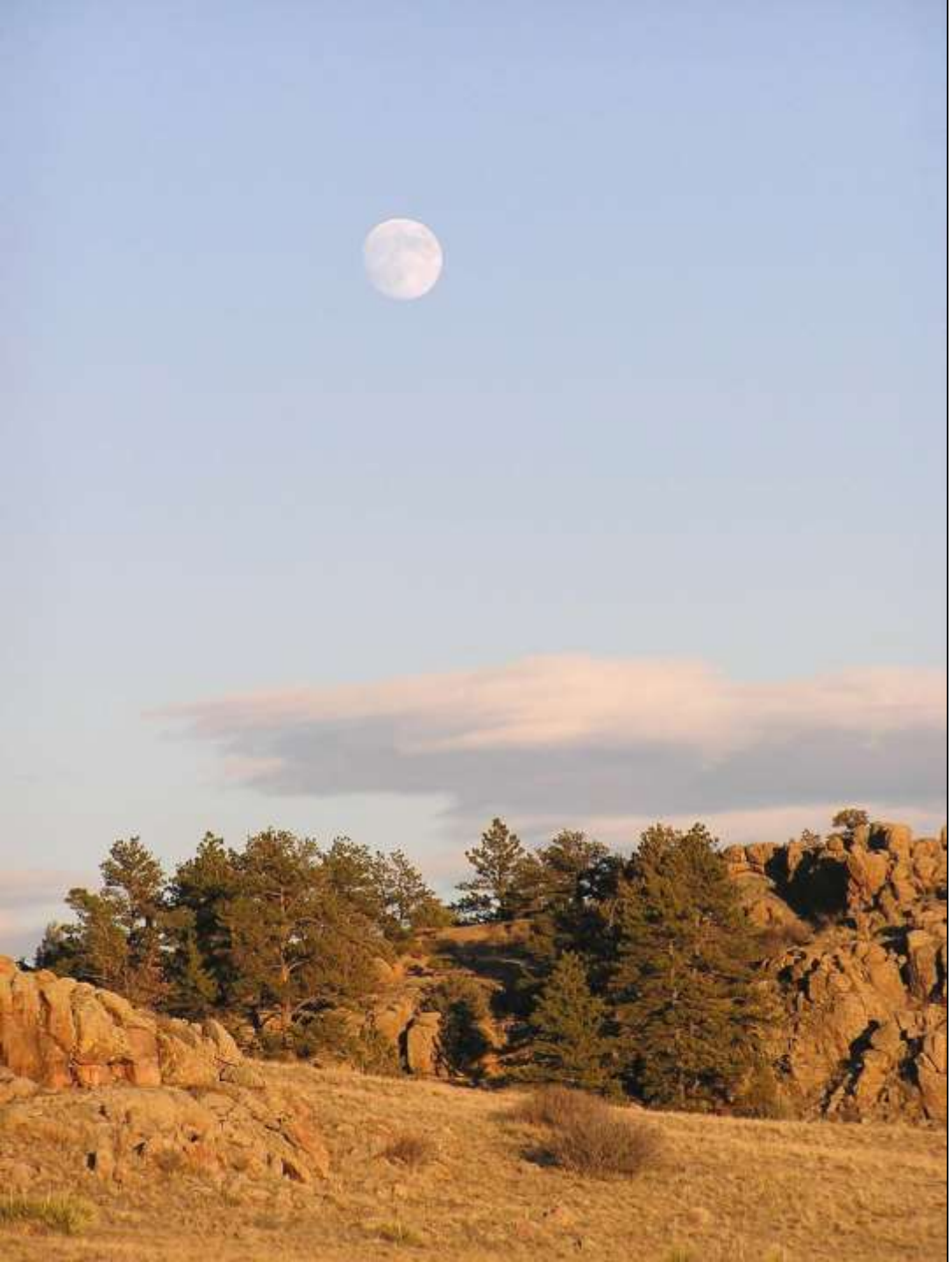


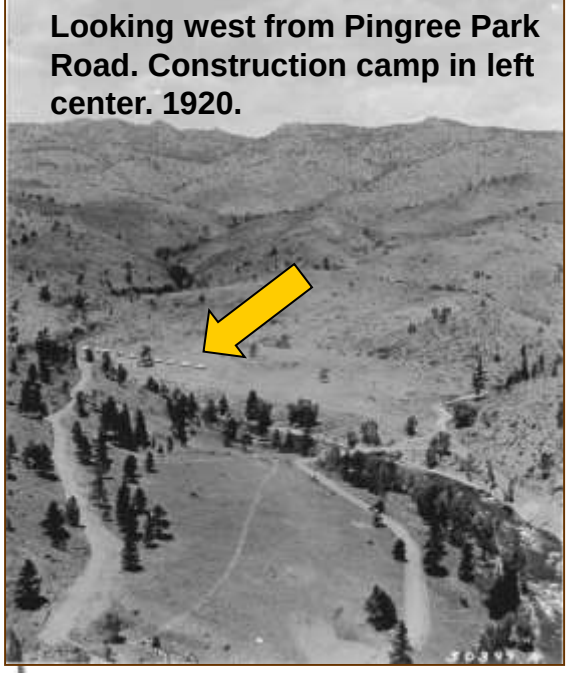
Trees tell the tale of climate, fire and humans over the last 1000 years in the Larimer County foothills

Laurie Huckaby, USFS Rocky Mountain Research Station

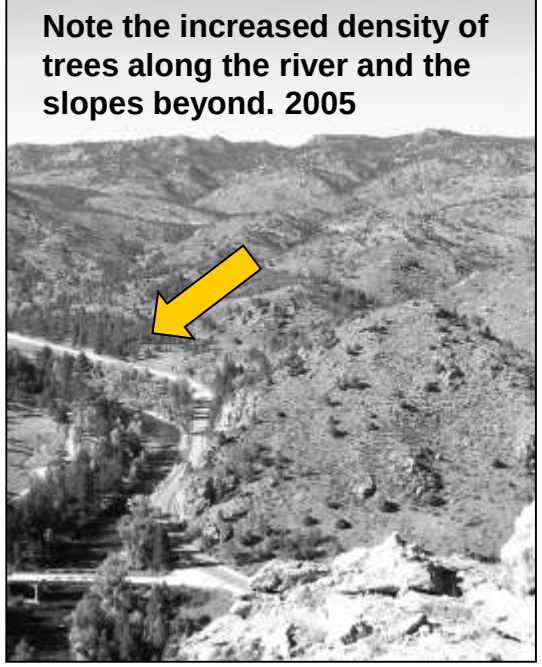
Historical Ecology

How did things get to be the way they are now?

How can we manage forests to meet human needs and to be resilient in the face of disturbance and climate change?



Looking west from Pingree Park Road. Construction camp in left center. 1920.

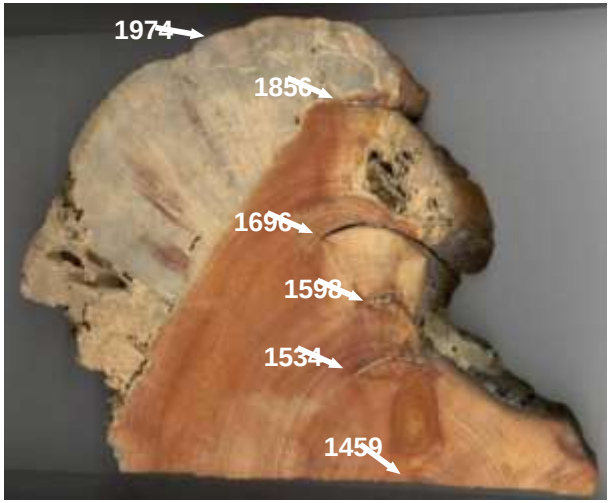


Note the increased density of trees along the river and the slopes beyond. 2005

80.00 Set Granite mck 20x6x4 marked IIII S. +1 E. 6 in. in ground in mound of mck for Cor. to Sec. 11-12-13-14
Soil 3rd rate
Surface mountainous
Timber very small and on last 1/4 mile is all dead.
Veg. brush grass and under brush.

Tools for reconstructing past landscapes:

- Historical records
- Historical photos
- Dendrochronology—fire scars, age structure of trees
- Archaeology

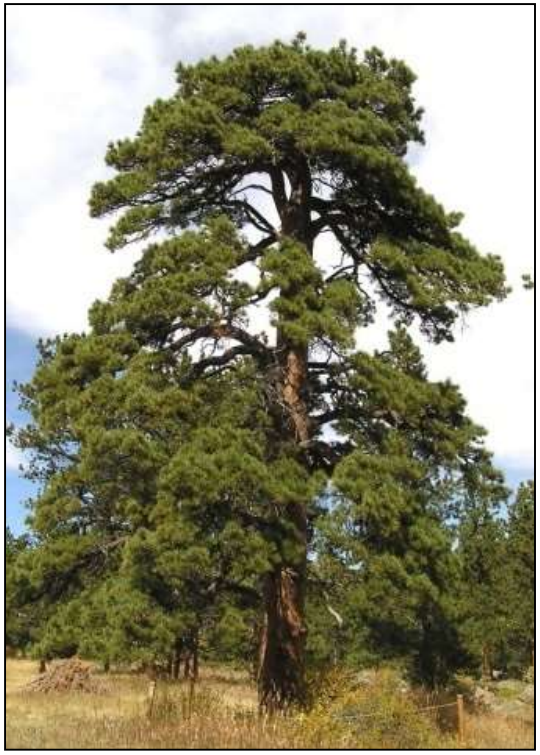


Old trees in Larimer County

Old tree on a poor site

Ponderosa pine, pith 1381

Old tree on a good site



Ponderosa pine, pith 1321

Young tree on a moderate site

Ponderosa pine, pith 1840s

Old trees are not necessarily big trees—age and size are poorly correlated
Old trees tend to have large branches and open crowns
Old trees often have flat “bonsai” tops or dead tops
Old trees often have scars from fire or lightning

Ponderosa pine, Douglas-fir, Rocky Mountain Juniper, Engelmann Spruce, Limber pine, Bristlecone pine may all live 500+ years; lodgepole pine and Subalpine fir live 200-400 years; Aspen and Cottonwoods are short-lived—stems rarely more than 200 years, roots can live thousands of years

Old trees grow on slopes and rocks protected from fire and competition with grasses.

Foothills trees are succumbing to fires and beetles in the 21st century.

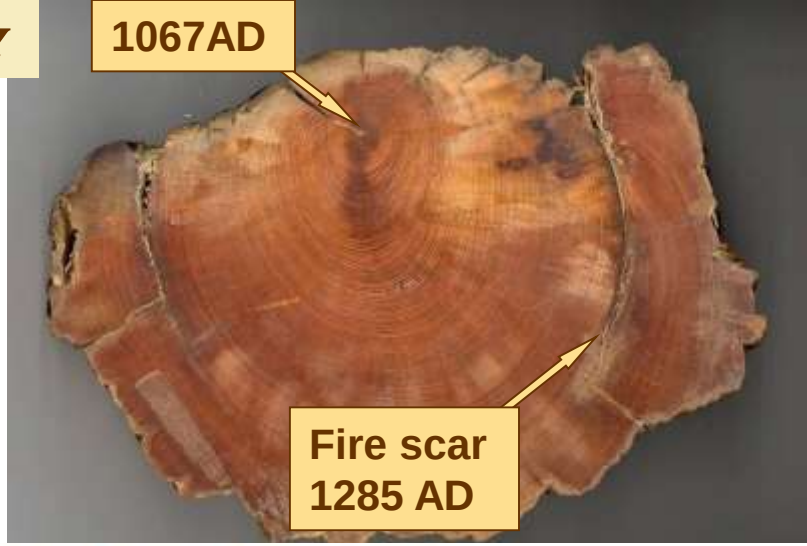
The foothills were not commercially logged but trees were cut for local use. Often junipers were cut for fence posts or furniture.

Fire scars occur on all species but often heal over between fires.

Methods: subjective sampling for tree age and fire history in the foothills

Snags and old logs are relatively common above 6500'. Wood decays slowly here, especially when it has been scarred by fire.

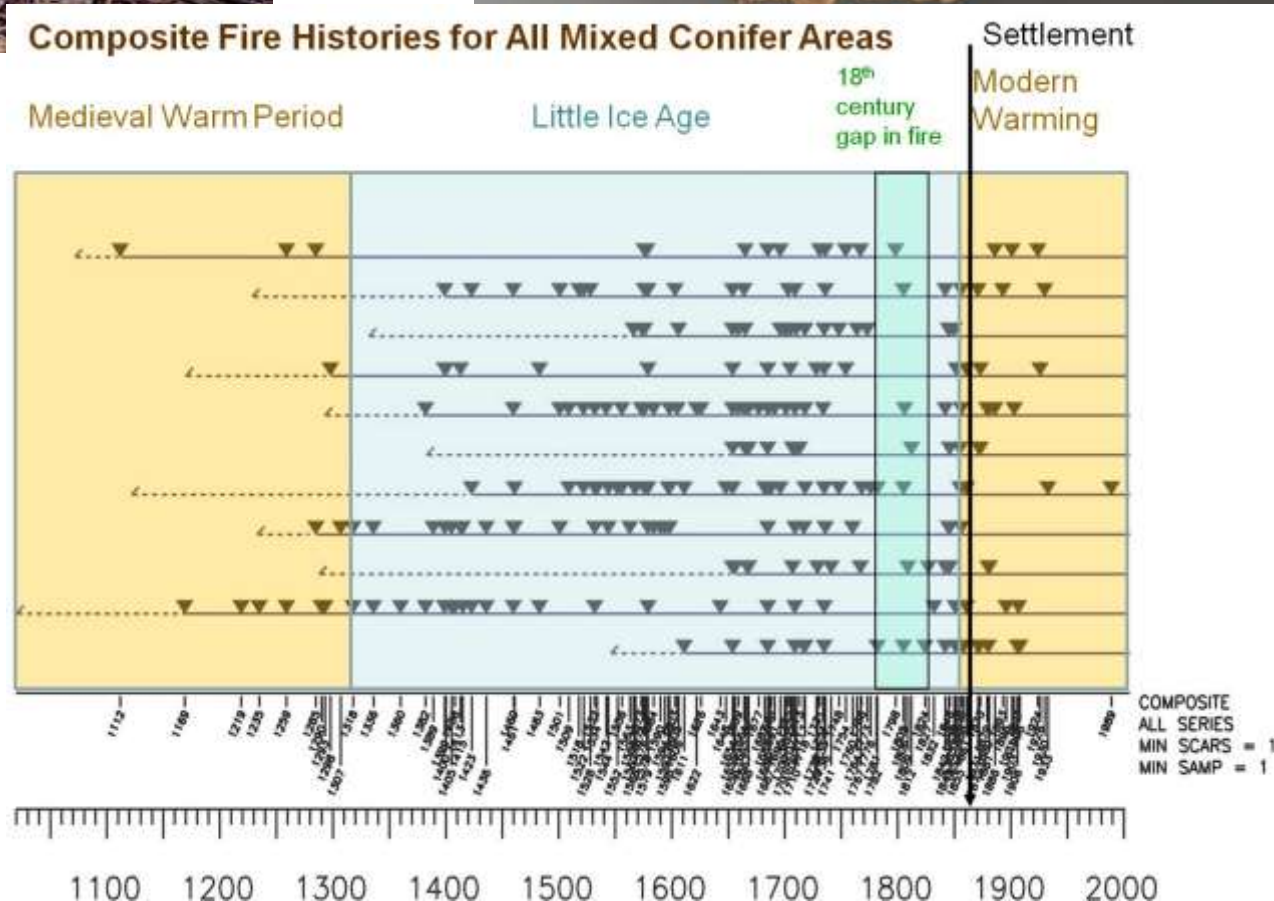
Old wood and Climate in Larimer County



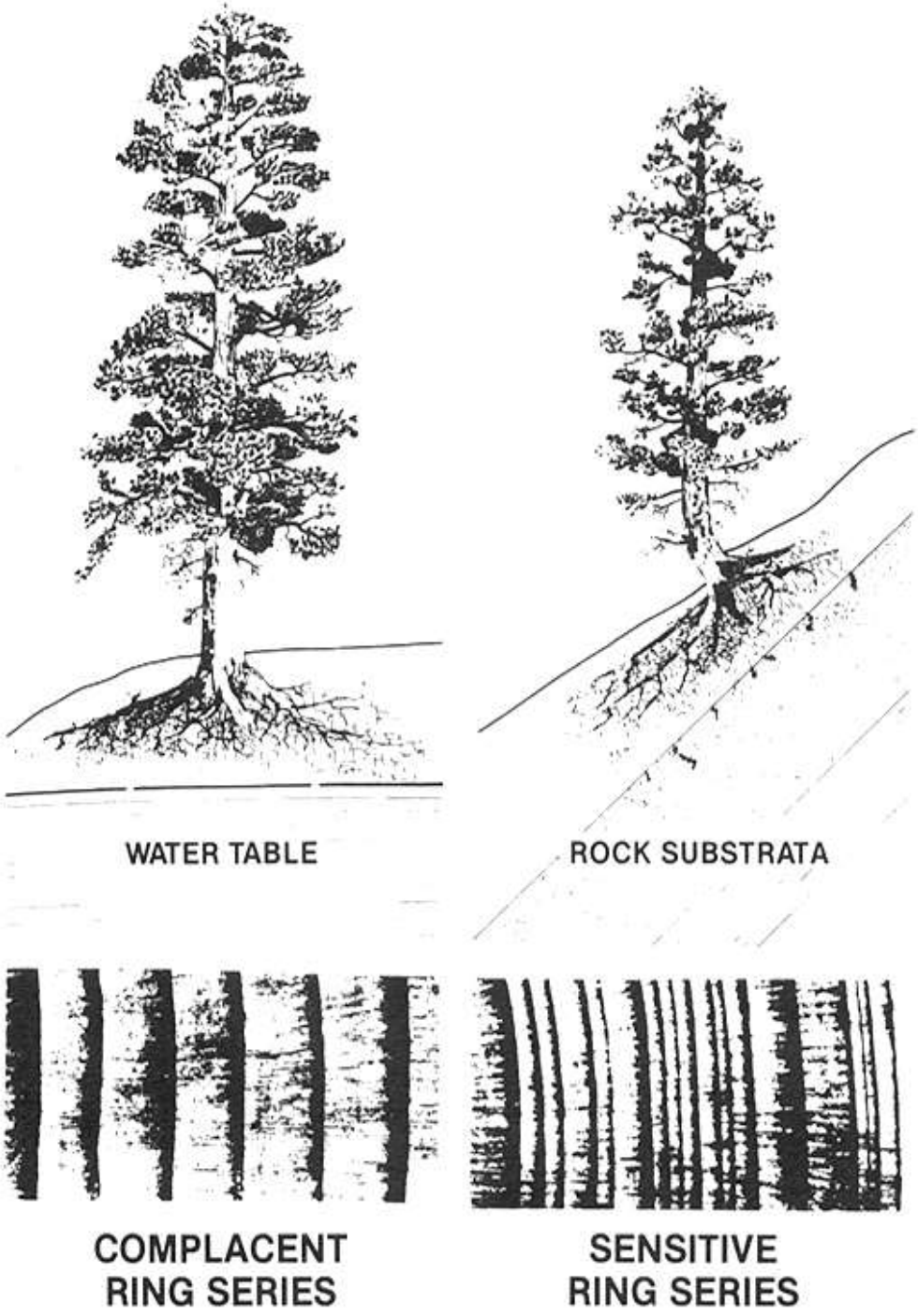
Larimer County has two of the longest tree-ring chronologies in ponderosa pine:

Mixed conifer, Earliest pith date: 1020, earliest fire date: 1107
Red Mountain, Earliest pith date: 980, earliest fire date: 1029

The Medieval Warm Period from 800 AD to the mid-1300s was warmer and drier than the 20th century.
The Little Ice Age was cooler than the 20th century; it ended in the mid-1800s, around the same time as Euro-American settlement.



Tree-ring dating

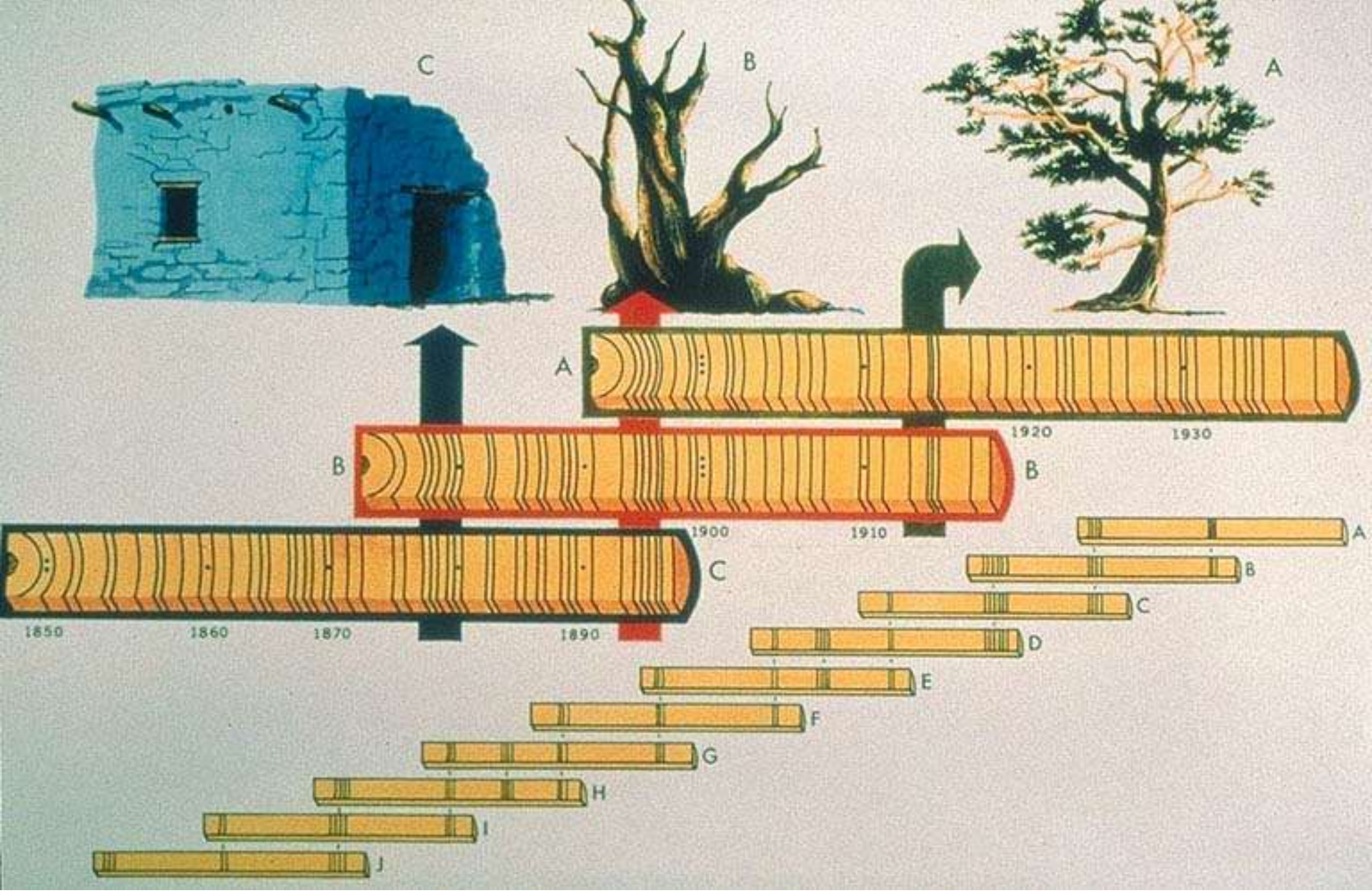


Trees grow a ring of wood every year in temperate regions.

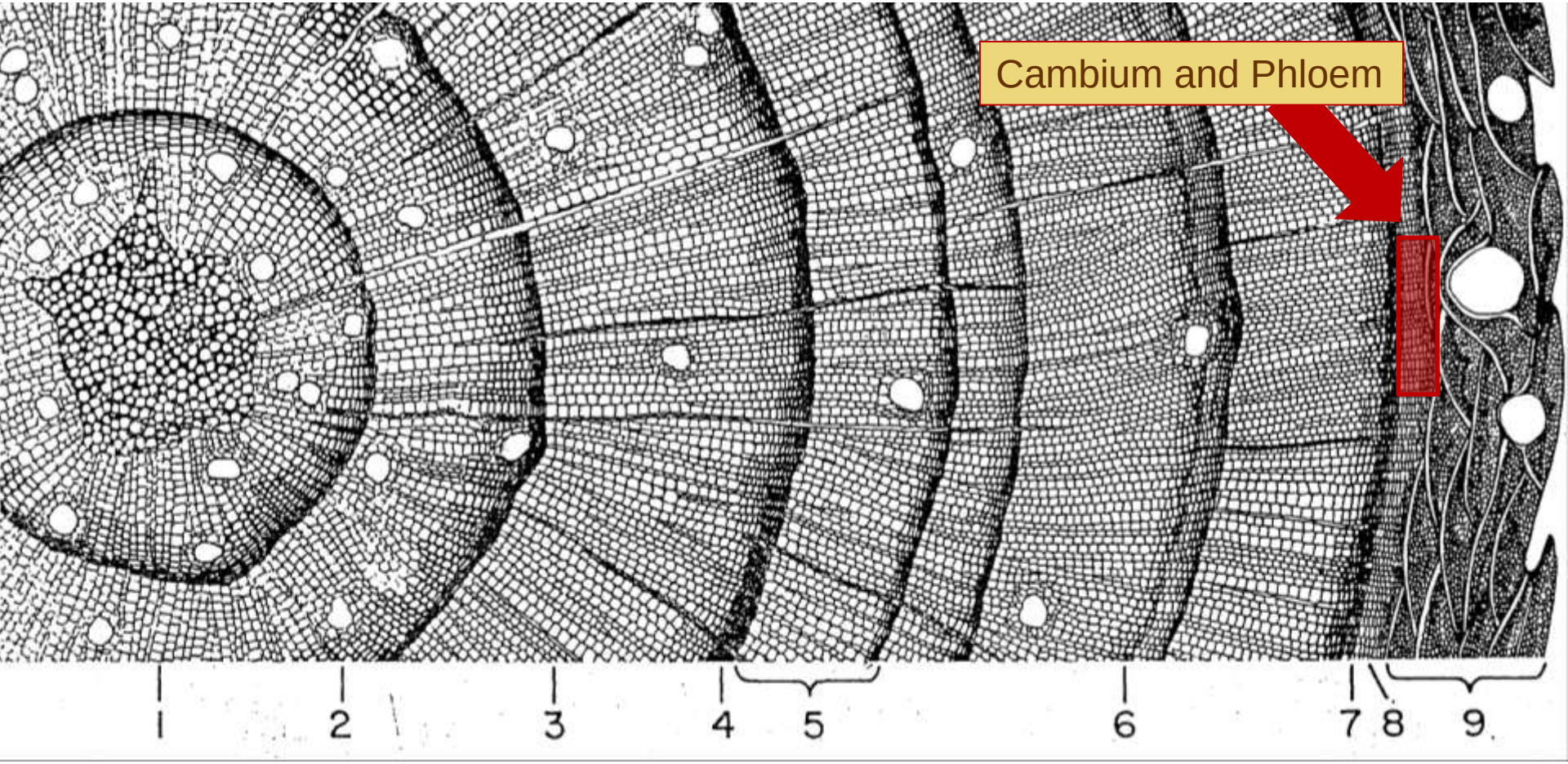
Annual ring width is related to environmental factors that limit tree growth. At low and mid-elevations, water availability is limiting.

Cross-dating involves matching patterns of ring width between samples.

A chronology is constructed from multiple samples that experience the same environment. Unknown samples can be matched to a chronology with annual resolution.

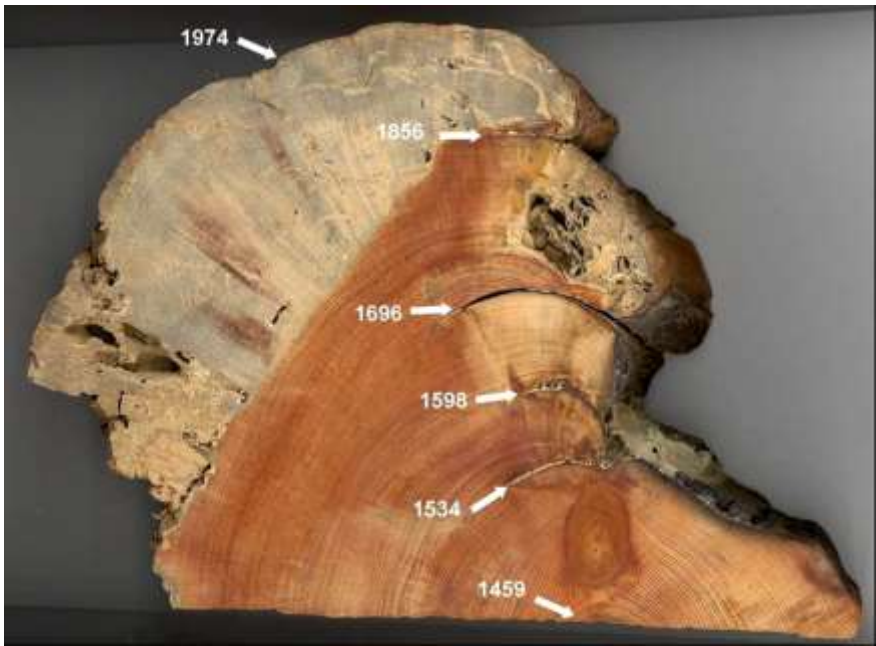


The principle of crossdating—matching ring patterns across samples to extend a chronology back in time.



Cross section of a conifer stem showing: (1) pith, (2) resin duct, (3) earlywood, (4) latewood, (5) annual ring, (6) false interannular ring, (7) cambium area, (8) phloem, and (9) bark.

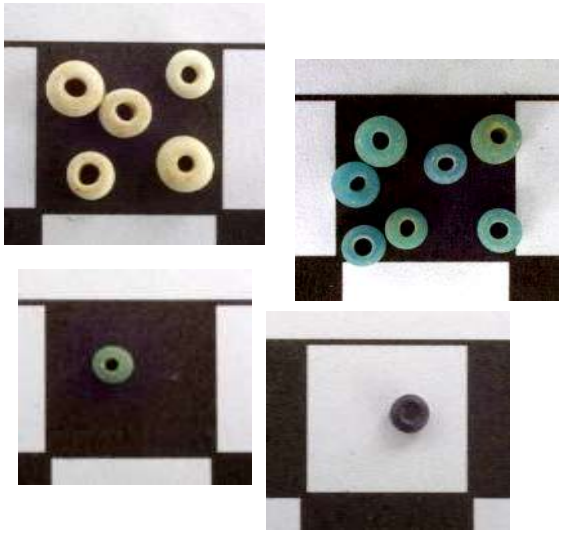
Fire scars occur when the cambium is killed by heat on part of the circumference of a tree. For a fire scar to form, the tree must survive the fire. It will try to grow wood over the wound in subsequent years. Trees scarred once often scar again.



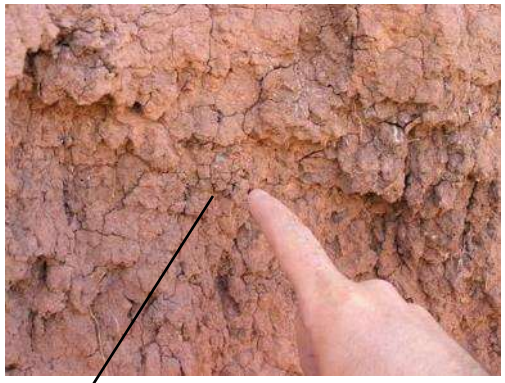
Land use history in Larimer County

Native Americans lived here for at least 13,000 years, until they were relocated around 1880. Irrigated agriculture and widespread grazing occurred from 1860 onward, intensifying after 1880. Little mineral wealth was discovered, so no railroad was built into the mountains; much of the area was remote ranch land until around 1920. Agriculture, urban development, logging, grazing, recreation and fire suppression occurred during the 20th century.

Evidence of Native American land use is subtle but abundant in Larimer County.



White, blue, green and black glass trade beads



Buried flint flakes exposed in a wash

A Folsom point

Peeled tree; scar 1681

Buried oven and layers of organic deposition exposed in a wash

Bison skull embedded in creek bank

Stone circle “tipi ring”

People and trees—how trees record human activity

Individual trees:

- Structures
- Tools
- Marking
- Peeling for food

Forest landscapes:

- Logging
- Clearing for transportation or agriculture
- Fire use
- Fire suppression
- Planting trees
- Changing species composition

The Arapaho Council Tree

Tree rings yield precise annual dates of scars, germination and death that allow us to compare dates of Native and Euro-American land use with other events recorded by trees, such as climate changes, fires, floods, and droughts over the last 1000 years, which has been a period of rapid climatic and cultural changes.

Using Peeled Trees to date Native American activity

Trees were deliberately shaped for different purposes, such as platforms. This tree was also peeled.

Live tree, peel scar 1794

Native people peeled the bark from trees to eat the cambium beneath, to use the bark or sap, or for territorial or ceremonial purposes. These scars can be dated just like fire scars. So far, we have found 42 in Larimer County. The peel dates on trees in Northern Colorado are generally a century earlier than those in the southern part of the state.

Snag, peel scar 1681

Live tree, peel scar 1681.

Undated scar with tool marks

Why peel trees?

- For emergency food—people ate the cambium under the bark, especially in spring
- For stored food—people rolled the cambium into balls and dried it or ground it into flour for later
- For sugar—people boiled the cambium in spring to get sugar
- For pitch—to seal baskets and glue things
- For the bark—trays, cradleboards, baskets, twist into cord
- Bow trees—cut a bow blank from outer wood
- To mark territory, trails, boundaries and sacred sites

The scars on peeled trees can be cross-dated, so we can know the year they were formed.

Peel Scar 1874

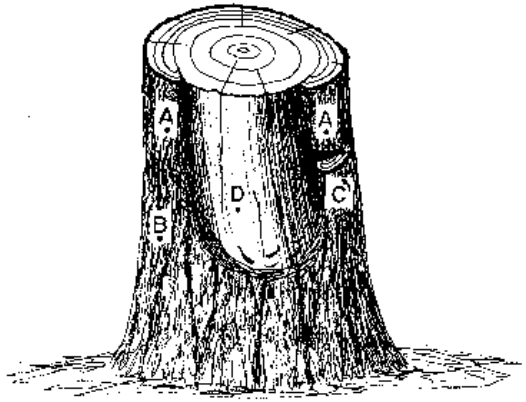


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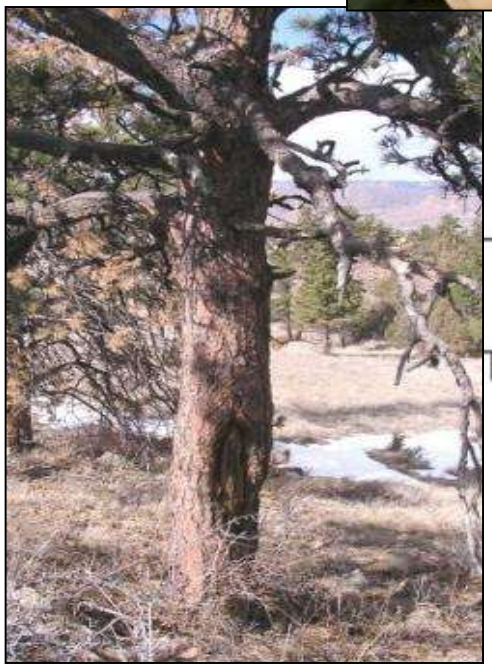
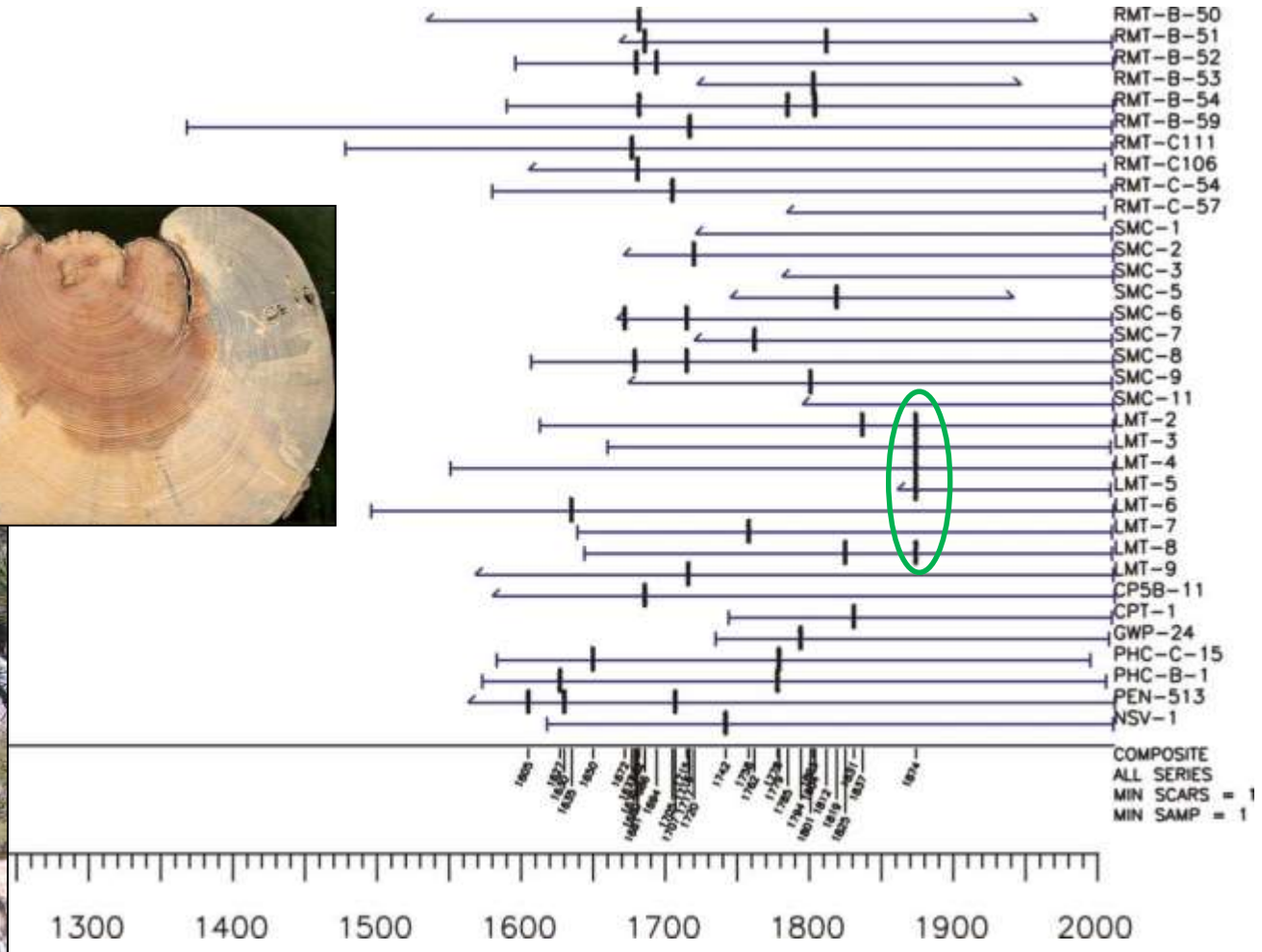
FIG. 2—Increment core sampling is recommended at positions A and B. While Stokes (1954) obtained increment cores from the sides of the peeling scar — A, and he also notched some of his sample trees — C, and then counted the annual rings from the bark in to the scar, Mertzenno (1981) obtained increment cores from the exposed surface of the peeling — D, and from the untreated side of the tree — B.

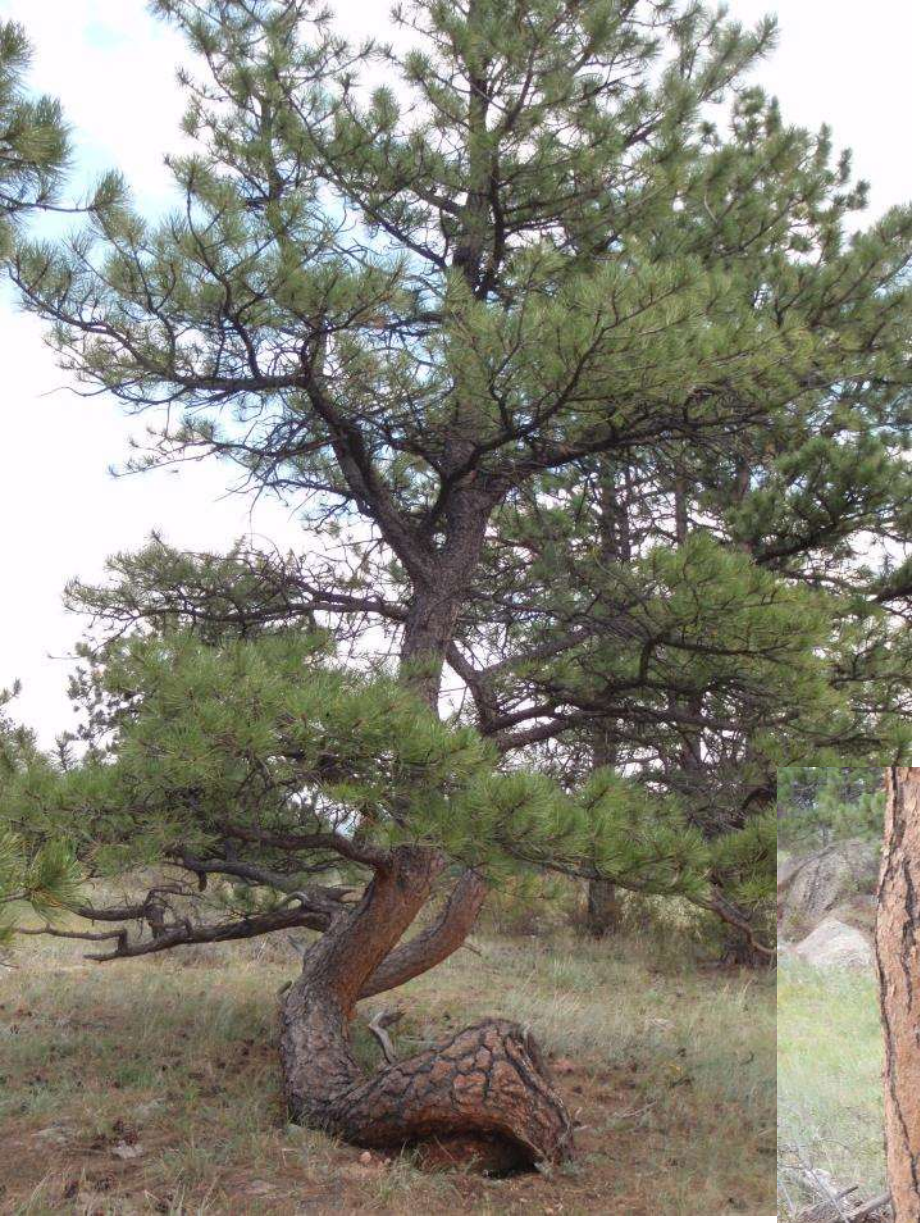
Peel scar dates in Larimer County





1605-1837

The cluster of dates in 1874 is likely from Euro-American settlement activities



Bent tree adjacent to peeled tree.

Cherokee Park

Scar date 1686

Peeled trees at high elevations

Peeled Engelmann Spruce in southern Wyoming, scars late 17th-mid 18th century.

Peeled Bristlecone Pine with axe mark, near Windy Ridge, 1874.

Other scars can look like peels…

Ponderosa pine

Fire Scars

Lodgepole pine

Engelmann spruce

Fire scars usually go all the way to the ground.

Other scars can look like peels…

Felling scars

Lightning

Porcupine feeding

Wickiups and other native structures

Wikiups were wood frames covered with hide or brush for temporary or seasonal shelter. Tree rings can only give a general range of time such structures were used.

Juniper stump cut with stone tools

Wood corral, age unknown

Game drive walls were usually built of stone, often above treeline, but included wooden poles and parts. Some wooden game drive walls have been found in Wyoming. Nearby hearths were used for game processing.

Stone circles—often called tipi rings—were not necessarily for tipis. Some had a woven wooden superstructure like a dome tent.

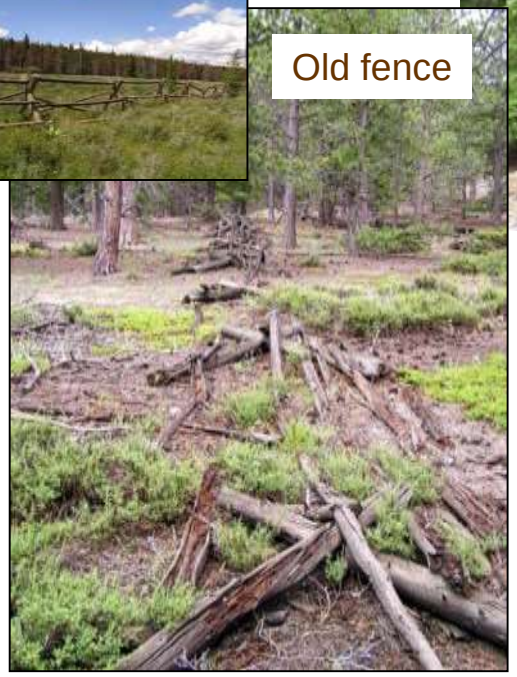
Old buildings and markings of the settlement era

Boundary marks on ponderosa pine

Red Mountain Cabin

Mine structure, 1879

Old fence



Axe-cut stump, 1930s

Young ponderosa pine growing in logging skid trail

Lodgepole pine near Crown Point Trailhead, peel scar 1837, with inscriptions from 1881 and 1903

Using tree rings to date logging at Saloon Gulch

Surviving trees show an increase in growth after their neighbors were removed

a. inside date 1793, release 1884, outside 2000

b. pith 1602, release 1885, outside 2000

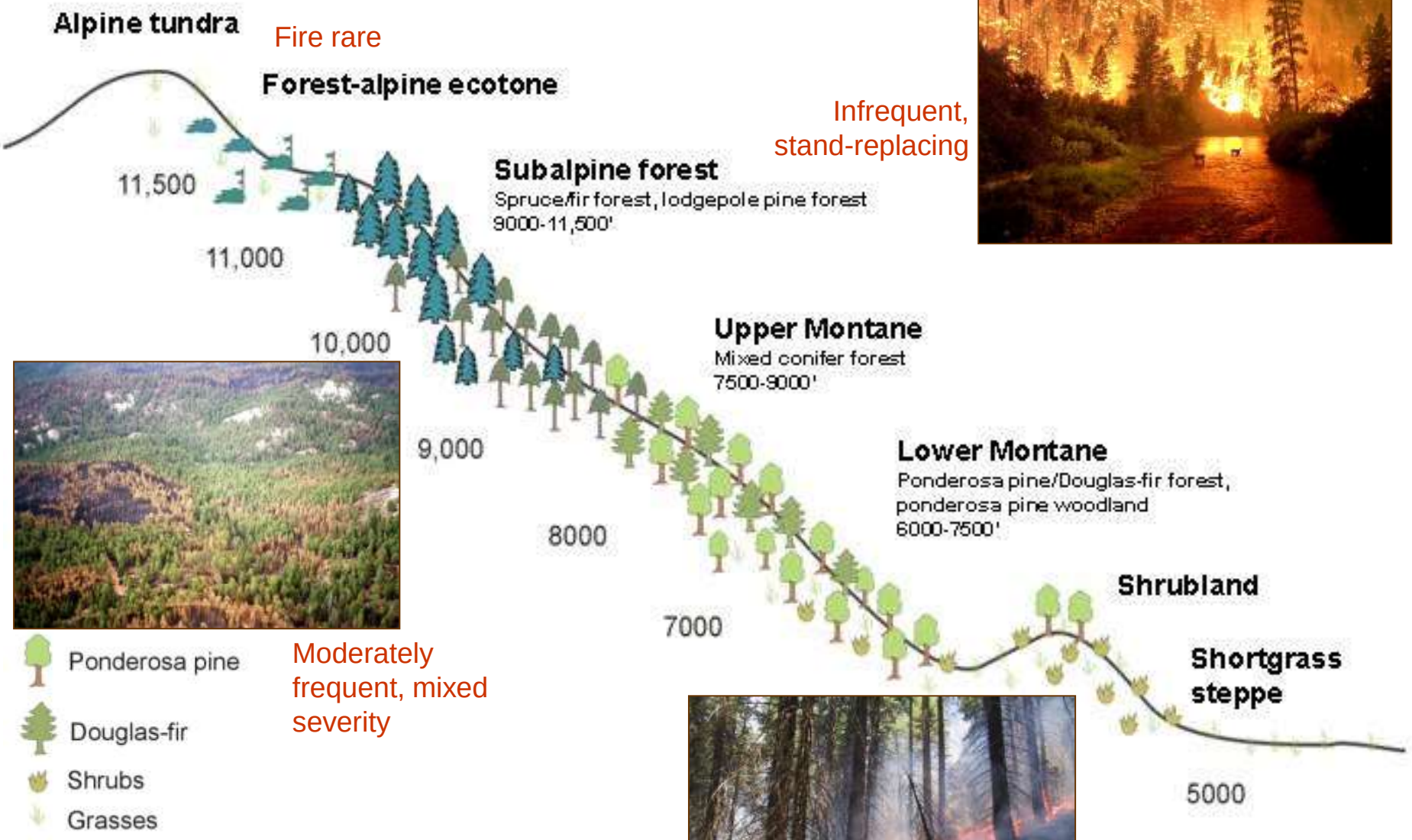
c. inside date 1661, release 1889, outside 2000

Owl Canyon Pinyon Grove

A disjunct population of pinyon pine near Livermore may have been planted by Native Americans. The seeds of pinyon pine are used as food by many Native groups.

The oldest living trees date to the late 1400s. Genetic work analysis in the 1980s suggests these trees are more closely related to ones in Utah than those south of Denver.

A ***fire regime*** is the pattern of frequency and intensity of fire over space and time. Fire regimes are dynamic; they change over space and time. Components of fire regimes include a number of interacting factors: ***Climate, Vegetation, Topography, and Ignitions***



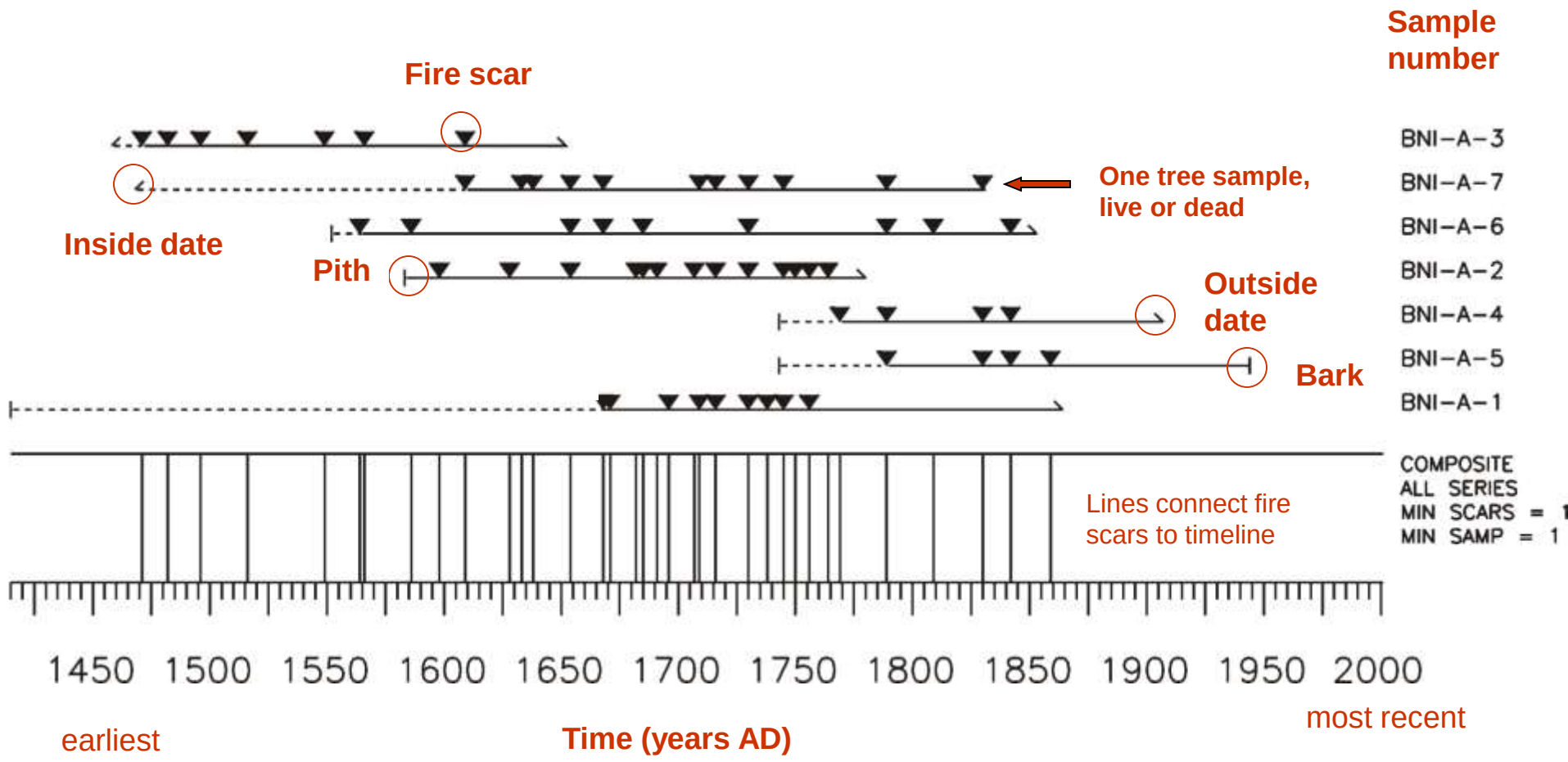
Infrequent, stand-replacing

Moderately frequent, mixed severity

Frequent, surface fire

Elevational gradient of ecosystems and historical fire regimes in the Colorado Front Range. Approximate elevations in feet.

Bar NI Ranch fire history—site A



Standard representation of fire history: each horizontal line represents a sample through time; each inverted triangle represents a fire scar date. Fire history analysis includes computing mean fire intervals for samples and for sites.

Young's Gulch Fire History

Elevation: 6263-6783 feet
Ponderosa pine, Douglas-fir
1546-2005, 91 samples
Earliest fire: 1365
Most Recent fire: 1973
Mean Fire Interval: 7 years
Burned hot in 2012, now not forested

Probably a lightning-driven fire regime, no peel scars

Late 1800s-early 1900s

1842

1871

1717

Late 1700s-early 1800s

18th century gap in fire frequency

1685

Mid-late 1500s

grazing

Fire suppression

1782

Burned hot 2012, complete stand replacement

1550 1600 1650 1700 1750 1800 1850 1900 1950 2000

Bobcat Ridge Fire History

Elevation: 5798-6767 feet
Ponderosa pine (2 PSME)
1446-2007, 38 samples
Earliest fire: 1542
Most Recent fire: 1917
Mean Fire Interval: 9 years
Burned hot 2000

Tree establishment
Late 1700s-early 1800s

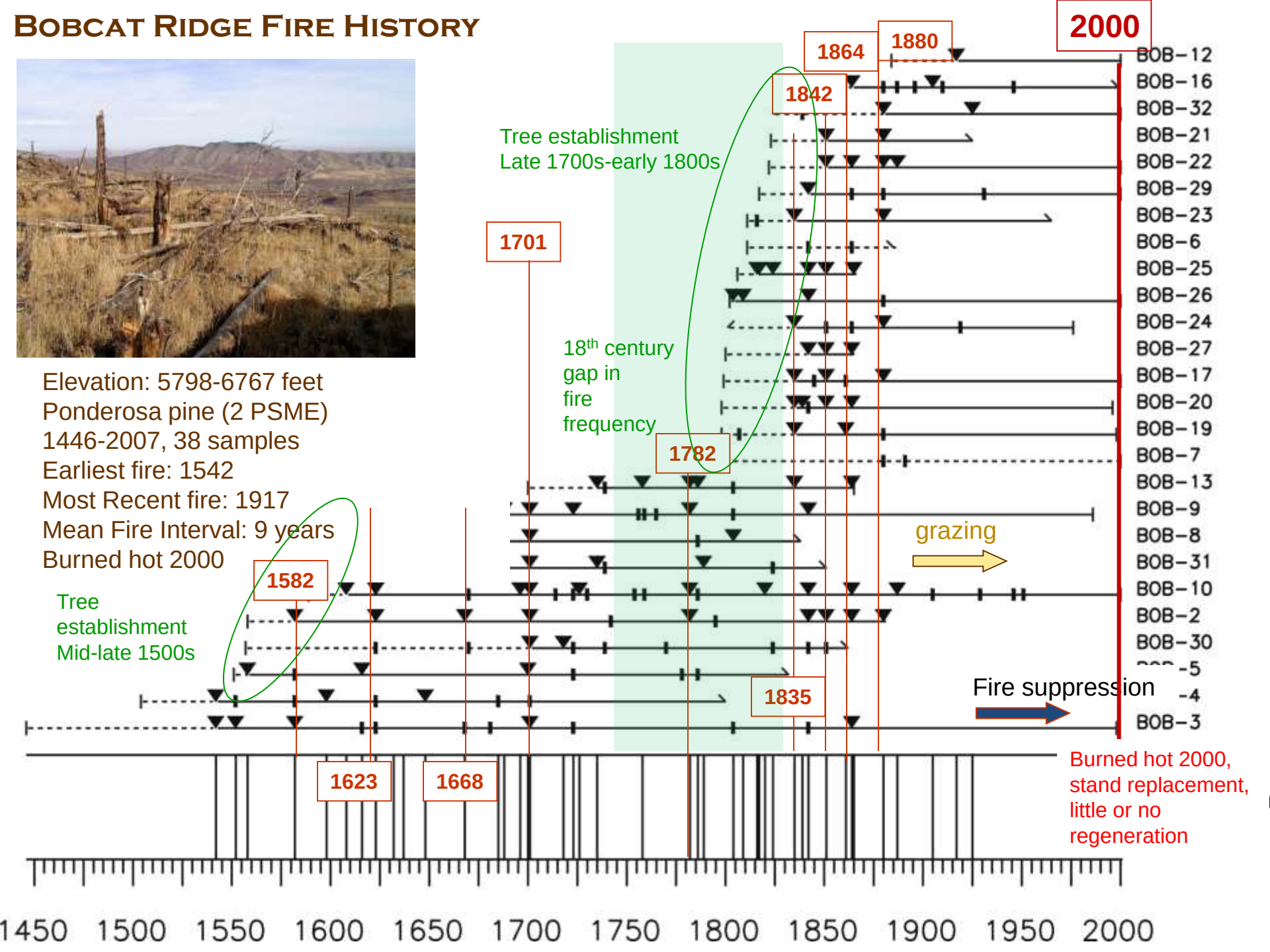
18th century gap in fire frequency

Tree establishment
Mid-late 1500s

grazing

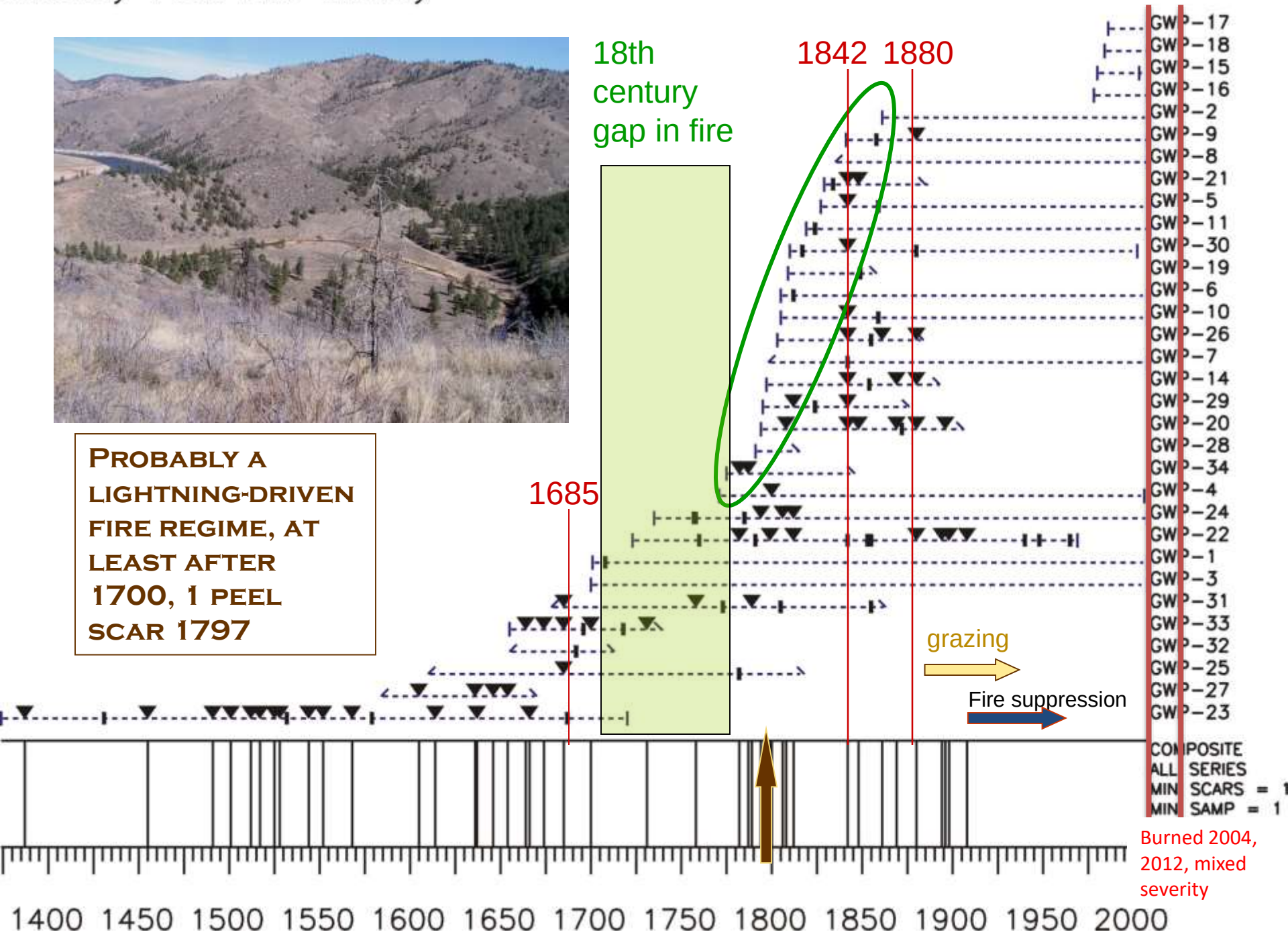
Fire suppression

Burned hot 2000, stand replacement, little or no regeneration



Gateway Park Fire History

Probably a lightning-driven fire regime, at least after 1700, 1 peel scar 1797

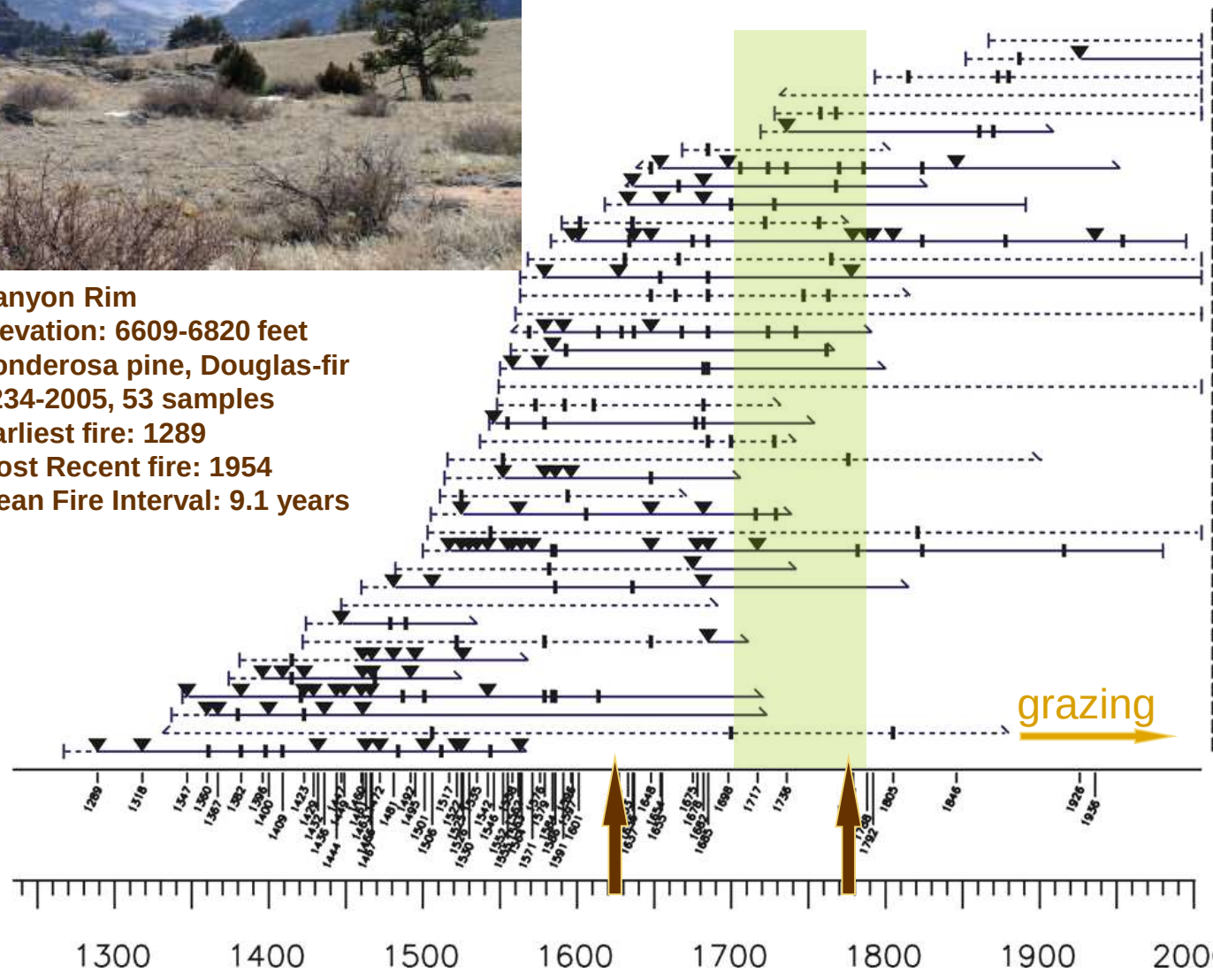


Burned 2004, 2012, mixed severity

Phantom Canyon Rim sites

Probably a human-driven fire regime until around 1700, peel scars in 1627 and 1778

Canyon Rim
Elevation: 6609-6820 feet
Ponderosa pine, Douglas-fir
1234-2005, 53 samples
Earliest fire: 1289
Most Recent fire: 1954
Mean Fire Interval: 9.1 years



Only 11 out of 83 fire dates (13%) were synchronous between the rim and the canyon bottom.

Limited surface fire reintroduced by TNC after 2000

Cherokee Park -- 4 plots from the Front Range Stand Reconstruction Project

Ponderosa Pine
1150-2012 CE, 52 samples
Earliest fire: 1240 CE
Most recent fire: 1943 CE
Mean fire interval: 27 years

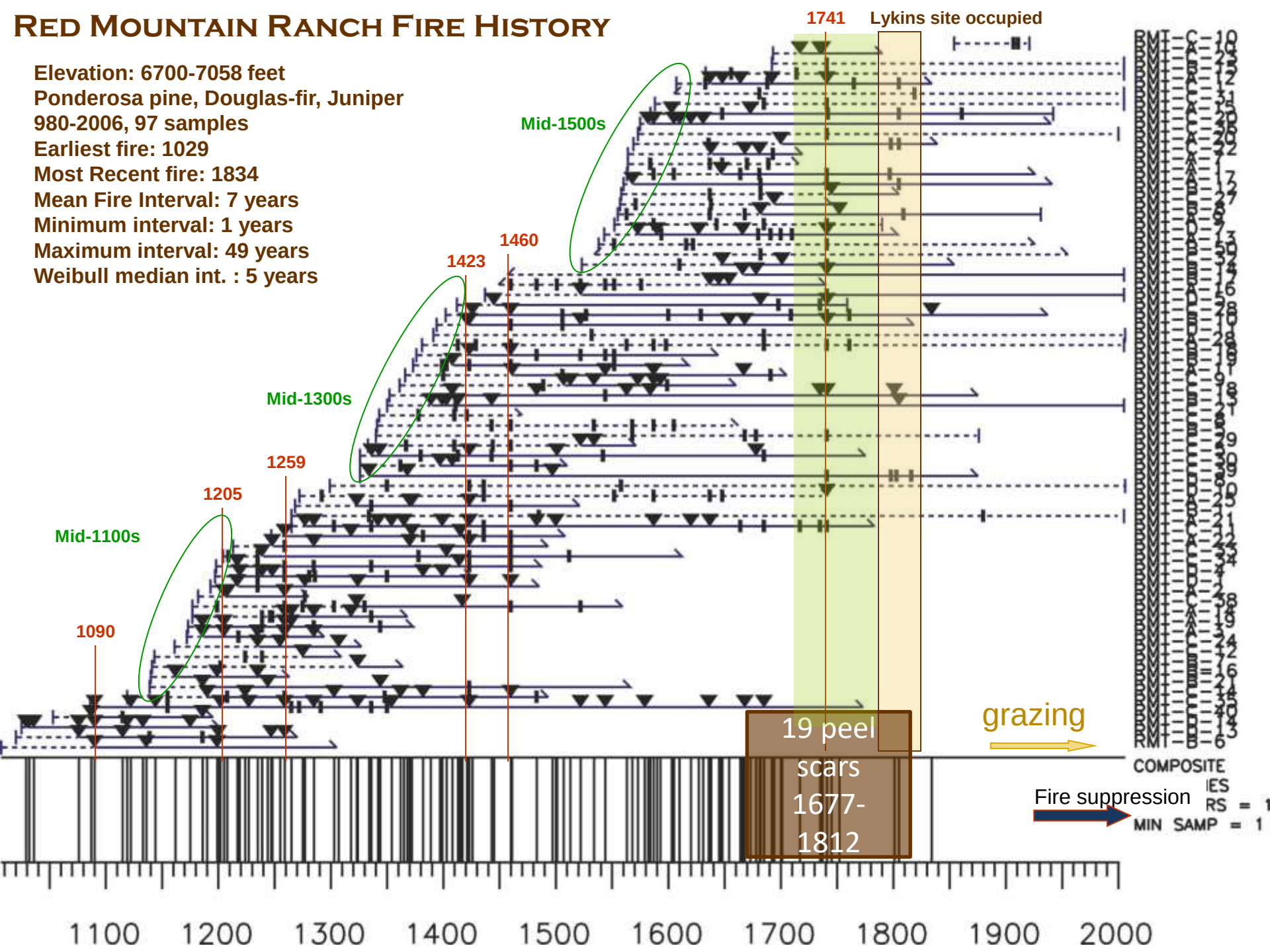
Possibly a human-driven fire regime before 1750, lighting-driven after 1750, 1 peel scar 1686

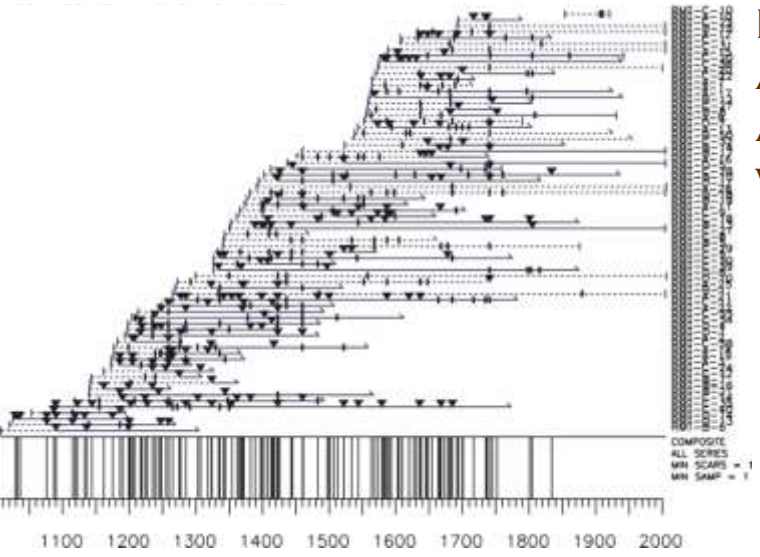
grazing

Fire suppression

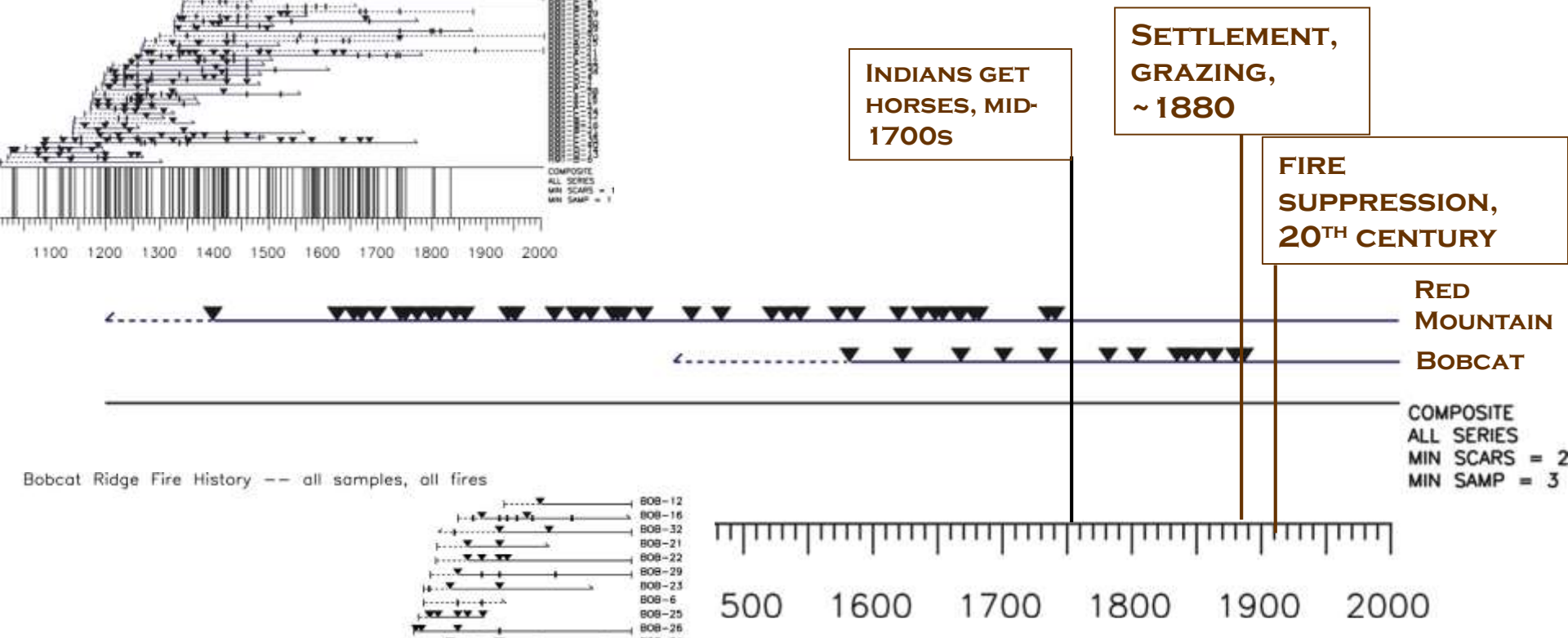
Year

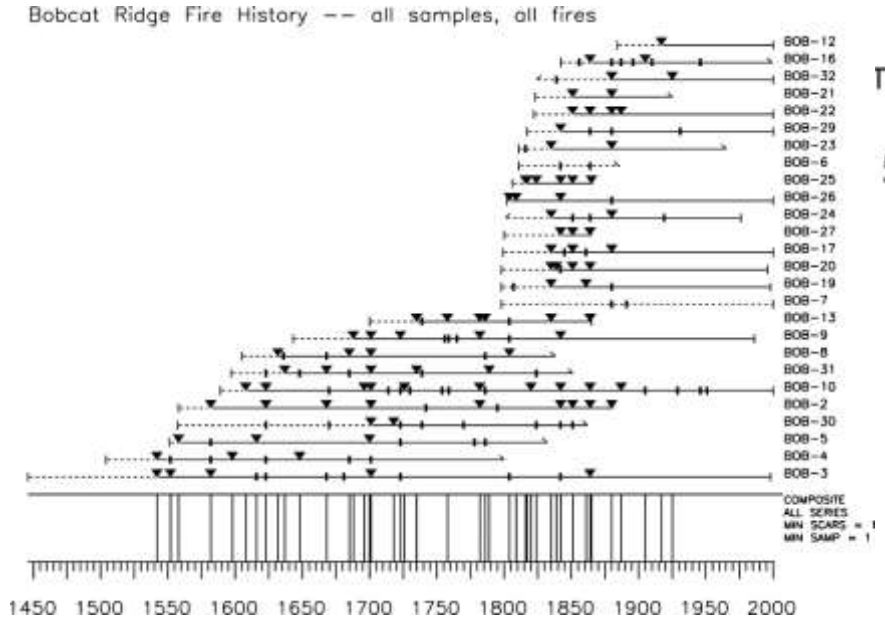
Red Mountain Ranch Fire History





Red Mountain: Human-driven fire regime until around 1741; lightning-driven fire regime until around 1900 when fire was suppressed. Very weak El Nino effect.





Bobcat Ridge: Lightning-driven fire regime until the early 1900s, when fire was successfully suppressed by humans. Somewhat stronger El Nino and drought effects.

Tree establishment is episodic and highly dependent on climate. Seedling establishment requires a good seed year followed by several wet years without fire. Historically, these conditions were rare.

Periods of Tree Establishment by Site

Seedling on bare soil at Soapstone

Young trees moving downslope at Bobcat Ridge

Phantom Canyon seedlings in the lee of a rock outcrop where snow accumulates

WERE PRE-SETTLEMENT LANDSCAPES "NATURAL?"

Can we tell if a fire was ignited by humans or lightning?
Not for individual fires. Lightning ignitions are plentiful, but patterns of fire occurrence over time can tell us about past human land use.

VS.

Native Americans in Larimer County did not practice agriculture, but they did manage the land. Their management practices changed over time, especially after they obtained horses in the mid-1700s.

Why would Native Americans burn?

- By accident
- To drive or confuse game
- To create game habitat
- To clear travel corridors or water courses
- To encourage food plants
- To encourage other useful plants
- To fire-harden wood, esp. lodgepoles
- Warfare

Skunkbrush sumac—edible berries, branches good for baskets

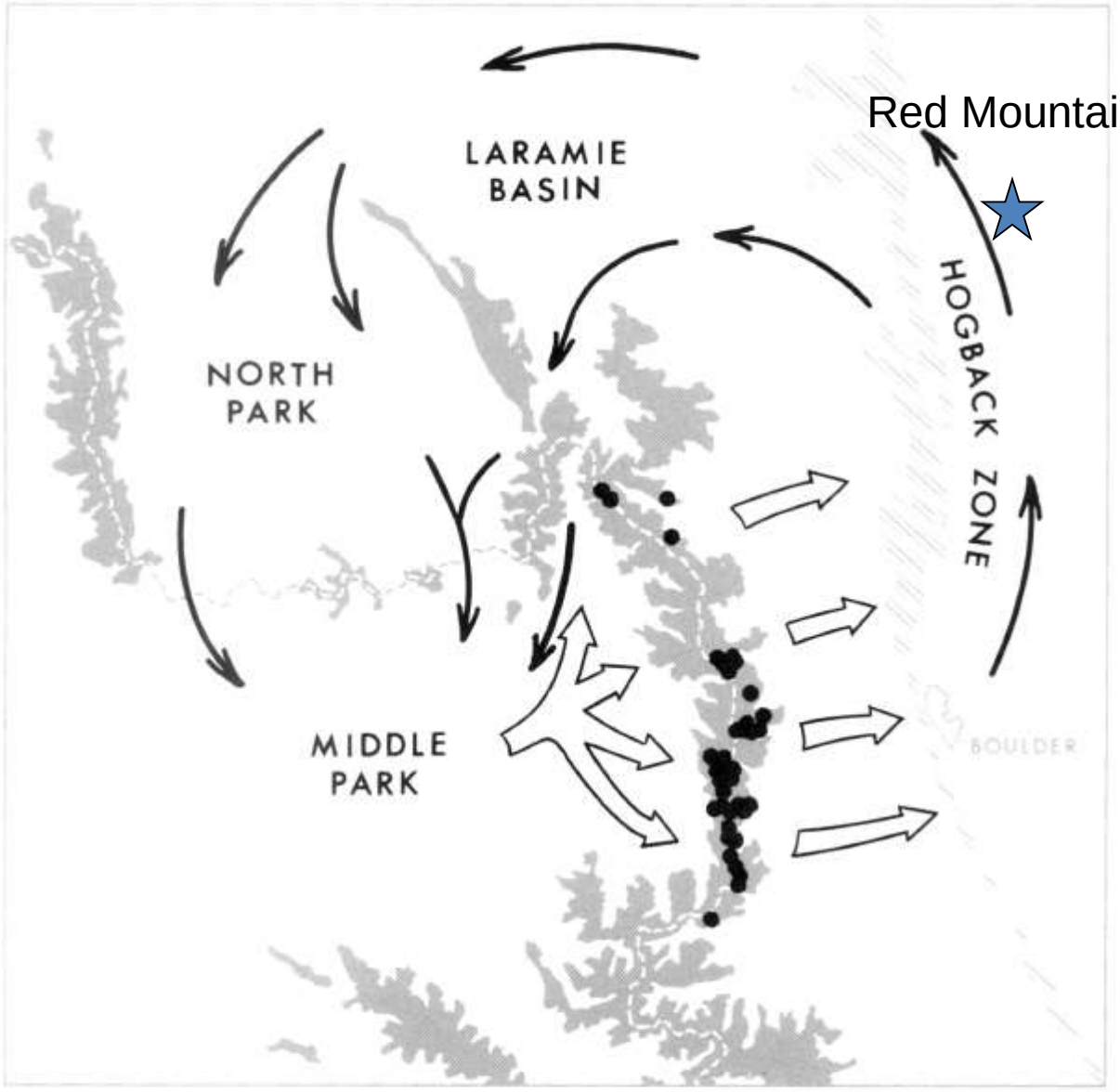
Mountain mahogany—very palatable to wildlife, especially sprouts

Common useful native plants that respond favorably to burning

Sego Lily—edible roots

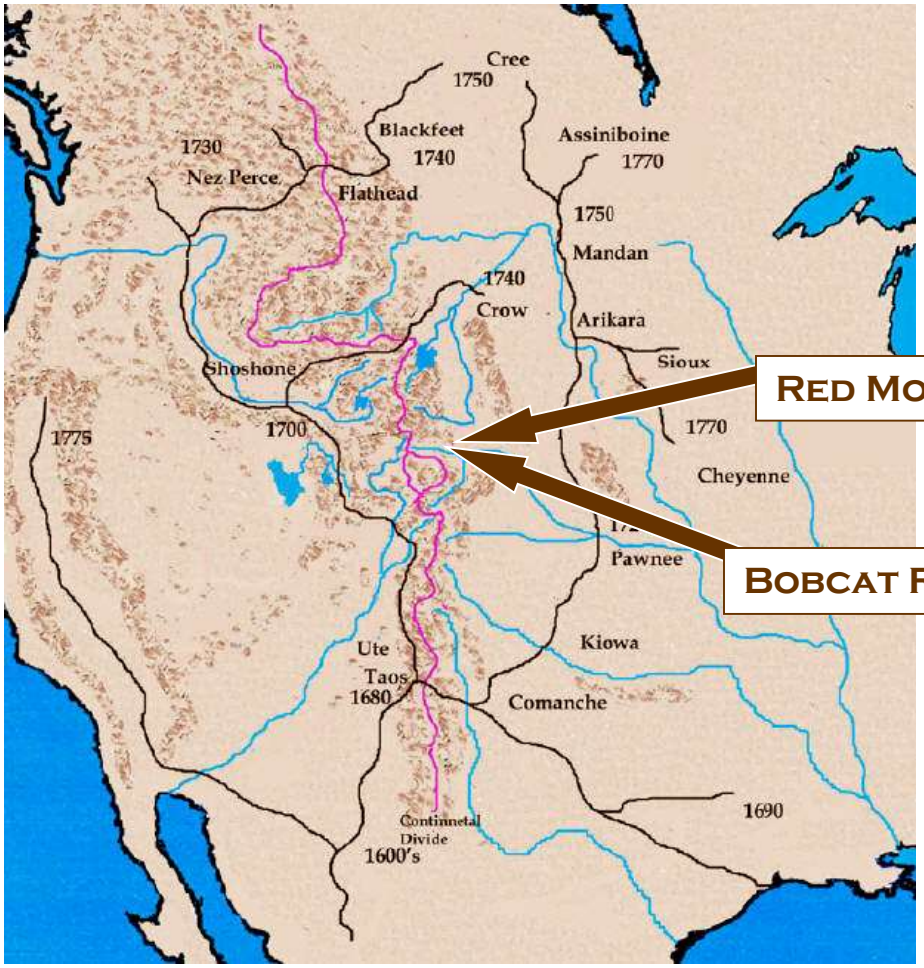
Yucca—edible flowers and roots, leaves useful for fiber

Chokecherry—edible fruit



The Rotary Transhumance system of Benedict

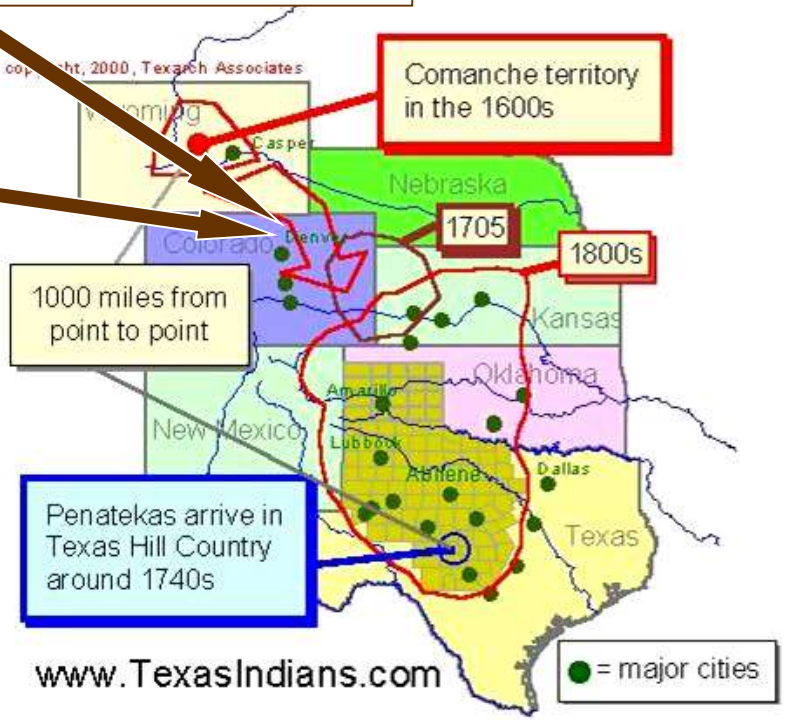
People spent the winter in the hogback zone in small groups, then migrated north through the parks to high elevations in summer, staged communal hunts at high elevations in fall and returned to the foothills for the winter. Perhaps they burned at winter campsites when they left in the spring?



Migration of the Comanches from 1600; they may have been in Larimer County in the early 1700s, when they obtained horses.

Red Mountain, Phantom Canyon

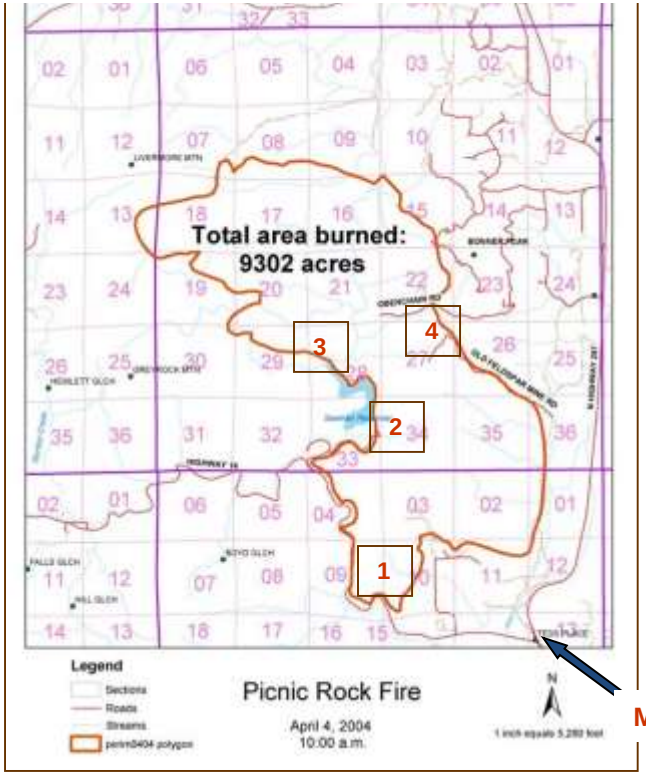
Bobcat Ridge



Comanche Migration

How horses spread through the West after being re-introduced by the Spanish in the 1500s; most natives obtained horses after the Pueblo Revolt in 1680.

Picnic Rock Fire, April 2004: Maybe a typical foothills fire?



The Picnic Rock fire was caused by human burning.

Grasses and shrubs sprouted vigorously after the fire.

Areas along roads were seeded to prevent erosion.

Settlement era burning and 20th century fire suppression

Land use in Colorado changed rapidly in the mid-19th century. Mining, logging, grazing and building occurred on an unprecedented scale. Locomotives started many fires.

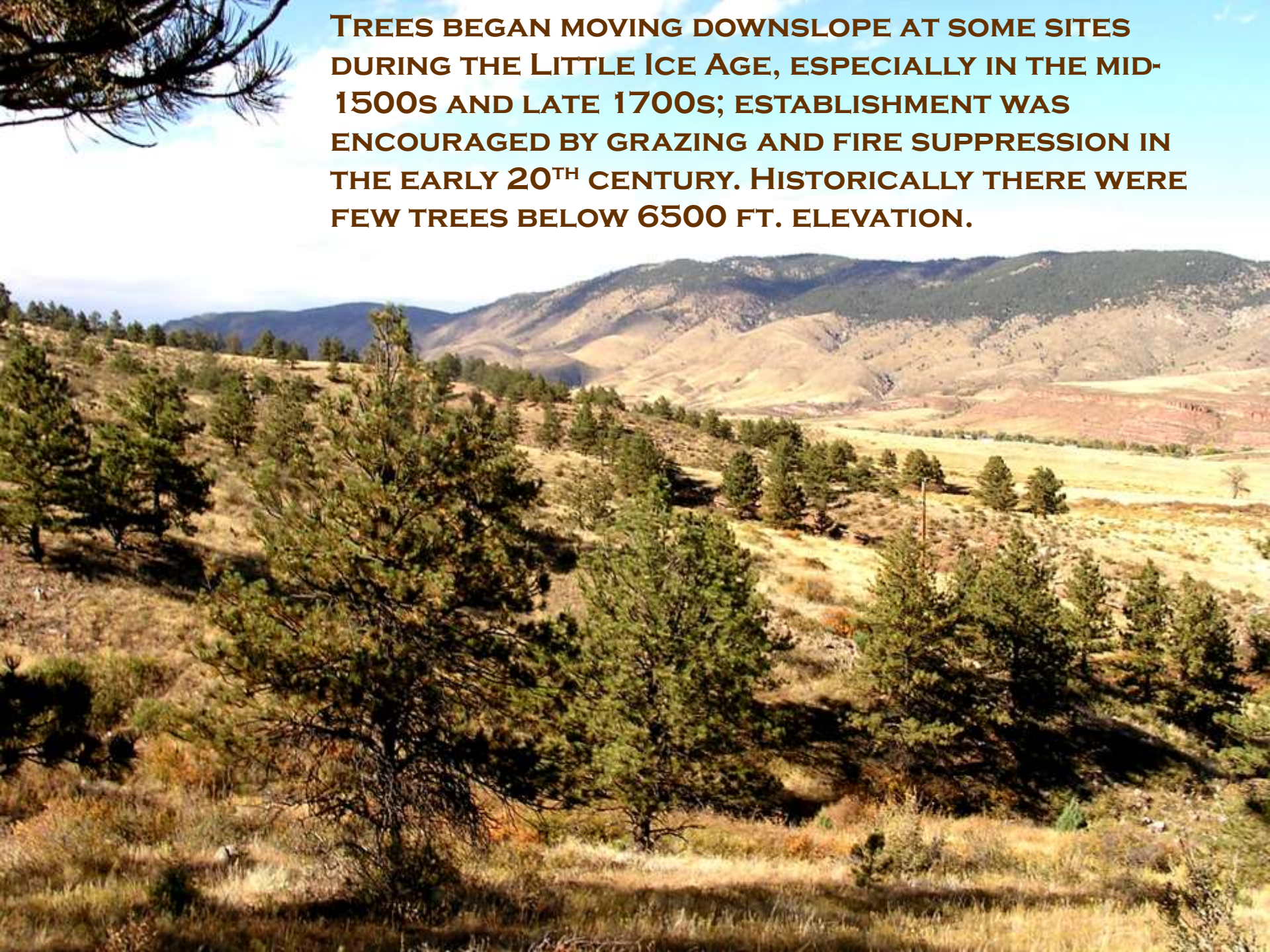
The U.S. Forest service was founded in large part to stop human-ignited fires in the West. Fire suppression did not become really effective in Colorado until the 1920s, but it has changed the structure of some forests profoundly.

Looking west from Inspiration Point from Pingree Park Road. Construction camp in left center. 1920.

Note the increased density of trees along the river and the slopes beyond. 2005

Consequences of fire suppression and climate change

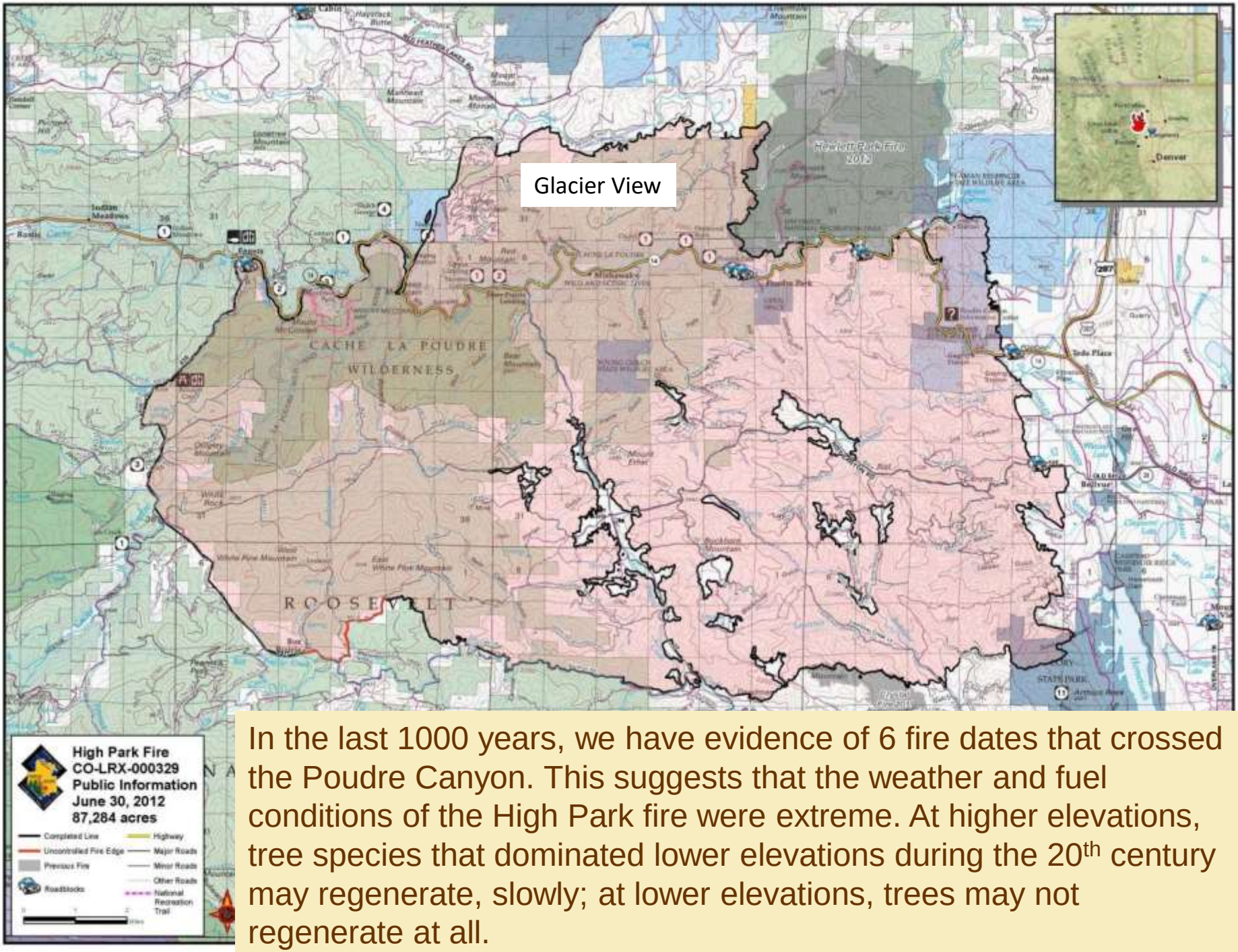
20th century changes in forest density and composition have been more evident below 7500 feet elevation than above. Trees were planted in the 1930s.


Trees began moving downslope at some sites during the Little Ice Age, especially in the mid-1500s and late 1700s; establishment was encouraged by grazing and fire suppression in the early 20th century. Historically there were few trees below 6500 ft. elevation.

Bobcat Gulch fire, May 2000: 10,600 acres burned, little to no regeneration of trees detected 19 years later. Reverting to grassland in a warmer climate?

Climate change: the past predicts the future

Climate changes affect the disturbance regimes and composition of forests. Past climates have been both warmer and cooler than the 20th century, and forests adapted to those changes. However, the rate of current climate change is faster than any before. Change to a warmer and drier climate over the last few decades is allowing for more frequent and intense fire, larger insect populations and shifts in the elevation ranges of species.



In the last 1000 years, we have evidence of 6 fire dates that crossed the Poudre Canyon. This suggests that the weather and fuel conditions of the High Park fire were extreme. At higher elevations, tree species that dominated lower elevations during the 20th century may regenerate, slowly; at lower elevations, trees may not regenerate at all.

Wanted Dead or Alive!

Have you seen these trees?


Ponderosa pine, scar date 1681


Dead ponderosa, scar not dated


Ponderosa pine, scar date 1?94


Dead ponderosa, scar date 1?70


Engelmann spruce, scar not dated


Dead ponderosa, scar not dated


Engelmann spruce, scar not dated


Dead ponderosa, scar date 1?40


Ponderosa pine, scar date 1794

Culturally modified ("peeled") trees are known from many parts of the country and the world. They are well-documented in the southern half of Colorado, but very few are recorded from Northern Colorado, especially Larimer County. We want to change that! Help us look for "peeled trees"!

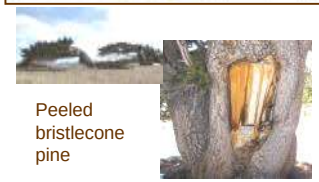
Native Americans peeled the bark from trees for many reasons:

- To eat the cambium inside the bark, either as emergency food or dried as portable, easily stored rolls or flour
- To make medicines
- To boil the cambium for sugar
- To use the bark to make trays, baskets, cradleboards and other items
- Marking territory or special locations

Characteristics of peeled trees:

- Trees older than 200 years
- Scars on mid-trunk, do not reach ground level
- Scar diamond or square shaped
- Axe marks may be visible on more recent peels
- Older peels may be mostly healed over
- Ponderosa pine and Engelmann spruce are best known; other species may be peeled, too.

Culturally modified trees are a vanishing resource! Old trees are being destroyed by wildfires, bark beetles, drought, changing land use and time. We must document them soon or lose them forever.



Peeled bristlecone pine

Other disturbances can scar trees. Don't be fooled!

Felling scars—caused when a falling log scrapes a nearby tree

Lightning scars—often spiral up into the crown

Fire scars—more common at lower elevations

Fire scars—more or less triangular shape

Fire scars—may be any height but usually go to the ground

Porcupine feeding—irregular shape, near ground or a branch

Peel scars can be dated to the year of formation using dendrochronology, even if the tree is dead. This can help us precisely date nearby archaeological sites, human movements and past land use.

If you think you have found a culturally modified tree, please contact us!

Laurie Huckaby
USFS-RMRS
lhuckaby@fs.fed.us
(970) 498-1298

Marcy Reiser
USFS-Arapaho-Roosevelt NF
mreiser@fs.fed.us
(970) 295-6890

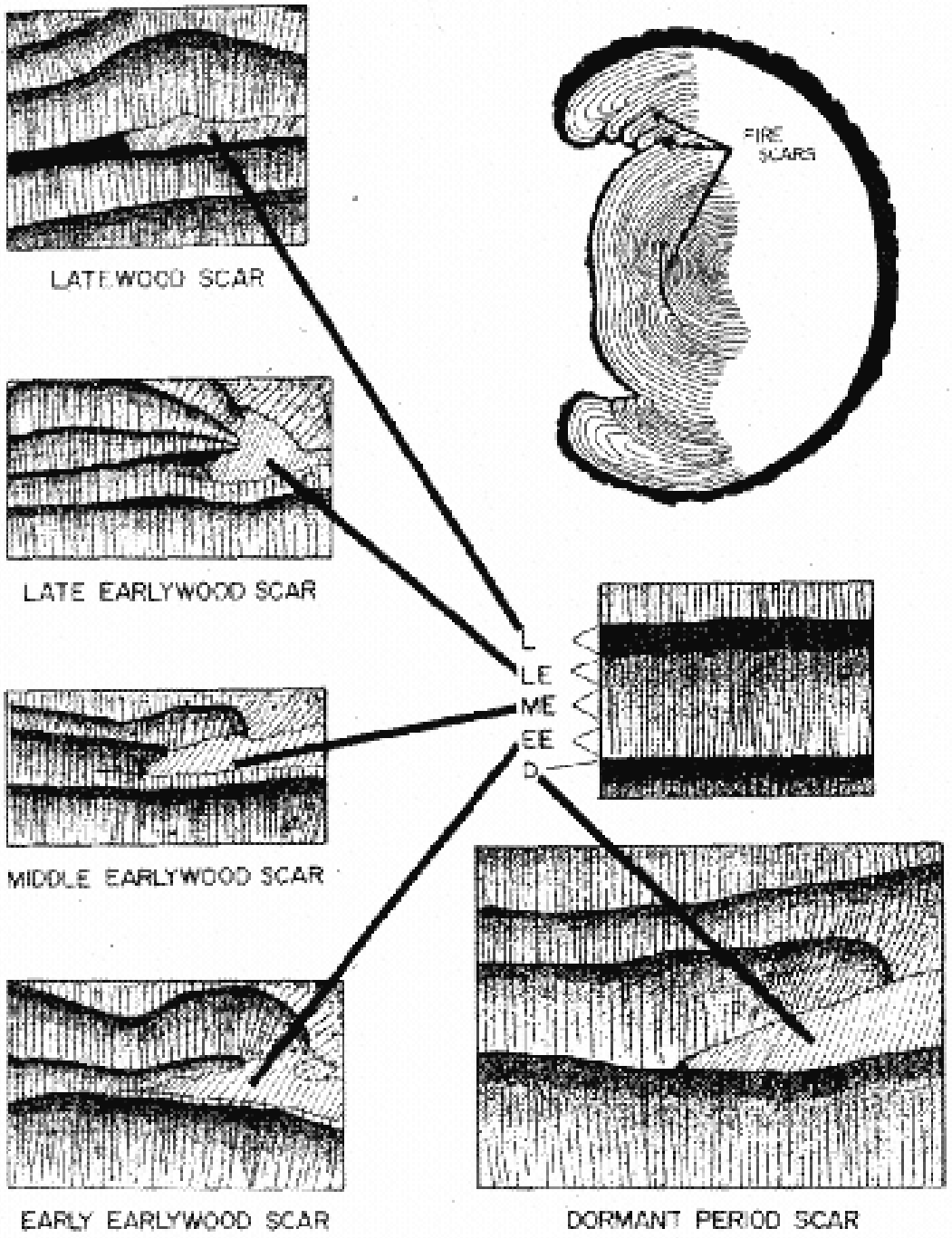
If you can, take a photo and get GPS coordinates or mark the location on a map. Be sure not to move or damage the tree—help us preserve this priceless heritage resource.

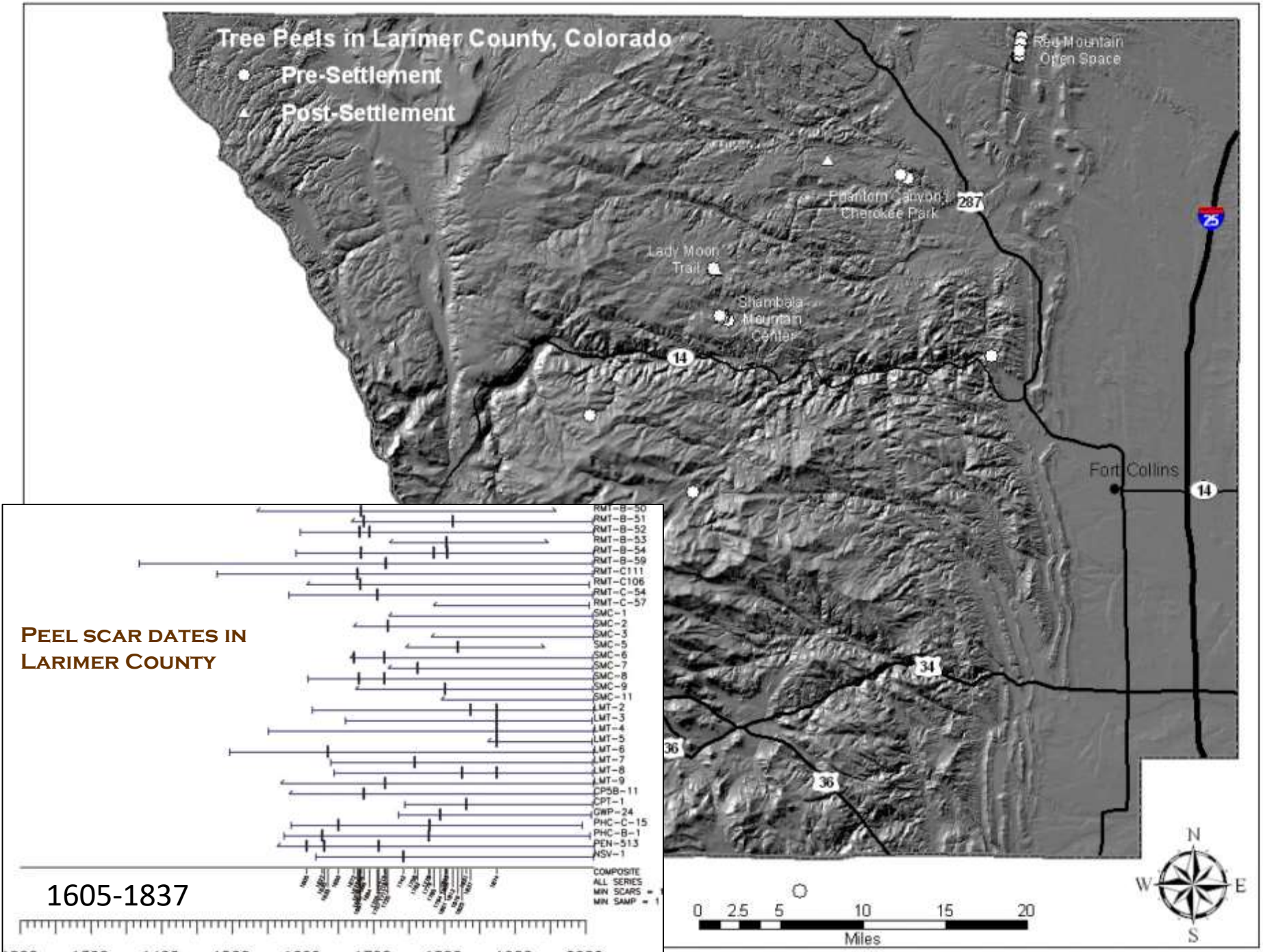
Why Cross-date?

False rings in Mexican cypress (*Cupressus lusitanica*). Photo by Peter Brown

Locally absent ring in Scots pine (*Pinus sylvestris*). Photo by Johathan Pilcher, Queen's College

When a ring is wide enough, it may be possible to determine when during the growing season the tree was scarred by fire. If a scar appears between rings, the fire occurred in the dormant season, either spring or fall.





Peel scar dates in Larimer County

1605-1837

Peeled Trees on Phantom Canyon Rim

Recently dead log with multiple scars inside the scar face, Phantom Canyon.
Pith date: 1583
Death date: 1997
Peel Scars: 1650, 1778

Live tree, peel scar
1778, Phantom Canyon

Red Mountain Fire History site B–Skull Canyon south rim

RMT-B-50

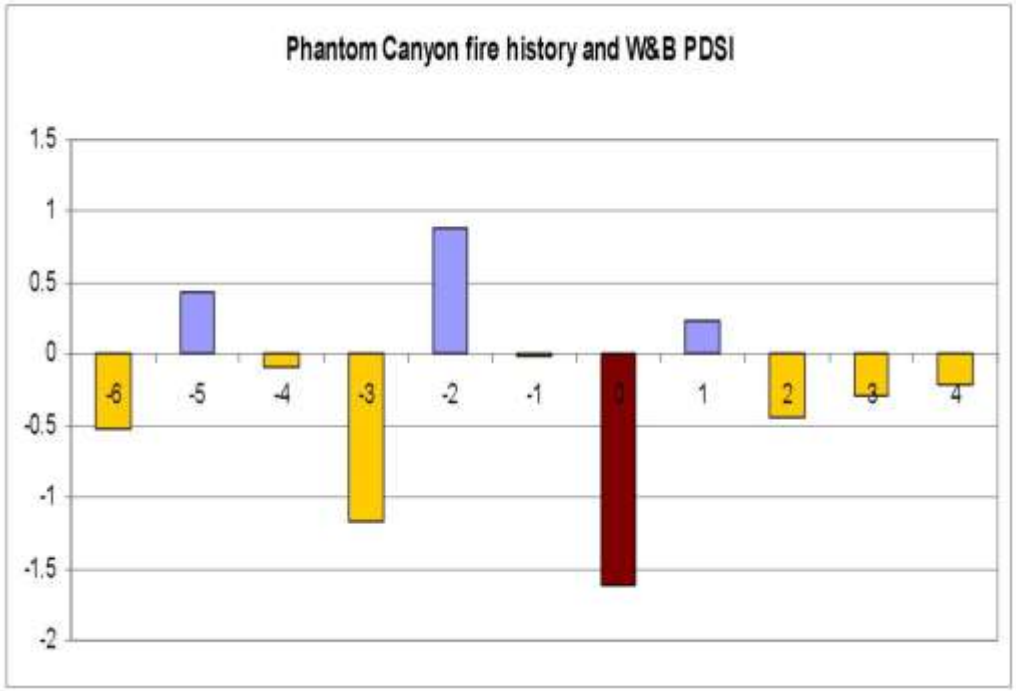
PIPO (*Pinus ponderosa*, ponderosa pine)

Dead

Elevation: 2089 m

Pith date: 1534 inside

This is the first one we found back in 2006! The big bump at the bottom of the scar is a burl formed by the tree as a reaction to the injury. Scar on south side of tree, 1682.



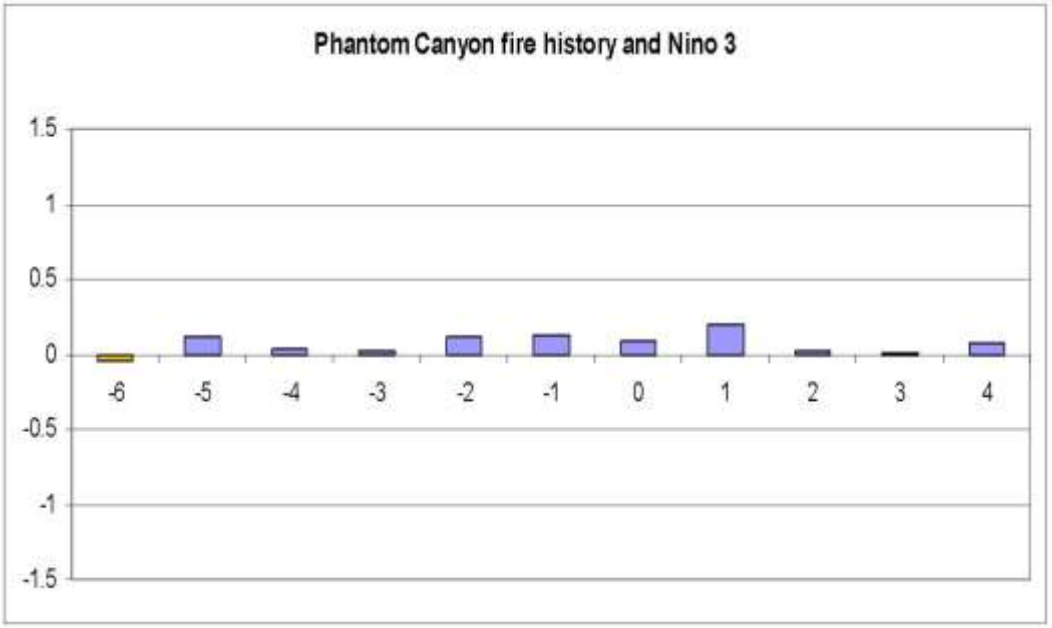
Fire and Climate–Superposed Epoch Analysis

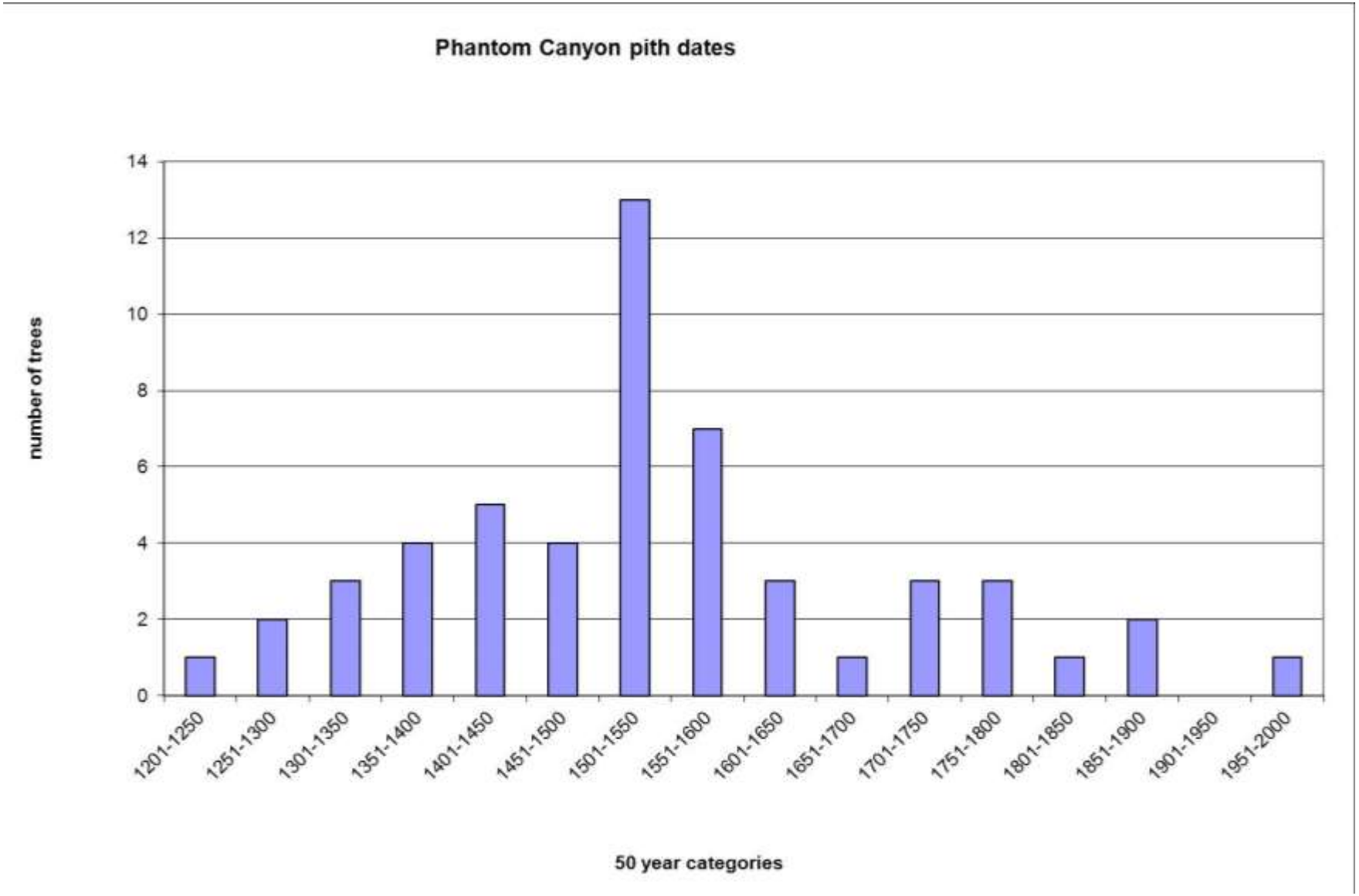
Fire years relative to reconstructed Palmer Drought Severity Index (PDSI) for 6 years prior to and 4 years after fire. The year 2 years before a fire was often slightly wetter than average, but the year of fire was always significantly drier.

(PDSI from Woodhouse and Brown 2001)

Fire dates compared with the occurrence of El Niño, reconstructed from tree rings for 6 years prior to and 4 years after year of fire. El Niño/La Niña cycles are not significantly related to fire occurrence at Phantom Canyon.

(Nino 3 from Cook et al. 2000)





Pith dates of fire history samples show a spike of tree establishment in the early 1500s. This event occurs all over the Front Range. Because we did not do a full age structure study at Phantom Canyon, regeneration appears to decline in the 18th and 19th centuries, but this is only because we sampled mostly dead wood. Other foothills sites show a spike of regeneration in the late 1700s-through early 1800s, and often a post-fire suppression regeneration event in the 20th century.

Chimney Hollow Open Space fire scars and age data

Probably a lightning-driven fire regime

18th century gap in fire frequency

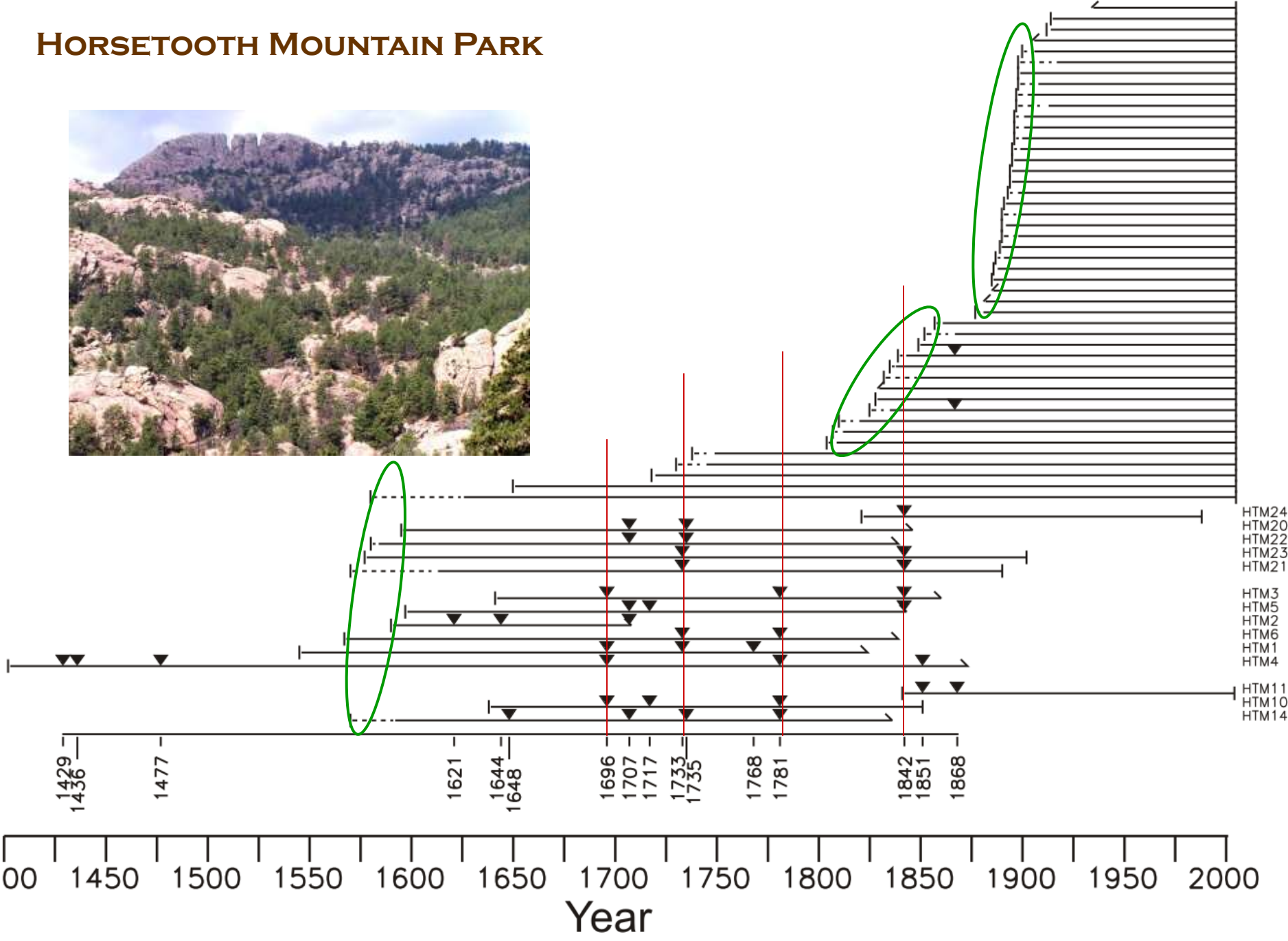
CHO→12
CHO→10
CHO→26
CHO→25
CHO→19
CHO→22
CHO→3
CHO→18
CHO→16
CHO→11
CHO→13
CHO→29
CHO→5
CHO→21
CHO→9
CHO→2
CHO→15
CHO→17
CHO→1
CHO→24
CHO→28
CHO→23
CHO→20
CHO→27
CHO→7
CHO→30
CHO→4
CHO→8
CHO→14
CHO→6

1328 1588 1596 1611 1667 1682 1695 1707 1713 1818 1820 1832 1846 1854 1931 1938

COMPOSITE
ALL SERIES
MIN SCARS = 1
MIN SAMP = 1

1550 1600 1650 1700 1750 1800 1850 1900 1950 2000

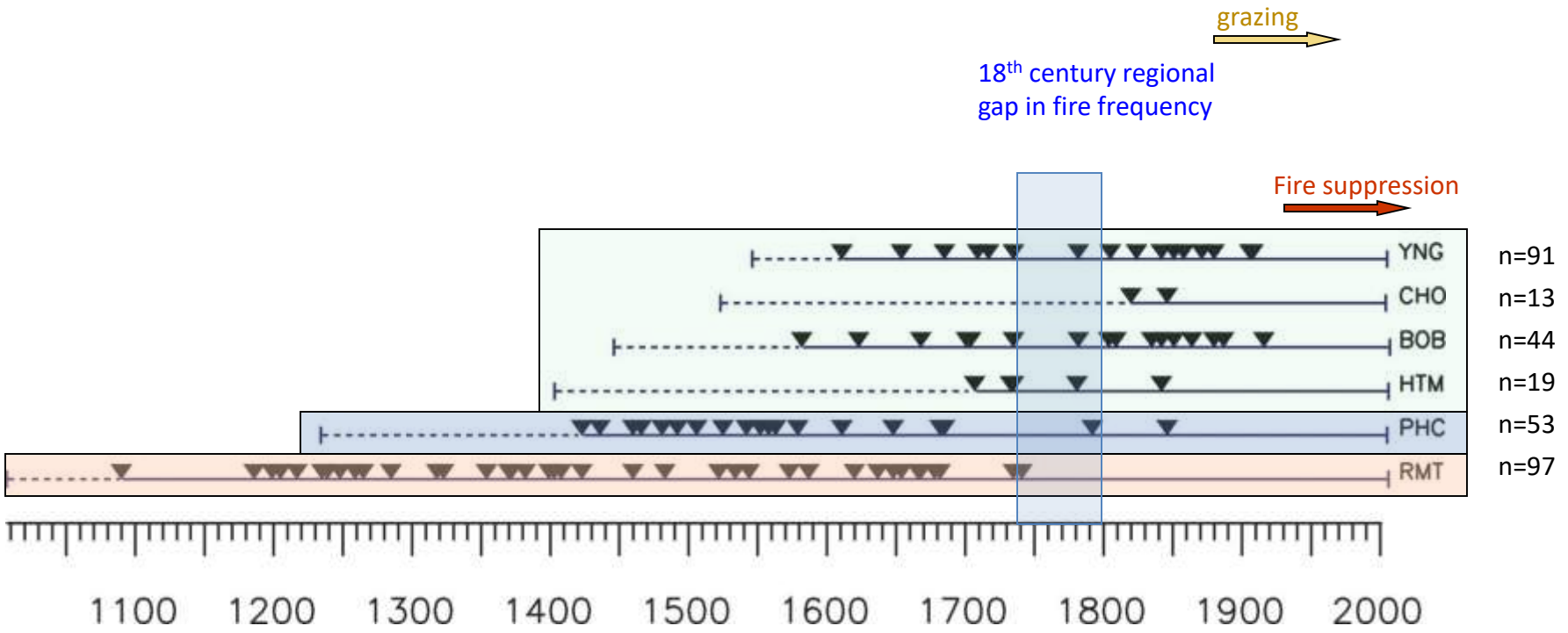
Horsetooth Mountain Park



Composite fire chronologies for foothills sites

Minimum of two scars for the year, three existing trees

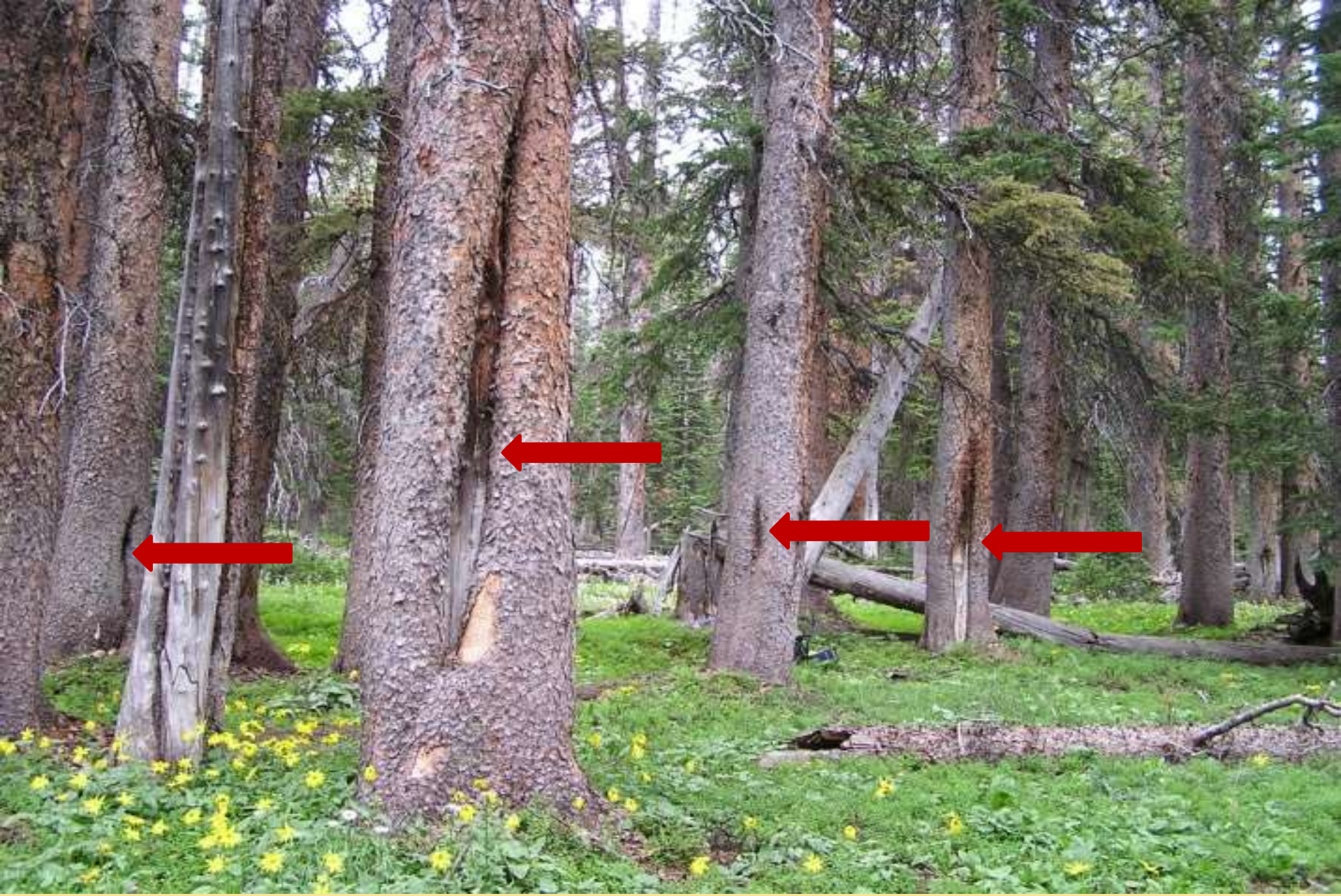
Medieval Warm Period | Little Ice Age | Modern Warming



Some differences between sites may be artifacts of sample number or size of sampling area. All sites showed the 18th century gap to some degree; sites on the mountain front resumed frequent fire afterward, but Red Mountain and Phantom Canyon did not. Fire regimes at the northern sites (PHC, RMT) were likely human-driven until around 1700; fire regimes at the eastern front sites (YNG, CHO, HTM, and BOB) were probably lightning-driven.

This is a packrat midden we found on the canyon wall near plot D; the upper part is indurated (sub-fossilized), but the lower part with the fresh twigs is still active. Preserved vegetation can be carbon dated and used to reconstruct local vegetation thousands of years ago.

Part I: historical ecology and tree-ring dating



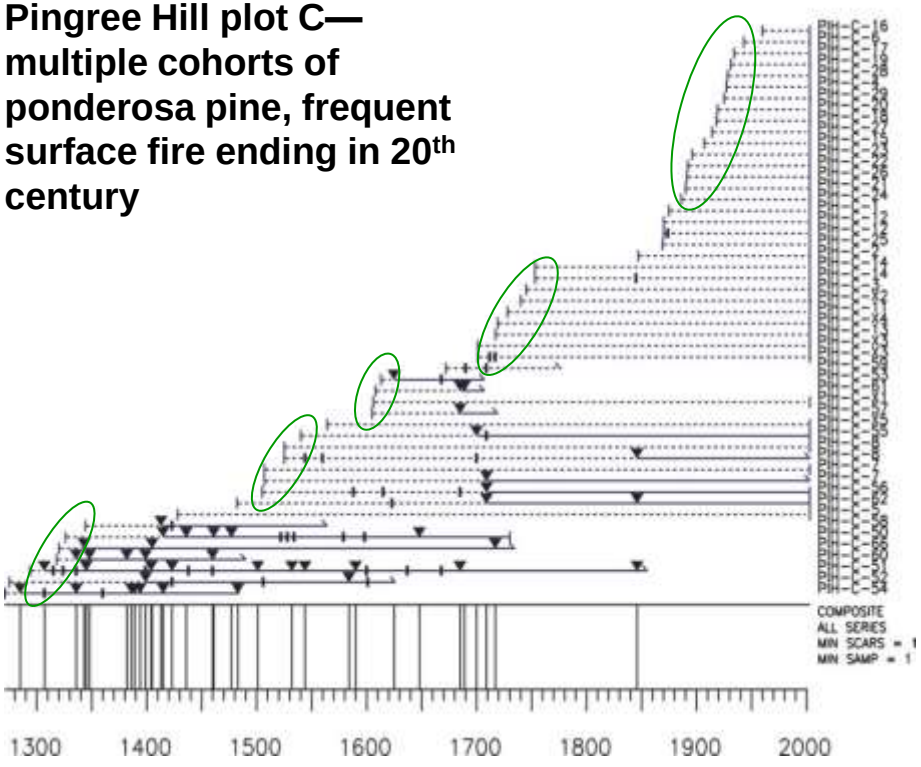
Part II: Culturally Modified Trees and Structures

Conical lodges near the Coffin Bison Kill site in Jackson County date to the 18th-19th centuries

Bow stave trees and marker trees

Trees were bent in the direction of a trail, water, or sacred site.

Pingree Hill plot C—multiple cohorts of ponderosa pine, frequent surface fire ending in 20th century



Surface fire regimes at Pingree Hill

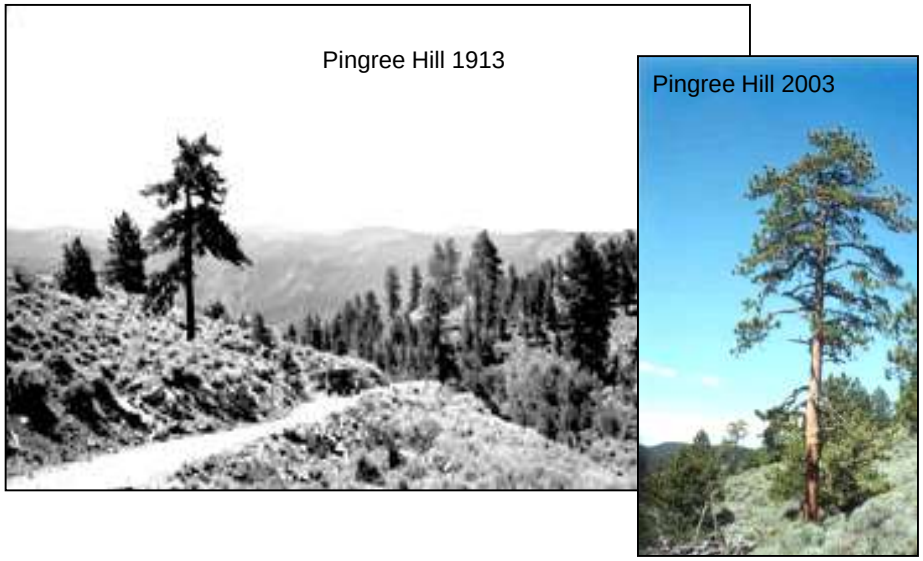
--Tree establishment episodes usually do not immediately follow fires

--fire dates and tree establishment dates differ even between adjacent sites

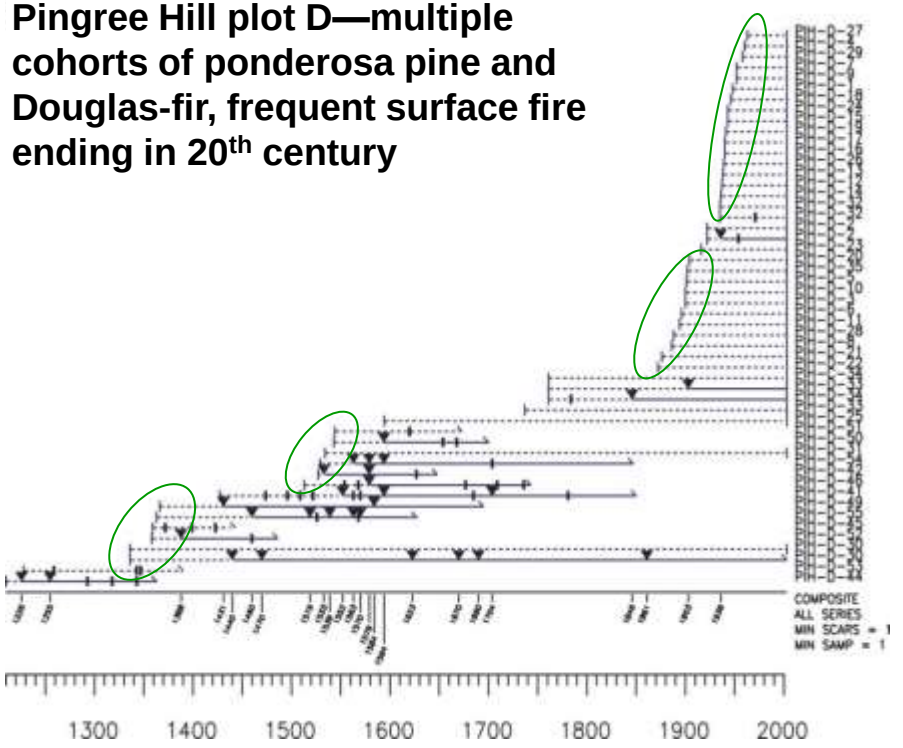
--sites have been dominated by ponderosa pine for at least 700 years

--regional gap in fire frequency in the mid-late 18th century

--episode of tree establishment in the 20th century



Pingree Hill plot D—multiple cohorts of ponderosa pine and Douglas-fir, frequent surface fire ending in 20th century



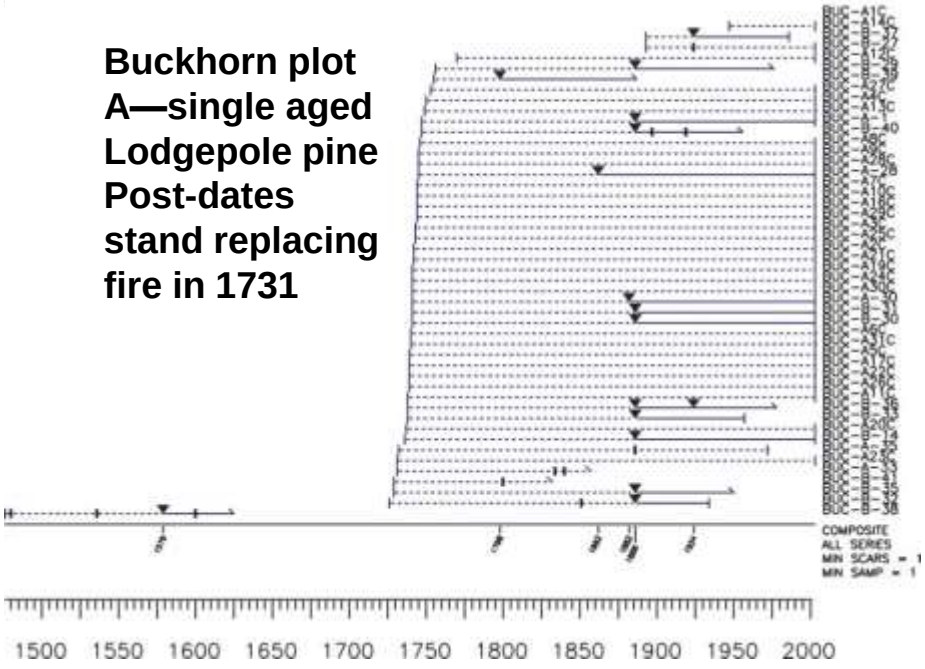
Lodgepole pines produce single cohorts from serotinous seeds

Many lodgepole pine stands have some trees with serotinous cones

Age structure can be used to date stand-replacing fire by detecting post-fire cohort formation.

Aspen sprouts from surviving rootstock

Buckhorn plot A—single aged Lodgepole pine Post-dates stand replacing fire in 1731



Age structure reveals stand-replacing fire regimes at Buckhorn

--Tree establishment episodes immediately follow fires

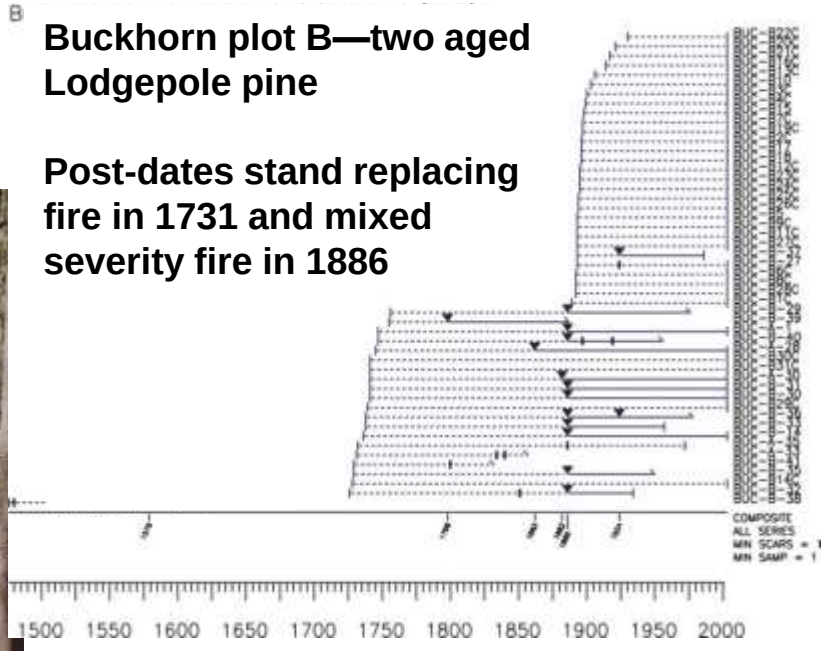
--fire dates and tree establishment dates are the same between adjacent sites, suggesting widespread fire

--sites have been dominated by lodgepole pine for at least 300 years

--no episode of tree establishment in the 20th century

Buckhorn plot B—two aged Lodgepole pine

Post-dates stand replacing fire in 1731 and mixed severity fire in 1886



Mountain mahogany sprouting three weeks after Hayman fire

Yucca sprouting within weeks of Hayman fire

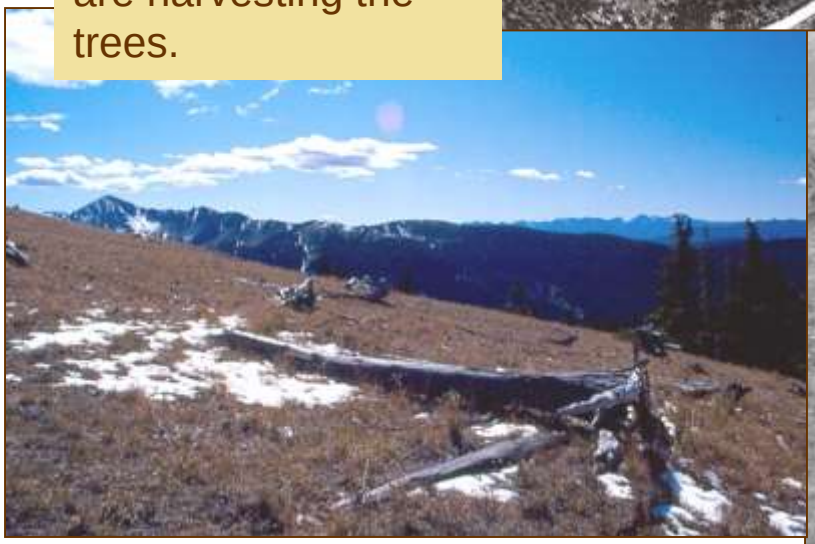
Most native vegetation in Northern Colorado is Fire-adapted

Many native bunchgrasses sprout after fire

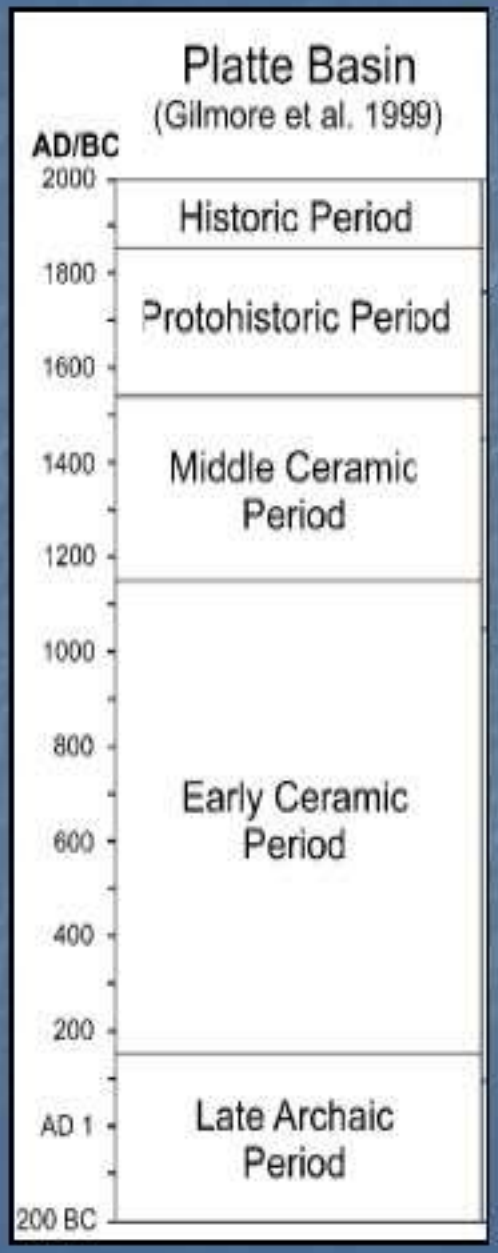
Native willows and riparian plants sprout after fire

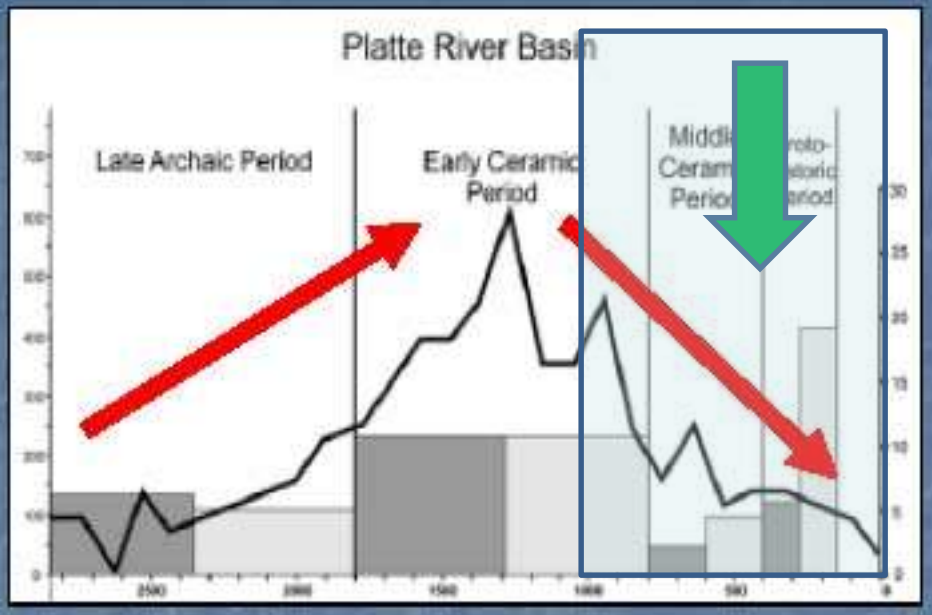
Reconstructing upper treelines—complicated by human use of high elevations

Treeline is usually climate-controlled—except when humans are harvesting the trees.



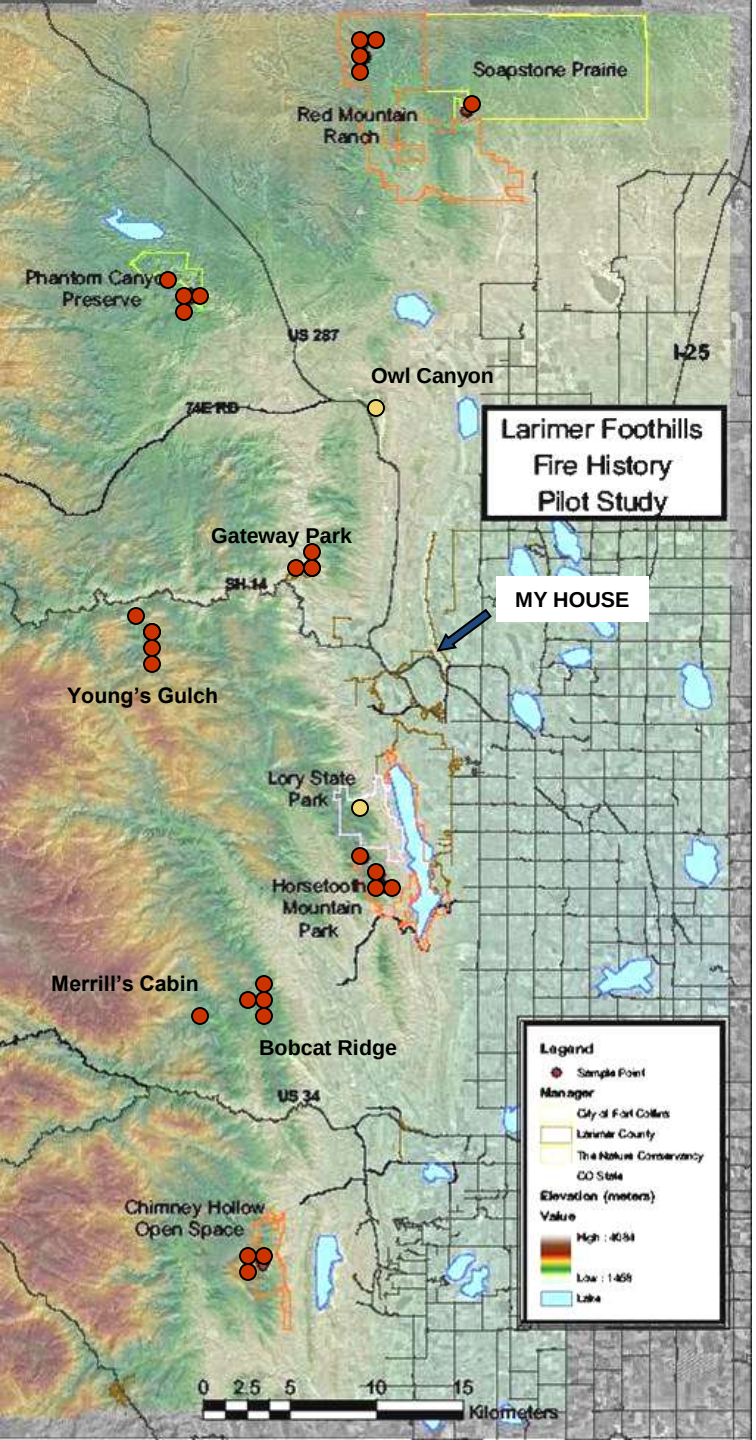
Cultural Chronology In Northern Colorado (Gilmore 2008)





Population Decline For The Middle Ceramic Through Protohistoric Periods, In Regard To Dated Components

The Irony Is That This Period Is the Strength of the Fire History Record



Sites in the Larimer County foothills fire history

Site	Elevation Range (ft)	Area (acres)	Ownership
Red Mountain Open Space	6655-7043	13,500	Larimer County
Soapstone Prairie	6369-6438	18,000 (~30)	City of Fort Collins
Phantom Canyon Preserve	6175-6820	1,700	The Nature Conservancy
Young's Gulch	6263-6783	~2,000	US Forest Service
Horsetooth Mountain Park	5878-6964	2,696	Larimer County
Bobcat Ridge Natural Area	5798-6767	2,600	City of Fort Collins
Merrill's Cabin	6792-7150	35	Private
Chimney Hollow Open Space	6377-3696	1,847	Larimer County

Sampling Methods

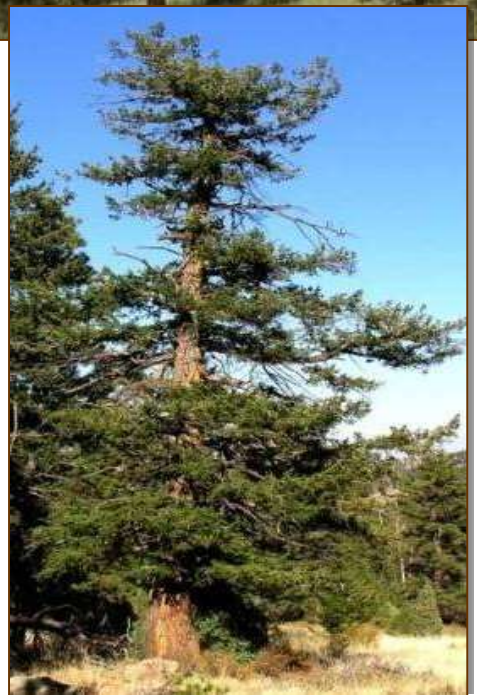
Old Trees

Historically, old trees existed on a substantial proportion of the Front Range montane landscape, surviving multiple fires during their lifetimes. Even after extensive logging and fire in the montane zone, old trees are common.

Ponderosa pine, pith date 1594, near Pennock Pass.

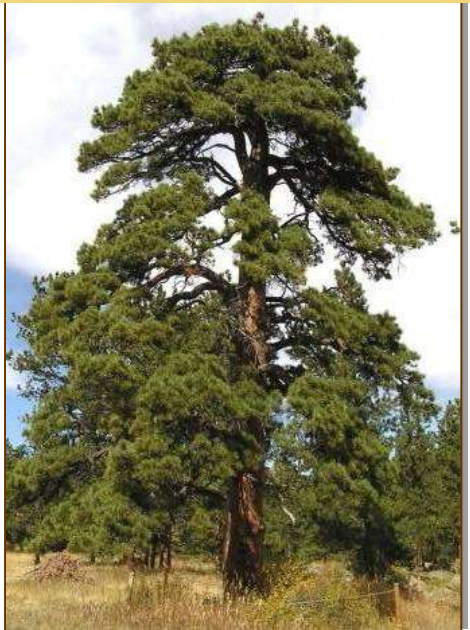
Ponderosa pine, pith date 1381, on a poor site in the foothills.

The conditions under which a tree lives affects its appearance.



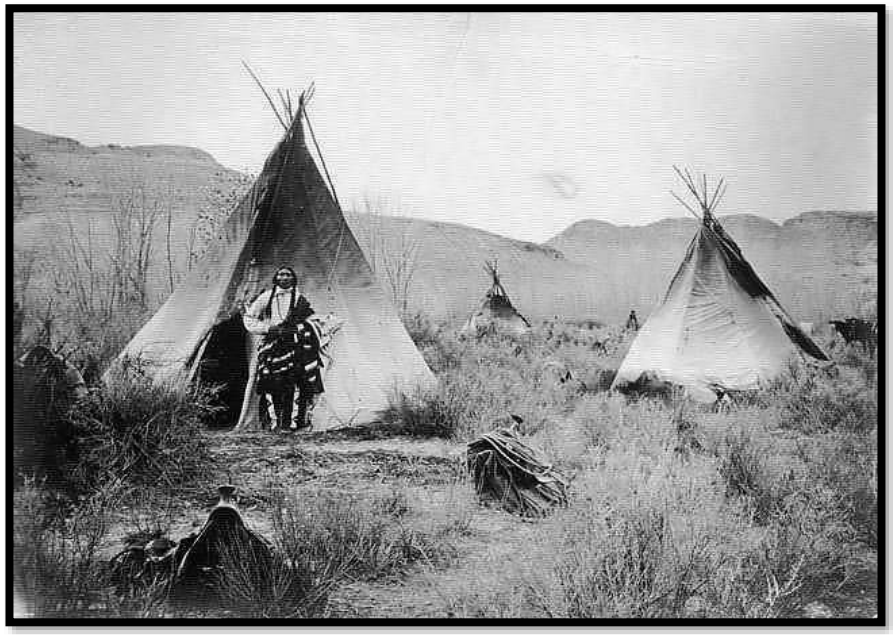
Douglas-fir at middle elevations, pith date 1474.

Rocky Mountain juniper, foothills, inside date 1437.

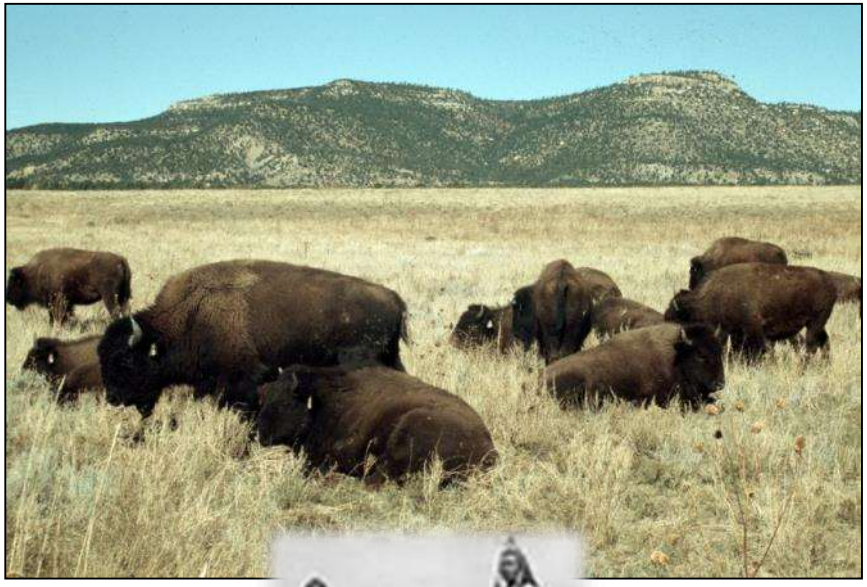


Ponderosa pine, pith date 1321, on a good site at 8000 feet elevation.

Humans



And other animals…

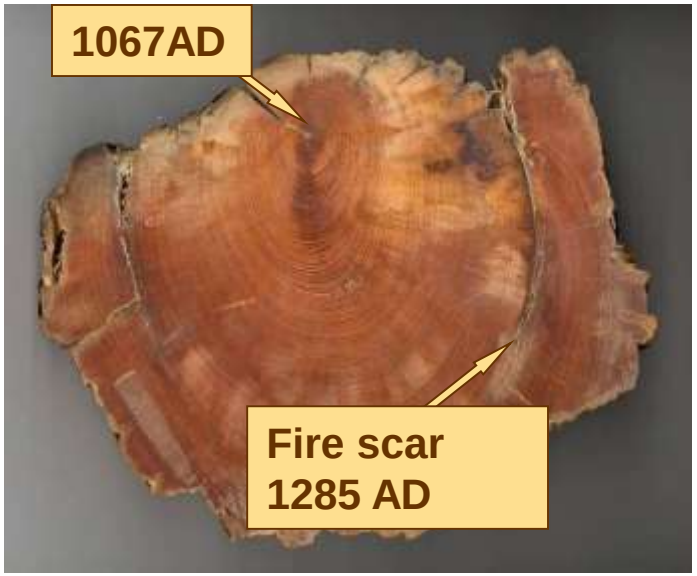


VERY LONG CHRONOLOGIES IN LARIMER COUNTY

Old trees and old wood are essential to building a fire history chronology. We have two of the longest chronologies in ponderosa pine:

Mixed conifer between 7500 and 9000 ft. Earliest pith date: 1020 CE, earliest fire date: 1107 CE

Red Mountain between 5000 and 7200 ft. Earliest pith date: 980 CE, earliest fire date: 1029 CE

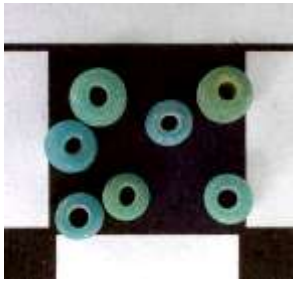


Climatically driven episodes of tree establishment occurred in the early 1100s, 1300s, the mid-1500s, the late 1700s and the early 20th century. Some of the early 1300s trees are still alive.

Even with the attenuating record over time, the number of samples at these sites confirm the trends of a warmer and drier Medieval Warm Period (800 CE to early 1300s) with frequent surface fire and a cooler Little Ice Age with drought-driven mixed severity fire.

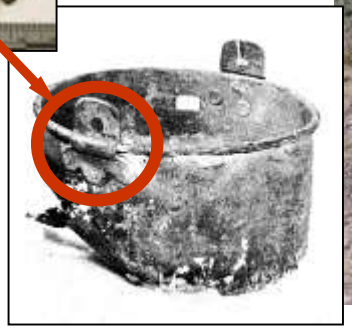
Signs of Native Americans at Red Mountain Open Space

Red Mountain and Soapstone are currently being surveyed for historic and prehistoric archaeology by Dr. Jason LaBelle and his team from Colorado State University



Contact-era trade goods found at the Lykins site

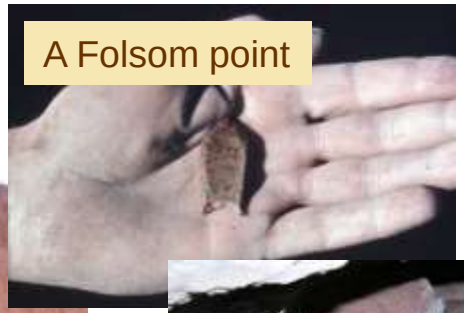
Fitting from a brass kettle



Peeled tree on the rim of Skull Canyon; scar 1681

Buried flint flakes exposed in a wash

Tinkler ornament



Buried oven and layers of organic deposition exposed in a wash

Bison skull embedded in creek bank

Layer of buried ash and charcoal exposed in a wash, Lykins Valley