Supplementary Information

S1 Pyrodiversity and environmental heterogeneity weighted metrics

S1.1 Pyrodiversity

To calculate the weighted pyrodiversity metric we used a functional diversity framework (Villéger *et al.*, 2008; Schleuter *et al.*, 2010; Laliberté & Legendre, 2010). We treated fires like traits and the different fire severity values as trait values. Within a fire, the severities are treated as ranked traits (so low severity fire is more similar to a moderate severity fire than a high). Pixels are species categorized by different combinations of fire traits. We also weighted the importance of different fires in determining the uniqueness of fire histories by the number of years ago they occurred. Within each buffer around the monitoring site, we calculated the number of pixels of each combination of fire traits. We then used the metric of functional dispersion to calculate the diversity of fire histories weighted by similarity (Laliberté & Legendre, 2010).

S1.2 Environmental heterogeneity

Spatial data were prepared in ArcGIS 10.2. Environmental variables originated with a USGS 10 meter Digital Elevation Model and projected using bilinear interpolation into NAD 83 UTM 11N (Gesch *et al.*, 2002). Heat load and topographic compound index were generated with an ArcScript (Fig. S1, McCune & Keon, 2002; Dilts, 2010; Evans *et al.*, 2014). We rounded the values of the environmental variables to the hundredth decimal place.

We used a similar procedure to calculate environmental heterogeneity as we did for pyrodiversity. We treated environmental variables like traits and the different values of those variables as trait values. Pixels are species categorized by different values of each environmental variable. Unlike pyrodiversity, however, the weighted diversity of each environmental variable was calculated separately because treating the different variables as different "traits" of pixels lead to too many unique combinations of traits values to estimate a meaningful metric of heterogeneity.

S2 Dissimilarity standardization

Dissimilarity estimates can be affected by the total number of species sampled at a site (e.g., Chase *et al.*, 2011). We use null models to estimate the deviation of the observed β-diversity from that which would be expected under a completely random community assembly process Chase *et al.* (2011).

Randomly assembled communities were generated by constraining the species richness so that they were the same as those in the observed communities. The algorithm randomizes a binary matrix while maintaining the same row sums (species richness at a site) and column sums (number of sites at which a species was observed) using the quasiswap method in the R function commsimulator (Oksanen *et al.*, 2013). We then calculated the fraction of randomly assembled communities with dissimilarity values less than (and half of those equal to) that of the observed community. We used this fraction as a "corrected dissimilarity score" for our observed data. Corrected dissimilarity values near one indicate that our observed communities exhibit more species turnover between sites than expected under a random assembly process while values near 0.5 indicate that our observed communities exhibit levels of turnover more in line with the null expectation.

To account for the fact that the same pair-wise comparisons were included in each year (i.e., the dissimilarity between site 1 and site 2), we included a random effect of each site-site combination. This helps account for the non-independence of pair-wise dissimilarities but does not account for spatial non-independence (i.e., the dissimilarity of site 1 and site 2 is not independent from the dissimilarity of site 2 and site 3, Anderson *et al.*, 2011). P-values for linear mixed models were obtained using Satterthwate's approximations (Kuznetsova *et al.*, 2014).

References

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Table S1: The support for including pyrodiversity weighted by fire history similarity and its interaction with fire severity and drought intensity. χ^2 values represent the ratio of the likelihoods of the model with and without the variable of interest. P-values are calculated via 1000 parametric bootstrap iterations. They represent the probability of observing a χ^2 value more extreme than the observed value when data is simulated from the model without the variable of interest. Symbols denote significance, with ′, * and ** indicating 0.1, 0.05 and 0.01, respectively. Significant terms are bolded.

	Buffer radius	χ^2	P-value	χ^2	P-value	χ^2	P-value
Bee Richness	100	2.821	0.133	4.487	0.383	8.345	0.369
	150	0.1	0.764	10.683	0.057′	14.051	0.08′
	200	0.364	0.576	9.085	0.109	10.653	0.184
	250	0.191	0.713	3.454	0.481	6.182	0.562
Floral Richness	100	1.745	0.257	5.901	0.246	8.943	0.309
	150	1.592	0.259	9.682	0.088′	10.808	0.177
	200	2.361	0.2	5.356	0.303	5.916	0.563
	250	0.572	0.511	4.409	0.385	4.608	0.678
Interaction Richness	100	2.835	0.175	4.483	0.352	10.316	0.190
	150	0.11	0.762	10.698	0.057′	15.236	0.063′
	200	0.376	0.577	8.973	0.097′	11.219	0.175
	250	0.21	0.726	3.406	0.511	7.169	0.439

Table S2: The support for including heat load diversity and interaction with fire severity and drought intensity.

	Buffer radius	χ^2	P-value	χ^2	P-value	χ^2	P-value
Bee Richness	100	2.131	0.205	6.124	0.243	11.7	0.177
	150	2.749	0.153	6.643	0.227	10.115	0.228
	200	**5.596**	0.043$*$	6.911	0.199	9.651	0.235
	250	**6.275**	0.027$*$	7.627	0.148	11.165	0.185
Floral Richness	100	0.968	0.415	5.803	0.280	7.173	0.452
	150	1.58	0.268	5.47	0.274	5.881	0.588
	200	2.196	0.205	2.986	0.566	3.48	0.817
	250	1.99	0.236	3.051	0.535	4.278	0.737
Interaction Richness	100	2.164	0.210	6.158	0.244	14.162	0.070
	150	2.75	0.149	6.644	0.217	11.8	0.136
	200	**5.561**	0.030$*$	6.865	0.221	11.033	0.175
	250	**6.219**	0.034$*$	7.584	0.171	12.852	0.103

Table S3: The support for including topographic compound index diversity and interaction with fire severity and drought intensity. Including this variable in the model was not supported by the data.

	Buffer radius	χ^2	*P*-value	χ^2	*P*-value	χ^2	*P*-value
Bee Richness	100	1.058	0.363	1.062	0.852	3.565	0.828
	150	1.479	0.288	1.564	0.782	5.361	0.619
	200	0.914	0.414	1.345	0.823	3.635	0.798
	250	0.247	0.653	1.714	0.761	3.318	0.845
Floral Richness	100	0.384	0.594	0.741	0.902	2.771	0.881
	150	0.736	0.458	0.856	0.904	1.858	0.960
	200	1.213	0.336	1.305	0.824	2.766	0.903
	250	0.861	0.432	1.453	0.808	2.829	0.854
Interaction Richness	100	1.033	0.371	1.037	0.893	4.726	0.723
	150	1.466	0.278	1.557	0.775	7.102	0.449
	200	0.904	0.432	1.334	0.838	4.698	0.706
	250	0.243	0.659	1.686	0.775	4.003	0.777

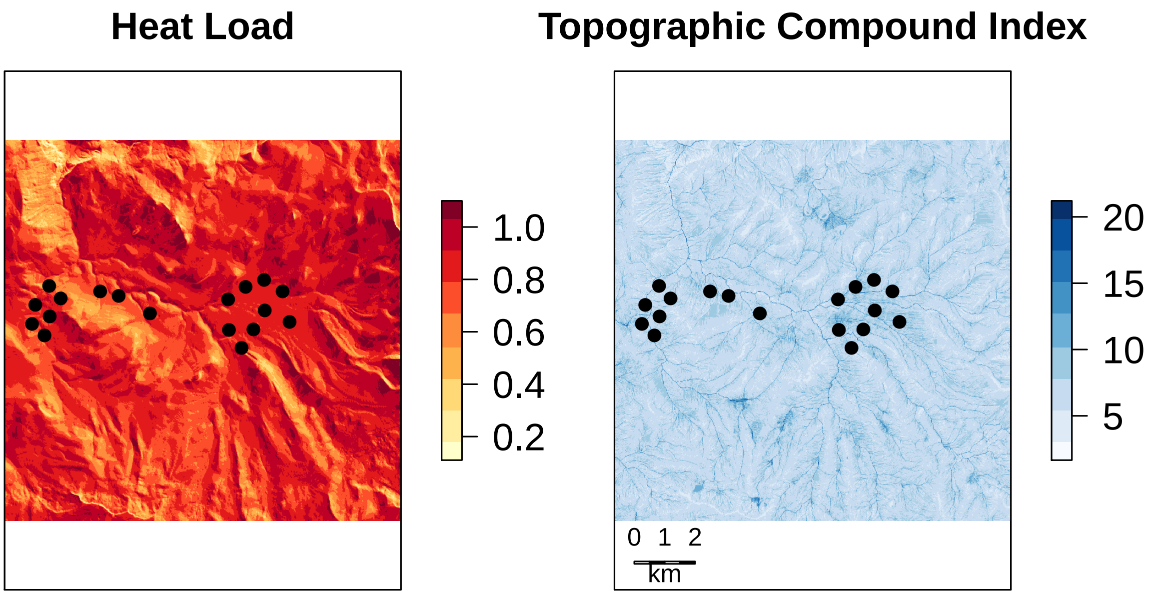

Figure S1: The distribution of heat load estimates, topographic compound index estimates in the Illilouette Basin. Monitoring sites are indicated by points.

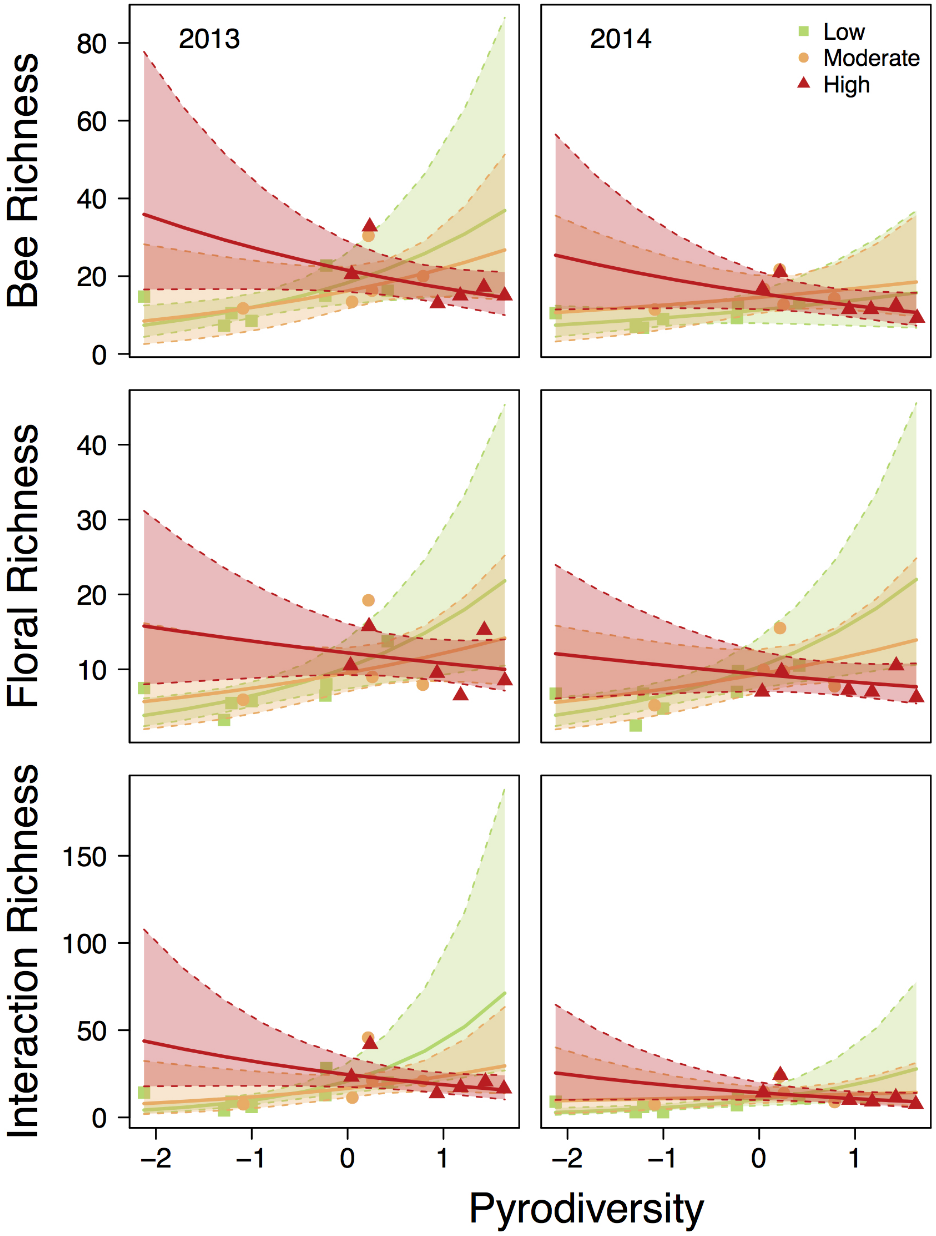

Figure S2: The response of floral, bee and interaction richness to pyrodiversity weighted by the similarity of fire history. The color of the curves and points correspond to low, moderate and high severity fires classifications. The columns depict trends in 2013 and 2014, severe and extreme/exceptional drought years, respectively. The solid line indicates the mean slope estimate and the dashed lines are the 95% confidence intervals around the estimate. Points represent the richness of plants, pollinators and interactions averaged across the study season. Pyrodiversity axis is scaled so zero represents the mean pyrodiversity.

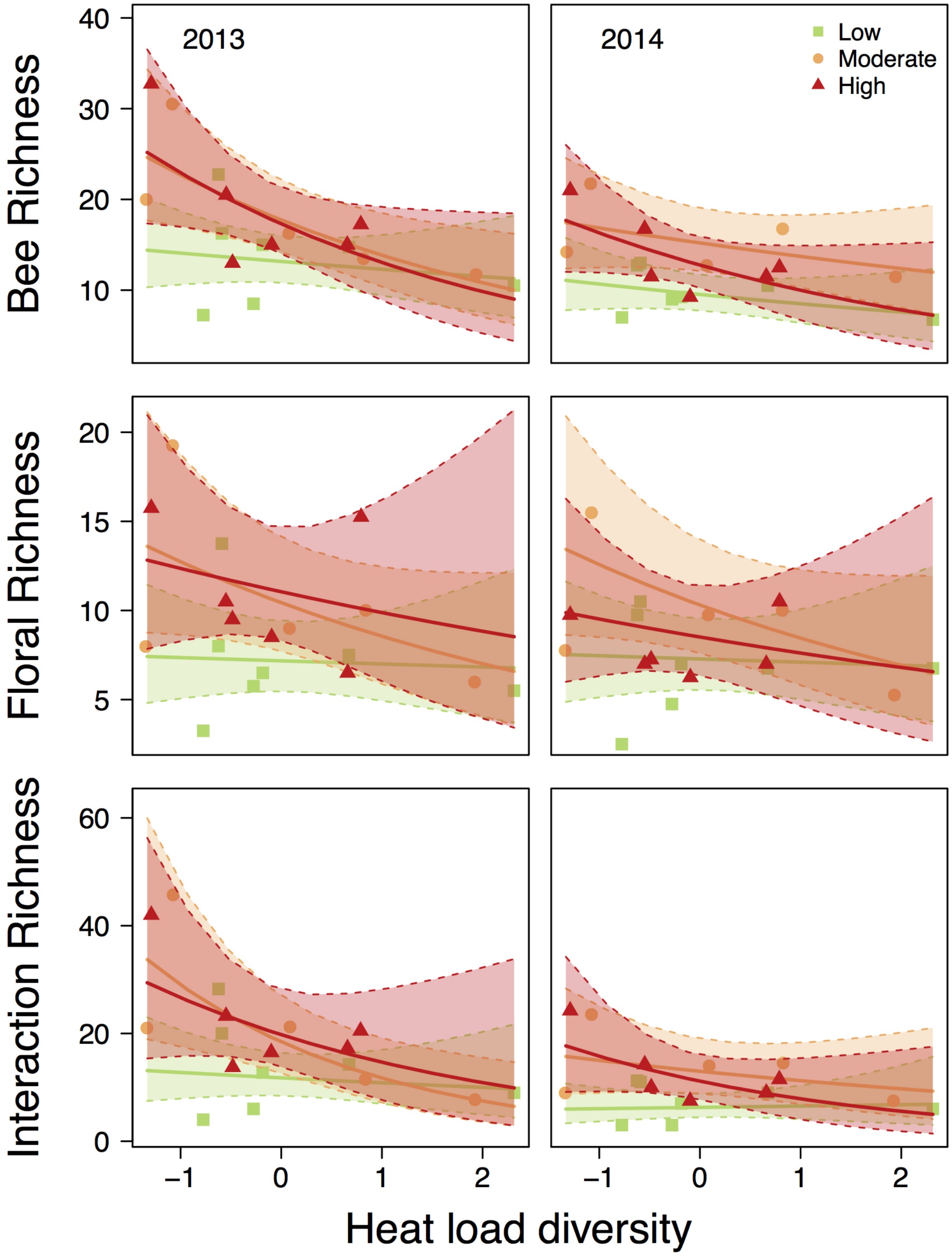

Figure S3: The response bee, floral and interaction richness to heat load diversity.

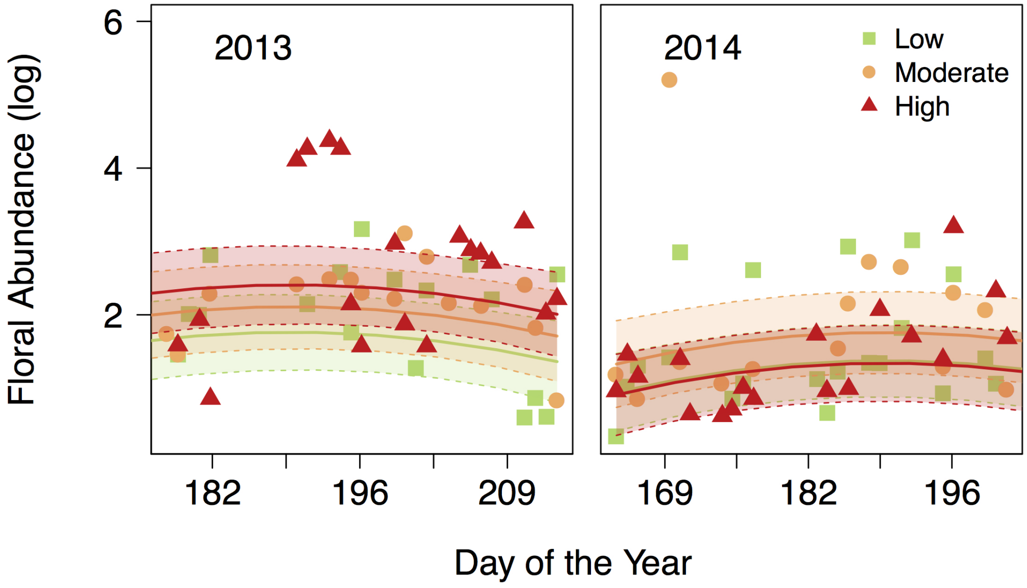

Figure S4: The effect of fire severity on the abundance of floral resources throughout the study season. Points represent the mean species abundance of floral resources at each site.

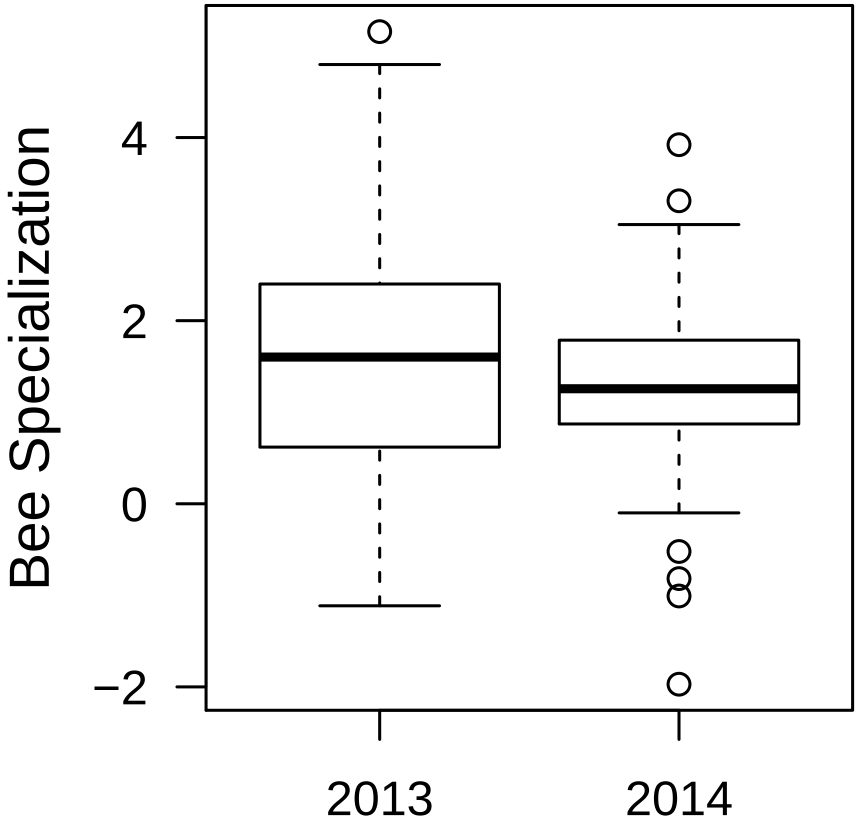

Figure S5: The specialization of pollinator communities across the study landscape in severe (2013) and extreme (2014) drought years. To account for the differences in the abundance distributions and species richness between years, we generated an ensemble of 9999 randomly assembled communities and calculated *z*-scores of specialization by subtracting the mean of the specialization estimator of the randomly assembled communities from the observed specialization estimator and dividing by the standard deviation of the specialization estimators.

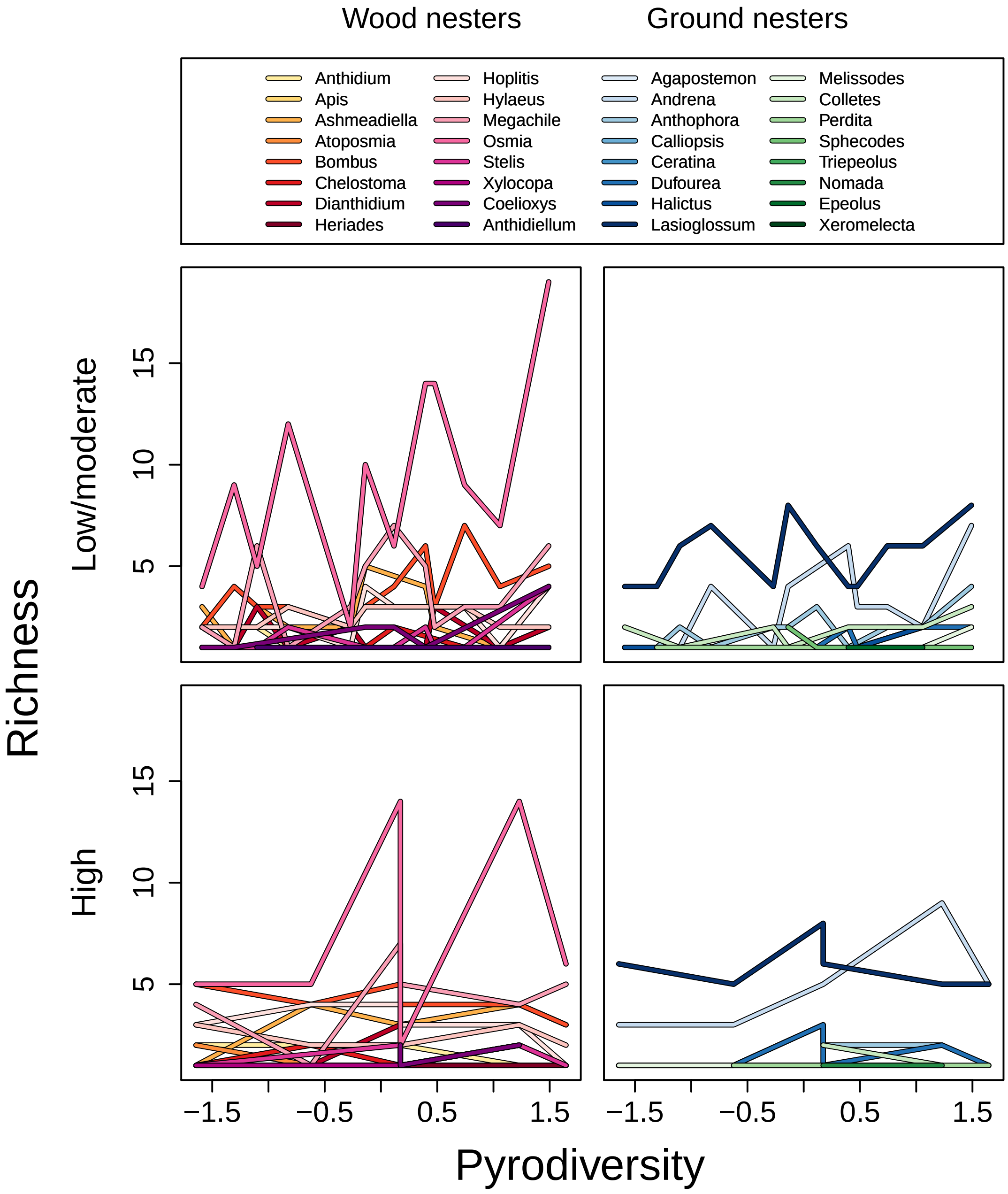

Figure S6: The response of richness of species within the 32 genera collected to pyrodiversity. The top panels are the patterns found in sites where the most recent fire was of low or moderate severity, and the bottom panels are high severity sites. The left panels are the genera where the majority of species use wood to nest, and primarily ground-nesting genera are on the right panel. Multiple genera of both wood- and ground- nesters responded positively to pyrodiversity in the low and moderate severity sites. Few genera responded to pyrodiversity in high severity sites.