Lowly termite, not the lion or elephant, may be the star of Africa's savanna

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This is a soldier termite in a fungal comb. These termites are rarely seen above ground, but their subterranean activities support the productivity and biodiversity of African savannas. Credit: Robert M. Pringle

The majestic animals most closely associated with the African savanna -- fierce lions, massive elephants, towering giraffes - may be relatively minor players when it comes to shaping the ecosystem.

The king of the savanna appears to be the termite, say ecologists who've found that these humble creatures contribute mightily to grassland productivity in central Kenya via a network of uniformly distributed colonies. Termite mounds greatly enhance plant and animal activity at the local level, while their even distribution over a larger area maximizes ecosystem-wide productivity.

The finding, published this week in the journal PLoS Biology, affirms a counterintuitive approach to population ecology: Often, it's the small things that matter most.

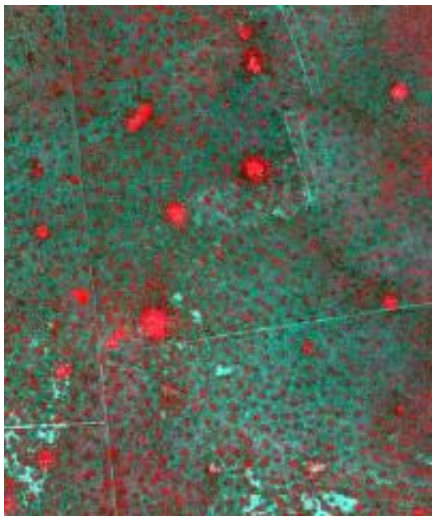
"One of the kind of typical things I think that people think about is, what drives a savanna in terms of its structure and function?" said Todd Palmer, one of the paper's authors and an assistant professor of biology at the University of Florida."We think about big animals, but these termites are having a massive impact on the system from below."

Said Robert M. Pringle, a research fellow at Harvard University and the lead author, "As (famed biologist) E.O. Wilson likes to point out, in many respects it's the little things that run the world."

Prior research on the Kenya dwarf gecko initially drew Pringle's attention to the peculiar role of grassy termite mounds, which in this part of Kenya are some 30 feet in diameter and spaced some 180 to 300 feet apart. Each mound teems with millions of termites, who build the mounds over the course of centuries.

After observing unexpectedly high numbers of lizards in the vicinity of mounds, Pringle, Palmer and their colleagues began to quantify ecological productivity relative to mound density. They found that each mound supported dense aggregations of flora and fauna: Plants grew more rapidly the closer they were to mounds, and animal populations and reproductive rates fell off appreciably with greater distance.

What was observed on the ground was even clearer in satellite imagery. Each mound - relatively inconspicuous on the Kenyan grassland - stood at the center of a burst of floral productivity. More important, these bursts were highly organized in relation to one another, evenly dispersed as if squares on a checkerboard. The result is an optimized network of plant and animal output closely tied to the ordered distribution of termite mounds.



This satellite photo shows the uniform distribution of termite mounds. Small red regions are indicative of rapid plant growth. Credit: Robert M. Pringle

"In essence, the highly regular spatial pattern of fertile mounds generated by termites actually increases overall levels of ecosystem production. And it does so in such a profound way," Palmer said. "Seen from above, the grid-work of termite mounds in the savanna is not just a pretty picture. The over-dispersion, or regular distribution of these termite mounds, plays an important role in elevating the services this ecosystem provides."

The mechanism through which termite activity is transformed into far-reaching effects on the ecosystem is a complex one. Pringle and Palmer suspect termites import coarse particles into the otherwise fine soil in the vicinity of their mounds. These coarser particles promote water infiltration of the soil, even as they discourage disruptive shrinking and swelling of topsoil in response to precipitation or drought.

The mounds also show elevated levels of nutrients such as phosphorus and nitrogen. All this beneficial soil alteration appears to directly and indirectly mold ecosystem services far beyond the immediate vicinity of the mound.

While further studies will explore the mechanism through which these spatial patterns of termite mounds emerge, Pringle and Palmer suggest that the present work has implications beyond the basic questions of ecology.

"Termites are typically viewed as pests, and as threats to agricultural and livestock production," Pringle said. "But productivity - of both wild and human-dominated landscapes - may be more intricately tied to the pattern-generating organisms of the larger natural landscape than is commonly understood."

More information: Pringle RM, Doak DF, Brody AK, Jocque´ R, Palmer TM (2010) Spatial Pattern Enhances Ecosystem Functioning in an African Savanna. PLoS Biol 8(5): e1000377. doi:10.1371/journal.pbio.1000377

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