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

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## Introduction

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 effects of bilby (*Macrotis lagotis*) diggings on the microclimate and physical and chemical properties of the soil in Western Australia's goldfields.

Photo Bert and Babs Wells / DEC

## Methods

Conducted at ex-pastoral Lorna Glen Station (Mutawa), about 1,100km northeast of Perth (Figure 1), this project was part of a broader program: Operation Rangelands Restoration. Lorna Glen is a 244,000 ha proposed conservation reserve managed by the Department of

Environment and Conservation in conjunction with the Martu Aboriginal community from nearby Wiluna.


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

Microclimate loggers were placed in diggings and in duplicate positions on nearby undisturbed soil for 12 diurnal periods and 12 nocturnal periods in August and September 2011. An electronic cone penetrometer was used to record soil compaction for digging spoil heaps 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 a c. three year old bilby digging (Photo Tamra Chapman / DEC).**

## Results

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

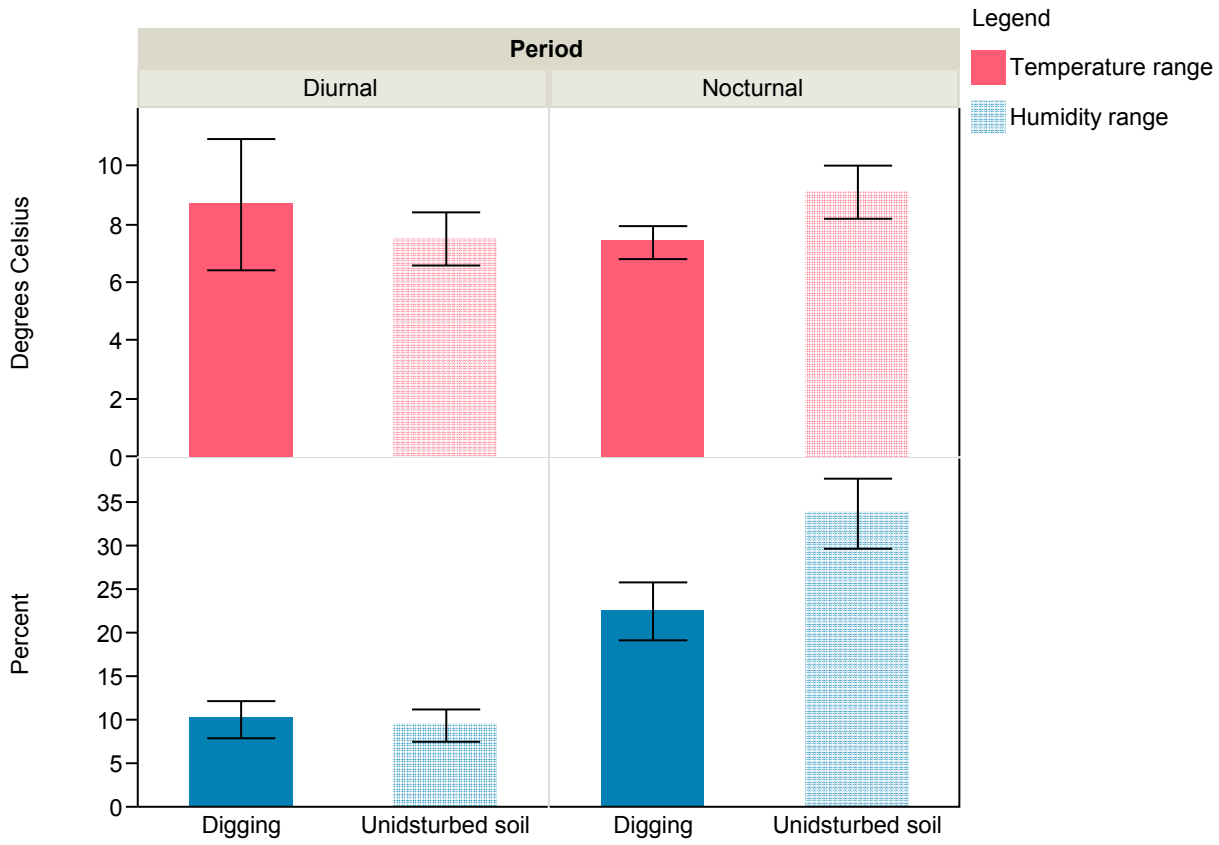


**Figure 3 Comparison of variation in mean temperature and humidity in bilby diggings for 12 diurnal periods and 12 nocturnal periods in August and September 2011 (bars show standard error).**

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 than undisturbed soil (Table 1). The soils of digging spoil heaps were less compact than undisturbed soil (Figure 4).

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

| | 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** |

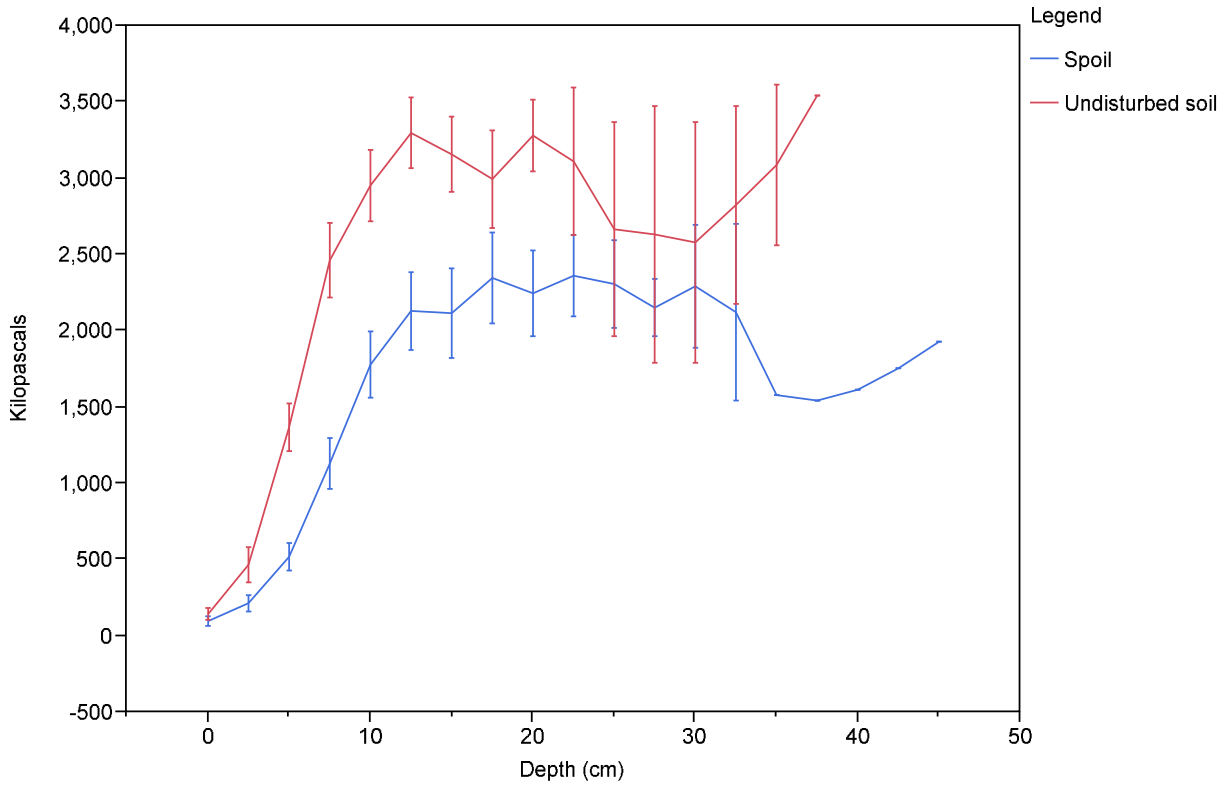


**Figure 4 Comparison of soil compaction for digging spoil heaps and adjacent undisturbed soil (*n* = 23 replicates, bars show standard error).**

## Discussion

Greater soil fertility in diggings may be explained by a number of processes operating alone or in combination. First, removal of the nutrient deficient surface soil by bilbies exposes the more fertile sub-soil. Second, given that the diggings were around three years old, accumulation and mixing of litter and soil, including that transported from the de-compacted spoil heaps, may have increased soil fertility. Third, the milder and less variable microclimate conditions in diggings may facilitate nutrient mineralisation via litter breakdown and the activity of soil fauna and fungi. Finally, exchangeable nutrients may be released in pulses during periodic alternate wetting and drying of the soil, typical of the 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.

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