ARCHAEOBOTANY

Methods and Research

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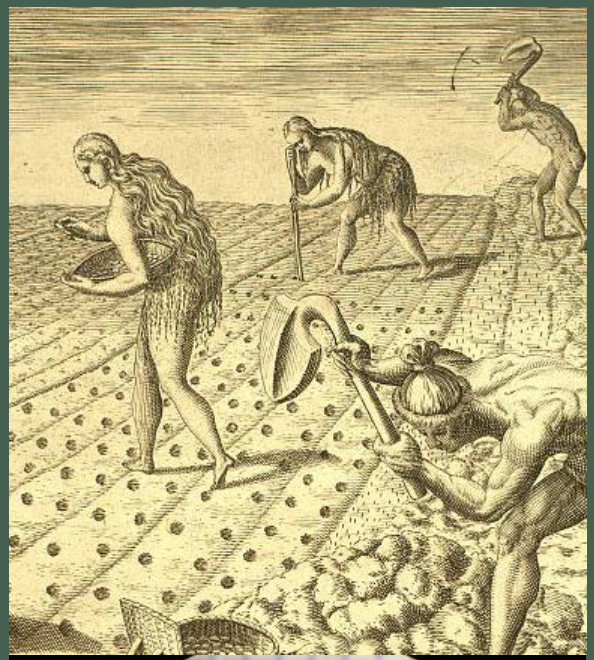
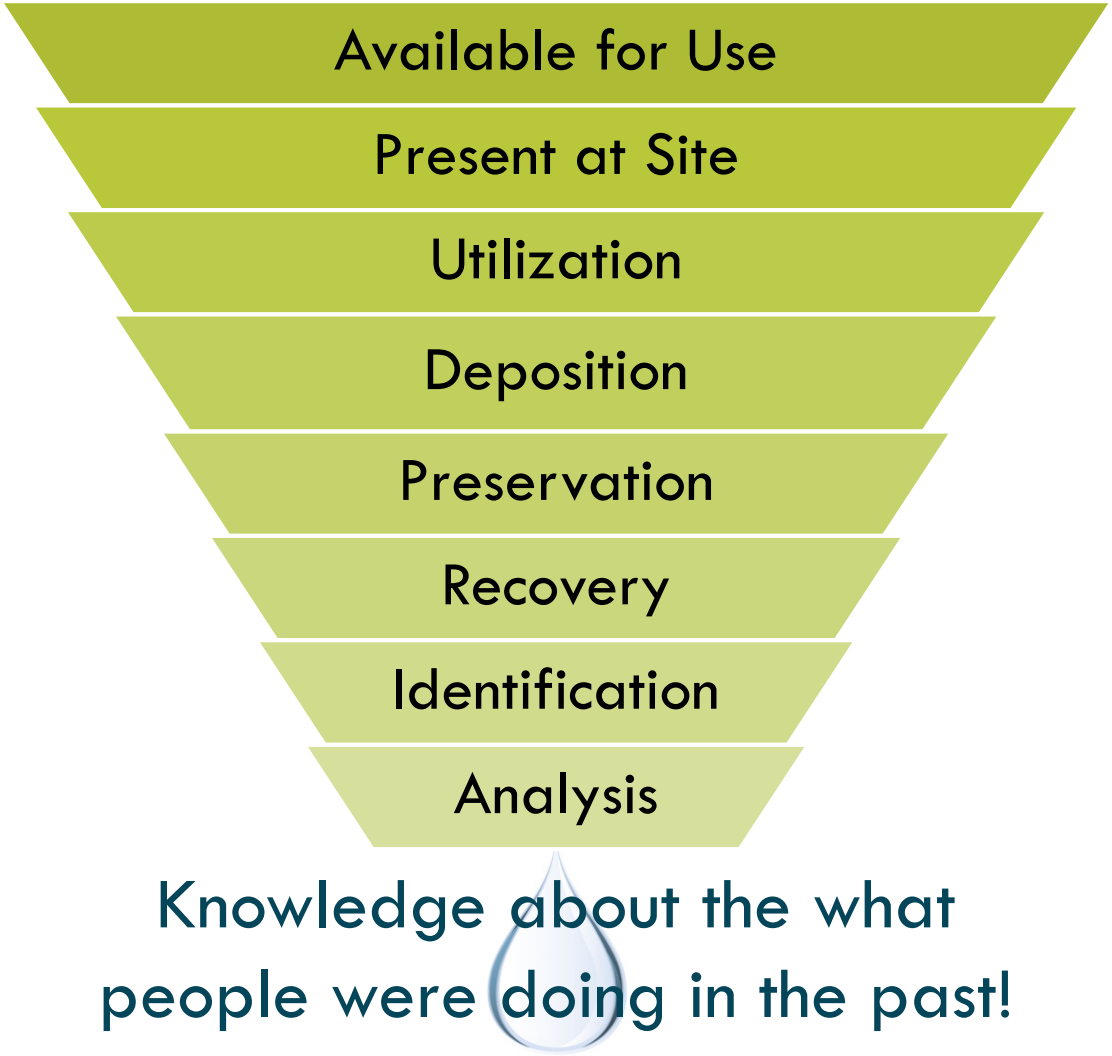
Office of State Archaeology
NATURAL AND CULTURAL RESOURCES



Topics

- Types of plant remains
- Preservation
- Recovery
- Identification and analysis
- Research

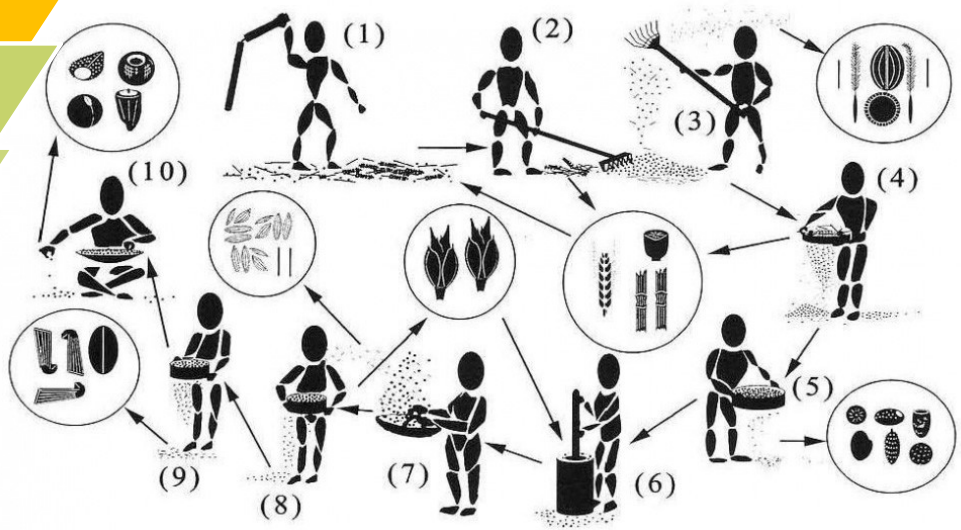
Taphonomy: studying the process by which organisms become artifacts



How do plant remains end up in the ground?

- Available for Use
- Present at Site
- Utilization
- Deposition
- Preservation
- Recovery
- Identification
- Analysis

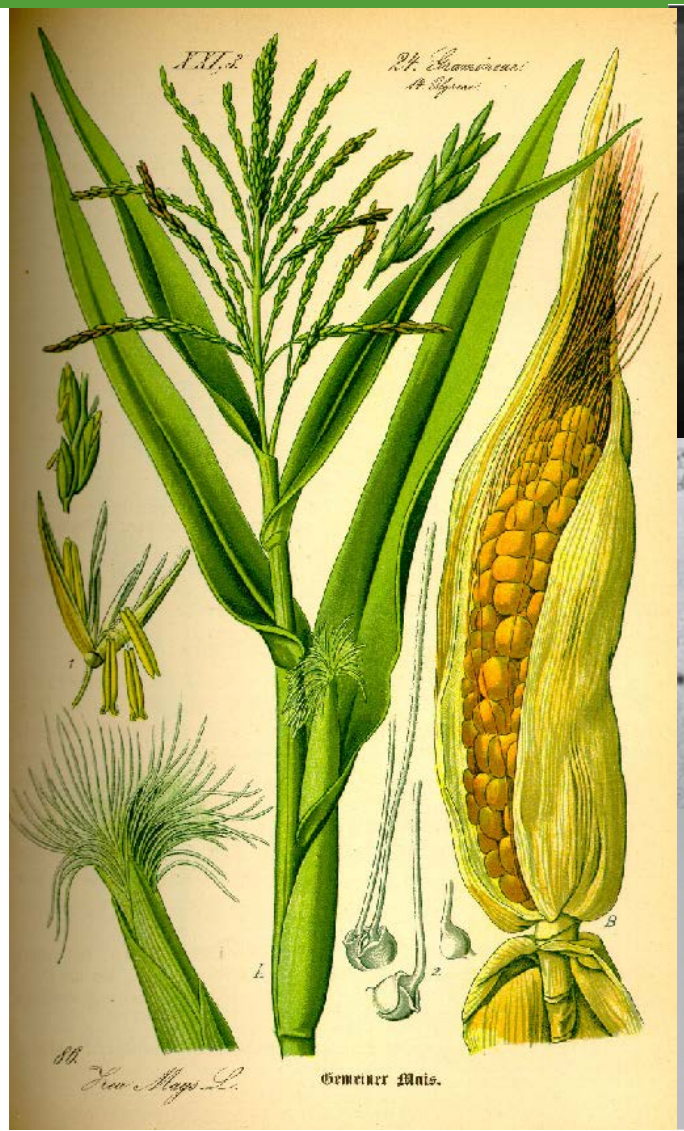
Pathways specific to each plant

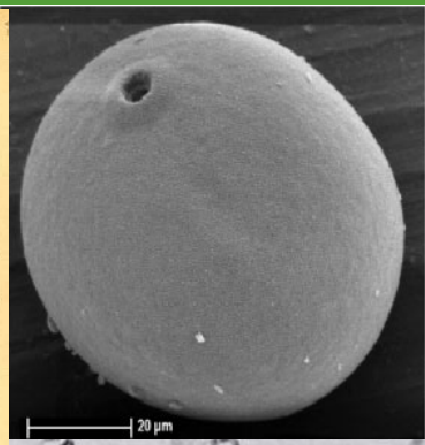


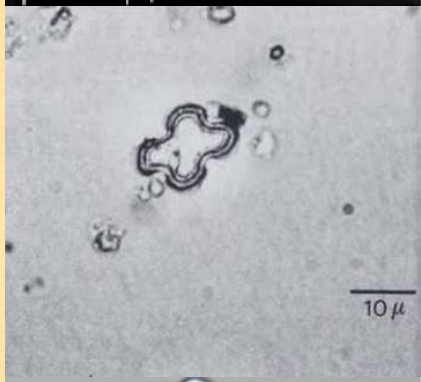
Processing wheat

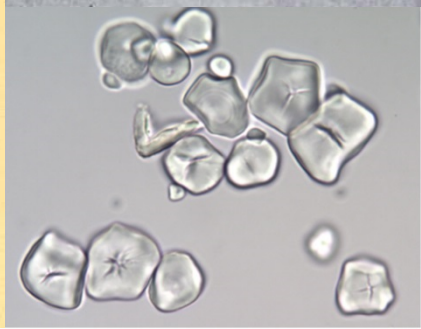
Types of Plant Materials

- Microbotanical
  - Pollen
  - Phytoliths
  - Starch grains
- Macrobotanical
  - Rachis
  - Seeds
  - Nutshell
  - Wood

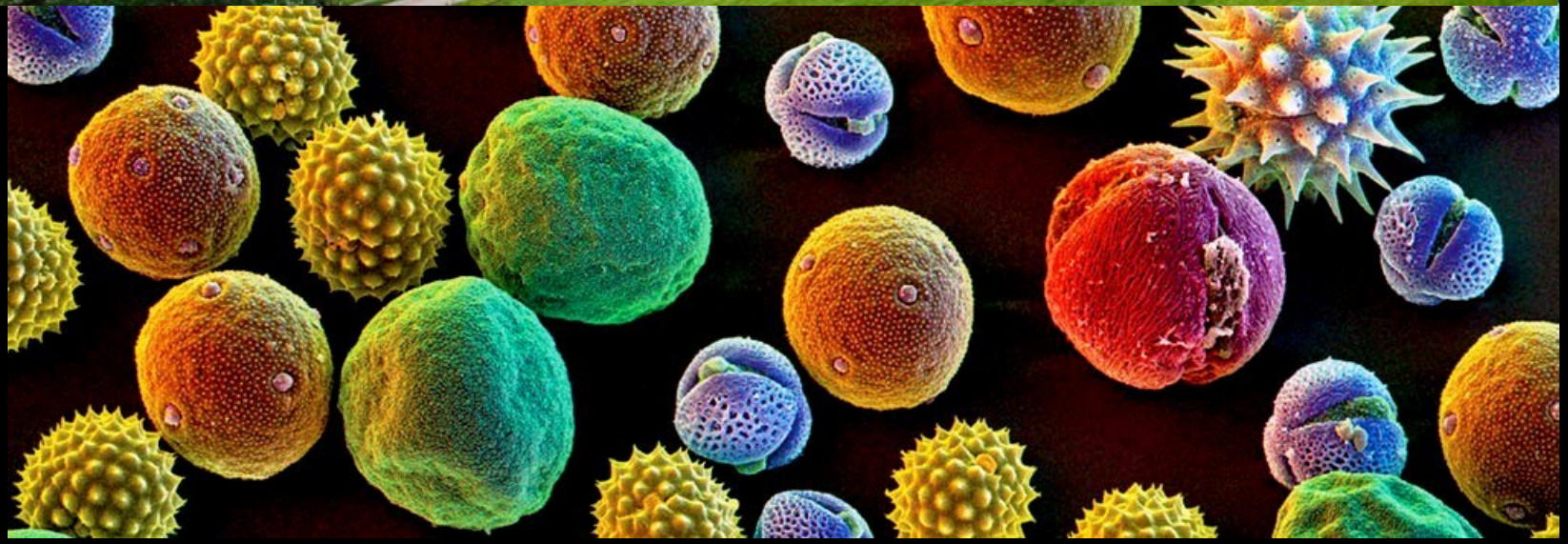




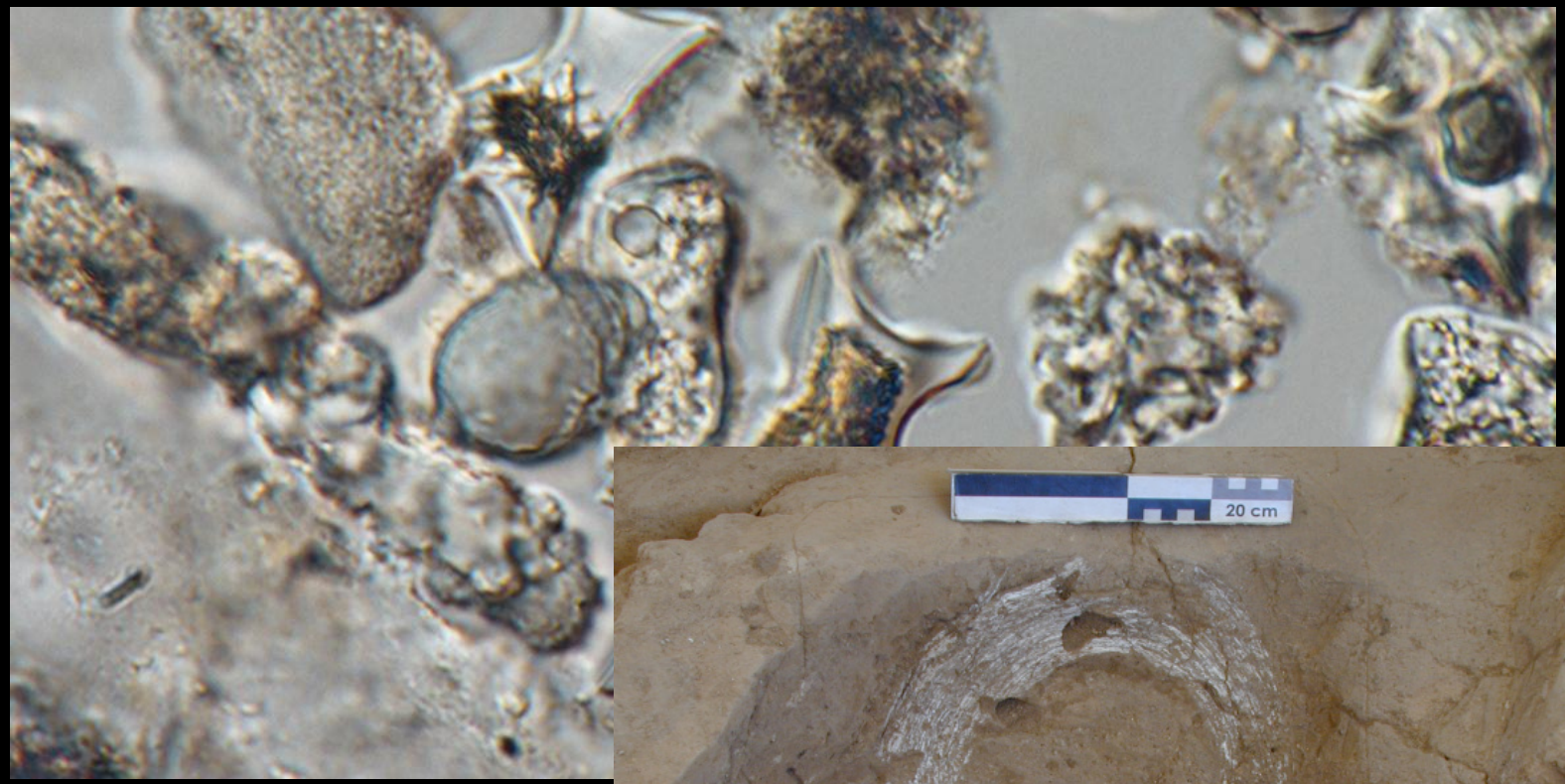




Pollen



Phytoliths



Starch Grains

A

Granules: Round or Polyhedral; Diameter 5-35 µm; Hilum: Distinct, central, triangular; Striations Absent

C

Granules: Lenticular circular or oral in shape, Diameter:5-50 µm; Hilum: Central Concentric; Striations: Faintly marked; Components 2-4

B

Granules: Polyhedral; Diameter: 2-12 µm; Components: 2-150; Hilum: Minute, central point, rarely conspi-cuous; Striations: Absent

D

Granules: Simple; irregularly avoid or spherical and subspherical; Diameter: 30-100 µm; Hilum: Eccentric; Striations: well marked and concentric;

Fig. 3.1 Characteristic Features of (*A*) Maize Starch, (*B*) Rice Starch, (*C*) Wheat Starch, (*D*) Potato Starch.

Sampling for Microbotanical Remains

Column Sample

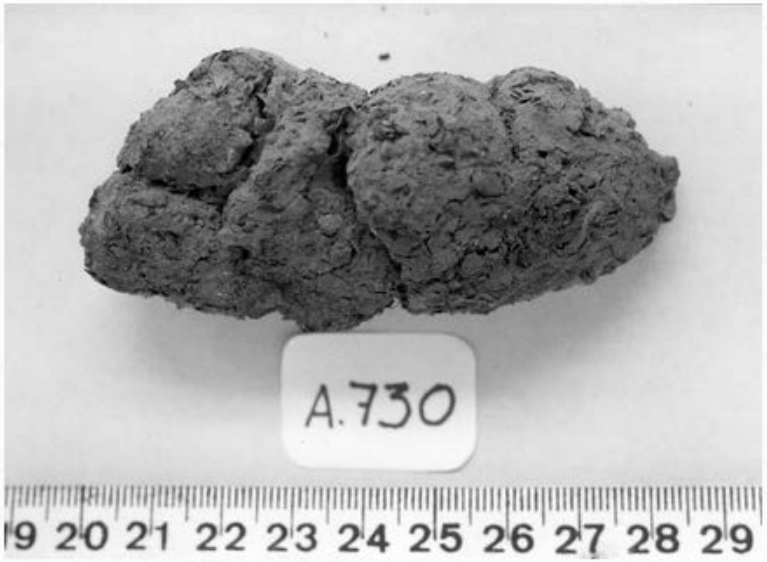
Sediment Core

Other Sources of Microbotanical Remains

To Truly Know an Ancient Society, One Must Analyze Its Feces

By Sarah Laskow JANUARY 28, 2016

1,950



A human coprolite [Photo: Sianto et al. 2012/Wikimedia]

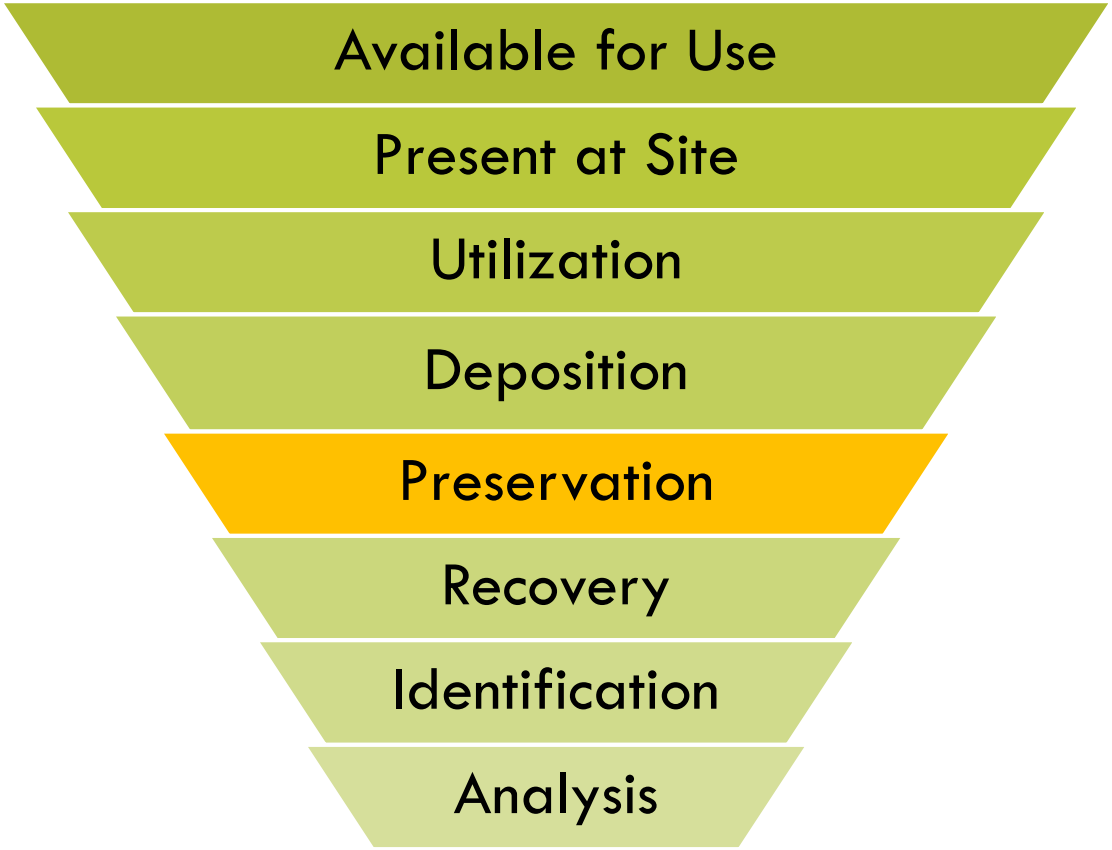
Archeological digs, like any work environment, can get tedious. Even scientists need to have fun. In the 1960s, at one of Vaughn Bryant's first digs, workers would collect "dozens of flat, cow patty-shaped human coprolites"–hunks of ancient human fecal matter–through the course of the morning. After lunch, those coprolites would be used as entertainment.

The game was to see how far the patties could be thrown, frisbee-like, from the site. "As each coprolite sailed out over the canyon the crowd would cheer or launch, depending on how far the thermal updrafts carried each coprolite," Bryant writes, "It was great sport."

Food Processing Residue

Dental calculus

Macrobotanical Remains



Macrobotanical Materials: Preservation

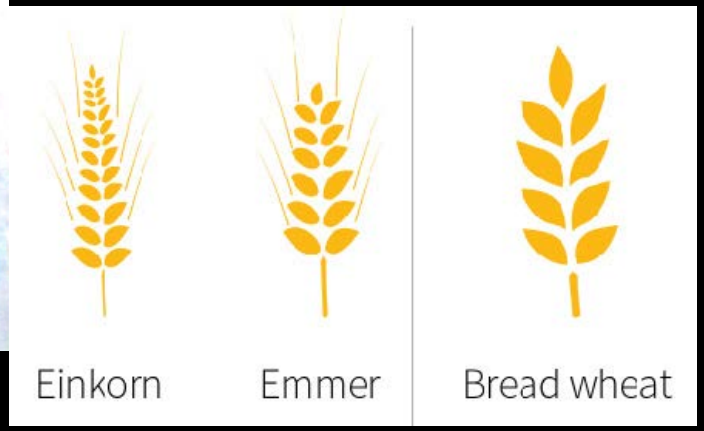
- Frozen
- Waterlogged
- Desiccated
- Mineralized
- Carbonized

- Frozen

Ötzi the Iceman: preserved in the ice for 5300 years

Ötzi, the glacier mummy, is displayed in the South Tyrol Museum of Archaeology in Bolzano, Italy together with his clothing and equipment.

Frozen wheat

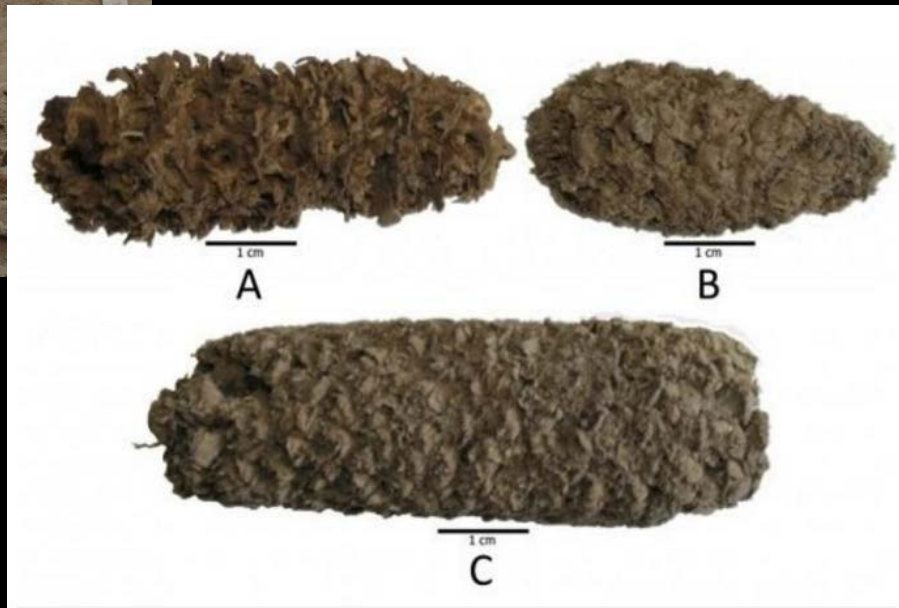


Waterlogged, mineralized

Mineralized Hackberry ($CaCO_3$)

- Desiccated

Huaca Prieta, Peru

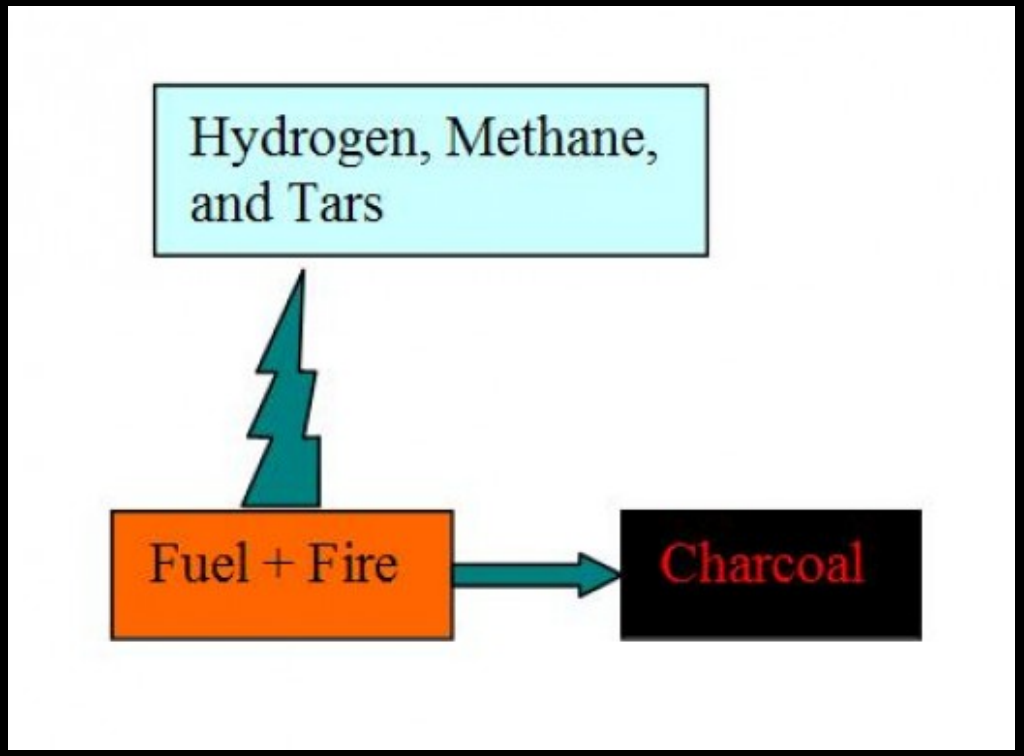


These ancient corn cobs date roughly from 6,500-4,000 years ago. A is Proto-Confite Morocho race; B, Confite Chavinense maize race; and C is Proto-Alazan maize race.

Credit: Tom D. Dillehay

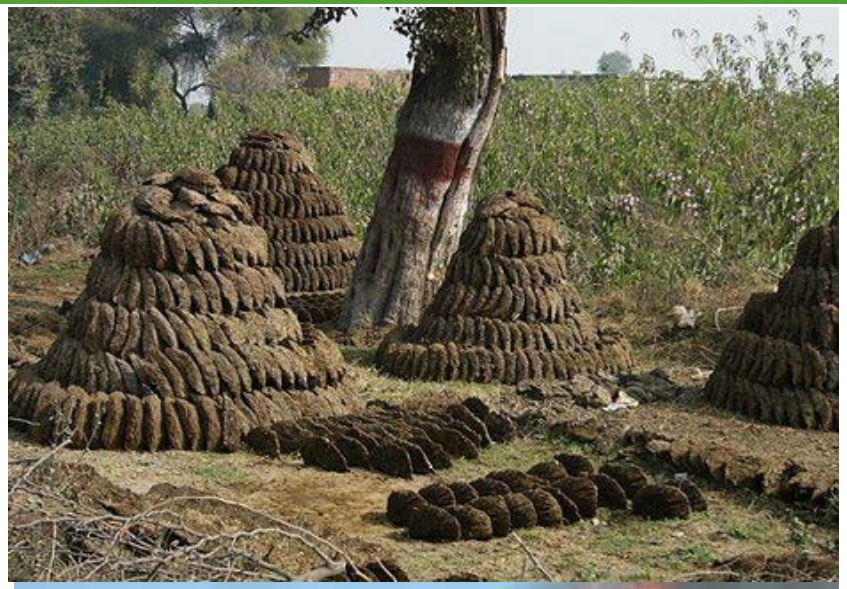
Carbonized

Carbonization: pyrolysis of plant material, producing charcoal (carbon + tar + ash)



Carbonization: How?

- Intentional burning
  - Fuel
  - Trash
- Unintentional burning
  - Structure fires
  - Cooking spills/roasting fails



Factors Affecting Carbonization

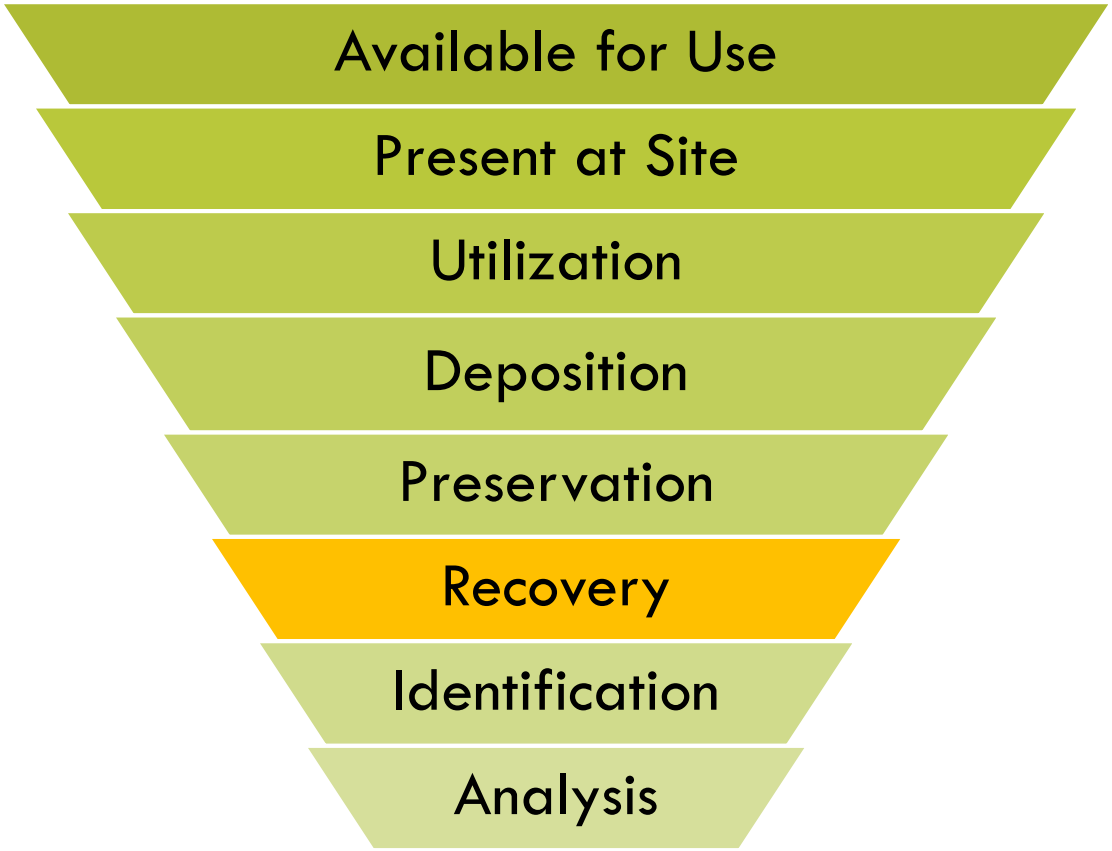
- Temperature, oxygen
- Qualities of material
  - Density
  - Water and oil content

	Carbohydrates	Fat	Protein
Acorn	42%	51%	5%
Hickory	11%	81%	6%

Preservation of Carbonized Materials

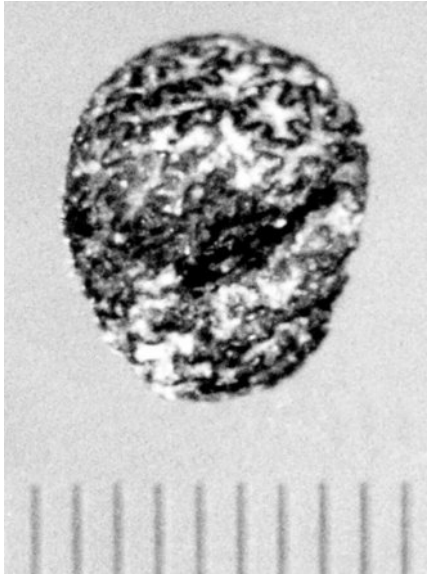
- After deposition and carbonization, condition affected by
  - Soil acidity
  - Temperature

Field Methods: Recovery



Recovery Goals

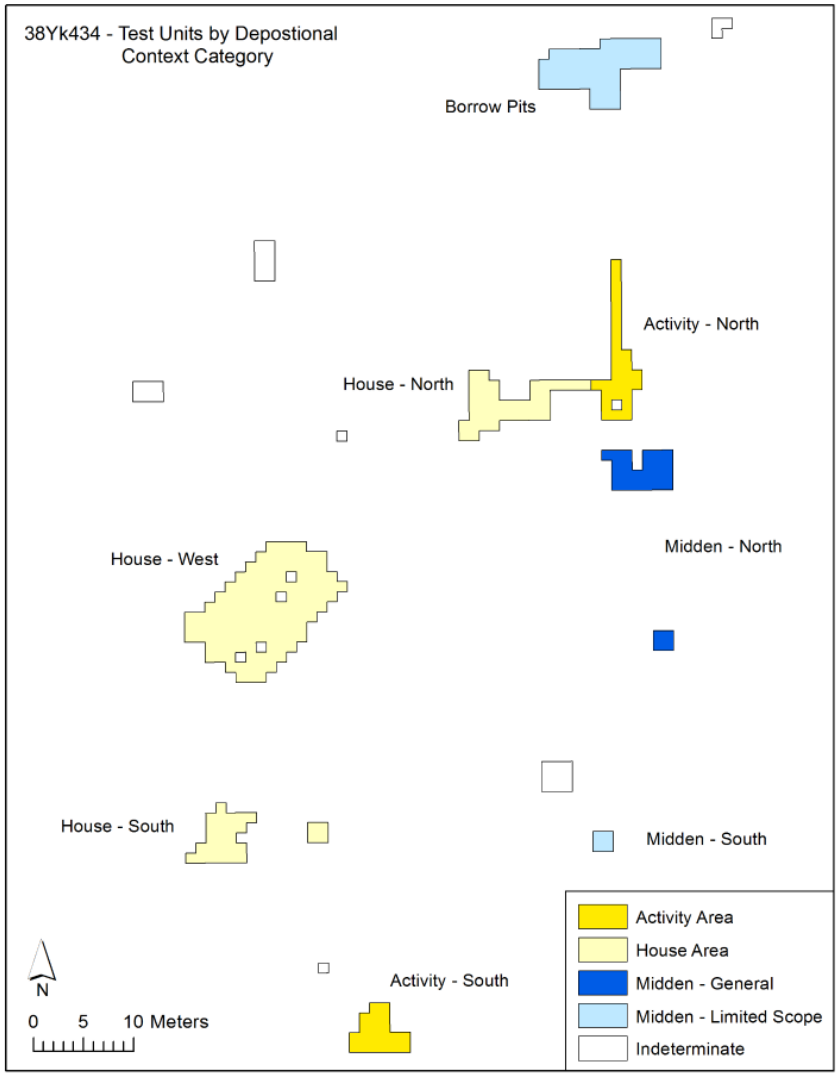
- Limit breakage of carbonized materials
- Good separation of carbonized materials from other artifacts
- Retain tiny seeds like tobacco and poppy
- Avoid contamination



0.1 millimeters

Sampling

- Get coverage of all different types of contexts
  - Clarify formation processes
  - Identify rare species
- Sampling strategies
  - Blanket
  - Interval
  - Probabilistic

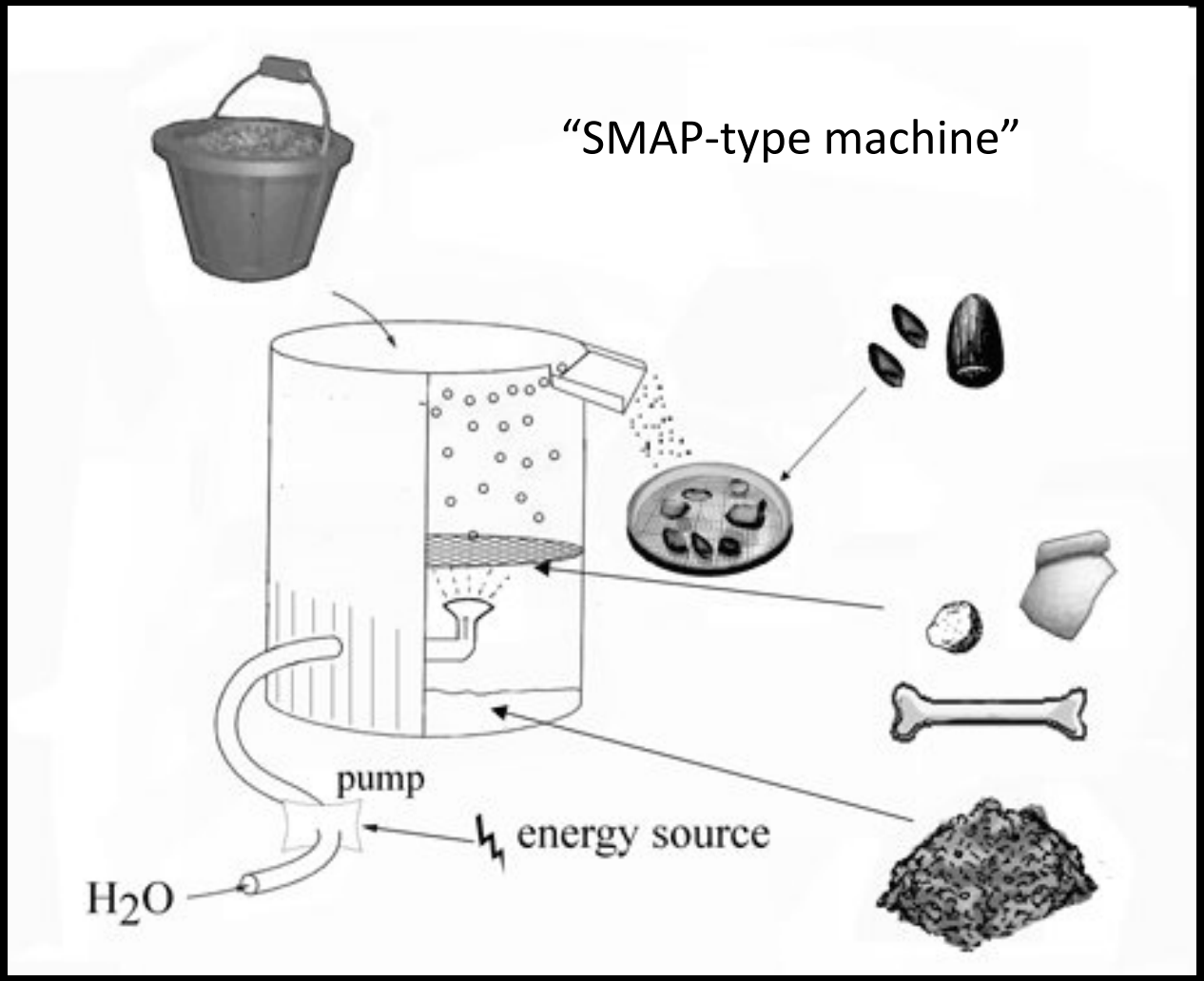


Taking Samples in the Field

- Block sample vs. grab sample
- Don't screen
- Don't dry before flotation

FLOTATION: SMAP

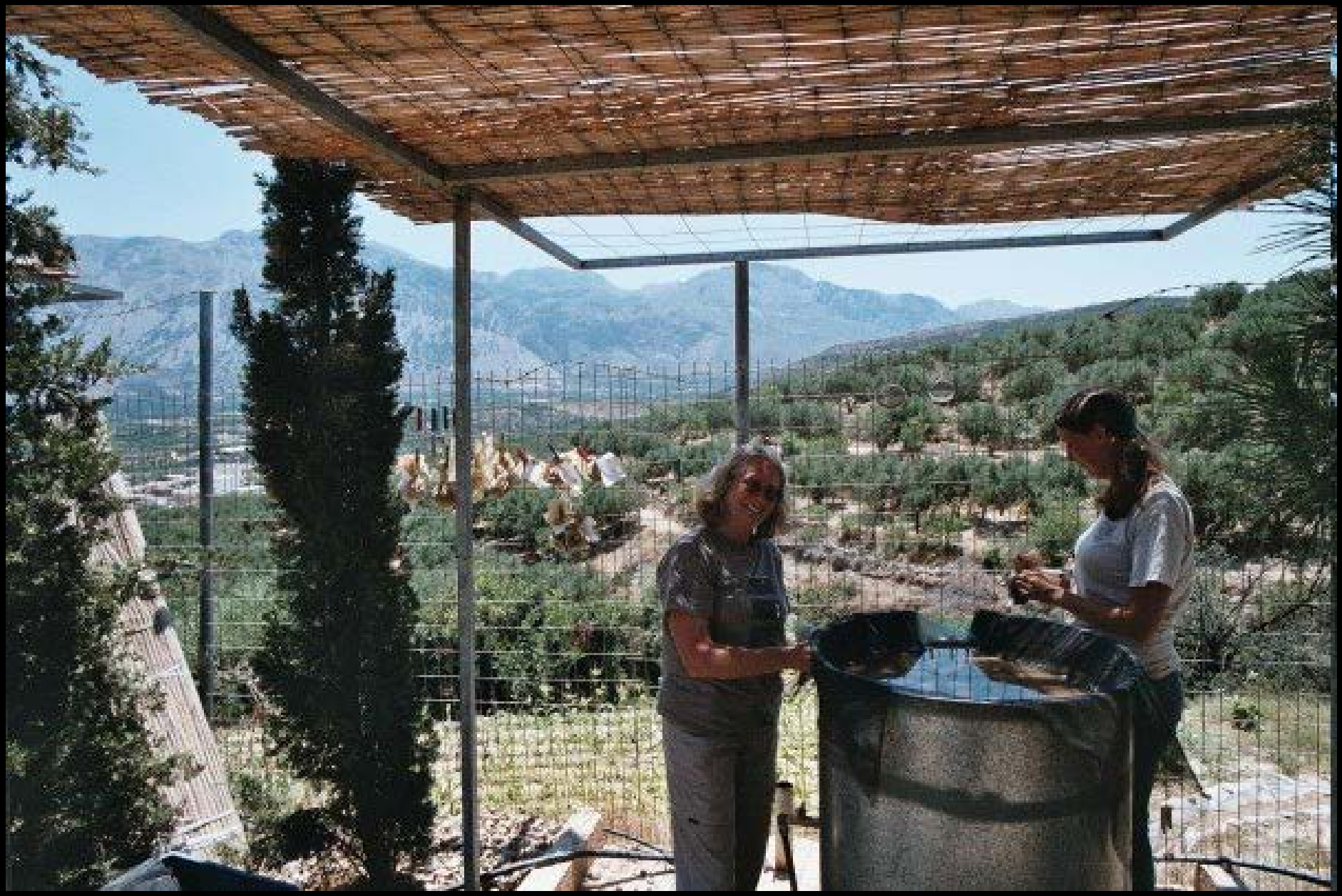
Flotation sample



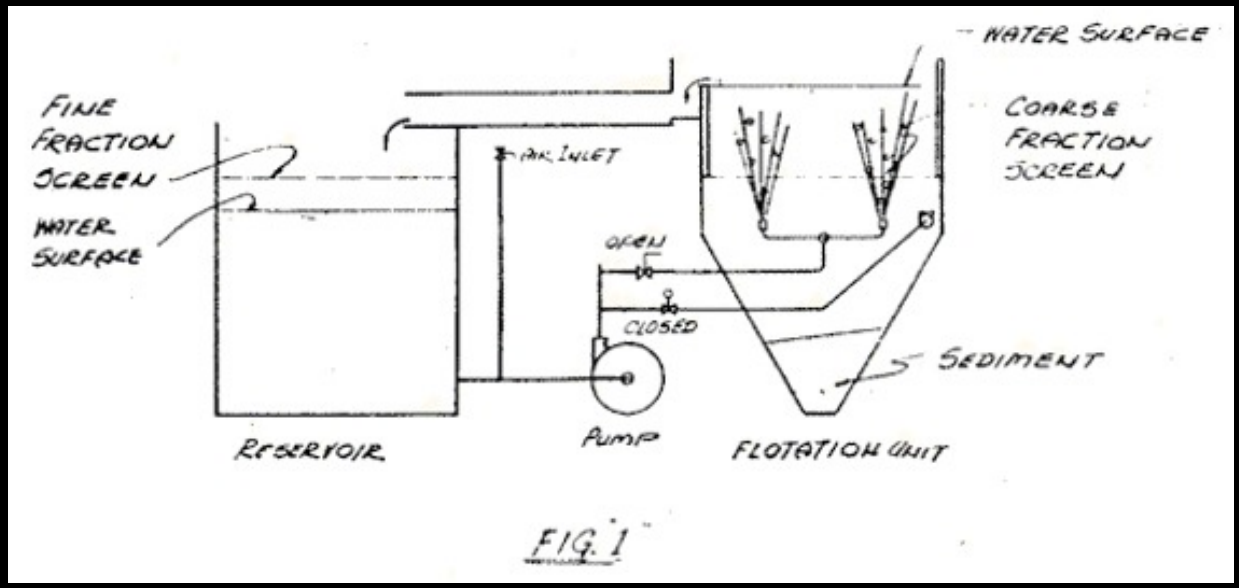
Carbonized material
"light fraction"

Artifacts, rocks, and sand
"heavy fraction"

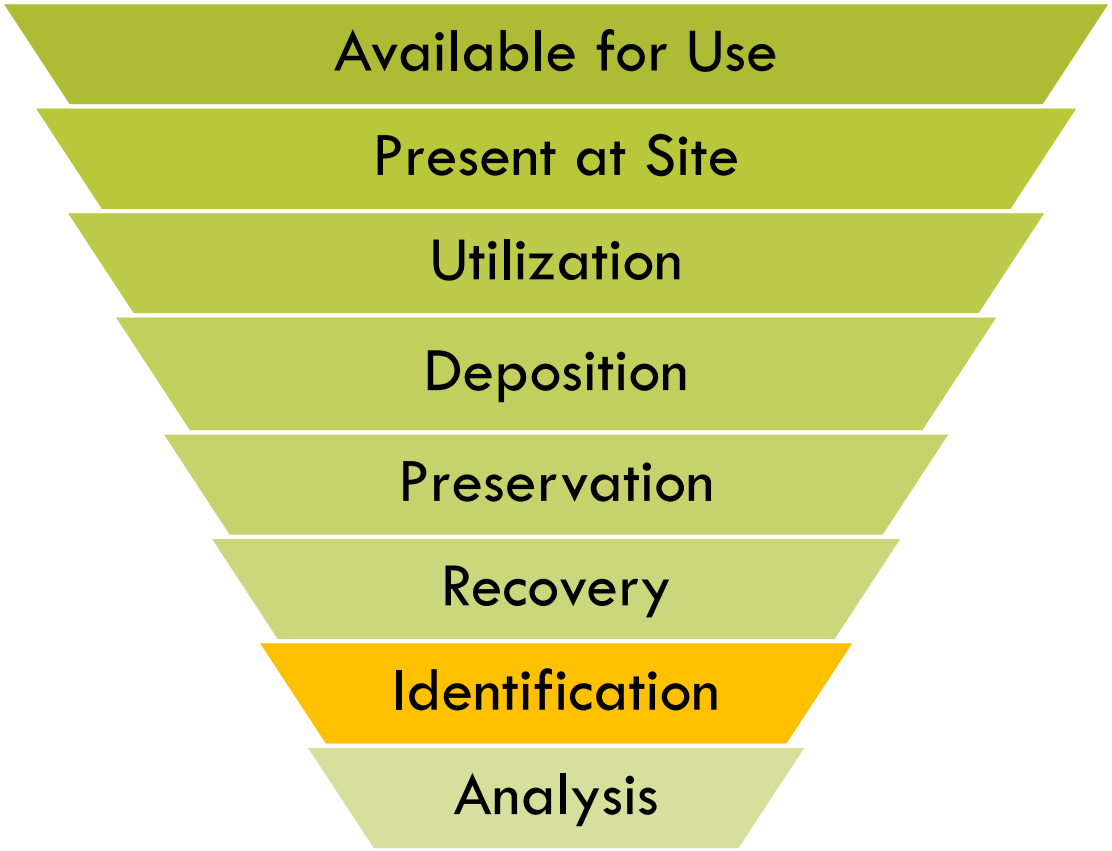
Very fine sand, other particles
"sludge"



FLOTATION: FLOTE-TECH



Lab Methods: Identification



2 mm

1.4 – 2 mm

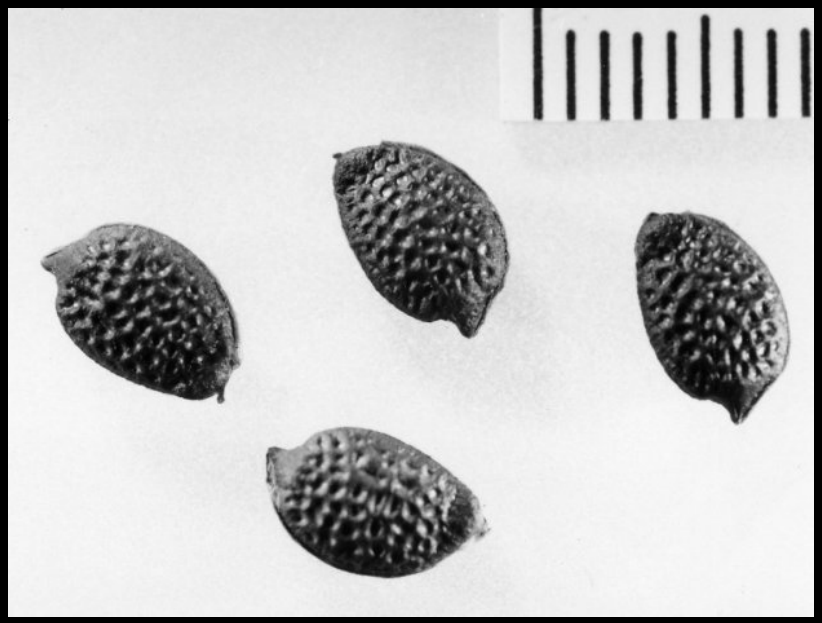
0.7 – 1.4 mm

“dust”

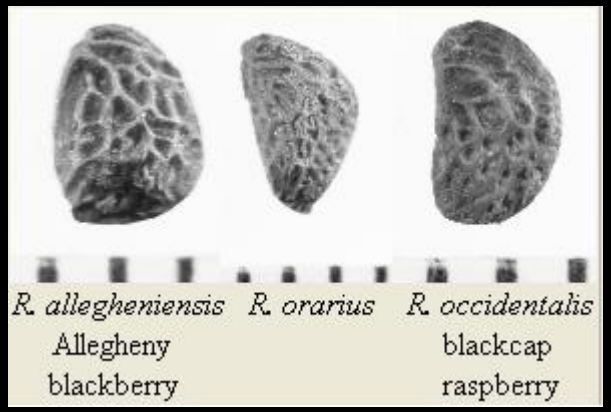
Biases in Identification

- Materials with distinctive patterned textures easier to identify, even when fragmentary
- Smaller seeds less likely to break

Passiflora incarnata L. - Maypops (passionflower; maypops)

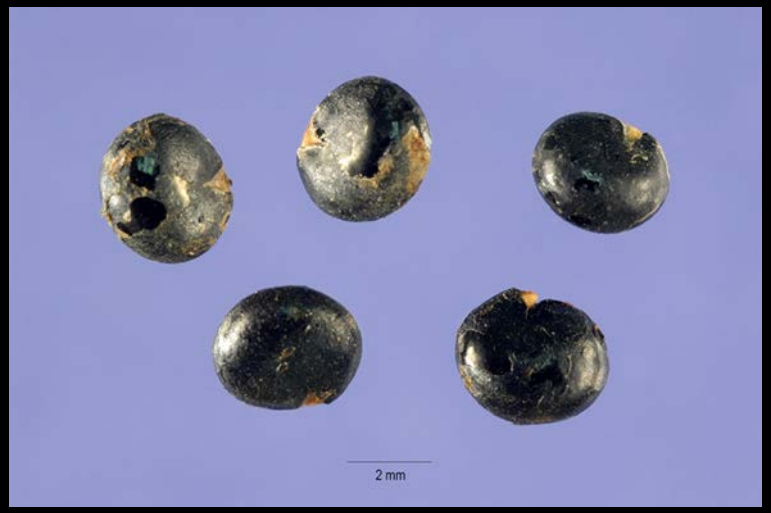


***Rubus* spp.** - Blackberry, raspberry, dewberry, bramble



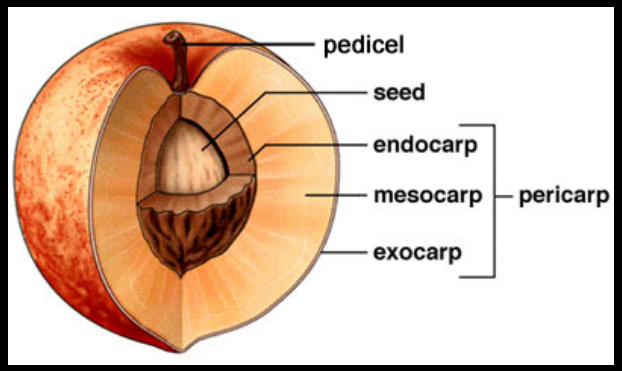
***Vitis* sp. – grape**

Phytolacca americana, pokeweed

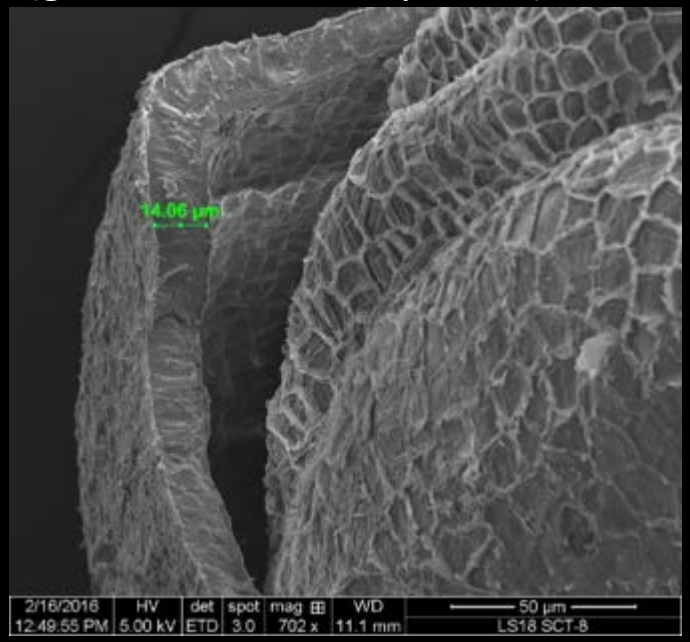


Carya sp. Hickory nutshell

Prunus persica, peach

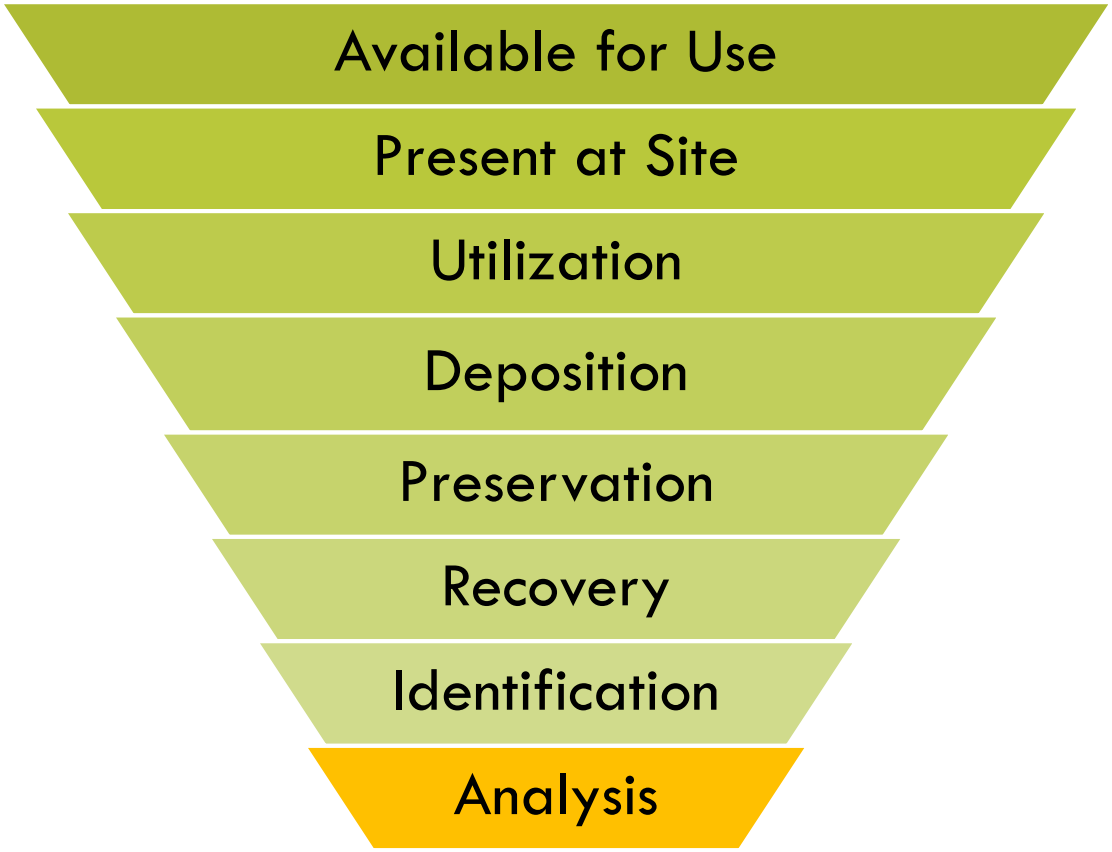


Chenopodium berlandieri,
(goosefoot, lambs quarter)



Zea mays, corn cupule

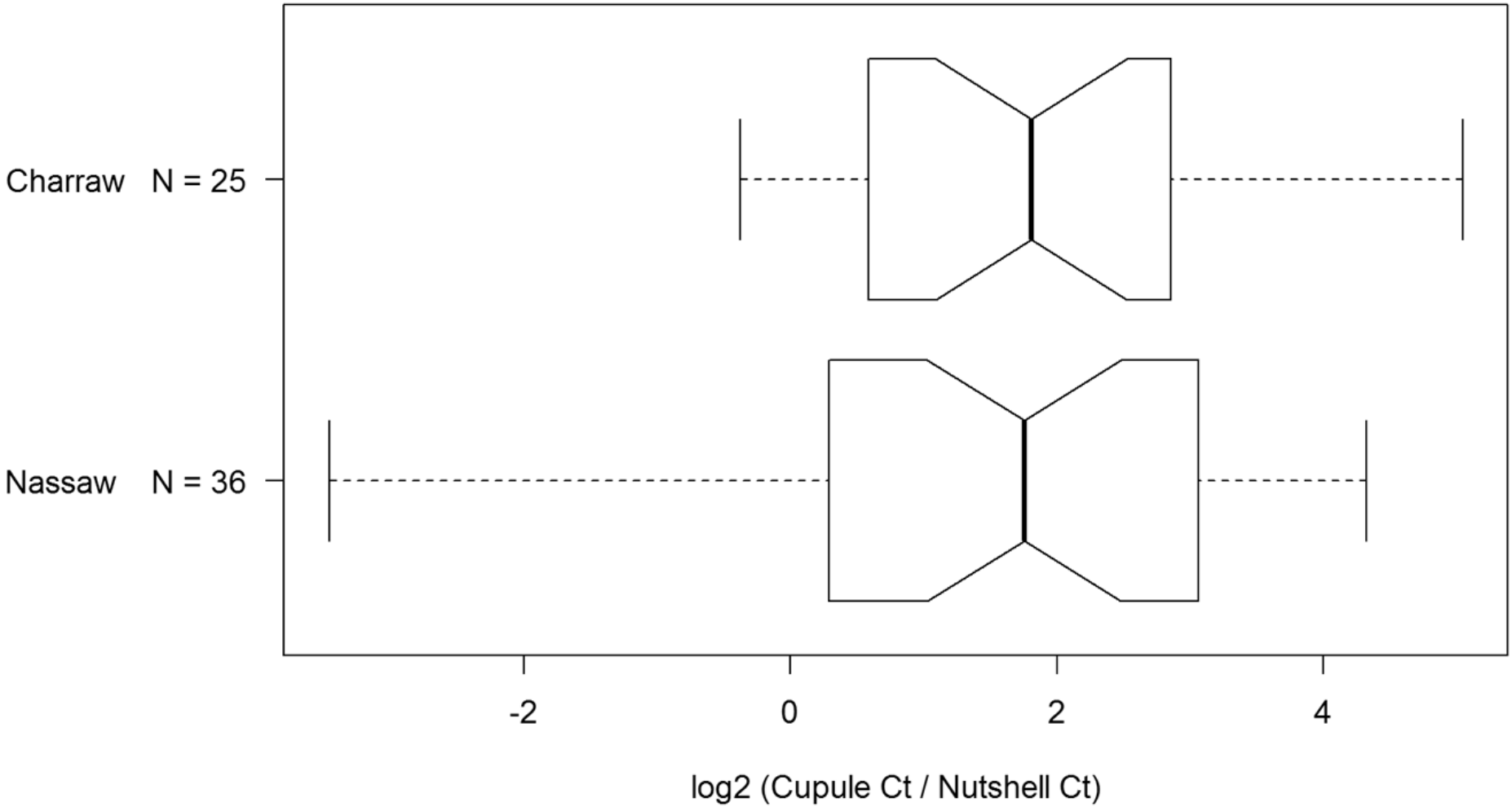
Making Sense of Data: Analysis



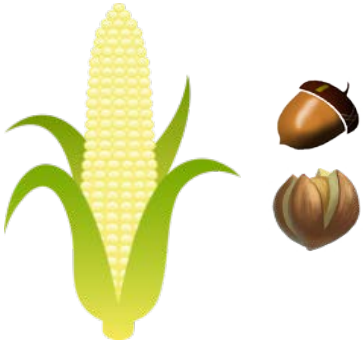
Interpreting Archaeobotanical Data

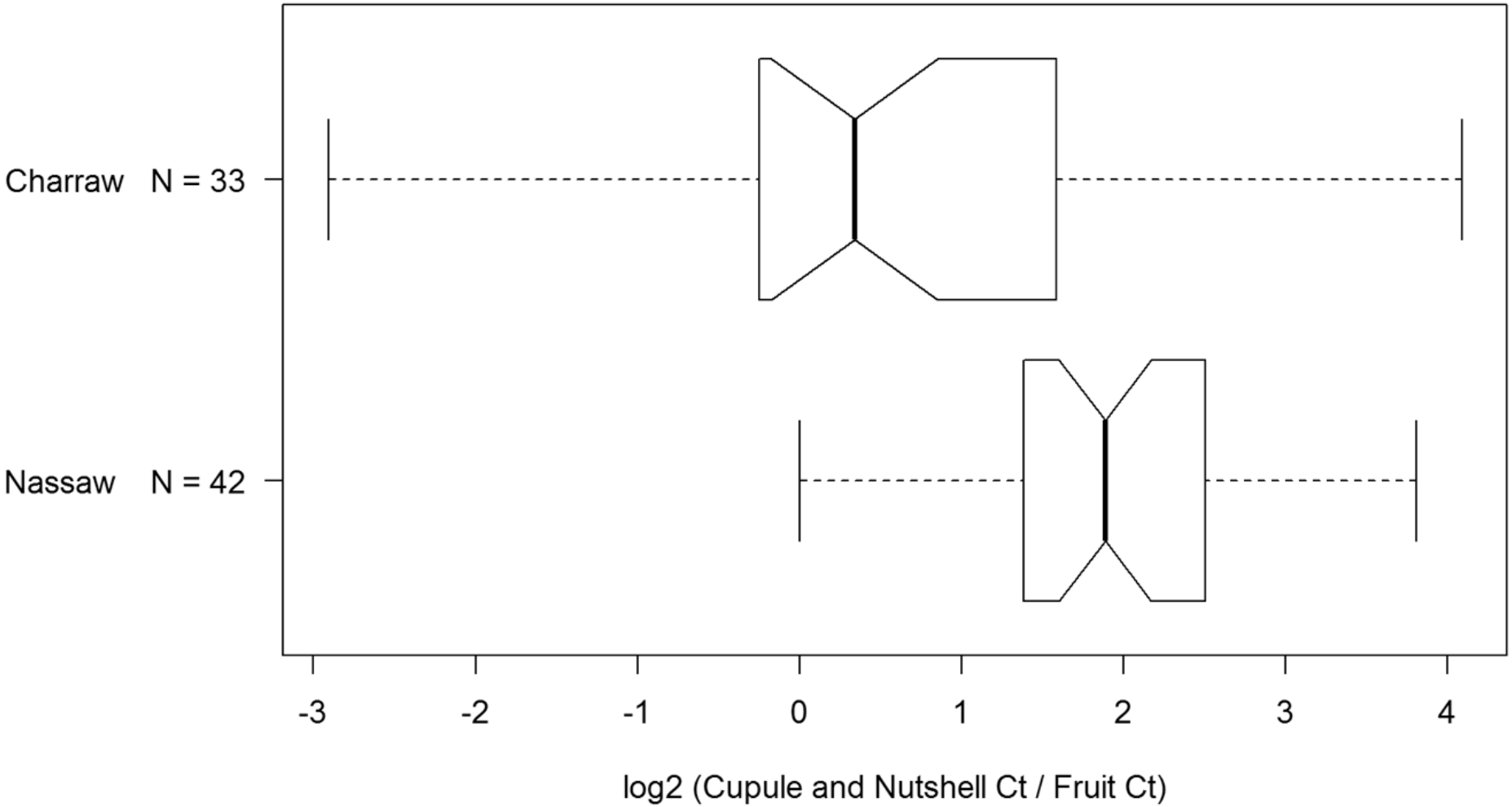
- **Problem:** Counts of different species more related to preservation factors than use
- **Solution:** Use proportions of one material type relative to another

VS



VS




Charraw N = 33
Nassaw N = 42
-3
-2
-1
0
1
2
3
4
log2 (Cupule and Nutshell Ct / Fruit Ct)

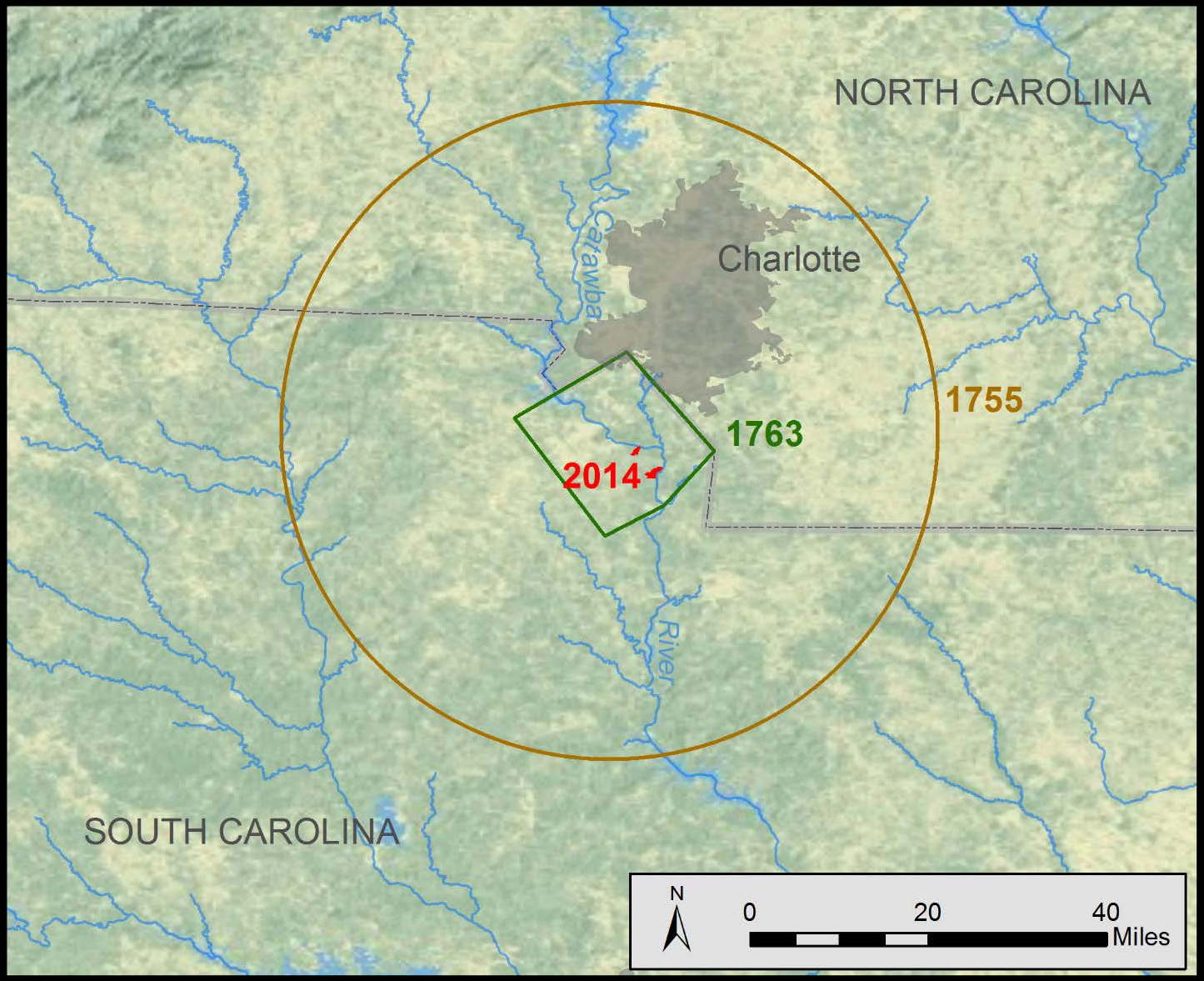
Other Means of Standardization

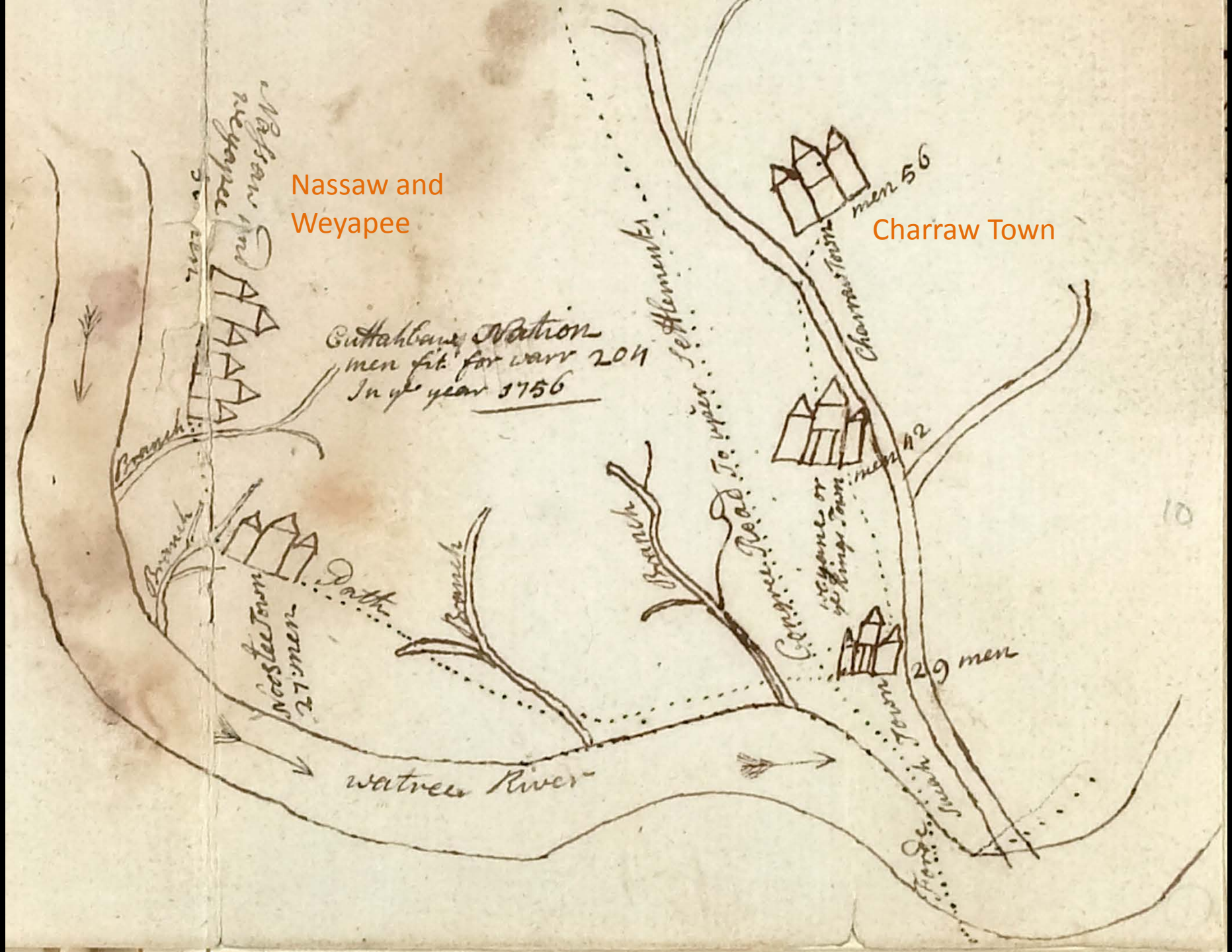
- Divide by volume of sample
- Divide by weight of carbonized material
- Ubiquity

Examples of Research Topics

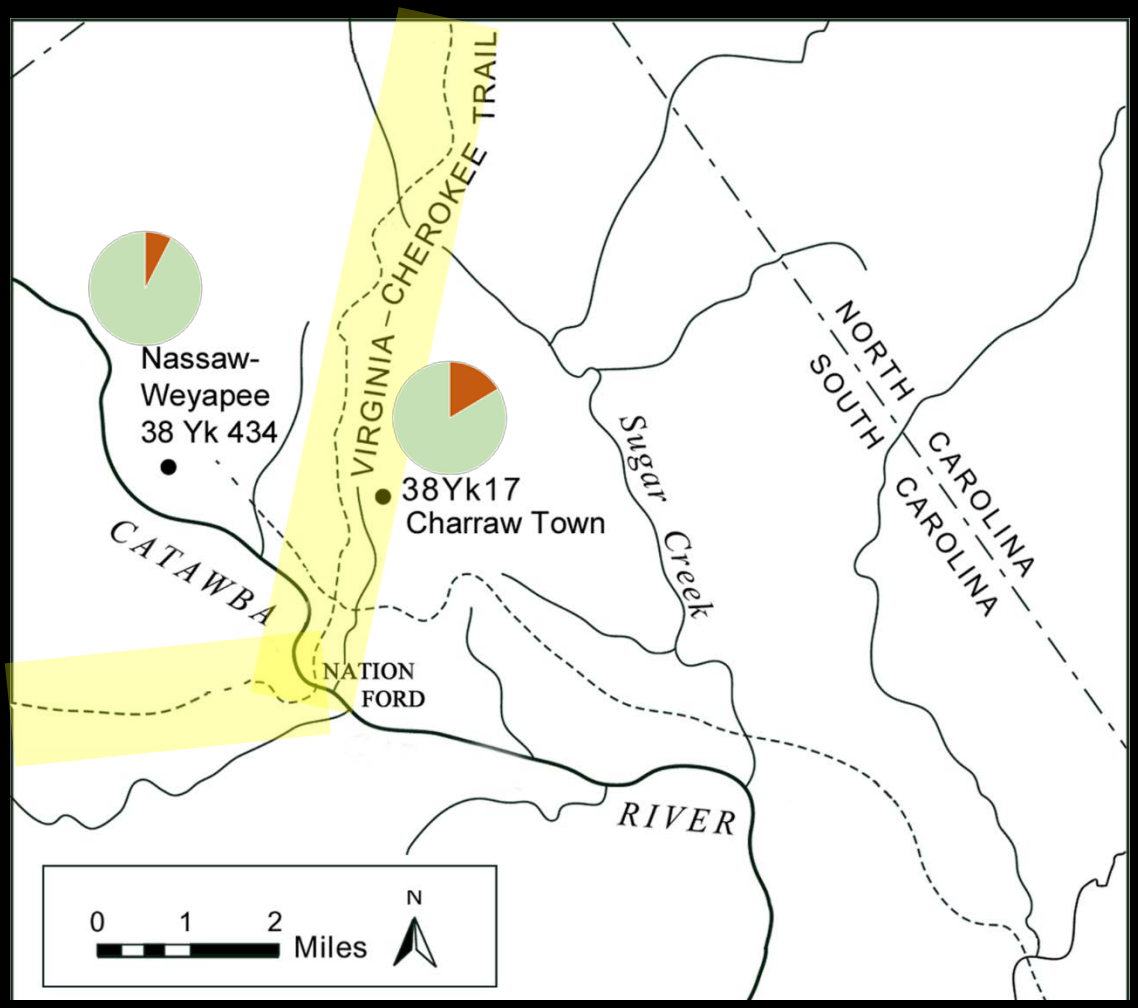
- What was the environment like in the past, and how did people impact the environment?
- How, where, and why were certain plants domesticated? How and why were introduced plant foods adopted?
- What role did feasting play in past societies? How were staple plant foods stored, and who owned and controlled these stores?

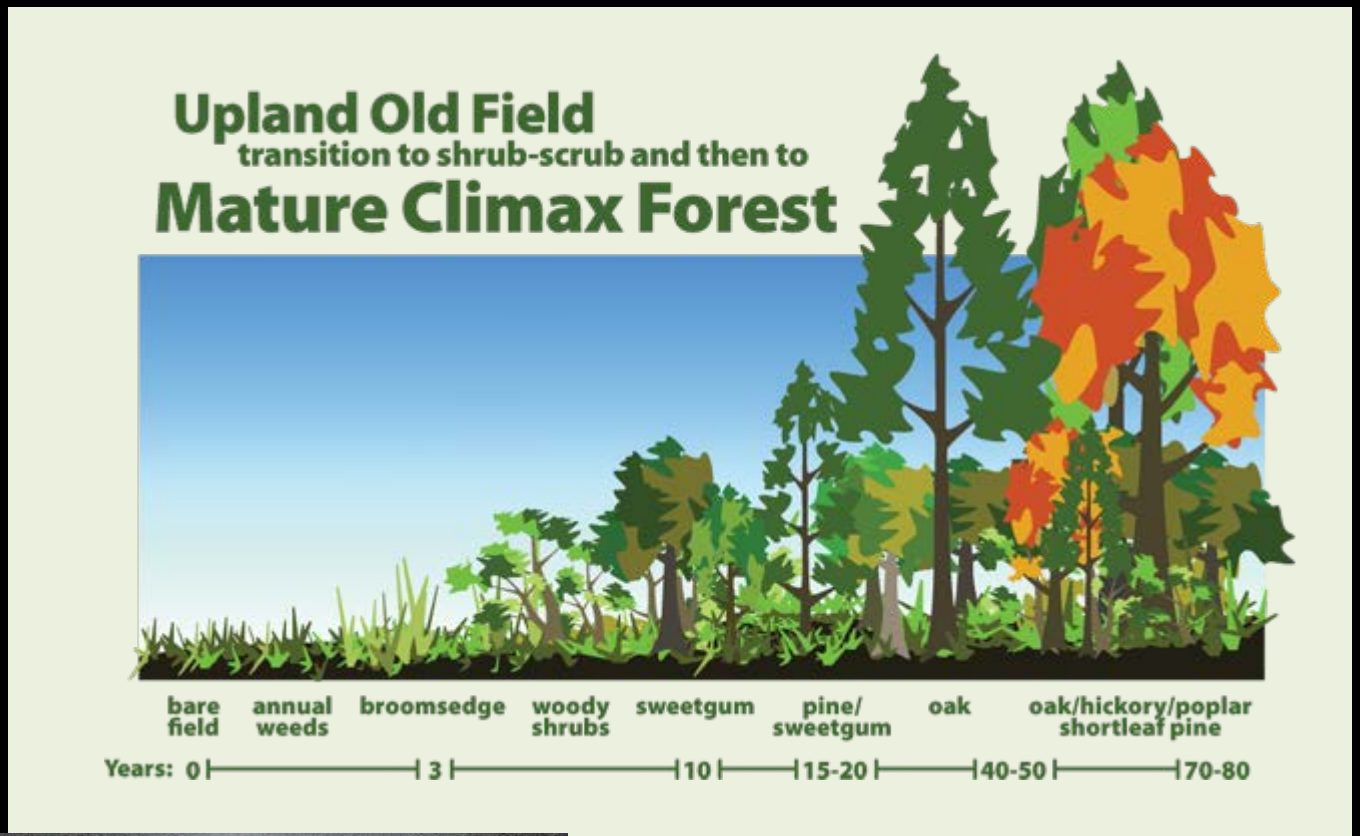
Extent of Catawba Indian Nation, 1755 to 2014

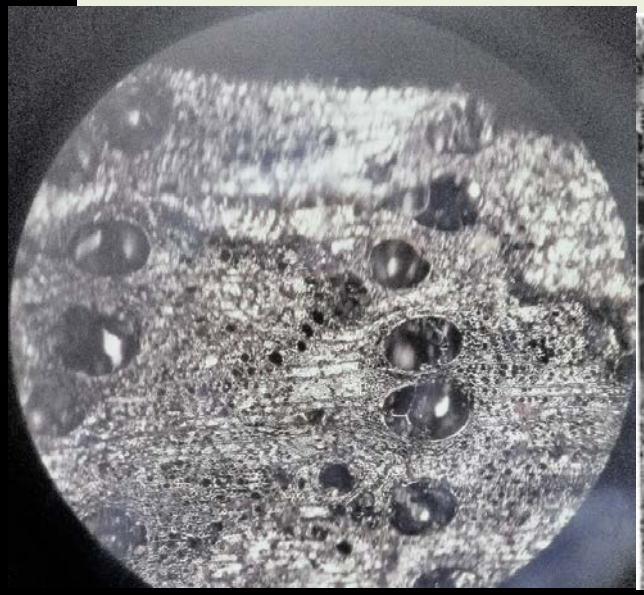


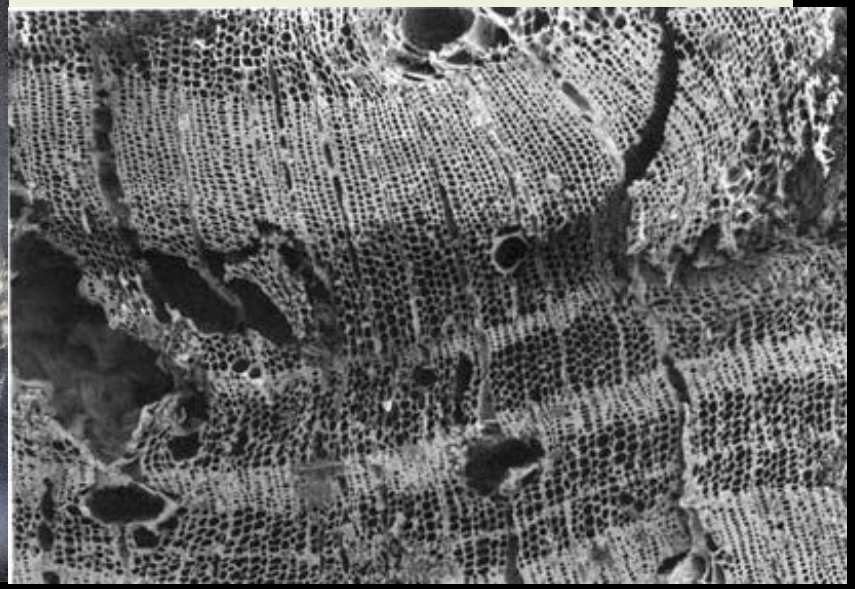

Nassaw and Weyapee
Charraw Town
Cuttahbaw Nation
men fit for warr 204
In ye year 1756
men 56
men 42
29 men
Path
Branch
Branch
Branch
Road to Upper settlements
Weatree River
Charraw Town
Weyapee or Lower Town
Nassaw Town
Nassaw Ind
Weyapee Ind
10

Vine/Shrub Fruit	Nassaw-Weyapee	Charraw Town
Maypop	66	191
Grape	22	55
Blackberry/Raspberry	92	27
TOTAL	180/2358	273/1666



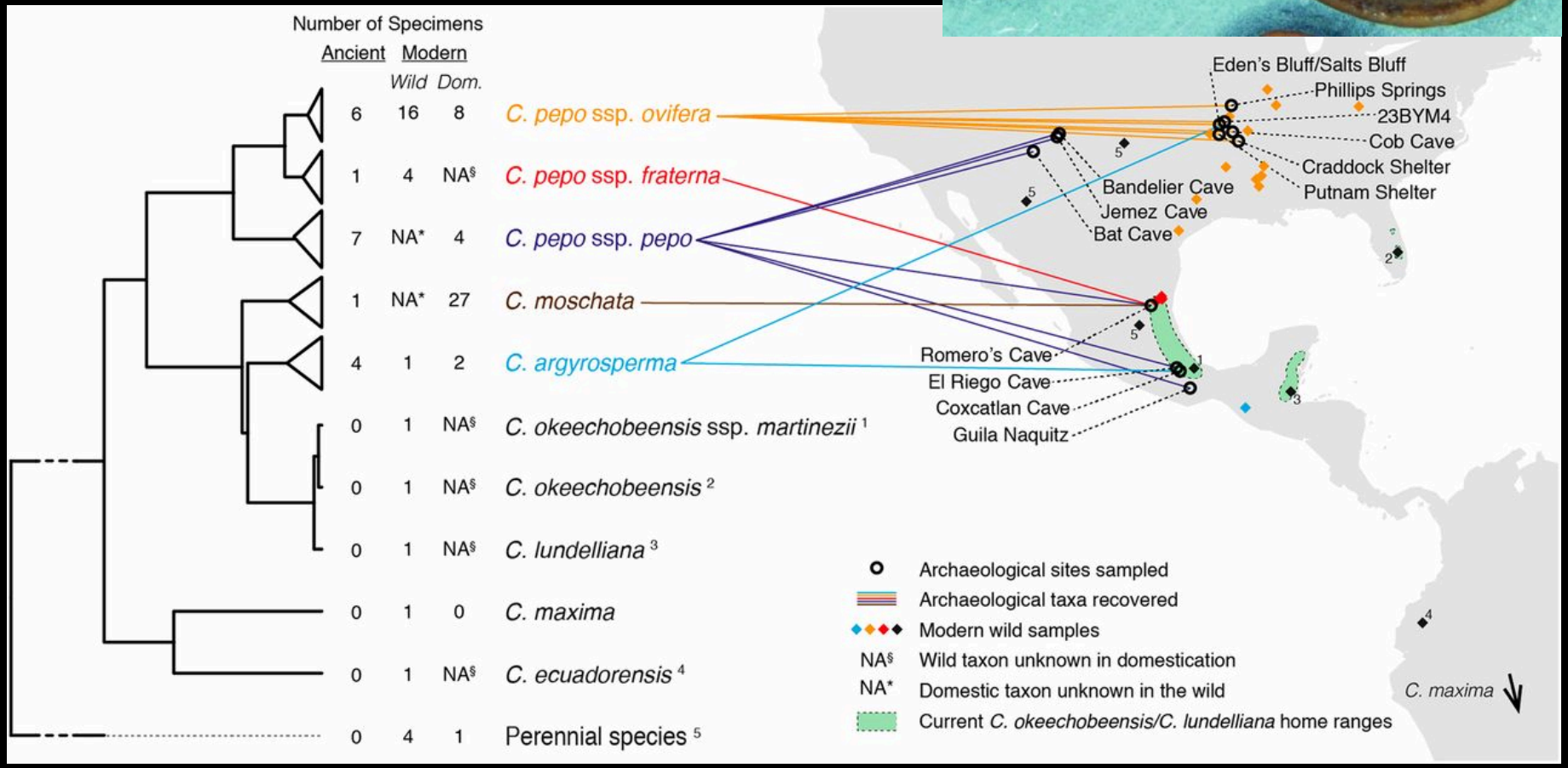

Upland Old Field
transition to shrub-scrub and then to
Mature Climax Forest
bare field
annual weeds
broomsedge
woody shrubs
sweetgum
pine/ sweetgum
oak
oak/hickory/poplar shortleaf pine
Years: 0
3
10
15-20
40-50
70-80

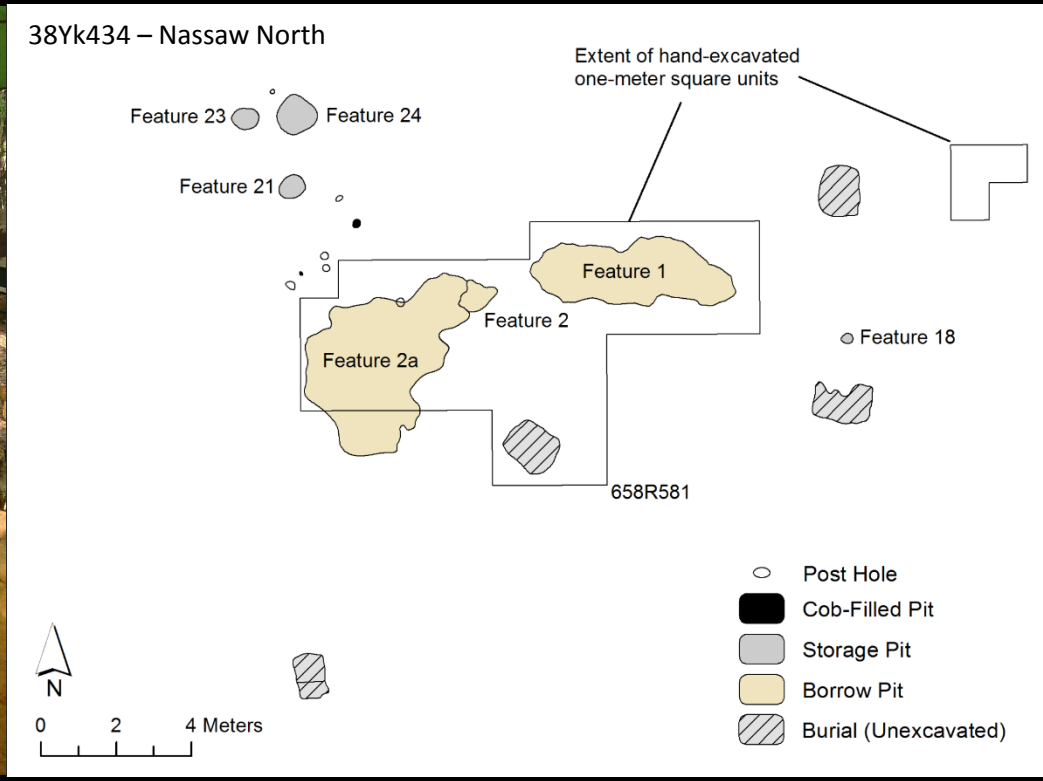


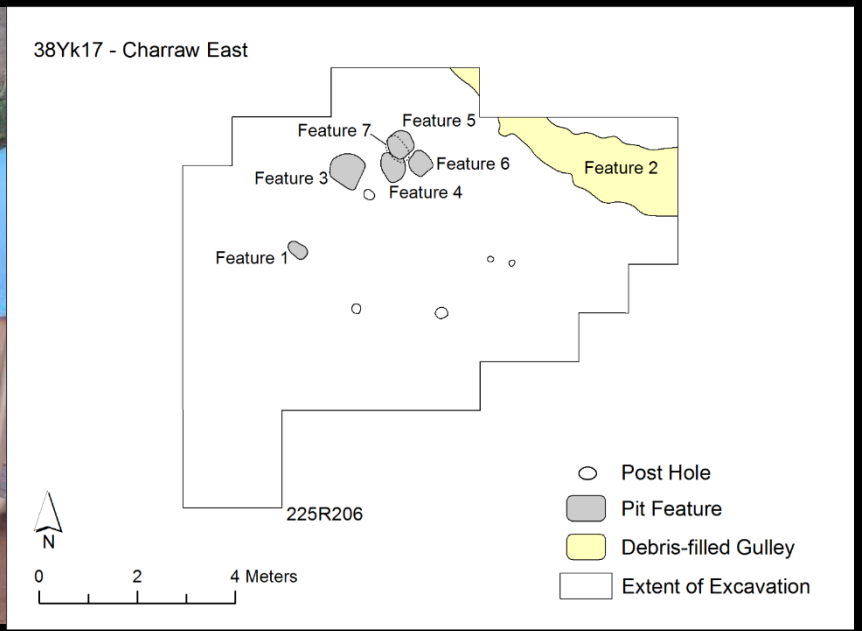


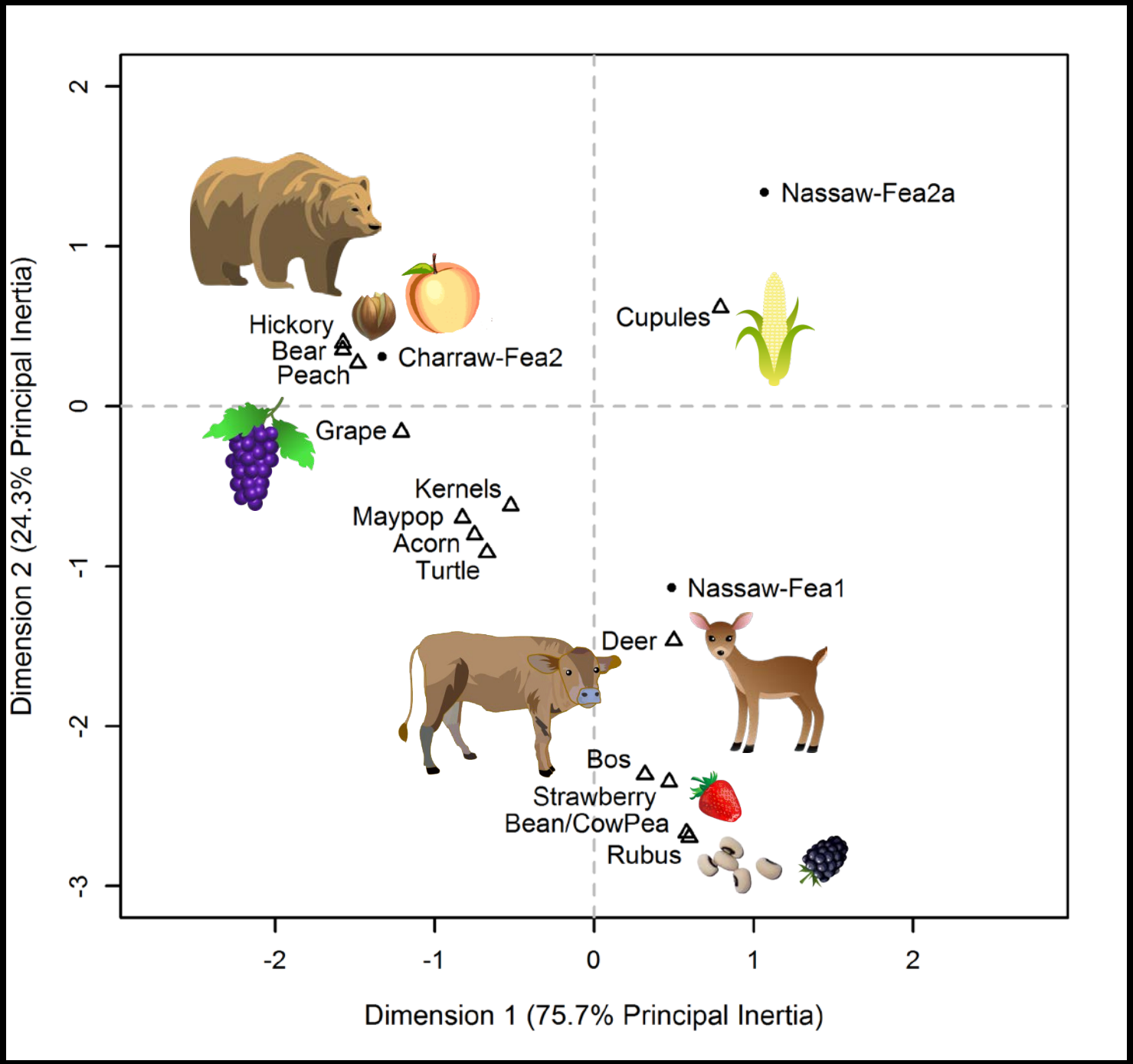
Gourds and squashes (*Cucurbita* spp.) adapted to megafaunal extinction and ecological anachronism through domestication

Logan Kistler[a,b,c,1], Lee A. Newsom[a,d], Timothy M. Ryan[a,e], Andrew C. Clarke[f], Bruce D. Smith[g,h], and George H. Perry[a,b,1]




38Yk434 – Nassaw North
Extent of hand-excavated one-meter square units
Feature 23
Feature 24
Feature 21
Feature 1
Feature 2
Feature 2a
Feature 18
658R581
Post Hole
Cob-Filled Pit
Storage Pit
Borrow Pit
Burial (Unexcavated)
N
0
2
4 Meters


38Yk17 - Charraw East
Feature 7
Feature 5
Feature 6
Feature 3
Feature 4
Feature 2
Feature 1
225R206
Post Hole
Pit Feature
Debris-filled Gulley
Extent of Excavation
N
0
2
4 Meters


Nassaw-Fea2a
Cupules
Hickory
Bear
Peach
Charraw-Fea2
Grape
Kernels
Maypop
Acorn
Turtle
Nassaw-Fea1
Deer
Bos
Strawberry
Bean/CowPea
Rubus
2
1
0
-1
-2
-3
-2
-1
0
1
2
Dimension 2 (24.3% Principal Inertia)
Dimension 1 (75.7% Principal Inertia)

Conclusion: Take-Away Points

- Plant materials can help answer many different types of questions, not just about what people ate
  - Site formation processes
  - Fuel use and environmental impact
  - Community organization
- Importance of sampling
  - Design sampling strategies in accordance with site type, materials present, and research questions