Evaluating competing scientific claims about forest successional and disturbance dynamics in the southern Blue Mountains

Overview

A science synthesis to inform the development of moist mixed conifer zones of agreement and a technical paper that describes variation in forest structure and composition over time on the Malheur National Forest indicate that:

- Mean fire return intervals prior to 1900 ranged from 11-21 years in a wide range of forest types ranging from dry pine to moist mixed conifer.
- Both ponderosa pine and mixed conifer forest types on the Malheur National Forest were historically characterized by low densities, probably related to frequent fire across the landscape.
- There has been a significant increase in forest density in all forest types between the late 1800s and today.
- Mixed conifer stands, including moist mixed conifer stands, have experienced significant change over time, with early seral species like ponderosa pine and western larch declining relative to late seral species like grand fir and Douglas-fir.

A number of scientific papers have been cited as evidence that historical disturbance regimes have been mischaracterized and that the extent to which forests have experienced change are exaggerated. This paper suggests methods for evaluating competing scientific claims and summarizes scientific literature that presents alternative views of forest dynamics.

Criteria for evaluating science

Three criteria suggest themselves for evaluating scientific papers that potentially inform restoration treatments on the Malheur National Forest:

1. Applicability—does the geographic scope of the study encompass the southern Blue Mountains and/or the forest types in question?
2. Quality of evidence—Is the information presented appropriate for making inferences about forest dynamics of interest?
3. Scientific consensus—To what degree does other research concur with the conclusions presented?

Other science papers

Alternative hypotheses about historical successional and disturbance dynamics

Studies cited as evidence that current restoration strategies are inappropriate fall into two categories: 1) Papers that suggests that our current understanding of historical successional and disturbance dynamics are flawed, and 2) papers that suggest that the historical extent and/or contemporary ecological effects of fire are misunderstood.

Alternative views of successional and disturbance dynamics are exemplified by Baker and Williams 2015, Williams and Baker 2012, and Baker 2012. Baker and Williams use Government Land Office (GLO) records from the late 19th century to infer historical density, composition, and fire disturbance processes across 740,000 to 990,000 acre study areas on the east slope of the Cascades and the northern Blue Mountains. They claim that less than 40% of the Blue Mountains study area and less than 24% of the east Cascades study area historically consisted of low-density, pine dominated forests that experienced frequent fire.

The Blue Mountains study area appears to include a portion of the northern part of the Malheur National Forest, but most of the Blue Mountains study area consists of Umatilla and Wallowa-Whitman managed lands.

The GLO records utilized by Baker and Williams, unlike the historical timber inventories utilized by Hagmann et al. (2014 and 2013), contain no purposive data about density or basal area. GLO records merely provide notes designed to be sufficient to relocate a handful of monument trees, generally 8 trees per square mile. Although foresters have sought methods to reliably estimate forest density with parsimonious tree measurements for hundreds of years (Beasom and Haucke 1975, Stearns 1949), neither the sample size or configuration of trees with locations noted by GLO surveyors—two trees on either side of a 0.8 km grid line—lends itself to an empirical proven or mathematically derived method for estimating density. Williams and Baker present a “Voronoi-based plotless density estimator,” but their use of this estimator pointedly ignores their own citations to the literature on the use of Voronoi polygons, which cautions that the area occupied by trees cannot be estimated without mapping the spatial arrangement of more than two trees (Williams and Baker 2011, Kleinn and Vilcko 2006).

Other studies demonstrate that Baker and Williams consistently overestimate forest density using information from GLO surveys and their work has been criticized for unsupported inferences about fire severity (Stephens et al. 2015, Hagmann et al. 2014, Fulé et al. 2014).

There is an overwhelming scientific consensus that provides managers with a high degree of confidence that much lower forest densities composed of a higher proportion of early seral species were the norm across ponderosa pine and mixed conifer forests throughout eastern Oregon. These studies include dendroecological reconstructions (Johnston in press, Merschel et al. 2014, Perry et al. 2004, Heyerdahl et al. 2001, and Hall 1976), analysis of historical timber inventories (Hagmann et al. 2014, Hagmann et al. 2013) and first-hand written accounts about historical forest conditions (Weaver 1959, Munger 1917, Langille 1906).

In summary, Baker and Williams 2015, Williams and Baker 2012, and Baker 2012 may have little applicability to the southern Blue Mountains, they rely on low quality evidence relative to other studies, and present conclusions that are contradicted by other scientists.

Studies that address the historical extent and ecological effects of fires.

Other studies suggest that current restoration strategies that focus on reducing fire severity are misplaced because high severity fire was common in the historical period, and/or that widespread high severity fire is desirable on the landscape today.

Williams and Baker (2012) use notes about tree diameters from GLO surveys to estimate historical fire severity. They claim that the presence of a certain proportion of trees below a particular diameter threshold is evidence of high severity fire. Then they compare the proportion of areas that they determine show evidence of high severity fire with satellite data that estimates the proportion of high severity fire within recent wildfire perimeters. They conclude that there is little difference in the historical proportion of high severity fire and proportion of high severity fire within contemporary fire perimeters. They report estimates of the proportion of historical high severity fire from a study area that appears to contain a small portion of the northern part of the Blue Mountains, but is primarily located within the Umatilla and Wallowa-Whitman National Forests.

Fulé et al. (2014) point out that diameter classes noted in GLO surveyor notes provide no reasonable basis for inferences about historical fire severity. They also point out that although the GLO surveyor notes relied on by Williams and Baker frequently report low severity fire, they rarely or never report high severity fire.

In summary, this paper may have limited applicability to the southern Blue Mountains, uses low quality evidence, and is contradicted by other scientific studies that have broad support in the scientific community.

Odion et al. (2014) use modern Forest Inventory and Analysis (FIA) plot data to estimate historical fire severity. Similar to Williams and Baker (2012), they assume that Forest Service field crews' estimates of plot stand age reflects historical fire severity and conclude that most forests in the western United States historically experienced "mixed-severity" fire, including high severity fire. Of the 2,137 FIA plots they analyze, only 7 plots were from eastern Oregon, all on the Deschutes or Fremont-Winema national forests. Stevens et al. (2016) demonstrate that FIA stand age estimates are unreliable indicators of past fire patterns.

In summary, this paper has little applicability to the southern Blue Mountains, uses low quality evidence, and is contradicted by other scientific studies.

Bradley et al. (2016) found that protected areas (e.g., wilderness and roadless areas) generally experience lower severity fire than unprotected areas. This paper divides the western United States into 10 different ecoregions, but reports results only for the entire western United States. It is unclear from this paper if there is any evidence that protected areas within the Malheur National Forest generally burn at lower severity than unprotected areas. Given that wilderness areas and inventoried roadless areas on the Malheur National Forest seem to have experienced a higher proportion of high severity fire than areas outside of wilderness or roadless area (see Figure 1), this study would seem to have little applicability to the southern Blues.

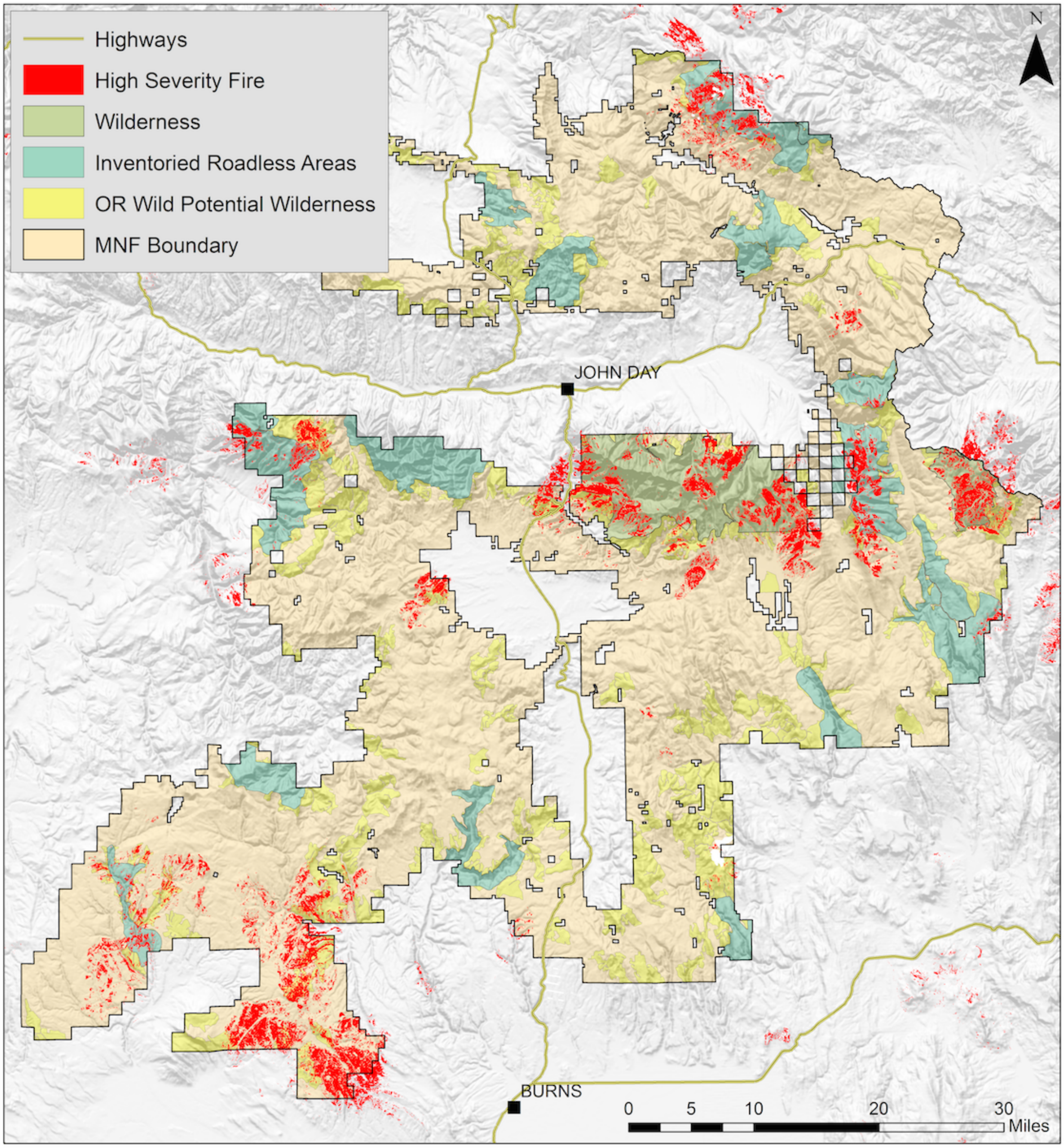

Figure 1. High severity fire between 1984-2015 on the Malheur National Forest in relation to wilderness areas, inventoried roadless areas, and roadless areas proposed for wilderness protection by Oregon Wild (see http://www.oregonwild.org/sites/default/files/pdf-files/Oregon_Proposed_Wilderness.pdf)

A variety of paleo-ecological studies of charcoal deposition demonstrate that there has been considerable variability in large-scale fire over the last several thousand years in the American West, and these studies are frequently cited as evidence of a "fire deficit" (Marlon et al. 2012, Pierce and Meyer 2008, Pierce et al. 2004).

Recent research that describes historical fire frequency on the Malheur National Forests suggests that historical fire sizes were indeed likely much larger than fires during the modern period (Johnston et al. in review). Between 1650-1900, fire was recorded at more than half of 13 randomly located sites during three different years and more than a third of sites 25 times. During an average fire year in the historical period, approximately one-quarter of sites burned. In contrast, one fire year after 1900 (1910) burned approximately 14% of the MNF and the next two largest fire years (2001 and 2007) each burned less than 9% of the forest. During the average fire year after 1900 in which more than 1,200 acres burned, less than 2% of the total area of the forest burned. This information does not, however, suggest that fuel reduction thinning treatments are inappropriate, since most fuel treatments are designed to facilitate future fire. In summary, it is unclear how evidence of a "fire deficit" relative to a prehistorical period is relevant to current planning efforts.

A number of papers suggest that high severity fire effects are desirable because a variety of wildlife species are associated with high severity fire effects (Hutto et al. 2016, Keane et al. 2009, Hutto 2008). However, there is nothing in these papers that suggests that forest restoration treatments will preclude high severity fire sufficient to provide for the needs of different wildlife species.

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