

Effects of prescribed fire on riparian function and biological integrity in riparian areas of southwest Oregon mixed-conifer forests

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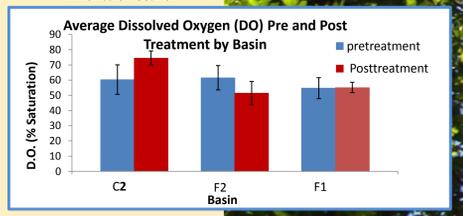
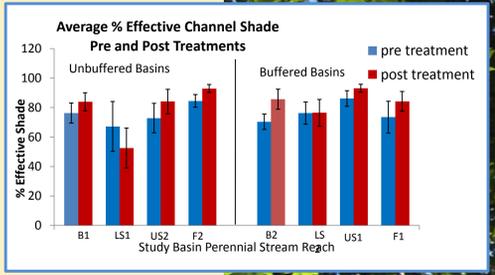
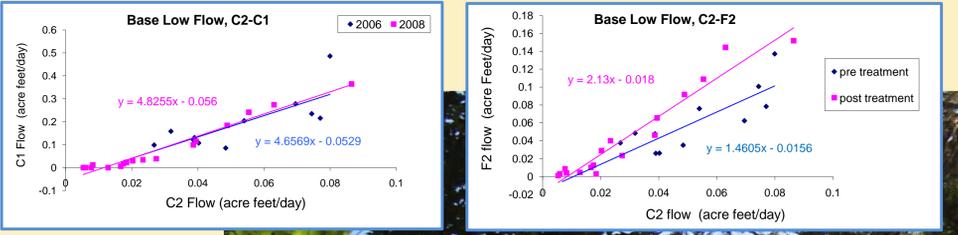
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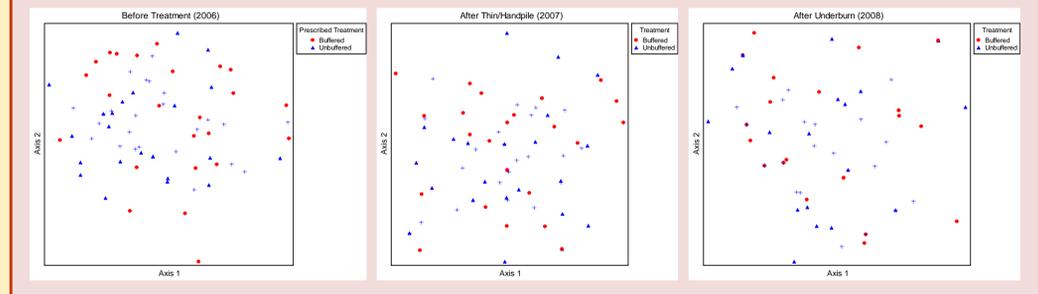
Abstract

Past studies in southwest Oregon have suggested that many riparian areas of mixed-conifer forest historically burned with similar frequencies and intensities as associated upland areas and that fire played an important role in maintaining these areas. However, extensive fuels treatments implemented by the local BLM have not been incorporating riparian areas, due to the perception that these areas are sensitive to any type of anthropogenic disturbance. Land managers lack needed data to support decisions regarding whether or not to include riparian areas in landscape treatment projects. Our study implemented thin/pile burn and broadcast burn treatments in riparian areas of intermittent and perennial stream basins, paired with control sites that were treated only in the upland, as is the typical prescription. The health of these areas before and after treatments was quantified using standardized techniques to examine a number of indicators including: riparian vegetation, hydrological parameters, and avian communities. We present results that determine the effectiveness of fuels treatments and corresponding affects on riparian functions and integrity. Results of this study will offer guidance to land managers in implementing riparian fuels prescriptions in southwest Oregon.

Hydrology Study - Utilizing the paired watershed before/after approach, and incorporating two no treatment control basins, the hydrology component of this study investigated the effects of vegetative fuels treatments on hydrological and riparian function by examining summer base water yield, percent effective shade, and water quality parameters.



Avian Community - We determine the short-term effects of fuels reduction on bird community composition and reproductive success of focal species. Point count surveys were completed annually during the breeding season from 2006 to 2008 (Ralph et al. 1993). Standardized spot-mapping and behavioral reproductive surveys were completed once every five days during the breeding season (May through mid-July) each year to determine the number of territories on a plot and reproductive success of five focal species: Oregon Junco (ORJU), Cassin's Vireo (CAVI), Black-headed Grosbeak (BHGR), Western Tanager (WETA), and Pacific-slope Flycatcher (PSFL) (Vickery 1992).

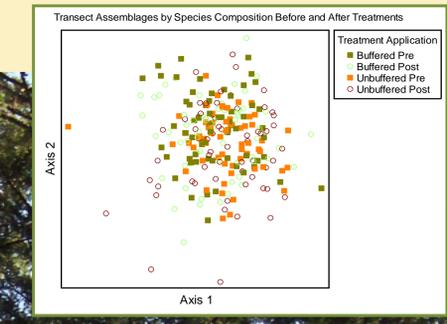


Figures 1, 2 & 3. PC-ORD Version 4.25 (McCune and Mefford 1999) Non-metric Multidimensional Scaling (NMS) ordinations of the avian community before (fig.1) and following both thin/handpile (fig.2) and prescribed fire (fig.3) treatments. The circles and squares represent the bird community at a point count. The + symbols indicate where individual species fall within the ordination.

Methods

This study design reflects the complexity of a multi-party interdisciplinary venture. After exhaustive efforts the needs of the lead agency and private interests ultimately determined the final criteria for study basin selection. The eight selected basins adhere to aspects of the original selection criteria developed by the interdisciplinary team. Paired study basins are adjacent and include a perennial and intermittent stream reach. Slope, aspect, elevation, geology, annual precipitation and vegetative qualities are similar between adjacent basins, but differ throughout the study area. Vegetation ranges from mixed-conifer forest, to a mixed-conifer/hardwood forest with patches of oak woodland and shrub within upland and riparian areas. The history of fire, placer mining and timber activity also varies between basins. Fuels treatments (buffered vs. unbuffered riparian zone) were randomly assigned to basins. The initial year of treatment (2006) included manual fuels reduction (cutting and hand piling) during the winter and spring months. This treatment prescription removed brushy species and small diameter (<6") conifers. In 2007 and 2008 winter and spring pile and broadcast burning occurred in basins where conditions favored these management applications.

Riparian Vegetation - This component examined the short-term effects to understory species composition, diversity and cover. Species data was collected along point-intercept transects following standard protocols (FIREMON (PO) 2004/ National Park Service Fire Monitoring Handbook (NPS FMH) 2003) during the growing seasons (May-July) of 2006 through 2008. Repeat visits in subsequent sampling seasons occurred in similar phenological periods.



PC-ORD v5.0 (McCune and Mefford 1999) NMS ordination of transects using species point-intercept data. Squares represent pre-treatment transects, and circles post-treatment values.

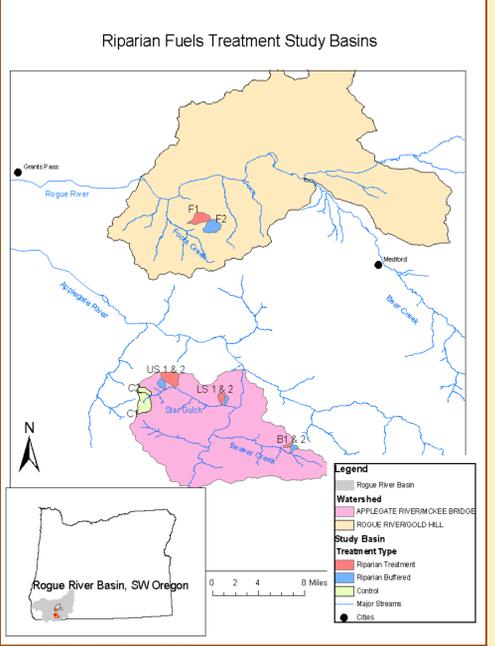
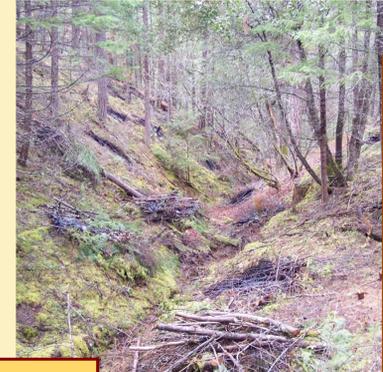
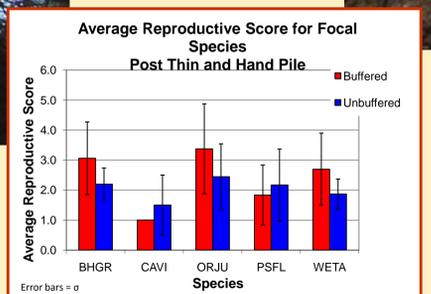
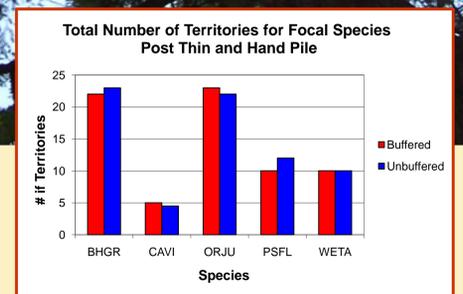
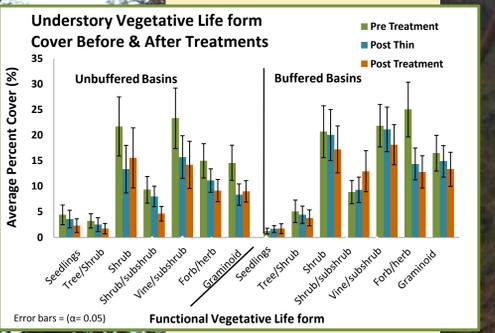
Preliminary Results

- Fuels treatments reduced crown fire hazard
- Riparian burn severity was significantly lower in buffered basins
- Plant composition and diversity varied among basins prior to treatments
- Vegetative species diversity declined in all basins
- Plant compositional changes appeared more pronounced in unbuffered basins
- Functional vegetative life form cover generally declined
- Effective shade was maintained or improved in all but one unbuffered basin
- Select water quality parameters were not significantly affected
- Summer flows potentially increased for both treatment case studies
- No consistent differences existed in pre-treatment bird community composition
- Potential effects on avian composition were similar for all treatments
- Bird territories and reproductive success did not change

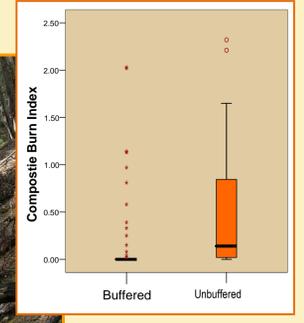
Mean Species Diversity Values Before & After Treatments

Treatment & Year	Max # Unique Encounters	S	H
Buffered Pre	43.14	18.5	2.205
Buffered Post Thin	41.35	16.5	2.099
Buffered Post Rxfire	41.41	15.5	2.014
Unbuffered Pre	43.95	15.4	1.992
Unbuffered Post Thin	36.84	13.5	1.871
Unbuffered Post Rxfire	34.32	11.5	1.661

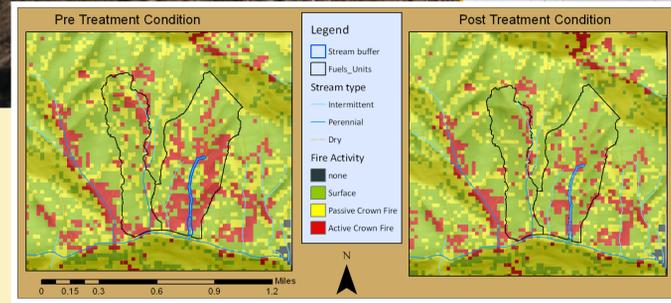
S = (Richness) = number of non-zero elements in row
 H = (Shannon's diversity index) = -sum (Pⁱln(Pⁱ))



Fuels treatment effectiveness & Burn Severity - We utilized pre and post FIREMON plot data to evaluate treatment effect on fuel models (Scott & Burgan 2005) and fuel base heights. Landfire Rapid Refresh Landscape data (2008) was altered with FARSITE Ver4.1.052 (Finney 1998) to reflect these changes. We modeled potential crown fire activity with FlamMap3 (Finney 2006). Total Composite Burn Indices (CBI), including substrate to upper canopy strata, were evaluated following CBI methods outlined in FIREMON at shared plot locations following broadcast burning.



Buffered and unbuffered burn severity values derived from the CBI scale (0.5 < x < 1.5 Low; 1.5 < x < 2.0 Moderate; 2.5 < x < 3.0 High)



A FlamMap3 image of potential crown fire pre- and post-treatment within the lower Star Gulch paired basins.

Acknowledgments - Many, many thanks to the Ashland Resource Area Fuels Specialists (Greg Chandler, Al Mason, Jerry Serabia and Mike Appling) for their tireless cooperation, "can-do" attitudes and lots of acres burned; to the support, assistance and patience graciously offered from BLM managers; to the numerous field technicians for braving poison oak and blackberries up to their eyeballs to gather piles of data; to all of those individuals who have offered their knowledge and expertise throughout the various stages of this project from inception to conclusion, including Dr. Paul Hosten, Bruce Barry, Dr. Charles Welden and Tim Moenfort; to the Joint Fire Science Program for funding this study, and to family, friends and everyone else who carried a drip torch and ate smoke along the way.