Healthier Forests Mean Cleaner Water

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Crown Fire vs. Surface Fire

Historical Change: Estes Park, over time

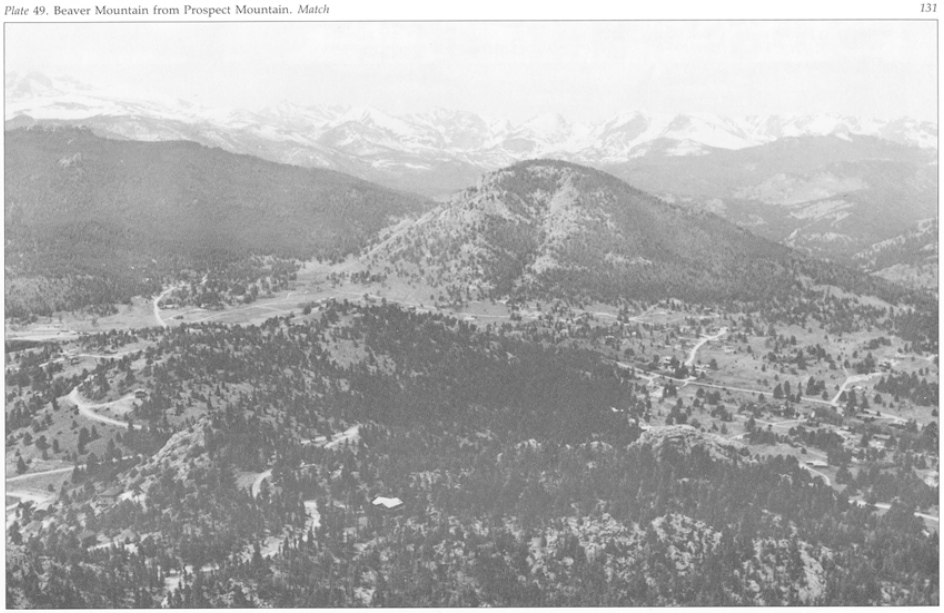
Plate 49. Beaver Mountain from Prospect Mountain. *Original* 130

Location: This is a west view of Beaver Mountain taken from Prospect Mountain. The camera point was 0.4 km west of the intersection of sections 36 and 30, T5N R73W, at an elevation of 2623 m. *Original:* 1921, W. T. Lee No. 2037, USGS. *Match:* 1986, T. T. Veblen and D. C. Lorenz No. L2.

1921

1986

Plate 49. Beaver Mountain from Prospect Mountain. *Match* 131



Description: The open ponderosa pine woodlands of the center and foreground in the old photograph appear to have been logged. The match shows a marked increase in tree density, particularly of Douglas fir. The gray tones in the right center of the present photograph are crowns of Douglas fir defoliated by spruce budworm.

What Happens After Intense Wildfire?

- Loss of ground cover to intercept rain
- Water-repellent soils
- Unstable slopes
- Tree/root death = reduced water absorption

***Much greater potential for post-fire flooding, erosion, sediment loads**

And then, when the rains come…

1996 Buffalo Creek Fire

2002 Hayman Fire

*The Hayman and Buffalo Creek fires led to almost $28 million in restoration/repair costs to Denver Water's collection system.

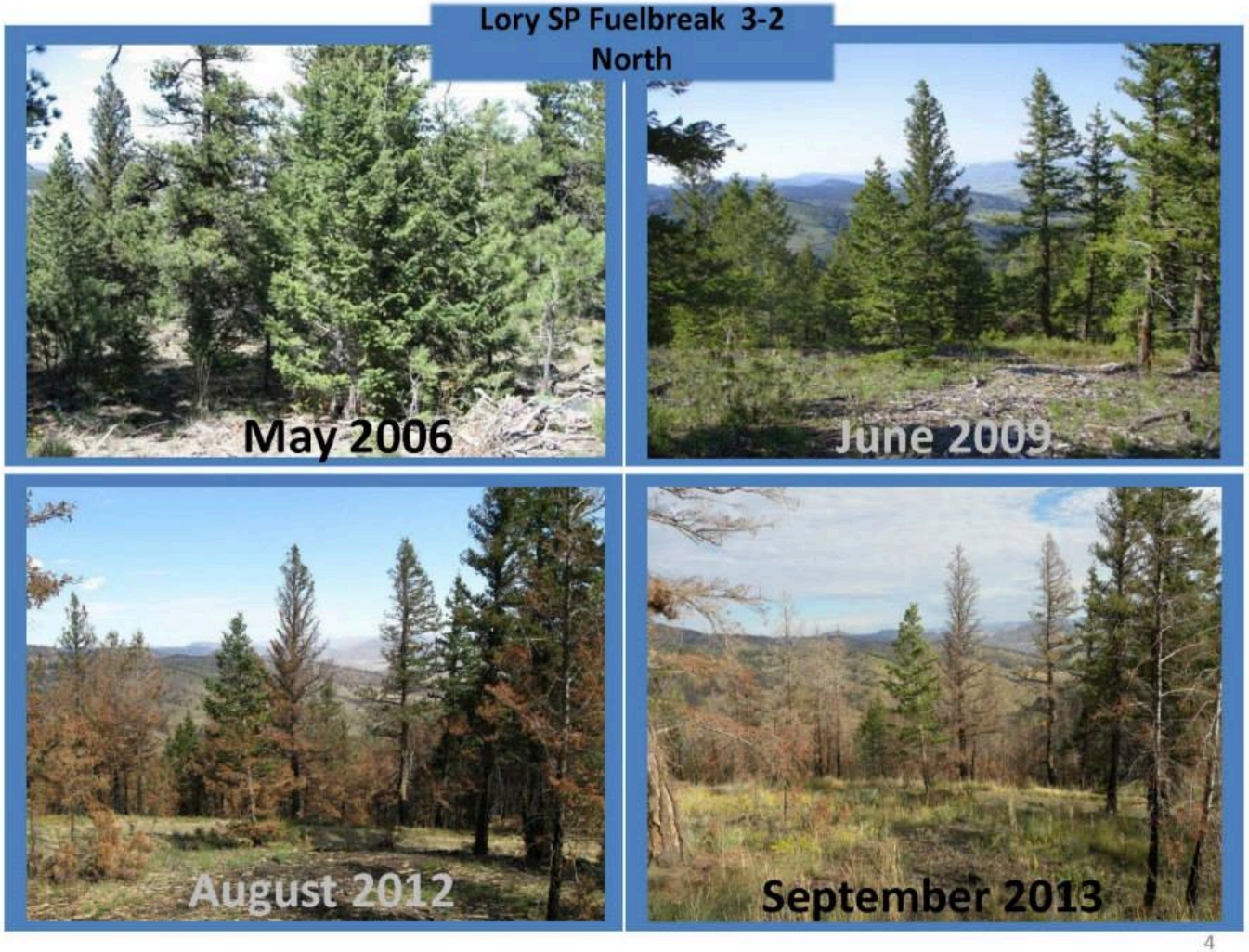
2012 High Park Fire

Forest Management: A Solution

- Thinning trees for more historical tree densities
- Creating fuelbreaks to slow fire spread, reduce intensity and help firefighters manage fire
- Reducing risk for intense crown fire by removing “ladder fuels”
- Reducing woody fuels available for wildfire, and risk of insect and disease

Less risk of severe runoff/erosion, infrastructure damage and reduced water quality if a wildfire occurs

Example: Lory State Park/High Park Fire



The Alternative: Being Reactive

Thank you!

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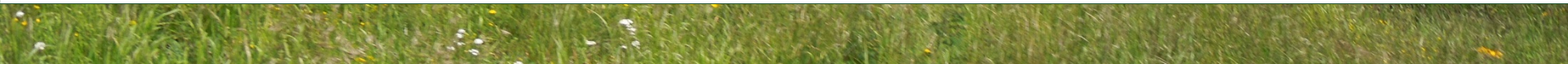
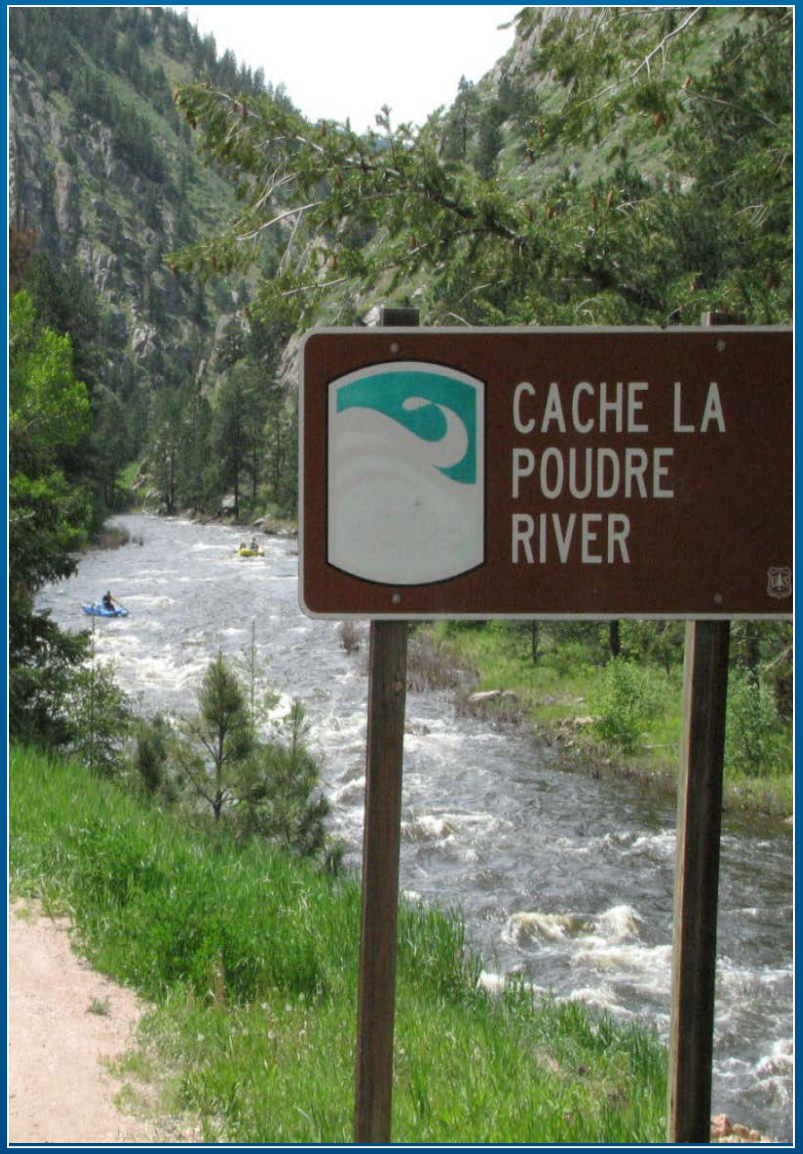


Expecting and Detecting Changes -

Source Water Quality Monitoring on the Poudre River



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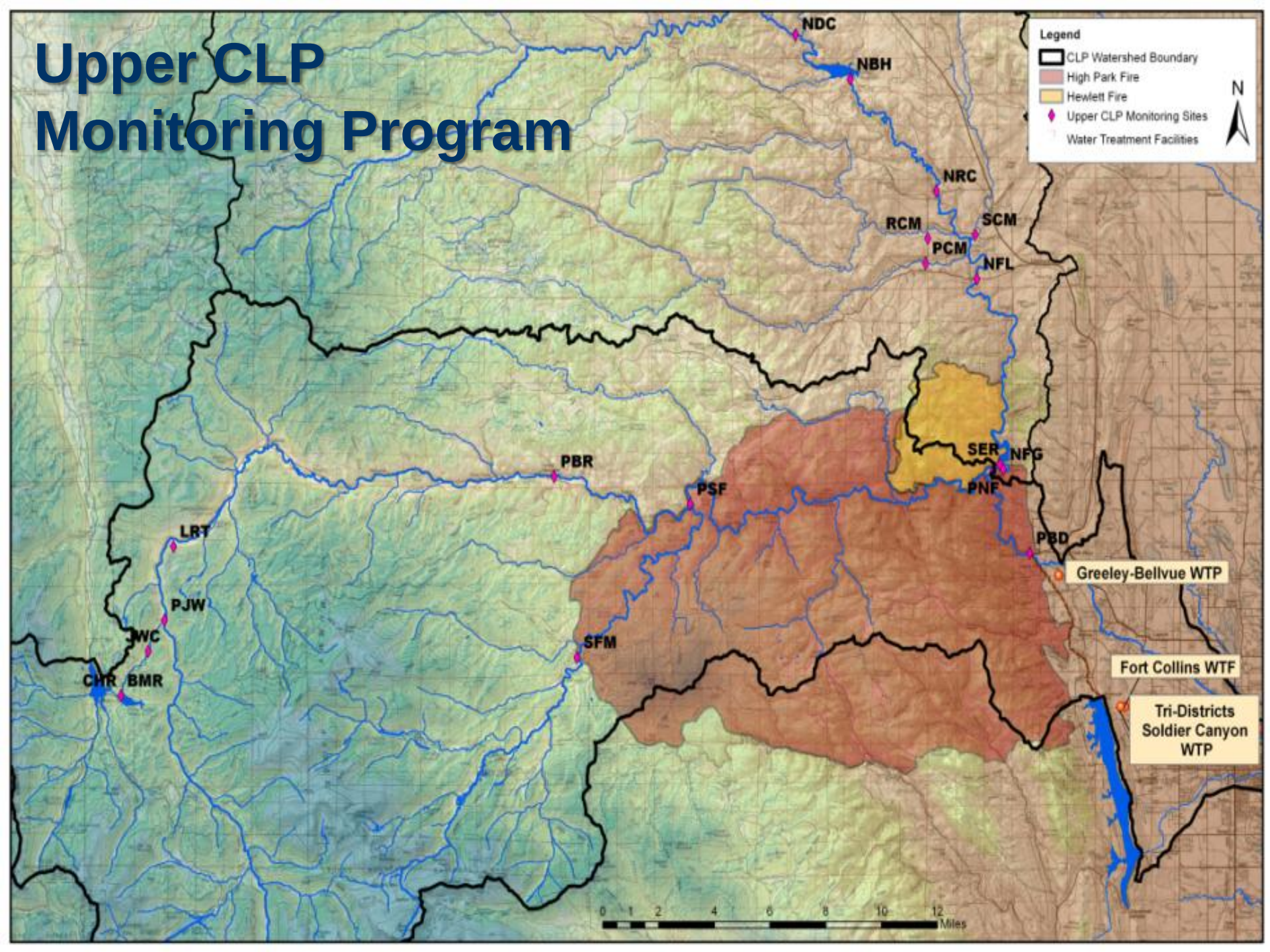
City of Fort Collins

Fort Collins Utilities
Source Watershed Program

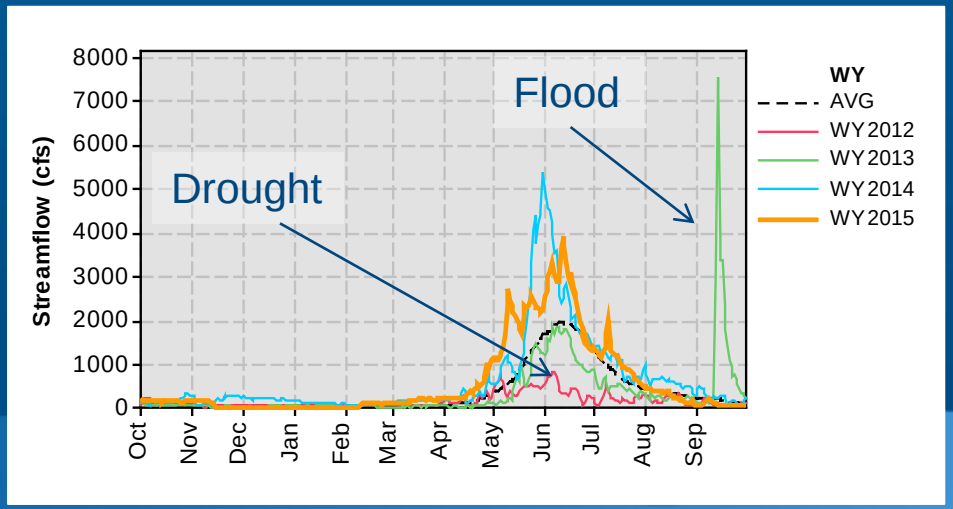
Protecting the City of Fort Collins' raw drinking water supplies through water quality monitoring and collaborations that support and sustain healthy watersheds.

Upper Cache la Poudre Cooperative Water Quality Monitoring Program

- City of Fort Collins
- City of Greeley
- Tri-Districts


Upper CLP Monitoring Program
Legend
CLP Watershed Boundary
High Park Fire
Hewlett Fire
Upper CLP Monitoring Sites
Water Treatment Facilities
N
NDC
NBH
NRC
RCM
SCM
PCM
NFL
SER
NFG
PNF
PBD
PBR
PSF
LRT
PJW
JWC
CHR
BMR
SFM
Greeley-Bellvue WTP
Fort Collins WTF
Tri-Districts Soldier Canyon WTP
0 1 2 4 6 8 10 12
Miles

Anticipating Future Stressors



Water Quality Lessons: Hewlett Gulch and High Park Wildfires (2012)

- Post-fire storm events drive rapid and dramatic changes in water quality
- Sediments are sources of turbidity, nutrients, metals and TOC and can persist within stream channel
- Background nitrate concentrations remain elevated 5 years post-fire
- Sediment and ash differ require different treatment approaches

Mitigating Risks to Water Quality

Fort Collins Source Water Protection Plan (2016)

- Support and fund remaining post-fire restoration projects that impact water quality
- Participate in the development of a Watershed Resiliency Plan, through the Coalition for the Poudre River Watershed (CPRW) Stakeholders group
- Identify and target critical areas for forest health / fuels reduction treatments
- Maintain early-warning water quality alert system and monitoring partnerships

Thank you!

Learn More:

http://www.fcgov.com/utilities/what-we-do/water/water-quality/source-water-monitoring

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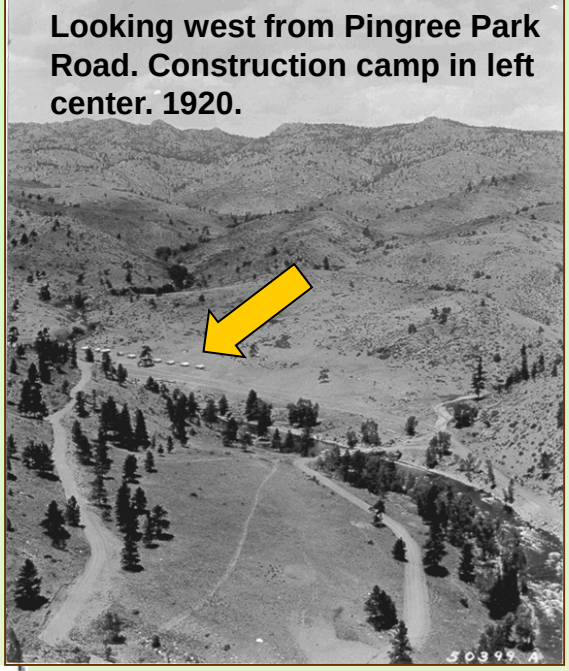
City of Fort Collins

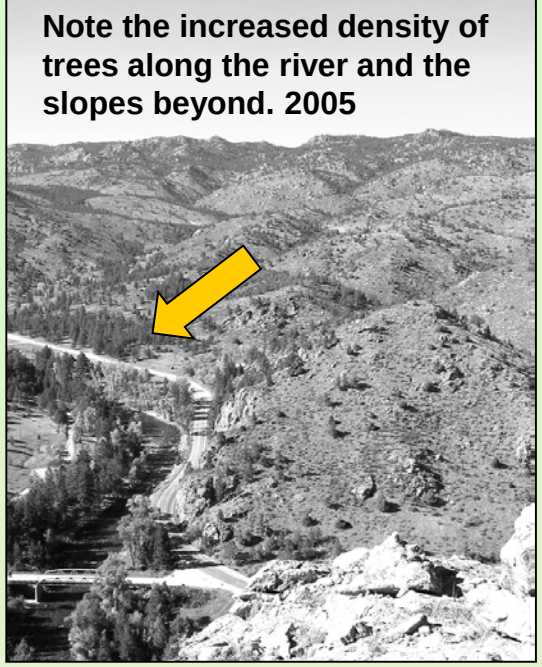
Historical Ecology

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

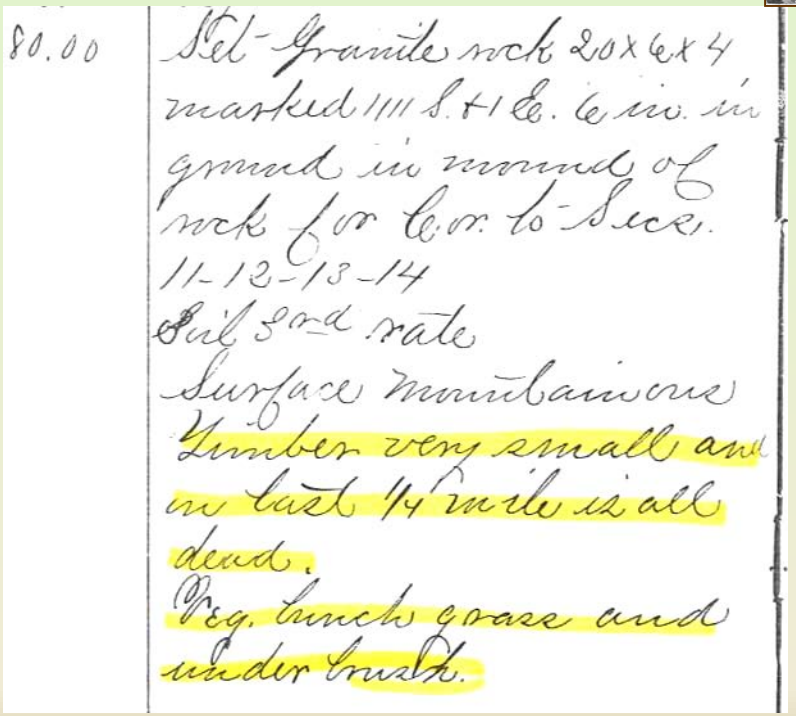
How can we manage forests to meet human needs and to be resilient in the face of disturbance and climate change?



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



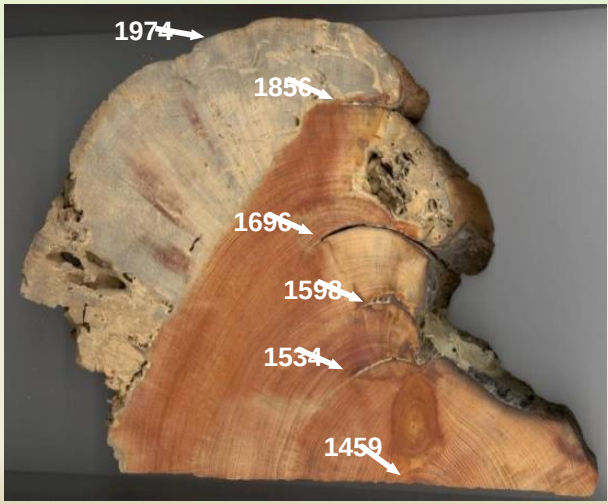
Note the increased density of trees along the river and the slopes beyond. 2005



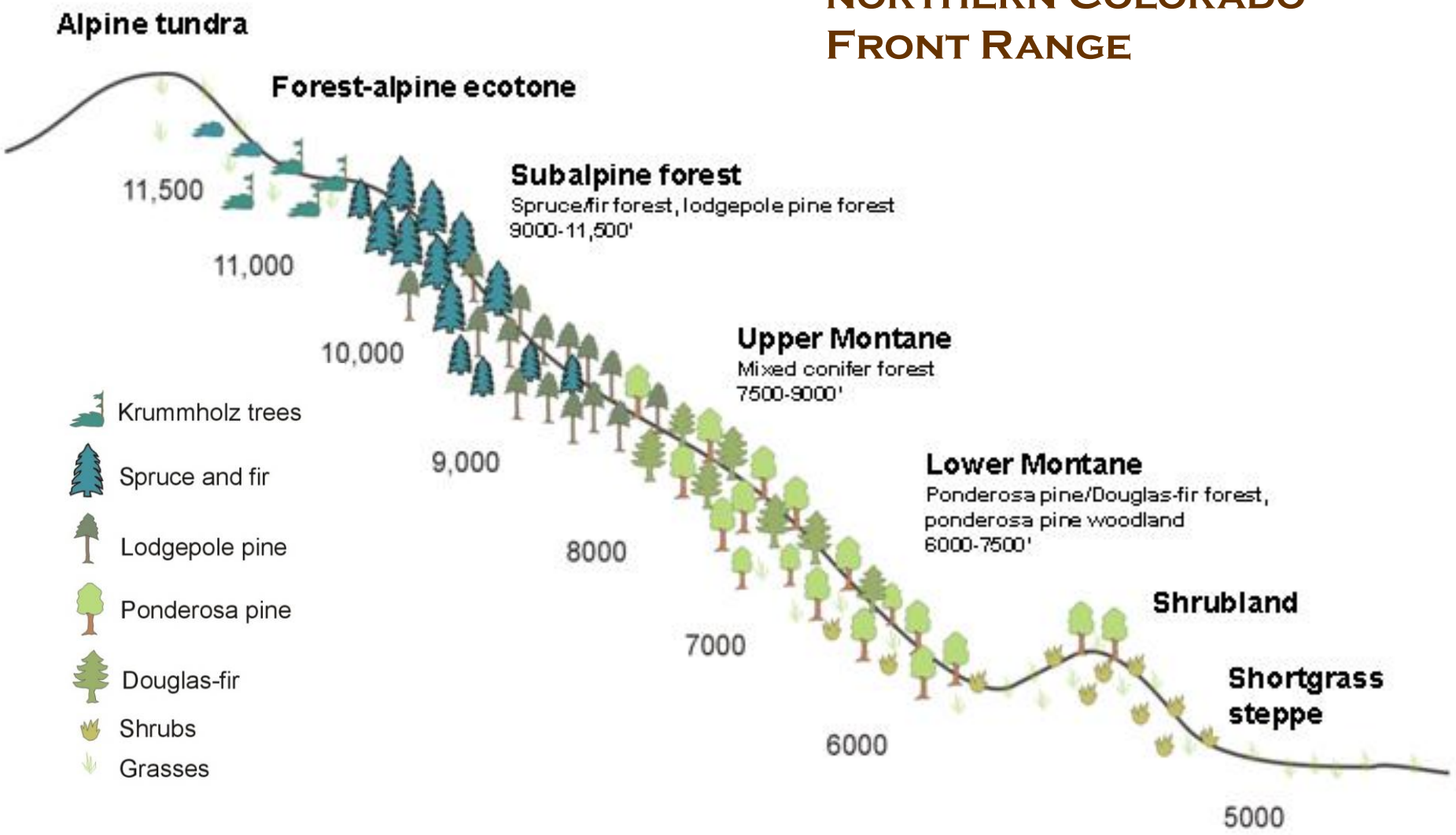
80.00 Set Granite mck 20x6x4 marked IIII S.+1 E. 6 in. in ground in mound of mck for Cor. to Sec. 11-12-13-14 Soil 3rd rate Surface mountainous Timber very small and on last 1/4 mile is all dead. Veg. brush grass and under brush.

Tools for reconstructing past landscapes:

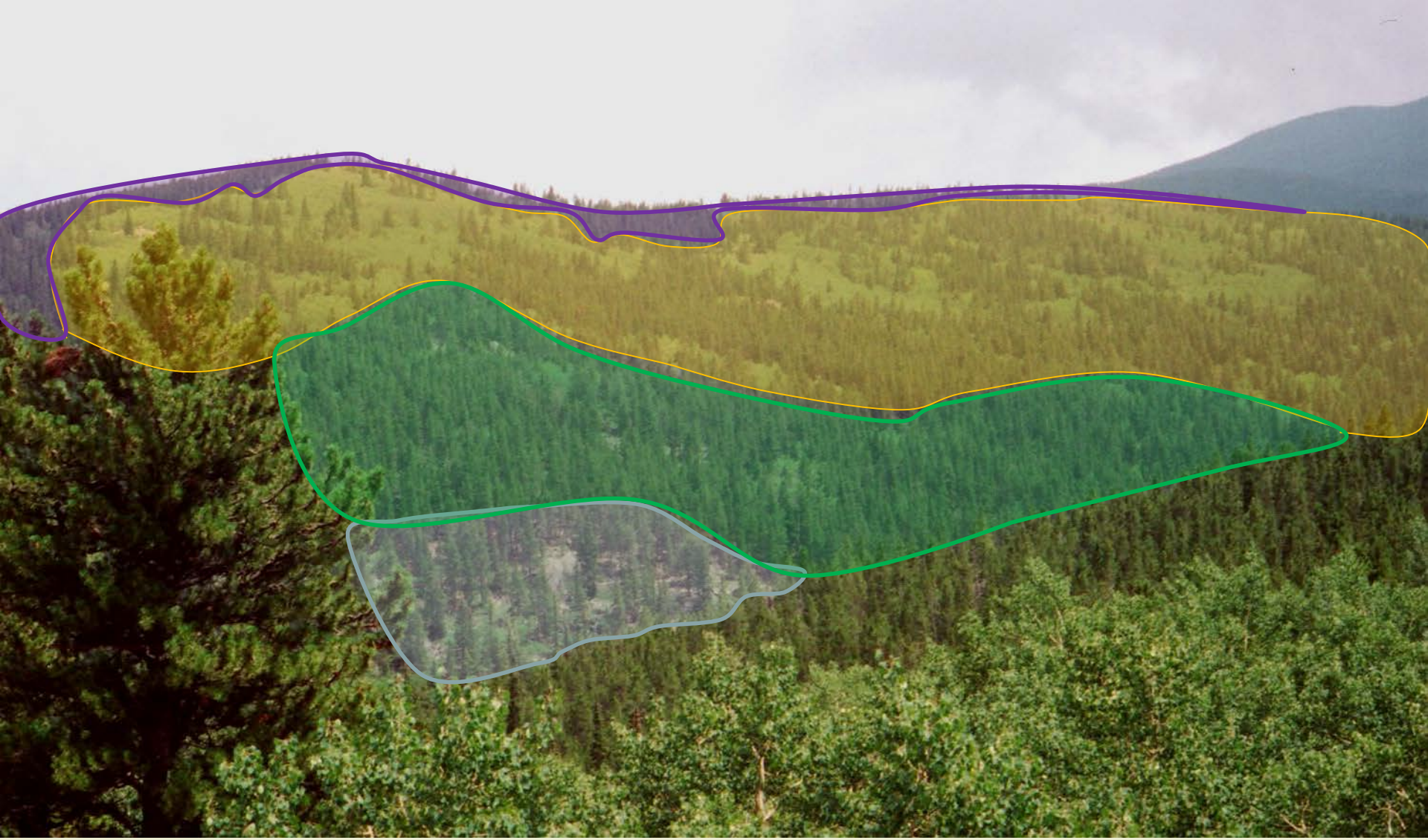
1. Historical records
2. Historical photos
3. Dendrochronology —fire scars, age structure of trees
4. Archaeology



Ecosystems of the northern Colorado Front Range



The species composition of the forest varies with elevation because environmental conditions change with increasing elevation, generally becoming cooler and wetter as elevation increases. Above 9000 ft., snow persists all winter long.



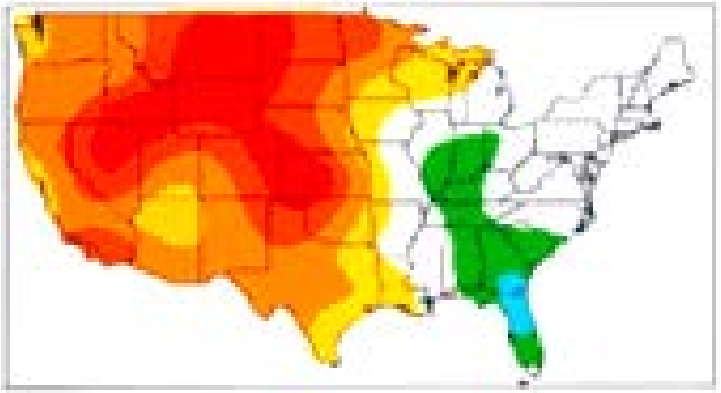
Patterns of vegetation are created by climate, topography and disturbances, creating a mosaic of species and stand age across the landscape.

A ***fire regime*** is the pattern of frequency and intensity of fire over space and time.

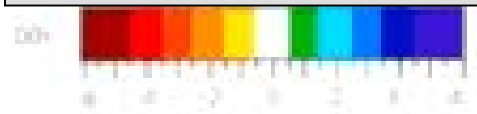
Fire regimes are dynamic; they change over space and time.

Components of fire regimes include a number of interacting factors: ***Climate, Vegetation, Topography, Ignitions***

Drought reconstruction from tree rings for the United States, 1863

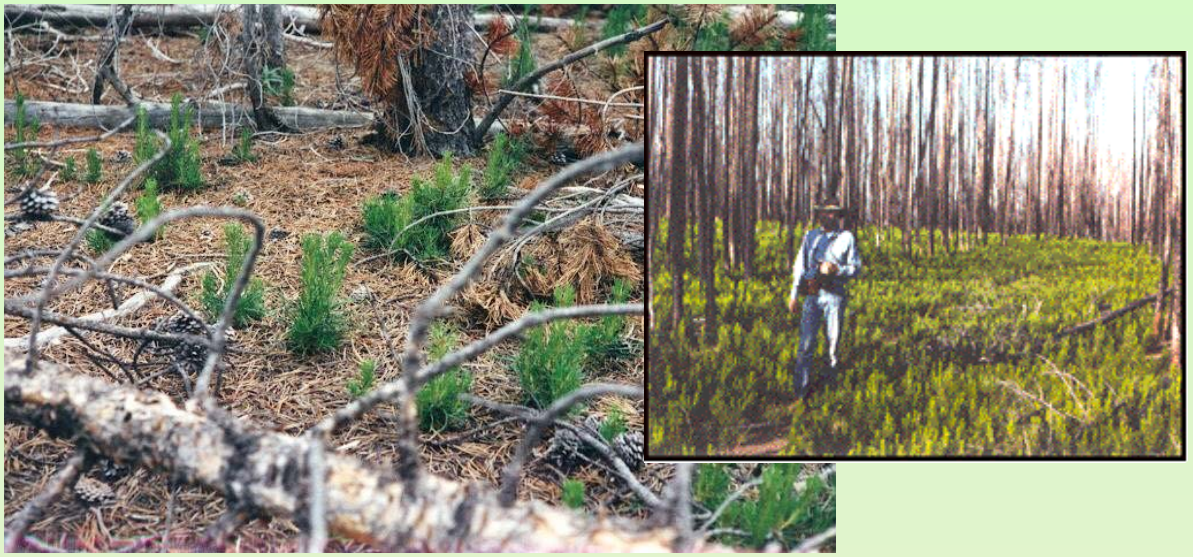


Palmer Drought Severity Index



Stand-replacing fire—usually infrequent, intense, overstory killed

Stand-replacing fires are typical of higher elevations in Colorado.



Lodgepole pines produce cohorts from serotinous seeds.

Aspen sprouts from surviving rootstock.

Species adapted to stand-replacing fire have fire-dependent reproductive strategies.

Mixed severity fire–usually moderate frequency, variable intensity, variable effects

Parts of the Hayman fire (2002) burned with mixed severity; patches of stand-replacement and patches of surface fire.

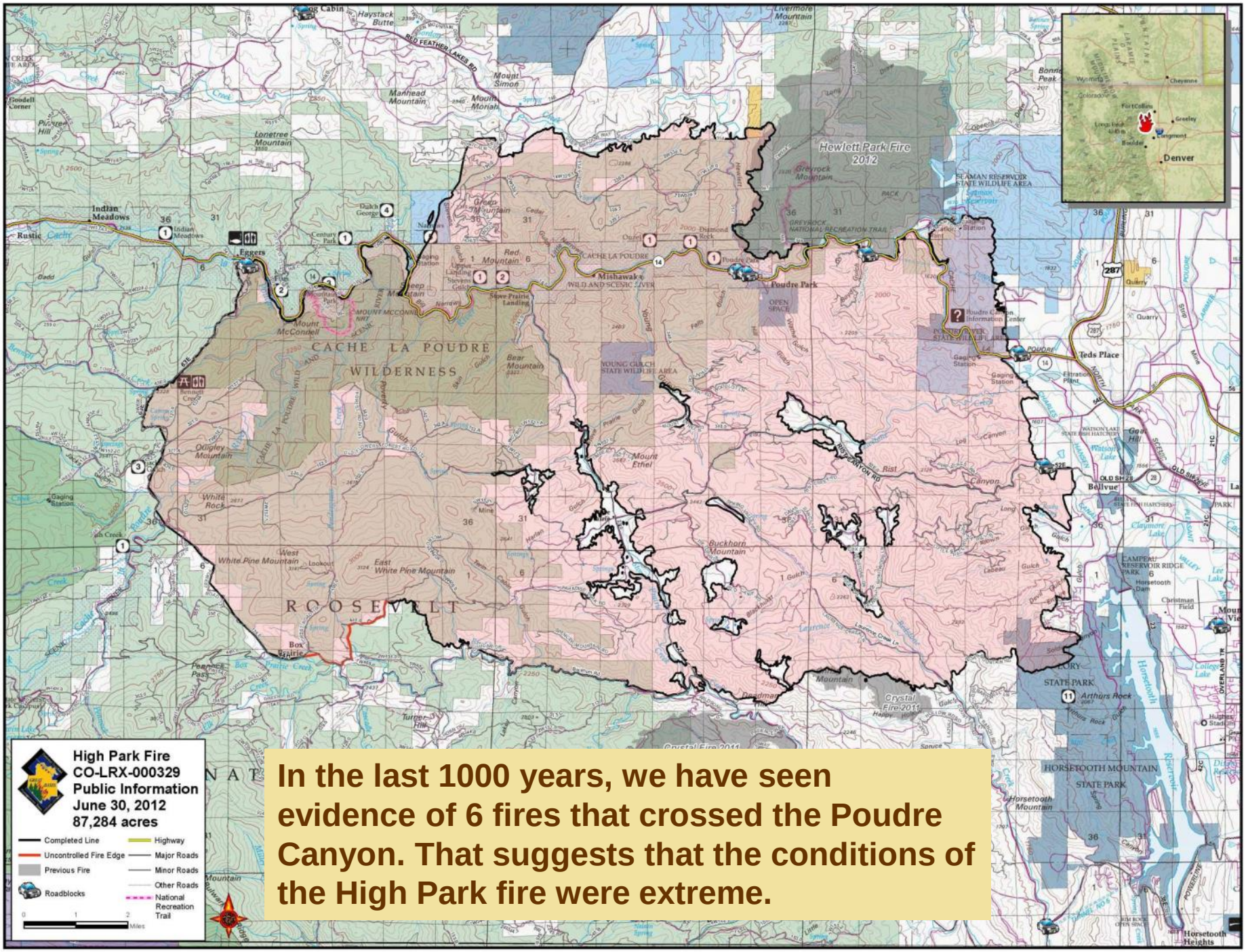
Mixed severity fires are typical of middle elevations in Colorado.

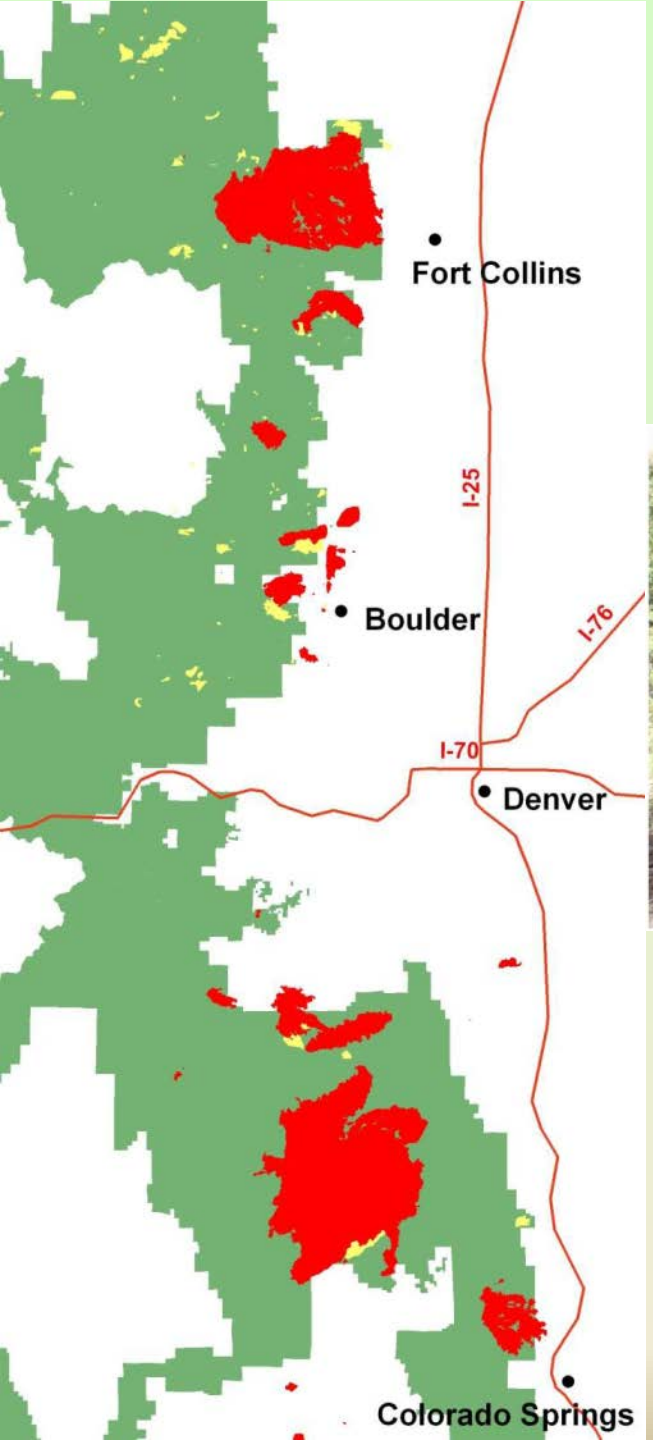
Surface fire–relatively frequent, low intensity, overstory survives

Prescribed surface fire in ponderosa pine.

This area burned as a surface fire in the Bobcat Gulch burn (2000); it had also burned in 1993.

Surface fires are typical of lower elevations in Colorado.


High Park Fire
CO-LRX-000329
Public Information
June 30, 2012
87,284 acres
Completed Line
Uncontrolled Fire Edge
Previous Fire
Roadblocks
Highway
Major Roads
Minor Roads
Other Roads
National Recreation Trail
Miles
Hewlett Park Fire 2012
Crystal Fire 2011
CACHE LA POUDRE WILDERNESS
ROOSEVELT
Denver
In the last 1000 years, we have seen evidence of 6 fires that crossed the Poudre Canyon. That suggests that the conditions of the High Park fire were extreme.



The Colorado Front Range has seen a substantial increase in large severe fires in the last decade, with extreme fire behavior in stands where we know were dominated by surface fire historically.

High Park Fire, 2012 Youngs Gulch Plot 18 North (sampled 30 May 2012, burned 9 or 10 June 2012), typical of a post-settlement ponderosa pine stand.

Recent fire footprints in the Front Range. Yellow: before 1996. Red: after 1996. The green shaded area is National Forest lands.

Climate change: the past predicts the future

Bobcat Gulch fire, May 2000; 10,600 acres burned. Little to no regeneration of trees has been detected 15 years later. The burn area may be reverting to grassland in a warming climate.


larvae


Adult


Mountain pine beetle galleries

Mountain pine beetle-killed trees near Virginia Dale

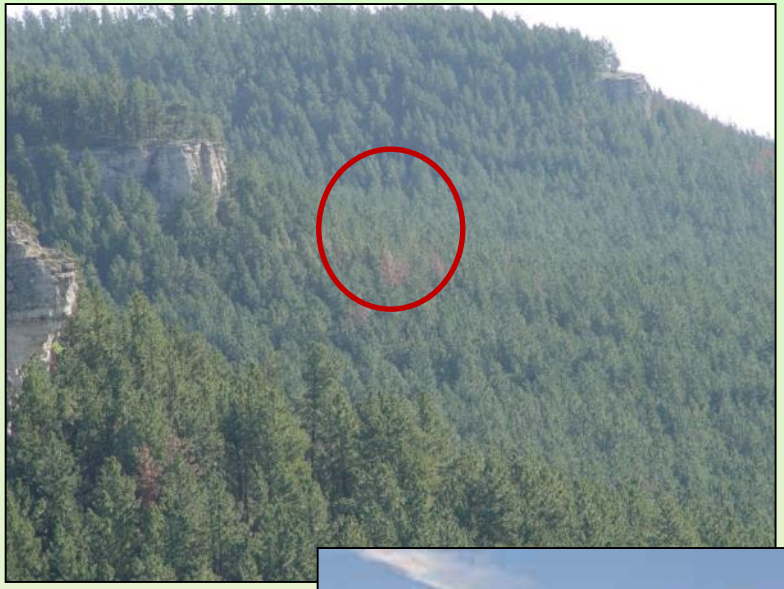
Mountain Pine Beetles

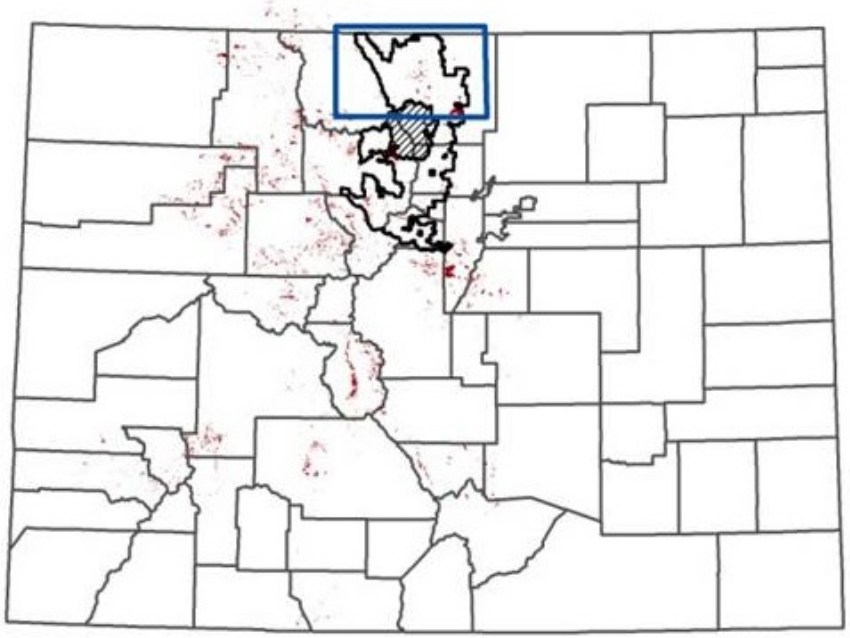
Mountain pine beetles are native insects that evolved with native trees. They exist in the forest all the time, but when climatic conditions are right, their populations explode, as they have in the last decade. Drought, abundance of suitable host trees and warm temperatures trigger large-scale outbreaks.


Trees defend against beetle attack by pitching them out

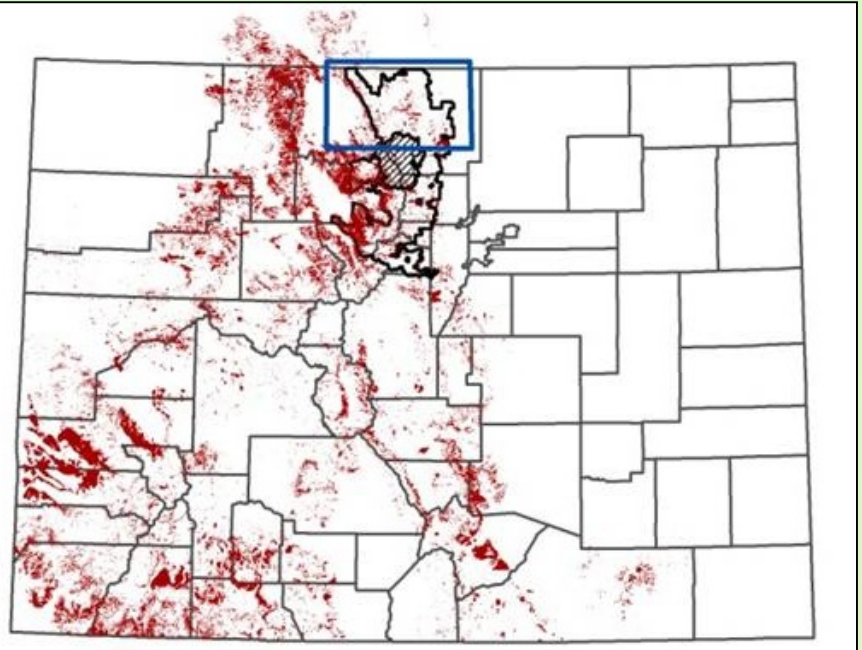

Blue stain fungus on a beetle-killed log

Bark Beetle attacks are not always epidemics—they vary in space and time just as fires do

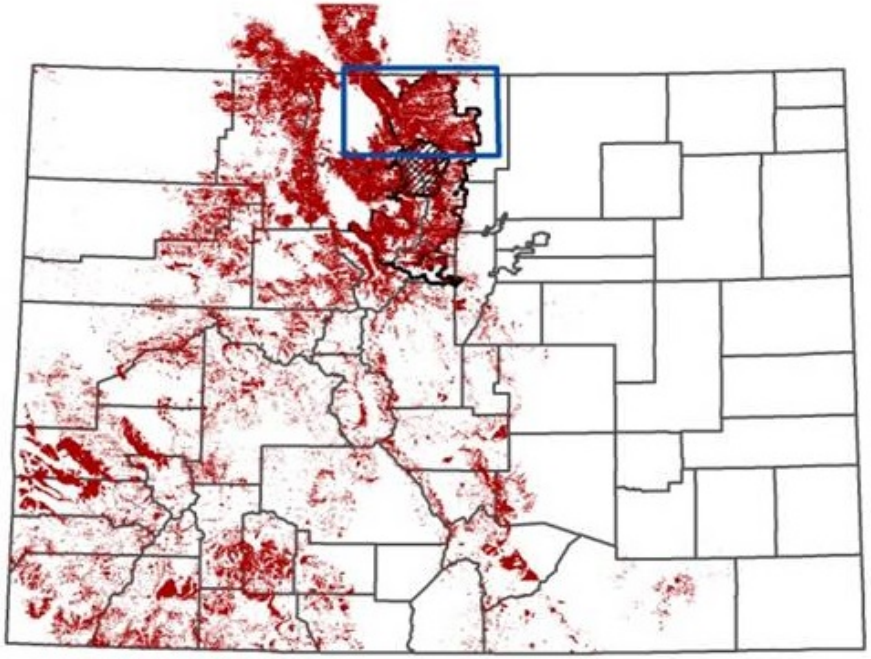




Tree Mortality 2000



Tree Mortality 2000-2005



Tree Mortality 2000-2010

Progression of mountain pine beetle mortality, 2000-2010. The beetle outbreak started in high elevation lodgepole pine on the western slope in the late 1990s, and progressed east into Front Range ponderosa pine.

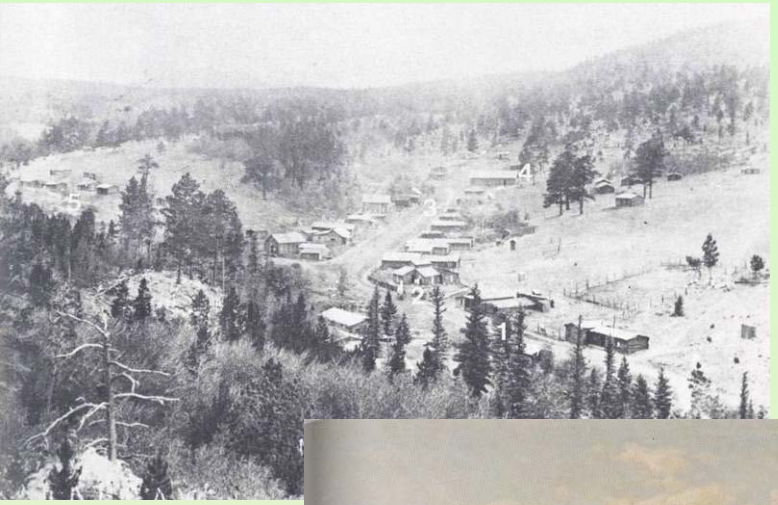
Mountain pine beetles usually attack the larger trees in a stand. Just because these trees are dead does not mean the forest is dead. Many trees have survived the outbreak, and many young trees are regenerating within beetle-killed stands. Young lodgepole pines and aspen sprouts are common in beetle-killed forest near Fraser.

Aspen sprouts under beetle-killed lodgepole pine

Lodgepole pine seedlings

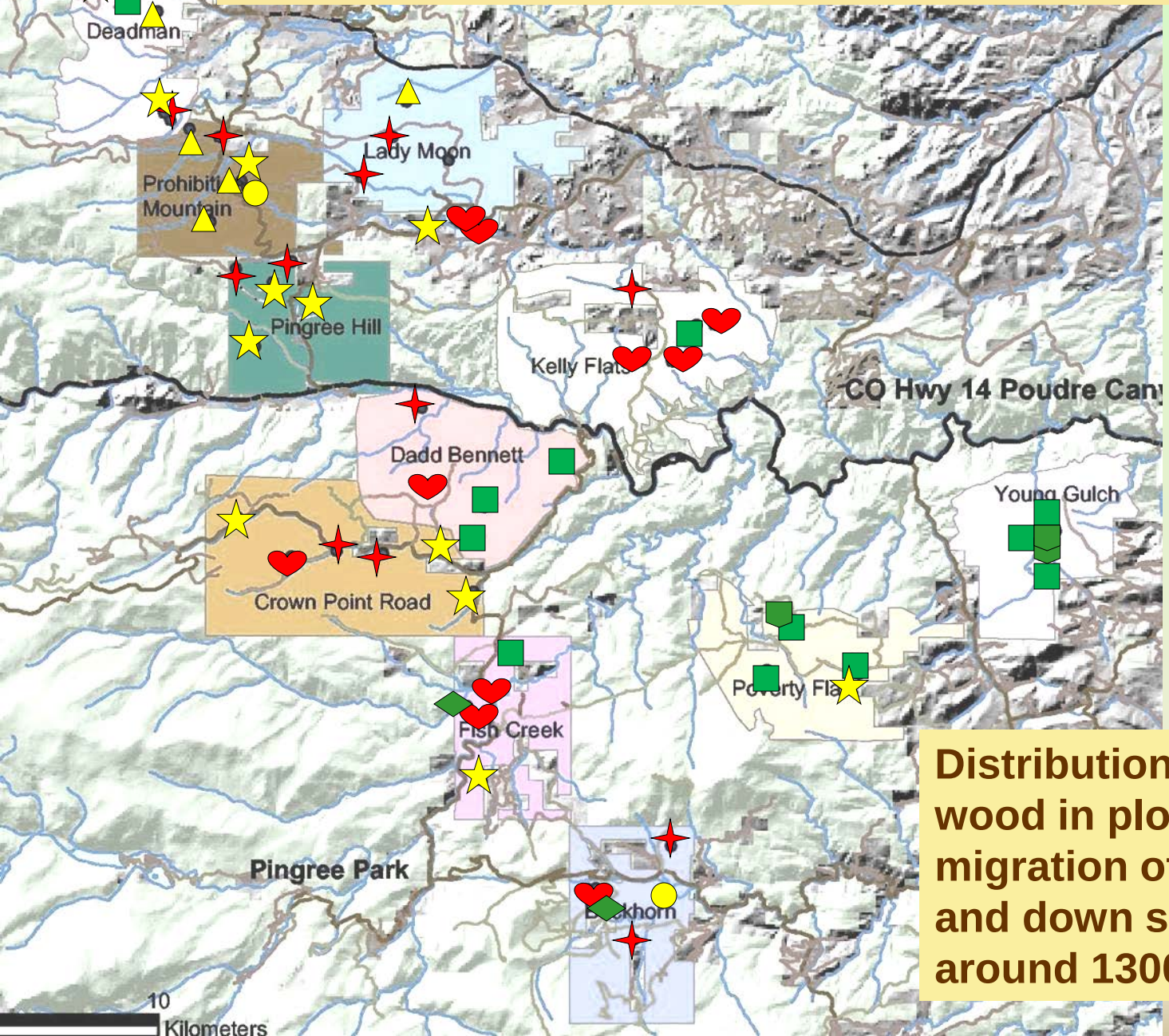
Land use history in Larimer county

Native Americans lived in Larimer County for at least 13,000 years, until they were relocated by 1880. Localized Euro-American logging and widespread cattle grazing occurred during the settlement era from 1860 onward, intensifying after 1880. Little mineral wealth was discovered and no railroad was built. Most of the county was remote ranch land until around 1920. Logging, grazing, and recreation accompanied fire suppression during the 20th century.




Trees began moving downslope at some sites during the cool, wet late 18th century; this was encouraged by grazing and fire suppression in the early 20th century. Historically there were few trees below 6500 ft. elevation.

Ponderosa pine migration downslope during Little Ice Age



Establishment dates for oldest trees in plots

- 1000-1099
- 1100-1199
- 1200-1299
- 1300-1399
- 1400-1499
- 1500-1599
- 1600-1699
- 1700-1799

Distribution of the oldest wood in plots suggests a migration of trees eastward and down slope starting around 1300 AD.

Part IV: A glimpse into the future?

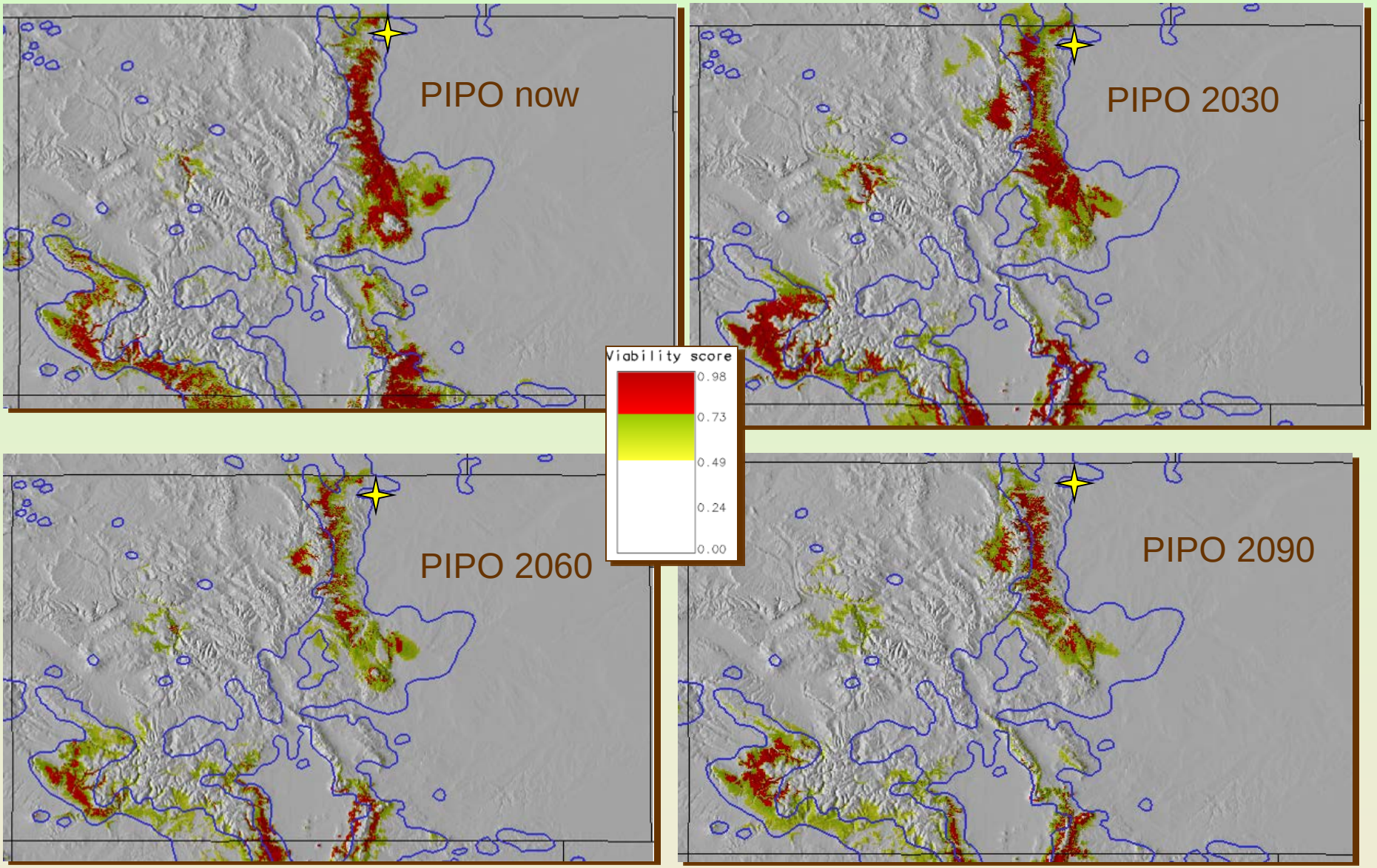
Modeling vegetation migration based on several different climate models predicts changes in species and community ranges similar to what we saw during previous climate transitions—but more with extreme changes and at a much faster rate.

Scientists at the US Forest Service Rocky Mountain Research Station Moscow Forestry Sciences Laboratory have developed plant-climate relationships for the present and predicted future species ranges based on information from three different General Circulation Models.

Rehfelt, G.E., N.L. Crookston, M.V. Warwell, and J.S. Evans. 2006. Empirical analyses of plant-climate relationships for the western United States. International Journal of Plant Science 167(6):1123-1150.

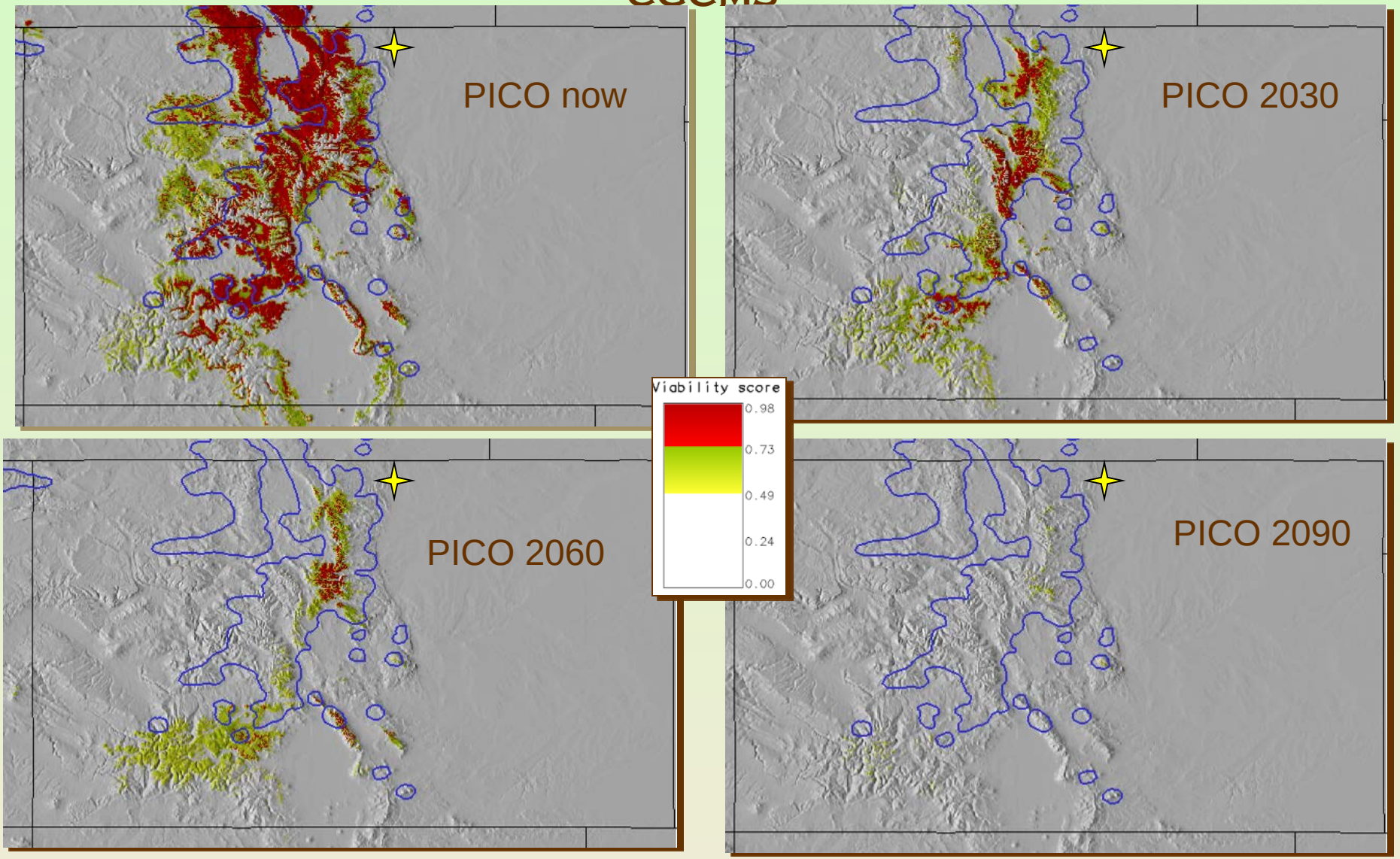
http://forest.moscowfsl.wsu.edu/climate/

Ponderosa pine migration in Colorado based on climate model CGCM3



Ponderosa pine habitat approaches the Continental Divide in 80 years! Existing live remnant stands at 10,000 ft. may make this a possibility.

Lodgepole pine migration in Colorado based on climate model CGCM3



The elimination of lodgepole pine habitat from the Front Range by 2090 seems like an extreme scenario given lags in vegetation migration in the past.