Ecography

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Supplementary material

Appendix 1.

Woody biomass and vegetation ground cover in paired reintroduction and control plots

Introduction

Woody biomass surveys were conducted in order to compare habitat types in the reserves and control plots in order to assess that the study plots are true representations of the same habitat on both side of the predator-proof fence. Woody plant structure indicates long-term (decade-long) plant responses to the environment (e.g. Clarke et al. 2010), so should provide a good indication of site similarity prior to reintroductions. The surveys did not aim to be representative of the whole landscape, but to test the validity of the paired control and reintroduction study plots as replicates. It was assumed that if the measured woody biomass (alive and dead) is not different, that the long living annual species had undergone similar ecological processes on both sides of the predator proof-fence A similar woody biomass measure provides evidence that plots belong to the same habitat type and had undergone similar ecological processes prior to the installation of predator-proof fences and reintroduction of soil disturbing mammals. If the plots were different in their woody structure, it is highly likely that the paired plots did not belong to the same habitat type within a site and the soil processes at the study plots would have been driven by the local habitat type rather than soil disturbing mammal presence/absence.

Methods

Woody biomass surveys were conducted in each 20 m by 20 m study plot for the landscape-scale study, using two transects running east-west 6 m from the northern and southern edge of the plot to estimate differences between reintroduction and control plots. We conducted woody cover surveys along two 20 m transects at each study plot. Every metre along the transects, at each study plot, a pole was dropped, and the woody ground cover type that the pole hit first was recorded. This resulted in a 20 point-record documenting the woody ground cover. Woody cover types included: dead wood, tree and shrub. The total number of hits of each woody cover type was analysed as a proportion of hits per plot. In addition to the point-transects, percentage tree canopy cover was estimated every 4 m along each transect (resulted in a 10 point - survey) by the same observer at every study plot. A mean percentage over the whole study plot was used in analyses. Woody biomass was also assessed by counting individual trees and measuring the chest-height circumference (of ten randomly selected individuals) of the site's dominant tree species to estimate tree age and assess any major changes.

Non-woody ground cover was surveyed using the same methods as described above for the woody cover survey. We used this data to test if non-woody ground cover differed between reintroduction and control plots and if altered ground cover might drive changes in the measured soil variables. Vegetation cover types included bare ground, cryptogamic crust cover, litter or dead wood cover, plant ground cover (grass and forb species), shrub and tree cover.

Woody biomass of the paired plots was compared using one-way analysis of variance testing each site separately to detect differences between paired reintroduction and control plots for the landscape-scale study. Spearman's correlation tests were used to test correlations among soil variables (available C and N, microbial enzymes) and vegetation ground cover proportions for the landscape-scale study to assess if the vegetation cover in sanctuaries were altered by soil disturbing mammal activity, which could drive the changes in measured soil variables.

Results and Discussion

We found no significant differences in long term habitat structure between the paired plots in the reintroduction and control plots for all but one variable: tree numbers in Karakamia differed between reintroduction and control plots (Table S1.1). This significant difference was represented by only an average difference of one tree between reserve (average tree number=8.6) and control plots (ave. tree number = 9.6, however the variance was greater inside the reserve (standard error = 0.4) than in the control plots (standard error = 0.2). This difference (of one) at Karakamia therefore was not identified as a major change between the reserve and control plots. Given that the woody biomass and structure did not differ within each site, we could confirm that plots were of the same habitat type and same habitat age at each site.

In general, there were no consistent trends in the response of either carbon or nitrogen, or soil enzymes to environmental variables (Fig. S1.1). Although we found no consistent relationships among enzyme activities and environmental variables across the gradient, activities of the four enzymes were correlated positively with litter cover, but negatively with plant cover, at the site with the greatest precipitation (877 mm; Karakamia, Figure S1.1). This trend might be caused by nutrient-poor leaves of the Jarrah eucalypt (*Eucalyptus marginata*), which dominated our wettest site (Hingston et al. 1980, Banning et al. 2008). Finally, biocrusts occurred at only two of our sites (Yookamurra and Scotia), where they were positively correlated with most enzymes, consistent with the large body of literature on biocrusts, soil enzymes and nutrients (e.g. Delgado-Baquerizo et al. 2013).

Table A1.1. F-ratio (p-value) from analysis of variance testing for differences in woody biomass between paired plots in the reintroduction and control plots at each site. Significant differences are presented in bold type.

	Dead wood density	Tree density	Canopy cover	Tree no.	Tree circumference
Arid Recovery	0.37 (0.55)	1.90 (0.17)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)
Scotia	0.04 (0.84)	1.18 (0.28)	0.58 (0.45)	1.08 (0.30)	1.89 (0.18)
Yookamurra	0.20 (0.66)	0.00 (1.00)	NA	0.08 (0.78)	0.03 (0.87)
Mt Rothwell	0.00 (1.00)	0.00 (1.00)	0.36 (0.54)	0.05 (0.82)	1.16 (0.29)
Karakamia	0.11 (0.74)	0.22 (0.64)	2.21 (0.14)	4.45 (**0.04**)	0.02 (0.89)

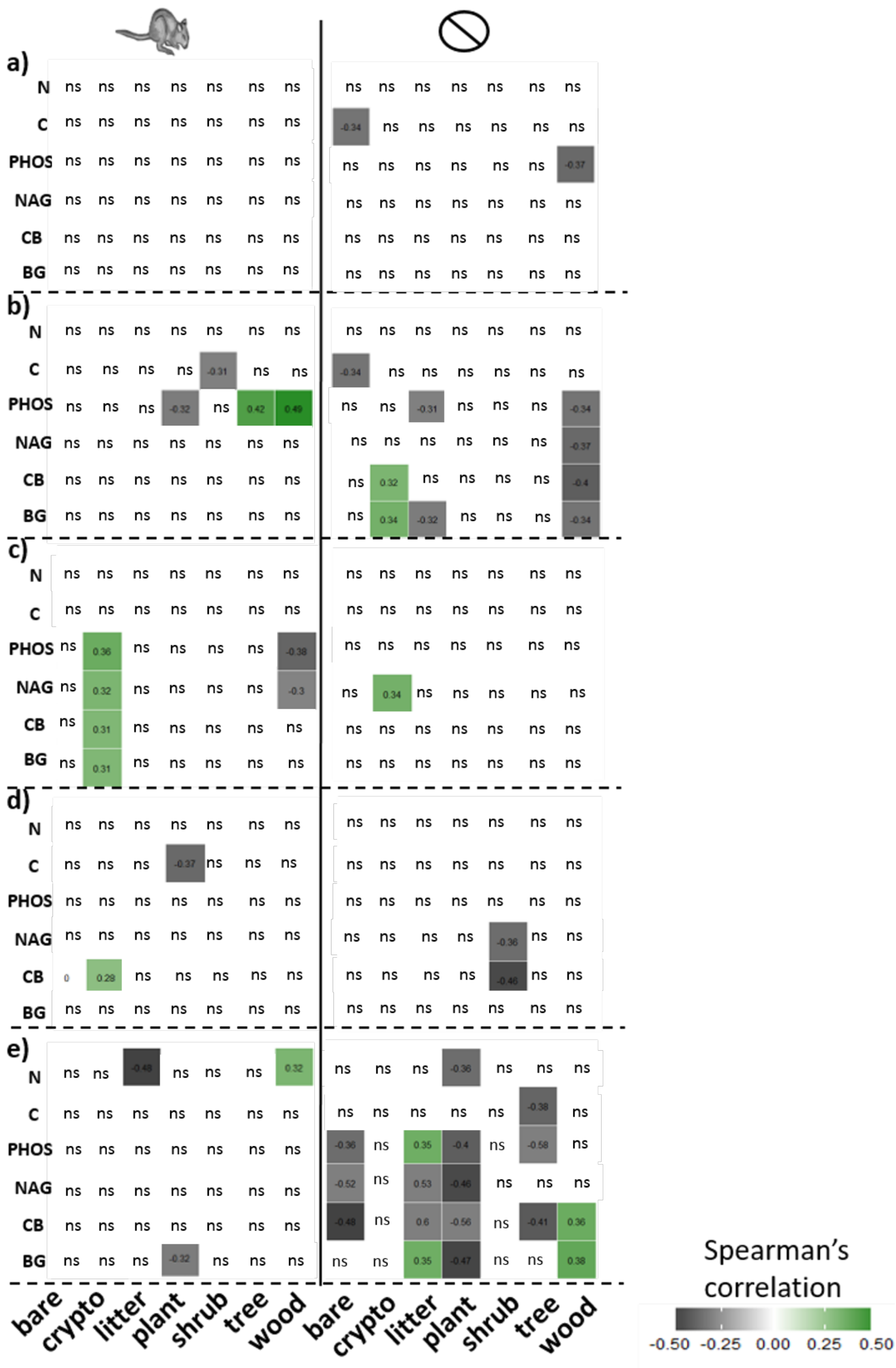

Figure A1.1. Spearman rank correlation matrix of cover and soil variables at **a)** Arid Recovery, **b)** Scotia, **c)** Yookamurra, **d)** Mount Rothwell and **e)** Karakamia. Sites are separated into reintroduction (left) and control plots (right). Only significant correlations are shown in the table ($p > 0.05$), whereas values coded with ns are not significant correlations.

References

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