

Managing Fire Refugia in the Pacific Northwest

Outcomes of the first Fire Refugia Workshop in the Pacific Northwest (May 17th 2017, Portland Oregon)

[Introduction] Fire refugia are areas with lower fire effects than the surrounding area, where biota (or cultural resources) can persist and expand from during and after a fire event. These areas are important landscape elements that contain habitat for species, can increase ecosystem resilience, and provide ecosystem services by retaining seed sources. Examples of fire refugia include unburned patches of old-growth for spotted owl habitat or unburned patches of sagebrush rangelands important for greater sage grouse.

Natural resource managers are increasingly interested in identifying fire refugia to preserve the ecological function of these areas. Researchers at the University of Idaho and Utah State University have developed an unburned islands database for approximately 2,300 fires across the Inland Northwest from 1984 to 2014 (Fig. 1, Meddens et al, 2016, Meddens et al, in prep).

To make this unburned islands database useful for natural resource management, a means to rank the importance of fire refugia contingent upon management objectives is critical. We invited natural resource managers to participate in a workshop to guide future research in identifying fire refugia on the landscape for management purposes. We discussed three key topics using example fires. Here, we describe the primary outcomes of the workshop.

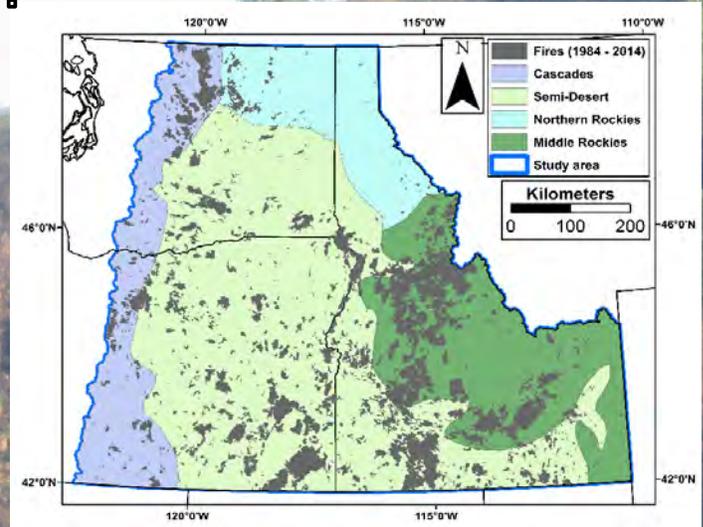


Figure 1: Fire locations of the unburned area database in the inland northwestern USA (Meddens et al, in prep).

➤ Fire refugia formation and management limitations

Fire refugia are formed by (1) topographic/hydrologic, (2) weather/climate, (3) fuel arrangement, and (4) random effects. By manipulating the spatial arrangements of fuels, managers can influence the formation and creation of refugia. Prescribed burning might increase the chance of a given fire refuge to survive a fire (refugia “hardening”), while eradication of fire-adapted grasses might reduce fuel continuity, increasing the formation of fire refugia. Other influences managers could have over refugia formation are: (1) changing grazing allotments, (2) active suppression during wildfires, (3) changing backburn/burnout tactics, and (4) varying the intensity of prescribed burning to promote heterogeneity.

Perceived management constraints included: identification of fire refugia within managed units, presence of fire-adapted invasive species, suppression

Criteria for ranking unburned island importance for natural resource management

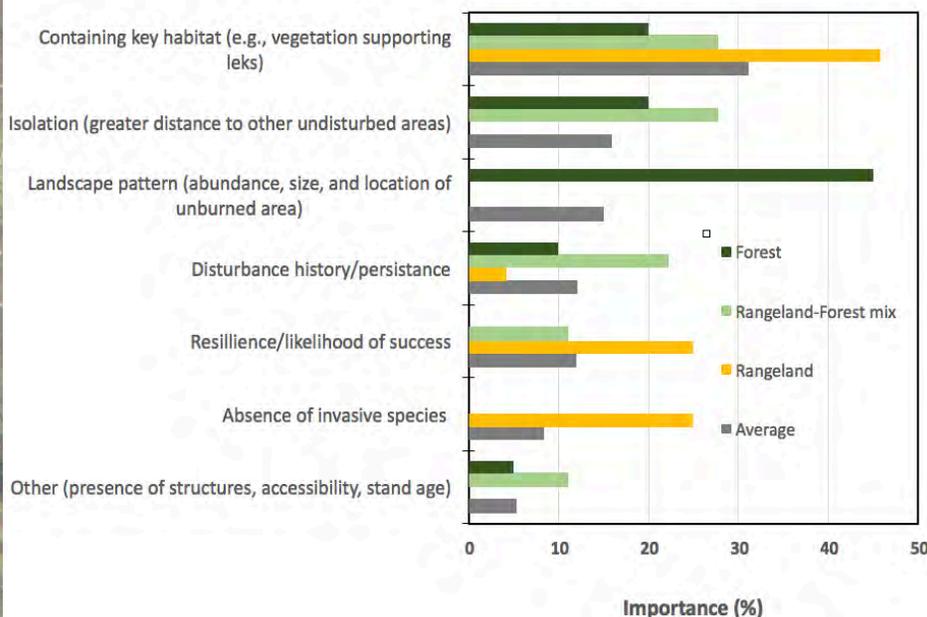


Figure 2: Importance (%) of criteria for ranking unburned islands. A group of 14 natural resource professionals was asked to list and rank criteria that could be used for identifying important unburned areas for management purposes across a (1) forested area, (2) a mixed rangeland-forest area, and (3) a rangeland area. A wide range of criteria were identified and are summarized by importance in the bar chart on the left. Unburned areas containing important habitat in isolated locations were generally considered important. Landscape pattern was considered important in forest, whereas invasive species were considered more important in rangelands. Disturbance history/persistence and resilience/likelihood of success were other factors that were identified as important.

strategies and tactics (e.g., high severity back burns), public/political support and risk aversion, and different jurisdictions with different management goals/targets.

➤ **Criteria for identifying fire refugia**

Workshop participants ranked criteria for identifying fire refugia across three fires; one fire burned predominantly in closed canopy forest (Table Mountain Fire in central WA, 2012), one fire burned through a mix of rangeland and forest types (South Fork Complex fire in central OR, 2015), and one fire that burned through predominantly rangeland (Buzzard fire in eastern OR, 2015). Unburned areas that contain key habitat for fire sensitive species were deemed most important for identifying fire refugia across the three fires. Location and isolation were found more important in forest and forest/rangeland mix, resilience/likelihood of success and invasive species were more important in rangelands (Fig. 2).

➤ **Management tools and future research**

[Pre-fire] We need increased understanding of the effects of climate/weather, topography, fuel arrangements, fire behavior, landscape permeability, pathogens, and drought related to fire refugia formation. For management utility, identified fire refugia should be integrated into the IFTDSS (Interagency Fuel Treatment Decision Support System) system for fuel treatment planning.

[During fire] Management decisions during fire can be critical for the formation or preservation of fire refugia. Integration of a fire refugia data layers into the Wildfire Decision Support System (WFDSS) will enhance active protection of fire refugia. In addition, better understanding/communication of the importance of refugia or other ecologically significant sites with the Incident Command and line officers will facilitate improved fire refugia preservation.

[Post-fire] Identification of fire refugia is important post-fire; in addition, mapping the distribution of refugia patches and the probability of restoration success are essential for successful management of these locations. Spatial data on the disturbance history



Figure 3: Identified fire refugia within the Table Mountain Fire, central Washington 2012. Imagery courtesy of Google Earth.

(e.g., presence of invasive species), fire severity, or time since last fire disturbance (persistence) will be instrumental. Two fire refugia of particular interest for future research were identified: (1) a yellow cedar relic site in central Oregon, and (2) the Steens Mountain area. These areas are of increased perceived ecological value and should be considered values-at-risk when active fires are burning nearby.

Conclusion: Fire refugia are important and management agencies can influence the maintenance of these areas. Our workshop revealed many opportunities for actionable science on the topic of fire refugia. Key aspects of fire refugia are as yet not well-defined; therefore, more research is needed to link unburned islands to key habitat, identify management techniques and constraints, and provide information specific to pre-fire, active fire, and post-fire contexts of fire refugia.

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References

Meddens AJH, Kolden CA, & Lutz JA. (2016). Detecting unburned areas within wildfire perimeters using Landsat and ancillary data across the northwestern United States. *Remote Sensing of Environment*, 186, 275-285

Meddens AJH, Kolden CA, & Lutz JA (in prep). Spatial and temporal patterns of unburned areas within fire perimeters in the northwestern United States from 1984 to 2014. *In preparation for Ecological Applications*.

