

## Supplemental Information for:

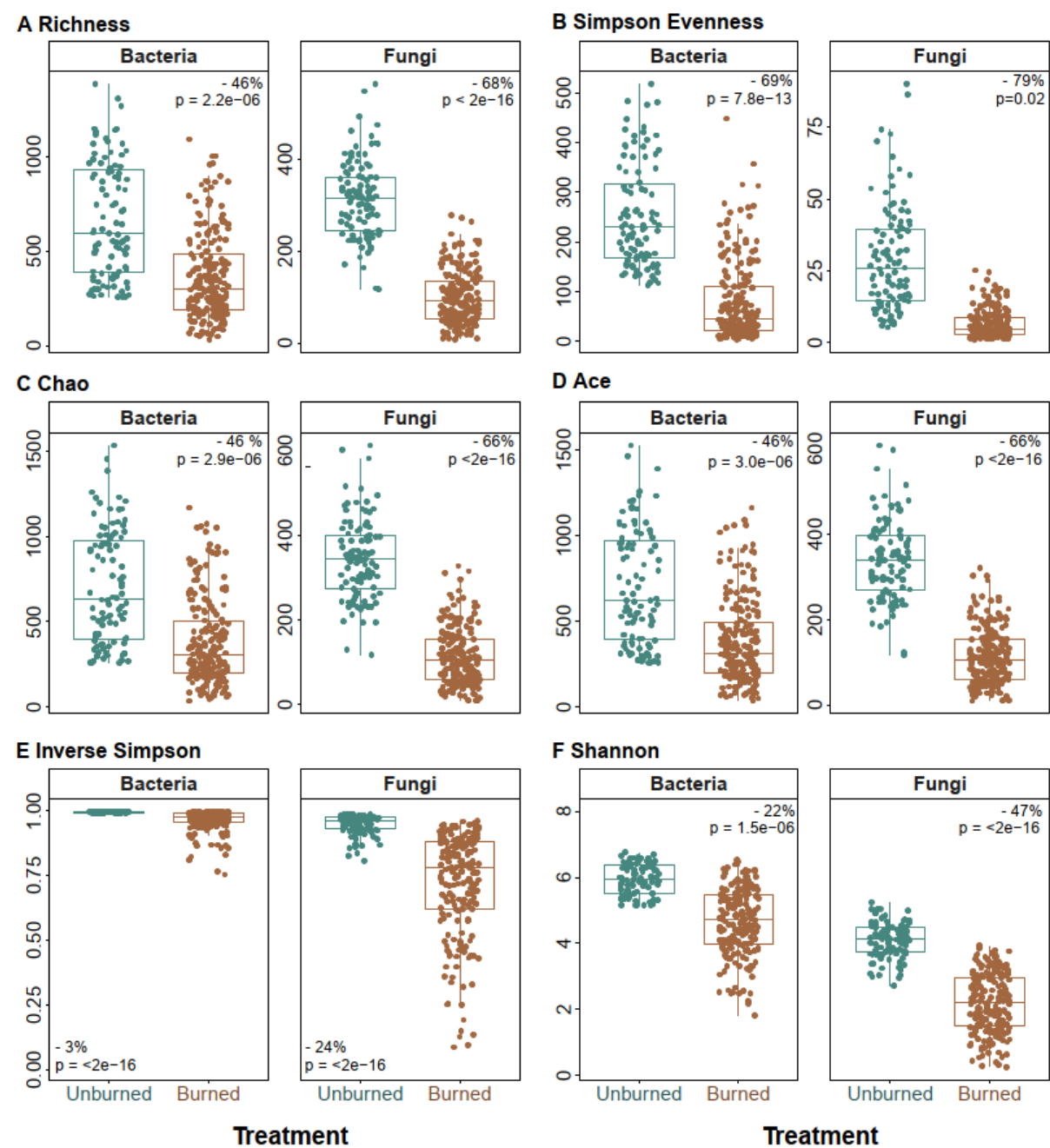
Rapid bacterial and fungal successional dynamics in first year after Chaparral wildfire

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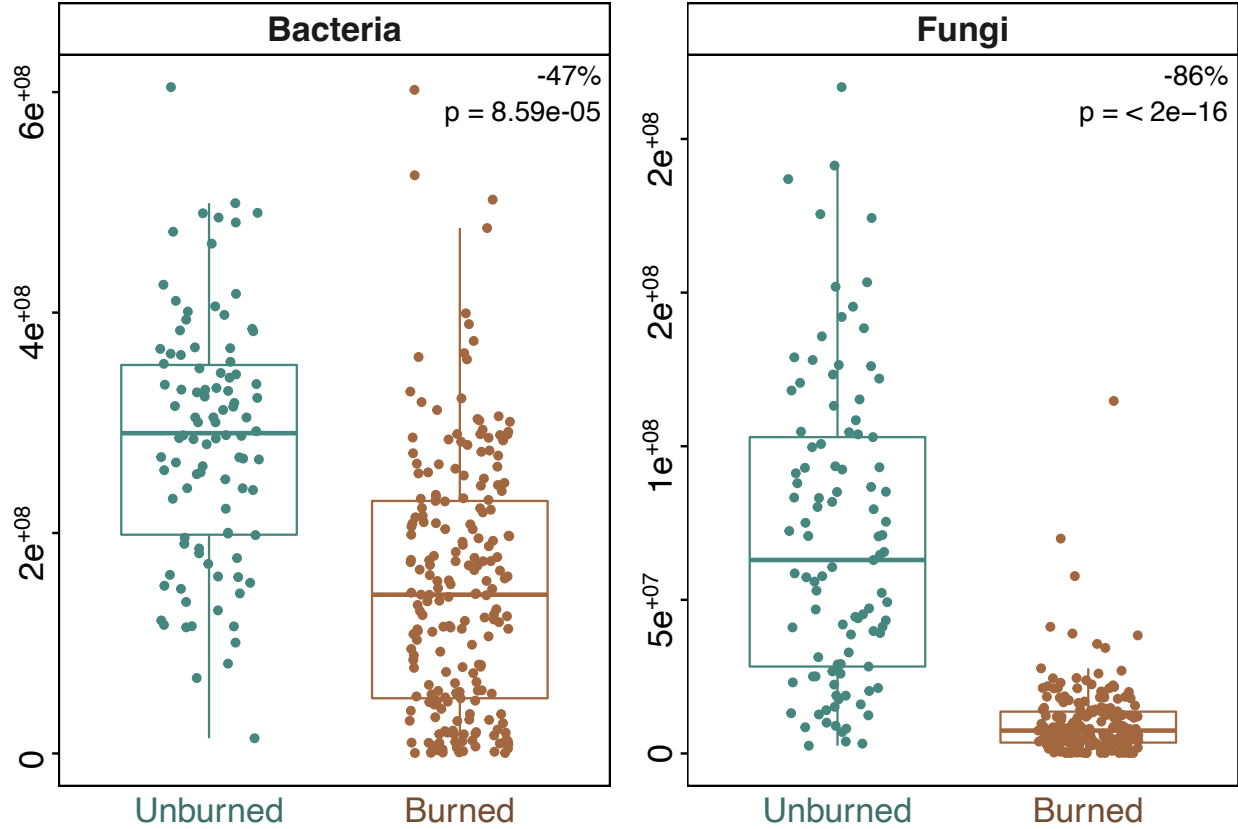
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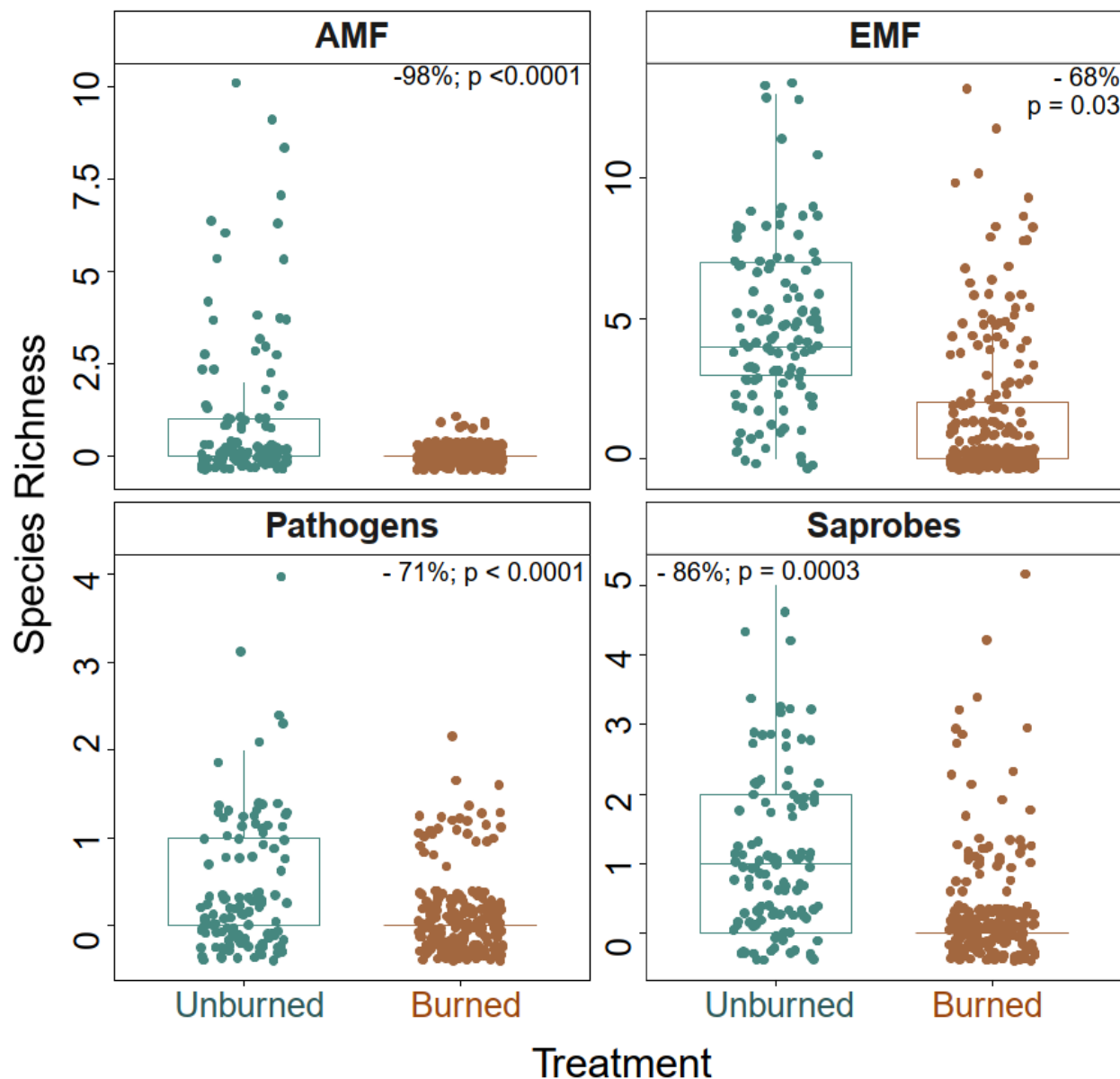
**Figure S1.** Comparison of alpha diversity metrics for bacteria and fungi between burned (brown) and unburned (blue-green) plots for A) observed species richness (ASVs), B) Simpson, C) Chao1, D) ACE, E) Inverse Simpson (dominance), and F) Shannon. Significance based on negative binomial regression with plots and time since fire as random effects for all alpha metrics except for bacteria inverse Simpson which was based on a generalized mixed effect model. Percent value represents the percent change in alpha diversity from the unburned to burned communities, where the negative value represents a decrease in alpha diversity.



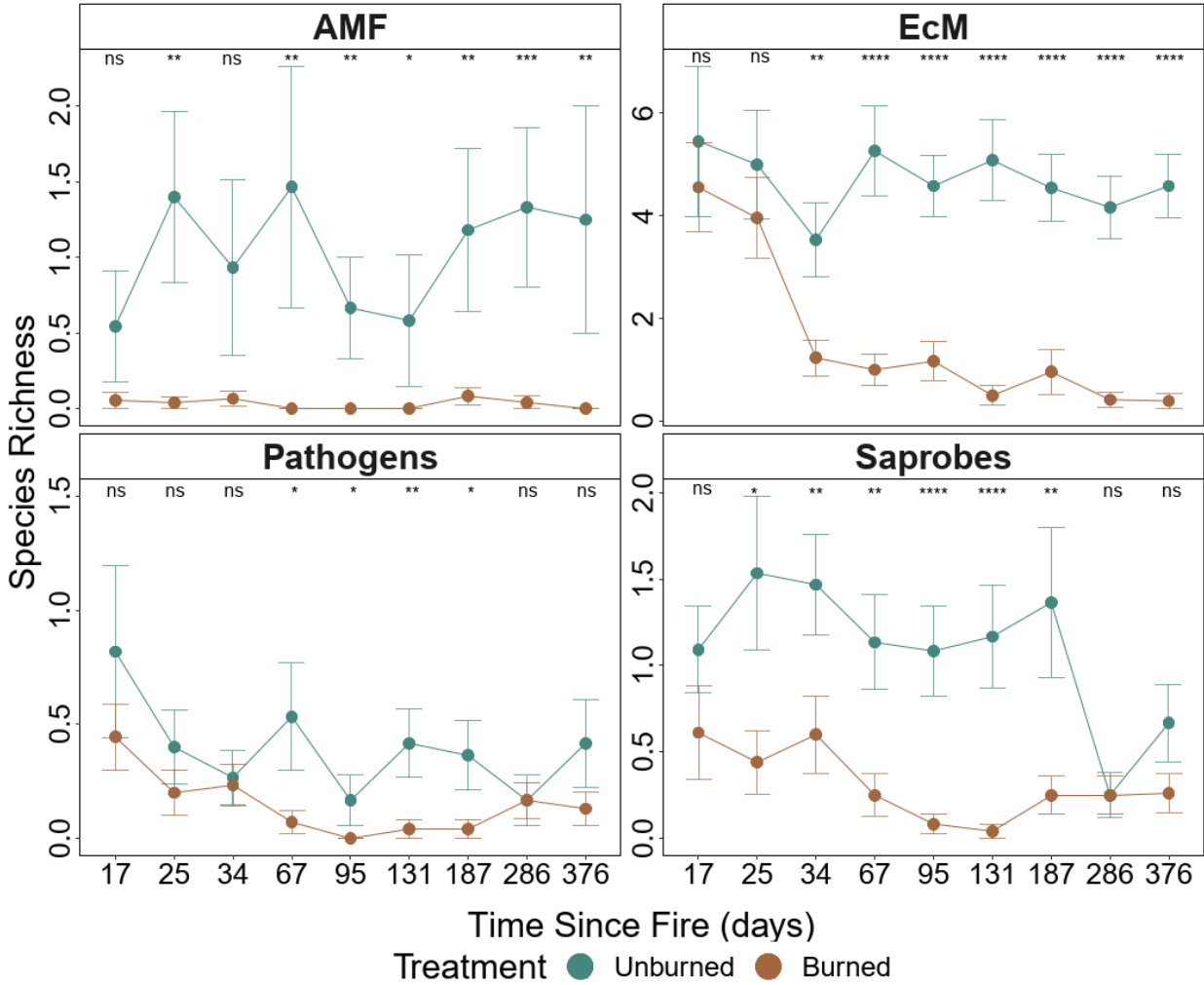
**Figure S2.** Change in average A) bacterial and B) fungal estimated biomass (per gram of soil) between the burned (brown) and unburned (blue-green) communities across all time points. Boxes represent the 25<sup>th</sup> and 75<sup>th</sup> quartiles, and the horizontal line is the median of the data—significance based on negative binomial regressions with plot and time since fire as random effects. Percent value represents the percent change in biomass from the unburned to burned communities, where the negative value represents a decrease in biomass.



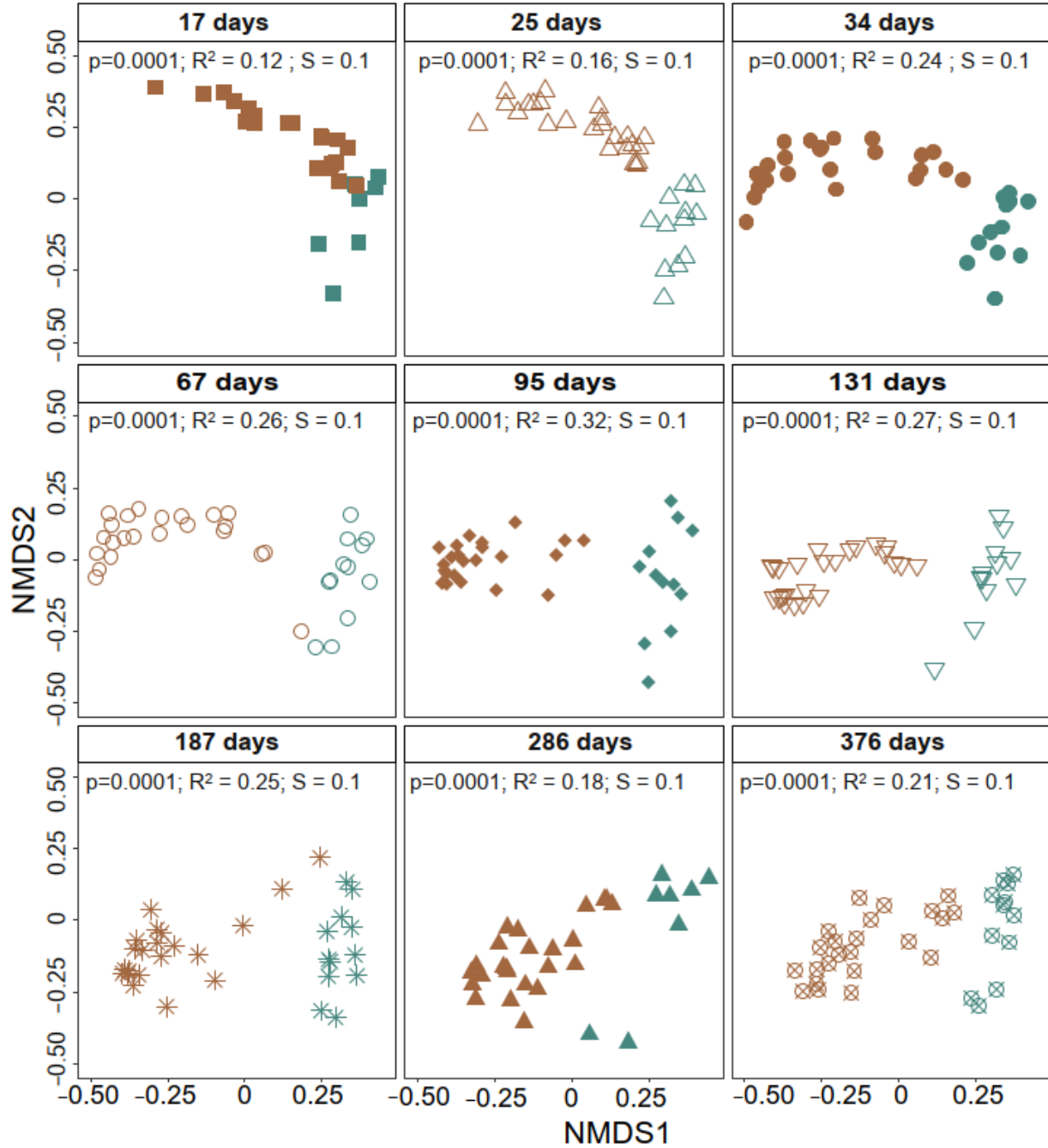
**Figure S3.** Change in average richness for A) arbuscular mycorrhizal fungi (AMF), B) ectomycorrhizal fungi (EMF), C) pathogenic, and D) saprobic fungi between burned (brown) and unburned (blue-green) plots across all time points. Boxes represent the 25<sup>th</sup> and 75<sup>th</sup> quartiles, and the horizontal line is the median of the data. Significance based on negative binomial regressions with plot, subplot, and time since fire as random effects. Percent value represents the percent change in species richness from the unburned to burned communities, where the negative value represents a decrease in richness.



**Figure S4.** Change of species richness in burned (brown) versus unburned (blue-green) plots at each of the 9-time points for all four fungal guilds (arbuscular mycorrhizal fungi (AMF); ectomycorrhizal fungi (EMF), pathogens, and saprobes). Points represent the mean, and bars represent the standard error of the mean.



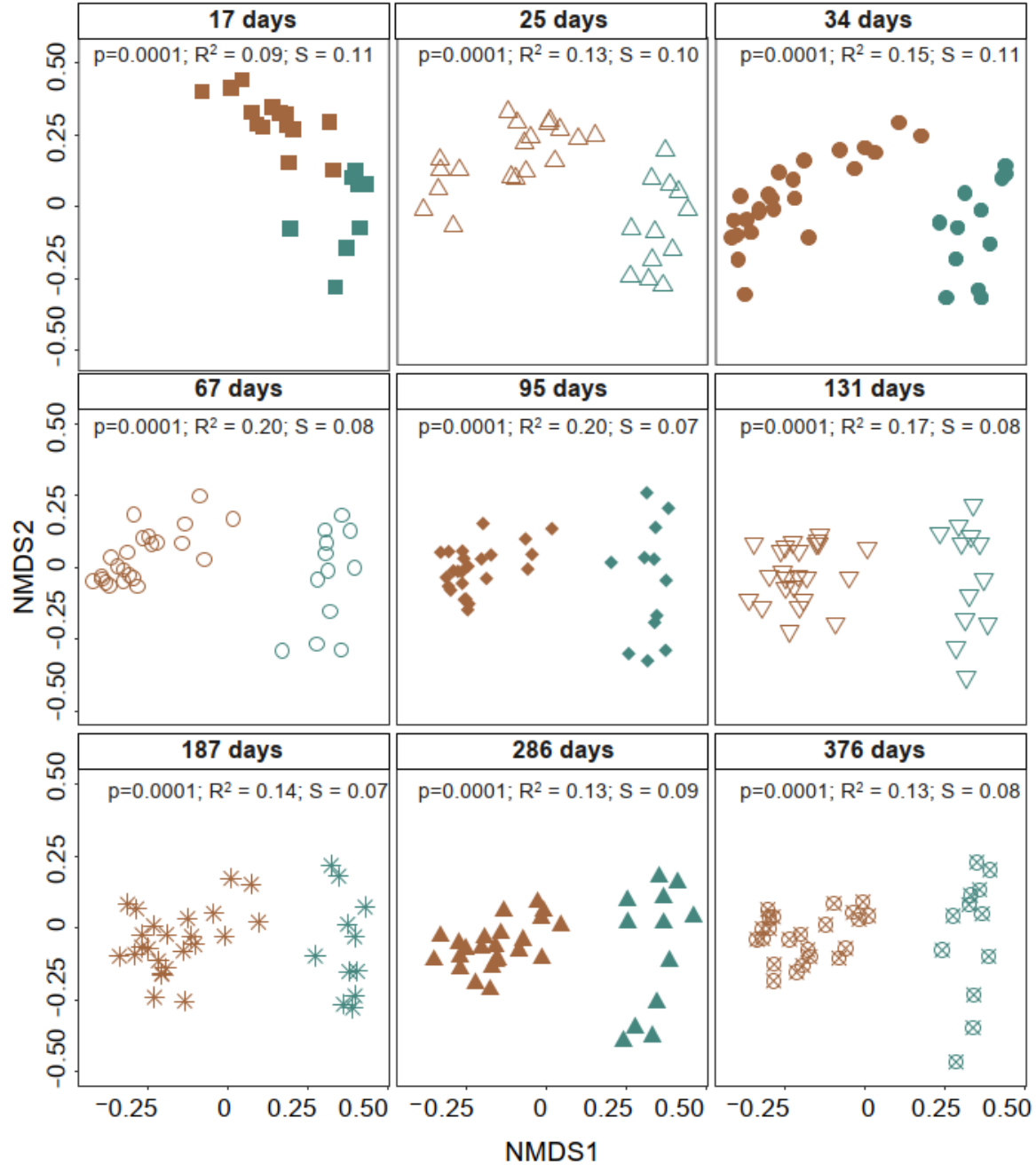
**Figure S5.** NMDS plots for bacterial community composition in burned (brown) versus unburned (blue-green) plots at each of the 9-time points with  $R^2$ , significance, and stress (S) based on ADONIS. NMDS is based on the Bray-Curtis dissimilarity matrix on 3-dimensions.



Treatment ● Burned ● Unburned

Time Since Fire (days) ■ 17 △ 25 ● 34 ○ 67 ◆ 95 ▽ 131 ✱ 187 ▲ 286 ⊗ 376

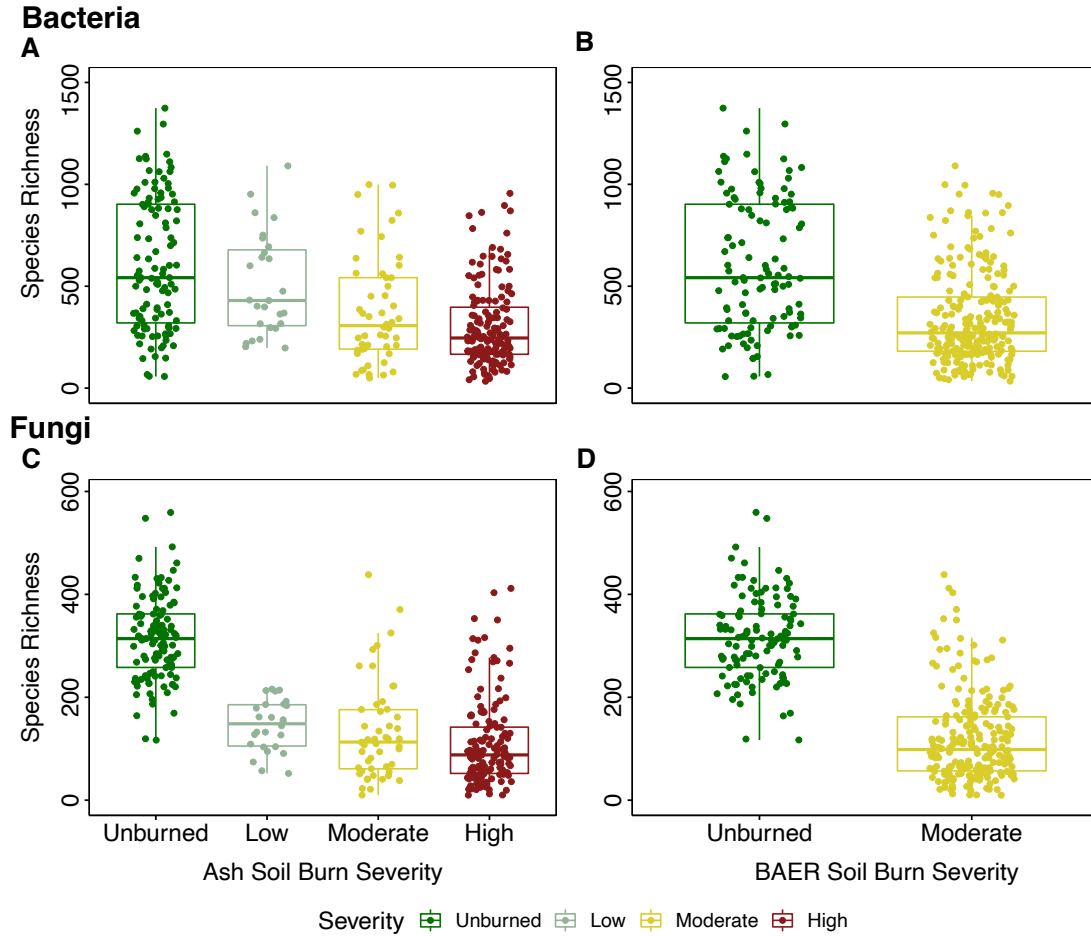
**Figure S6.** NMDS plots for fungal community composition in burned (brown) versus unburned (blue-green) plots at each of the 9-time points with  $R^2$ , significance, and stress (S) based on ADONIS. NMDS is based on the Bray-Curtis dissimilarity matrix on 3-dimensions.



Treatment ● Burned ● Unburned

Time Since Fire (days) ■ 17 △ 25 ● 34 ○ 67 ◆ 95 ▽ 131 ✱ 187 ▲ 286 ⊠ 376

**Figure S7.** Soil burn severity effect on species richness. Severity categories were based on initial ash depth (cm) following Parson et al., 2010 (unburned = 0 cm; Low = 0.1-1.49 cm; Moderate = 1.5-2.9cm; and High => 3.0cm) and compared to BAER soil burn severity categories.





**Table S1.** Holy Fire Site-specific characteristics for the nine sampling plots (6 burned, 3 unburned) located within the 2018 Holy Fire.

Site ID	Treatment	Latitude	Longitude	Elevation	Soil pH		Soil Taxonomic Class
					25 days	376 days	
CNF01	Burned	33.6901	-117.463	1228	7.25	6.33	Cieneba series; Loamy, mixed, superactive, nonacid, thermic, shallow Typic Xerorthents (Entisols)
CNF02	Burned	33.69537	-117.471	1260	6.71	6.74	
CNF03	Burned	33.69326	-117.467	1237	6.79	7.1	
CNF04	Burned	33.68456	-117.457	1260	7.11	6.84	Friant series; Loamy, mixed, superactive, thermic Lithic Haploxerolls (Mollisols)
CNF05	Burned	33.67809	-117.457	1195	6.94	7.17	
CNF06	Burned	33.67168	-117.459	1285	6.92	7.48	
CNF07	Unburned	33.67135	-117.459	1283	6.1	6.85	
CNF08	Unburned	33.66813	-117.456	1250	6.12	6.88	
CNF09	Unburned	33.6678	-117.455	1240	6.18	6.18	

**Table S2.** Total sequences and ASVs per control (positive mock communities and negative DNA extraction and PCR controls) based on Qiime2 data. Note rarefying removed all negative controls. Mock communities were manually removed after verification of taxonomy with Zymo Mock information.

Organism	Sample Type	Seq/Sample	ASVs	ASVs After Rarefaction
Fungi	All	78,202	11,480	7,445
Bacteria	All	31,052	33,078	24,874
Fungi	Mock	2997*	5*	removed
	Neg DNA Extraction	235*	9*	removed
	Neg PCR control	183*	5*	removed
Bacteria	Mock	33533*	10*	removed
	Neg DNA Extraction	1668*	12*	removed
	Neg PCR control	194*	5*	removed

\* Denotes: average sequence per sample

**Table S3.** Descriptive statistics and percent change in estimated biomass (per gram soil) and species richness (observed ASV's) between treatment (unburned (burned)) and time since fire for bacteria and fungi. The mean copy number is based on the 16S rRNA for bacteria and 18S rRNA for fungi.

	Time since fire (days)	Biomass		Richness	
		Mean Copy Num. (g <sup>-1</sup> soil)	% Change	Mean ASVs	% Change
<b>Bacteria</b>	17	243,288,300 (39,632,680)	-84	462 (604)	31
	25	235,169,333 (36,530,267)	-84	688 (486)	-29
	34	252,455,133 (107,186,067)	-58	962 (313)	-67
	67	293,834,733 (132,186,480)	-55	621 (250)	-60
	95	329,736,333 (245,489,900)	-26	302 (180)	-41
	131	276,979,018 (167,983,317)	-39	972 (378)	-61
	187	291,303,200 (241,265,883)	-17	933 (244)	-74
	286	323,115,100 (169,881,567)	-47	368 (411)	12
	376	283,013,818 (160,504,850)	-43	533 (411)	-23
<b>Fungi</b>	17	83,624,650 (2,345,940)	-97	292(161)	-45
	25	75,569,867 (3,067,448)	-96	369(117)	-68
	34	90,105,000 (10,755,267)	-88	305(77)	-75
	67	71,132,133 (14,439,620)	-80	328(60)	-82
	95	54,003,967 (10,113,017)	-81	335(85)	-75
	131	43,502,333 (4,985,833)	-89	312(93)	-70
	187	53,313,133 (11,076,350)	-79	344(118)	-66
	286	86,949,156 (16,557,783)	-81	268(119)	-55
	376	73,025,167(14,810,867)	-80	257(99)	-61

**Table S4.** Model summary results of the effect of treatment (burned vs. unburned), time since fire (TSF in days), precipitation (mm), and soil burn severity measured as ash depth (cm) at day 17 on bacterial and fungal estimated biomass (per gram soil) and richness (observed ASV's). Significance is based on the negative binomial generalized mixed effect models with plot, subplot, and time since fire as the random effect for richness and plot and time since fire as random effect for estimated biomass (gram per soil)—significance at  $p < 0.05$  (bold).

	Bacteria			Fungi		
	Est.	z value	P value	Est.	z value	P value
Biomass						
(Intercept)	19.45	91.46	< 2e-16	18.01	79.91	< 2e-16
Treatment (Burned)	-0.82	-3.29	0.001	-2.11	-7.62	2.47E-14
TSF	0.15	1.17	0.24	-0.02	-0.16	0.87
Precipitation	0.05	0.39	0.70	-0.16	-1.06	0.29
Soil burn severity (ash depth)	-0.01	-0.50	0.62	-0.0004	-0.01	0.99
Treatment (Burned): Precip	0.30	3.02	0.003	0.20	1.61	0.11
TSF x Soil burn severity (ash depth)	0.06	3.72	0.0002	-	-	-
Treatment (Burned) x TSF	-	-	-	0.44	3.46	0.001
Random Effects						
Variance/Std.Dev	0.08/0.29 <sub>Plot</sub> ; 0.11/0.33 <sub>TSF</sub>			0.08/0.29 <sub>Plot</sub> ; 0.11/0.33 <sub>TSF</sub>		
Mar. R <sup>2</sup> / Cond. R <sup>2</sup> (delta)	0.30/0.46			0.47/0.56		
Richness						
(Intercept)		47.27	<0.0001	5.8	54.69	<0.0001
Treatment (Burned)		-2.56	0.01	-0.9	-5.76	<0.0001
TSF		-0.84	0.4	0.19	2.13	0.03
Precipitation		1.38	0.17	-0.01	-0.36	0.72
Soil burn severity (ash depth)		-3.83	0.0001	-0.07	-3.48	0.001
TSF x Precipitation		-4.64	<0.0001	0.34	3.27	0.001
TSF x Soil burn severity (ash depth)		2.38	0.02	0.03	3.82	0.0001
Random Effects						
Variance/Std.Dev	0.02/0.13 <sub>Plot</sub> 0.02/0.14 <sub>Subplot</sub> 0.08/0.28 <sub>TSF</sub>			0.02/0.12 <sub>Plot</sub> 0.04/0.20 <sub>Subplot</sub> 0.01/0.08 <sub>TSF</sub>		
Mar R <sup>2</sup> / Cond. R <sup>2</sup> (delta)	0.32/0.57			0.63/0.74		

**Table S5.** Model summary results of the effect of treatment (burned vs. unburned), time since fire (TSF in days), precipitation (mm), and ash depth (cm) on arbuscular fungi (AMF), ectomycorrhizal fungi (EMF), Saprobes and Pathogens. Significance based on the negative binomial generalized mixed effect models with plot, subplot, and time since fire as random effect—significance at  $p < 0.05$  (bold).

	AMF			EMF		
	Est.	z value	P value	Est.	z value	P value
(Intercept)	-0.98	-1.71	0.09	1.52	4.57	<b>&lt;0.0001</b>
Treatment (Burned)	-4.10	-4.34	<b>&lt;0.0001</b>	-1.09	-2.18	<b>0.03</b>
TSF	-	-	-	-0.09	-1.25	0.21
Soil burn severity (ash depth)	-	-	-	-0.19	-2.77	<b>0.01</b>
Precipitation	-	-	-	0.00	-0.06	0.95
Treatment (Burned) x Precipitation	-	-	-	-0.37	-3.92	<b>&lt;0.0001</b>
Treatment (Burned) x TSF	-	-	-	-0.68	-7.04	<b>&lt;0.0001</b>
<b>Random Effects</b>						
Variance/Std.Dev	0.23/0.48 <sub>Plot</sub> 0.45/0.67 <sub>Subplot</sub> 0.03/0.17 <sub>TSF</sub>			6.3e <sup>-10</sup> /2.5e <sup>-05</sup> <sub>Plot</sub> 3.06/1.75 <sub>Subplot</sub> 0.06/0.25 <sub>TSF</sub>		
Mar R <sup>2</sup> / Cond. R <sup>2</sup>	0.55/0.81			0.20/0.37		
	Saprobes			Pathogens		
	Est.	z value	P value	Est.	z value	P value
(Intercept)	-0.06	-0.35	0.73	-1.28	-4.83	<b>&lt;0.0001</b>
Treatment (Burned)	-1.96	-7.37	<b>&lt;0.0001</b>	-1.48	-3.63	<b>0.0003</b>
TSF	-0.36	-3.07	<b>0.002</b>	-	-	-
Precipitation	-	-	-	0.09	0.52	0.60
Treatment (Burned) x Precipitation	-	-	-	-0.88	-2.16	<b>0.03</b>
Treatment (Burned) x TSF	0.68	3.42	<b>0.001</b>	-	-	-
<b>Random Effects</b>						
Variance/Std.Dev	1.01e <sup>-11</sup> /3.2e <sup>-06</sup> <sub>Plot</sub> 0.18/0.42 <sub>Subplot</sub> 0.01/0.08 <sub>TSF</sub>			7.2e <sup>-12</sup> /2.7e <sup>-06</sup> <sub>Plot</sub> 0.34/0.58 <sub>Subplot</sub> 3.9e <sup>-13</sup> /6.3e <sup>-07</sup> <sub>TSF</sub>		
Mar R <sup>2</sup> / Cond. R <sup>2</sup>	0.21/0.25			0.11/0.16		

**Table S6.** Permutational multivariate analysis of variance (PERMANOVA) of bacterial and fungal community composition and the effects of treatment (burned vs. unburned), time since fire (TSF) in days, Initial ash depth (soil burn severity), and total precipitation (mm) and their respective interactions. Significance  $p < 0.05$  (bold).

	Variable	Sum of Sqs.	R2	F	P value
Bacteria	Treatment	14.34	0.13	50.47	<b>0.0001</b>
	Time since fire	4.33	0.04	15.25	<b>0.0001</b>
	Total Precipitation	3.20	0.03	11.26	<b>0.0001</b>
	Initial Ash Depth	1.98	0.02	6.97	<b>0.0001</b>
	Treatment x Initial Ash Depth	2.27	0.02	8.00	<b>0.0001</b>
	Treatment x Total Precipitation	1.53	0.01	5.39	<b>0.0001</b>
	Time since fire x Initial Ash Depth	0.52	0.005	1.82	<b>0.03</b>
Fungi	Treatment	12.49	0.10	34.52	<b>0.0001</b>
	TSF	1.80	0.01	4.98	<b>0.0001</b>
	Total Precipitation	1.12	0.01	3.10	<b>0.0001</b>
	Initial Ash Depth	2.32	0.02	6.40	<b>0.0001</b>
	Treatment x Time Since Fire	1.16	0.01	3.21	<b>0.0005</b>
	Treatment x Total Precipitation	0.66	0.01	1.82	<b>0.02</b>
	Time since fire x Initial Ash Depth	0.43	0.003	1.17	0.23

**Table S7.** Measures of successional dynamics for bacterial and fungal communities between treatments (burned vs. unburned) where the unburned values are inside the parenthesis. Turnover rates (proportion of species that differ between time points), appearance (relative species appearance between time points) and disappearance (relative species disappearance between time points), rates of change (rate of directional change in community composition over time), Stability (of total species abundance as a measure of equilibrium) and Synchrony (a measure of whether abundance fluctuations are homo- or heterogeneous over time). Higher values represent a higher rate for each category.

Microbe	TSF days	Turnover Rate	Appearance	Disappearance	Rate of change	Stability	Synchrony
<b>Bacteria</b>	25	0.59 (0.54)	0.25 (0.40)	0.34 (0.14)			
	34	0.51 (0.50)	0.15 (0.21)	0.36 (0.29)			
	67	0.45 (0.43)	0.21 (0.27)	0.24 (0.16)			
	95	0.50 (0.56)	0.15 (0.14)	0.35 (0.42)	0.16	8.35	0.03
	131	0.37 (0.40)	0.19 (0.16)	0.19 (0.24)	(0.12)	(5.36)	(0.22)
	187	0.50 (0.58)	0.31 (0.21)	0.19 (0.38)			
	286	0.50 (0.64)	0.28 (0.32)	0.22 (0.32)			
	376	0.50 (0.35)	0.26 (0.25)	0.24 (0.10)			
<b>Fungi</b>	25	0.61 (0.50)	0.26 (0.37)	0.34 (0.13)			
	34	0.52 (0.43)	0.14 (0.30)	0.38 (0.13)			
	67	0.52 (0.53)	0.28 (0.28)	0.24 (0.25)			
	95	0.42 (0.47)	0.27 (0.25)	0.15 (0.23)	0.49	6.42	0.04
	131	0.52 (0.57)	0.29 (0.27)	0.23 (0.30)	(0.08)	(8.58)	(0.05)
	187	0.55 (0.53)	0.40 (0.24)	0.15 (0.29)			
	286	0.53 (0.53)	0.15 (0.24)	0.38 (0.29)			
	376	0.42 (0.58)	0.19 (0.31)	0.23 (0.27)			