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Microclimate and soil properties of older bilby diggings at Lorna Glen rangelands restoration project

Dr Tamra F Chapman

Figure 1 Location of Operation Rangelands Restoration, Lorna Glen, Western Australia.

For rangeland areas that have been set aside for conservation, ecosystem processes can be restored by re-introducing native fauna that dig while foraging. This study investigated the microclimate and soil properties of three year old bilby (*Macrotis lagotis*) diggings in Western Australia's goldfields.

Methods

Conducted at ex-pastoral station Lorna Glen (Mutawa), about 1,100 kilometres northeast of Perth (Figure 1), this project was part of a broader program: Operation Rangelands Restoration. Lorna Glen is a 244,000-hectare proposed conservation reserve managed by the Department of Environment and Conservation in conjunction with the Martu Aboriginal community from nearby Wiluna.

Microclimate loggers were placed in diggings and in duplicate positions on nearby undisturbed soil for 12 diurnal periods and 12 nocturnal periods. An electronic cone penetrometer was used to record soil compaction of digging spoil mounds and adjacent undisturbed soil. Three dimensional digital modelling was used to measure the morphology of the diggings, which was compared with microclimate to determine if microclimate varied with digging size and shape.

Figure 2 Microclimate logger in three-year-old bilby digging. Photo – Tamra Chapman/DEC.

Results

During the daytime, diggings had significantly higher mean relative humidity and dew point temperature and significantly lower wind speed than undisturbed soil. At night, mean temperature was significantly higher and mean relative humidity was significantly lower for diggings than undisturbed soil. Diggings also had significantly lower range for temperature and relative humidity than undisturbed soil at night (Figure 3). Humidity was less variable in large volume diggings and more variable in small volume diggings at night.

Soils from the bottom of the diggings were significantly higher in available nitrogen (ammonium and nitrate), exchangeable potassium and magnesium and total cation exchange capacity (CEC)than undisturbed soil (Table 1). The soils of digging spoil mounds were less compact than undisturbed soil (Figure 4).

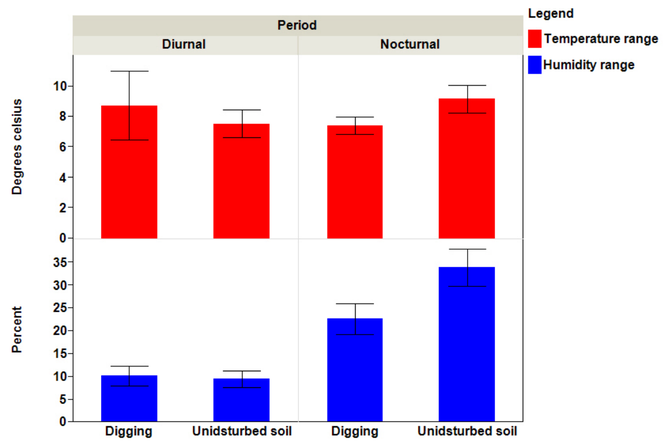

Figure 3 Comparison of range for mean temperature and humidity in bilby diggings (bars show standard error).

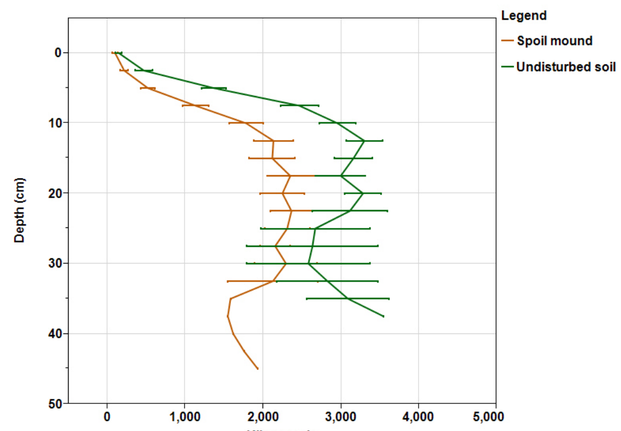

Figure 4 Comparison of soil compaction for digging spoil mounds and adjacent undisturbed soil (n = 23 replicates, bars show standard error).

	Digging		Undisturbed soil		Test results	
Parameter	**Mean**	**s.e.**	**Mean**	**s.e.**	**t**	**p**
Ammonium+nitrate mg/Kg	8.667	1.810	2.750	0.279	-3.616	0.0041
Phosphorus (Colwell) mg/Kg	3.167	0.207	3.917	0.358	1.529	0.1546
Potassium (Colwell) mg/Kg	112.083	10.602	87.917	8.914	-2.374	0.0369
Organic Carbon %	0.235	0.028	0.246	0.037	-0.001	0.9993
Total Carbon %	0.301	0.032	0.309	0.041	-0.230	0.8223
Total Nitrogen %	0.059	0.004	0.059	0.003	-0.029	0.9771
Exc. Magnesium meq/100g	0.185	0.014	0.093	0.009	-5.378	0.0002
Exc. Potassium meq/100g	0.296	0.033	0.194	0.016	-5.590	0.0002
CEC Ca,Mg,K,Na meq/100g	0.868	0.069	0.603	0.065	-3.346	0.0065

Table 1 Comparison of soil chemistry for diggings and undisturbed soil using paired t-Tests (n = 12).

Discussion

Greater soil fertility in diggings may be explained by a number of processes operating alone or in combination.

- Removal of the nutrient deficient surface soil by bilbies exposes the more fertile sub-soil.
- Given that the diggings were around three years old, accumulation and mixing of litter and soil, including that transported from the de-compacted spoil mounds, may have increased soil fertility.
- Milder and less variable microclimate conditions in diggings may facilitate nutrient mineralisation via littler breakdown and the activity of soil fauna and fungi.
- Exchangeable nutrients may be released in pulses during periodic alternate wetting and drying of the soil; a typical climatic pattern at Lorna Glen.

This study has shown that bilbies increase heterogeneity of soil fertility, compaction and microclimate. Milder microclimate and greater soil fertility in diggings may potentially benefit plant germination and productivity and fauna seeking to use diggings as refuges and habitats.

Photo – Bert and Babs Wells/DEC.

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