

ECOSYSTEM SERVICES PROVIDED BY DUNG BEETLES

How many people now living in Perth remember the dreadful swarms of bushflies that were such an annoyance at any form of outdoor picnic in summer? Coming from England, I was appalled. But now they have gone, rarely will you see even one or two. The good guys that have achieved this are dung beetles introduced from Europe during a long-running CSIRO project (see WW 2/2 and WW 7/2*). But dung beetles provide lots of other ecosystem services apart from reducing the numbers of bushflies (see WW 11/4* for a definition of ecosystem services). A recent paper discusses the importance of dung beetles to ecological processes on a global scale **.

Dung beetles are in the Scarabacinae group of insects. They are found world wide, with the highest diversity in tropical forests and savannas. They feed on the microorganism-rich liquid component of mammalian dung and use the more fibrous material to brood their larvae, often burying lumps of it in 'brood balls'. While they are doing this they facilitate a series of ecological processes that may be seen as ecosystem services beneficial to humans.

The ecological processes include:

- **nutrient cycling**

Transformation of the nutrients within faeces back into a mineral form plants can use.

- **bioturbation (mixing of soil particles)**

This process, which occurs when the animal digs a tunnel to bury dung balls, may increase soil productivity by increasing aeration and water porosity.

- **plant growth enhancement**

The two points above can increase plant productivity in soils where they occur.

*OK, so many readers will have been overseas (or even to the zoo) and gazed, astonished, at the size of piles of elephant dung! What a feast for dung beetles! Now, consider the size of a pile of dinosaur dung - a superabundance of food for someone! Dung beetles? Yes! Recent fossil evidence** suggests that beetles evolved coprophagy (dung-eating) through association with dinosaurs, long before mammals became the dominant beasts!*

- **secondary seed dispersal**

Dung beetles don't eat the seeds they find in droppings, to them they are a useless contaminant. Nevertheless, some seeds do get rolled up and carried away in the brood ball, then buried in a suitable place for germination, as well as being out of the way of seed predators. However, this could be negative, as very small seeds could be buried too deep for successful germination.

- **parasite suppression**

Through feeding and nesting, dung beetles can control the abundance of flies, nematodes and protozoa that breed in dung. This is an extremely important factor in the health of domestic stock. Alternatively, it is possible that the beetles may have a positive role in spreading parasites, but there is little convincing evidence of this.

- **fly control**

We, in the wetter south-west of

WA, can testify to the effectiveness of this action!

- **trophic (feeding) regulation**

Some specialist dung beetles can affect other species by competition for food - they may regulate the population of leaf-cutter ants in the American tropics by predated the queens, for example.

- **pollination**

Even more oddly, dung beetles are the principle pollinators of some carrion-smelling flowers, in the Arum Family especially. (Perhaps this merits investigation to see if they are important as pollinators of the rotting-meat stinky, low-growing honeypot dryandras. These flowers attract clouds of bushflies and blowflies, why not dung beetles too?)

So, how many of these are ecosystem services that are beneficial to the human condition? Most importantly in Australia, CSIRO's dung beetle project has had major benefits to the livestock industry (especially cattle) and bush fly control. Their other actions may increase plant productivity and so ecosystem health across a wide range of vegetation and land use types. Land use changes - particularly the conversion of forest into agricultural land - could cause loss of dung beetle diversity, with unknown effects. The authors conclude: "An improved understanding of the ecological importance of dung beetles is one contribution to understanding the consequences of diversity loss in natural and human dominated ecosystems."

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* Remember that past issues of Western Wildlife are available on the LFW website www.dec.wa.gov.au/landfor/wildlife.

** For refs, contact Ed.