give & take

Do camelthorn trees use Sociable Weavers to forage for nutrients?

Plant–animal interactions are ubiquitous in natural ecosystems. Mutually beneficial relationships, such as those between plants and pollinators, are well studied, as are negative herbivorous interactions. Birds building nests in trees may entail a one-sided interaction, with the trees providing a structure for birds, but seemingly not gaining benefits or suffering severe costs. One exception may be the hosting of massive nest colonies of Sociable Weavers in the Kalahari, a task often 'forced' on the slow-growing camelthorn trees. Sociable Weavers have been a popular study system at the Fitztitute for at least four decades, but to date their impact on their host trees and other vegetation has been overlooked.

Both camelthorns and Sociable Weavers are considered ecosystem 'engineers', species that play a disproportionate role in ecosystem structure. Camelthorns create fertile soils below their canopy through shading and by increasing soil moisture and nutrient availability, which allows less hardy plant species to establish in the harsh desert conditions. Similarly, the large, colonial nests of Sociable Weavers act as refugia or foraging sites for many Kalahari animals. Weaver colonies can persist in the same tree for decades, hosting hundreds of birds and other animals that roost and breed in the nest structures year-round. Standing under a large weaver nest, two things are apparent: the ground under the nest is covered with animal faeces, but there are also often broken branches. The question therefore arises whether camelthorn trees gain benefits or incur costs by hosting Sociable Weaver colonies.

We investigated this interaction by teaming up with Professor Michael Cramer, a plant physiologist from the University of Cape Town. Honours students Carla du Toit and Kervin Prayag found that the soil below camelthorns that host weaver colonies contained up to four times more essential nutrients required for plant growth – nitrogen, potassium and phosphorus – than soil under similar trees without colonies. Hundreds of weavers import nutrients to the colony trees, creating hotspots below nest trees in an otherwise nutrient-poor landscape. But do the trees use these nutrients? Analyses of nitrogen isotopic signatures confirm that camelthorns do indeed use the nutrients imported by weavers. The trees invest these nutrients in leaf growth, with camelthorns that host weaver colonies having 27 per cent more leaves per unit branch length, suggesting clear benefits of hosting weaver colonies.

However, hosting a weaver colony is not without its costs. The colonies reduce overall canopy cover and broken braches were found almost exclusively at trees that bore weaver nests. Nests are heavy and, especially after rainstorms, they can cause branches supporting them to collapse or even entire trees to topple over. Tree mortality might also occur as a result of fires (for example, after a lightning strike), when nest trees can be completely consumed because of the enormous amount of fuel that the nest represents, the so-called 'bonfire effect'.

The net balance of these costs and benefits are still unknown. We speculate that hosting weaver colonies may benefit younger camelthorns, where the birds provide resources that allow investment in growth and reproduction. However, as the camelthorns age and the weaver colonies expand, the costs increase. This apparent trade-off forms the focus of Timothy Aikins Khan's PhD study. Timothy is also evaluating these interactions in the shepherd's tree, another iconic Kalahari species that often hosts weaver nests. Understanding how these interactions function is vital to explaining the structure of animal and plant communities and should help to predict how the Kalahari landscape might respond to global climate change.

ANTHONY LOWNEY (2)

Sociable Weaver colonies may cause extensive damage to camelthorn trees. The colonies' nests often become too heavy and break the supporting branch.

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