FINAL REPORT, JOINT FIRE SCIENCE PROGRAM PROJECT 03-3-3-36
December, 2007

Project Title: Fuels Reduction in Oak Woodlands, Shrublands, and Grasslands of SW Oregon: Consequences for native plants and invasion by non-native species

Principal Investigators: Patricia S. Muir (muirp@science.oregonstate.edu) and Paul Hosten (Paul_Hosten@or.blm.gov)

Project Location: Medford BLM district, southwest Oregon

This final report summarizes key findings from the project and lists completed deliverables. Key findings are also summarized on the web page created for this project http://oregonstate.edu/~muirp/FuelsReductionSWOregon/ which we consider to be part of this final report.

PROJECT OBJECTIVES

(*The following text is modified from the Abstract and Problem Statement of the funded proposal, and is provided here to set context and provide background*.)

Decades of fire suppression have led to an unnatural accumulation of fuels and changes in many ecosystems, including those of the oak woodlands, shrublands, and grasslands of Southwestern Oregon. Land managers on the Medford District of the Bureau of Land Management (BLM) in this region, much of which is in urban/wildland interface, are attempting to decrease fuel-loads and restore ecosystems that have been altered by fire suppression using several methods, including mechanized "slash busting," hand cutting of brush and small trees followed by piling and burning, and prescribed fire.

(See descriptions of treatments at: http://oregonstate.edu/~muirp/FuelsReductionSWOregon/ResearchReports/Research_WildfireEffects/Research_WildfireEffects.html and http://oregonstate.edu/~muirp/FuelsReductionSWOregon/Publications/lessons_learned10YrsFuelsRedux.pdf).

In addition, some treated areas are seeded with native grasses to minimize the threat of invasion by nonnative plants and stabilize soils. These treatments have been applied at great expense to over 5,000 acres since 1995 in the Ashland Resource Area (ARA) of the BLM alone. However, little is known about the consequences of these treatments for native plant communities, which are some of the least well understood plant communities in the Pacific Northwestern U.S. These communities also include several sensitive species and, in many cases, have been substantially altered from their natural condition by fire suppression-induced changes in vegetation. Further little is known about consequences of fuel reduction treatments for invasion by exotic plant species, or subsequent fire behavior and effects.

The project's central objectives were to:
(1) map current vegetation conditions in oak woodlands, shrub lands and grasslands, and

(2) assess impacts of fuel reduction treatments on plant communities in oak woodlands and shrub lands.

Two smaller scale projects focused on:

(1) assessing consequences for plant communities of seeding with native grasses after fuel reduction treatments, with and without follow-up prescribed burns, and
(2) comparing wildfire effects between sites treated for fuel reduction and untreated sites.

For the extensive, landscape-level mapping portion of the work, we collected data on plant species composition and environmental variables for the range of non-coniferous plant communities found across the ARA. The intensive stand-level impact assessment component took place within the Applegate Valley Adaptive Management Area within the ARA. We compared control (untreated) areas with areas treated with two fuels treatment methods (mechanical cutting and mulching of shrubs and small trees ["mechanical mastication"] and hand-cutting of this material followed by piling and burning ["manual treatment"] to assess consequences for: (1) native plant communities; (2) invasion by nonnative species; and (3) resultant fuel loads and implications for future fire behavior and effects.

The work was directed towards Tasks 2 and 3 from AFP 2003-3 (development and implementation of administrative studies that meet specific local land management needs, and local scientific knowledge gaps that are significant to fire management program implementation, respectively) and Task 4 from AFP 2003-1 (techniques for restoring ecosystems altered by changing fire regimes). Results were expected to lead to suggestions for stand-level treatments that reduce fire hazard while simultaneously fostering the restoration of native plant communities, minimizing invasion by exotic species, and allowing for safe reintroduction of fire to the landscape. We also anticipated that results would benefit land managers by providing basic information on the types and locations of plant communities that occur in the area, the factors responsible for their distribution, and their likely responses to fuel reduction treatments; this knowledge would facilitate their making informed decisions for future management. A related goal for this Joint Fire Science Program project was that the information it provided would enhance managers' ability to explain their approaches to the concerned public, and contribute to our understanding of processes that affect plant and animal communities in these and similar areas.

KEY FINDINGS

IMPACTS OF FUEL REDUCTION THINNING ON OAK WOODLAND AND CHAPARRAL COMMUNITIES OF SOUTHWESTERN OREGON

Central questions were: Do fuels reduction treatments cause changes in understory plant communities? Do treatments result in expansion of weedy plant species, either native or exotic? Alternatively, are native species, particularly perennial grasses and forbs, favored by treatment?

We compared vegetation and abiotic characteristics between thinned and unthinned chaparral and oak woodland communities of southwestern Oregon 4 to 7 years post-treatment, and contrasted impacts of mechanical mastication *versus* manual treatment (*N* = 30 pairs of transects in thinned and unthinned sites).

Herbaceous cover increased on thinned sites, but species richness did not change. Herbaceous communities at thinned sites had an early-post-disturbance type of composition dominated by native annual forbs and exotic annual grasses; cover by annuals was nearly twice as high on treated as on untreated sites. Absolute and proportional cover of native annual forbs increased more than any other trait group, while exotic annual forbs and native perennial forbs declined. Exotic annual grass cover (absolute and proportional) increased while cover by native perennial grasses did not. Shrub re-establishment was sparse after thinning, probably due to a lack of fire-stimulated germination.

Manual and mechanical mastication treatment impacts on abiotic site conditions differed; masticated sites had more ground cover by woody debris, which manually treated sites had more cover by burn pile scars. Differences in vegetation impacts between the two treatment types were not, however, statistically significant. Additional study with larger sample sizes is warranted.

Sites were assigned into one of three canopy vegetation community types: *Arctostaphylos viscida*-dominated chaparral, *Ceanothus cuneatus*-dominated chaparral, or mixed *Quercus garryana* and shrub. Impacts of fuel reduction on plant communities appeared to differ among these types, but inference is limited by (1) pre-existing differences among communities in untreated sites and (2) relatively small sample sizes within each type.

In summary, fuel-reduction thinning may have some unintended negative impacts, in these systems, including expansion of exotic grasses, reductions in native perennial species cover, persistent domination by annuals, and increased surface fuels. Coupled with sparse tree or shrub regeneration, these alterations suggest that ecological state changes may occur in treated communities. Such changes might be mitigated by retaining more woody cover than is currently retained, seeding with native perennials after treatment, or other practices; further research is needed to inform management in these ecosystems.

For More Information see:

Perchemlides, K.A. 2006 Impacts of fuel reduction thinning treatments on oak and chaparral communities of southwestern Oregon. MS Thesis, Oregon State University, Corvallis, OR. Available at:
http://oregonstate.edu/~muirp/FuelsReductionSWOregon/Publications/KeithFinalTHESISLIBRARYCOPY.pdf

And:

http://oregonstate.edu/~muirp/FuelsReductionSWOregon/ResearchReports/Research_FuelsReduxImpacts/Research_FuelReduxImpacts.html

And:

Perchemlides, K.A., P.S. Muir and P.E. Hosten. 2008. Responses of chaparral and oak woodland plant communities to fuel-reduction thinning in southwestern Oregon. *Journal of Range Ecology and Management* (In press – Jan. '08 issue)

LANDSCAPE SCALE PATTERNS OF GRASSLAND, SHRUBLAND, AND WOODLAND VEGETATION IN RELATION TO ENVIRONMENT AND DISTURBANCE: CURRENT CONDITIONS AND HISTORICAL PERSPECTIVES

Central questions were:

What are the current spatial patterns of non-conifer plant communities relative to environmental factors? How do stand structural variables correspond with environmental factors? What changes have occurred in the distribution of non-conifer plant communities since the time of European settlement?

Thirteen plant assemblages were delineated based on species composition from 425 stands representing grassland, shrubland and woodland vegetation types. Most of the assemblages were limited to exposed, southerly aspect sites with shallow, rocky, fast draining, loam soils. Some of the assemblages were fairly restricted by environmental conditions, while others were found in a number of ecological sites defined by topographic and edaphic conditions. The highest proportion of naturalized taxa is in the form of exotic annual grasses. This functional group is found in mostly low elevation, low canopy situations.

The assemblages with the highest average stand richness appear to be rare locally and perhaps regionally. The rarity, high species richness of native plants, and the potential for extirpation of the fescue grassland and black oak woodland plant assemblages warrant efforts to ensure their persistence on the landscape.

We also examined the distribution of components of stand-level non-conifer vegetation structure relative to plant community, soil, geology, topography, and past management across the Applegate landscape. The derivation of models (using Non-parametric Multiplicative Regression [NPMR]) including environmental factors and elapsed time since the last fire provided inference about the influence of fire on vegetation structure over time. Herbaceous dominated areas declined with time, but maintained themselves on excessively well-drained or clay-dominated soils. Modeling indicated that the shrub component increases for the first 40 years following fire. Immature shrubs were the only shrub maturity class to occur across the landscape independent of time since the last fire. Shrubs showed a predilection for low-clay combined with high silt or sand soils. Hardwood cover increased more slowly than shrubs, but over a longer time-period. The common inclusion of soil depth, precipitation, and evapo-transpiration in models emphasizes the role of water relations in governing the relative distribution of life-forms and branching pattern. Large single-stemmed trees were thus commonly found on deeper alluvial substrates with the ability to grow large fire-safe trees before the next fire event. The association of branched oaks with shallow soils indicates that water availability may govern the rate of tree growth and ability to attain fire-safe size. Higher percentages of branched hardwood stems at toe to mid-elevations reflect patterns of high fire-severity corresponding with historic chaparral, whereas high percentages of branched oaks at upper elevations reflect the presence of *Quercus garryana subsp breweri*, a variety prone to sprouting from epicormic buds without fire. High fire severity thus appears to be a natural event at specific topographic/edaphic locations.

Restoration practices should favor sites likely to see an increase in fire severity consequent to elongated fire-return interval and accumulation of fuels. The accumulation of shrubs/saplings in areas with large single-stemmed oaks on alluvial soils and within historic ridgetop meadows should be prioritized for restoration in the Applegate valley of southwest Oregon.

Little information exists about vegetation change over time in the grasslands, shrublands, and woodlands of southwest Oregon. Multi-aged oak stands, encroachment of shade-tolerant conifers into non-conifer vegetation, reduced reproduction by pine, and the loss of meadows support the generally accepted belief that fire suppression has negatively impacted historically open vegetation types. However, a collation of historic anecdotes, General Land Office (GLO) survey records, homestead patent applications, original and repeat photographs, and other historic information on the general dynamics among oak, chaparral, grassland, and conifer vegetation in this area indicate a more diverse pattern of vegetation change only partially explained by fire exclusion. The historic and continued persistence of some meadows and savanna without recent fire are counter to general assumptions about the loss of open (i.e. herbaceous dominated) plant community structures as a result of fire-suppression. Naturally open areas (shallow soils underlain by fractured bedrock, and vertisol clay dominated soils) and ecotones between edaphically mediated grasslands and woody dominated sites continue to support large oaks with an open herbaceous understory despite effective fire suppression since the 2nd World War. Coarse vegetation reconstructions derived from General Land Office Surveys indicate that oak woodlands were far more common than oak savanna at the time of Euro-American settlement. Early descriptions of chaparral and high-elevation oak thickets indicate the existence of stand structures facilitated by stand replacement fire at the time of European colonization. The range of historic data indicates that woody canopy cover dominated much of the southwest Oregon landscape. Where forest structure was open, the understory was often dominated by shrubs rather than herbaceous species. Structural/compositional changes within woody dominated communities include: shrub to conifer, conifer to shrub, hardwood to conifer, hardwood to mixed hardwood and shrub, and conifer to hardwood. A more comprehensive understanding of vegetation change in response to both ecological and anthropogenic factors (pre and post European colonization) is necessary to help land managers achieve the mutual attainment of fuel-reduction and the maintenance of ecological processes in the grasslands, shrublands, and woodlands of southwestern Oregon. This work is on-going in a related project, also funded by the Joint Fire Science Program (Hosten and Muir, PI's).

For more information see:

Pfaff, E. 2006. Landscape-scale patterns of grassland, shrubland, and woodland vegetation in relation to environment and disturbance. MS Thesis, Southern Oregon University, Ashland, OR. Available at: http://oregonstate.edu/~muirp/FuelsReductionSWOregon/Publications/PfaffMastersThesis.pdf

And:

Hosten, P.E. and E. Pfaff. In prep. Factors contributing to spatial and temporal patterns of stand structural variables in non-conifer vegetation of the Applegate Valley, southwest Oregon.

And:

Hosten, P.E., E.O. Hickman, and F. Lang. In prep. 150 years of vegetation change in the grasslands, shrublands, and woodlands of southwest Oregon.

And:

DiPaolo, D.A. and P. Hosten. In review. Vegetation Change Following the 2nd Forest Homestead Act of 1906 in the Applegate Valley, Oregon.

And:

Hosten, P.E., G. Hickman, F. Lake, F. Lang and D. Vesely. 2006. Oak woodland and savanna restoration. *In:* D. Apostol and M. Sinclair, eds. RESTORING THE PACIFIC NORTHWEST: The Art and Science of Ecological Restoration in Cascadia. Island Press. http://www.ser.org/content/Apostol.asp

And:

http://oregonstate.edu/~muirp/FuelsReductionSWOregon/ResearchReports/Research_PlantAssemblages/Research_PlantAssemblages.html

A COMPARISON OF WILDFIRE EFFECTS BETWEEN SITES TREATED FOR FUEL REDUCTION AND UNTREATED SITES

Central questions were:
Does fuel-reduction influence vegetation composition and dynamics the same way as wildfire? What are patterns of vegetation change following wildfire, and how are they influenced by fuel-reduction prior to the wildfire event?

We used historic reports and photos to characterize shrubland conditions and fire effects for the Applegate Valley in the early 20th century. We also established and sampled plots in recently disturbed areas to improve our understanding of vegetation dynamics following recent fire and fuel-reduction.

Vegetation dynamics following recent fire showed an initial positive response from the native perennial geophyte, *Dichelostemma congesta* and the annual *Lotus micranthus*. Annual grasses and forbs became numerically dominant by the third post-fire growing season. We compared post-fire vegetation dynamics among sites affected by wildfire, treated for fuel reduction with hand-cut-pile-and-burn, and treated with mechanical mastication. Plant communities following hand-cut-pile-and-burn emulated post-wildfire vegetation composition more closely than did those following mechanical mastication. However, the retention of the shrub seedbank under both fuel-reduction is likely to result in management dilemmas as the shrub seed bank germinates in the longer-term. Little difference in the survival of oak individuals was noticed between burned areas that had previously been treated for fuel reduction and those that had not been so treated. The above-ground survival of individual oaks will result in a mixed age class stand as top-killed oak individuals resprout.

Historic acts of “incendierism” in the late fall and the relatively small size of historic fires suggest a late season opportunity for prescribed fire. Such treatments may provide an alternative method of fuel-reduction that preserves the historic role of fire in non-conifer communities such as chaparral.

The literature and historic descriptions of extensive “brush types” indicate that shrublands predate Euro-American colonization. Photos of burned shrublands show little difference in fire-severity between the early 20th century and recent fires, indicating that shrublands experiencing high fire-severity historically may not be strongly influenced by elongated fire return interval.

We reexamine reports and vegetation data collected following the 1915 Matney Gulch fire to describe early twentieth century management issues, the results of a seeding trial, and post-fire vegetation dynamics in a whiteleaf manzanita plant community. Historic accounts describe widespread initiation of fires by stockmen to produce forage, and subsequent heavy spring livestock use resulting in severe soil erosion. The attempt to introduce non-native forage species was largely unsuccessful. However, observations of reduced soil erosion within a livestock exclosure led to the recommendation of keeping livestock off burned areas to allow the rapid recovery of native vegetation. The exclosure also provides several insights about historic shrubland dynamics. Results show a scarcity of long-lived perennial grasses and forbs, early domination by the geophyte *Dichelostemma congesta* (years 1 and 2), *Epilobium spp* (year 4), *Madia spp* (year 5), and annual grass *Vulpia microstachys* (year 5), a pattern of change characteristic of chaparral. The predominant grasses and forbs from the early 1900s remain present at the site today. Comparison of historic post-fire and adjacent recent post-fuel-reduction shrub seedling counts discounts the notion that *Arctostaphylos viscida* and *Ceanothus cuneatus* are entirely fire-obligate. Higher shrub seedling counts associated with modern fuel-reduction activities indicates that the lack of fire to reduce shrub seedbank density may alter vegetation dynamics relative to chaparral influenced by wildfire.

For more information see:

Hosten, P.E. in prep. A comparison of historic and recent fire to current fuel reduction activities in chaparral and woodlands of the Applegate Valley, southwest Oregon.

And:

Hosten, P.E, J. DeJulio, and D. DiPaolo. In Prep. The Matney Gulch Experimental Area, southwest Oregon**.**

And:

http://oregonstate.edu/~muirp/FuelsReductionSWOregon/ResearchReports/Research_WildfireEffects/Research_WildfireEffects.html

NATIVE GRASS SEED APPLICATION FOLLOWING FALL AND SPRING PRESCRIBED FIRE IN MECHANICALLY MASTICATED FUEL REDUCTION PROJECTS

Central question was:

What are the consequences of seeding native bunchgrasses on spring and fall prescribed burnt mechanically masticated sites? Can seeding with native grasses reduce invasion by annual grasses?

Preliminary analysis indicates that seeding following prescribed fire in oak-chaparral that has been mechanically treated is more effective than seeding mechanically masticated sites that were not subsequently burned. Germination was successful in 13/15 (China Gulch) and 11/15 (Hukill Hollow) plots burned and seeded in fall treatment blocks. In contrast, results show no germination taking place in spring burnt and seeded treatment blocks. Poor germination in spring treated plots is likely due to the (1) drying out of seedlings and (2) patchiness of burn due to moisture still present in the soil. The warm, dry weather that following the spring burn and the thatch left behind by the patchy spring burn resulted in no successful germination occurring in spring burn treatment blocks at both study sites.

The abundance of exotic plant species increased throughout all treatments at both study sites from summer 2005 to spring 2007. Current trends indicate that fall burn treatment blocks are, and will continue to be, dominated by non-native grasses. However, the effects of prescribed fire treatments followed by seeding may not noticeably impact the abundance of exotics until 2-3 years following application. With time, seeded native bunchgrass may begin to dominate by outcompeting exotics. Alternatively, the opportunity for seeded grasses to outcompete exotics may be possible only immediately following burning, when abundance of exotics is low. If native bunchgrass species do not dominate initially following treatment, exotics may quickly resume domination by out-competing native germinants.

Longer term study over a wider range of sites will be necessary to determine the effectiveness of post-treatment seeding with native perennial grasses.

For more information see:

Coulter, C. In prep. Vegetation response to seeding and prescribed fire following mechanical fuel reduction: preliminary results. (MS thesis, Southern Oregon University, Ashland, OR)

SUMMARY

Thirteen plant associations representing grasslands, shrublands, and woodlands were derived for low-elevation non-conifer communities of the Applegate Valley in southwestern Oregon. While it is commonly assumed that the landscape occupied by these associations was more open historically prior to the advent of effective fire suppression, historic anecdotes and photos indicate that chaparral and high canopy woodlands do predate Euro-American settlement. In some cases, however, fire suppression does appear to have had effects; many of the plant associations derived in the work reported here have increased in density or show a taller stature since effective fire-suppression began. Repeat photos show the loss of fire-mediated meadows, but edaphically-maintained meadows have remained open.

Current stand structural data reflect different patterns of vegetation change with topography, geology, soil, and climatological factors. Models describing temporal and spatial patterns of stand structure emphasize time since the last fire and water balance as primary factors explaining the present-day distribution of structural variables and patterns in fire severity. The ability of trees on relatively deep alluvial substrates to grow rapidly enough to attain a fire-safe size prior to the next fire illustrates this concept.

The above-described temporal and spatial patterns explain the difficulty in defining differential influences of hand-cut-and-pile-burn (HPB) *versus* mechanical mastication fuel reduction treatments on vegetation composition and dynamics in southwestern Oregon's chaparral and woodlands. Differences in vegetation responses between wildfire and fuel-reduction are more distinct. All disturbances result in an increase in annual grasses and forbs, though fire elicits a much stronger chaparral-like growth and flowering response from geophytes. A historic study, begun in 1915 at Matney Gulch in the Applegate Valley, indicates that native annuals may have played an important role in post-fire vegetation dynamics, which might explain why chaparral sites appear predisposed to domination by annuals (native and non-native) after recent fires and after fuel reduction treatments. The Matney Gulch study and associated historic anecdotes highlight the role of high fire severity in thinning the shrub seedbank. In contrast, those HPB sites that experienced high heat in interspaces between pile burns show a more chaparral-like vegetation response characterized by very dense germination of the shrub seedbank. The density of young seedlings in these situations probably represents the absence of the wildfire pruning influence on the seedbank. In contrast, relatively few shrub seedlings were found on sites treated with mechanical mastication or with HPB that lacked intense heating of the soil surface except under burn piles. It is quite likely that formerly open **woodland** areas that are currently dominated by shrubs in the understory previously supported more bunchgrass than they do at present. The loss of bunchgrasses and accumulation of a shrub seedbank under woody canopy may predispose a site to more chaparral-like dynamics following disturbance, whether by wildfire or by fuels treatments.

While studies have established a historic precedent for the occurrence of chaparral in southwestern Oregon, repeat photos also record losses of fire-mediated meadows from midslopes to ridgetops and of open woodlands with large single-stemmed trees on alluvial substrates at lower elevations. Since plant communities that developed under high fire-severity (e.g., chaparral) are unlikely to experience altered fire severity with fire suppression, former meadows and open woodlands should become the favored location to overlay fuel-reduction with restoration. Fall seeding of perennial native grasses and forbs in formerly open sites following wildfire or fuel-reduction combined with prescribed fire is recommended. Seeding rates should be high, to counteract the competitive influence from annual grasses and forbs. Sites of historic chaparral dominance, however, do not appear to be good candidates for restoration via either manual or mechanical fuel reduction treatments of the types employed in our study area. Rather, data suggest that chaparral stands thinned to very low residual shrub densities without follow-up prescribed burning may convert to annual-dominated systems with expanded cover of exotic annual grasses following fuel treatments. When chaparral occurs in close proximity to human habitations or other structure, fuel reduction goals are paramount, of course, but in more remote areas, drastic thinning of these systems may be associated with some undesirable consequences.

DELIVERABLES CROSSWALK

Crosswalk between proposed and delivered project products.

PRO-POSED	DELIVERABLE	STATUS
Annual reports	Submitted annually to Joint Fire Science Program	done
Papers, posters and presentations	Oral presentation: Perchemlides, K. and P.S. Muir. 2006. Impacts of fuel reduction thinning on oak and chaparral vegetation communities of southwestern Oregon. Paper presented at annual meeting of Northwest Scientific Association, Boise, ID March 6 – 8, 2006	done
	Oral presentation: Hosten, P., P.S. Muir, K. Perchemlides, E. Pfaff and K. Sikes. 2005. Fuels reduction in oak woodlands and shrub lands of SW Oregon: consequences for native plants and invasion by non-native species. Joint Fire Science Program Principal Investigators Workshop. San Diego, CA., Nov. 2005	done
	Oral presentation: Perchemlides, K. 2006. Impacts of fuel reduction thinning treatments on oak and chaparral communities of southwestern Oregon. Seminar presented to Department of Botany and Plant Pathology, Oregon State University. June 2, 2006.	done
	Oral presentation: Hosten, P. 2006. 150 years of vegetation change in the grasslands, shrublands, and woodlands of southwest Oregon. Oral presentation at The Third International Fire Ecology and Management Congress. Town and Country Resort, San Diego, California, November 13-17	done
	Oral presentation: Hosten, P. 2007. Considering spatial and temporal change in southwest Oregon Garry oak communities as a basis for restoration. Oral presentation at ESA/SER Joint meeting August 5-10, San Jose, CA.	done
	Poster presentation: Perchemlides, K. and P.S. Muir. 2006. Impacts of fuel reduction and restoration thinning on oak and chaparral communities of southwestern Oregon. Annual meeting of the Ecological Society of America, Memphis, TN, Aug. 6-11, 2006. Abstract in Proceedings at: http://abstracts.co.allenpress.com/pweb/esa2006/document/?ID=62554	done
	Poster presentation: Perchemlides, K. and P.S. Muir. 2006. Impacts of fuel reduction and restoration thinning on oak and chaparral communities of southwestern Oregon. 3rd International Fire Ecology & Management Congress in San Diego, CA Nov. 13 – 17, 2006.	done
	Poster presentation: Mason, A., P. Hosten, G. Chandler and J. Serabia. Fuel reduction treatments: treatment types and a landscape strategy to achieve restoration and a fire-safe landscape in the Applegate Valley of southwest Oregon. 3rd International Fire Ecology & Management Congress in San Diego, CA Nov. 13 – 17, 2006. **http://oregonstate.edu/~muirp/FuelsReductionSWOregon/Publications/**	done

	FuelsReduxTreatments.pdf	
	Poster presentation: Chandler, G., P. Hosten, and A. Mason. Lessons learned after 10 years of fuel-reduction and monitoring in woodlands/chaparral of the Lower Thompson Creek, Applegate Valley, Southwest Oregon. 3rd International Fire Ecology & Management Congress in San Diego, CA Nov. 13 – 17, 2006. **http://oregonstate.edu/~muirp/FuelsReductionSWOregon/Publications/lessons_learned10YrsFuelsRedux.pdf**	done
	Poster presentation: Mazzu, L. and P. Hosten. Vegetation response to wildfire across and elevation gradient in southwest Oregon. 3rd International Fire Ecology & Management Congress in San Diego, CA Nov. 13 – 17, 2006. **http://oregonstate.edu/~muirp/FuelsReductionSWOregon/Publications/PlantresponseSanD_ver10.pdf**	done
	Poster presentation: Coulter, C. and D. Southworth. Effect of grass seeding on native and exotic vegetation following fuel-reduction treatments by mastication and burning. 3rd International Fire Ecology & Management Congress in San Diego, CA Nov. 13 – 17, 2006.	done
	Poster presentation: Pfaff, E. and P. Hosten. Grassland, shrubland, and woodland plant assemblages in relation to landscape-scale environmental and disturbance variables, Applegate Watershed, Southern Oregon. 3rd International Fire Ecology & Management Congress in San Diego, CA Nov. 13 – 17, 2006. **http://oregonstate.edu/~muirp/FuelsReductionSWOregon/ResearchReports/Research_PlantAssemblages/Research_PlantAssemblages.html**	done
	Poster presentation: Hosten, P. Interaction of the Squires Fire with the Buncom Bowl fuel-reduction project of the Applegate Valley, Southwest Oregon. 3rd International Fire Ecology & Management Congress in San Diego, CA Nov. 13 – 17, 2006. **http://oregonstate.edu/~muirp/FuelsReductionSWOregon/ResearchReports/Research_WildfireEffects/Research_WildfireEffects.html**	done
	Poster presentation: Pfaff, E. and P.E. Hosten. 2007. Grassland, shrubland, and woodland plant assemblages of the Applegate Valley, southwest Oregon. Poster presented at ESA/SER Joint meeting August 5-10, San Jose, CA.	done
	Training session: 150 Years of Vegetation Change in Bear Creek Valley Bear Creek Watershed council. 2006.	done
	Training session: Historic vegetation change in non-conifer communities of southwest Oregon. BLM staff. 2006.	done done
	Outreach: Historic vegetation change in non-conifer communities of southwest Oregon. Ashland High School. 2007	done
	Newspaper article: Description of study. Mail Tribune. 2006	done
	Newspaper article: Description of study. Capitol Press. 2006	done
	DiPaolo, D.A. and P. Hosten. submitted. Vegetation Change Following the 2nd Forest Homestead Act of 1906 in the Applegate Valley, Oregon.	In review
	Hosten, P.E. in prep. A comparison of historic and recent fire to current fuel	In prep.

	reduction activities in chaparral and woodlands of the Applegate Valley, southwest Oregon.	
	Hosten, P.E, J. DeJulio, and D. DiPaolo. In prep. a. The Matney Gulch Experimental Area, southwest Oregon**.**	In prep.
	Hosten, P.E., E.O. Hickman, and F. Lang. In prep. b. 150 years of vegetation change in the grasslands, shrublands, and woodlands of southwest Oregon.	In prep.
	Hosten, P.E. and E. Pfaff. In prep. Factors contributing to spatial and temporal patterns of stand structural variables in non-conifer vegetation of the Applegate Valley, southwest Oregon.	In prep.
	Peer-reviewed paper: Perchemlides, K.A., P.S. Muir, and P.E. Hosten. 2007. Responses of Chaparral and Oak Woodland Plant Communities to Fuel Reduction Thinning in Southwestern Oregon. *Journal of Range Ecology and Management* (in press).	In press
	Book Chapter: Hosten, P.E., G. Hickman, F. Lake, F. Lang, and D. Vesely. 2006. Oak Woodland and Savanna Restoration. In: Apostol, Dean and Marcia Sinclair (eds). Restoring the Pacific Northwest: the Art and Science of Ecological Restoration in Cascadia. Island Press, Washington DC.	done
Data, information on plot locations, and GIS maps	**For the study of impacts of fuel reduction thinning on plant communities, see the following appendixes in Perchemlides MS thesis (see below) at: http://oregonstate.edu/~muirp/FuelsReductionSWOregon/Publications/KeithFinalTHESISLIBRARYCOPY.pdf** **Appendix 2.** Map of study area showing locations of the 30 transect pairs used in analyses. **Appendix 3.** Paired transect names, location coordinates, bearings, treatment type and dates, and related information. **Appendix 5.** CD containing Excel spreadsheets of study data (available at Valley Library, Oregon State University, Corvallis, OR, and from P. Muir; one of the Co-PI's on this JFSP project.	done
	For the studies defining plant community associations (Pfaff 2006) CD containing Excel spreadsheets of study data are available at Southern Oregon University (available at the Hannon Library) and from Paul Hosten, one of the PI's.	done
MS theses	Perchemlides, K. 2006. Impacts of fuel reduction thinning treatments on oak and chaparral communities of southwestern Oregon. MS Thesis. Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR. **http://oregonstate.edu/~muirp/FuelsReductionSWOregon/Publications/KeithFinalTHESISLIBRARYCOPY.pdf**	done
	Pfaff, E. 2006. Landscape-scale patterns of grassland, shrubland, and woodland vegetation in relation to environment and disturbance. MS Thesis, Southern Oregon University, Ashland, OR. **http://oregonstate.edu/~muirp/FuelsReductionSWOregon/Publications/**	done

	PfaffMastersThesis.pdf	
	Coulter, C. in prep. Vegetation response to seeding and prescribed fire following mechanical fuel reduction. MS Thesis, Southern Oregon University, Ashland, OR	In prep.
Permanent monitoring plots	See Appendixes 2 & 3 in Perchemlides thesis **http://oregonstate.edu/~muirp/FuelsReductionSWOregon/Publications/KeithFinalTHESISLIBRARYCOPY.pdf**	done
Field-trips	Fieldtrip to the Applegate Valley to discuss local models of vegetation dynamics associated with Fire Regime Condition Class (FRCC, participants included Forest service, Bureau of Land Management, and The Nature Conservancy)	done
Out-reach	Website summarizing findings, intended for public and land manager audiences: Responses of chaparral and oak woodland communities to fuel reduction thinning treatments in southwestern Oregon. http://oregonstate.edu/~muirp/FuelsReductionSWOregon/index.html	done
	FIREHouse fact sheet. Fuels reduction in oak woodlands and shrub lands of southwest Oregon: consequences for native plants and invasion by non-native species. http://depts/washington.edu/nwfire/project.php?projectID=218&microweb=0	done
	Perchemlides' and Muir's work on consequences of fuel reduction treatments for plant communities is included in: H.E. Erickson and R. White. 2007. Invasive Plant Species and the Joint Fire Sciences Program. USDA Forest Service Pacific Northwest Research Station General Technical Report. USDA-GTR-707. November 2007. (see pg 8)	

DEVIATIONS FROM WORK AS ORIGINALLY PROPOSED

Most work was carried out as proposed. There were, however, a few exceptions, which generally resulted from operational constraints.

- Post-treatment seeding with native plants is not being carried out on an operational scale, hence less research than planned focused on this. The research that was done (see Coulter and Southworth poster, listed above) was implemented specifically as an experiment under this JFSP project.
- Post-treatment prescribed fire is rarely used on an operational scale in the non-coniferous plant communities in which we worked, hence prescribed fire was not studied as a third treatment type as originally proposed. In one portion of the study area (Lower Thompson Creek), however, the pile burning phase of a manual treatment resembled a broadcast burn and, later, prescribed fire was applied. Vegetation data were gathered at that site after the pile burning phase and before the prescribed fire, but not after the prescribed fire, owing to time constraints. These data are not reported in thesis or manuscript form, given that they concerned one case study and that post-prescribed fire data were not collected. Qualitative information on that case was reported in a poster (see Chandler et al. poster, listed above). presented at the 3rd International Fire Ecology & Management Congress in San Diego, CA Nov. 13 – 17, 2006.
- Grasslands were studied as part of the extensive, landscape-scale vegetation survey, but were not included in assessments of fuel reduction consequences; such treatments are not applied in grasslands.
- Neither of the threatened epiphytic lichen species that occur in the general region (*Sulcaria badia* and *Bryoria tortuosa*) were encountered in study plots.
- We quantified the abundance of woody debris on the ground in fuel-hour based diameter categories, and quantified cover by woody debris and fine litter. Data were reported in Appendix 5 of Perchemlides thesis, however we did not develop formal fuel models.