Effect of brush mastication on mycorrhizas in a mixed hardwood chaparral

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Much of the vegetation at Whiskeytown National Recreation Area is a dense, fire-prone chaparral.

Brush mastication reduces ladder fuels, but leaves a dense layer of chipped debris. Burning debris heats the soil hotter than with ladder fuels (Busse et al. 2005).

Upper layers of soil contain roots of woody plants that form mycorrhizas, symbiotic associations of fungi and roots. Many mycorrhizal fungi are hypogeous, producing fruiting bodies below ground (Valentine et al. 2004, Frank et al. 2006).

Objective: Examine effects of brush mastication and burning of masticated debris on mycorrhizal fungi belowground.

Hypotheses

H1: Species richness and abundance of mycorrhizas will increase following mastication, but decrease after burning of masticated debris.

H2: Richness of hypogeous fungal fruiting bodies will increase following mastication, but decrease after burning of masticated debris.

H3: Mastication and burning will select for distinct communities of mycorrhizal fungi.

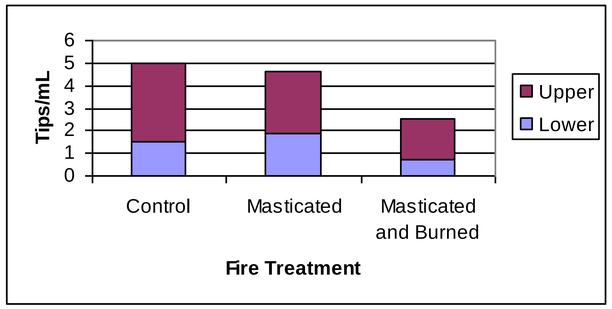
Methods

Site: Whiskeytown National Recreation Area, CA, in Klamath-Siskiyou bioregion, elevation 500 m. Summers hot and dry, annual rainfall 1.5 m.
Overstory: mixed conifers and hardwoods—knobcone pine, ponderosa pine, black oak and canyon live oak.
Shrub cover white-leaf manzanita intermixed with toyon, poison oak, buckbrush and chamise.

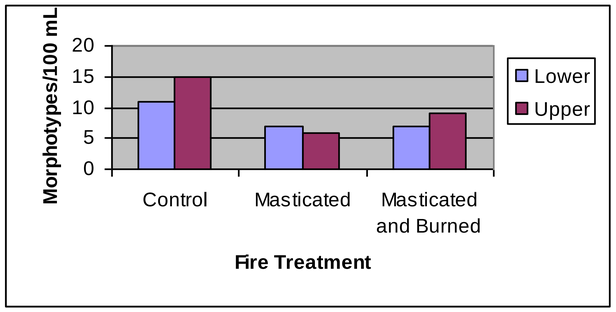
Treatments: 2-acre macroplot divided into blocks, two replicates each, with treatments applied randomly among blocks.
Brush masticated 2003 (low-ground pressure, rubber-track brush masticator).
Burned 5 months later in spring 2004.

Sampling of roots and mycorrhizas: 2006 and 2007. Soil corer (2-cm diam x 30-cm deep). Soil cores divided into upper (0-10 cm) and lower (10-20 cm) samples.
Mycorrhizas sorted, described microscopically as morphotypes; DNA sequences on some morphotypes.

Sampling of hypogeous fungi: 8 plots of 0.25 m^2 in each treatment block. Litter raked away; soil loosened to expose fungal fruiting bodies.



•Mycorrhizas were more abundant in control plots but differences in counts were variable and not significant.
•Ratio of tips (upper to lower layers) in masticated plots differed significantly from control and burned plots.



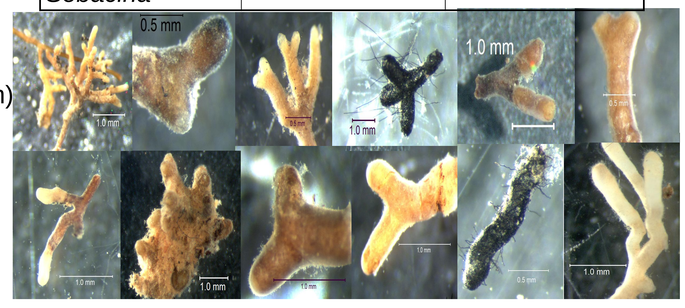
•Mycorrhizal diversity was greatest in control plots, followed by masticated-burned plots. The least diversity was found in masticated plots.
•Upper and lower soil layers did not differ significantly in mycorrhizal diversity.
•Controls differed significantly from treated plots.
• Masticated plots, either unburned or burned, did not differ significantly from one another.

Mycorrhizal fungi associated with fuel reduction treatments

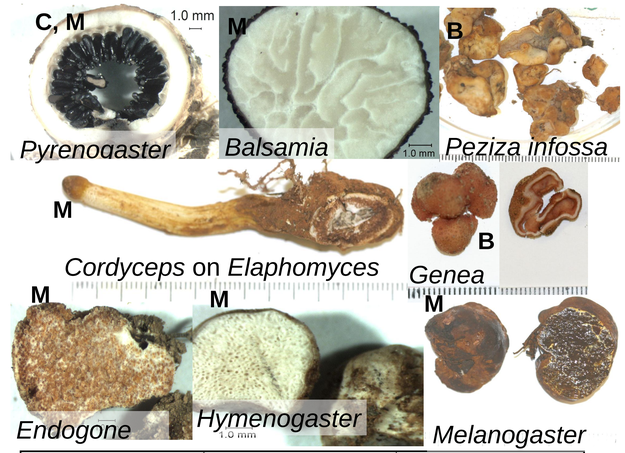
Control	Masticated	Masticated and burned
Atheliaceae	Atheliaceae	
Cenococcum	*Cenococcum*	*Cenococcum*
Thelephoraceae	Thelephoraceae	Thelephoraceae
Tomentella		*Tomentella*
Geopora	*Hydnoplicata*	*Laccaria*
Inocybe		*Russula*
Scutellinia		
Sebacina		

Upper (0-10cm)

Lower (10-20cm)



Hypogeous fungi associated with fuel reduction treatments



Control	Mastocated	Masticated and burned
Pyrenogaster	*Pyrenogaster*	*Peziza infossa*
Gymnomyces	*Balsamia*	*Genea*
	Elaphomyces	
	Melanogaster	
	Endogone	
	Hymenogaster	

Preliminary conclusions

H1: **Species richness of mycorrhizas**, as determined by morphotypes, decreased following mastication, and remained low following burning.

Abundance of mycorrhizal tips did not vary among treatments.

H2: **Species richness of hypogeous fungi** increased following mastication, but decreased with burning of masticated debris.

H3: **Hypogeous fungal fruiting bodies** differed on masticated, and masticated-burned, and untreated plots, with the greatest species richness on masticated plots.

Mycorrhizal species occurred in overlapping sets on untreated, masticated, and masticated-burned plots, with the greatest species richness on untreated plots.

References

Busse et al. 2005 Lethal soil temperatures during burning of masticated forest residues.*Int J Wildland Fire* 14:267-276

Valentine et al. 2004 Diversity of ectomycorrhizas associated with *Quercus garryana* in southern Oregon. *Can J Bot* 82:123-135

Frank et al. 2006 Mammal mycophagy and dispersal of mycorrhizal inoculum in Oregon white oak woodlands. *Northwest Sci* 80:64-273

Acknowledgements

Research funded by Joint Fire Science Program 05-2-1-87 and National Science Foundation grant DEB-0516229 and DBI-0115892.