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Factors that Control Non-native Plant Species within Shaded Fuelbreaks at Whiskeytown National Recreation Area

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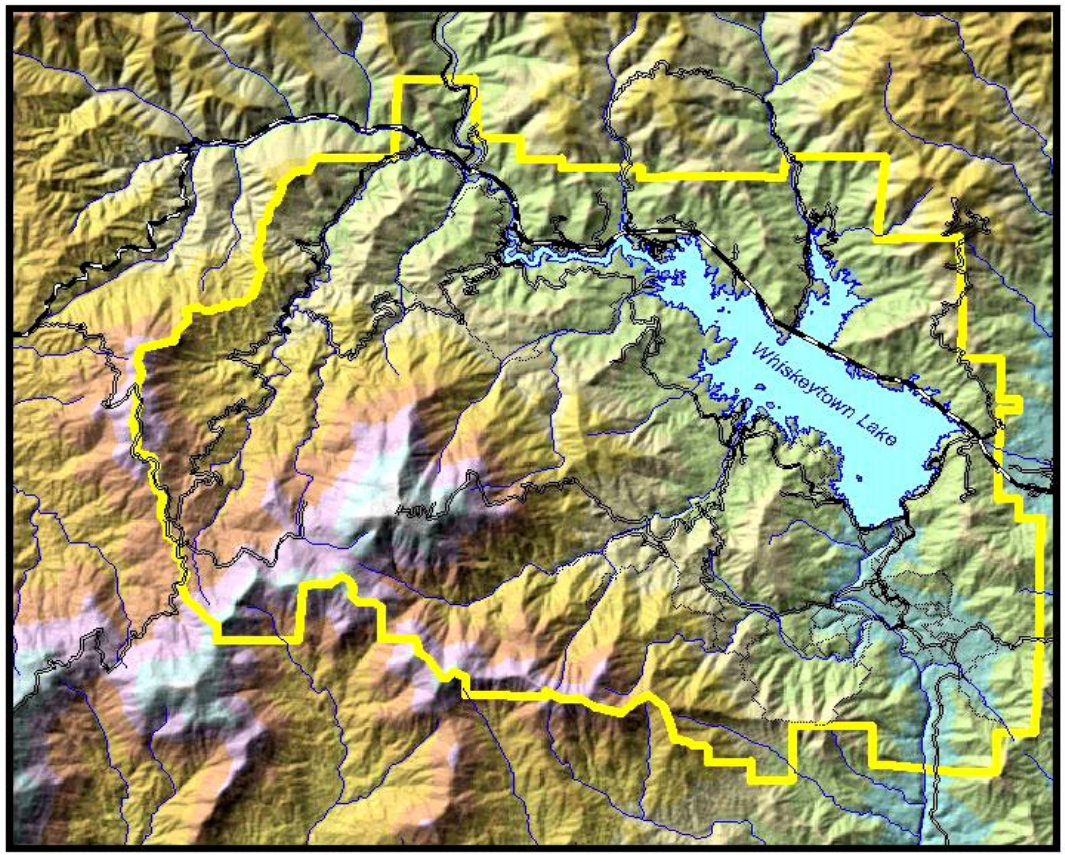
Whiskeytown NRA



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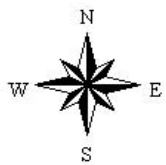

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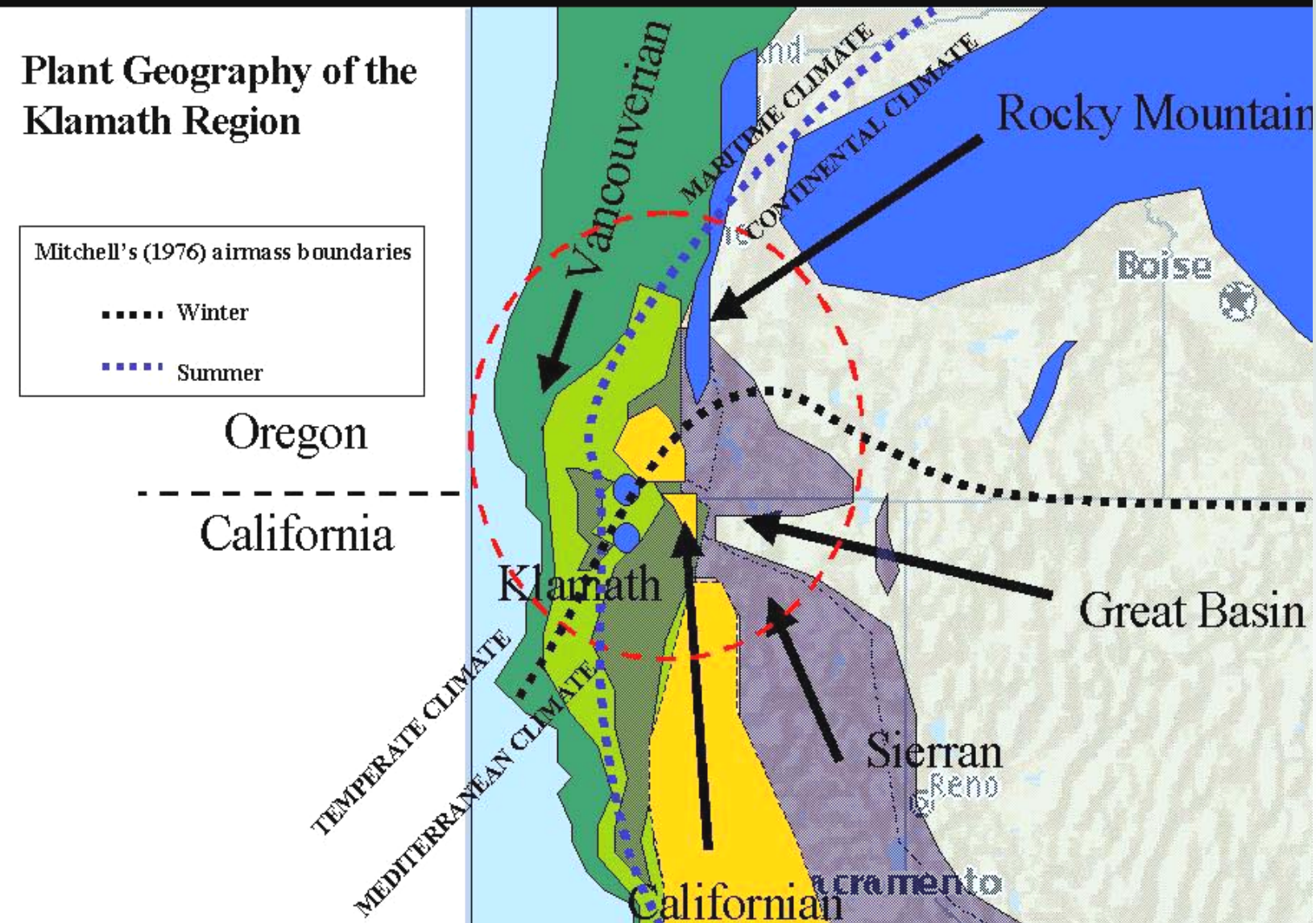

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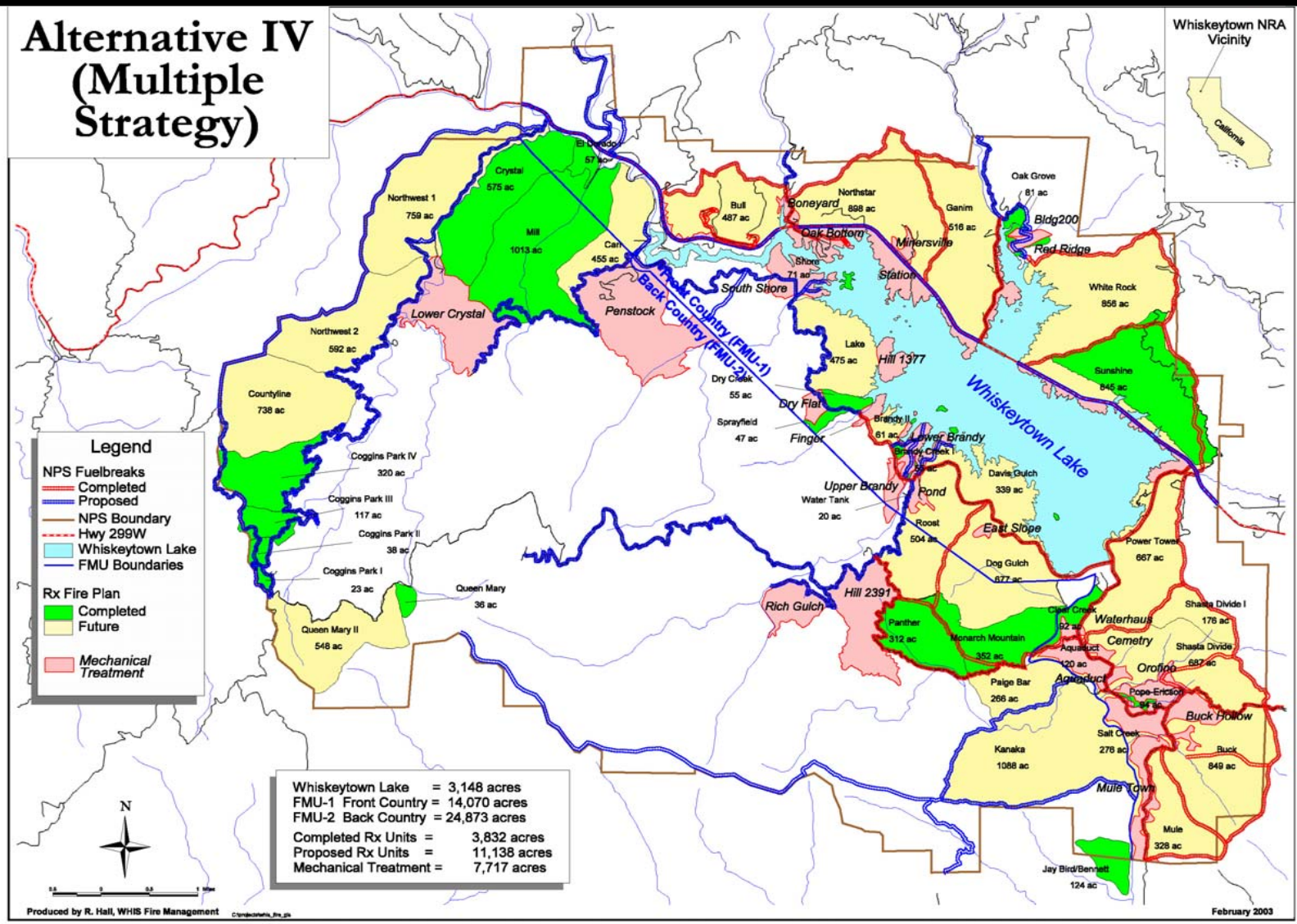

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- Provide areas where containment of wildfires is more feasible (e.g., firing operations).
- Slow the rate of spread of fires.
- Provide safe egress and access for firefighters and public by reducing fire intensity.
- Provide for prescribed burn unit boundaries.

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Introduction and spread of non-native mountain bikers?

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Conduit for invasion of high priority non-native and invasive plants?

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Non-native annual grasses…

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Greater than 25% of Whiskeytown's flora is composed of non-native plant species.

- Scotch Broom
- French Broom
- Tree of Heaven
- Himalayan Blackberry
- Yellow Star Thistle
- Bull Thistle
- Mullein

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Research Questions:

1. Do shaded fuelbreaks play a role in the introduction and spread of non-native plant species?

2. What thinning practices and structural characteristics minimize this spread into low-elevation plant communities?

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Educate and inform resource and fire managers as to what thinning practices and prescriptions minimize the introduction and spread of non-native plant species.

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1. **Desirable (“The Good”)** - representing ideal ecological conditions.
   - few invasive plants.

2. **Marginal (“The Bad”)** - representing intermediate conditions.

3. **Undesirable (“The Ugly”)** - representing the least desirable conditions.
   - established non-native plants.

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Fuelbreaks Sampled in 2001:

- Buck (new - cut & burned)
- Kennedy (new - cut & chipped)
- Lower Mule (old - cut & burned)
- Lower Mule Control
- Orofino (old - cut & burned)
- Orofino Control
- PG&E (old - cut & burned, bull dozed)

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Fuelbreaks Sampled in 2002:

- Buck (collected in 2001)
- Orofino (collected in 2001)
- PGE (collected in 2001)
- Shasta Divide (very old - cut & burned)
- Sunshine - (old - cut & burned)
- Whiskey - (new - cut and chipped)

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Methods

- 5 transects, randomly located along a 1-1.5 miles section
- Each transect was 30 meters long.
- Drawn out in a random degree bearing - within the fuelbreak.
- 5 one-square meter plots were randomly located along the transect.

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- Slope and aspect
- Percent cover of substrate
- Percent cover of species (Daubenmire Values)
- Depth of substrate
- Height of the tallest Grass, Herb, Shrub, and Tree
- Canopy Cover at 5 feet (spherical densiometer)

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A Canonical Correlation was used to determine which microhabitat characteristics of these fuelbreaks were related to the percent cover of non-native plant species.

Canonical Root 1	**R(exotic*environmental) = 0.477**		**P<0.001**
Exotic Plant Variables	**Loadings**	**Microhabitat Variables**	**Loadings**
Percent Cover of Exotic Grass species	0.885	Canopy Cover	-0.969
Percent Cover of Exotic Herbaceous species	0.943	Bare Ground	0.288
		Litter Depth	-0.246
		Percent Cover of Litter	-0.546

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Take home message:

Canopy Cover, Litter Cover and Litter Depth are important factors that control non-native grasses and herbaceous species within the fuelbreaks.

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But, how do we translate this information into specific prescription targets for management?

- Condition Rating
- Principal Components Analysis

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$$\text{Condition Rating} = \frac{\text{\% cover of non-native species}}{\text{(\% cover of native + \% cover of non-native species)}} * 100$$

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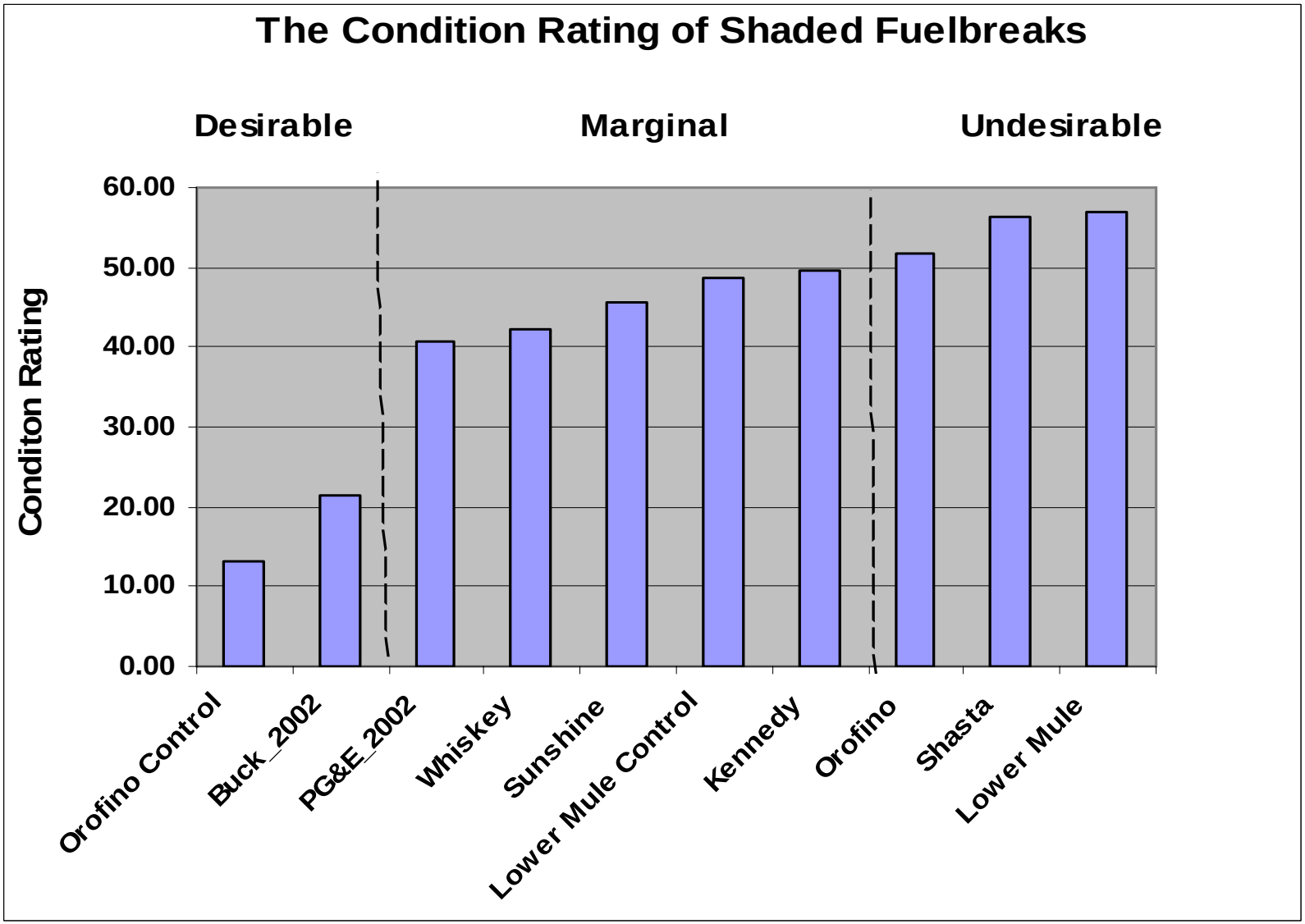

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Used a Principal Components Analysis (PCA) to characterize the fuelbreaks in terms of the percent cover of native and non-native plant species and such microhabitat characteristics as **canopy cover, slope, aspect and substrate.**

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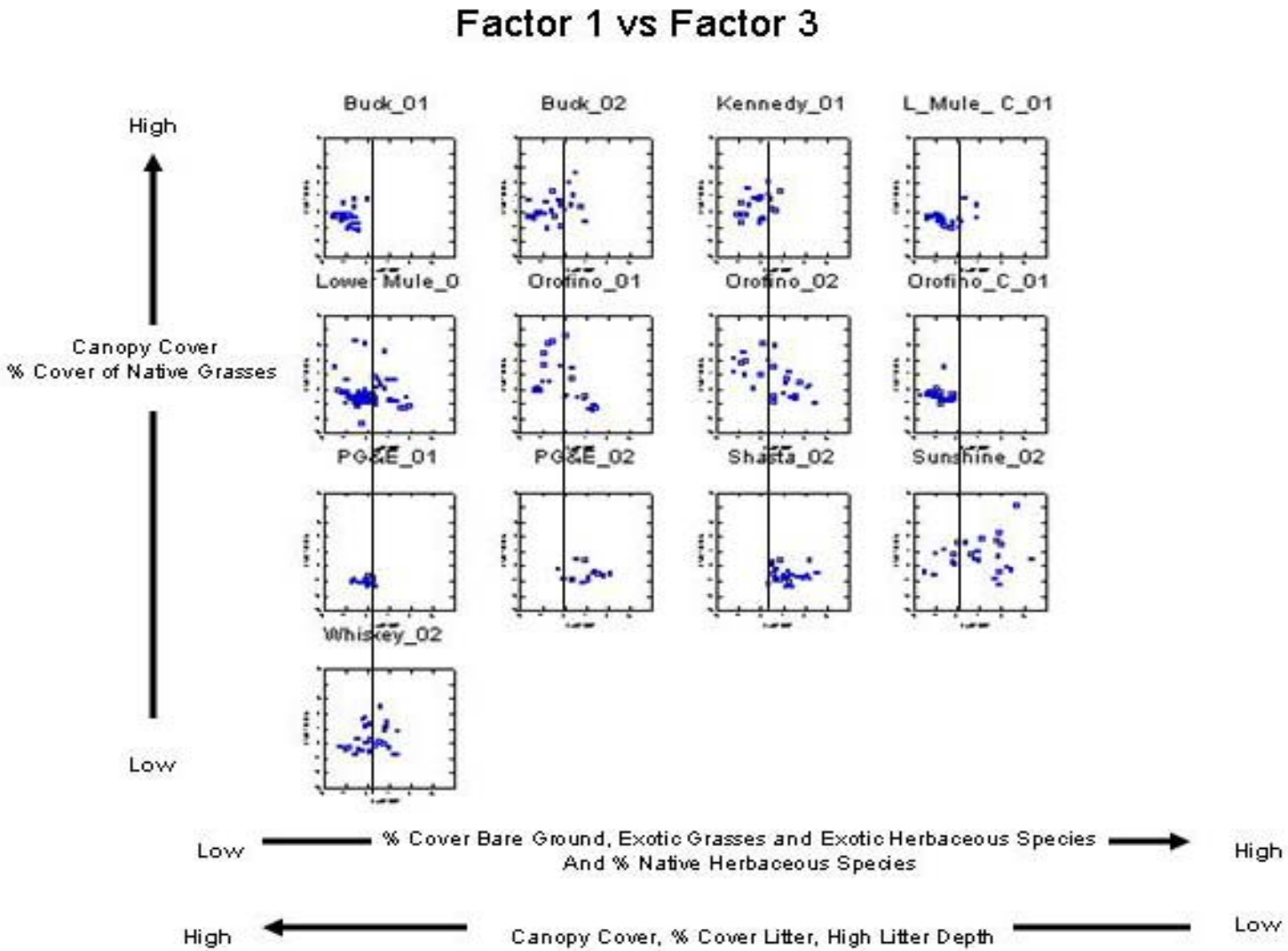

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PCA Factor Scores

Variable	Factor 1	Factor 3
Canopy Cover	-0.689	0.382
Bare Ground	0.597	0.131
Percent Cover of Litter	-0.644	0.111
Litter Depth	-0.577	-0.129
Percent Cover of Exotic Grasses	0.719	0.109
Percent Cover of Exotic Herbaceous species	0.635	0.187
Percent Cover of Native Grasses	0.081	0.899
Percent Cover of Native Herbaceous species	0.609	0.255
Percent Variance Explained by Factor	**35.67**	**13.87**

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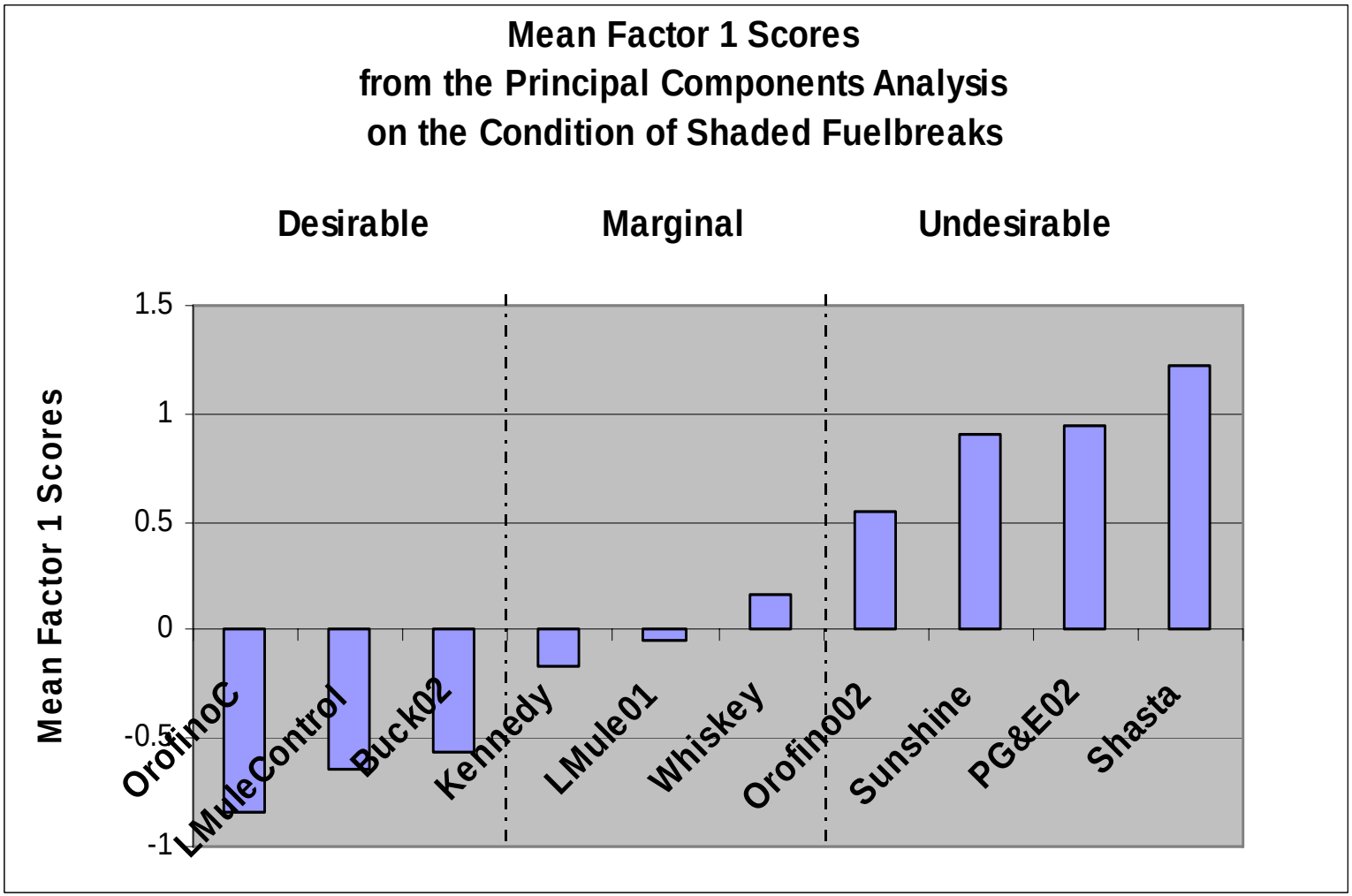

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A One-Way Analysis of Variance on the PCA Factor 1 scores characterizing non-native plants on the fuelbreaks determined that there was a significant difference ($P<0.001$) between fuelbreaks.

Contrasts:

- Roadside fuelbreaks vs. ridgeline fuelbreaks
- Old fuelbreaks vs. new fuelbreaks
- Control plots vs. plots within the fuelbreak

Source	Sum-of-Squares	df	Mean-Square	F-Ratio	P
Fuelbreak	113	9	12.638	17.575	<0.001
Roadsides vs. Ridgelines	4	1	4.237	5.892	0.016
Old vs. New	20	1	20.331	28.276	<0.001
Control vs. Treatment	4	1	4.857	6.755	0.010
Error	165	230	0.719		

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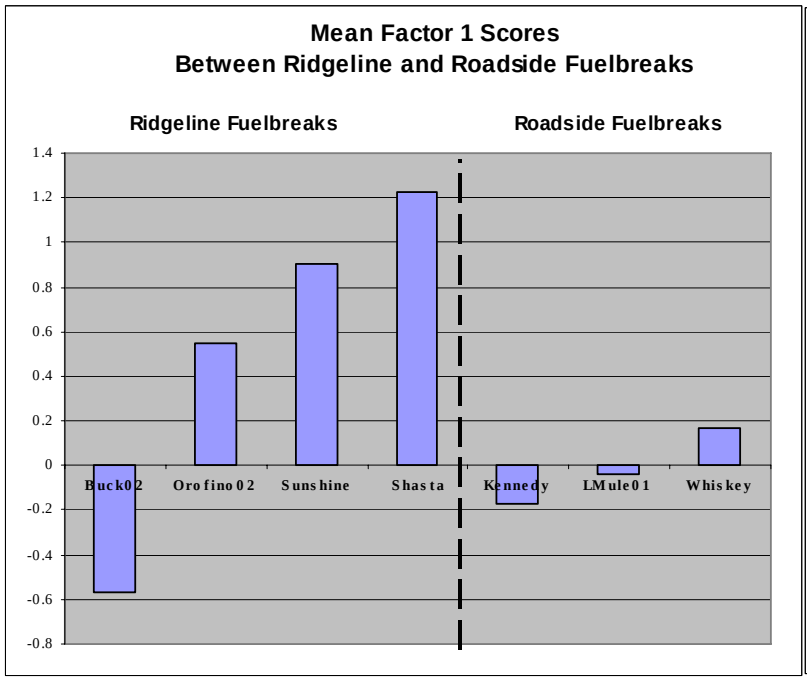
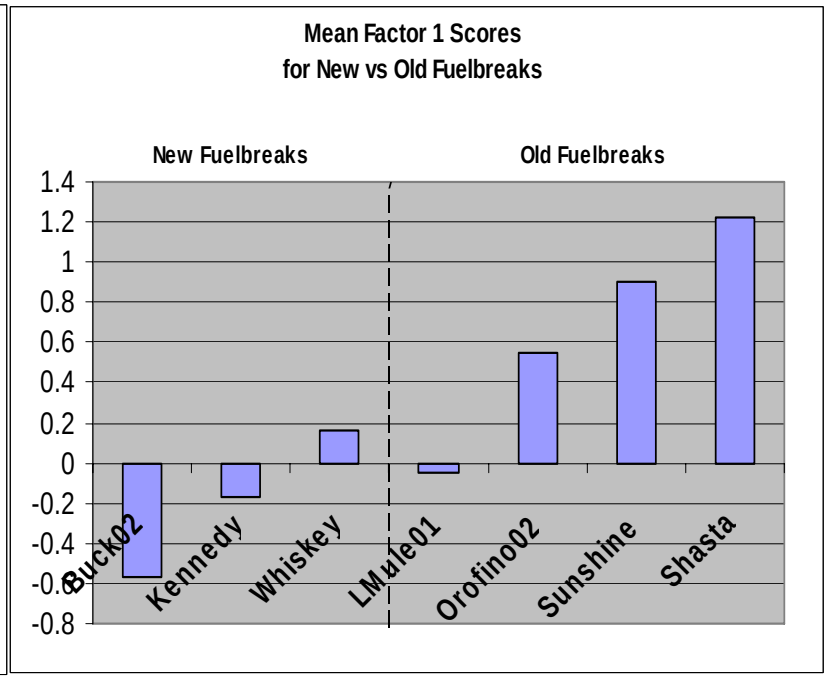
Contrasts:

- **Ridgeline fuelbreaks are less desirable** than roadside fuelbreaks.
- **Old fuelbreaks are less desirable** than new fuelbreaks.
- **Control plots are much more desirable** than plots in the fuelbreak.





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Desirable		Marginal		Undesirable	
PCA	**Condition Rating**	**PCA**	**Condition Rating**	**PCA**	**Condition Rating**
Orofino Control	Orofino Control	Kennedy	PG&E_02	**Orofino_02**	**Orofino_02**
Lower Mule Control	**Buck_02**	Lower Mule	Whiskey	Sunshine	**Shasta**
Buck_02		Whiskey	Sunshine	PG&E_02	Lower Mule
			Lower Mule Control	**Shasta**	
			Kennedy		

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Fuelbreak	Highest Cover (Native)	Highest Cover (Non-native)
Buck_2001	*Toxicodendron diversilobum*	*Vulpia bromoides*
Buck_2002	*Heteromeles arbutifolia*	*Gnaphalium luteo-album*
Kennedy_2001	*Ceanothus lemmonii*	*Aira caryophyllea*
Lower Mule Control_2001	*Heteromeles arbutifolia*	*Hypochaeris radicata*
Lower Mule_2001	*Heteromeles arbutifolia*	*Aira caryophyllea*
Orofino Control_2001	*Styrax officinalis*	*Aira caryophyllea*
Orofino_2001	*Styrax officinalis*	*Aira caryophyllea*
Orofino_2002	*Lotus micranthus*	*Aira caryophyllea*
PG&E_2001	*Aristolochia californa*	*Bromus madritensis*
PG&E_2002	*Heteromeles arbutifolia*	*Gastridium ventricosum*
Shasta_2002	*Ceanothus lemmonii*	*Aira caryophyllea*
Sunshine_2002	*Toxicodendron diversilobum*	*Aira caryophyllea*
Whiskey_2002	*Heteromeles arbutifolia*	*Vulpia bromoides*

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•Of the shaded fuelbreaks sampled, **approximately 23% of the grass and herbaceous species were non-native**.

•**No infestations** of the park's most invasive exotics were found.

•However, surveys have found star thistle, Tree of Heaven, Scotch Broom, and etc. on isolated fuelbreaks.

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The Canonical Correlation demonstrated that **non-native plants were inversely related to canopy cover, the percent cover of litter and litter depth.**

The Principal Components Analysis and Condition Class Rating **identified desirable, marginal, and undesirable fuelbreaks**.

So, data collected from the **desirable fuelbreaks became the guidelines for construction**.

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Desirable

Buck Fuelbreak

Average Canopy Cover =70%

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Marginal
Lower Mule Fuelbreak
Average Canopy Cover = 55%

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Undesirable

Shasta Fuelbreak

Average Canopy Cover = 7%

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PGE Lines – Marginal?

Average Canopy Cover = 11%

High Percent Cover of Bareground

Very little plant cover.

Hardly any litter.

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Review of the Research Questions:

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•The 2001 and 2002 Redwoods Fire Effects Crews
•Robin Wills, National Park Service
•Dr. Shannon Bros, San Jose State University
•Rob Klinger, UC Davis
•Daniel Sarr, Klamath Network I&M Coordinator