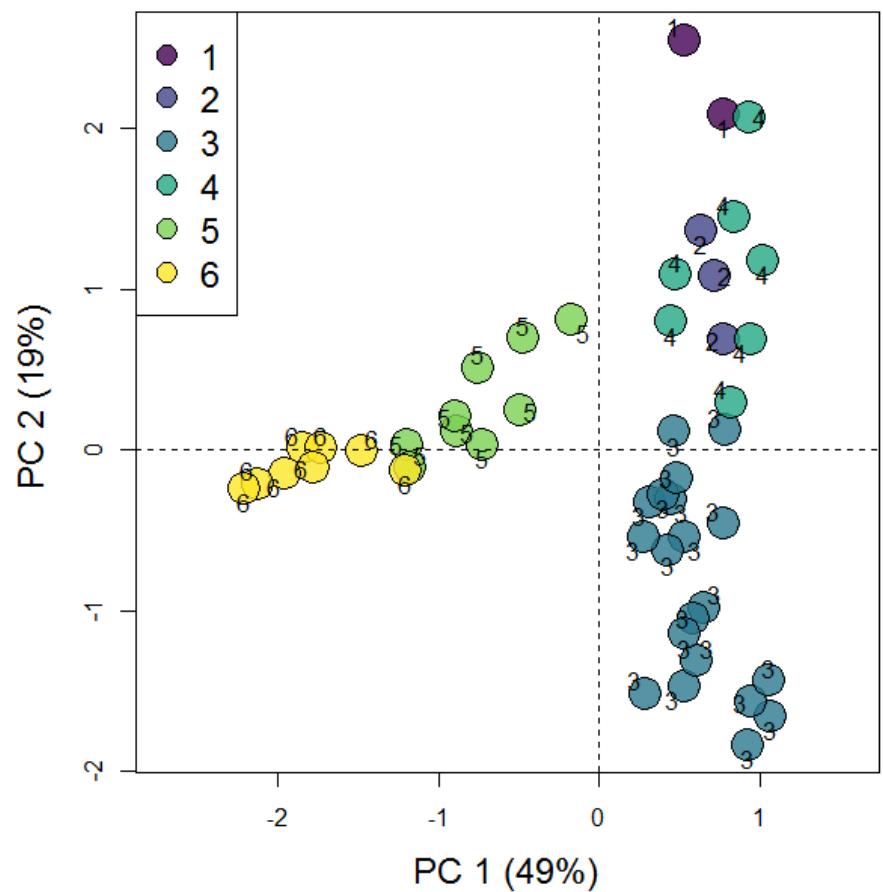
### PCA



# Paw Paw Valley: Unit 1

## Sediment Chemistry

### PCA



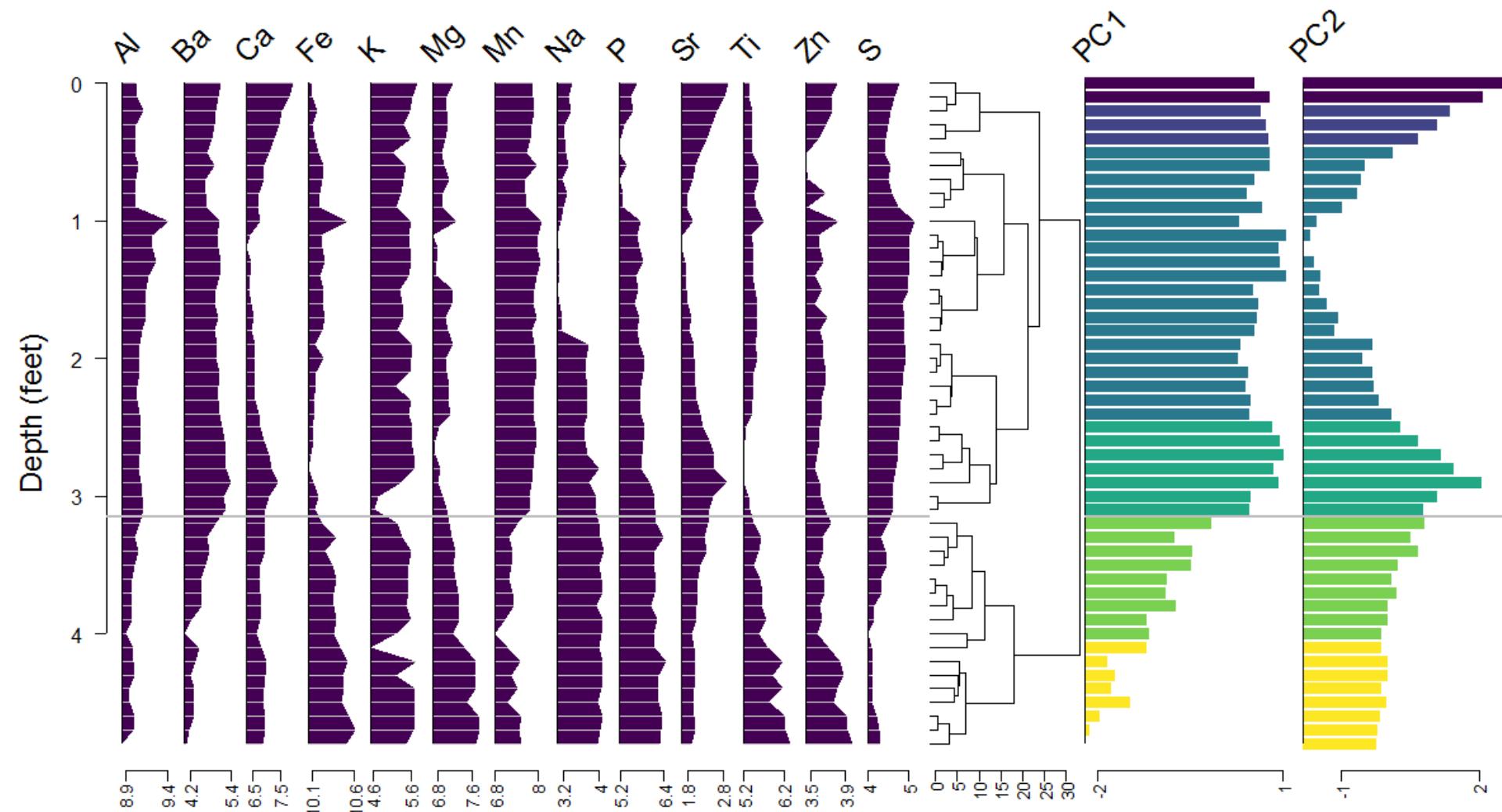
# Paw Paw Valley: Unit 1

## Sediment Chemistry

### PCA

*weathering*

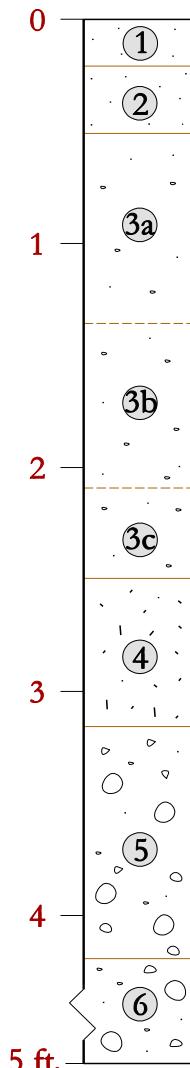
*O-horizon  
inputs*



# Paw Paw Valley: Unit 1

## Lithostratigraphy and Grain Size

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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



**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.**

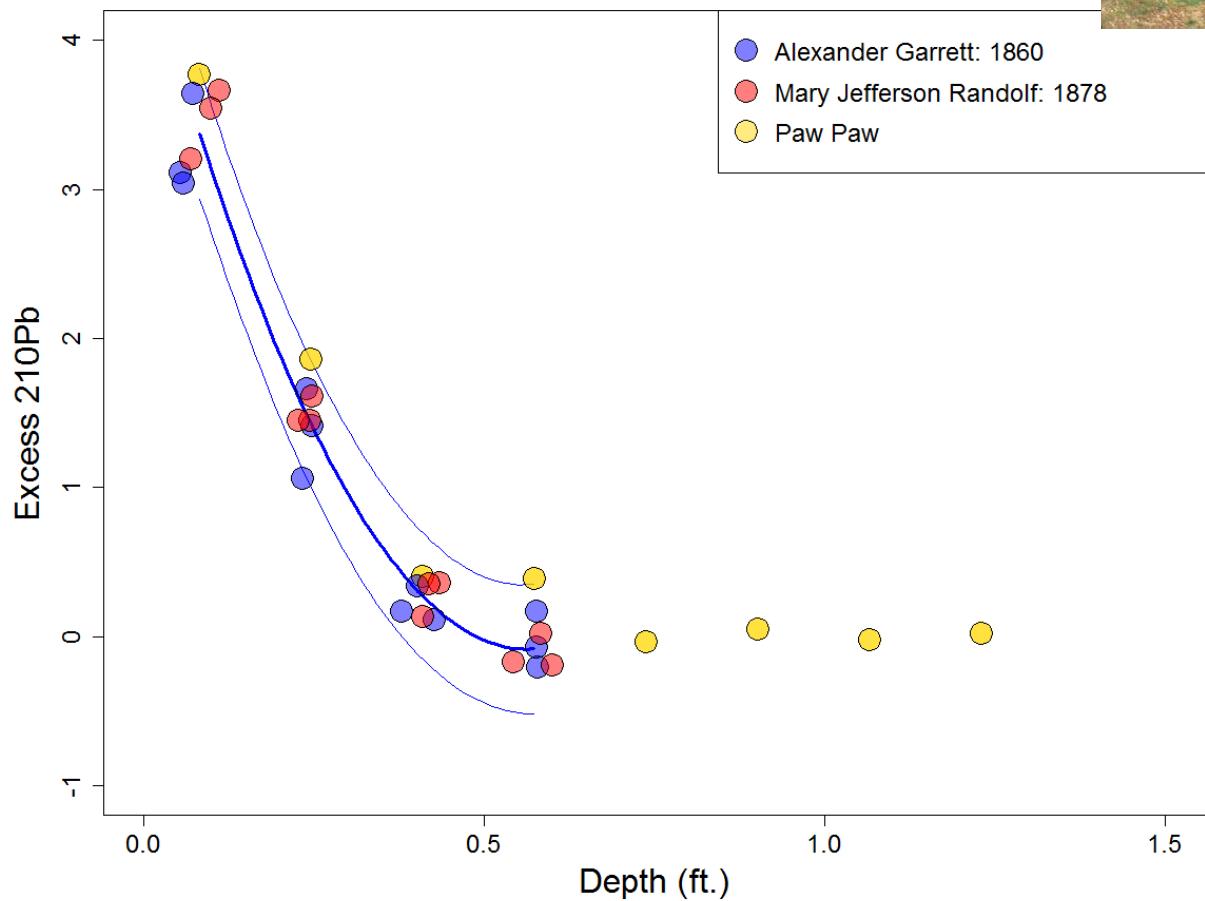
**4.**

**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

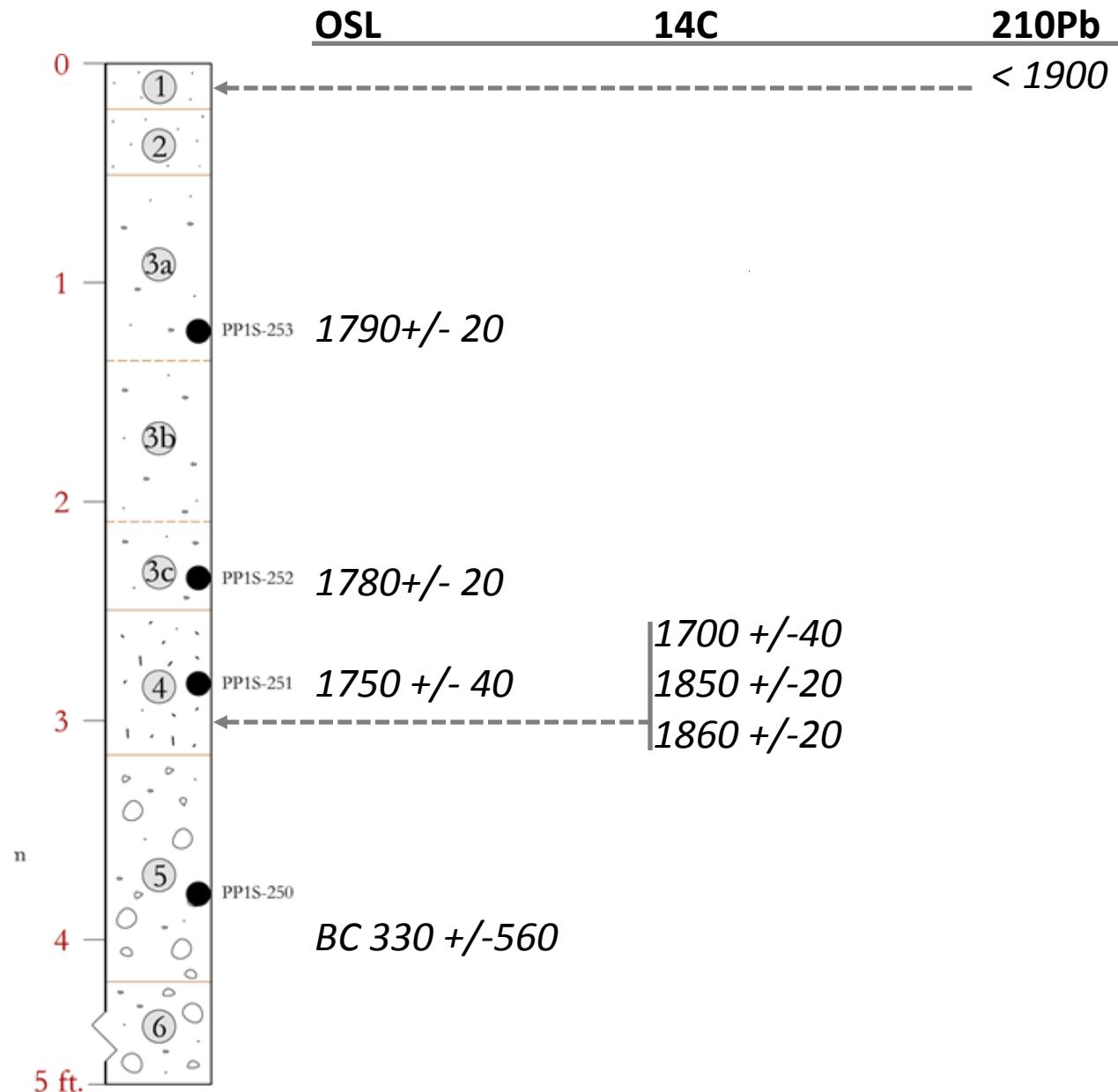
Dating:  $^{210}\text{Pb}$



# Paw Paw Valley: Unit 1

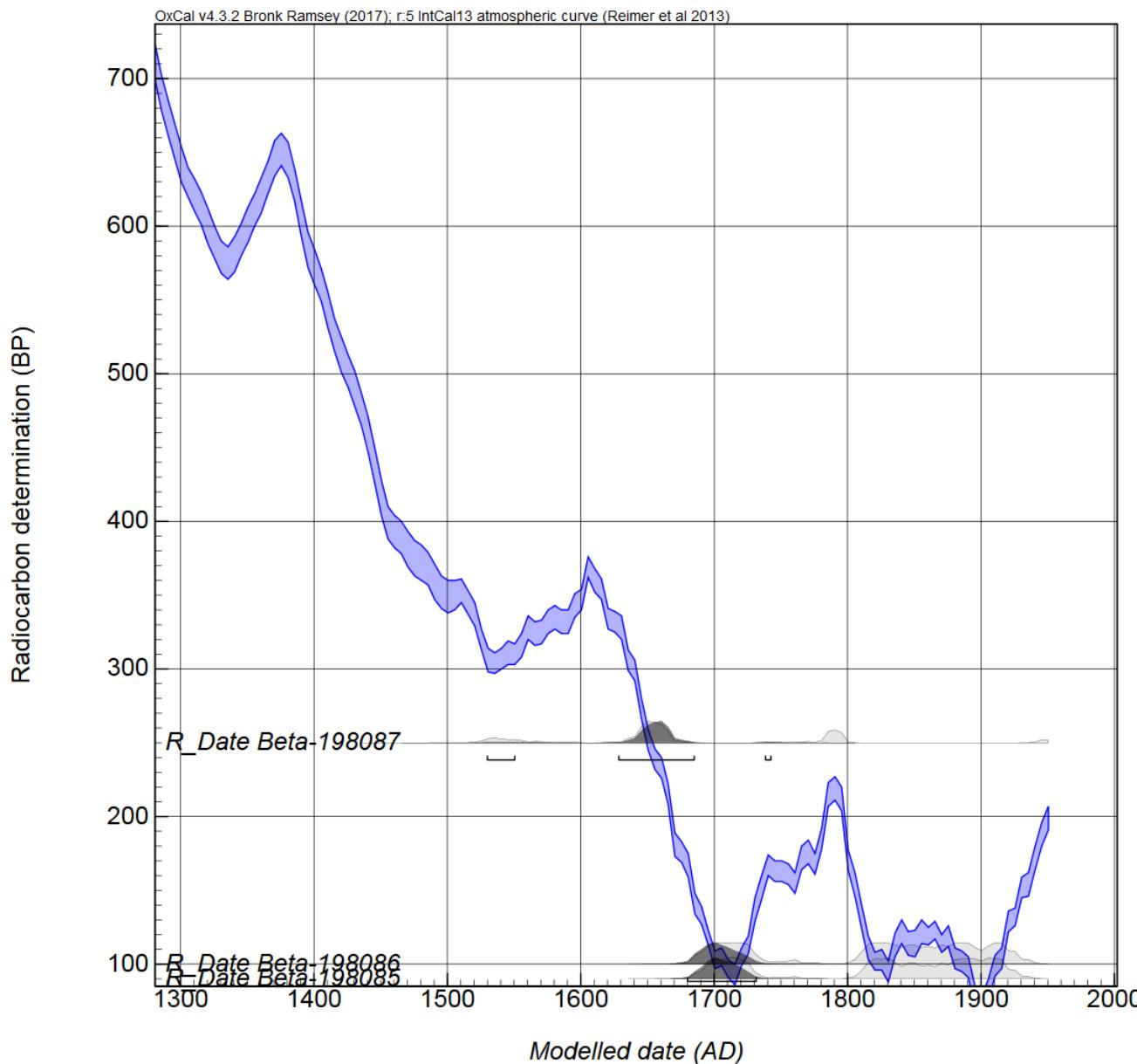
## Dating: OSL, 14C

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# Paw Paw Valley: Unit 1

## 14C Date Calibration



# 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***”.

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

# Paw Paw Valley: Unit 1

## Posterior Estimates from the Bayesian Chronological Model

**Mean      (95% credible interval)**

*OSL: BC 298 (BC 1422 – AD 826)*

1528      (1347 – 1709)

14C: 1636      (1530 – 1742)

14C: 1706      (1680 – 1731)

14C: 1706      (1681 – 1730)

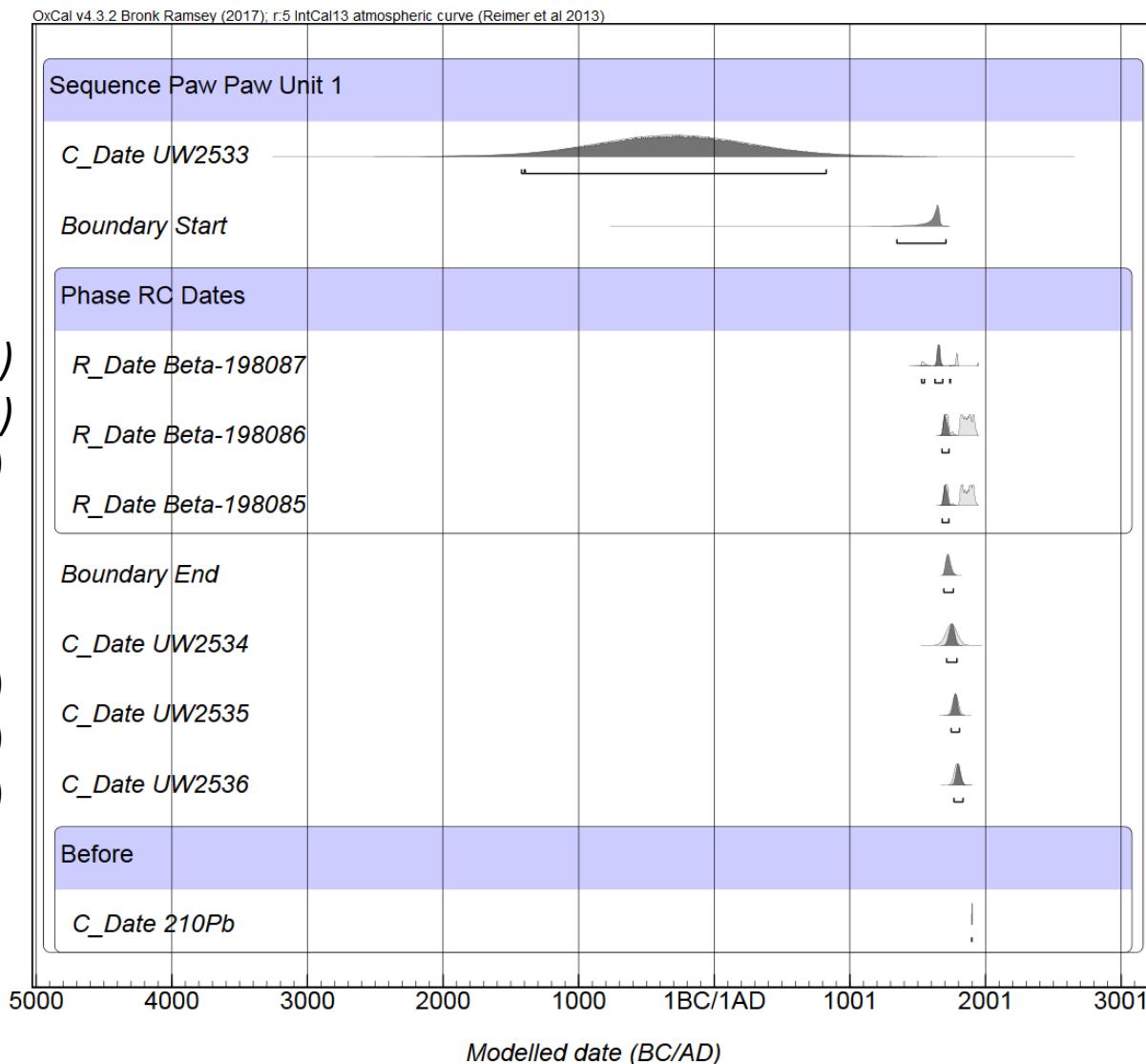
1728      (1693 – 1764)

*OSL: 1752      (1714 – 1790)*

*OSL: 1778      (1747 – 1809)*

*OSL: 1801      (1768 – 1834)*

*210Pb: < 1900*



# Paw Paw Valley: Unit 1

## Posterior Estimates from the Bayesian Chronological Model

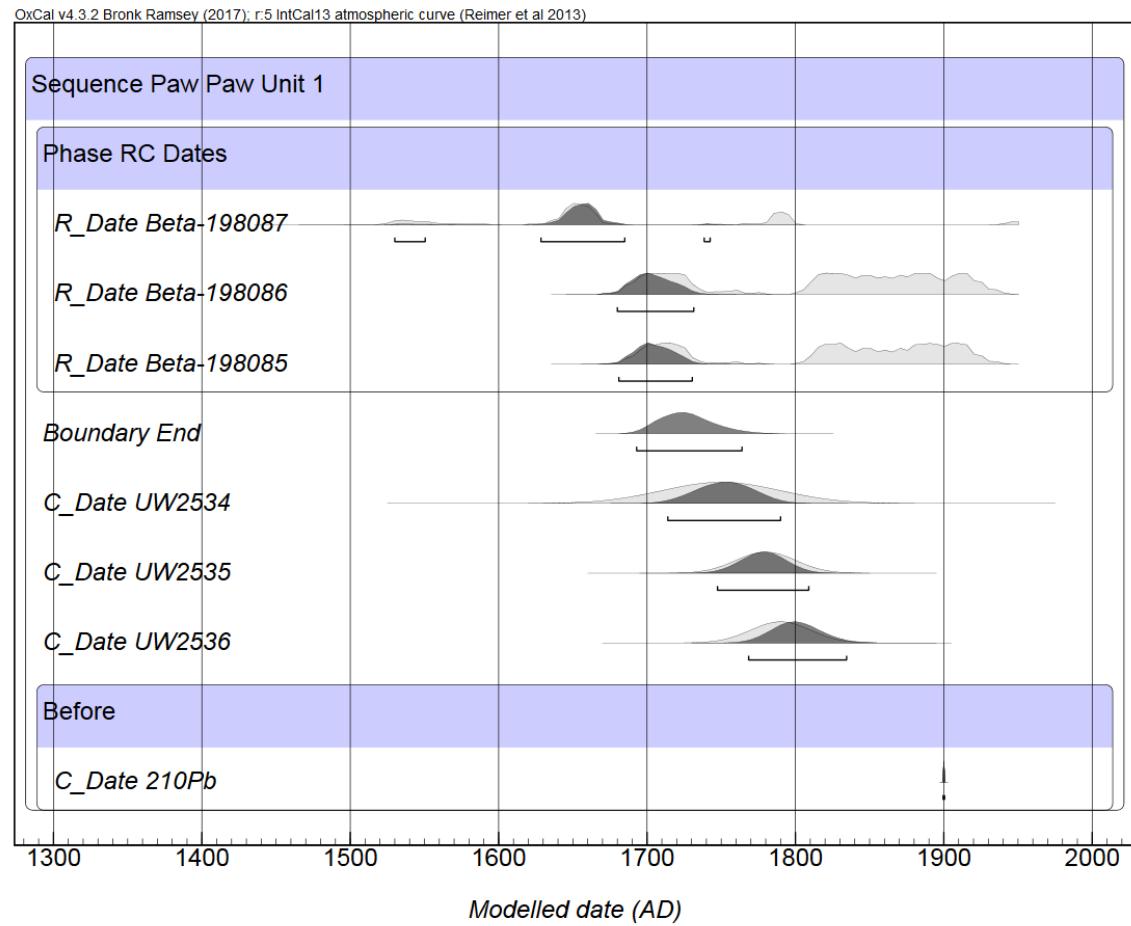
Mean      **(95% credible interval)**

*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)**

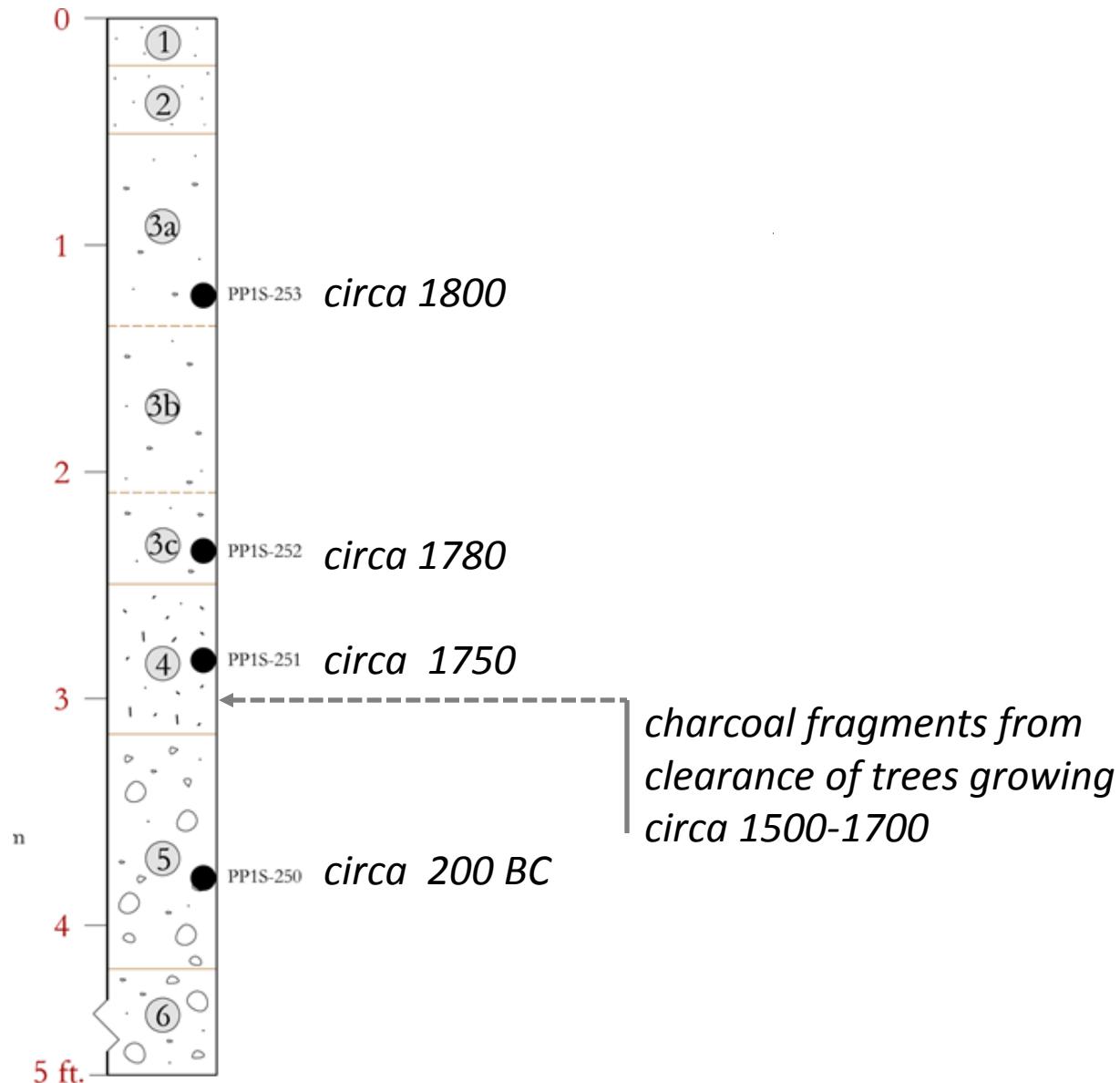
*210Pb: < 1900*



# Paw Paw Valley: Unit 1

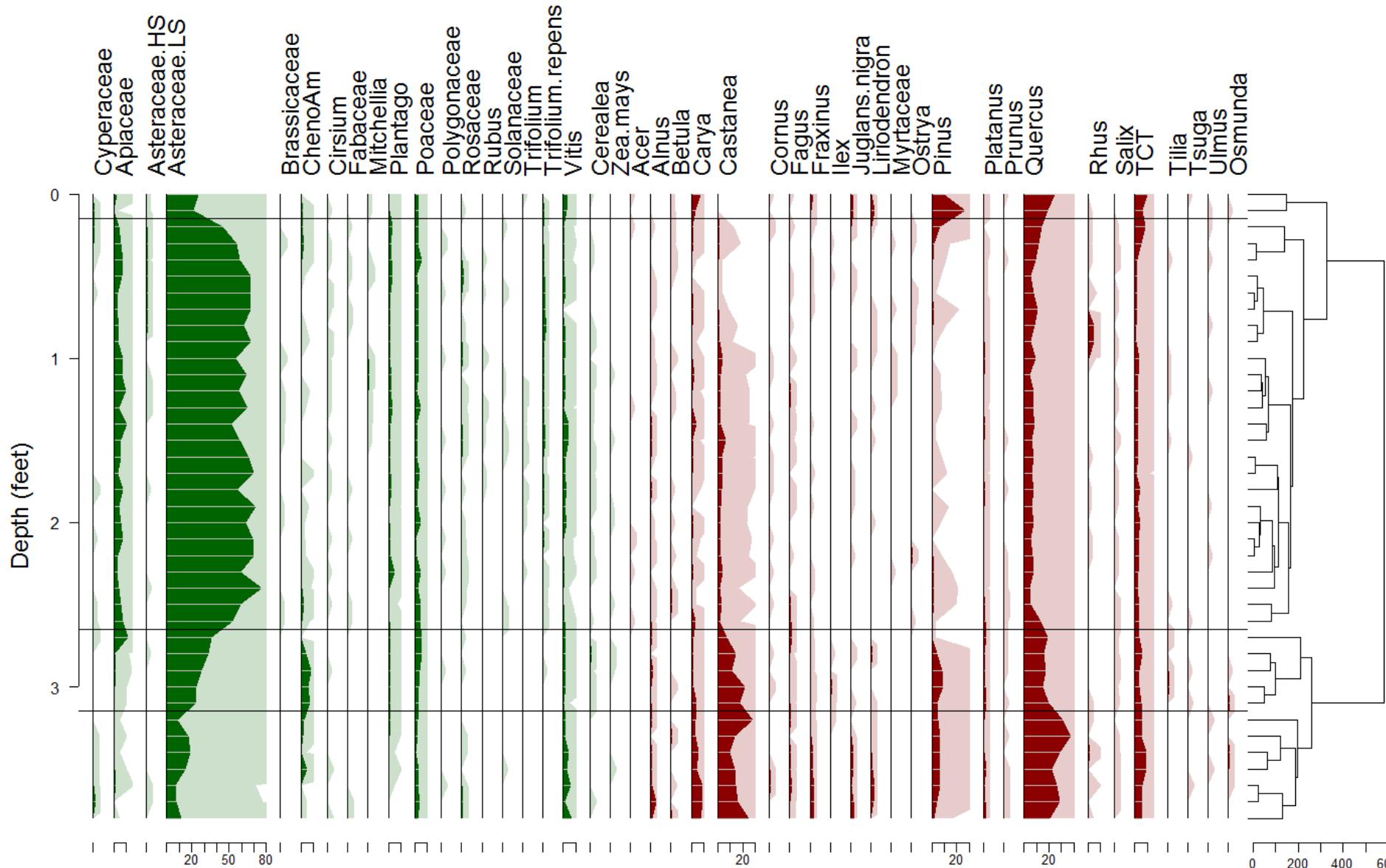
## Proposed Chronology

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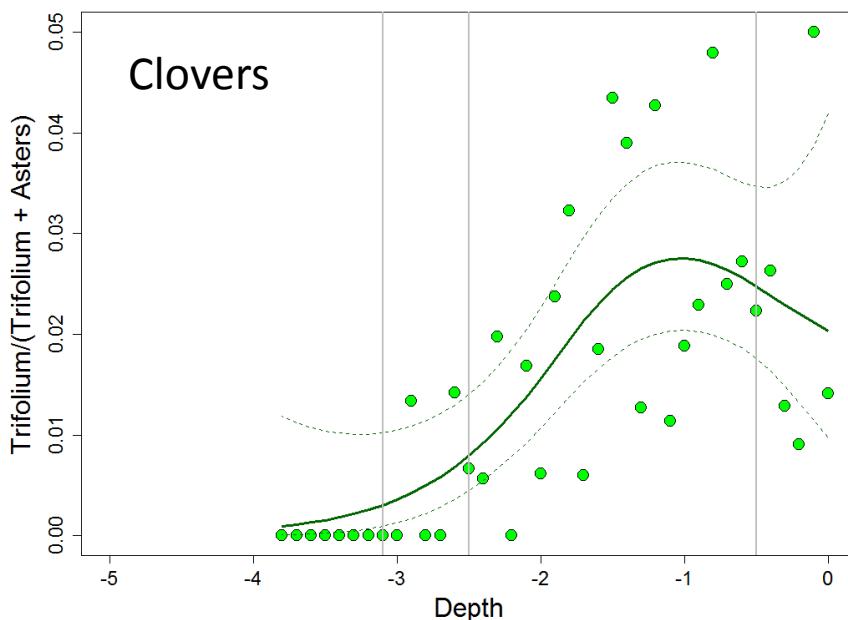
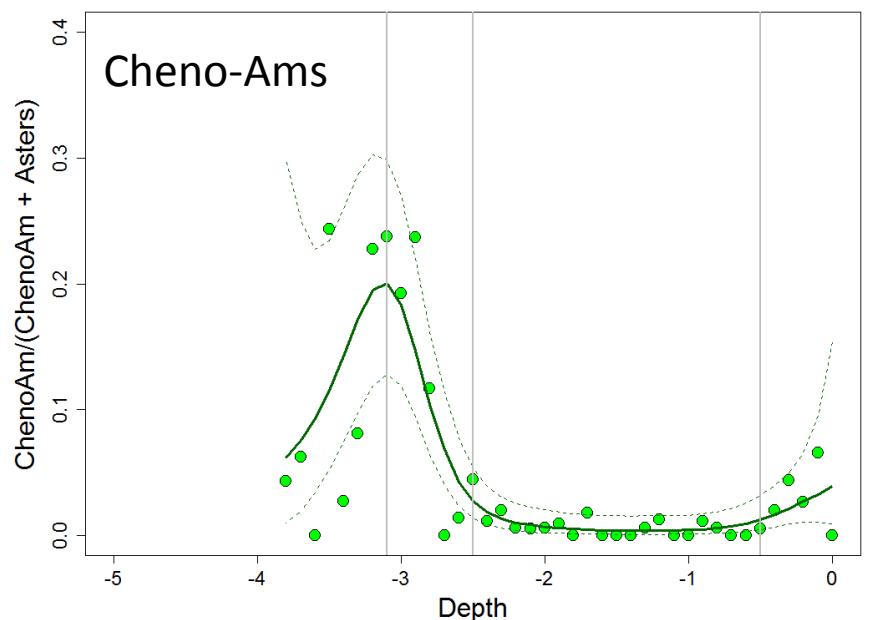
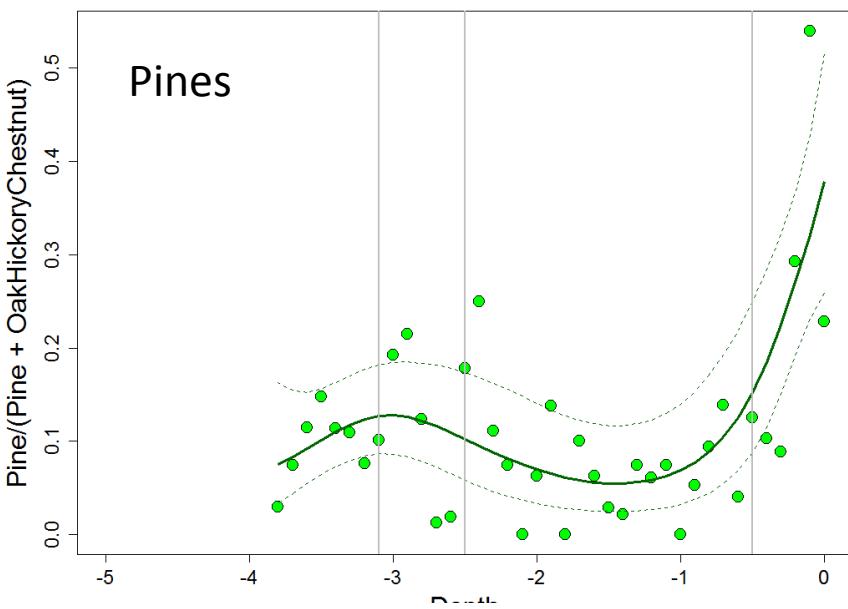
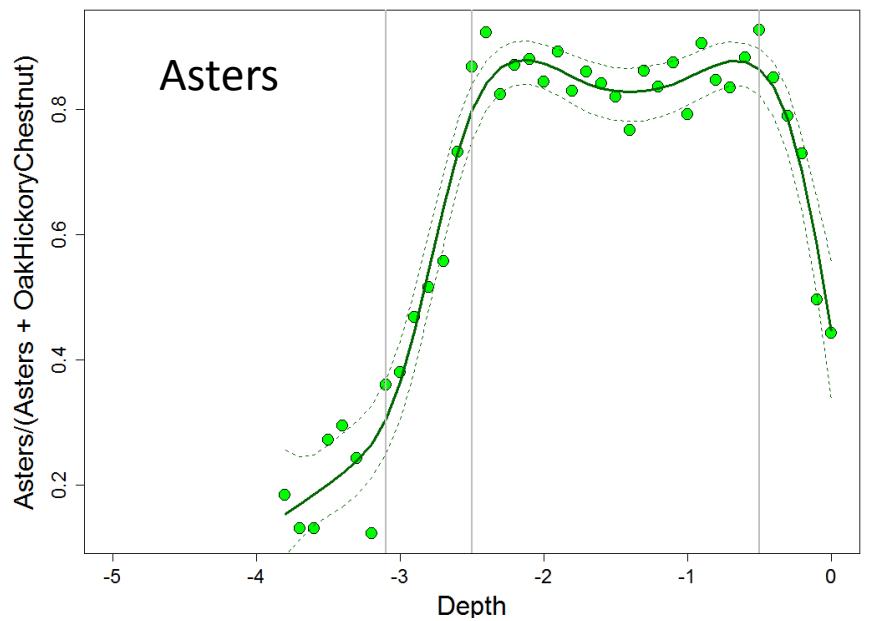
# Paw Paw Valley: Unit 1

# Pollen



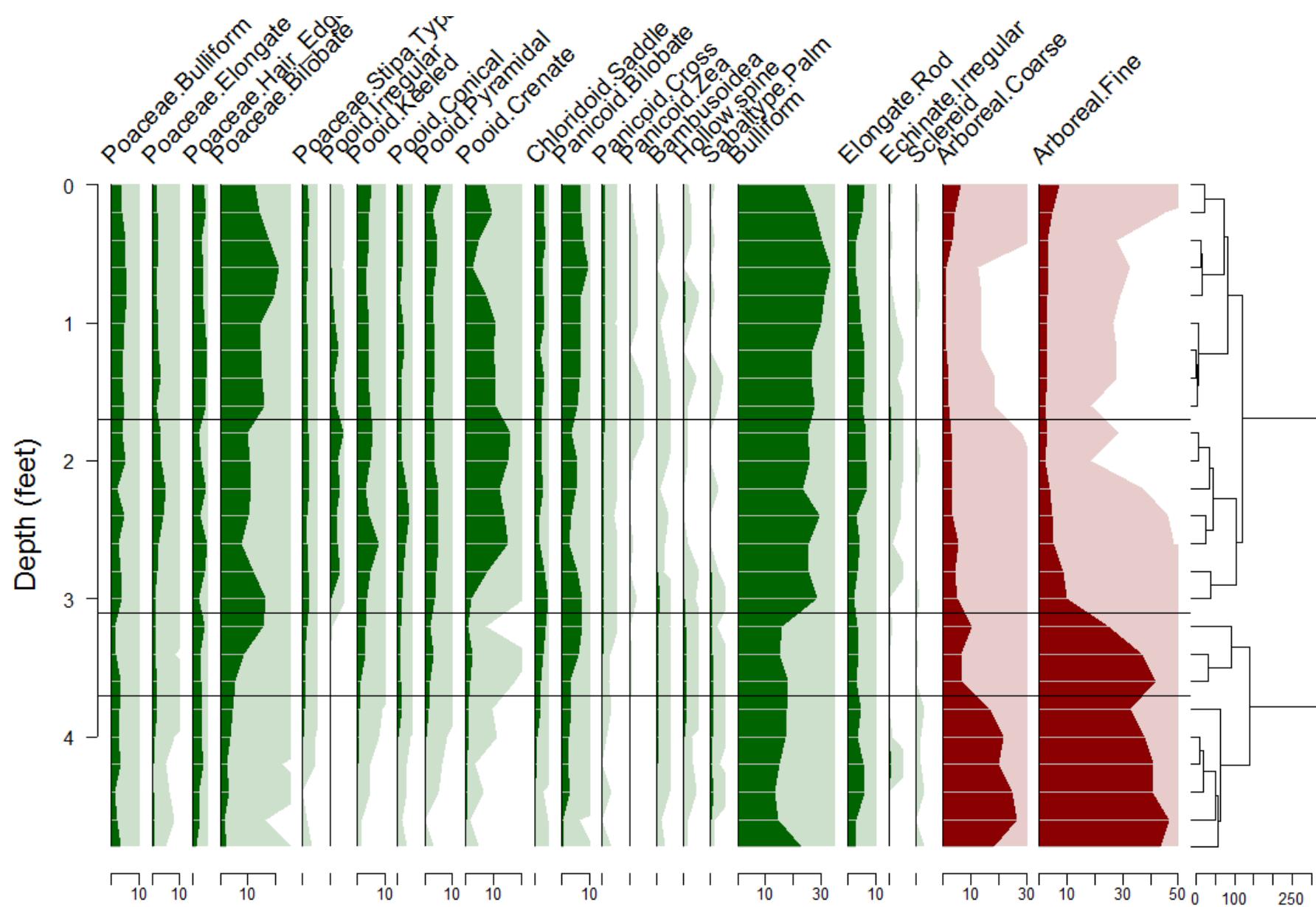
# Paw Paw Valley: Unit 1

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



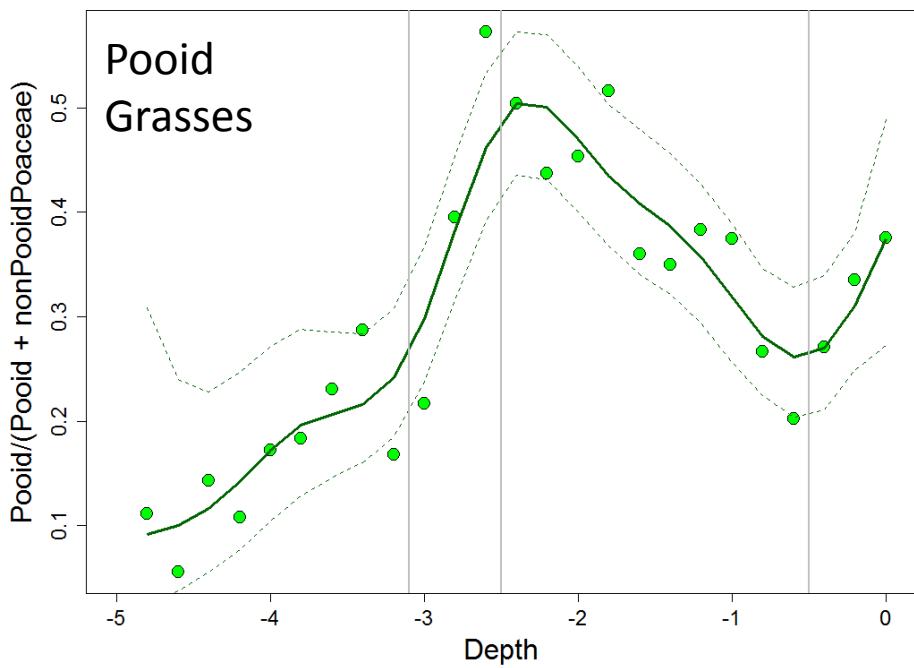
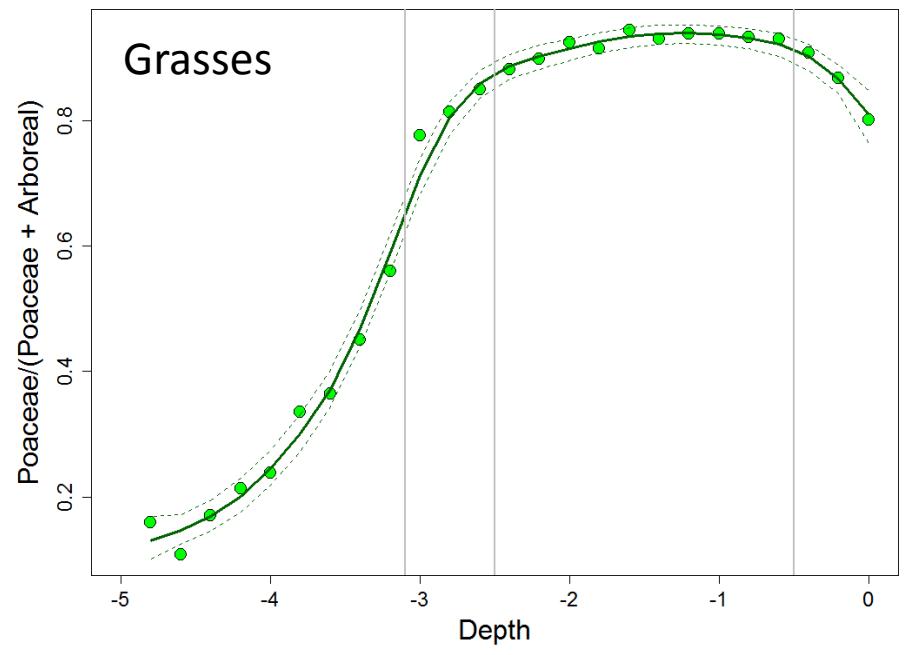
# Paw Paw Valley: Unit 1

## Phytoliths



# Paw Paw Valley: Unit 1

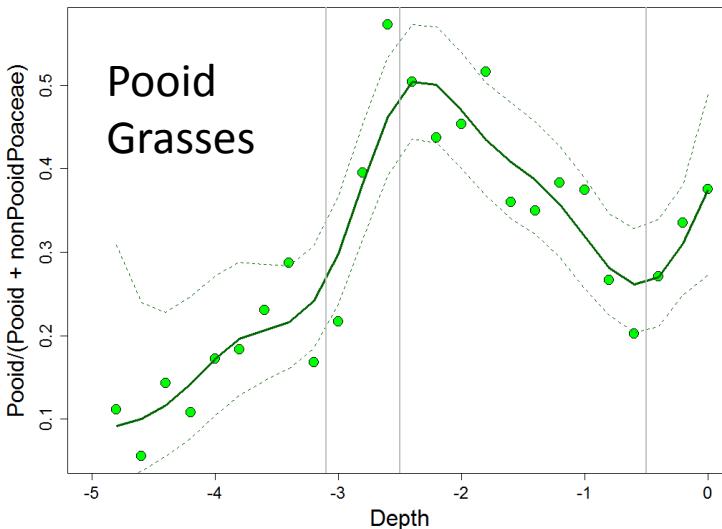
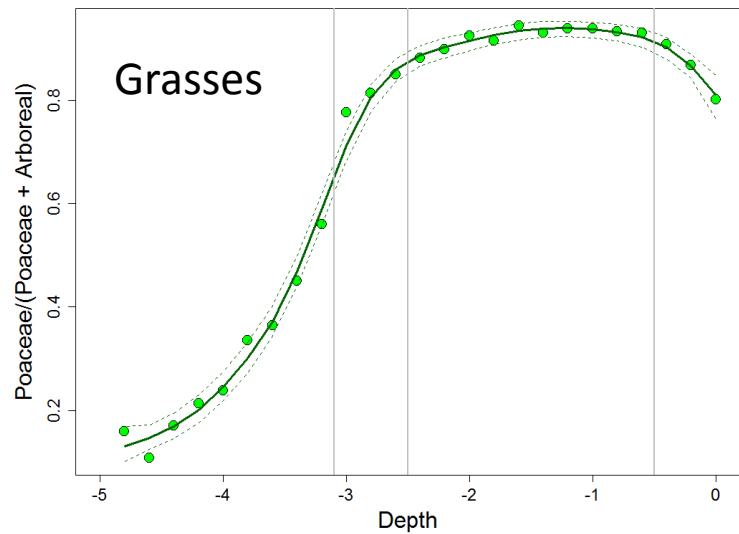
## GAMs for Select Phytolith Taxa: Logistic link, quasi-binomial errors



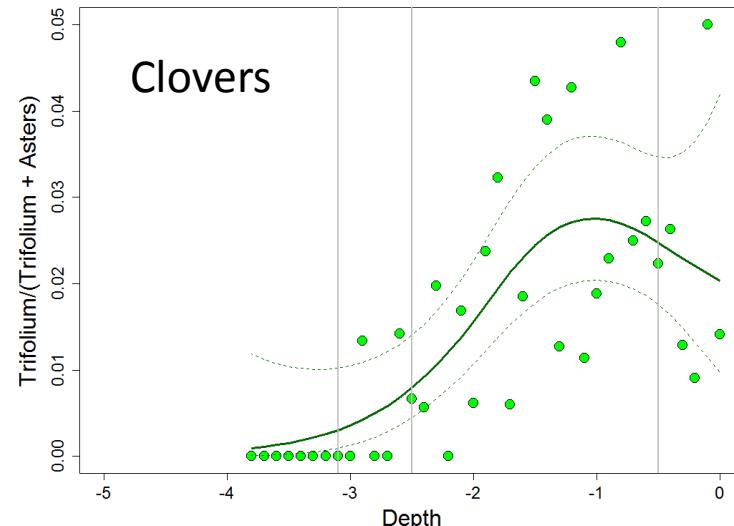
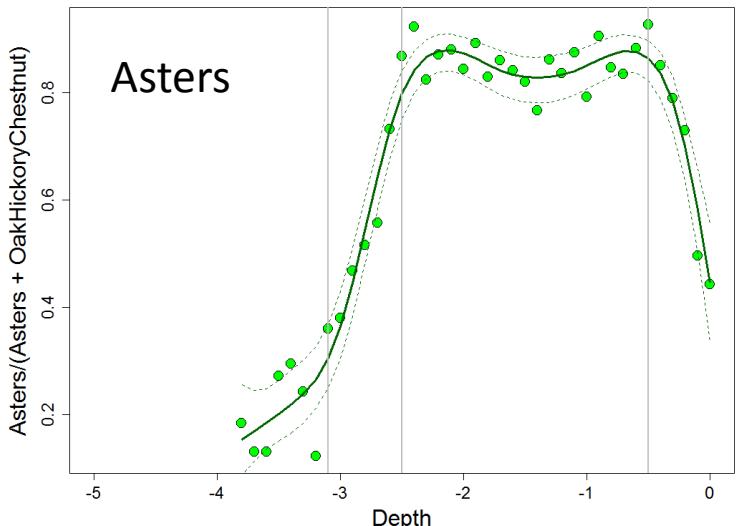
# Paw Paw Valley: Unit 1

## GAMs for Phytolith versus Pollen Taxa

### Phytoliths

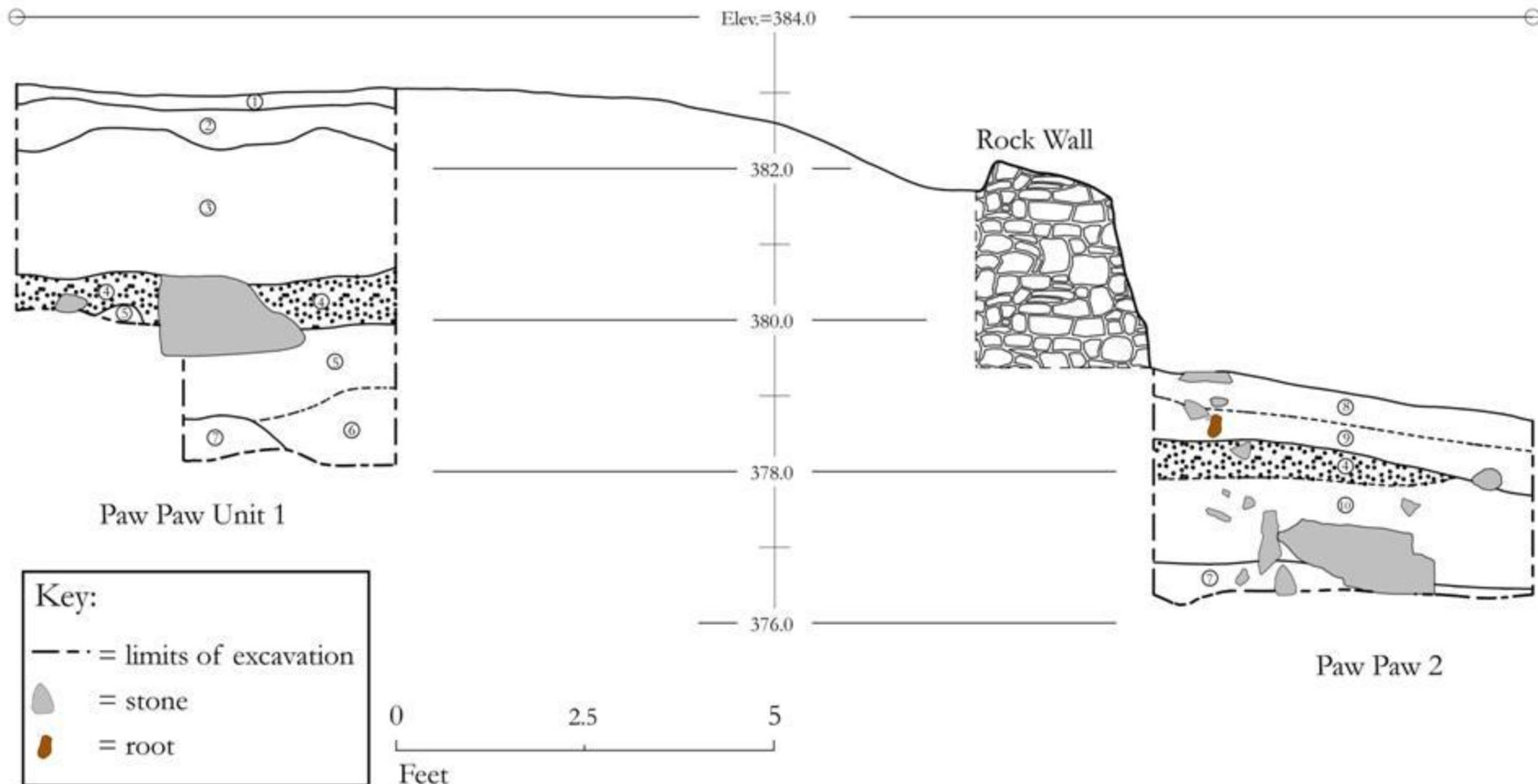


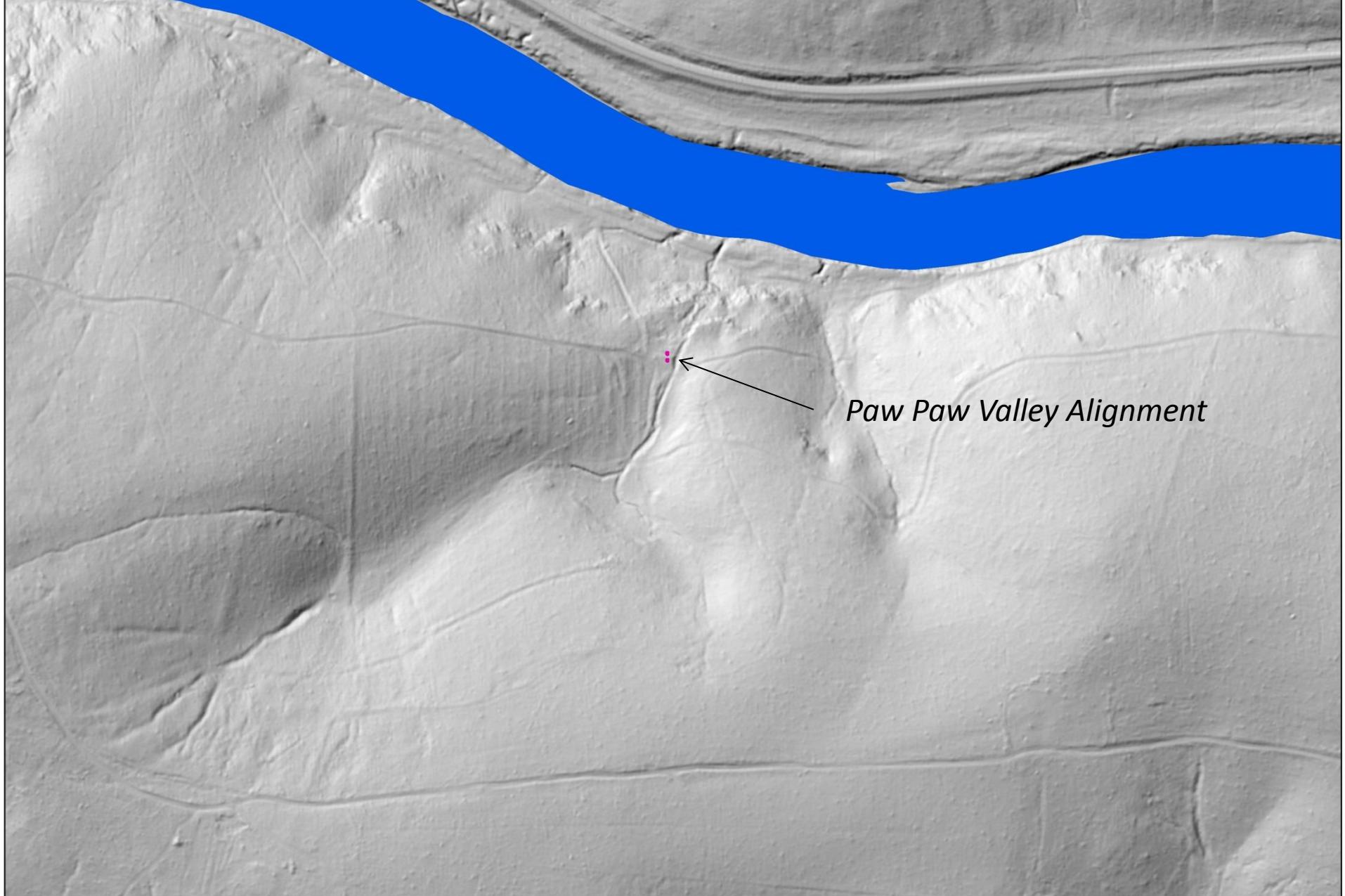
### Pollen

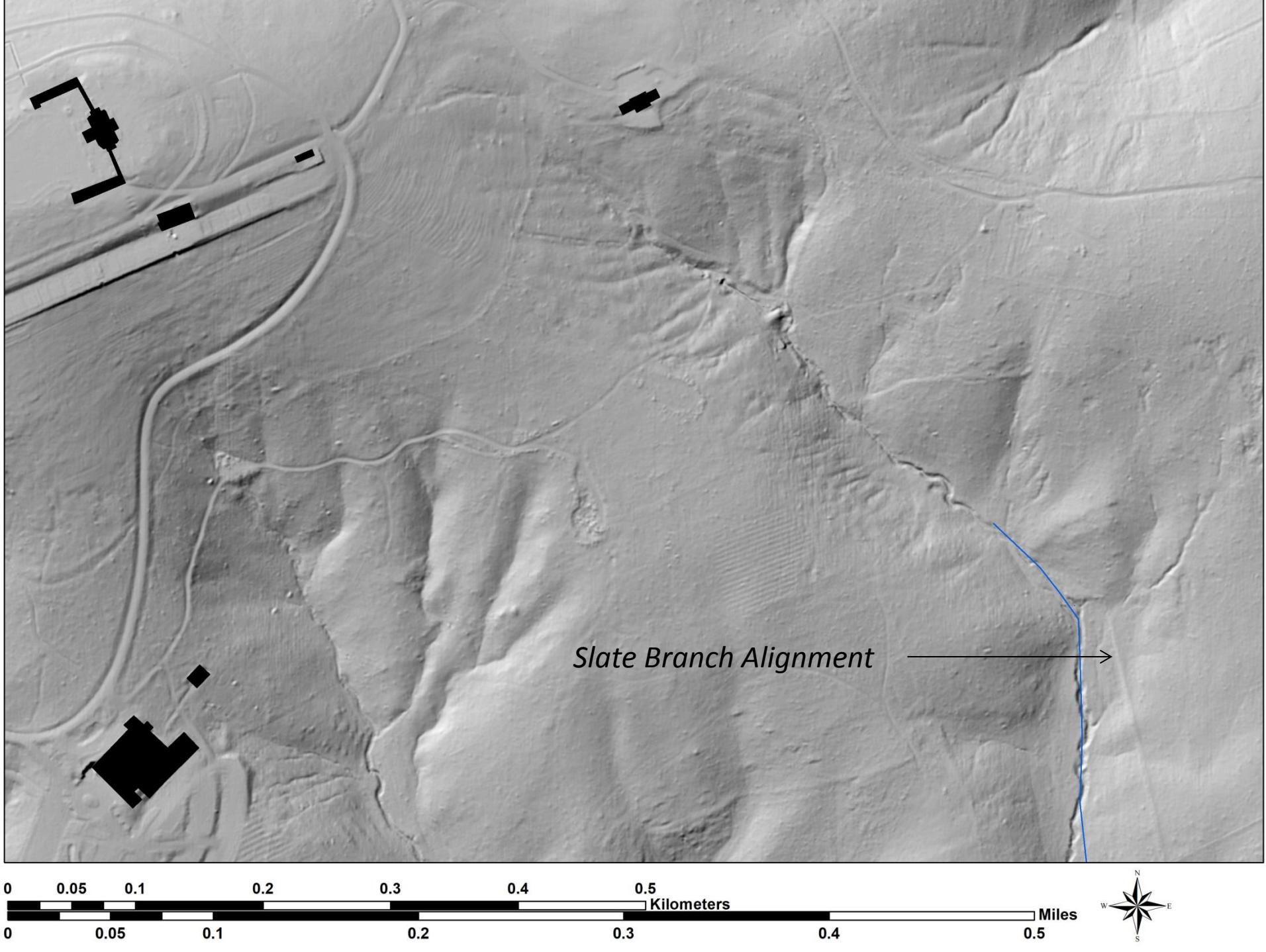




## Paw Paw Valley, Units 1 & 2, West Profile

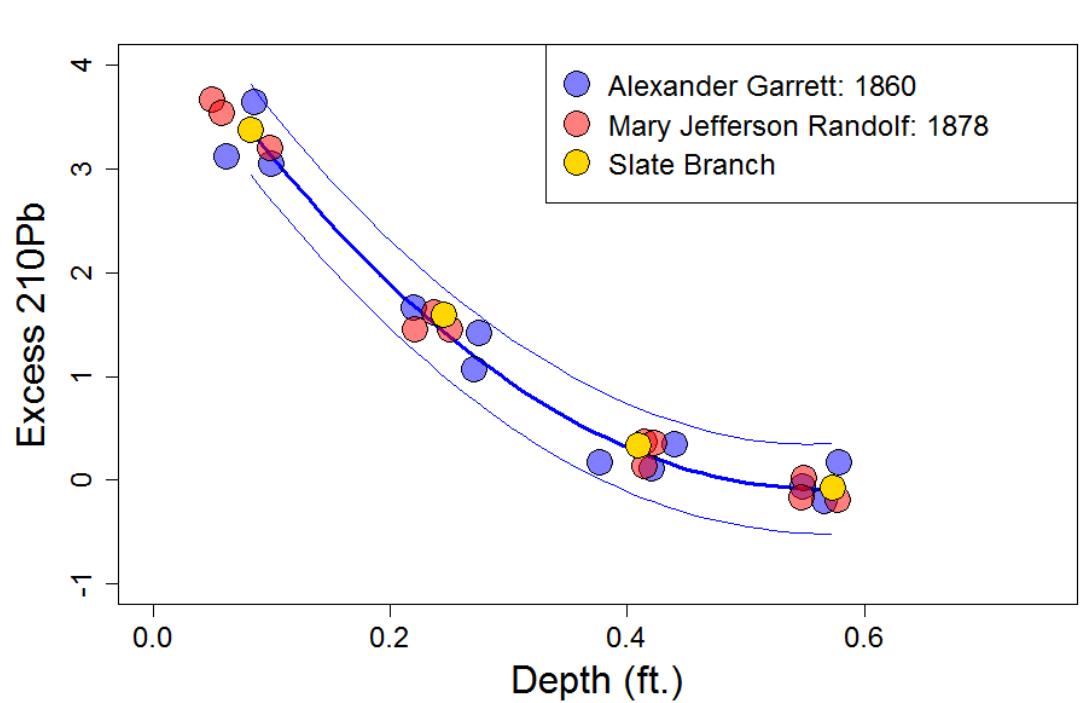






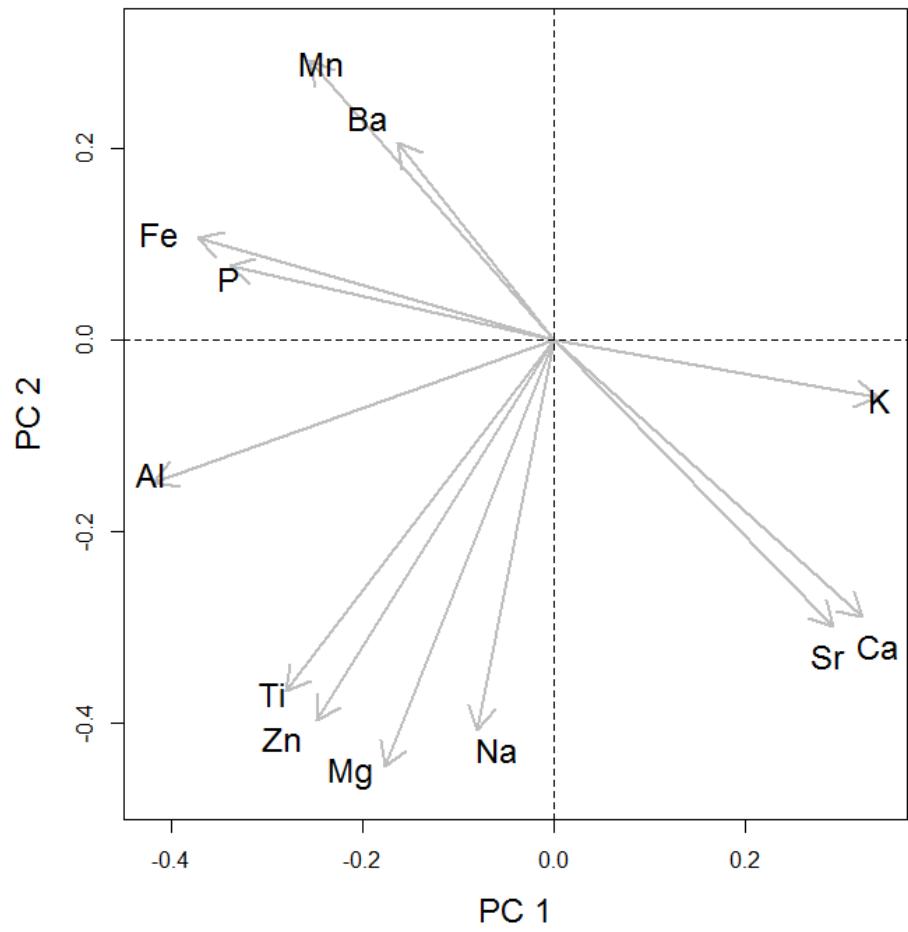
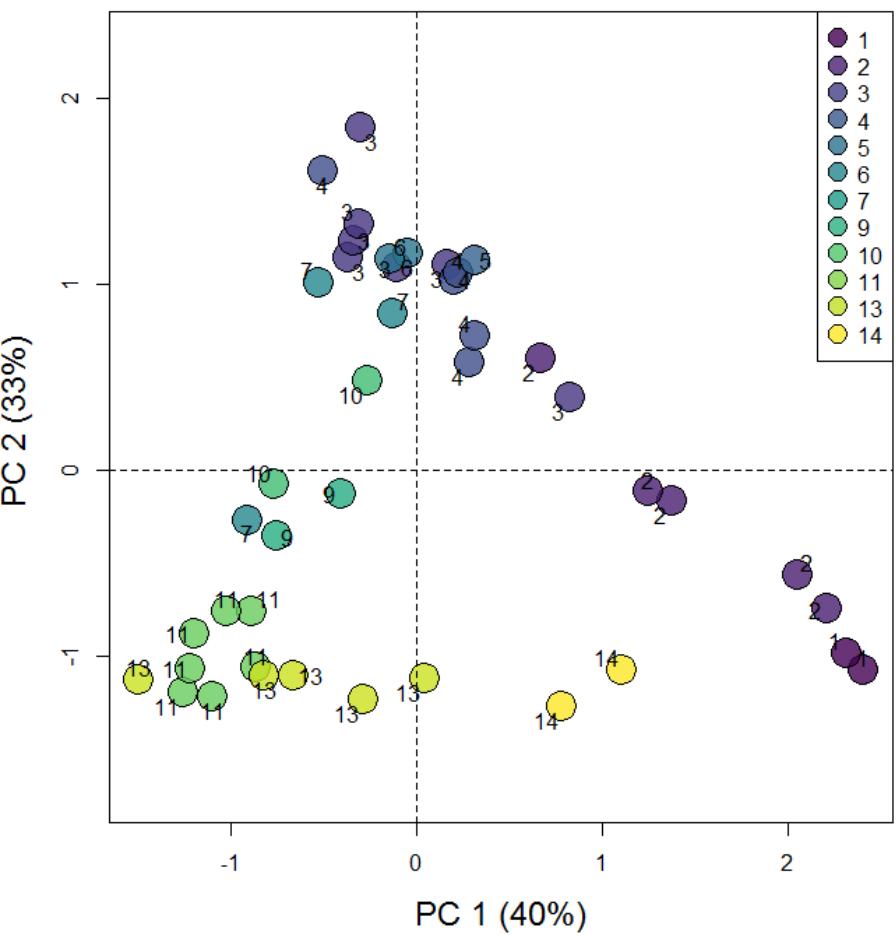
# Slate Branch: Alignment: Unit 2

## Dating: 210 Pb



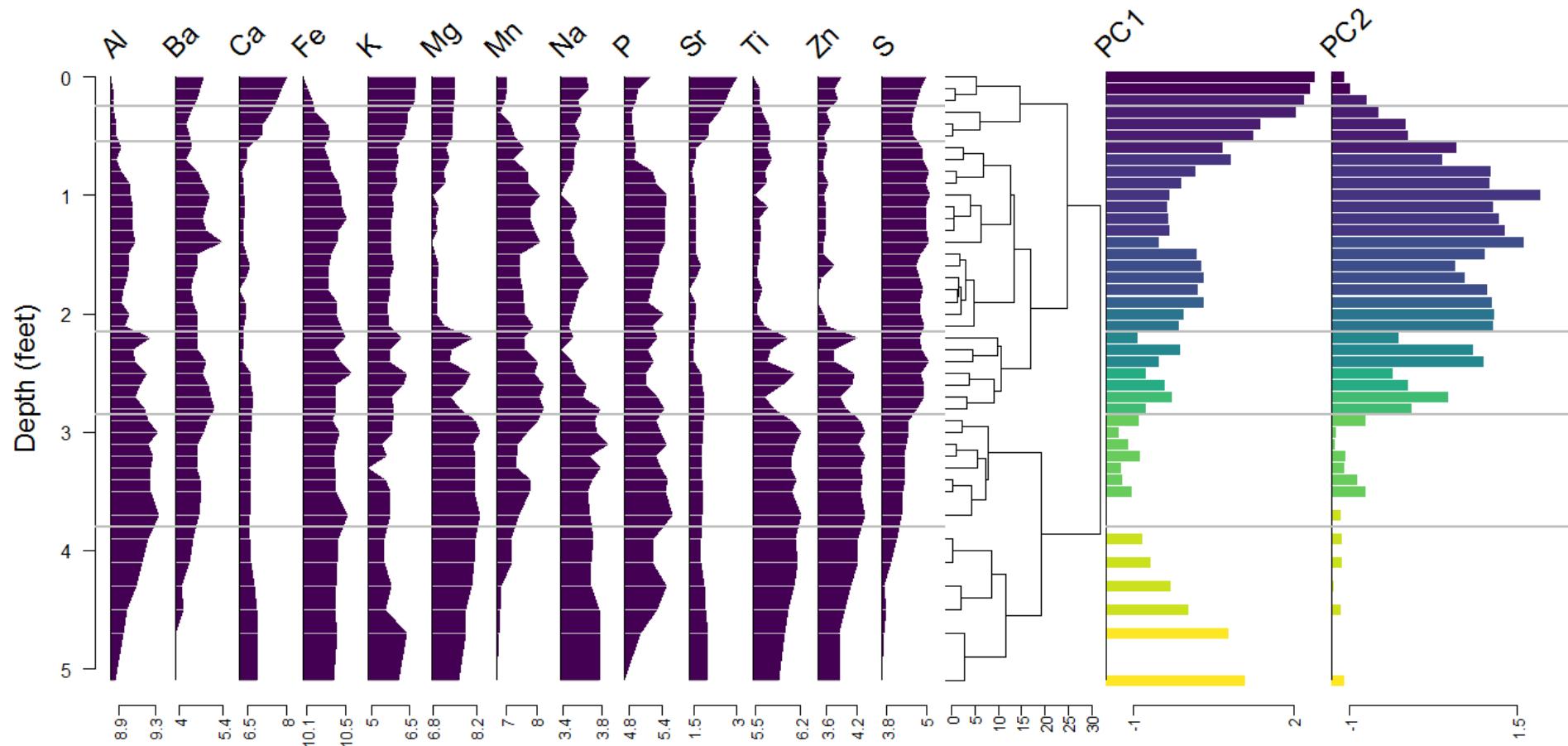
# Slate Branch: Unit 2

## Sediment Chemistry



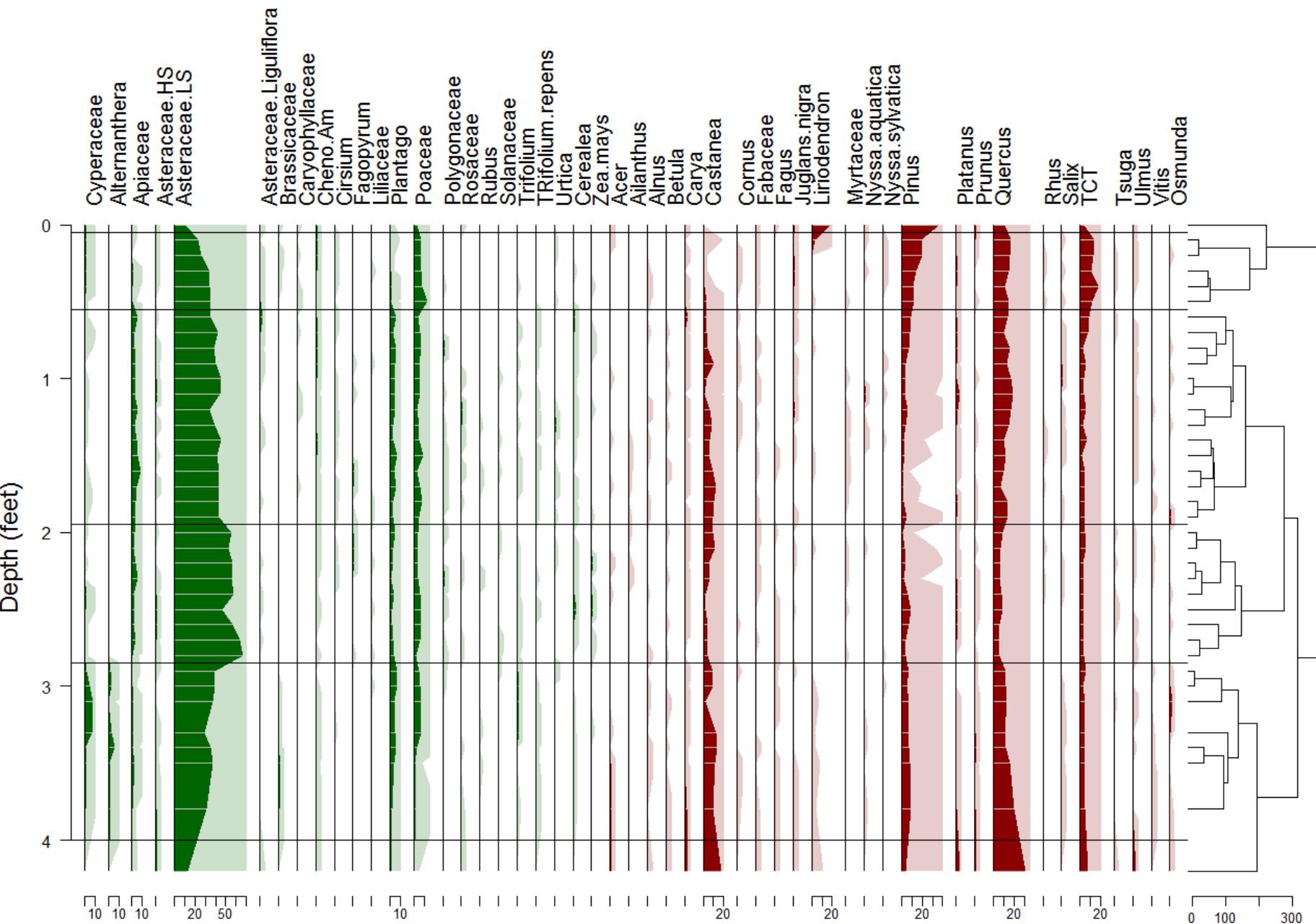
# Slate Branch: Unit 2

## Sediment Chemistry



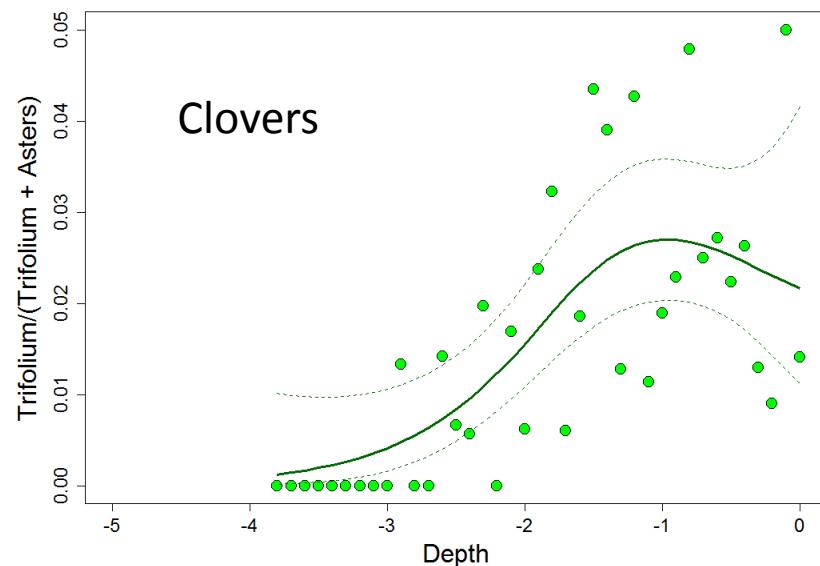
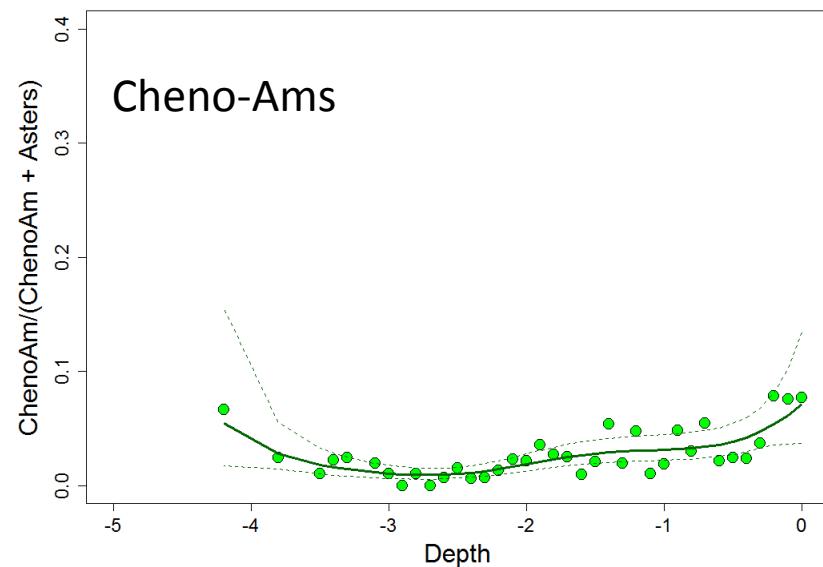
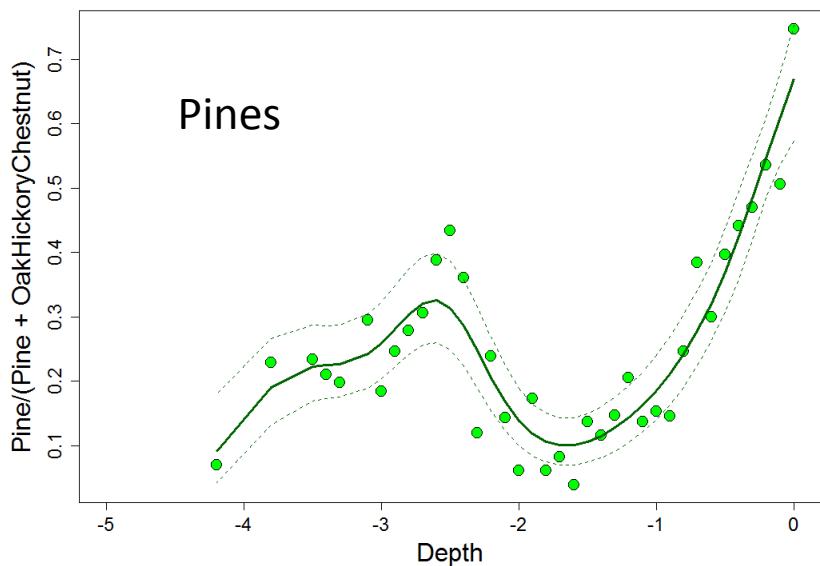
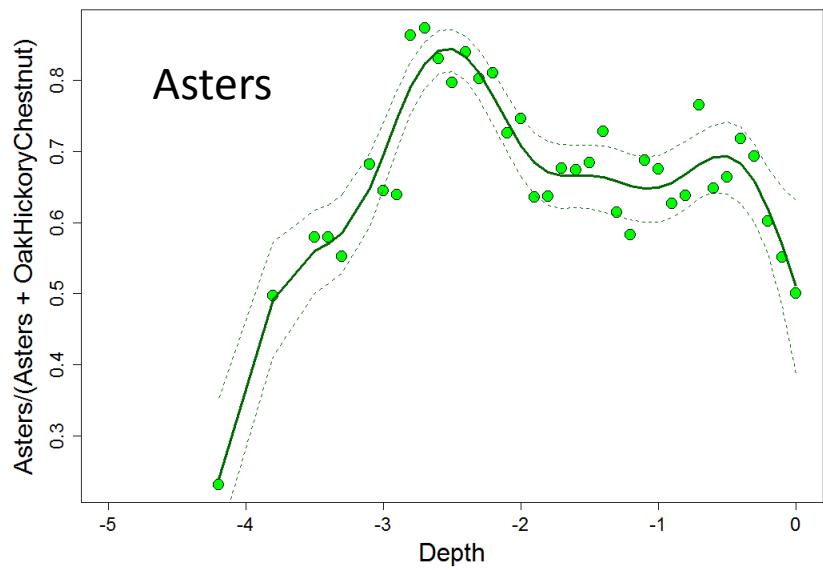
# Slate Branch: Unit 2

## Pollen



# Slate Branch: Unit 2

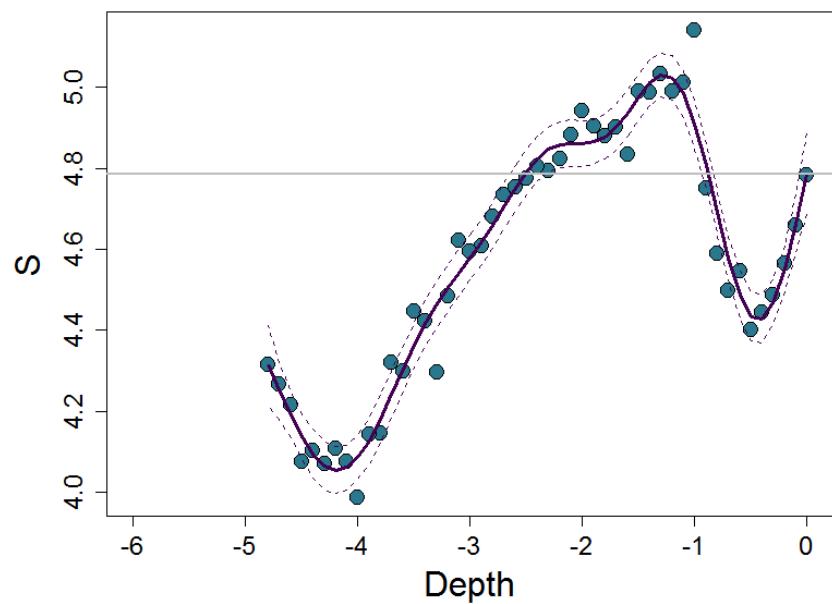
## GAMs for Select Pollen Taxa: Logistic link, quasi-binomial errors



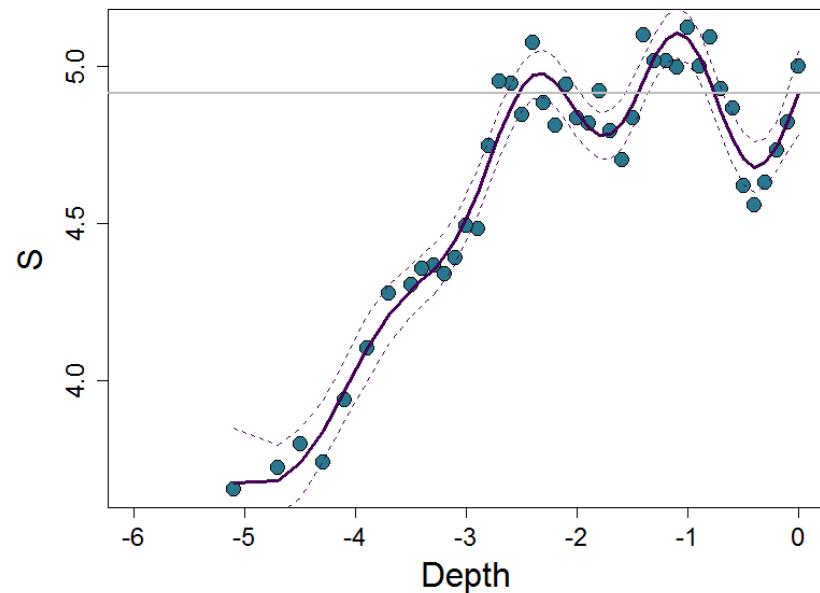
# Fertilizer: Gypsum

GAMs for Sulfur: identity link, Gaussian errors

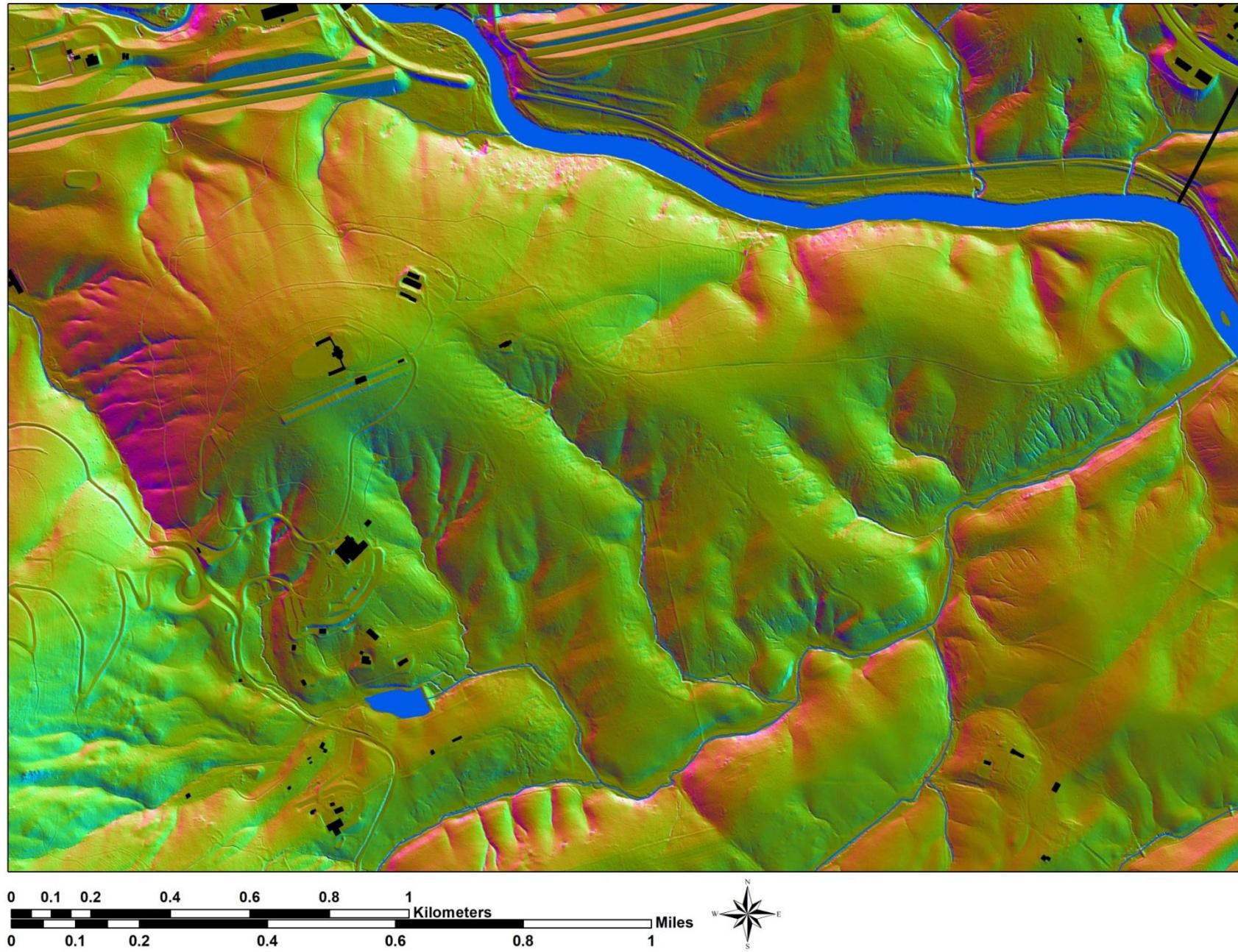
Paw Paw, Unit 1



Slate Branch, Unit 2



# Gullies





## Tobacco

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

## Wheat

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

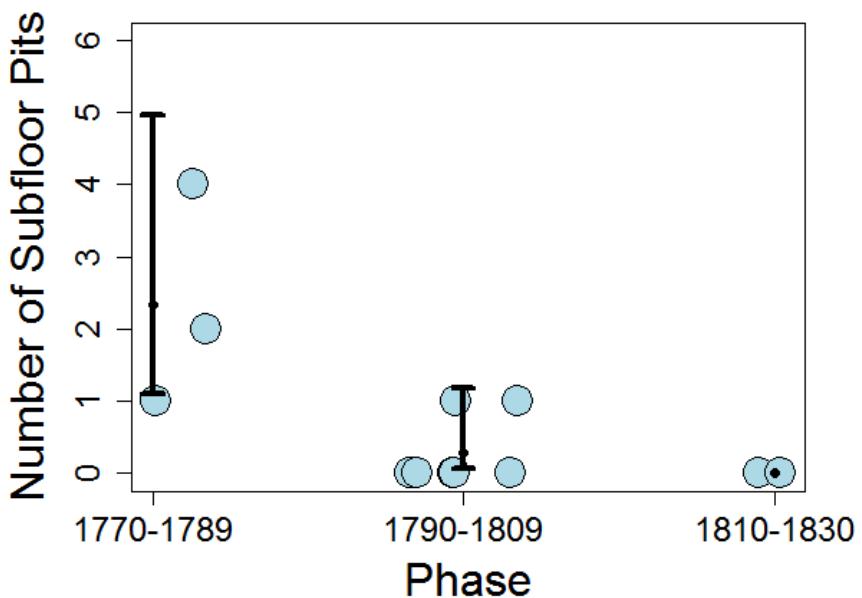
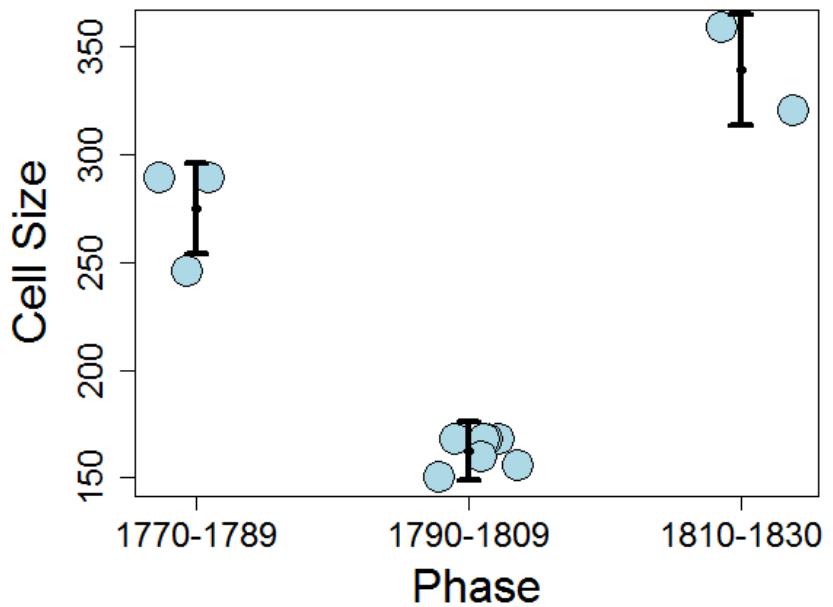
## Implications

- 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.



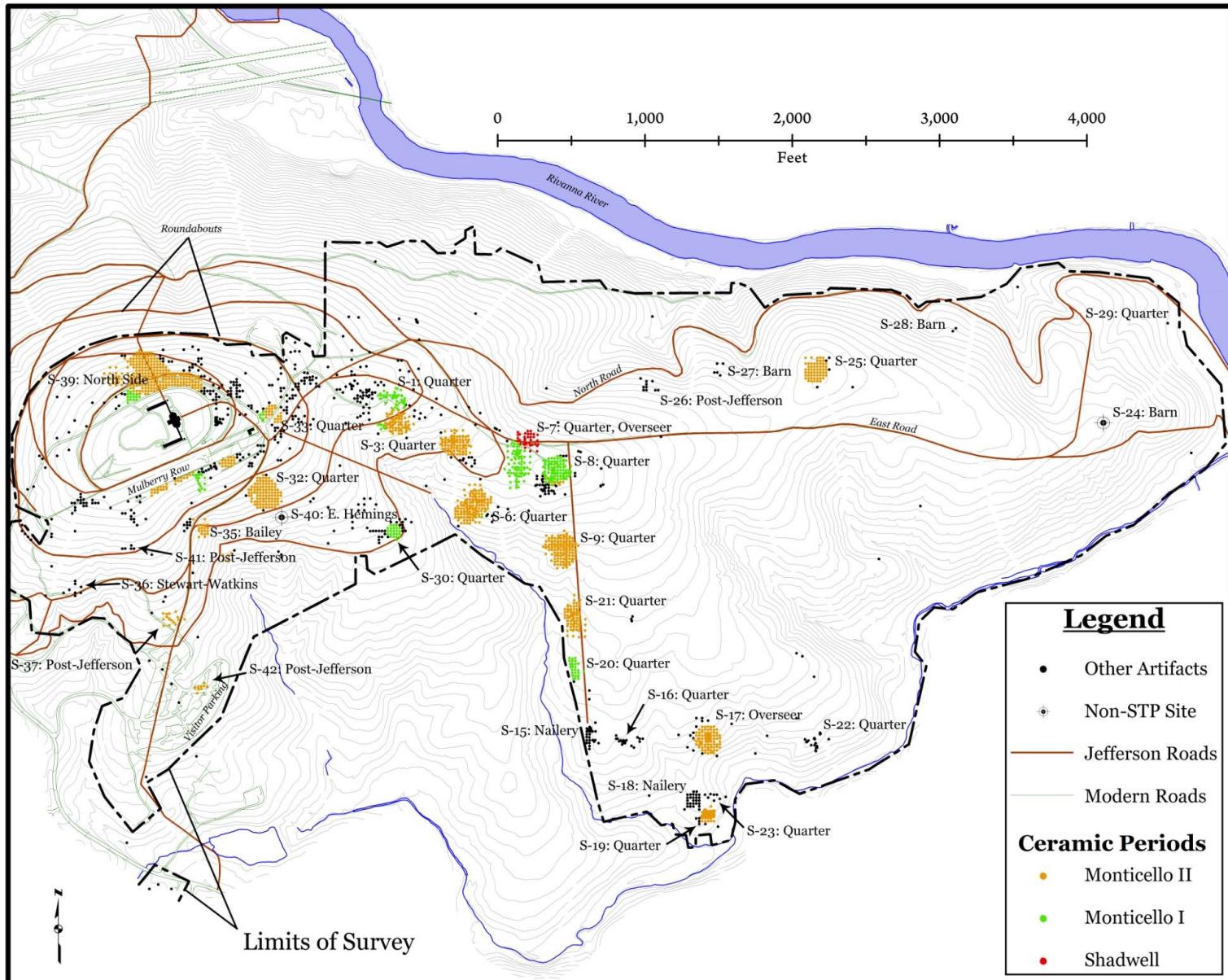
# Slave Houses on Mulberry Row

## Size vs. Number of Subfloor Pits

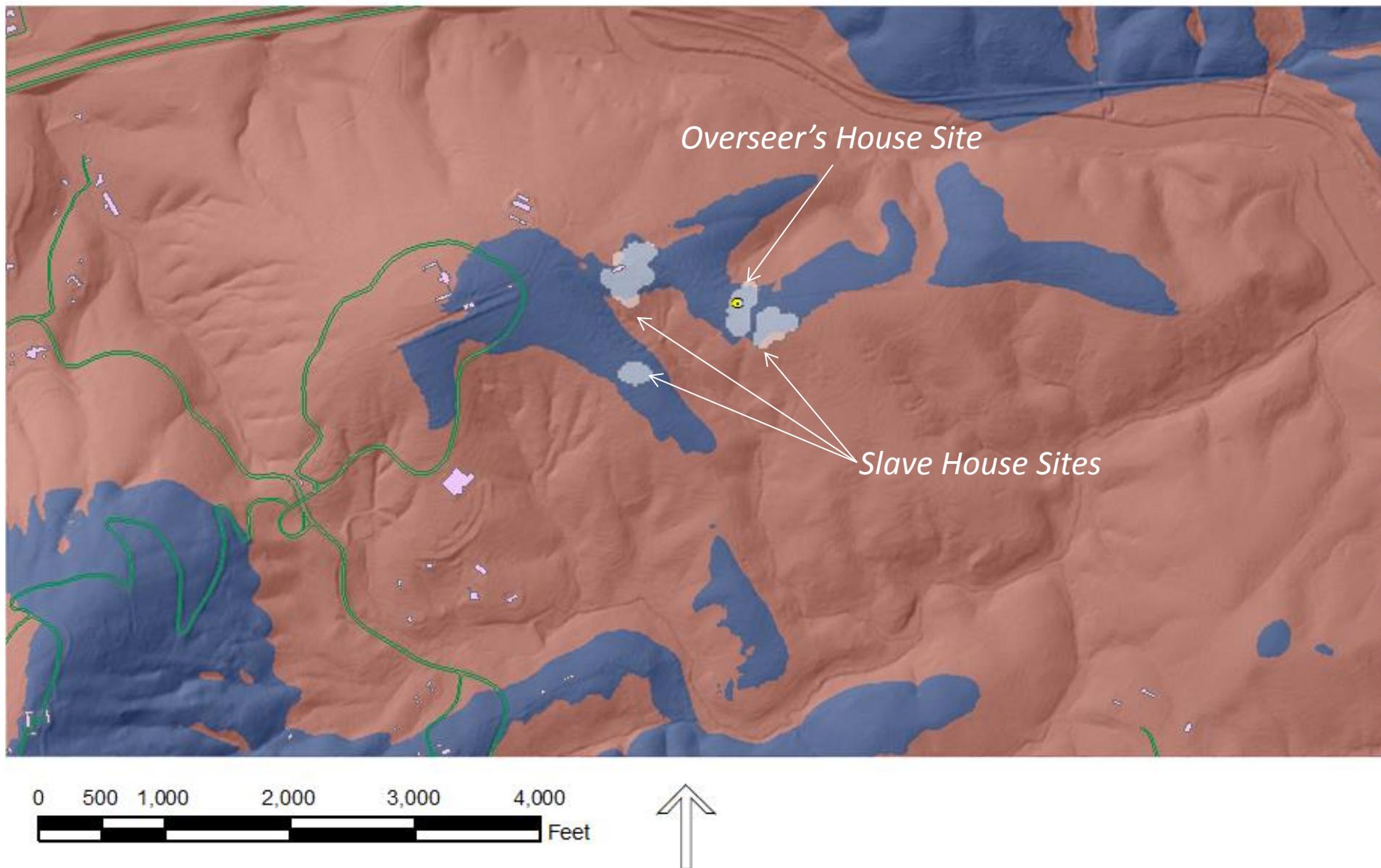


# Monticello Plantation Archaeological Survey

## Domestic Site Locations



# Viewshed from Tobacco-Period Overseer's House



# Viewshed from Wheat-Period Overseer's House

