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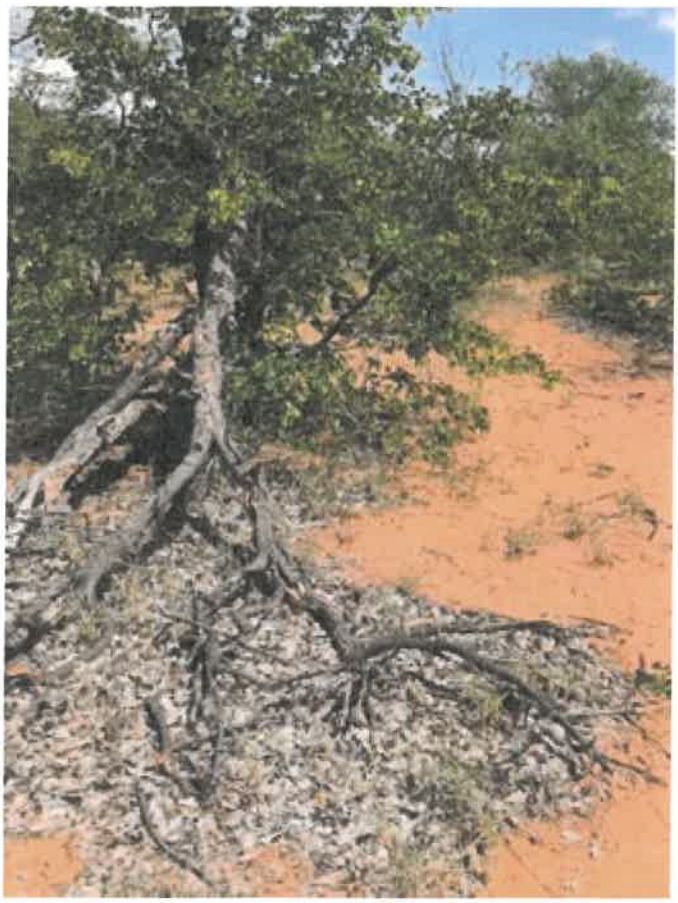
Mopane worms and soil fertility – an undervalued service provider?

Dr Corrie Swanepoel
ARC-Natural Resources and Engineering

Mopane worms, which are the caterpillar of the mopane moth (*Gonimbrasia belina*), are well known as a traditional food source and even considered a delicacy by many people in southern Africa. However, mopane worms do far more than provide food and generate income. They also provide an important ecosystem service that is often overlooked. Mopane worms facilitate nutrient cycling and contribute to soil fertility on a landscape level that is far more intricate and important than most of us realise. While all organisms play a role in a functional ecosystem, some organisms are considered keystone species

Mopane worm feeding on a mopane tree leaf



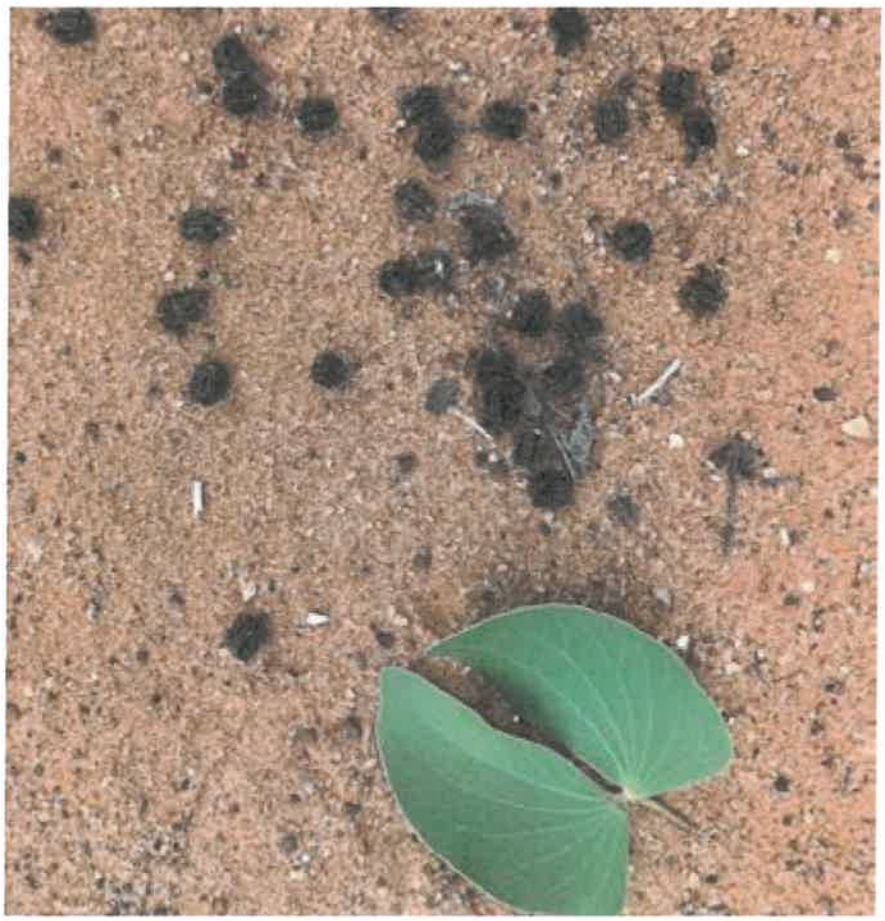
Dried leaves accumulate below a mopane tree

that help to define and shape the entire ecosystem. For example, termites sustain soil fertility and facilitate nutrient cycling by carrying grass and leaves into the soil. Just like mopane worms, termites are especially important in semi-arid regions. This is evident by the fact that large trees can often be seen growing on top of termite mounds, which are pockets of fertile nitrogen-rich soil within an otherwise poorly fertile area. Brown bears in North America is another interesting example. They feed on salmon and often carry partly eaten fish into the forest, effectively fertilizing the forest floor with nitrogen and phosphorus from the ocean.

Mopane worms can also be considered a keystone species. These caterpillars occur in semi-arid regions of southern Africa and typically have two outbreaks in mopane-dominated veld types during summer. A single moth can deposit up to 200 eggs, which hatch after 10 days. The caterpillars feed mostly on mopane leaves, although not exclusively.

After what can only be described as an extraordinary growth period, the caterpillars finally crawl down the tree trunks and burrow into the soil where they pupate and emerge again as moths. The abundance during these outbreaks is shared by people and animals alike. Birds and primates eat the caterpillars while mongooses and other small carnivores feed on the pupae that they dig out. Local residents, especially women, harvest mopane worms to supplement household protein, as well as generate a significant seasonal income.

During the outbreak periods, mopane worms can defoliate entire trees and in some cases, several hectares of trees. This may look destructive but on a landscape level, mopane worms are an essential part of the nutrient cycle. They effectively convert leaves into easily mineralizable or plant-available components through the castings (frass) that they produce. In these semi-arid areas, the combination of sparse vegetation, low rainfall and high temperatures results in



Mopane worm frass and mopane leaf

Incubating soils to determine nutrient release from mopane worm frass and mopane leaves

veld with a low carrying capacity. The soils have a low organic matter content and nutrient status, indicating that their fertility is very low. The large-scale defoliation of mopane trees by mopane worms results in a large-scale return of frass. Although only partially digested by the worms, frass has different properties compared to the leaves, which makes their decomposition different. Mopane leaves are tough and slow to decompose, and leaves that are shed during the winter tend to accumulate on the soil surface, where they can remain for months. Frass, on the other hand, has a fine texture and can easily mix with the soil. This aspect alone makes the frass more likely to be incorporated into the soil and decompose more effectively, releasing nutrients in the process.

To test just how much more nutrients are released from the frass compared to the mopane leaves, the Agricultural Research Council (ARC) in collaboration with the University of Venda conducted a research experiment. Frass and mopane leaves were collected from an area with a high outbreak history close to the Botswana border. In the laboratory we created conditions similar to the veld and measured how fast the frass and the leaves decomposed and released nutrients. Our results confirmed that nutrients are released much faster and more effectively from the frass than the leaves. This indicates that mopane worms facilitate large-scale nutrient cycling in these semi-arid areas. The study highlights the importance of protecting mopane worms since it is evident that they could become regionally extinct due to over-harvesting, habitat fragmentation and climate change.

For more information:
Dr Corrie Swanepoel
ARC-Natural Resources and Engineering
E-mail: SwanepoelC@arc.agric.za