Scratching below the surface with the quenda

by Leonie Valentine and Katinka Ruthrof

Australia is home to many mammals that dig for their dinner, including bettongs, bandicoots and echidnas. While foraging for food, these digging mammals often create shallow pits with an associated spoil heap of ejected soil. This combination of digging and discarding soil disrupts the microhabitat layer by exposing soil and burying organic matter and litter under the spoil heap. Although these actions may seem small at a local scale, they are surprisingly important for broader-scale ecosystem processes, and can influence soil turnover, water infiltration and nutrient cycling in landscapes. Consequently, many of Australia's digging mammals are considered to be important ecosystem engineers.

A regularly-seen native digging mammal around Perth bushland reserves is the quenda (*Isoodon fusciventer*). Previously considered to be a sub-species of the south-eastern Australian southern brown bandicoot (*Isoodon obesulus*), the quenda is now recognised as a separate species, endemic to south-western Australia. When food resources are plentiful, but predators are few, these solitary mammals often have over-lapping home ranges and can occur at high densities. However, like many other medium-sized marsupials in Australia, quenda have suffered declines in their population and range due to a combination of predation by foxes and cats, and habitat loss, and are classified as a priority species – in need of monitoring.

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Foraging pits created by quenda while searching for subterranean food at Craigie Bushland. Photo – Leonie Valentine.

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Quenda have strong forelimbs and long nails that help them dig through the dirt while they are foraging for food. Photo – Alice Reaveley.

Quenda have well-developed forelimbs that they use to forage for underground invertebrates, fungi and tubers. Each night, these prodigious diggers create about 45 foraging pits as they dig for food. Research estimates that an individual quenda (weighing between 800–1,200gm) can turn over nearly four tonnes of soil annually, although in the sandy soils of banksia woodlands they may turn over more than 10 tonnes of soil. While foraging for food, the quenda manipulate and alter many soil properties, and these microscale disturbances may be incredibly important for ecosystem functioning.

The digging actions of quenda may alter the environment in many ways. By creating the foraging pit, quenda mix soil by bringing deeper soil to the surface. They also break the soil crust, that subsequently changes soil hydrophobicity (water repellency), making it much more likely for water to infiltrate the soil compared to undisturbed soil. When quenda create the spoil heap, they are moving soil on top of surface organic matter and litter. This reduces the amount of surface litter and creates an environment more conducive to litter decomposition. Litter decomposition is one of the key pathways that nutrients are returned to the soil, and often occurs more quickly if litter is covered by soil. Soil properties important for plant growth, such as potassium and electrical conductivity, have been recorded at higher levels in the spoil heaps created by quenda compared to undisturbed soil. By mixing the soil and enhancing litter decomposition, quenda may also alter soil biota and mycorrhizal associations.

At the same time, the foraging pit captures organic debris and seeds, which may increase seedling recruitment. The extra nutrients and altered soil biota, may also facilitate seedling growth. For example, research has shown that tuart seedlings grown in the soil of a quenda spoil heap grow faster, and bigger, than seedlings grown in undug soil.

*Tuart (*Eucalyptus gomphocephala*) seedlings grow quicker and bigger in soil from a quenda spoil heap (right) compared to soil from the pit itself (centre) or undisturbed soil (left). Photo – Leonie Valentine.*

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The majority of Australian digging mammals are threatened, and their widespread decline may be linked to a reduction in key ecosystem processes. The persistence of native digging mammals, like quenda, in bushland may play an important role in maintaining the health and functioning of ecosystems. So, the next time you see a quenda, think of the many ways this little digger may be altering our world.

More information

Valentine LE, Bretz M, Ruthrof KX, Hardy G and Fleming PA (2017) Scratching beneath the surface: bandicoot bioturbation contributes to ecosystem processes. *Austral Ecology* 42: 265-276.

Valentine LE, Ruthrof KX, Fisher R, Hardy G Hobbs RJ and Fleming PA (2018) Bioturbation by bandicoots facilitates seedling growth by altering soil properties. *Functional Ecology* 32:2138-2148.

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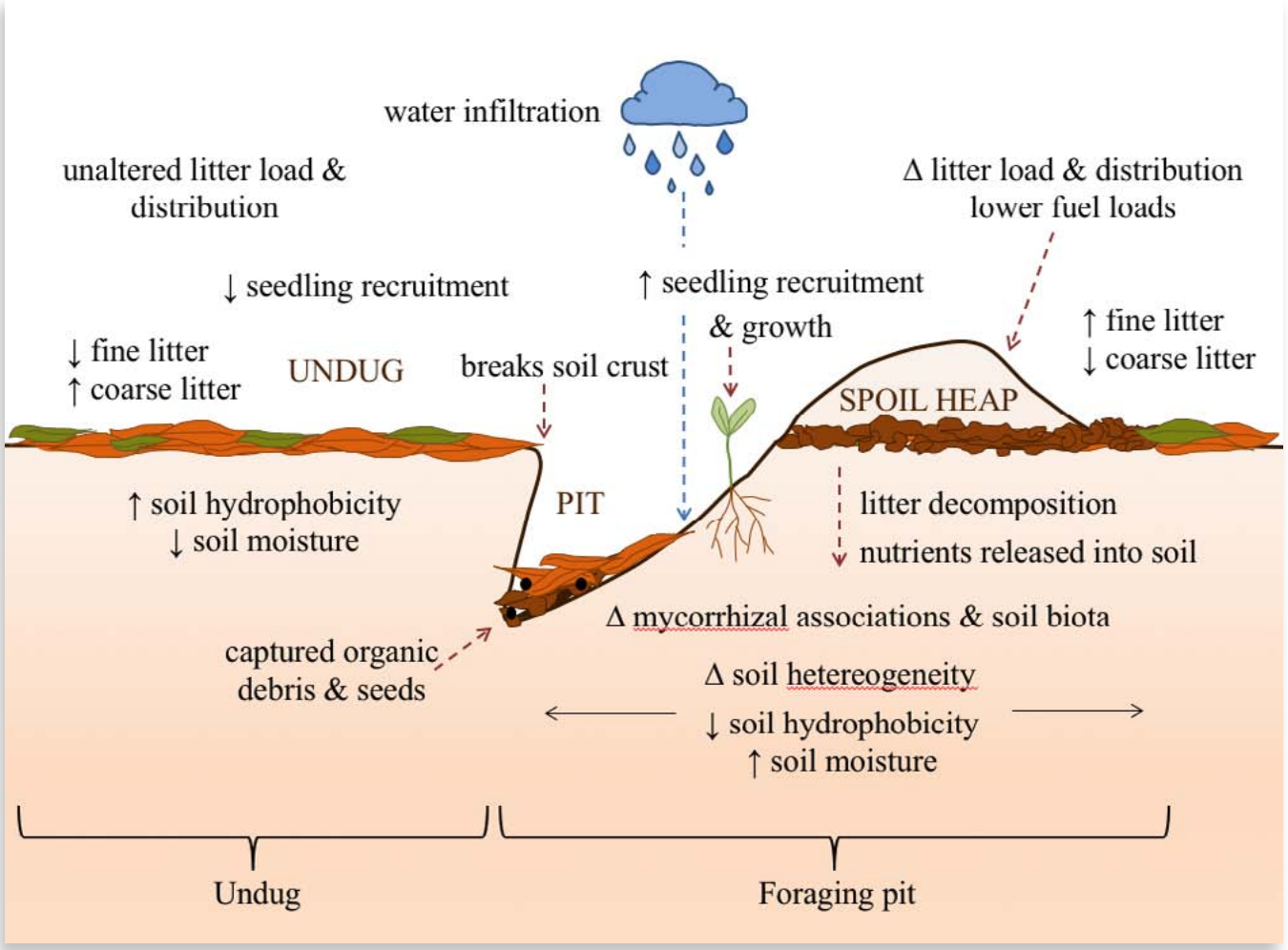

Schematic representation of how foraging pits created by a quenda may alter abiotic and biotic processes (modified from Valentine et al. 2017).