

Native and non-native invasive plant response to burn severity two years after the 2005 School Fire in Pomeroy, WA

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Background

- As a result of fire suppression in the past and climate change, fires in the United States are becoming more widespread and severe (Westerling, et al. 2006).
- Because disturbances such as wildfires create favorable conditions for invasive species, many western forests may be vulnerable to invasions by non-native species
- In collaboration with the University of Idaho, the Forest Service began a long-term vegetation monitoring project in the Umatilla National Forest
- One of the main goals of the project was to determine if burn severity was a factor in the intensity of non-native invasions in burned areas and if rehabilitation projects should be focused on those particular areas.

Study site and Methods

Low

Medium

High

Burn severity classifications
Burned Areas Reflectance Classification (BARC) burn severity map derived from dNBR techniques using Landsat-5 TM (24 July 2005 and 25 Aug. 2005) (Robichaud et al. 2004). The School Fire burned 49,515 acres 16 km south of Pomeroy, WA.

Data collection:
•64 total plots, each containing 5 -1m² subplots
•The following observations were taken at each subplot: 1) species-level vegetation cover and composition; 2) percent ash, mineral soil, and litter present; and 3) litter and duff depth

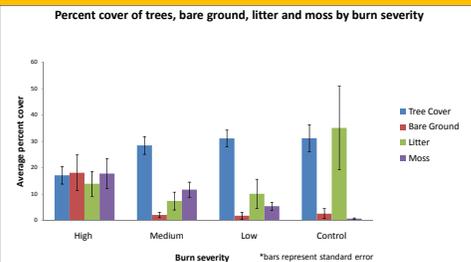


Fig. 1. Site conditions at low, medium, high severity, and control sites found during the 2008 field season.

Objectives

The goal of this project is to determine if invasive species are likely to become established after high severity fires and if those species employ specific colonization strategies. My two objectives were to:

- Determine whether presence and percent canopy cover of invasive and native herbaceous species differ in low, medium, and high severity burn areas.
- Contrast regeneration methods (vegetative reproduction vs. reproduction from seeds) and life span (annual vs. perennial) of native and invasive plant species responding to a fire. I also investigated how these characteristics differ among low, medium, and high severity burns.



Results

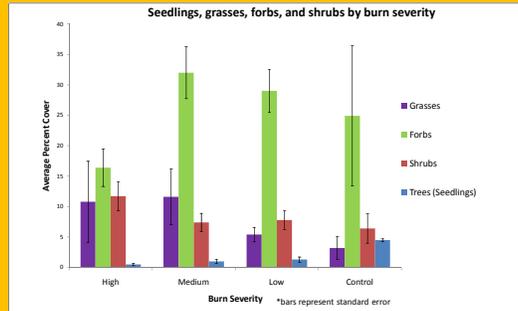


Fig. 2. Vegetation by physiognomic layer among high, medium, low severity, and control sites.

Table 1. Frequency of perennial and annual vegetation among high (H), Medium (M), low (L) severity, and control sites and regeneration strategy (R). I = present in site but in lesser abundance; X= present in greater abundance; O= absent. For regeneration strategies: V = vegetative regrowth; S = regrowth from seed; C = vegetative regrowth and regrowth from seed.

Perennials	H	M	L	C	R
	CIAR	I	I	I	I
ARCO	X	X	X	X	C
ACMI	X	X	X	X	C
EPAN	X	X	X	X	C
FEID	X	X	X	X	C
ANEM	I	I	X	X	C
ANPI	I	I	I	X	C
HAL	I	I	I	X	C
CAGE	O	I	I	X	V
THOC	O	I	X	I	C
SALIX	I	X	I	O	C
SASC	X	I	I	O	C
ELGL	X	I	I	O	S

Annuals	H	M	L	C	R
	EPMI	O	X	I	I
CLPE	I	X	X	O	S
STELL	I	X	X	O	C
LASE	X	X	I	O	S
CIVU	X	I	I	O	C
BRCA	X	I	I	O	S
BRTG	I	I	I	O	S

References:
Robichaud, P.R., A.T. Hudak, L.B. Lentile, S.A. Lewis, and P. Morgan (2004). Invasive species response to fire and post-fire rehabilitation following the 2005 School Fire, Umatilla National Forest: a rapid response proposal. USDA Forest Service, Rocky Mountain Research Station, Moscow, ID.
Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam (2006). Warming and earlier spring increase western US forest wildfire activity. Science, 313: 940-943.

Results cont.

Table 2. Percent cover (with standard deviation) of common invasive, grass, forb, and shrub species in high, medium, low severity and control plots. The test statistic is noted by χ^2 with a corresponding P value. Yellow highlighted species indicate those which were found to be significantly different among burn severities.

Species	High n = 8	Medium n = 15	Low n = 15	Control n = 4	χ^2	P
	Mean \pm std	Mean \pm std	Mean \pm std	Mean \pm std		
Invasive						
CIAR (forb)	1.1 \pm 2.0	0.4 \pm 0.8	<0.1 \pm 0.3	<0.1 \pm 0.1	3.75	0.28
CIVU (forb)	2 \pm 2.4	1.6 \pm 2	0.5 \pm 0.9	0	7.12	0.06
BRTG (grass)	<0.1 \pm 0.1	0.5 \pm 2	<0.1 \pm <0.1	0	2.75	0.43
Common Grasses						
FEID	2.2 \pm 3.7	1.7 \pm 4.8	0.7 \pm 1.2	0.4 \pm 0.5	0.3	0.95
CAGE	0	0.3 \pm 0.6	1.9 \pm 2.2	2.4 \pm 3.6	11.9	0.01
CARO	1 \pm 2.4	0.3 \pm 0.6	0.3 \pm 0.7	<0.1 \pm 0.1	0.61	0.89
BRCA	2.9 \pm 5.6	2.2 \pm 6.2	0.3 \pm 1.3	0	5.2	0.16
Common Forbs						
ARCO	2.3 \pm 3.4	4 \pm 4.6	5.8 \pm 5.4	5 \pm 3.4	4.17	0.24
EPAN	3.4 \pm 3.6	3.3 \pm 3.4	0.4 \pm 0.6	0.2 \pm 0.3	9.43	0.02
LASE	1.3 \pm 1	2.1 \pm 4.2	0.2 \pm 0.2	0	13.89	<0.01
CLPE	0.3 \pm 0.8	8.4 \pm 13.4	3.7 \pm 5.1	0	11.08	0.01
ACMI	0.4 \pm 0.5	1.2 \pm 2.3	2.1 \pm 3.2	0.4 \pm 0.5	0.78	0.85
STELL	0.6 \pm 0.8	1.8 \pm 3.2	0.4 \pm 0.5	0	7.49	0.05
ANEM	0.1 \pm 0.2	0.5 \pm 0.7	0.5 \pm 0.6	1.2 \pm 0.7	3.88	0.27
Common Shrubs						
SALIX	2.4 \pm 5.6	3 \pm 3.4	1.1 \pm 1.7	0	10.6	0.01
SPBE	0.8 \pm 1.7	1.2 \pm 1.8	1.7 \pm 2.1	0.5 \pm 1	4.01	0.25
SASC	6.1 \pm 6.6	0.7 \pm 2.4	0.3 \pm 0.9	0	14.12	<0.01

Conclusions

•Two years after the 2005 School Fire, the three non-native invasive species present in the study area, *Cirsium arvense*, *Cirsium vulgare* and *Bromus tectorum*, are more abundant in high severity burn sites than in medium to low severity burn sites, as was hypothesized.

• Medium and low severity burn sites experienced a strong recovery by the native vegetation. Two years post-fire, canopy cover and percent bare ground are similar to that of unburned sites. Low to medium fire severity seems to stimulate forbs in particular, not only by increasing their percent cover but also by recruitment of more species.

• High severity burn sites are not necessarily characterized by a greater number of annuals or plants from seeds than medium or low burn severity areas. Common species in unburned sites are mostly perennials capable of vegetative regrowth as well as reproduction from seed.

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