EFFECT OF BRUSH MASTICATION AND PRESCRIBED FIRE ON MYCORRHIZAS AND HYPOGEOUS FUNGI

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At Whiskeytown National Recreation Area near Redding, CA, the vegetation is a dense conifer-hardwood chaparral with black oak and knobcone pine, at the edge of a wildland-urban interface. Shrubs include white-leaf manzanita, toyon, poison oak, buckbrush, and chamise.

Treatments: Control, Burned, Masticated, Masticated + Burned
Blocks were masticated in 2003 (low-ground pressure, rubber-tracked brush masticator) with prescribed burns 5 months later (spring 2004). Mastication rearranged the ladder fuels, leaving a dense layer of woody debris on the soil surface.

Why are soil fungi important?
Mycorrhizas are symbiotic associations of roots with fungi. Truffles are hypogeous fungi which grow underground. Together, these fungi are important components of soil life and chemistry. Mycorrhizas play a critical role in the uptake and transfer of soil nutrients to plants. Truffles provide food for small mammals, which in turn can produce spores to inoculate new plant roots with fungi.

Objective: Examine effects of mastication and the burning of masticated debris on fungi belowground: mycorrhizas and truffles.

Hypotheses

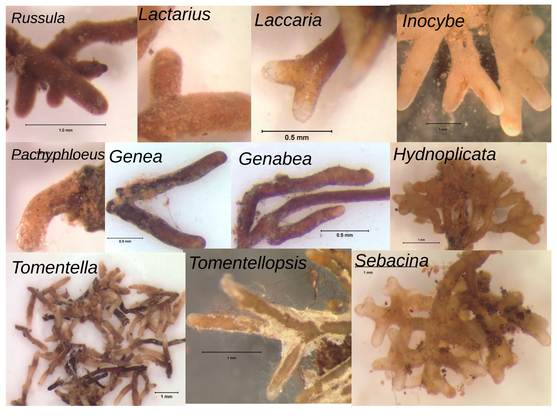
1. Mastication will increase abundance and species richness of mycorrhizal fungi and truffles due to chipped debris.
2. Burning without mastication will decrease truffles, but not mycorrhizas.
3. Mastication + burning will decrease abundance and species richness of mycorrhizas and truffles due to soil heating.

Treatment	Sensor Location	Highest temp (ºC)	Most frequent temperature
Masticated	Aerial (0.5 m)	750	<175
	Litter surface	1000	1000
	Soil surface	175	<175
Nonmasticated	Aerial (0.5 m)	1000	<175
	Litter surface	1000	<175
	Soil surface	225	<175

Mastication reduced ladder fuels and increased fire temperatures at the litter surface, but did not increase temperatures at the soil surface.

For mycorrhizas, soils were cored in 2006, 2007 at the canopy edge of oaks and pines. Mycorrhizas were described microscopically, and the DNA (ITS region) sequenced for identification.

Ectomycorrhizas at Whiskeytown National Recreation Area

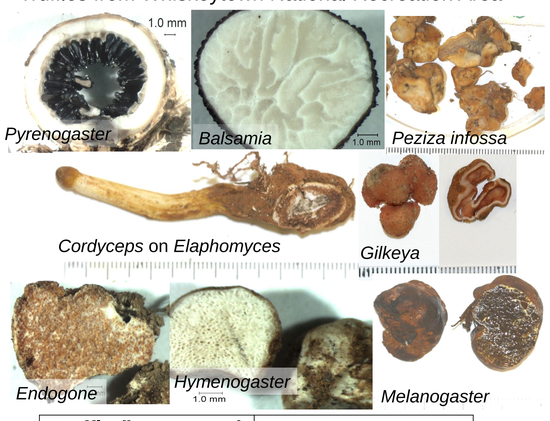


Ectomycorrhizal fungus	Treatment C	B	M	MB
Cenococcum	5	5	4	5
Thelephoraceae	4	4	2	3
Inocybe	3	3	3	3
Sebacinaceae	4	4	1	3
Lactarius	3	2	2	4
Russula	3	3	2	1
Laccaria	1	1	2	2
Cortinarius	1	2	1	1
*Hydnoplicata**	2	0	2	0
*Rhizopogon**	1	0	0	3
Total fungal species	32	28	17	19

Frequency of most common ectomycorrhizal fungi by genus or family on 5 replicated blocks. **Rhizopogon* and *Hydnoplicata* are truffles.

For truffles, litter was raked away and the soil loosened to expose sporocarps (8 plots of 0.25 m^2 per treatment block). Truffles were identified by morphology and DNA.

Truffles from Whiskeytown National Recreation Area



Truffle (hypogeous) fungus	Treatment C	B	M	MB
Balsamia	3	2	1	
Elaphomyces			2	
Endogone			1	
Geopora			1	
Gilkeya compacta		1		1
Gymnomyces	1		1	
Hymenogaster			1	
Hysterangium	1			
Melanogaster			1	
Peziza infossa				1
Schenella pityophilus	2		2	
Rhizopogon	1		3	
Total collections	**8**	**3**	**13**	**2**
Total truffle species	**5**	**2**	**9**	**2**

Number of specimens collected on 5 replicated blocks of each treatment.

Conclusions

1. **Species richness and community composition of ectomycorrhizal fungi were not altered significantly by any of the treatments.**
   Neither mastication alone nor followed by prescribed fire damaged ectomycorrhizal fungal communities.
   What matters to mycorrhizal fungi is the survival of host trees, e.g., oaks and pines.

2. **Mechanical mastication without burning maintained a suitable habitat for truffles.**
   More truffle fruiting bodies and more species were found on masticated blocks.

3. **Prescribed fire, whether in standing chaparral or in masticated chaparral, greatly reduced truffle production.**
   Direct effects of fire (e.g. charred ground surface and loss of organic matter) may have created conditions not conducive to fruiting.
   Indirect effects of vegetation removal may have rendered soils hotter and drier over several years.

Management Recommendations

1. **In mechanical mastication treatments, retain trees greater than 12 ft in height.**
   This preserves the ectomycorrhizal community on tree roots out past the canopy edge.

2. **In prescribed burns on both masticated and unmasticated sites, burn less intensely and leave unburned islands.**
   This would improve truffle production which supports rodent populations and provides spores for mycorrhizal inoculation of seedlings.

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