Southern Willamette Forest Collaborative
Rigdon Collaboration Committee
Monday, April 3rd, 1:00 – 4:00

Rigdon Landscape Changes over Time

Participants: Sarah D, Tim B, BJ K, Jean C, Kris E, John K, Melanie K-M, Loren H, Thalia L, Mike B, Bob L, Lon O, Alan D, Christopher Y, Laurie P, Leslie D, Fergus M, Cindy N, James J

Forest Service: Jane K, Leslie E, Rob M, Molly J, Allen H

Facilitator: Sarah A, Intern: Patrick W

Rigdon Dry Mixed Conifer: Past, Present, and Future

James Johnston – Faculty Research Associate OSU; Degrees: History & Forest Ecology

The Rigdon area is a unique area. Most of James's research involves tree ring analysis, which provides an inference about past conditions. The past can provide insight to the range of variability that we will be experiencing in the future. His research focuses on change over time, and the changes that occur in forests. We may think of forests as static, longed lived conifers, but rapid environmental change is a fact of life in Oregon forests. Natural disturbance provides an enormous variation – James's interested in difference in disturbance patterns and drivers of those differences.

Presentation:

1) First: Review and framework for understanding fire disturbance in forests
    a. Characterizing Fire Disturbance: Multiple spatial and temporal scales
    b. Variability in fire regimes from watersheds to tress and over time
    c. Drivers of change
2) Second half of presentation: Rigdon dry mixed conifer change over time
    a. Historical documents
    b. Landscape setting
    c. Historical fire patterns
    d. Current fire patterns
    e. Future fire patterns
    f. Forest change under different fire regimes
3) Last: Brainstorm, what do we want the Rigdon DMC zone to look like in the future?

Characterizing Fire Disturbance

1) Characterizing fire disturbance:
    a. Important to understand and clarify scale: Region (Willamette National Forest), Watershed, Stand of Trees, Individual Tree
    b. Understanding time: hard to visually represent, but basic phenomenon there is change at different temporal scales.
2) Variability in fire regimes: associated with different forest patterns

a. **Dry mixed conifer pine:** high frequency, low severity surface fire
    i. 2-25 year MFRI – Mean Fire Return Interval (aka: average amount of time fire returns)
    ii. 0-20% mortality of overstory species- did not kill large overstory trees
    iii. management implications: forests that assume fire was frequent, but excluded for many years, it is reasonable to use thinning to reduce fuels and reintroduce fire
b. **Mesic mixed conifer (douglas fire dominated):** high severity fire
    i. 125+ year MFRI
    ii. 75-100% mortality
    iii. management implications: less scientific consensus of how to appropriately manage these types of forests
c. **Mixed fire regimes:**
    i. 25-100 year MFRI?
    ii. 20-70% mortality?
    iii. Broad, scientifically sloppy category; problematic with this category is spatial scale that is referenced– "what really matters and varies is the spatial scale
    iv. How you chariterize fire severity is a function of the scale of observation
        1. (mixed severity is a combo of low, moderate, and high severity within a larger fire)
d. The smallest scale of fire effects is the individual tree
    i. Measure effects by dead or alive
    ii. Data sets in slideshow (data from Central Oregon Cascades) demonstrating probability of death from fire in low severity, moderate severity, and high severity fires based upon diameter.
    iii. Different trees have different mortality rates, range conditions could impact the trees (so based on graph Douglas Fir might appear more resilient than Ponderosa Pine, but it's really that they exist in different ranges and those ranges are more/less susceptible).

3) Temporal Variation: see slideshow. Amount of fire variable over time, strong correlation with drought (fires during drought); strong correlation over last 100 years with population (lower fire as higher population)
    i.

Sidebar: "What kills trees?"

a. Crown damage → top of tree incinerated
b. Cambium kill → fuel around base of tree, heats and kills cambium. (lag effect, 6-12 months until trees die)
c. Root damage → less common (dense canopy and dense surface fuels, ground fire super heats, radiant heat kills crown, but is not necessarily a "crown damage fire")

d. Trees are more vulnerable to fire and insects as a function of water. "What killed a tree?" Basic answer is usually "fire" or "x", but it is usually a function of stress (such as lack of water), which is usually a function of climate.

e. Graph - Different trees have different tollarnce to fire. Some are more fire tolerant than others
    a. Doug and ponderosa pine are very fire tolerant species – much more than cedar or white fir
    b. Somewhat different response to moderate and low severity fire b/t doug fir and ponderosa pine. Interesting and significant for Rigdon area
    c. Ponderosa Pine like low severity fire
    d. Small Douglas Fir is more easily killed by low severity fire
        i. Could have a different range of stand conditions that might contribute to why trees die
        ii. Doug fir mortality is strongly influenced by stand conditions.
    e. This graph is real field data – so cant control for all environmental conditions. One of the things that make PPine resilient is that it is very drought tolerant. Other species, without water they die. Persists on dry sites because it is both drought and fire tolerant

f. So far we have talked about variation in fire effects in watershed stand and tree scales. Important to keep in mind, fire regimes are variable in the same place, over time

g. Temporal variation graph – important to look at fire occurrence over the past 1400 years. The amount of fire world wide and North America is extremely variable, and at large special scale, it is strongly correlated to drought & temperature.
    a. More fire 600-800 years ago compared to 200 years ago because of climate conditions
    b. warmer dryer conditions worldwide correlates with more fire

h. Q: Long term decline? Dramatic decrease in fire last 100 years – correlated to increase in population

Drivers of Change

1) Succession – plants growing over time can include shifts in species, aligned with increase of biomass. More or less fuel can be associated with fire regimes.
2) Land management/Structure – density of fuels
3) Climate – at broad special scales most important
    a. Annual & Decadal variation– every year or decade there is variability of climate - often correlated with Ocean changes
    b. Ex/ La Nina and El Nino – involves changes of behavior over the Pacific ocean
4) Directional –anthropogenic CO_2 emissions – strong relation b/t climate change signals and wildfire

a. Temperature – 1970 – 2000 overall increase in temp associate d with increase in wildfire occurrence
b. spring snow melt and increase in fire season length

Rigdon Dry Mixed Conifer Change Over Time

1) Historical documents
    a. The Journals of John Work (Hudson Bay Company 1834) – Came through this area, up through Rogue and Umqua and into Upper Willamette valley to Springfield area. Said this area had never been visited by whites, referenced Oakridge or Upper middle fork valleys, mention of plentiful beavers, sent party out for two months of trapping. Haven't been able to find any follow-up writings of the trappers, probably illiterate.
    b. HD Langille, Gifford Pinchot's right hand, surveying forest conditions in the west
        i. South end of Willamette Forest (then Cascade Forest Reserve) 1903 – heavy mention of yellow-pine and sugar pine. Mention of rough-bark cedar (thick bark, likely incense-cedar); large number of sheep driven from eastside.
        ii. "District dry during summer, numerous large fires have devastated large tracts" (he's probably talking about large scale surface fire that is killing off small trees)
        iii. "Most of the burns free from litter, the fires, on account of climate, have consumed litter." He's talking about a forest with a clear understory, not a lot of dead trees on the ground. "conflagration" probably describing frequent, low severity fire regime that he attributes to dry climate.
2) This leads to a Q: Is this a uniquely dry climate?
    a. Landscape setting
    b. Prominent ridge (moistures comes from south/west hits calapooia divide – 6100 feet – strong rain shadow effect from this divide) -- not good climatological data for this region
    c. Rigdon dry mixed conifer ~2100 feet elevation
    d. Anecdotal evidence
    e. Precip models from PRISM – OR state - precip 35-45"
    f. Extensive evidence of Aboriginal use of the Upper Middle Fork
        i. Possible that there is an aboriginal influence on historical fire regimes. Still needs to be explored.
        ii. Even if there was, sort of chicken and egg question: did Native Americans use fire to create this landscape or did they use fire because the landscape was suitable to that use. Of what we know, the landscape is reminiscent of to how we know the Native Americans managed the Willamette Valley, using fire to maintain Oregon white oak crops and maintain open savanna

like conditions. Would speculate commonality with the Willamette Valley climate and Native use in the Upper Middle Fork.

iii. Would like to do dendroecological study of trees

3) Results of preliminary Upper Middle Fork data set
   a. Historical Fire patterns
   b. Tree cores
   c. Sawed dead trees – fire scars (lesions in the bole of Ponderosa pine)
   d. Measure tree ring widths with special computer program that corresponds a ring with a calendar year. Cross dating rings.
   e. Fire years from research, plot located nearest to river, east of Jim's Creek, fire MFRI 7.2 years between 1793-1886 (plot of about 3 acres) – exclusion of fire after this point likely: diminished herbaceous surface fuel, cooler and moister climate, and early fire protection efforts which began in 1880s.
      i. Things to note:
      ii. Fuel limited system – frequent fire associated with the amount of fuel. If fuel, then burn. If no fuel, no burn
      iii. Primarily low severity fire effects – no areas of 100% fire mortality
      iv. Large fire extents – likely large in space, but low in severity
      v. Extensive herbaceous surface fuel – in order to have regular fire 7.2 MFRI, need native perennial grasses (quickly regenerate)
   f. Q: Why the exclusion of fires after 1880? Think 3 factors:
      i. Denuding of surface fuels by sheep
      ii. Cooler moister climate 1880-1890
      iii. Early forest protection efforts – Cy Bingham and others
4) Current Large Fire Patterns (Forest Service Data for ignition strikes and suppression)
   a. Shady Beach 1988 (possibly 1989)
   b. Warner Creek 1991
   c. Tumblebug 2009
   d. Deception Creek 2014
   e. Smaller fires w/ no severity data
      i. S Zone complex 1996
      ii. Monteeth/ Prior
      iii. Kitsen Springs
   f. Fire starts data: actual ignitions that the FS suppressed, on a grid because it dates back for 50 years and fires were reported by sections. Gap at private land b/c there is no data.
   g. Data: every year, plenty of strikes to begin a fire, only 4 actual fires, others were suppressed.
   h. Main Point: historically whether there was Native American or lightning ignitions, there was more than enough ignitions to start a fire every 3-4 years in the Rigdon area. There was enough ignitions and herbaceous fuels and dry conditions to cause extensive and very frequent fire. Today most ignitions are suppressed except rare weather and operational limitations.

i. There has been a very dramatic change in fire pattern between 1800s and 1900s.

5) Future Fire Patterns (see slides) – study considers topography, precipitation, temperature, and land form
    a. 1981-2010
    b. 2031-2060
        i. Moderate/High fire suitability increasing
            1. model is predicting decreased precipitation, higher temperature NOT predicting actual fire location -- but the two are related
            2. really modeling the suitability of a large wildfire, i.e. changes in prep and temperature
            3. Took all large wildfires that have burn and assessed wildfire factors during the year of the fires and then used a variety of existing projections of temp and precipitation from a variety of climate change models and interpreted how the landscape may change. Assuming moderate emissions under Paris climate accord (conservative estimate)
            4. The south end of the forest is going to see a significant increase in wildfire activity because of the lower precipitation
                a. Its not telling you the type of fire you will have, instead the probability of increased fire activity where there is decreased precipitation and increased temperature
    c. Climate variability over time – cored trees, cross dated and measured, hundreds of years. Tree ring widths show tree growth patterns (see slides) based on past precipitation and temperature from 1500 - 2016
        i. 1900-2000: overall, no significant drought during that time period – had some drought signals in 2000s compared to significant droughts in 1830s/1600s.
        ii. The combination of significant drought/climate variability and frequent fire likely the reason for so much Ponderosa pine forest in the area.
            1. 1830s and mid 1600 droughts (twice as strong as any modern drought)
            2. In the data, strong evidence of why the stands are dominated by ponderosa pine. Combo of significant drought events and climate variability.
            3. Q: age of Pines in the area? Some established in 1300s, oldest tree ring 1447.
        iii. NOTE: Tree growth in PNW is correlated with pacific ocean current patterns to several thousand miles to the Northwest of us because all water we get is from North Pacific Ocean
    d. Succession of forests under different fire regimes
        i. Measured the width of trees on plot

e. Succession under different fire regimes in the one Rigdon plot
    i. Cored all the trees with white ribbons, measured the width of tree rings
        1. Example ponderosa pine growth pattern
    ii. No tree species in the plot before 1870 except for Ponderosa pine
    iii. In vicinity mostly old growth PPine, some old growth Doug fir, lots of younger Dough fir trees
        1. Example doug fir established 1880s
    iv. For this one plot – adding fire years - the years in which fire burned frequently, the trees had more growth.
    v. Paints a dramatic picture of change over time in this one plot
        1. Previsouly there was forest landscape of widely spaced, drought tolerant, fire tolerant ponderosa pine that were growing well under a frequent fire regime. As fire ceased the doug fir encroached and began to outpace the ponderosa pine.

Questions:

1) Any data that shows prevalence of oak stands?
    a. Seem to be distinctive groves of oaks and some ethnographic evidence that Native American family's were cultivating white oak stands. Synchronicity across some of the groves.
    b. Cored about 12 of them, oldest was 350 years old and 12" dbh.
    c. They were more prevalent when there was frequent fire
    d. Presence of oak groves supports hypothesis that the climatologically, ecologically and culturally the Upper Willamette valley is an extension of the larger Willamette valley
    e. The FS is working with Ray Davis to try to use Lidar to see if they can ID oak groves
2) When you measured tree rings to get date, did you look at the thickness of the summer wood band?
    a. Not in these samples.
    b. Tim: have noticed a variation in summer wood that that might indicate a warmer summer
    c. Late wood, thicker cell wall, looks browner
        i. It could be a moister summer or could be indicative of cooler, dryer Aug. or July. Not sure.
3) Based on projections the task seems hopeless. How do you keep fire?
    a. Fire is cheap, examples in Southwest forests that use fire for land management and let fires burn under natural processes and conditions.
    b. Need to have high frequency, low intensity fire
    c. One of the keys to future fire behavior is the fuel strata. One of the changes from historical conditions is the change in overstory cover, but also the change in understory vegetation composition. Historically there was contiguous native grass cover. A great fuel strata for managing fire. Dries out early, allows for early fire. Fine flashy fuel that doesn't get to be more than 6' flame lengths and doesn't get

into the crown. What you want to have to have low severity fire. Jims creek restoration efforts have provided a really good recovery of native grasses.

4) How does logging factor in?
    a. First you have to get fuel levels down to where you can do fire maintenance.
    b. Removal of Douglas Fir – there is a market for it. Removing most of the younger douglas fir will reduce ladder fuels, important for reintroduction of fire. Will help open up the canopy, allow more light to forest floor and regenerate of grasses -- which helps with fire maintenance.
    c. Selectively cut the trees
    d. How does the private land factor into this?
        i. Probably not interested in thinning, they're managing for timber. Likely wouldn't mind thinning/fire around private land since it will reduce their fire risk
5) What stands in the way of restoration?
    a. Red Tree Vole; Northern Spotted Owl territory designations (not historically in these areas because it was a Ponderosa Pine forest, but now are because of Douglas Fir stands, etc)
        i. There are some exceptions for Dry Forest sites, but this is not classified as a "dry forest" (based on perhaps arbitrary line).
    b. Spotted owls are not native to the ponderosa pine, sugar pine habitat. They have expanded there now that the area is encroached by douglas fir. Now that the Doug fir are 100 years old they are considered habitat.
6) At Jim's Creek, what extent of wind storm damage was influenced by logging/thinning exposure?
    a. Some influence, at Jims creek they lost many trees in a major wind event. Mostly a fluke event, east winds, not the southwest winds that usually hit the area.
        i. The project planned for possible tree mortality and left more trees than would historically be there.
        ii. The trees that were left were the largest, most major trees that had experienced wind before.
        iii. Tim: there is evidence that the main mortality/ regeneration factor for Ponderosa Pine is wind throw. A 5-6 diameter pine is not killed by fire.
            1. The pine are dying now because they competition for water and crowns are dying - not accounting for overcrowding that is now occurring b/c of fire suppression
7) The south zone of the Middle Fork District and the Umqua are important transition zones from dry to moist forest types.

What would the group like to see in the future?

1) Structural key: Tall tree boles that are free of ladder fuels.
    a. Response: That's the beauty of fire → Q: how feasible is natural fire?
2) Structural key: Horizontal heterogeneity with private lands that provides fire protection
3) Changes in recreational use of this area in the future.

   a. Restoring some of the open forest pine is a good way to manage for some of the human ignition aspects
   b. Important travel corridors, expected increased use by mountain bikers and probably other users.
4) Biodiversity: Right now we are loosing oaks, pines and meadows and flowering plants. Many wildlife If we try to reestablish the open forest
5) Climate change resilience: protect species like oak and pine that can expand with climate change before we loose that genetic pool that could be an important set of species to expand.