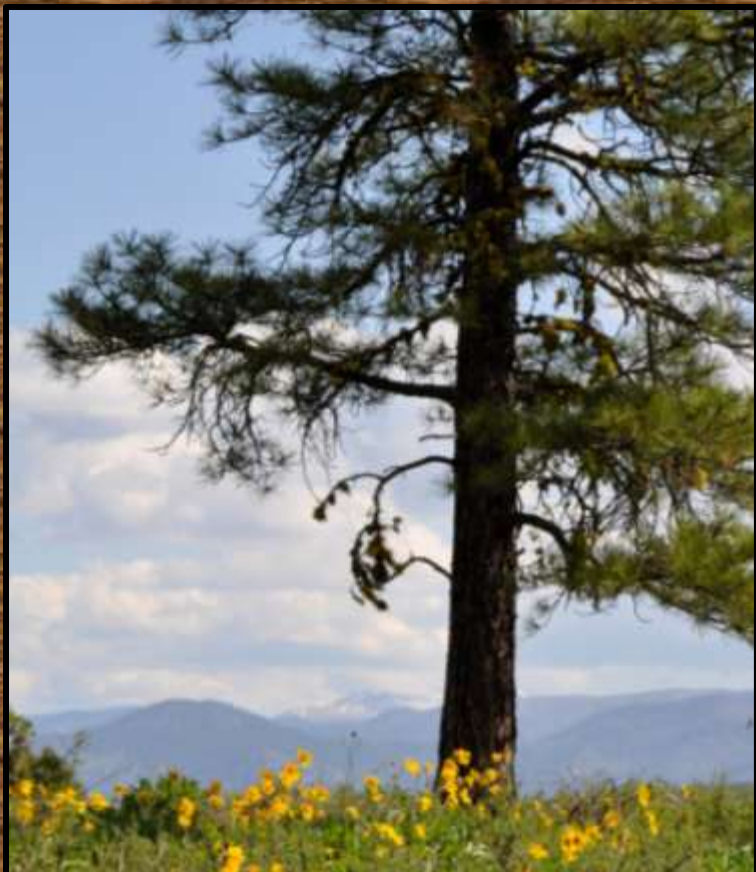
East-side Cascades Dry Forest Ecosystems: ecological relationships to wildfire



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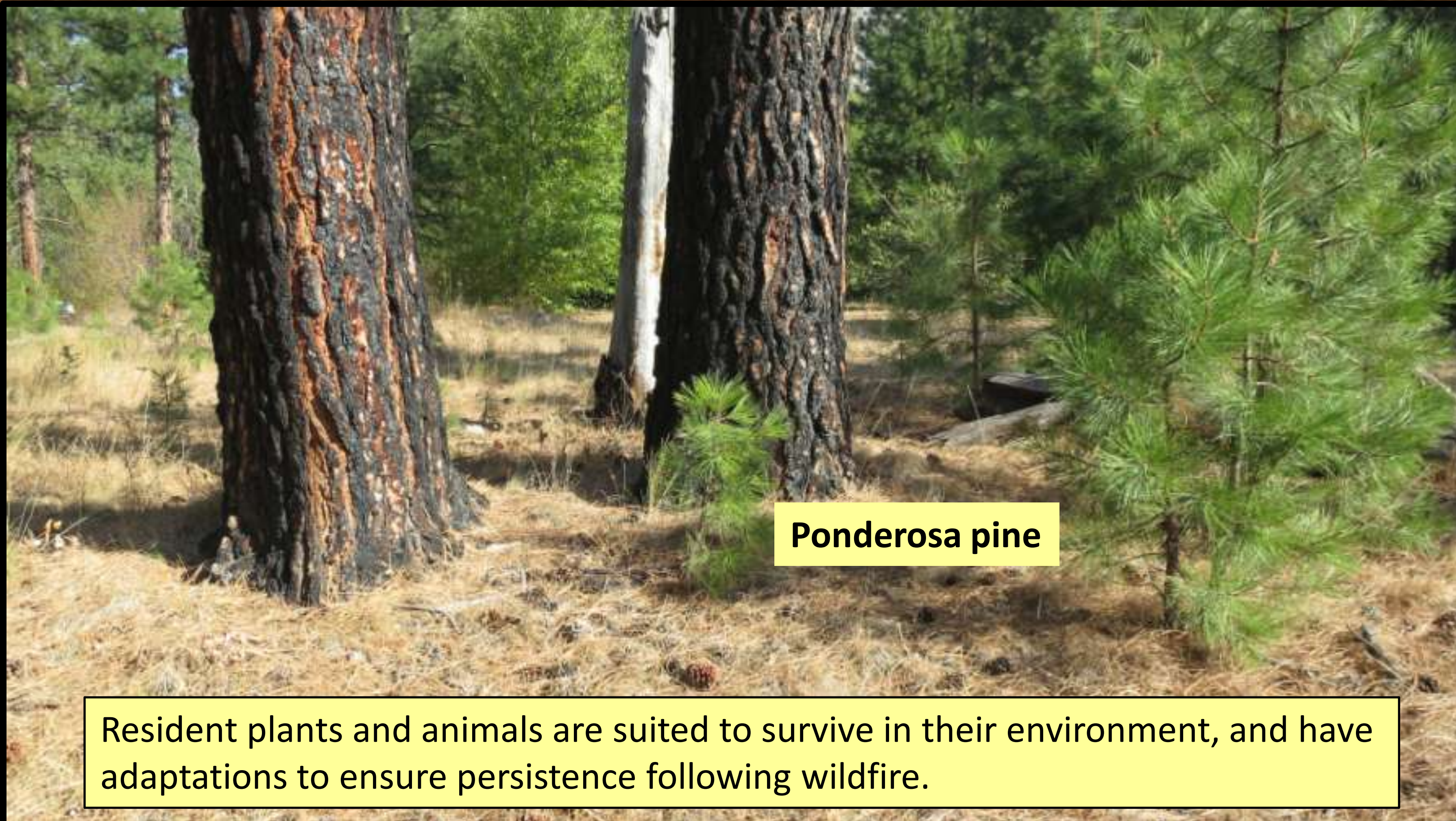
ponderosa pine

For thousands of years, our east-side Cascades forest ecosystems have been subjected to naturally occurring and intentionally set wildfires.



Resident plants and animals are suited to survive in their environment, and have adaptations to ensure persistence following wildfire.

Within the Wenatchee Watershed, different ecosystems each have a specific, historical pattern of wildfire type, frequency & intensity

Low elevation dry forests at 1500-2500 ft. characteristics: ponderosa pine, with some Douglas-fir and an understory of deciduous shrubs like bitterbrush and ceanothus had **low-and moderate intensity frequent fires, every 15-45 years**

High elevation mixed-species forests at 5000-8000 ft. characteristics: whitebark pine, lodgepole pine, Englemann spruce, and subalpine fir burned in **mostly stand-replacement fires (But also moderate intensity fires) at > 150 year intervals**. Some ridgetops burned more frequently, due to exposure to lightening strikes.

The fuel for wildfires is plant material – living and dead

2 types of fuel

SURFACE fuels: on or above the ground; down logs & branches, stumps, low shrubs, grasses, fallen needles, leaves.

CANOPY fuels, starting from the ground up: living branches, needles, & tree tops & tall shrubs, snags

Ladder Fuels like low-hanging limbs allow ground fires to climb into the tree's crown

SURFACE FUELS include Duff & Litter: the top layer of soil containing roots, dead & decaying leaves & wood.

Historically, different ecosystems are characterized by a spectrum of different types of wildfire, from low-intensity *surface* to *high intensity canopy* fires

Historically, **ponderosa pine forest**, experienced *mixed surface and crown fire behavior* that moved through quickly, not damaging soils or most large trees. With flame height less than 4-5 feet, fires consumed fuels on the floor, and triggered shrubs , grasses, & wildflowers to re-sprout. Some large trees did burn, creating sun-openings to the forest floor when new ponderosa pine seeds could sprout.

1-month post low-intensity wildfire

Outcome of Low Intensity Surface & Crown fires On Eastside forests

Trees: >80% of trees survive. Small seedlings die

Shrubs: most resprout
Perennial grasses and flowers: most resprout
Soil: surface ash layer acts a fertilizer

2 years post low-intensity wildfire

Outcome of Historical High Intensity Surface & Crown fires on Eastside forests

- **Most** burn patches were small (1-10 acres) to medium (10-100 acres in size). **Few** patches were large (100-1000 acres)
  - **Trees:** <30% of trees survive: new seeds need to be brought
  - **Shrubs:** replacements delayed: new seeds need to be brought
- **New seeds blown in by wind or carried by animals from adjacent non-burned patches of forest**

Lodgepole pine

Photos taken of the 9/2012 Wildfire at 6184 ft. on Table Mountain., looking NW toward Blewitt Pass on 6/7/2015. During this fire, low-wind weather conditions held thick smoke over the fire. A result was a patchwork pattern of burned and unburned stands of trees.

Plant species utilize different strategies to adapt to fire

Traits that allow either the survival of a individual OR traits that facilitate reproduction and the perpetuation of the species

Ponderosa pine has traits that allow survival of the individual

- Thick corky insulating bark to protect inner tissues
- Successive fires scorch and kill lower branches that fall off
- Tall bare trunks- have high up branches so living needles are out of reach of ground-fire flames

Lodgepole pine has traits that allow perpetuation of the species

- Thin bark offering no protection from fire heat.
- Fast growing, short lifespan tree.
- Resin-sealed cones require the heat of fire to open. They then shed seeds over newly burned ashy seedbed.

Ponderosa pine- traits allow survival of the individual

Wildfire can burn through & kill part of a living tree. Sap then seals off the damage, creating a “cat-face” scar .

As trees age, the base of the living crown is elevated far up, due to earlier wildfires that scorch & killed lower limbs.

This ponderosa forest has been thinned, then prescribed fire was used to reduce ground fuels. The burn killed seedling conifers that would compete for limited water and nutrients. Water-stressed mature ponderosa pines are more susceptible to disease and less able to repel insect infestations.

Thick corky bark serves as insulation against the heat of a low-intensity ground fire

Ponderosa pine are well-suited for ecosystems with frequent, low-intensity wildfires

Ponderosa pine has:

- Thick corky bark that serves as an insulator, protecting the living inner cambium from heat damage by wildfire.
- As trees age and experience fire, lower limbs are scorched and shed, which widens the space between the ground and foliage in the crown.
- Cones survive low-intensity wildfire and then provide seeds to fall onto recently burned soils.
- Seeds need full sun & a mineral soil seedbed to germinate, so are well-suited to frequent wildfires that remove dense underbrush.
- After fire, many seedling trees grow before the next fire comes. When the next low-intensity wildfire sweeps through the grove, some of the young trees with “fist-sized” trunks will survive.

ponderosa pine

Lodgepole pine are well-suited for ecosystems with less frequent, high-intensity wildfires

Thin bark & dense growth-
This is not a fire-proof tree!

A wildfire burned & killed this tree. The heat melted the resin that sealed the serotinous cone's scales. Post-fire, they opened and shed seeds.

Lodgepole seeds need full sun to sprout, and compete with other species like sub-alpine fir, whose seeds sprout in shade.

Lodgepole depends on wildfires to create non-shaded & exposed mineral soils that favor its seeds over competitor seeds.

Lodgepole is a fast-growing relatively short-lived conifer (60-80 yrs**).** Historically, **lodgepole pine forests** likely experienced both *high severity* (all trees killed) and *moderate severity* fires, depending on the amount of fuels and past fire history.

How has human activity (1850-present) changed wildfire patterns in Eastside Cascades?

Effective fire suppression & grazing has extended the time between fires, allowing build up of fuels on forest floor.

Composition of forest has shifted to species whose seeds can sprout in shade, like Douglas-fir & grand fir.

When fire comes, Douglas-fir & grand fir serves as a ladder, allowing fire to climb into the canopy. What historically was a low-intensity fire now is a high-intensity stand replacing fire.

Just as in a city, increased density makes it easier for insects and diseases to spread (i.e.dwarf mistletoe, root rot, many insects that feed on trees).

low elevation dry forest

Increased density of trees means more competition for limited water, nutrients, and sunlight. Stressed, less vigorous trees are then more vulnerable to insects & disease.

Solutions for today's Dry Forests

Mimic the effects of historical frequent wildfires by reintroducing controlled, low-intensity burning by:

- prescription burning
- For forests with high levels of fuel, first limb & thin the trees to reduce fuels, then follow with prescription burning.

Today, large sections of forest need the treatment of prescribed burns.
Current air quality standards severely limit the number of days when prescribed burns are allowed.
Often with prescribed burns, smoke can be moved high into the upper atmosphere so local smoke issues are minimized, and much less as compared to a wildland forest fire's smoke impact.

In Sept. 2012, a wildfire quickly burned here without damaging the tree canopy. Photo: 5/2015

Forests can be treated to mimic the effects of wildfire.

When a naturally caused fire burns here, it will be low intensity wildfire.

This stand of Ponderosa pine and Douglas-fir near Lake Wenatchee has been treated.

1. Small trees were cut down and removed
2. larger trees were limbed up, slash piles were made.
3. Slash piles were burned in winter on snow to safely reduce the fuel load.
4. A prescribed fire was implemented to reduce ground fuels. Shrubs, grass, & wildflowers re-sprouted the next year.
5. Every 3-5 years, this stand is re-burned by prescription.

Suggestions for further reading

- *Natural and Prescribed Fire in Pacific Northwest Forests* by John D. Wastad, et. al. (1990)
- *Flames in Our Forest: Disaster or Renewal?* by Stephen F. Arno and Steven Allison-Bunnell (2002)
- *Fire Ecology of Pacific Northwest Forests* by James K. Agee (1993)