Impact of Mineral Exploration on Ecosystem Characters and Mallee Vegetation of Pinkawillinie Conservation Park, South Australia

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“So erst the Sage with scientific truth
In Grecian temples taught the attentive youth;
With ceaseless change how restless atoms pass
From life to life, a transmigrating mass;
Hoe the same organs, which to day compose
The poisonous henbane, or the fragrant rose,
May with to morrow’s sun new forms compile,
Frown in the Hero, in the Beauty smile.
Whence drew the enlighten’d Sage the moral plan,
That man should ever be the friend of man;
Should eye with tenderness all living forms,
His brother-emmets, and his sister-worms.”

‘The Temple of Nature’ by Erasmus Darwin 1731-1802

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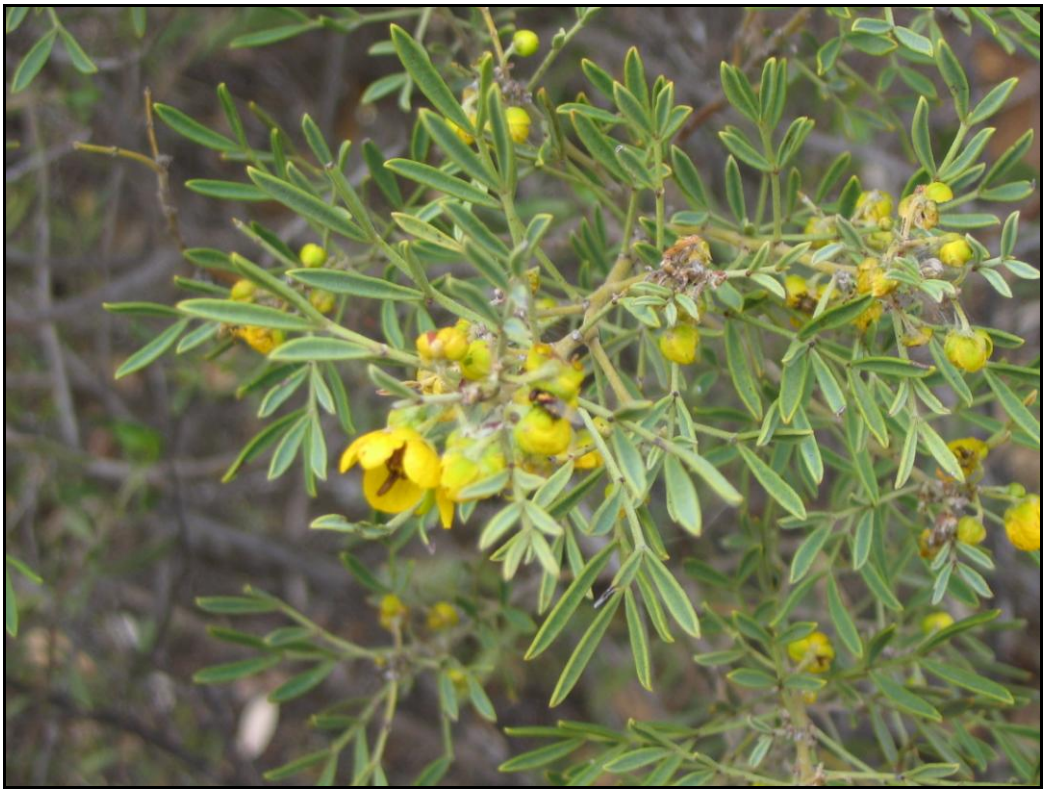

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Abstract

Recent mineral exploration in South Australia has resulted in many kilometres of tracks cleared in areas of natural vegetation. This study investigates the impact of linear disturbance in formerly pristine mallee vegetation on sand dunes in central Eyre Peninsula.

Paired measurements and samples were taken in the main topographic positions (crest, slope, footslope and swale) along ~400 m of each of three tracks, and closely adjacent undisturbed sites. The tracks were sampled across microtopographic features: centre, wheel rut, shoulder. Measurements of physical characters of soil included: compaction, bulk density, structure, water content, erosion. Chemical characters assessed were: soil nutrients, pH, conductivity, soil carbon (total), along with litter distribution. Vegetation composition and processes were characterised by measuring: soil seedbank emergence, abundance of annual and perennial plants, seed predation by ants, effect of litter on seedling emergence, weed invasion potential, perennial regrowth on the tracks and growth of planted seedlings, soil crust and mycorrhizae.

Soil compaction and bulk density were higher in the swale and wheel rut on the tracks. The swale had higher soil water content for all positions across the tracks and in the undisturbed area, while the wheel rut had more than the other positions. In the swale soil dried out at a similar rate in the wheel rut and undisturbed area, whereas at the crest the wheel rut dried out fastest. After heavy rainfall there was more soil movement down the slope on the tracks than in the undisturbed area. Soil nutrients were higher in the swale, while the wheel rut was more alkaline and less saline than the other positions. Carbon content was slightly higher in the swale, while the amount of litter was no different along the tracks, but was greater in the undisturbed area.

Annual plants were the main emergents from the soil seedbank. More emerged from swale soils from the tracks than from other topographic positions and from undisturbed positions. This pattern was reflected in the distribution of annual plants in the field. The addition of litter had no consistent effect on seedling numbers. Seed removal by ants was independent of topography or disturbance. Tagged perennial plant survival was low at all positions along the tracks over 28 weeks. Overall, fewer dicots died than monocots, particularly at the swale and slope. To assess for weed invasion potential a phytoassay using *Carrichtera annua* resulted in higher growth in swale soils and slightly higher in disturbed soils. Planted seedlings of *Eucalyptus incrassata* reached higher biomass in the undisturbed

area in the swale and slope and showed little effect from grazing. Biological crusts were more intact in the undisturbed area and the mycorrhizal content was higher on the tracks.

Clearing of vegetation along access tracks resulted in changes in patterns of transport and retention of materials (water, nutrients, litter, seeds) and this was accentuated by the topographic gradient. Consequently, functioning of the ecosystem changed as was reflected in the vegetation composition in the disturbed area, where there was much less perennial vegetation compared to the undisturbed area.

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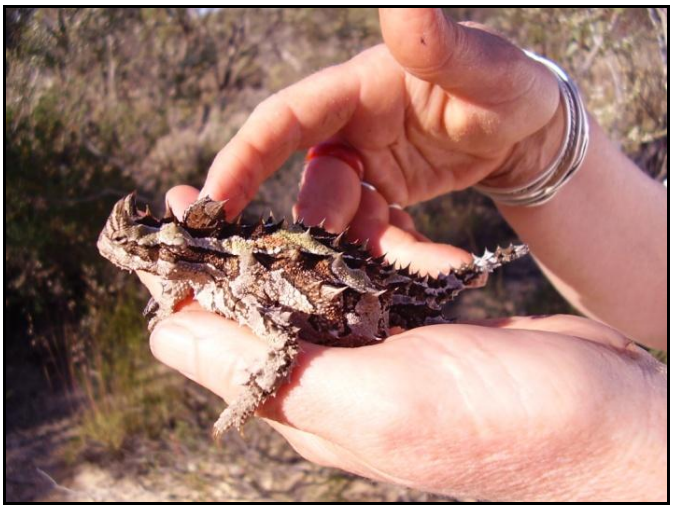

Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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Lindy Ann Scott Date

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