

Joint Ecology Working Group

Front Range Fuels Roundtable – Colorado Bark Beetle Cooperative

Working Group Summary

Organizations Represented At Joint Ecology Working Group Meetings

The following organizations are represented within the group: The Nature Conservancy, Bureau of Land Management, United States Forest Service, El Paso County, Colorado State Forest Service, Colorado State University Extension, Colorado State University (CSU), CSU – Colorado Forest Restoration Institute, Colorado Tree Farmers, USFS Rocky Mountain Research Station, Wilderness Workshop, Jefferson County Open Space, United States Geological Survey, United States Fish & Wildlife Service, Clear Creek County, Colorado Wild, Douglas County, Helena Chemical Company, Rocky Mountain National Park, Benninghoff Company, Southern Rockies Conservation Alliance, Colorado State Parks, Landmark, Visions Service, Jefferson County Weed and Pests, Anchor Point Fire Management, The Wilderness Society, Western Forestry Leadership Coalition, Taddike Tree Company, etc.

Background

- Original focus of Front Range Fuels Treatment Partnership Roundtable (Roundtable) Ecology Work Group was ecology and restoration of ponderosa pine/Douglas-fir ecosystems along the Front Range.
- With the Mountain Pine Beetle (MPB) outbreak now moving into the Front Range the Roundtable was interested in following a similar process to investigate lodgepole pine ecology.
- However, unlike the previous ecological working group, this one is jointly supported by both the Roundtable and the Colorado Bark Beetle Cooperative (CBBC). The reason for doing this was to incorporate the experience and lessons learned from the CBBC's work with the MPB and high elevation forest ecosystems along with the Roundtable's experience with forest and fuels management on the Front Range.
- February 15th, 2008 the Joint Ecology Working Group held its first meeting in Lakewood, Colorado at the Bureau of Land Management's Colorado State Office. A large number of people attended the first meeting. Five key issues were identified as the main focuses for the initial work of the group. They were*:
 - ❑ **Issue #1 – MPB spread from lodgepole pine to ponderosa pine**
 - ❑ **Issue #2 – Lodgepole pine ecosystem landscape diversity**
 - ❑ **Issue #3 – Fire ecology and fire regimes of lodgepole pine**
 - ❑ **Issue #4 – Consensus on the impacts of past management**
 - ❑ **Issue #5 – Immediate need for knowledge:**

* The order of these issues does not suggest priority.

Products Developed

For over a year the members of the Joint Ecology Working Group have been working hard to develop the following documents:

- Working group summary
- One-page lodgepole pine ecology summary
- One-page summary of the impacts and interactions of fire and the MPB in lodgepole pine ecosystems
- One-page glossary of terms found throughout the one page summaries.

All of these documents have been well vetted and are considered consensus documents with the support of both of the Joint Ecology Working Group's parent organizations, the Colorado Bark Beetle Cooperative and the Front Range Fuels Roundtable.

The purpose of these documents is to offer short one-page summaries of key information surrounding lodgepole pine ecology and the issues of the mountain pine beetle and fire associated with ecosystems dominated by this species. It is the hope of the Joint Ecology Working Group that these documents will be utilized as educational tools for land managers, elected officials, journalists and other individuals tied to the media, as well as the general public.

Contact Information: If you have any questions regarding the Joint Ecology Working Group or any of the following documents please feel free to contact Jeff Kitchens, one of the chairs of the Joint Ecology Working Group, at (303) 239-3752.

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Summary of Lodgepole Pine Ecology

Habitat

Lodgepole pine (*Pinus contorta*) is a common middle to higher elevation species that grows throughout the Rocky Mountains. In Colorado its range is predominantly limited to elevations of 7,000 to 11,000 feet from south central Colorado toward the Wyoming border. It is a relatively shade-intolerant species and grows best in full sunlight. However, lodgepole pine tolerates a wide variety of climatic and soil conditions, but grows best on gentle slopes and in basins with well-drained, slightly acidic, sandy, or gravelly loam soils.

Forest Cover Types

Following a major disturbance, lodgepole pine tends to be the first tree species to occupy a site within its given range and habitat. At higher elevations lodgepole pine stands tend to succeed to stands dominated by subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*). At lower elevations lodgepole pine stands tend to succeed to Douglas-fir (*Pseudotsuga menziesii*). Lodgepole pine can maintain a climax state in cold, dry zones where it is sometimes the only tree species able to successfully occupy the site.

Life History

Lodgepole pine regenerates best in full sunlight. Cones can remain on trees without opening for one or more years and may only open after heat is provided by a fire or under very hot and dry conditions. These types of cones are referred to as serotinous. Seeds in these serotinous cones can remain viable well beyond their first year of life. The serotiny of cones and light seed production annually often provide a competitive advantage after stand-replacing events such as a wildfire. Receptive sites with limited duff and/or competitive understory vegetation, such as the conditions following a wildfire or timber harvest (which disturbs the duff and/or soil layers) generally result in prolific regeneration that produces a dense, even-aged lodgepole pine stand.

Following establishment after a stand replacement event lodgepole pine tends to remain the dominant or co-dominant component of an even-aged forest stand for 50-80 years. Its fast early growth allows it to become the dominant overstory tree, with an understory of more shade tolerant species sometimes getting established later, after the canopy has lifted. After 50-80 years more shade tolerant species (e.g. spruce and fir) tend to take over through natural succession, altering the diversity and age structure of the stand. However, lodgepole pine can persist for centuries where other species are unable to become or remain established. In these types of ecosystems, lodgepole pine is the climax vegetation. The average life span of a lodgepole pine tree is 250 years or less. In Colorado the average age of lodgepole pine stands varies between 80 and 200 years. Stands that are 350-400 years old have been recorded, but are uncommon.

Disturbance Ecology

Most lodgepole pine forests in Colorado experience stand-replacement fires about every 100-300 years. These are typically large fires that kill most of the trees, with scattered pockets of trees surviving. As mentioned above, lodgepole pine is well-adapted to this fire regime with seedlings often quickly establishing at high densities after a fire. Mountain pine beetle can periodically kill most of the larger diameter lodgepole pine trees during epidemic outbreaks. Lodgepole pine stands susceptible to pine beetle attacks are often dense, greater than 80 years old, with an average tree diameter (at breast height) of at least eight inches. Unlike with fire, smaller (under four inch diameter) trees and other tree species typically survive mountain pine beetle epidemics with the litter and duff remaining. Pine beetle epidemics can have the effect of releasing existing understory trees resulting in uneven-aged stands. Trees killed by bark beetles often decay at their base and begin falling within 5-15 years of the infestation with the larger diameter trees generally standing longer than the smaller snags. Dwarf mistletoe is also a key disturbance agent in lodgepole pine stands. Although its effects are not as dramatic as fire or mountain pine beetle, due to its slow spread throughout a stand, it can significantly impact growth and form. Stunted growth, witch's brooms (areas of dense and deformed branch growth), and other defects are often utilized by some bird species for cover, food, and even nesting. Other significant pests and pathogens of lodgepole pine include armillaria root rot and ips beetles.

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Summary of Lodgepole Pine Fire Behavior

Fire Behavior in Lodgepole Pine Forests (without epidemic mountain pine beetle populations)

- The natural fire regime of lodgepole pine stands involves infrequent but intense stand-replacing fire, occurring on average every 100-300+ years.
- Lodgepole pine forests always have plenty of fuel to carry high-intensity fires even without mountain pine beetle infestations, windfall or other disturbances.
- Because high-elevation lodgepole stands are usually cool and moist, it is difficult for fires to ignite and spread in live fuels. Thus, fire risk (probability of ignition) is low.
- However, fires in lodgepole pine tend to be intense and to spread through the canopy once ignited, because such fires usually occur under hot and dry weather conditions. Thus, fire hazard (the severity and effects of fire) is high.
- Lodgepole pines are adapted to a high-intensity, stand-replacing fire regime. Though most trees are killed by fire, serotinous (fire-adapted) cones in tree canopies release large numbers of seeds immediately following a fire, and stands regenerate rapidly. This occurred following the Yellowstone fires of 1988.
- Under natural conditions, most fires in lodgepole pine forests are caused by lightning. However, during the past 150 years as human land use and development have expanded into higher elevations, fires have increasingly been started by humans.
- Establishment of a crown fire is predominantly a function of climatic conditions rather than forest fuels: a fire has a greater probability of becoming established in a lodgepole pine stand if weather conditions are hot and dry than if conditions are cool and moist, which impedes fire spread even with high fuel loadings.

Fire and Mountain Pine Beetle in Lodgepole Pine Stands in Colorado

The potential interaction between fire and large-scale mountain pine beetle infestation is unknown, because a mountain pine beetle event on this scale has not been observed in recorded history (a relatively short time compared to the lifespan of a lodgepole pine forest). Current predictions are based on events that have occurred during the last century. Research is underway in Colorado to improve our understanding of the dynamics between fire and mountain pine beetle in lodgepole pine forests, expanding on what we already know:

- When mountain pine beetles kill a tree, the needles dry out and turn red. The dry needles stay on the trees for several years, and during this 'red stage' scientists think that if there is an ignition, fire may spread more easily through the crowns due to decreased moisture content in the trees' needles.
- Once the needles have fallen, fire may be less likely to spread through the bare canopies. Fire hazard may be reduced for some years during this 'grey stage' due to the absence of canopy fuels.
- Once the dead trees have fallen, accumulation of large fuels may contribute to intense surface fires (rather than canopy fires) if an ignition occurs. Such fires may be very damaging to soils and emerging seedlings.
- Scientists are investigating whether weather and climate will continue to be the main drivers of fire probability, behavior, and effects in lodgepole forests, regardless of the beetle-caused changes in fuels.
- Some scientists also emphasize that the effects of the beetle outbreak are surprisingly patchy within stands. Considerable numbers of young trees remain alive in many stands, even though the larger canopy trees have been killed, and these young trees may grow quickly to become the future forest.

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Glossary of Terms

This document was created as a simple guide to go along with the summary documents. All definitions were taken from the Society of American Foresters Dictionary of Forestry (Helms 1998).

Aerial (Canopy) Fuel: The standing and supported live and dead combustibles (fuels) not in direct contact with the ground. These usually consist mainly of shrub and tree crowns, stems, foliage, branches, and vines. When contiguous aerial fuels ignite (e.g. in the case of multiple tree crowns burning) it is usually referred to as a crown fire.

Crown Class: A category of tree based on its crown position relative to those of adjacent trees.

- **Codominant Crown Class:** A category of tree or species whose crown(s) help to form the general level of the main canopy.
- **Dominant Crown Class:** A tree or species whose crown(s) extend above the general level of the main canopy.

Fuel Loading: The dry weight of fuel per a unit of area. It is usually characterized as live or dead, woody or herbaceous.

Regeneration: The act of renewing tree cover by establishing young trees naturally (e.g. via seed) and/or artificially (e.g. planting).

Release: A treatment or disturbance, which frees younger trees from overtopping, competing vegetation, thus allowing for increased growth potential and reduced competition.

Serotinous: Pertaining to fruit or cones (e.g. pine cones) that remain on a tree without opening for one or more years. In some species cones open and seeds are shed only when heat is provided by fires or hot and dry conditions.

Snag: A standing dead tree from which the leaves and most of the branches have fallen. A snag can also be a standing section of the stem of a tree, broken off usually below the crown.

Stand Replacing Event: When a disturbance kills 75 percent or more of the overstory of a forest stand resulting in a new/younger age class becoming dominant.

Succession: The gradual change of one community of plants to another through competition. Thus one community of plants is eventually supplanted by another.

- **Climax:** The culminating stage of plant succession that is considered static until some disturbance (e.g. fire) alters the state. Thus the climax state is considered a plant community that is not supplanted by another through traditional ecological competition.

Tolerance: The following definitions differentiate between shade-tolerant and shade-intolerant species.

- **Shade Intolerant:** Having the capacity to compete for survival under direct sunlight conditions. Thus the species needs open space and direct sunlight to perform well.
- **Shade Tolerant:** Having the capacity to compete for survival under shaded conditions. Thus the species can do well in low light/shaded conditions.