

The 'brown food web': Dead vegetation found to play essential role in desert ecosystems

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Researchers from UNSW say these insights could be used by the conservation managers of arid ecosystems in Australia. Credit: Prof. Mike Letnic

A reduction in decaying vegetation can have significant impacts on the desert food chain, UNSW scientists have found.

It's well understood that overgrazing by herbivores like kangaroos can change ecosystems dramatically, but the impact excessive grazing has on the cover of dead vegetation—and cascading effects on small vertebrates like lizards, desert frogs and dunnarts—hasn't been extensively studied.

Now, scientists at UNSW Sydney have shown that overgrazing can disrupt the desert [food](#) webs that exist between dead plant material, [termites](#) and animals that rely on termites as their main food source. This latest discovery has important implications for the conservation of biodiversity in arid Australia.

Researchers from the School of Biological, Earth & Environmental Sciences carried out [field work](#) in the arid region of South Australia and published their findings in the journal *Ecosystems*.

Lead author Ph.D. student Baptiste Wijas and Professor Mike Letnic observed brown food webs, which are based on the consumption of dead or decaying vegetation by detritivores, such as termites or earthworms. Mr. Wijas and his team found that overgrazing by kangaroos in arid ecosystems can negatively disrupt the brown food web—in a nutshell, kangaroos eat the plants before they can mature, dry out and become food for detritivores.

"We found that less dead biomass due to overgrazing herbivores can lead to a reduction in termites," says Mr. Wijas. "Fewer termites, the principal decomposers in these environments, could ultimately result in a reduction in the number of lizards and [small mammals](#) in arid ecosystems, as many of these small vertebrates feed on termites."

Green and brown food webs

Most food web research has focused on "green food webs" which, unlike brown food webs, begin with the consumption of living,

photosynthesizing vegetation by herbivores.

"A lot of research in arid ecosystems has focused on the green food webs that follow 'boom periods' prompted by large rainfall events," says Prof. Letnic. "These 'boom periods' see spectacular growth and blooming of desert plants and increases in the populations of many animal species that feed on the growth, such as herbivores and rodents. Drier periods are a lot less exciting and consequently have attracted less attention."

The researchers focused their work on Boolcoomatta Station Reserve, a conservation reserve managed by the non-government organization Bush Heritage Australia. The Adnyamathanha and Wiljakali peoples are the Traditional Owners of Boolcoomatta.

Boolcoomatta Station Reserve is inside the dingo fence in South Australia, an area where the predominant land use is sheep grazing and where the predator at the top of the food chain, the dingo, is "functionally extinct." This means that dingo numbers have become so reduced that they have a negligible influence on free-ranging prey species, like kangaroos and feral goats.



Inside the exclosures, where kangaroos were kept out, the team found increased numbers of lizards and dunnarts. Credit: Baptiste Wijas

"Kangaroos occur in large numbers across much of arid Australia because populations of their principal predator, the dingo, have been suppressed. The creation of artificial water points to supply water to livestock and inadvertently to kangaroos have also helped kangaroos to survive through dry periods," Prof. Letnic says.

The team compared the cover of living and dead vegetation, the abundance of detritivorous termites, and their predators inside the exclosures, from which kangaroos were excluded, to nearby control plots.

The researchers found that there was more cover of living and dead

vegetation inside the exclosures, where kangaroos were absent. As a result, there were more termites and small vertebrate predators of termites, like lizards and dunnarts, inside the exclosures.

"Our findings are one of the first to show in arid ecosystems that where herbivores were excluded, there was greater biomass of dead grass. In turn there were more termites and predators of termites inside the exclosures," says Mr. Wijas.

These small vertebrates are an important component of biodiversity in desert environments and play a significant role in desert food webs by being prey for larger animals, such as larger marsupials, birds of prey, snakes and goannas.

Implications for conservation of biodiversity in arid Australia

The latest study contrasts with the results from research carried out in different, more fertile environments which found that the presence of herbivores can increase animal decomposer populations. And while these findings are novel, there are more questions that need answering.

The team recommend that to continue to explore the impact of grazing in deserts, future studies should manipulate termite abundance to examine the relationship between termite abundance and the diversity and abundance of [small vertebrates](#) in more controlled conditions.

Prof. Letnic says the latest findings could have significant implications for the conservation and management of arid ecosystems in Australia.

"The research has important implications for the conservation of biodiversity in arid Australia because it sheds new light on how grazing

can affect the functioning of arid ecosystems.

"Conservation managers can use this information to make informed decisions on how to manage herbivore populations and look for early signs of habitat disruption that is critical for conserving other species."

More information: Baptiste J. Wijas et al, Herbivores' Impacts Cascade Through the Brown Food Web in a Dryland, *Ecosystems* (2022).
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