

How Have Forest Conditions Changed in the Laramie Foothills of Colorado during the past 60 years?



Introduction

Ecological processes, such as fire, historically played a role in shaping many of the native plant communities in the Laramie Foothills. Other things like wind events, drought, disease and human land uses also influenced our forested plant communities.

One goal of land managers is to maintain healthy vegetation types across watersheds by restoring ecological fire where it is safe and using other tools to mitigate the chance of extreme fire events threatening resources that communities wish to protect.

In many landscapes, like the Laramie Foothills, little is known about the historical role of fire and how or if the condition of fire dependent plant communities has changed during the past century of fire exclusion. Understanding this information will assist land managers to identify priority places to work in the future.

Research Goals

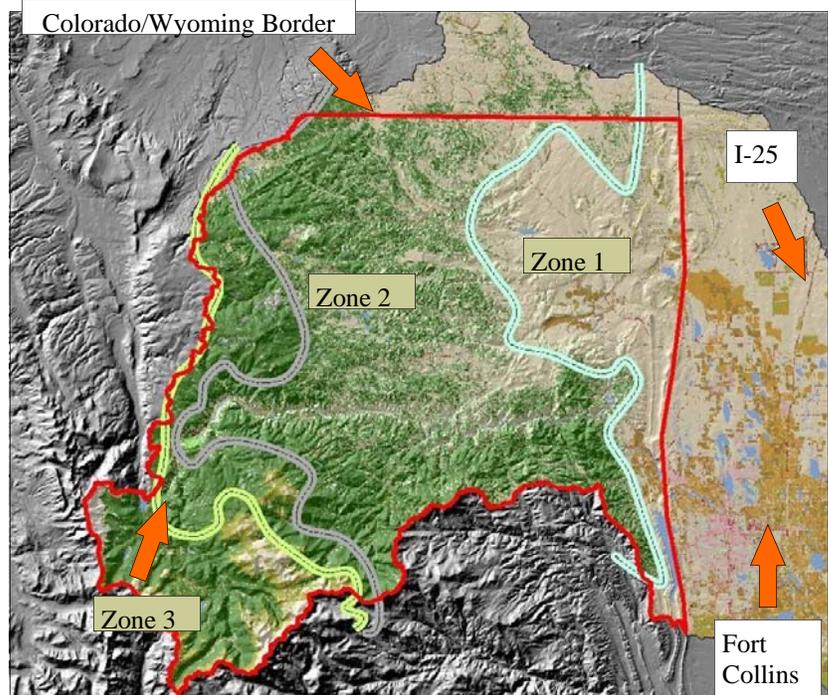
A research project was initiated to answer some of these questions. The project was funded by The Nature Conservancy's Fire Learning Network and Laramie Foothills Project and the USFS Rocky Mountain Research Station. Research was conducted by Dr. David M. Theobald, Nate Peterson and Melissa Sherburne at Colorado State University's Natural Resource Ecology Laboratory.

The goals were to:

- ⇒ document changes in density and vegetation types,
- ⇒ use available historic and current aerial photography to interpret land cover classes at randomly located plots.
- ⇒ map historic & current conditions,
- ⇒ identify if and where change had occurred, and
- ⇒ identify accessible areas for future treatments.

Photo courtesy
Mike Babler,
TNC, Colorado

Greater Laramie Foothills Study Area Larimer County, Colorado

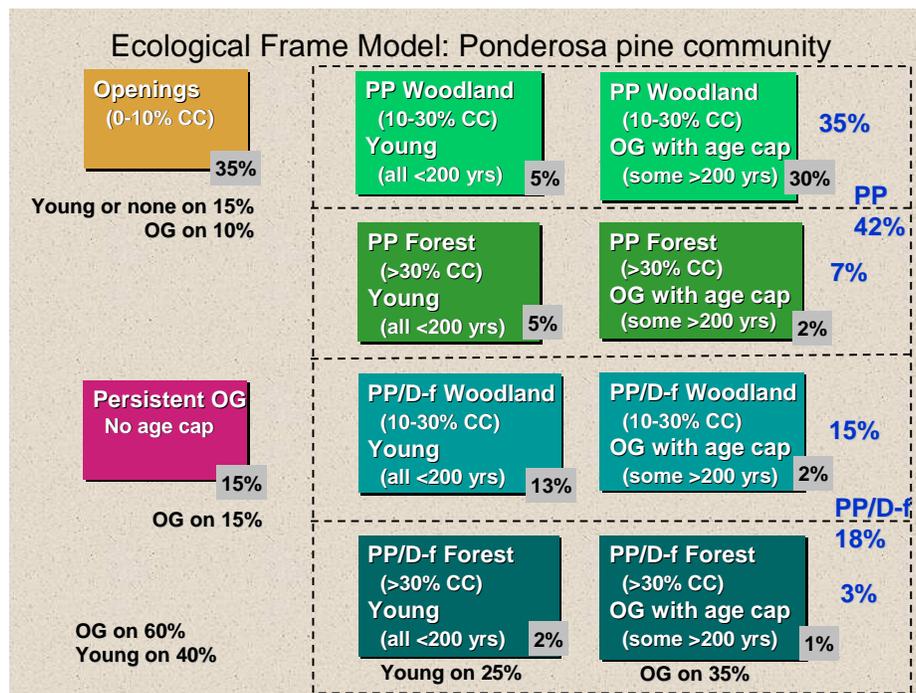


Ecological Frame Model: Ponderosa Pine Community

Ecological Models are used to describe the components of plant communities and the processes that shift components from one state to another. This model, depicted below, describes the vegetation components of Ponderosa pine and Douglas-fir forests. It is primarily based on data from research conducted by Merrill Kaufmann, Paula Fornwalt and Laurie Huckaby of the US Forest Service Rocky Mountain Research Station in the upper South Platte watershed.

“Openings” are areas that could potentially support trees, but have little tree cover (<10% canopy cover), either because of recent disturbance such as fire or because of poor site conditions. “PP Woodland” are more open forested areas comprised of mostly Ponderosa pines with grassy areas between and under trees (10-30% canopy cover), whereas “PP/DF Forest” component is comprised of both Ponderosa pine and Douglas fir and has a more closed canopy and less space between trees (>30% canopy cover). Within each of these categories age of the components is important with “young” being maximum tree ages greater than 200 years old versus “OG” (old growth) with at least some trees greater than 200 years.

Percentages inside the corners of each component box reflect our best estimate of the average amount of each component in the historical landscape. The numbers outside reflect subtotals. Hence historically we think Ponderosa pine (PP) woodlands comprised 42% of the community, while Openings only 35%.



Methods

Three zones were identified within the Laramie Foothills project area: stretching from the lower grassland and shrubland elevations (zone 1), to the middle elevations-predominantly Ponderosa Pine (zone 2) and the upper elevations-mostly mixed conifer and lodgepole (zone 3) (See map).

Black and white aerial photos from the early 1940s (for the dates 1938, 1941, 1947) were compiled from the Natural Resources Conservation Service and the digital library at University of Colorado, Boulder. Color photos for current conditions were obtained from Larimer County (summer 2000 data) and Rocky Mountain National Park, and were augmented by photos from TerraServer®.

Photos were interpreted at a series of random locations, resulting in 303 points for current conditions and 212 points for mid-20th century conditions. At each point, four 1 ha plots (1 center, 3 satellite-A, B, and C) were interpreted. We also ground-truthed 46 of the random points. Zone 2 is the primary zone of interest, dominated by ponderosa pine forest and woodland.

Methods continued

An ecological frame model based on our understanding of historical conditions of Ponderosa Pine forests was used to describe the zone 2 vegetation components in the study area. These components were assessed in the paired photo interpretation.

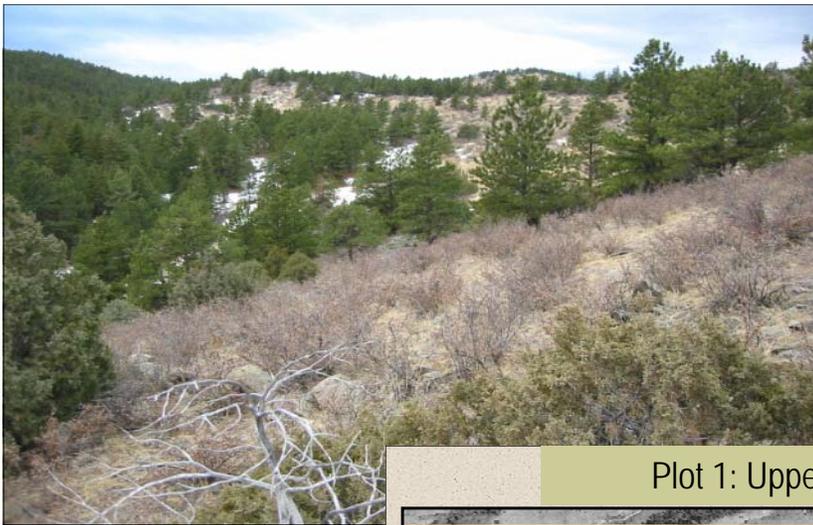
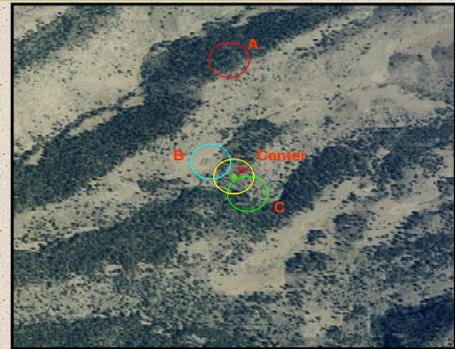
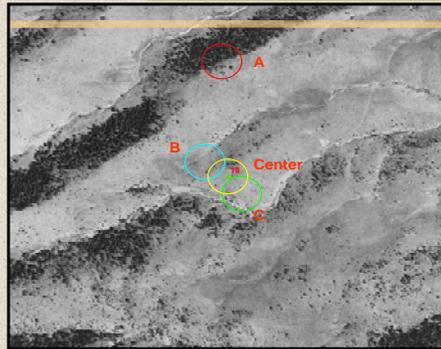


Photo taken in Hewlett Gulch area- one of the ground truth sampling locations, showing current condition of plant community.

Paired, historic and current, photos were interpreted-comparing vegetation type and density from 1940 to 2005. For each photo, four 1-ha plots were sampled-labeled here as "center, A, B, and C. Estimates of % cover were made for each class of vegetation type of interest.

Plot 1: Upper Hewlett Gulch



Point	Historic Class	Historic CC
Center	OPEN	3
A	PPFY	40
B	OPEN	3
C	OPEN	10

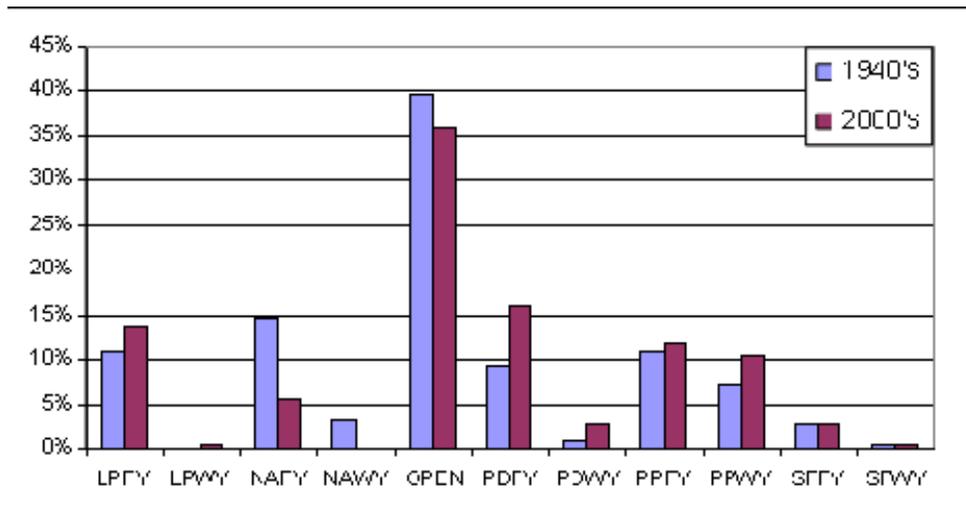
Point	Current Class	Current CC
Center	PPWY	15
A	PPFY	80
B	OPEN	5
C	PPFY	35

Results

- ◇ We documented a small net increase in overall forest density since the 1930s, but the increase was far less dramatic than has been seen in some other Ponderosa pine landscapes of the Rocky Mountains and southwest.
- ◇ We found a small net change from open areas to woodlands (6.6% of areas classified as open in the 1930s had converted to woodland by 2000, while only 1.9% of areas classified as woodlands in the 1930s had become open areas by 2000).
- ◇ We found a small net change from woodlands to forests (6.1% of areas classified as woodlands in the 1930s had converted to forests by 2000, at the same time only 3.8% of areas classified as forests in the 1930s had changed to woodlands by 2000).
- ◇ The land cover classes that we used did not fully capture the diversity of the forest composition.
- ◇ Natural forest change is confounded by land uses such as logging and exurban development.
- ◇ Overall, the forest conditions in the study area have not changed as much as expected in the past 60 years; bigger changes may have occurred prior to the 1930s, but we lack records of earlier conditions.

Results continued

Chart shows change in proportion of vegetation components.



PP=Ponderosa pine, LP=Lodegpole, PD= Ponderosa pine/Douglas fir, SF=subalpine fir, F=forest, W=woodland, Y=young, NA=not identified, Open=openings.

Accessibility Map of Laramie Foothills Study Area

Accessibility mapping can be used to prioritize locations for future land management treatments.

