Holocene Hunter-Gatherers, Domestication, & Food Production

1

Quick note about hunter-gatherers

- Today I will refer to hunter-gatherer groups a lot. When I say this, I mean the hunter-gatherer groups that lived at the end of the Pleistocene and the start of the Holocene
- I am not referring to cultural groups that practice hunting and gathering today, although they teach us a lot.
- I am not suggesting that hunter-gatherer groups have not changed in the last 10,000 years. This idea is certainly FALSE. But, instead they let us "see how hunting and gathering can work for a particular culture and environment."
- Also, archaeologists realize we aren't seeing the full cultural spectrum of hunter-gatherer lives in the ethnographic "present".
- Sometimes the term "foragers" is used interchangeably.

2

Foraging Society

Farming Society

Fossil Fuel Society

3

Foraging Society

For over 95% of all human history, everyone was a hunter-gatherer. There were zero farmers.

There were no political States or Empires.

There were no cities.

There were no Monarchs, no human-like deities or moralizing-punishing gods

Energy captured from "nature" based on wild (non-domesticated) plants and animals.

Average H-G produced ~5,000 kcal/cap/day
a little lower near the equator, higher near poles
-- as food, tools, cooking fuel, clothing, shelter

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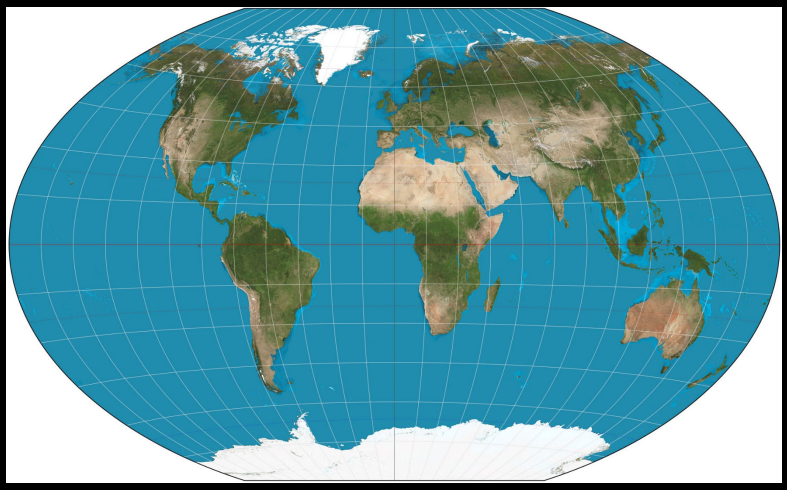
By 13,000 years ago, humans populated all continents (except Antarctica)



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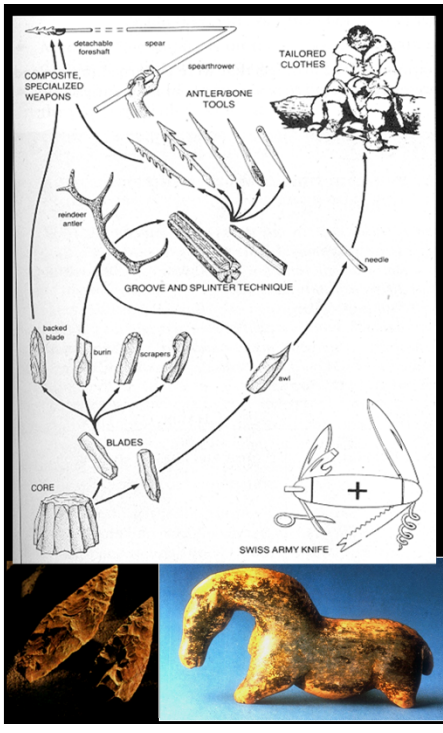

By the Upper Paleolithic, *Homo sapiens* showed cultural & technological adaptability to a diverse array of environmental & social conditions.

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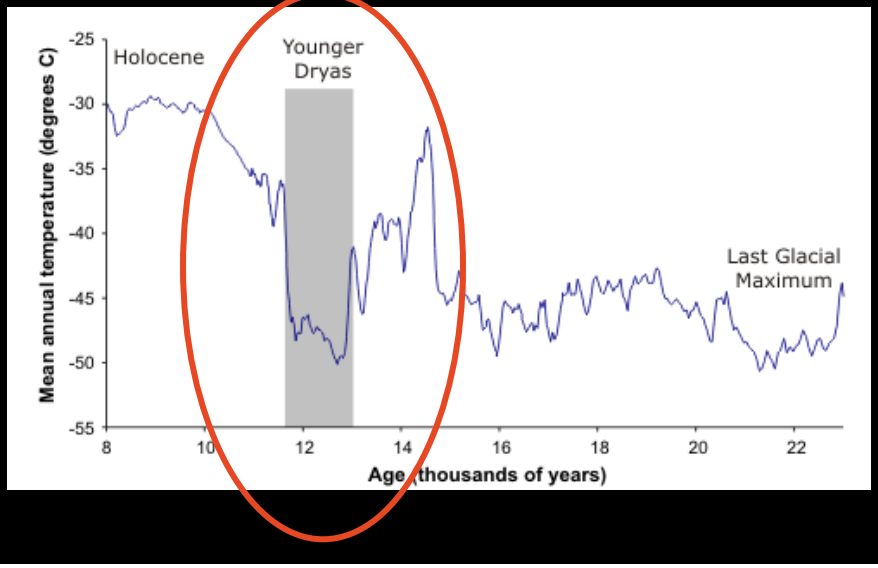
Major climatic oscillations at the end of the last Ice Age



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Major environmental changes at the end of the last Ice Age

- Glacial retreat in Northern Hemisphere, eventually to modern extent.
- Sea-level rises, by hundreds of feet, drastically changing coastlines and interior water courses.

1/3

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Major environmental changes at the end of the last Ice Age

- Redistribution of many animal and plant species.
- Extinction of many species, especially Ice Age megafauna.

2/3

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North American mammalian genera & species that went extinct in the Late Pleistocene (common name):

- Southern pampathere
- Northern pampathere
- Simpson's glyptodont
- Jefferson's ground sloth
- Ruscon's ground sloth
- Shasta ground sloth
- Harlan's ground sloth
- Short-faced skunk
- Dhole
- Spectacled bear
- Giant short-faced bear
- Saber-toothed cat
- Scimitar cat
- American cheetah
- Giant beaver
- Holme's capybara
- Pickney's capybara
- Aztlan rabbit
- Horses
- Tapirs
- Long-nosed peccary
- Flat-headed peccary
- Yesterday's camel
- Large-headed llama
- Stout-head llama
- Mountain deer
- Stag-moose
- Diminutive pronghorn
- Shuler's pronghorn
- Saiga
- Prongerns (*Stockoceros* spp.)
- Shrub ox
- Harlan's musk ox
- American mastodon
- Mammoth
- Beautiful armadillo
- Dire wolf
- Spectacled bear
- American lion
- Harrington's mountain goat
- Bison

Note: there is no reason to memorize this list!!

10

Major environmental changes at the end of the last Ice Age

- Northern expansion of biotic zones: ice-covered areas successively replaced by tundra, grassland, fir & spruce forests, pine forests, then mixed deciduous forests.
- Ice Age lakes in some regions dried up, creating arid and desert zones (e.g., parts of American West, Middle East, Africa).

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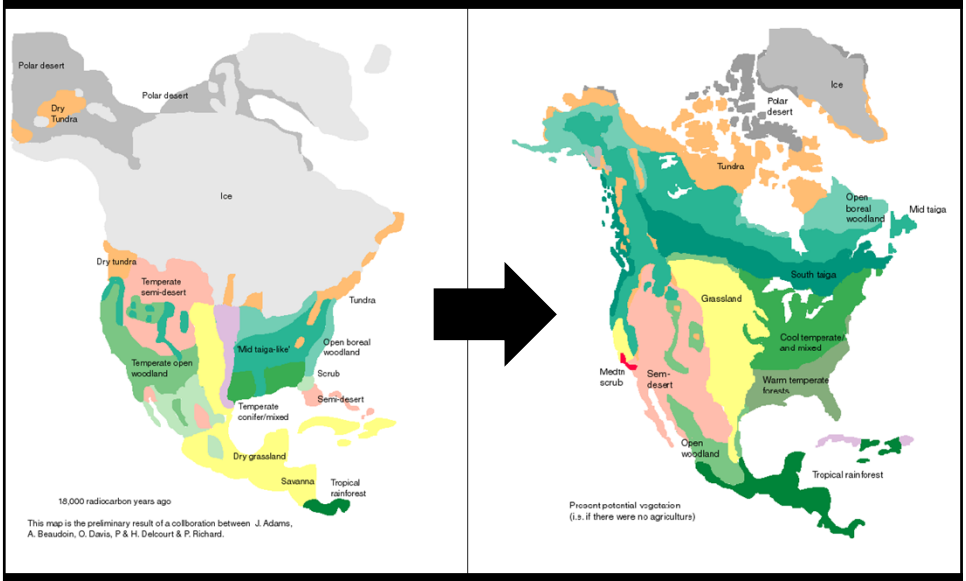

~20,000 years ago

5,000 years ago

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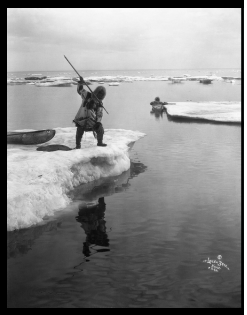
The human potential for cultural/technological & behavioral plasticity that allowed us to initially populate the entire world also allowed us to adapt to drastically changing local environmental conditions at the end of the Pleistocene (diversify culturally & technologically).



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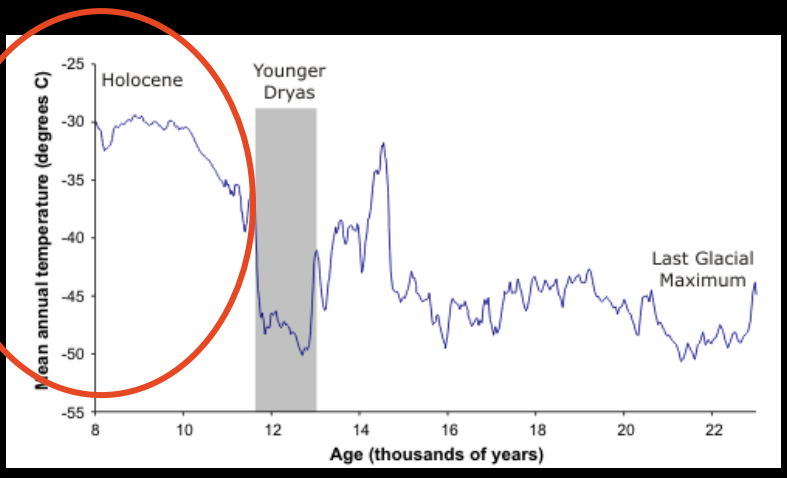

Holocene – geological epoch in which we live now*; the Holocene follows the Pleistocene, and began ~10,000-11,000 years ago.

"Upper Paleolithic" groups around the world diversified their cultures substantially during the early Holocene.

*but see literature on the "Anthropocene"

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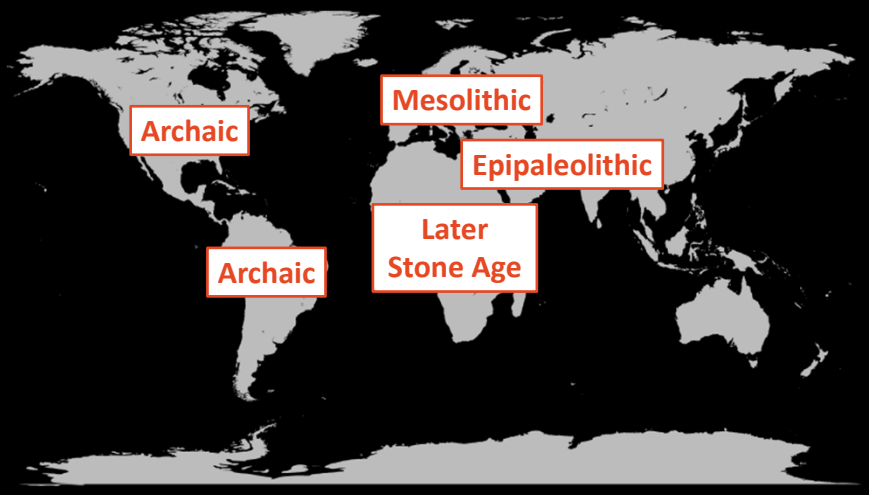
Early Holocene cultural adaptations & diversity among hunter-gatherers: Archaeological Culture Periods



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Early Holocene cultural adaptations & diversity among hunter-gatherers

- H-Gs Extracted resources from a range of local resources
  - Gathering (+diversity of plants), hunting, & fishing (including shellfish)
  - No (or very little) farming or food "production"
  - Targeting of smaller mammals, birds, fish, shellfish, reptiles
- Seasonal variation (mobility & resource scheduling)
- Continued broadening of resource base
  - "Broad Spectrum"

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Broad Spectrum "Revolution"

Kent Flannery, termed it the Broad Spectrum Revolution in 1968

- Archaeologically recognized broadening of the resource base, where H-G's began exploiting a much wider range of potentially edible plant and animal species.
- Seen as a social response to environmental changes (and fluctuations) and human population growth in many local areas.
- Originally thought to have been a response to populations "spilling over" from rich areas to areas where one or a few highly prized resources were less available.
- Archaeologists quickly realized that H-G's in so-called "rich" areas were broadening resource base too.
- The "Revolution" was not overnight, but a longer-term process begun by many groups during the Upper Paleolithic, as we've already seen.

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Southwest Asia

The "Fertile Crescent"
(eventual staging area for initial domestication of plants and animals; Agriculture/farming)

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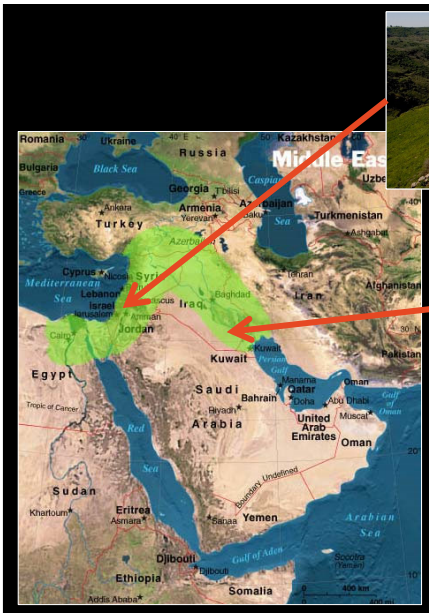

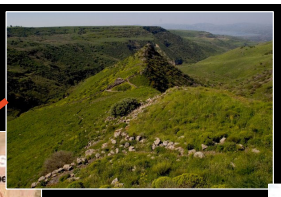

Setting:

Zone of open woodlands & grasslands

Wild animals, and wild stands of cereal grasses and legumes (non-domesticated!!)

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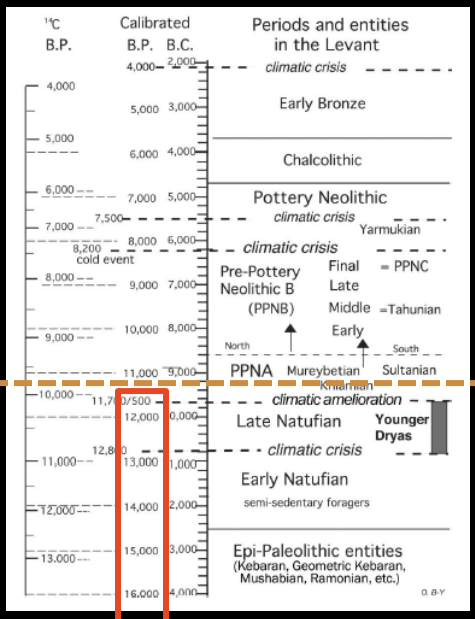

Ohalo II:

Shores of Sea of Galilee, Israel, ~19,000 BC

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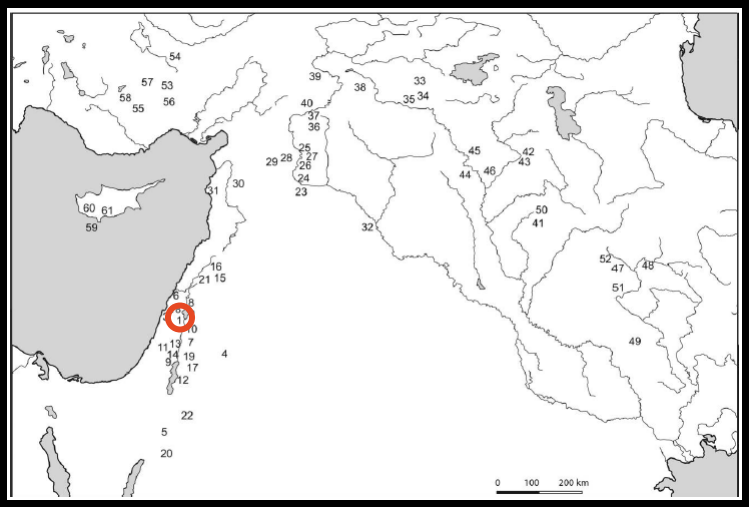
Ohalo II: shores of Sea of Galilee, Israel, ~19,000 BC



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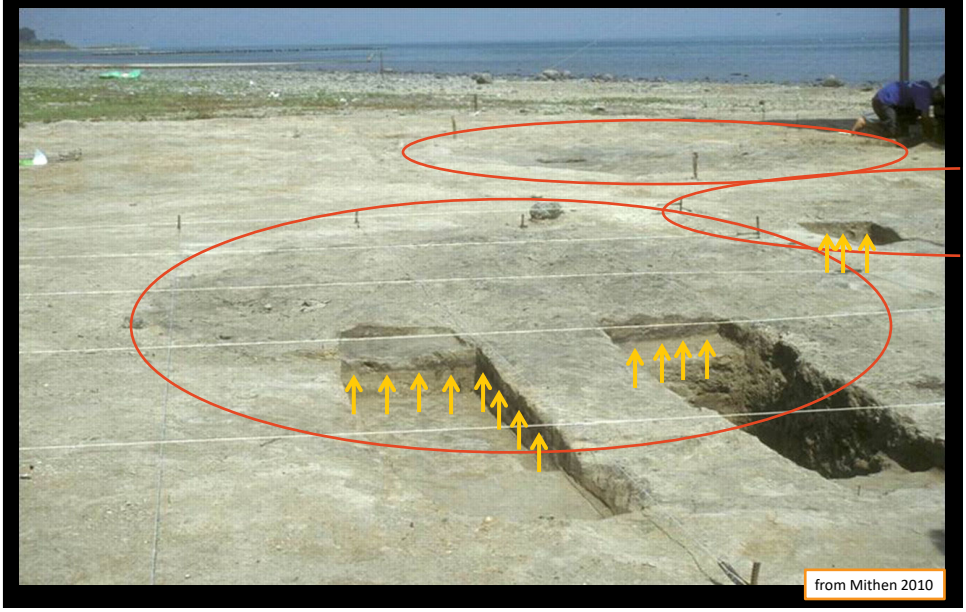
Brush hut features at Ohalo II



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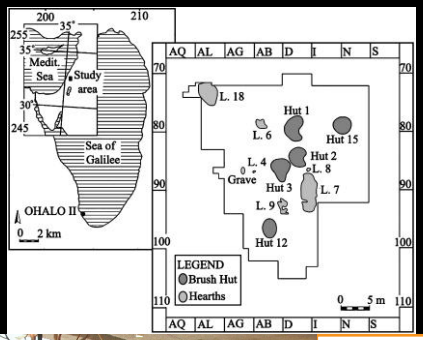
Ohalo II: ~19,000 BC

- Encampment with simple structures (how many months per year?)
- Exploiting wild emmer, barley, pistachio, grape, olives (early storage?)
- Upper Paleolithic blade toolkit, but also basalt "bowls" and pestles



Nadel et al. 2004

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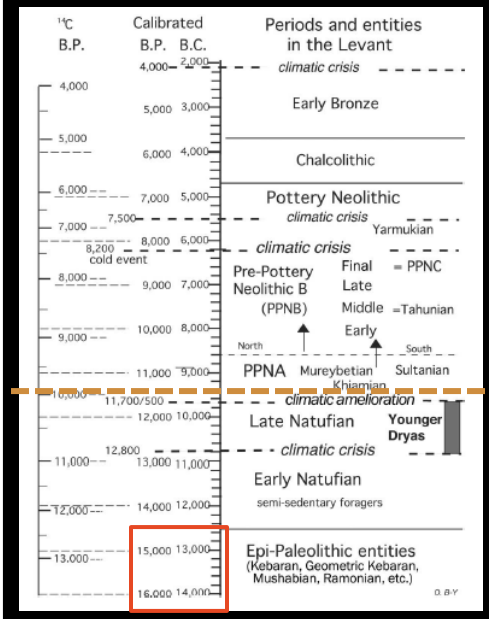

Epipaleolithic in the Levant: Geometric Kebaran

- Epi-Paleolithic "culture" in the Near East
- Small campsites & caves
- Most sites under 300 m^2
- Seasonally mobile hunter-gathers
- Becoming more focused on broad-spectrum diet

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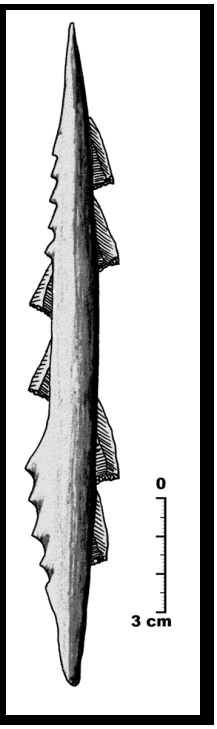
from antiquities.org.il

Geometric Kebaran

- Microlith industry (compound tools)
- Known for trapezoidal microliths
- Most sites under 300 m^2
- Seasonally mobile foragers
- Small circular huts



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The Hunter-Gatherer Lifeways Spectrum

"Foragers*" ⟷ **"Collectors*"**

- Live in very small groups
- Very mobile: As valued foods come into season within their home-range
- Little investment in shelters, storage features, etc.
- Often more difficult to locate because sites are small, lacking substantial structures, and few excess material goods left behind

- Larger population sizes
- Less mobile: Small task-groups sent out to collect resources to be brought back and shared with group
- Greater investment in shelters, storage facilities, sometimes cemeteries, etc.
- Often easier to locate because more robust structures, more pits and cooking features, and more trash/refuse accumulation (i.e., middens).

* Both of these terms refer to Hunter-Gatherers

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The Hunter-Gatherer Lifeways Spectrum

"Foragers" ⟷ "Collectors"

"Simply put, '**foragers** can be characterized as people moving to resources, while **collectors** move resources to people.'"

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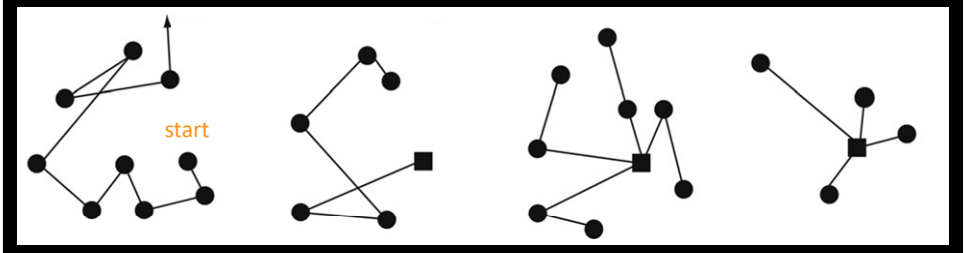
Spectrum displaying # of foraging moves (*n*) a group makes before returning to home base (*black square*)

"Foragers*" ⟷ "Collectors"



n=100 n=5 n=2 n=1

- **Foragers* are not "nomadic." Their movements are planned and within a culturally circumscribed territory*

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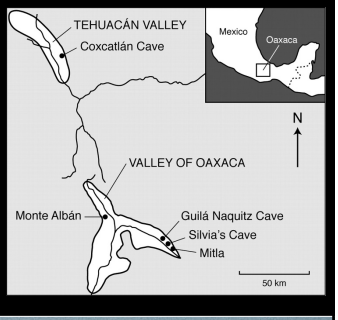
Early Holocene - Guila Naquitz site

- Stratified dry cave site
- Excavated 1960s-1970s by Kent Flannery and the Valley of Oaxaca Human Ecology Project



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Cave site excavations in Mexico

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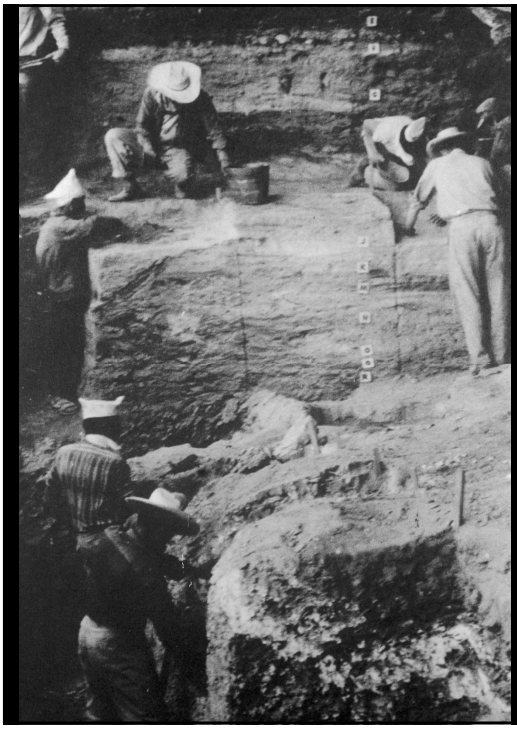

"stratified" archaeological deposits documenting several millennia of repeated human occupation

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Guila Naquitz Cave, Mexico: the Location

- Environment: **high seasonal variability**
  - Wild foods abundant in rainy season (June-Sept)
  - Wild foods scarce in dry season (Oct-May)
  - Wild foods seasonally available: oak (acorns), pinon pine (nuts), mesquite, fruits (e.g., prickly pear cactus)

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Guila Naquitz Cave, Mexico: the Setting

- Seasonal environmental variability and subsistence strategies influenced settlement systems (**scheduling**) and social organization – hunting & gathering BANDS

  - Dry Season (more "**forager**"): dispersed & highly mobile microbands (very small foraging family groups) exploiting scarce & spatially distributed resources; using upland rockshelters/caves as temporary campsites
  - Wet Season (more "**collector**"): aggregations of multiple families (probably in river valleys) into larger macrobands

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Dispersal and aggregation – US Atlantic Coast

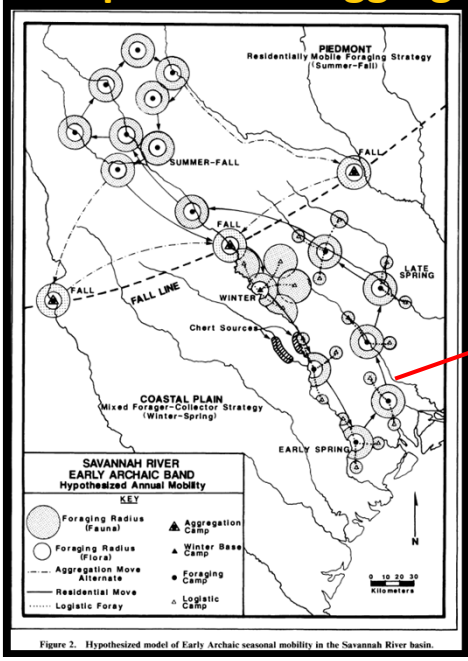

Figure 2. Hypothesized model of Early Archaic seasonal mobility in the Savannah River basin.

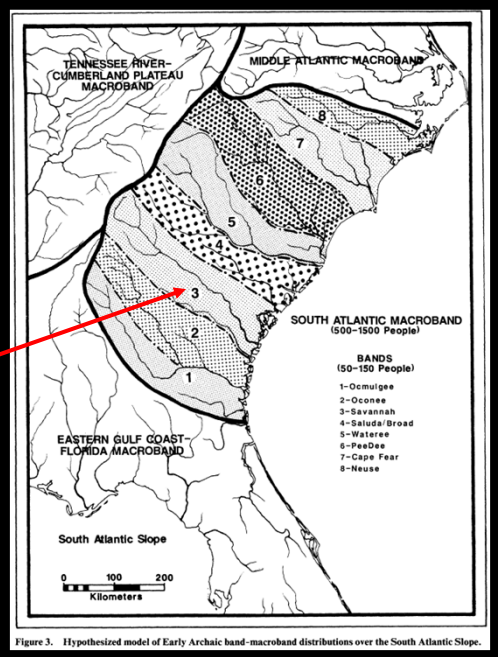

Figure 3. Hypothesized model of Early Archaic band–macroband distributions over the South Atlantic Slope.

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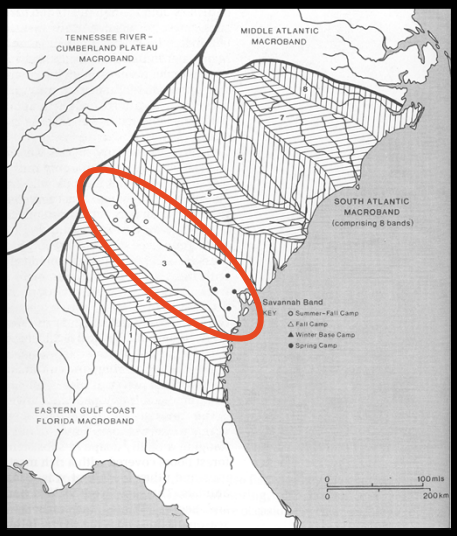
Dispersal and aggregation – US Atlantic Coast



- Lean seasons: **microbands** would be highly mobile & exploit low-density resources (scheduling).
- Productive seasons: **macrobands** would aggregate near rich sources of food & establish base camps that might be visited annually.
- Some of these aggregations would be complemented by purely social (i.e., not directly food-related) activities, such as trade, marriage, burial, etc.

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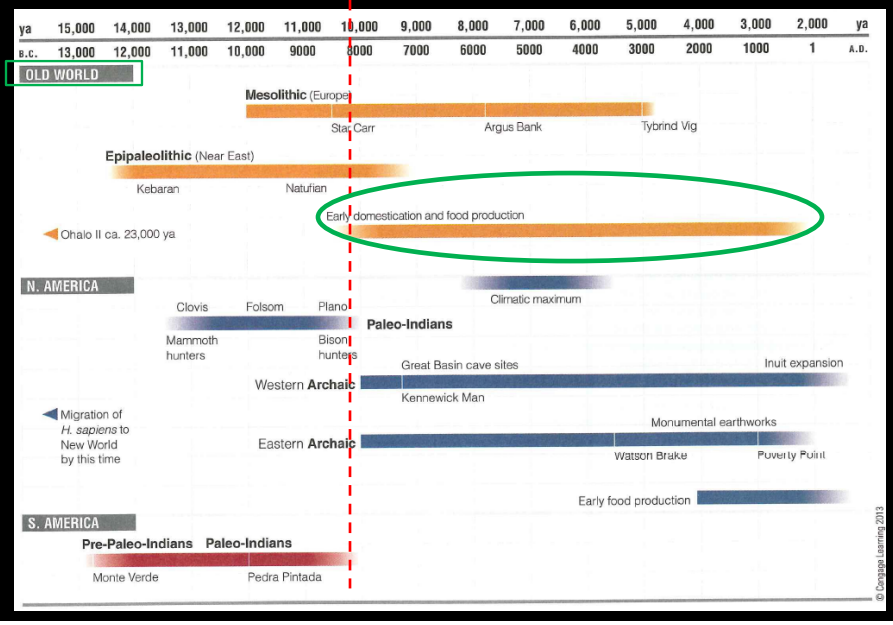
Holocene and domestication



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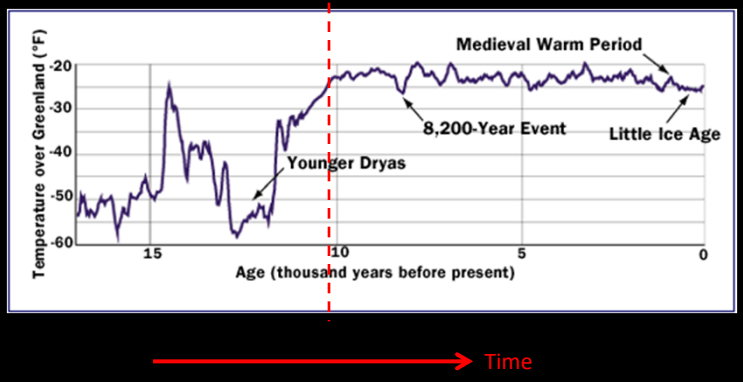
Terminal Pleistocene and Holocene Global Temperatures



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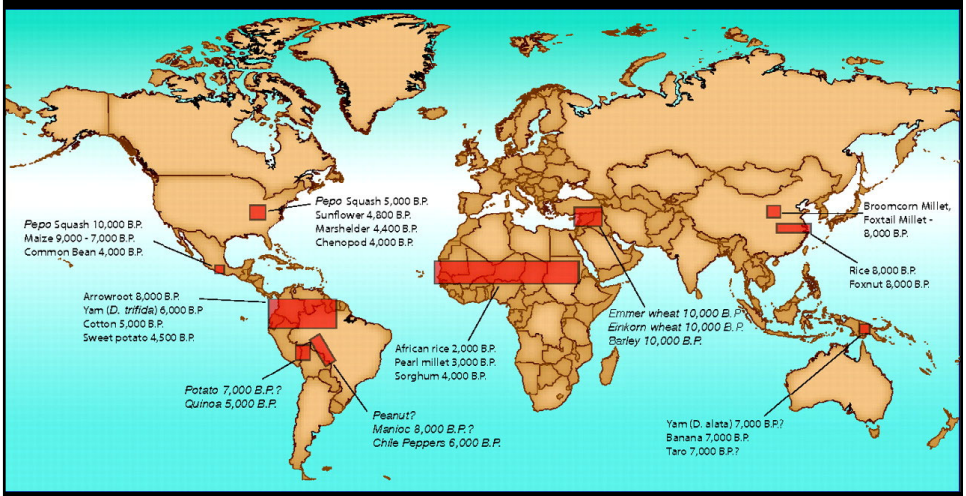
Independent plant domestication at different places and times during the post-Pleistocene (Holocene)



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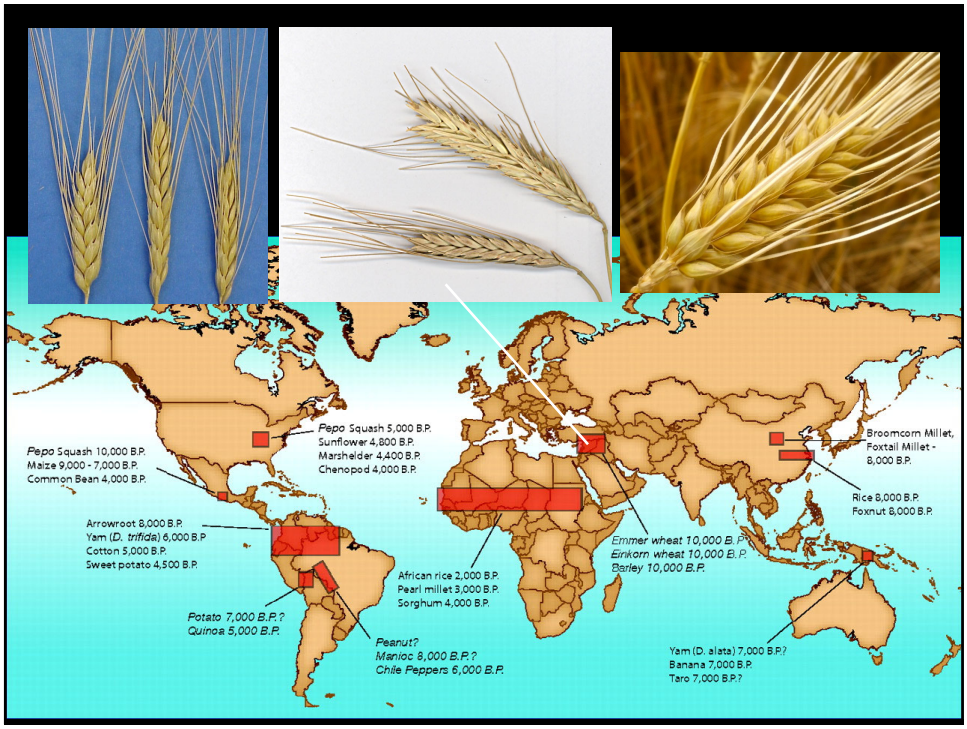
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Sweet potato 4,500 B.P.
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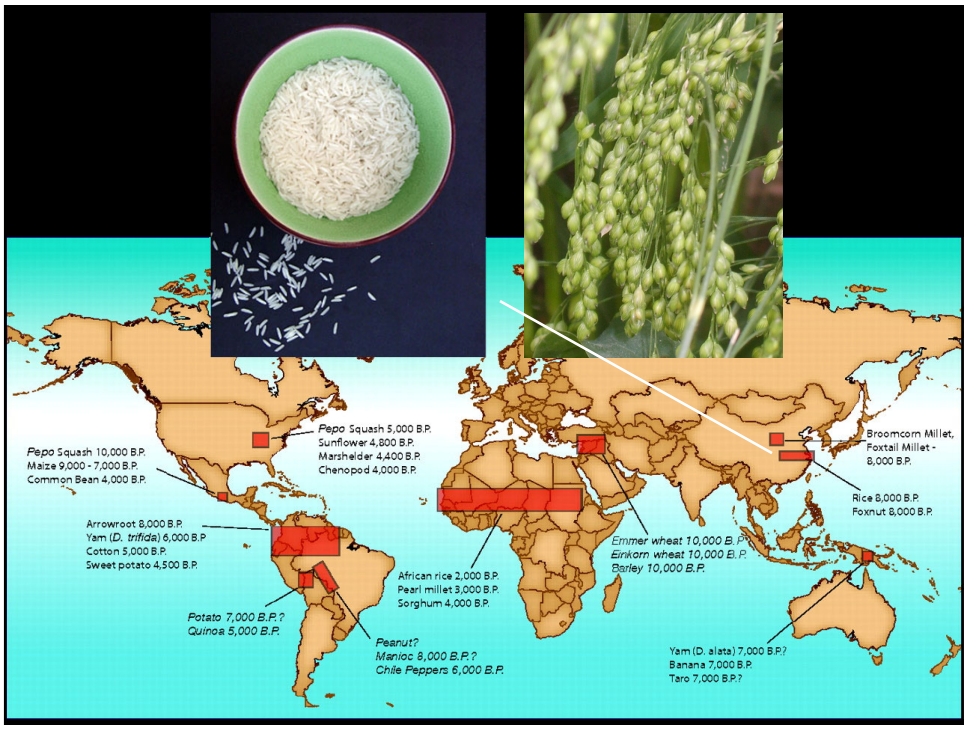
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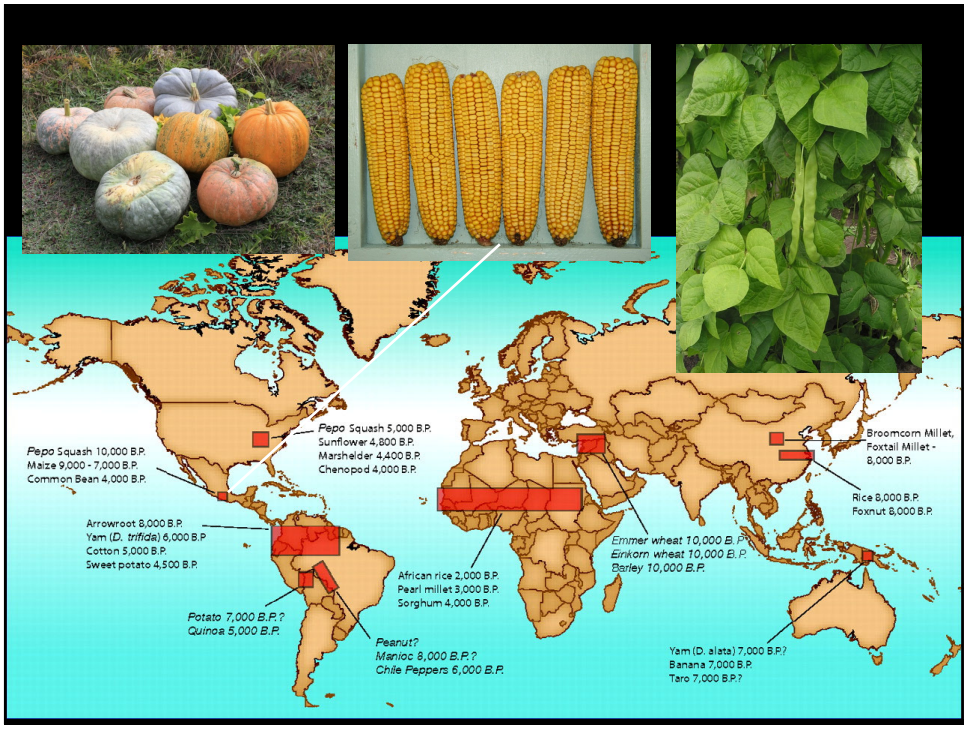
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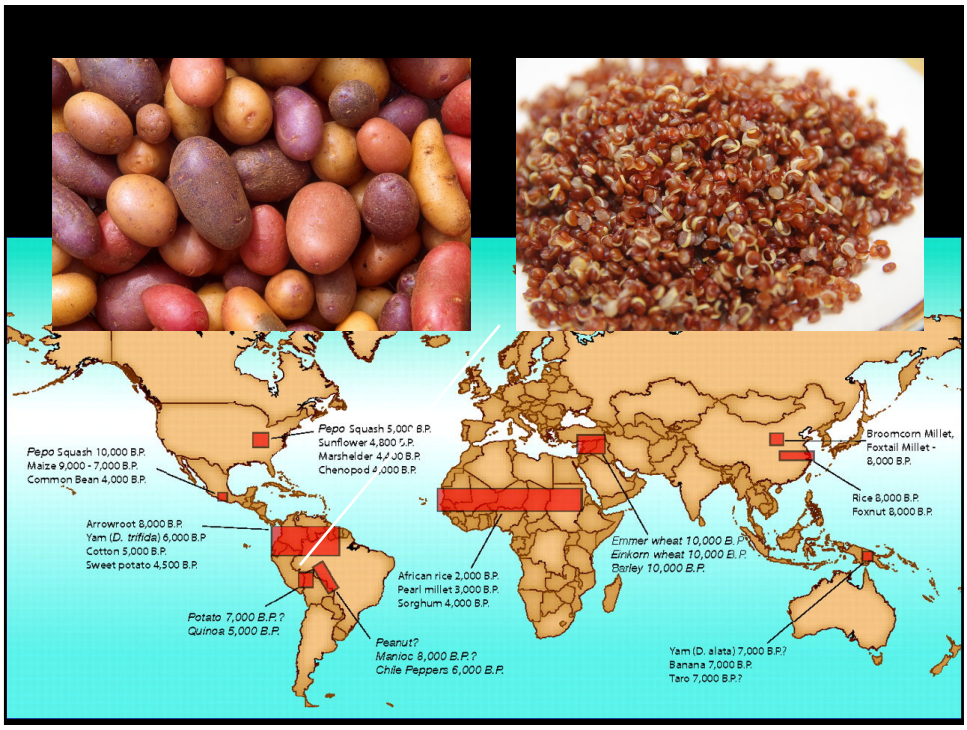
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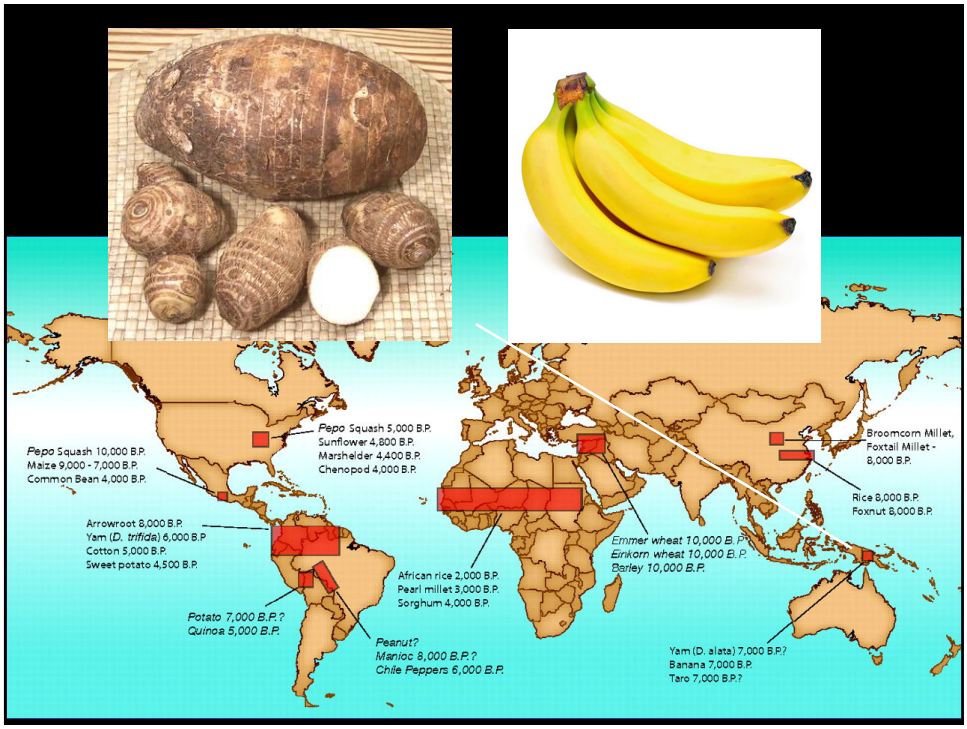
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Taro 7,000 B.P.?

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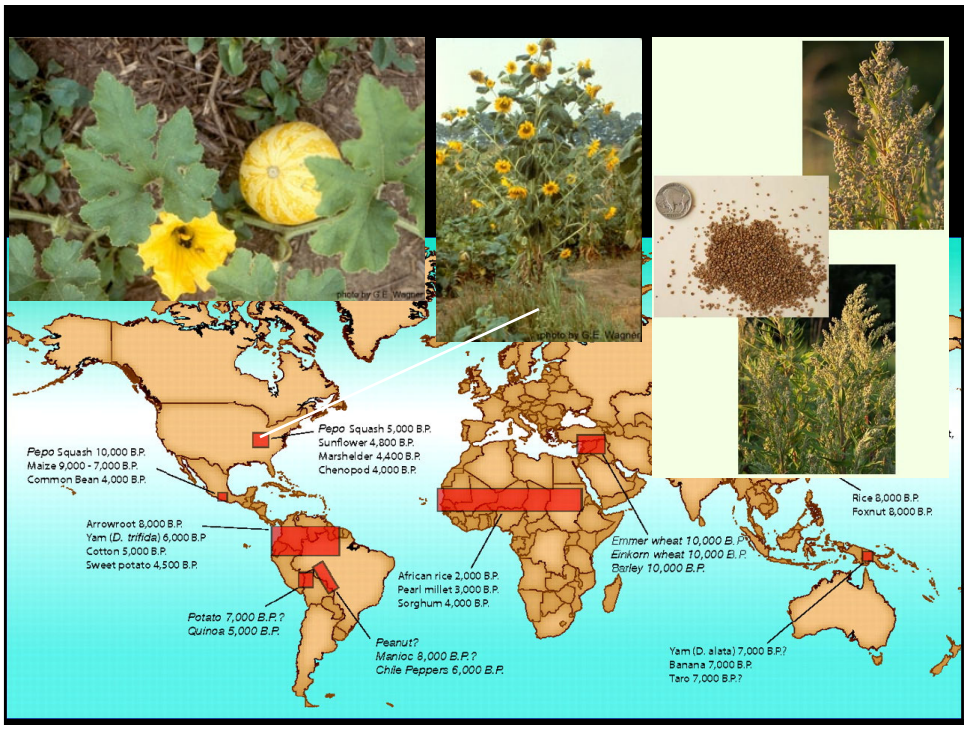
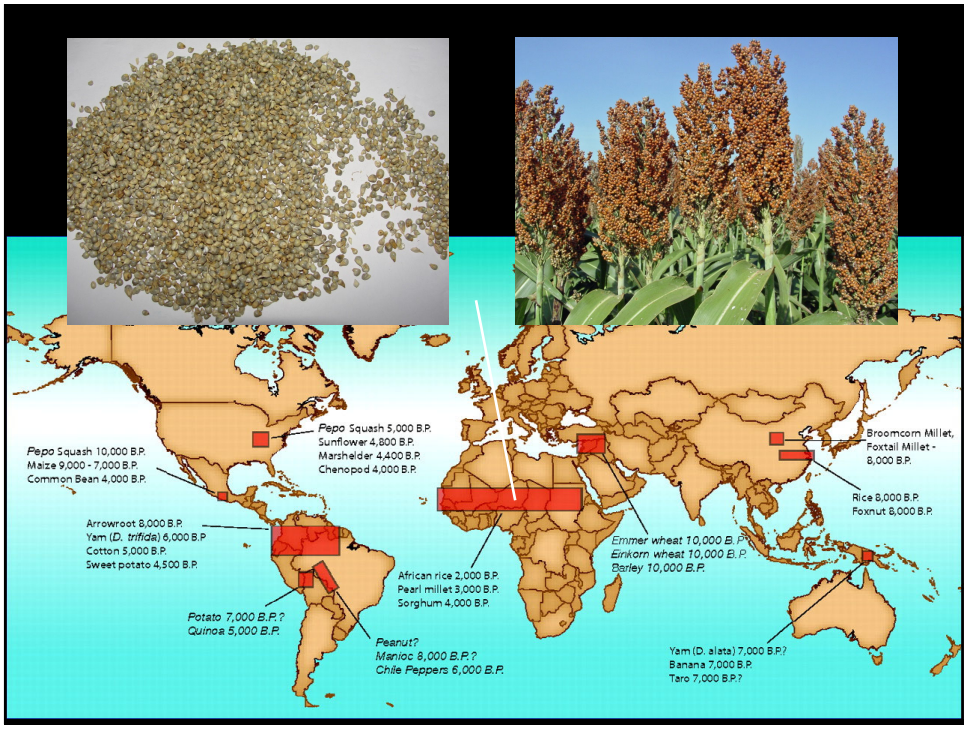


photo by G.E. Wagner
photo by G.E. Wagner
Pepo Squash 10,000 B.P.
Maize 9,000 - 7,000 B.P.
Common Bean 4,000 B.P.
Pepo Squash 5,000 B.P.
Sunflower 4,800 B.P.
Marshelder 4,400 B.P.
Chenopod 4,000 B.P.
Rice 8,000 B.P.
Foxnut 8,000 B.P.
Arrowroot 8,000 B.P.
Yam (D. trifida) 6,000 B.P
Cotton 5,000 B.P.
Sweet potato 4,500 B.P.
African rice 2,000 B.P.
Pearl millet 3,000 B.P.
Sorghum 4,000 B.P.
Emmer wheat 10,000 B.P.
Einkorn wheat 10,000 B.P.
Barley 10,000 B.P.
Potato 7,000 B.P.?
Quinoa 5,000 B.P.
Peanut?
Manioc 8,000 B.P.?
Chile Peppers 6,000 B.P.
Yam (D. alata) 7,000 B.P.?
Banana 7,000 B.P.
Taro 7,000 B.P.?

44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Marshelder 4,400 B.P.
Chenopod 4,000 B.P.
Broomcorn Millet,
Foxtail Millet -
8,000 B.P.
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Foxnut 8,000 B.P.
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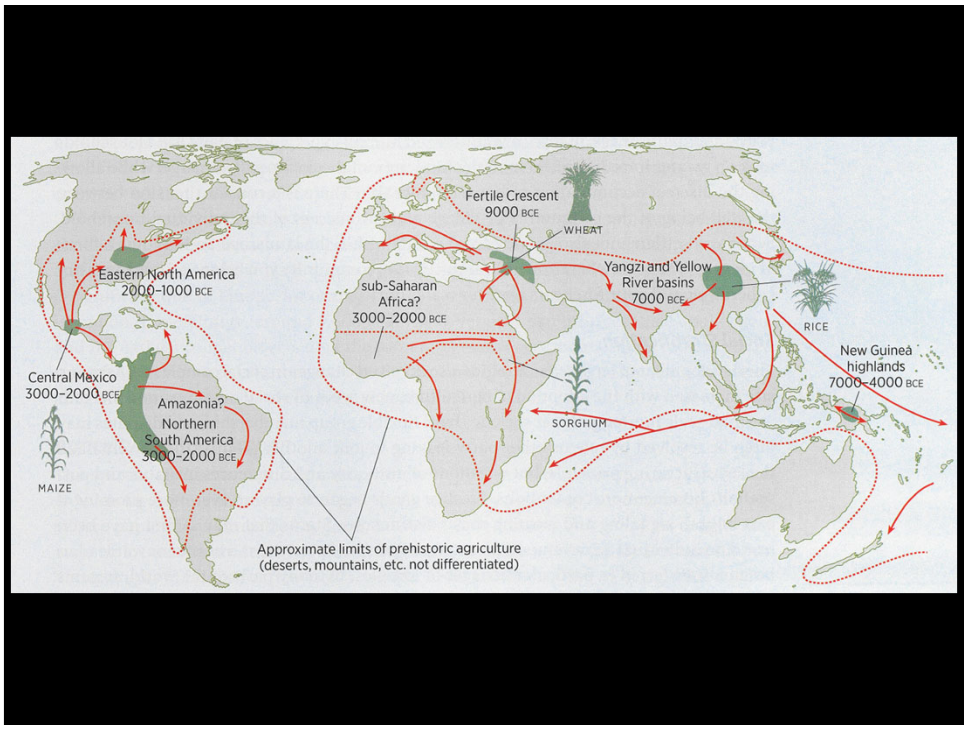
45


Fertile Crescent
9000 BCE
WHEAT
Eastern North America
2000–1000 BCE
sub-Saharan
Africa?
3000–2000 BCE
Yangzi and Yellow
River basins
7000 BCE
RICE
New Guinea
highlands
7000–4000 BCE
Central Mexico
3000–2000 BCE
Amazonia?
Northern
South America
3000–2000 BCE
SORGHUM
MAIZE
Approximate limits of prehistoric agriculture
(deserts, mountains, etc. not differentiated)

46

How can we start thinking about domestication?

How can we model, scientifically, this evolutionary process?

47

Useful definitions

Management – Manipulation and some degree of control of a wild species. Activities can be defined as any technique that may propagate or protect a species, reduces competition for a species, insures the appearance of a species at a particular time or place, modifies the range and/or distribution of a species, etc.

Cultivars – Wild plants fostered/managed by human efforts to make them more productive.

48

"*A number of different aspects of our current understanding of the initial, world-wide domestication of plants and animals points to domestication taking place within a broader behavioral context of niche construction strategies.*" -- B. Smith 2007:1797

Early strategists. Human niche construction, including controlled burning, may date back to as early as 55,000 yr B.P. Shown is an Australian aborigine.

from B. Smith 2007

49

Useful definitions

Management – Manipulation and some degree of control of a wild species. Activities can be defined as any technique that may propagate or protect a species, reduces competition for a species, insures the appearance of a species at a particular time or place, modifies the range and/or distribution of a species, etc.

Cultivars – Wild plants fostered/managed by human efforts to make them more productive.

Cultivation – Intentional preparation of the soil for planting wild or domesticated plants.

Domestication – A state of interdependence between humans and selected plant or animal species. Intense selection activity can induce permanent genetic change in the plant or animal population under selection.

Cultigen – A plant that is dependent on humans; a domesticate.

Agriculture – Cultural activities associated with planting, herding, and processing domesticated species; farming. A wholesale change toward a new cultural system

50

How did our domesticated food products evolve?

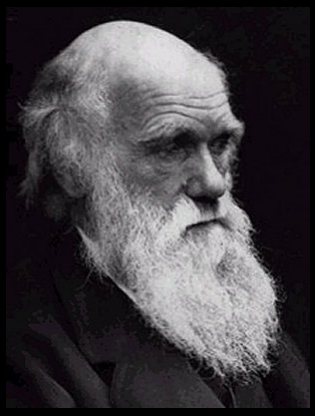
51

Evolution (biological):

a change in the relative frequencies of alleles (specific forms of genes) in a breeding population through time (or from generation to generation)

52

Charles Darwin
&
Evolution by Natural Selection



3 simple points –

(1) Phenotypic variation

(2) Heritabililty

(3) Reproductive competition
(i.e., only some alleles get passed on)

53

(1) Variation
(2) Heritability
(3) Reproductive Competition

Differential reproductive success leads to offspring with those genetic traits (variants, expressed phenotypically) who can again pass on more of those genes (alleles), leading to more individuals in a population having those specific genes.

Selective pressures act upon _____?

54

(1) Variation
(2) Heritability
(3) Reproductive Competition

Differential reproductive success leads to individuals with favorable genetic traits (variants, expressed phenotypically) who can again pass on more of those favorable genes (alleles), leading to more individuals in a population having those specific genes.

Selective pressures act upon INDIVIDUALS?

55

Evolutionary fitness

- When speaking of natural selection, a measure of relative reproductive success of individuals
- Measured by an individual's genetic contribution to next generation, compared with other individuals at that time

56

Bruce D. Smith - Curator Emeritus of North American Archaeology, Smithsonian National Museum of Natural History, Washington, D.C.

Domestication: "the human creation of a new form of plant or animal – one that is identifiably [phenotypically] different from its wild ancestors and extant wild relatives." Domesticated plants "have been changed so much that they have [often] lost the ability to survive in the wild."

Human beings became the agents of natural selection, and placed novel selective pressures on populations of wild plants and animals, thus interfering with the reproductive cycles of organisms!

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Maize (aka, corn) (*Zea mays*)

Wild teosinte

58

Human role as selective pressure in the evolutionary process of plant and animal domestication

minimal induced genetic change
"more wild – less domestic"

substantial induced genetic change
"less wild – more domesticated"

59

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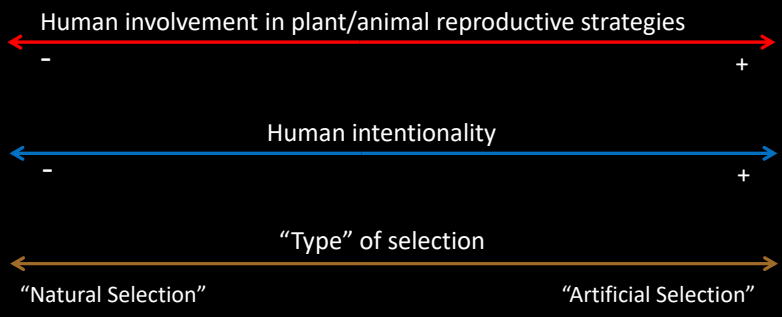
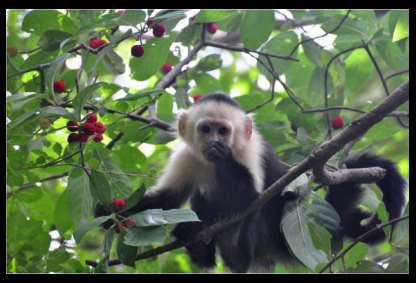


60

Other animals' involvement in plant reproductive cycles



61

Resource Management

Early strategists. Human niche construction, including controlled burning, may date back to as early as 55,000 yr B.P. Shown is an Australian aborigine.

- Burning of wild areas can increase amount of wild stands of foods
- However, intensive harvesting may not have appreciable effects on genetic make-up of wild stands

Because seeds left behind are exposed to full range of natural selective pressures, and it is all of those that contribute to the next generation

\+ Human intention to manage

\- Human selective pressure

62

Smith's "domesti-localities"

- Disturbance of soil and associated disruption of plant populations, particularly around edges of camps or settlements
- When settlements are retained for many years, or re-visited again and again, a new human-created plant habitat is created and sustained

63

3 important characteristics of "domestic-localities"

- Relatively clear of existing vegetation – open to colonization by pioneering plants
    - "weedy camp-followers" and grasses
- Disturbed areas close to hunter-gatherer settlements (~margins) where seeds may be unintentionally dropped or discarded
- Disturbed soils mimic broken ground of seedbeds, in effect creating quasi-gardens

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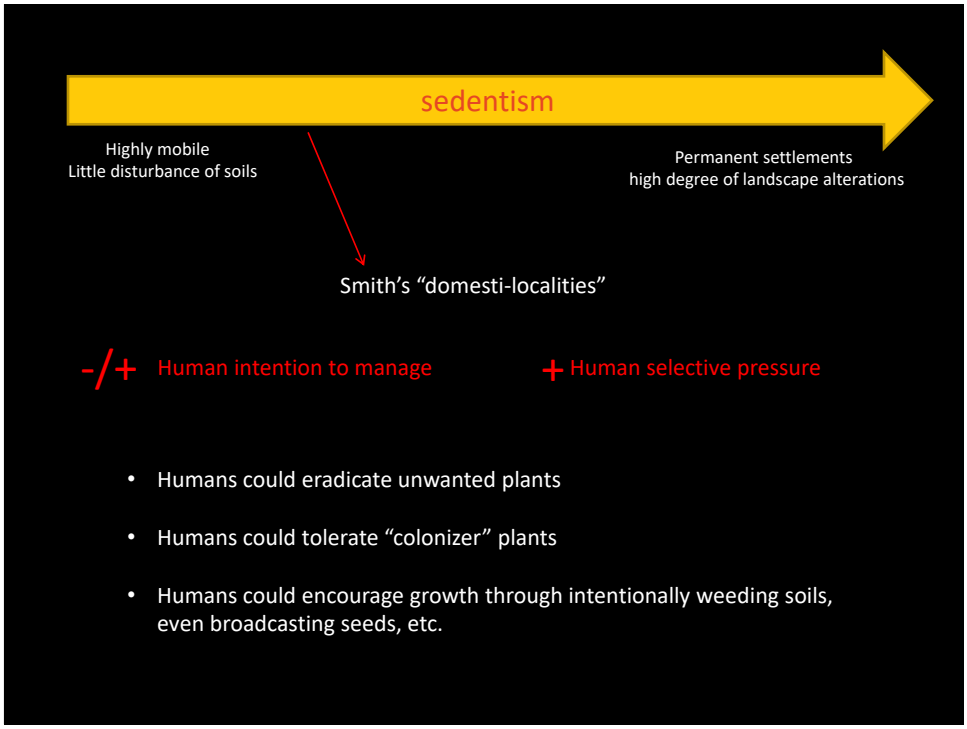
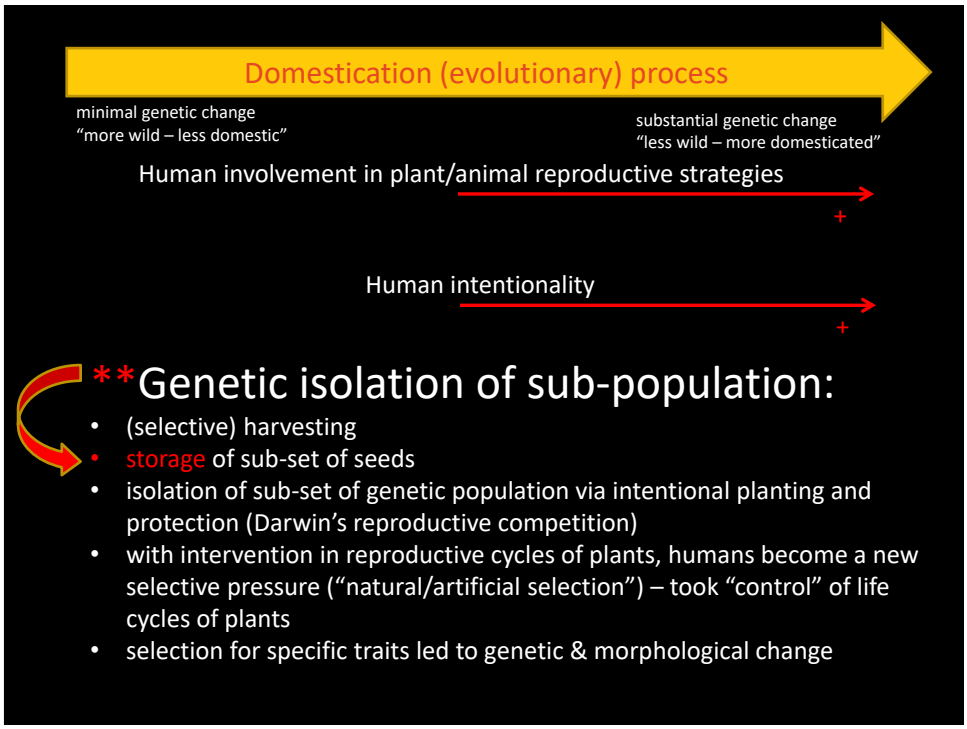

sedentism
Highly mobile
Little disturbance of soils
Permanent settlements
high degree of landscape alterations
Smith's "domesti-localities"
-/+ Human intention to manage
+ Human selective pressure
• Humans could eradicate unwanted plants
• Humans could tolerate "colonizer" plants
• Humans could encourage growth through intentionally weeding soils, even broadcasting seeds, etc.

65


Domestication (evolutionary) process
minimal genetic change
"more wild – less domestic"
substantial genetic change
"less wild – more domesticated"
Human involvement in plant/animal reproductive strategies
+
Human intentionality
+
**Genetic isolation of sub-population:
• (selective) harvesting
• storage of sub-set of seeds
• isolation of sub-set of genetic population via intentional planting and protection (Darwin's reproductive competition)
• with intervention in reproductive cycles of plants, humans become a new selective pressure ("natural/artificial selection") – took "control" of life cycles of plants
• selection for specific traits led to genetic & morphological change

66

Selection in the Wild (no human selective pressures)	Variants "selected for" during Human Cultivation
• Seeds with easy dispersal mechanisms (easily break away)	• Seeds less likely to disperse prior to harvest
• Seeds that can remain dormant during cold/dry season (thick seed coats)	• Selective pressure for thick coat relaxed (dormancy requirement minimized, easy processing)
• Seeds with less "start-up fuel reserves" (smaller seeds); can remain dormant	• Seeds with greater "start-up fuel reserves" (larger seeds → larger plants); quick sprouting & rapid growth
• Plants with non-synchronous ripening (so single events do not wipe out all plants)	• Plants with synchronous ripening (scheduling around labor and harvest)

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