

WATTLE-IT-BE? KEY FACTORS INFLUENCING REGENERATION OF ACACIA AFTER BUSHFIRE.

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Background

Woody legumes, typified by wattles (*Acacia* spp.), play a central role to restore ecosystems following bushfires. When their seeds are exposed to heat they germinate quickly, helping to stabilise soil and return nitrogen (N) to the system.

A low density population can fix up to 187 kg N per hectare in a year. Thus, acacias have been shown to boost net primary productivity, thereby increasing fuel production.

However, their population densities have not been predictable. A recent study suggested low levels of phosphorous (P) in soil might give acacias a competitive advantage.³ This knowledge is important to predict ecosystem resilience and fuel recovery following fire.

Aim

To investigate which soil and landscape factors favour dense recruitment of woody legumes following bushfire.

Synthesis

- ~ Population densities of woody legumes were highest on steeper, drier slopes – areas least conducive to hazardreduction burns.
- ~ Some woody legumes express enzymes known to increase soil available P.
- ~ These species boost ecosystem resilience in marginal areas helping to justify the decision not to prescribe-burn slopes.

End-User Statement

This research informs plans for hazardreduction burns and highlights natural processes allowing forests to rapidly recover following bushfire.

Ion Maher, Ranger in Charge, Kinglake, Parks Victoria

density A high density of woody legumes will increase resilience of ecosystems subjected to high intensity

bushfires in areas with

low fuel and soil

slopes.

index (TWI).

moisture and steep

Population.

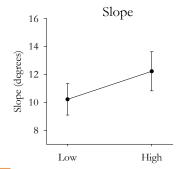
The accuracy of the full model to predict low versus high population density was similar when only three co-variables were used: slope, total P, and topographic wetness

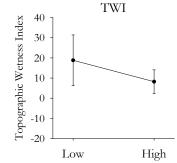
Ordinal logistic regression described a model with nine predictive covariables. The odds ratio describes their slope relative to increasing density

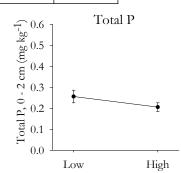
variables. The odds rado describes their slope relative to increasing density.							
	Estimate	Odds Ratio	Sig	Model fit	Deviance	Parallelism	
Model 1				< 0.001	0.8	0.131	
pН	-2.31	10.07	0.01	Population densities			
EC	-0.069	1.07	0.02	ਜੂ 5000 ਬੁ		Low density Medium density	
Total C	-0.021	1.02	0.03	- 4000 -	I	High density	
Total P	0.005	0.99	0.03	3000 -			
Percent clay	-0.078	1.08	0.01	2000	.	ī	
Solar hours, 2009	6.366*10-6	1.00	0.01	Individu			
Slope	-0.287	1.33	< 0.01	مح و	an in in	₩ XÞ	
Aspect	-0.004	1.00	0.04	Larige.	Eprosa Libraria de Abara G. Podra	grifter	
TWI	-0.798	2.22	< 0.01	b . k	W. W. G. Oly	rating and a second	

Full Model				
	Low	High		
Low	74.5	25.5		
High	24.1	75.9		

Slope, Total P, TWI						
	Low	High				
Low	59.3	40.7				
High	38.9	61.1				

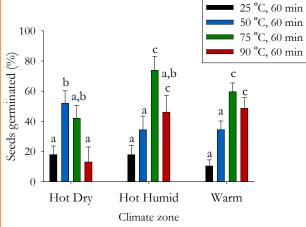






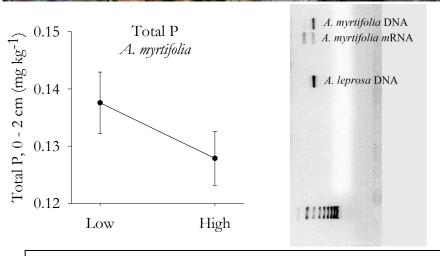
Seed germination

Woody legumes from bushfireprone areas germinate best at temperatures reminiscent of fire with a high rate of spread (e.g., uphill).



Species from arid climates germinated at temps achievable by solar irradiance. Significant difference indicated when bars have different letter.

P-acquiring enzymes A. myrtifolia from a high density population expressed gene for malate dehydrogenase – potentially enabling it to acquire P otherwise unavailable (bound by soil cations.)



- 1. Attiwill, P.M. & May, B.M., Mar Freshwater Res, 52:111, 2001.
- 2. Vitousek, P.M. et al, Biogeochem, 57:1, 2002.
 - 6. Houlton, B.Z. et al, Nature, 454:327, 2008.



