International Journal of Wildland Fire
doi:10.1071/WF10060_AC

Supplementary material

The role of fire severity, distance from fire perimeter and vegetation on post-fire recovery of small-mammal communities in chaparral

Jay Diffendorfer[A,E], *Genie M. Fleming*[B], *Scott Tremor*[B], *Wayne Spencer*[C] *and Jan L. Beyers*[D]

[A]Rocky Mountain Geographic Science Center, US Geological Survey, PO Box 25046, MS 507, Denver, CO 80225, USA.

[B]San Diego Natural History Museum, PO Box 121390, San Diego, CA 92112, USA.

[C]Conservation Biology Institute, 815 Madison Avenue, San Diego, CA 92116, USA.

[D]USDA Forest Service, Pacific Southwest Research Station, Forest Fire Laboratory, 4955 Canyon Crest Drive, Riverside, CA 92507, USA.

[E]Corresponding author. Email: jediffendorfer@usgs.gov

Table S1. Rotated factor correlation matrix resulting from principal components analysis of eight abiotic and vegetation variables

The factor correlation matrix shows the strength and direction of relationships between individual variables and the extracted components or factors. Only correlations ≥0.45 (in bold) are considered to contribute substantially to factor interpretations. Communalities show the percentage of variance in the individual variable accounted for by the set of extracted factors. Eigenvalues are the estimated variance of each extracted factor. %VAF shows the percentage of the total variance in the set of original variables accounted for by each extracted factor

Variables	PCA factors			Communalities
	Shrub composition	Growth form abundance	Slope inclination	
Elevation	**0.732**	–0.124	0.385	0.699
Northness	**0.780**	–0.010	0.244	0.669
Percentage slope	–0.028	–0.025	**0.864**	0.748
Percentage herb cover	0.034	**–0.895**	0.097	0.811
Percentage woody cover	0.123	**0.886**	0.074	0.805
ln(deerweed cover)	**–0.776**	0.266	0.001	0.672
ln(lilac cover)	**0.793**	0.049	0.101	0.641
ln(chamise cover)	–0.390	**0.700**	–0.127	0.659
ln(scrub oak cover)	**0.843**	0.030	–0.141	0.730
Percentage surface rock	0.232	–0.061	**0.801**	0.699
Eigenvalues	3.70	2.01	1.42	
%VAF	37.00	20.13	14.20	

Table S2. Results from hierarchical linear modelling (HLM) analyses of species specific abundances and compositional similarity between burned and unburned plots through time

HLM included specification of both random and fixed effects (see text). Random effects (e.g. amount and statistical significance of variation among plots in the effect of time, shown in bottom portion of table) were tested first using restricted maximum likelihood (RML) estimation. After the random model was specified, inclusion of fixed effects (e.g. influence of habitat on trend over time) was based on ΔAIC using full maximum likelihood estimation. The final coefficients and their associated statistics shown are based on RML. Proportional variance explained is derived from the reduction in estimated variance following addition of all Level 1 or Level 2 variables (see Raudenbush and Bryk 2002)

	Cactus mice				California mice			
Fixed effects	Coefficient	s.e.	d.f.	*P*	Coefficient	s.e.	d.f.	*P*
For similarity at 13 months or abundance at 28 months (β_0)								
Average at time $t = 0$ (γ_{00})	1.164	0.077	26	<0.001	0.91	0.168	27	<0.001
Eastness	0.269	0.102	26	0.014				
Riparian presence					0.805	0.235	27	0.002
Slope inclination	0.217	0.06	26	0.002				
Growth form abundance								
Shrub composition	–0.188	0.081	26	0.029	0.442	0.128	27	0.002
Average slope or instantaneous rate at 28 months (γ_{10})	–0.013	0.01	27	0.181	0.06	0.01	25	<0.001
Riparian presence	–0.042	0.011	27	0.001	0.027	0.012	25	0.037
Slope inclination								
Shrub composition					0.02	0.008	25	0.021
Distance	0.004	0.002	27	0.015	0.006	0.001	25	<0.001
Distance^2					–0.003	0.001	25	0.001
Average acceleration (γ_{20})			–0.001	0.001	25	0.444		
Riparian presence					–0.002	0.001	25	0.061
Slope inclination								
Shrub composition					–0.0005	0.0005	25	0.297
Distance					0.0002	0.0001	25	0.017
Distance^2					–0.0001	0.0001	25	0.034
Average slope or instantaneous rate at 28 months (γ_{30})	–0.0009	0.0002	172	<0.001	0.0004	0.0002	165	0.055
Average acceleration (γ_{40})			-2.00×10^{-6}	1.00×10^{-6}			165	0.048

Random effects	Variance	χ^2	d.f.	*P*	Variance	χ^2	d.f.	*P*
13-month similarity or 28-month abundance $(u_{0j})^A$	0.219	154.02	29	<0.001	0.617	277.33	29	<0.001
Proportion of among-plot variance explained by plot factors	0.35				0.68			
Time slope $(u_{1j})^A$	0.0009	80.61	29	<0.001	0.0008	109.37	29	<0.001
Proportion of among-plot variance explained by plot factors	0.59				0.6			
Time^2 slope $(u_{1j})^A$					4.90×10^{-6}	58.48	29	0.001
Proportion of among-plot variance explained by plot factors					0.63			
Within-plot variability $(r_{ij})^B$	0.44				0.554			
Proportion of within-plot variance explained by time and precipitation	0.31				0.67			

	California pocket mice				Deer mice			
Fixed effects	Coefficient	s.e.	d.f.	*P*	Coefficient	s.e.	d.f.	*P*
For similarity at 13 months or abundance at 28 months (β_0)								
Average at time $t = 0$ (γ_{00})	0.923	0.111	27	<0.001	2.07	0.081	29	<0.001
Eastness								
Riparian presence								
Slope inclination	0.328	0.093	27	0.002				
Growth form abundance								
Shrub composition	0.277	0.084	27	0.003				
Average slope or instantaneous rate at 28 months (γ_{10})	–0.01	0.01	27	0.298	–0.012	0.006	27	0.065
Riparian presence								
Slope inclination	0.017	0.005	27	0.002	–0.001	0.007	27	0.916
Shrub composition					0.018	0.006	27	0.005
Distance	0.004	0.002	27	0.035				
Distance^2								
Average acceleration (γ_{20})			–0.004	0.0004	172	<0.001		
Riparian presence								
Slope inclination					–0.001	0.0003	172	<0.001
Shrub composition					0.0002	0.0004	172	0.622
Distance								
Distance^2								
Average slope or instantaneous rate at 28 months (γ_{30})	–0.001	0.0002	172	0.001	0.001	0.0002	172	<0.001
Average acceleration (γ_{40})	-3.00×10^{-6}	1.00×10^{-6}	172	<0.001				
Random effects	Variance	χ^2	d.f.	*P*	Variance	χ^2	d.f.	*P*
13-month similarity or 28-month abundance (u_{0j})[A]	0.41	410.86	29	<0.001	0.117	84.13	29	0
Proportion of among-plot variance explained by plot factors	0.4							
Time slope (u_{1j})[A]	0.001	124.23	29	<0.001	0.0006	59.43	29	0.001
Proportion of among-plot variance explained by plot factors	0.35				0.28			
Time^2 slope (u_{1j})[A]								
Proportion of among-plot variance explained by plot factors								
Within-plot variability (r_{ij})[B]	0.365				0.658			
Proportion of within-plot variance explained by time and precipitation	0.49				0.44			

	Desert woodrat				Dulzura kangaroo rat			
Fixed effects	Coefficient	s.e.	d.f.	*P*	Coefficient	s.e.	d.f.	*P*
For similarity at 13 months or abundance at 28 months (β_0)								
Average at time $t = 0$ (γ_{00})	0.88	0.103	29	<0.001	2.578	0.102	26	<0.001
Eastness					–0.213	0.073	26	0.008
Riparian presence								
Slope inclination					–0.322	0.08	26	0.001
Growth form abundance					0.275	0.065	26	<0.001
Shrub composition								
Average slope or instantaneous rate at 28 months (γ_{10})	0.028	0.005	28	<0.001	0.039	0.004	27	<0.001
Riparian presence								
Slope inclination	0.003	0.003	28	0.296	0.013	0.004	27	0.003
Shrub composition					0.013	0.005	27	0.019
Distance								
Distance^2								
Average acceleration (γ_{20})	–0.002	0.0004	28	0.001	–0.002	0.0003	27	<0.001
Riparian presence								
Slope inclination	0.001	0.0002	28	<0.001	–0.0004	0.001	27	0.471
Shrub composition					–0.001	0.0003	27	<0.001
Distance								
Distance^2								
Average slope or instantaneous rate at 28 months (γ_{30})					–0.0003	0.0002	168	0.096
Average acceleration (γ_{40})			-3.00×10^{-6}	1.00×10^{-6}			168	<0.001
Random effects	Variance	χ^2	d.f.	*P*	Variance	χ^2	d.f.	*P*
13-month similarity or 28-month abundance (u_{0i})[A]	0.259	127.49	29	<0.001	0.353	237.46	29	<0.001
Proportion of among-plot variance explained by plot factors					0.65			
Time slope (u_{1i})[A]	0.0005	72.78	29	<0.001	0.0006	116.04	29	<0.001
Proportion of among-plot variance explained by plot factors	<0.01				0.46			
Time^2 slope (u_{1i})[A]	2.40×10^{-6}	39.82	29	0.087	1.30×10^{-6}	37.02	29	0.146
Proportion of among-plot variance explained by plot factors	<0.01				0.26			
Within-plot variability (r_{ij})[B]	0.393				0.459			
Proportion of within-plot variance explained by time and precipitation	0.52				0.73			

	Similarity[C]			
Fixed effects	Coefficient	s.e.	d.f.	*P*
For similarity at 13 months or abundance at 28 months (β_0)				
Average at time t = 0 (γ_{00})	0.183	0.014	28	<0.001
Eastness				
Riparian presence	0.151	0.031	28	<0.001
Slope inclination				
Growth form abundance				
Shrub composition				
Average slope or instantaneous rate at 28 months (γ_{10})	0.009	0.001	27	<0.001
Riparian presence				
Slope inclination	0.003	0.001	27	0.003
Shrub composition	0.004	0.001	27	<0.001
Distance				
Distance^2				
For time^2 slope (β_2)				
Average acceleration (γ_{20})				
Riparian presence				
Slope inclination				
Shrub composition				
Distance				
Distance^2				
Average slope or instantaneous rate at 28 months (γ_{30})				
For precipitation^2 slope (β_4)				

Random effects	Variance	χ^2	d.f.	*P*
13-month similarity or 28-month abundance (u_{0j})[A]	0.0046	40.316	29	0.079
Proportion of among-plot variance explained by plot factors	0.91			
Time slope (u_{1j})[A]	0.00003	58.008	29	0.001
Proportion of among-plot variance explained by plot factors	0.67			
Time^2 slope (u_{1j})[A]				
Proportion of among-plot variance explained by plot factors				
Within-plot variability (r_{ij})[B]	0.0239			
Proportion of within-plot variance explained by time and precipitation	0.46			

[A]Variance estimate and associated Chi-square statistic are from model excluding any plot-level factors.

[B]Variance estimate is from model excluding time and precipitation.

[C]Similarity values were square-root transformed and abundances were log-transformed before analysis.

Table S3. Results from regression of individual species' relative abundance onto community similarity ratio values (square-root-transformed) for each trapping session

Species in bold font have a statistically significant contribution to the regression model. Species denoted with * account for the greatest proportional variation in the square-root similarity ratio during that trapping session based on the squared semipartial correlation coefficient (sr^2). Large-eared woodrats and harvest mice were not included in some sessions because they were not trapped on any plots; voles were not included in any sessions because they were trapped on only one or two plots in sessions where they were present

Months post-fire	Species	B	s.e.	*P*	sr^2
13	(Constant)	0.258	0.031	<0.001	
	California pocket mouse	0.004	0.004	0.385	0.007
	San Diego pocket mouse	–0.013	0.009	0.144	0.022
	Dulzura kangaroo rat	**–0.010**	**0.004**	**0.015**	**0.066**
	Desert woodrat	–0.001	0.025	0.962	0.000
	Large-eared woodrat	–0.041	0.053	0.445	0.006
	California mouse	**0.126**	**0.051**	**0.023**	**0.057**
	Cactus mouse*	**0.022**	**0.005**	**0.001**	**0.161**
	Deer mouse	**–0.006**	**0.003**	**0.042**	**0.045**
	Harvest mouse	–0.003	0.047	0.956	0.000
18	(Constant)	0.168	0.024	<0.001	0.000
	California pocket mouse	0.017	0.014	0.225	0.010
	San Diego pocket mouse	–0.035	0.036	0.340	0.006
	Dulzura kangaroo rat	–0.003	0.003	0.266	0.008
	Desert woodrat	0.003	0.013	0.808	0.000
	Lage-eared woodrat	–0.016	0.061	0.794	0.000
	California mouse*	**0.043**	**0.008**	**<0.001**	**0.166**
	Cactus mouse	**0.026**	**0.007**	**0.002**	**0.077**
	Deer mouse	–0.003	0.002	0.240	0.009
	Harvest mouse	0.027	0.031	0.395	0.005
24	(Constant)	0.253	0.033	<0.001	0.000
	California pocket mouse	0.002	0.003	0.464	0.004
	San Diego pocket mouse	0.001	0.015	0.957	0.000
	Dulzura kangaroo rat	–0.004	0.002	0.070	0.025
	Desert woodrat	0.011	0.008	0.165	0.014
	California mouse*	**0.043**	**0.005**	**<0.001**	**0.443**
	Cactus mouse	0.000	0.003	0.897	0.000

Months post-fire	Species	B	s.e.	*P*	sr^2
	Deer mouse	**–0.006**	**0.002**	**0.002**	**0.082**
	Harvest mouse	–0.008	0.049	0.877	0.000
30	(Constant)	0.345	0.052	<0.001	0.000
	California pocket mouse	**0.021**	**0.004**	**<0.001**	**0.060**
	San Diego pocket mouse	**–0.018**	**0.007**	**0.010**	**0.019**
	Dulzura kangaroo rat	**–0.008**	**0.002**	**0.003**	**0.028**
	Desert woodrat	0.010	0.007	0.171	0.005
	California mouse*	**0.035**	**0.003**	**<0.001**	**0.368**
	Cactus mouse	0.008	0.004	0.100	0.007
	Deer mouse	**–0.010**	**0.003**	**0.001**	**0.038**
	Harvest mouse	0.048	0.042	0.261	0.003
36	(Constant)	0.562	0.043	<0.001	0.000
	California pocket mouse	0.002	0.003	0.461	0.001
	San Diego pocket mouse	**–0.020**	**0.006**	**0.003**	**0.026**
	Dulzura kangaroo rat*	**–0.020**	**0.002**	**0.000**	**0.186**
	Desert woodrat	**0.011**	**0.004**	**0.012**	**0.017**
	Dusky-footed woodrat	–0.049	0.053	0.372	0.002
	California mouse	**0.021**	**0.003**	**0.000**	**0.139**
	Cactus mouse	**0.011**	**0.003**	**0.003**	**0.027**
	Deer mouse	0.002	0.004	0.603	0.001
	Harvest mouse	–0.017	0.040	0.686	0.000
43	(Constant)	0.571	0.062	<0.001	0.000
	California pocket mouse	**0.018**	**0.006**	**0.006**	**0.035**
	San Diego pocket mouse	–0.016	0.010	0.139	0.009
	Dulzura kangaroo rat*	**–0.020**	**0.003**	**<0.001**	**0.157**
	Desert woodrat	–0.013	0.008	0.111	0.010
	Dusky-footed woodrat	–0.005	0.087	0.958	0.000
	California mouse	**0.030**	**0.006**	**0.000**	**0.092**
	Cactus mouse	–0.013	0.009	0.172	0.008
	Deer mouse	0.005	0.006	0.472	0.002

Photographs of study plots.

Site 3, in May 2006, 32 months post-fire.

Fig. S1. Facing east from plot centre.

Fig. S2. Facing west from plot centre.

Fig. S3. Facing north from plot centre.

Fig. S4. Facing south from plot centre.

Site 30, November 2005. Unburned.

Fig. S5. Facing east from plot centre.

Fig. S6. Facing west from plot centre.

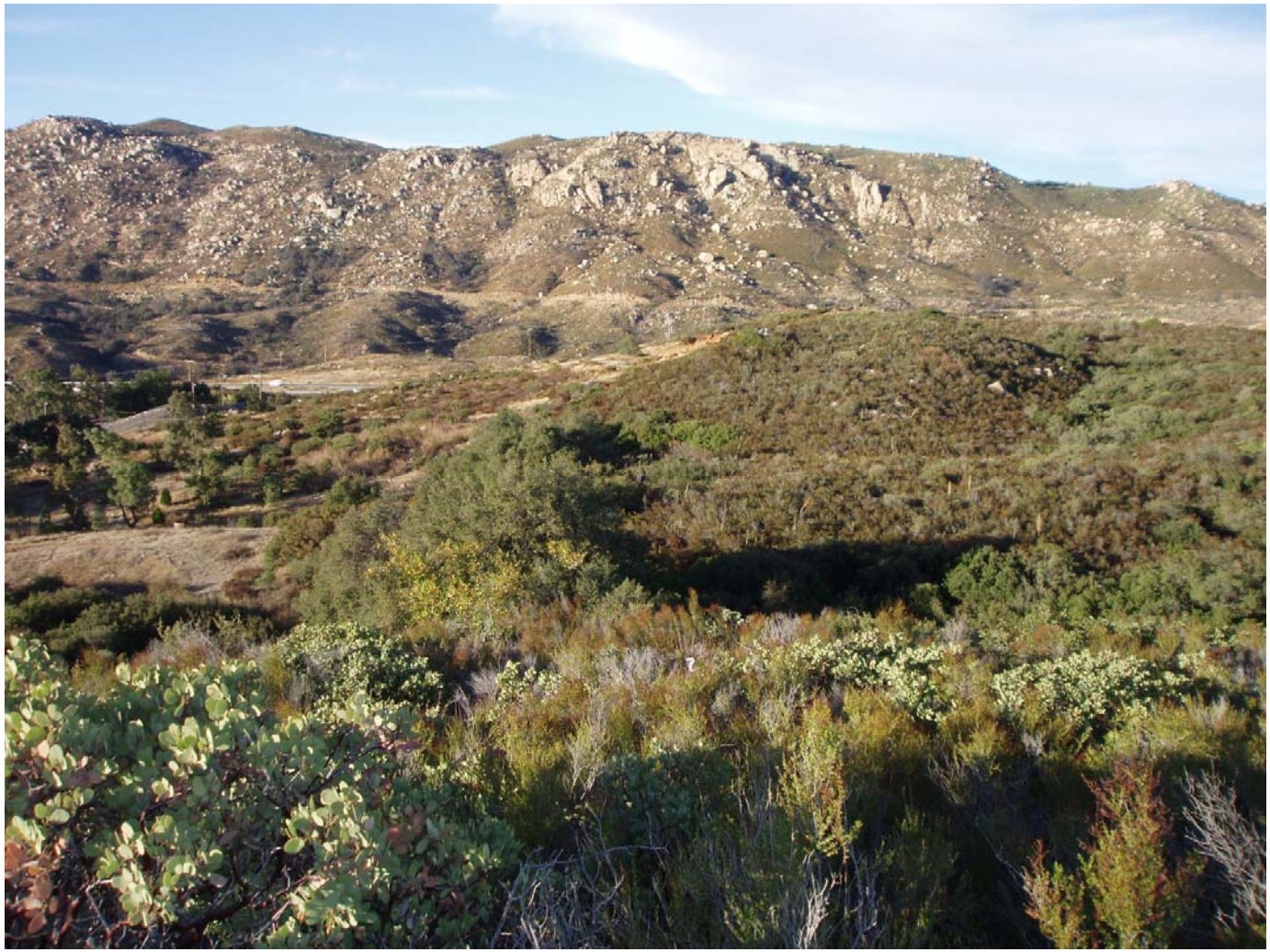

Fig. S7. Facing north from plot centre.

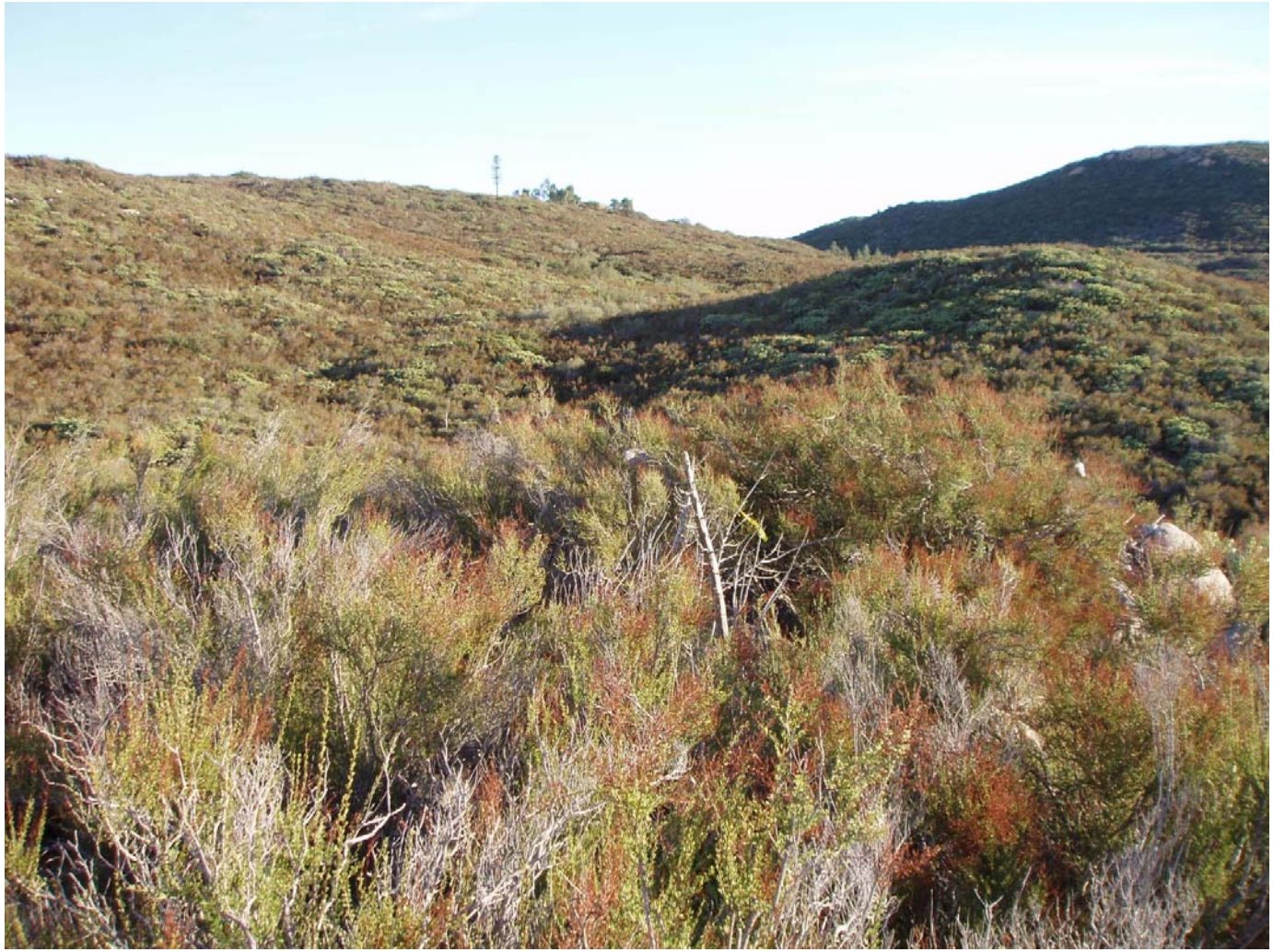

Fig. S8. Facing South from plot centre.

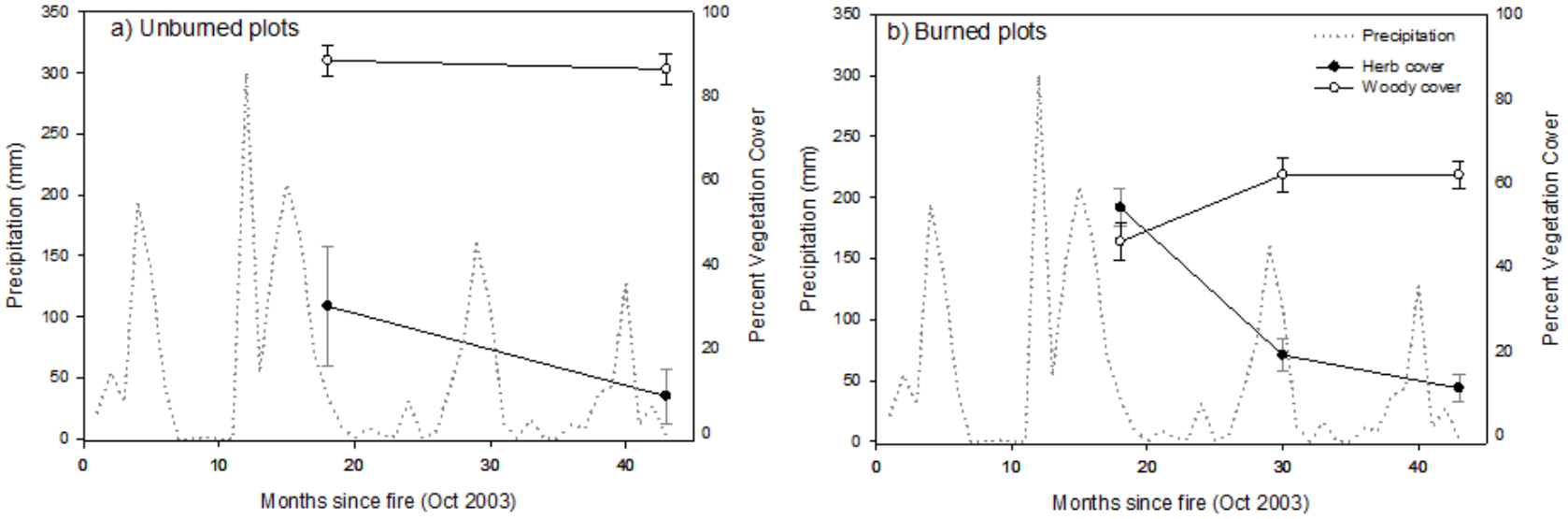

Fig. S9. Rainfall and vegetation cover following the 2003 October wildfire. (*a*) Vegetation cover on unburned plots. Unburned plots were sampled only in spring 2005 and 2007. (*b*) Vegetation cover on burned plots sampled in spring of 2005, 2006 and 2007. Symbols represent averages across all plots in each burn condition at the associated time point; bars represent 95% confidence intervals for the average.