

## **SANDAG Task 10: Fire severity vegetation re-survey.**

### **Response of Southern California chaparral communities burned in the 2003 fire storm to the subsequent re-burn by the 2007 Poomacha and Witch Fires.**

Jon E. Keeley and Teressa Brennen  
USGS

#### **Abstract**

Alien plants were a substantially greater threat in the immediate postfire year on sites burned twice, in 2003 and 2007. Comparing postfire recovery in 2003 fires with recovery on the same sites after the 2007 fires, alien density and cover were substantially greater in 2007. These results illustrate an important threat to native community integrity in San Diego County due to repeat fires and attention needs to be paid to how to reduce disturbance frequency on wildland landscapes.

#### **Introduction**

Approximately 60,000 of the 300,000 acres that were burned in the 2003 firestorms in San Diego County re-burned in the Poomacha and Witch Fires of 2007. Due to the short interval between fires on these native shrublands, there is an increased potential for significant impacts on the viability of the native shrubs and for invasion by non-native species. The purpose of this study was to investigate the response and resultant changes within these areas to determine if there has been a change in community composition and structure as a result of the short term fire interval and to make this information available for use in future land management plans and decisions.

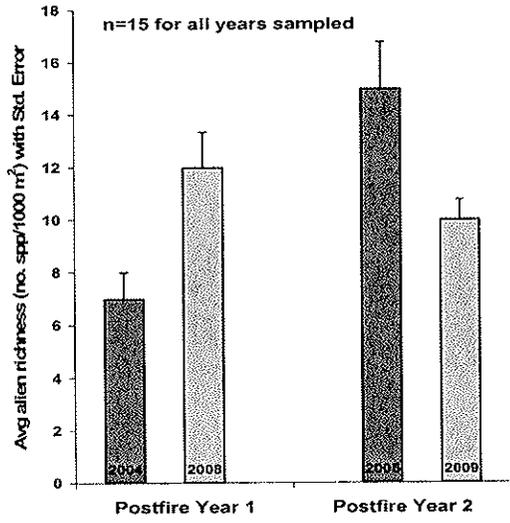
#### **Sites and Methods**

In 2004 and 2005 a study of 191 sites were established and surveyed within the 2003 Cedar, Otay, and Paradise Fires to investigate factors determining fire severity and ecosystem responses (Keeley et al. 2008). Of the sites that re-burned in 2007, fifteen could be located and accessed for a resurvey in 2008 and 2009. Ten new sites were established within both the old 2003 burn perimeters and new 2007 burn perimeters and 3 sites were resurveyed in areas that burned in 2003 but not in 2007. Sampling was conducted in the spring and early summer of the first and second years following the 2003 and 2007 fires. Each site consisted of a 20 x 50 m sample plot, positioned parallel to the elevational contour of the slope in order to capture the greatest variation in community composition. Each of these 0.10-ha plots was subdivided into 10 nested 100-m<sup>2</sup> square subplots, each with a single nested 1-m<sup>2</sup> square quadrat in an outside corner. Cover and density were recorded for each species within the quadrats, and a list of additional species was recorded from the surrounding subplot. Cover was visually estimated and a percentage of ground surface covered was recorded for each species.

for both the 2003 and 2007 fires alien plant cover and native woody cover were not found to be significantly related (Figure 2). In postfire year 2 however, for both the 2003 and 2007 fires, alien cover was found to be negatively correlated with native woody cover explaining 38% of the variation in 2005 ( $P = 0.014$ ) and 31% of the variation in 2009 ( $P < 0.001$ ). Additional analysis looking at individual native woody species may provide further insight for changes in community composition and structure.

**Table 1. Alien species present during the first two postfire years following the 2003 & 2007 firestorms; 36 total alien species.**

Species	Family	Life Form	2003 Fires		2007 Fires	
			Postfire Year 1	Postfire Year 2	Postfire Year 1	Postfire Year 2
<b>Forbs</b>						
<i>Anthemis cotula</i>	Asteraceae	Ann	---	Present	---	---
<i>Centaurea melitensis</i>	Asteraceae	Ann	Present	Present	Present	Present
<i>Conyza bonariensis</i>	Asteraceae	Ann	---	Present	Present	---
<i>Filago gallica</i>	Asteraceae	Ann	Present	Present	Present	Present
<i>Hedypnois cretica</i>	Asteraceae	Ann	Present	Present	Present	Present
<i>Hypochoeris glabra</i>	Asteraceae	Ann	Present	Present	Present	Present
<i>Lactuca serriola</i>	Asteraceae	Ann	Present	Present	Present	Present
<i>Picris echioides</i>	Asteraceae	Ann	---	Present	Present	---
<i>Senecio vulgaris</i>	Asteraceae	Ann	---	Present	---	---
<i>Sonchus asper</i>	Asteraceae	Ann	Present	Present	Present	Present
<i>Sonchus oleraceus</i>	Asteraceae	Ann	Present	Present	Present	Present
<i>Brassica nigra</i>	Brassicaceae	Ann	Present	Present	Present	Present
<i>Sisymbrium orientale</i>	Brassicaceae	Ann	Present	Present	Present	---
<i>Cerastium glomeratum</i>	Caryophyllaceae	Ann	---	Present	Present	---
<i>Herniaria hirsuta</i>	Caryophyllaceae	Ann	---	Present	---	---
<i>Silene gallica</i>	Caryophyllaceae	Ann	Present	Present	Present	Present
<i>Salsola tragus</i>	Chenopodiaceae	Ann	Present	Present	Present	Present
<i>Trifolium hirtum</i>	Fabaceae	Ann	Present	Present	---	Present
<i>Vicia hirsute</i>	Fabaceae	Ann	---	Present	---	---
<i>Vicia villosa</i>	Fabaceae	Ann	---	Present	---	---
<i>Erodium botrys</i>	Geraniaceae	Ann	Present	Present	Present	Present
<i>Erodium cicutarium</i>	Geraniaceae	Ann	Present	Present	Present	Present
<i>Anagallis arvensis</i>	Primulaceae	Ann	Present	Present	Present	Present
<b>Alien Grasses</b>						
<i>Avena fatua</i>	Poaceae	Ann	Present	Present	Present	Present
<i>Brachypodium distachyon</i>	Poaceae	Ann	---	Present	---	---
<i>Bromus diandrus</i>	Poaceae	Ann	Present	Present	Present	Present
<i>Bromus hordaceus</i>	Poaceae	Ann	Present	Present	Present	Present
<i>Bromus madritensis</i>	Poaceae	Ann	Present	Present	Present	Present
<i>Bromus tectorum</i>	Poaceae	Ann	---	Present	---	Present
<i>Gastridium ventricosum</i>	Poaceae	Ann	Present	Present	Present	Present
<i>Hordeum murinum</i>	Poaceae	Ann	Present	Present	---	---
<i>Lamarckia aurea</i>	Poaceae	Ann	---	Present	Present	Present
<i>Lolium multiflorum</i>	Poaceae	Ann	---	Present	---	---
<i>Phalaris minor</i>	Poaceae	Ann	---	Present	---	---
<i>Schismus barbatus</i>	Poaceae	Ann	---	Present	---	---
<i>Vulpia myuros</i>	Poaceae	Ann	Present	Present	Present	Present
<b>Total # of alien forbs</b>			<b>15</b>	<b>23</b>	<b>17</b>	<b>14</b>
<b>Total # of alien grasses</b>			<b>7</b>	<b>13</b>	<b>7</b>	<b>8</b>



**Figure 1. Changes in alien plant cover, density and species richness for postfire years 1 and 2 following the fires of 2003 & 2007.**

Table 3. Alien species population densities during the first two postfire years following the 2003 & 2007 firestorms; 36 total alien species,

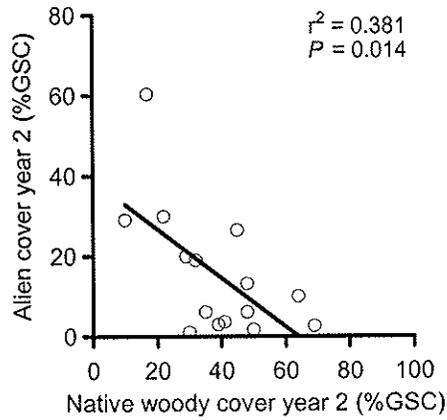
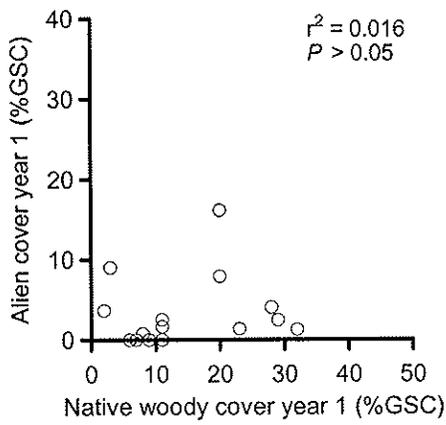
Species	Origin*	Life Form**	Density by year (no. species/ha) following 2003 Fires					Density by year (no. species/ha) following 2007 Fires							
			Post-Fire Year 1 (2004)		Post-Fire Year 2 (2005)		Post-Fire Year 1 (2008)		Post-Fire Year 2 (2009)						
			No. Sites	Mean	SE	No. Sites	Mean	SE	No. Sites	Mean	SE	No. Sites	Mean	SE	
<b>Forbs</b>															
<b>Asteraceae</b>															
<i>Anthemis cotula</i>	Eur	Ann	5	1,000	---	1	ND	---	6	217,000	124,859	---	5	979,400	555,602
<i>Centaurea melitensis</i>	MedEur	Ann	---	---	---	0	---	---	9	556,000	555,000	---	---	---	---
<i>Conyza bonariensis</i>	S Am	Ann	14	16,750	6,768	15	118,267	34,146	14	236,357	49,776	---	15	680,867	123,369
<i>Filago gallica</i>	MedEur	Ann	1	ND	---	3	1,000	---	1	ND	---	---	1	ND	---
<i>Hedynopsis cretica</i>	MedEur	Ann	11	2,000	707	15	13,500	3,551	14	19,000	9,689	---	15	175,600	56,848
<i>Hypochoeris glabra</i>	Eur	Ann	1	ND	---	9	4,000	---	1	ND	---	---	2	2,000	---
<i>Lactuca serriola</i>	Eur	Ann	---	---	---	---	---	---	1	2,000	---	---	---	---	---
<i>Picris echinoides</i>	Eur	Ann	---	---	---	2	ND	---	---	---	---	---	---	---	---
<i>Senecio vulgaris</i>	EurAs	Ann	---	---	---	8	1,000	---	5	ND	---	---	6	4,000	0
<i>Sonchus asper</i>	MedEur	Ann	4	ND	---	12	7,444	2,109	10	2,714	747	---	8	1,250	250
<i>Sonchus oleraceus</i>	MedEur	Ann	4	1,000	---	---	---	---	---	---	---	---	---	---	---
<b>Brassicaceae</b>															
<i>Brassica nigra</i>	Eur	Ann	4	ND	---	5	1,000	---	5	2,667	1,202	---	4	3,000	1,225
<i>Sisymbrium orientale</i>	Eur	Ann	1	ND	---	3	9,000	4,000	1	3,000	---	---	---	---	---
<b>Caryophyllaceae</b>															
<i>Cerastium glomeratum</i>	Eur	Ann	---	---	---	4	1,500	500	3	47,000	---	---	---	---	---
<i>Herniaria hirsuta</i>	MedEur	Ann	---	---	---	1	ND	---	---	---	---	---	---	---	---
<i>Silene gallica</i>	Eur	Ann	1	ND	---	5	1,000	0	8	5,500	2,630	---	4	1,000	---
<b>Chenopodiaceae</b>															
<i>Salsola tragus</i>	EurAs	Ann	2	ND	---	2	1,000	---	2	20,500	19,500	---	2	1,000	---
<b>Fabaceae</b>															
<i>Tribulum hirtum</i>	EurAs	Ann	1	ND	---	3	1,000	---	---	---	---	---	1	192,000	---
<i>Vicia hirsuta</i>	Eur	Ann	---	---	---	1	ND	---	---	---	---	---	---	---	---
<i>Vicia villosa</i>	Eur	Ann	---	---	---	3	ND	---	---	---	---	---	---	---	---
<b>Geraniaceae</b>															
<i>Erodium balforsii</i>	MedEur	Ann	3	ND	---	5	2,000	1,000	3	41,000	7,000	---	5	72,750	31,523
<i>Erodium cicutarium</i>	MedEur	Ann	6	2,000	707	6	11,000	5,128	6	45,833	21,053	---	8	64,500	34,386
<b>Primulaceae</b>															
<i>Anagallis arvensis</i>	Eur	Ann	8	3,000	1,304	7	9,500	4,555	7	7,333	4,602	---	1	ND	---
<b>Alien Grasses</b>															
<b>Poaceae</b>															
<i>Avena fatua</i>	Eur	Ann	1	ND	---	11	2,333	1,333	7	1,500	500	---	7	2,800	490
<i>Brachypodium distachyon</i>	MedEur	Ann	---	---	---	1	ND	---	---	---	---	---	---	---	---
<i>Bromus diandrus</i>	Eur	Ann	2	4,000	---	5	45,500	29,500	2	12,000	---	---	4	197,000	24,000
<i>Bromus hordeaceus</i>	EurAs	Ann	4	1,000	---	11	4,000	1,506	6	27,600	11,176	---	11	153,500	74,489
<i>Bromus madriensis</i>	Eur	Ann	12	3,125	1,187	15	46,067	16,368	15	340,643	189,792	---	15	942,800	295,799
<i>Bromus tectorum</i>	EurAs	Ann	---	---	---	4	ND	---	---	---	---	---	2	2,000	1,000
<i>Gastidium ventricosum</i>	Eur	Ann	11	23,833	10,419	14	78,182	46,495	15	228,846	108,116	---	15	228,429	82,277
<i>Hordeum murinum</i>	Eur	Ann	1	ND	---	5	ND	---	---	---	---	---	---	---	---
<i>Lamarckia aurea</i>	MedEur	Ann	---	---	---	10	ND	---	6	2,000	---	---	4	ND	---
<i>Lolium multiflorum</i>	Eur	Ann	---	---	---	1	ND	---	---	---	---	---	---	---	---
<i>Phalaris minor</i>	MedEur	Ann	---	---	---	1	3,000	---	---	---	---	---	---	---	---
<i>Schismus barbatus</i>	MedEur	Ann	---	---	---	3	10,000	---	---	---	---	---	---	---	---
<i>Vulpia myuros</i>	Eur	Ann	9	6,600	5,354	15	36,750	20,713	15	208,308	138,336	---	15	789,929	296,005

\* Origin: Aus, Australia; Eur, Europe; EurAs, EuroAsia; MedEur, southern Europe; S Af, South Africa; S Am, South America.

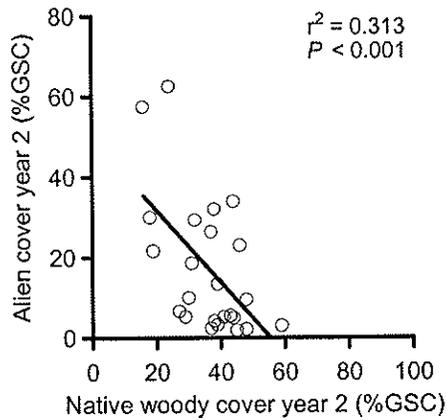
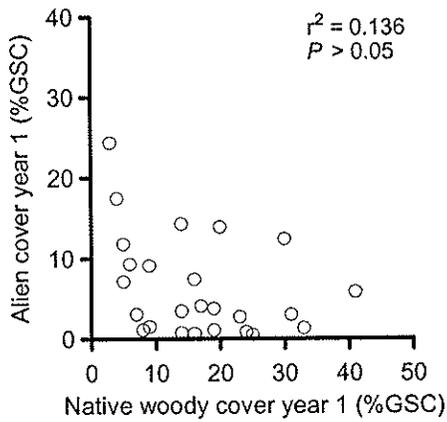
\*\* Life-Form: Ann, annual;

ND=no data. Species present within 10m<sup>2</sup> plot, but not within the 1m<sup>2</sup> subplot where density data were collected.

Postfire years following the 2003 fires



Postfire years following 2007 fires



**Figure 2. Relationship between alien cover and native woody cover (shrubs, subshrubs, suffrutescents, and trees) for postfire years 1 and 2 following the 2003 and 2007 fires; (%GSC)=percent ground surface covered; n=15 for 2003 fires and n=25 for 2007 fires.**