Ants take on Goliath role in protecting trees in the savanna from elephants

September 2 2010, by Cathy Keen

(PhysOrg.com) -- Ants are not out of their weight class when defending trees from the appetite of nature's heavyweight, the African elephant, a new University of Florida study finds.

Columns of angered ants will crawl up into elephant trunks to repel the ravenous beasts from devouring tree cover throughout drought-plagued East African savannas, playing a potentially important role in regulating carbon sequestration in these ecosystems, said Todd Palmer, a UF biology professor and co-author of a paper being published this week in the journal Current Biology.

"It really is a David and Goliath story, where these little ants are up against these huge herbivores, protecting trees and having a major impact on the ecosystems in which they live," Palmer said. "Swarming groups of ants that weigh about 5 milligrams each can and do protect trees from animals that are about a billion times more massive."

The mixture of trees and grasses that make up savanna ecosystems are traditionally thought to be regulated by rainfall, soil nutrients, plant-eating herbivores and fire, he said.

"Our results suggest that plant defense should be added to the list," he said. "These ants play a central role in preventing animals that want to eat trees from doing extensive damage to those trees."

While conducting research in the central highlands of Kenya, where

hungry elephants have destroyed much of the tree cover, Palmer said he and his colleague and former UF post-doctoral student, Jacob Goheen, now a University of Wyoming zoology, physiology and botany professor, noticed that elephants rarely ate a widespread tree species known as Acacia drepanolobium where guardian ants aggressively swarm anything that touches the trees. But they would feed on other trees that did not harbor these ants.

The researchers decided to test whether these tiny ants were repelling the world's largest land mammal by serving as bodyguards for the tree in exchange for shelter and the food it supplied in the form of a sugary nectar solution. So they offered elephants at a wildlife orphanage a choice between these "ant plant" trees, with and without ants on the branches, and their favorite species of tree, the Acacia mellifera, to which the researchers added ants to some of its otherwise antless branches.

"We found the elephants like to eat the "ant plant" trees just as much as they like to eat their favorite tree species, and that when either tree species had ants on them, the elephants avoided those trees like a kid avoids broccoli," he Palmer said.

Also, the researchers removed ants from "ant trees" out in the field to see if elephants would attack them undefended, and a year later found much more damage than on trees with ants. Satellite images between 2003 and 2008 confirmed the ants were having a widespread, long-term effect throughout the savanna, he said.

The ants did not seem to annoy tree-feeding giraffes, who used their long tongues to swipe away them away from their short snouts, in marked contrast to the long nose or trunk on an elephant, Palmer said. The inside of an elephant's trunk is tender and highly sensitive to thousands of biting ants swarming up into it, he said.

"An elephant's trunk is a truly remarkable organ, but also appears to be their Achille's heel when it comes to squaring off with an angry ant colony," he said.

Because it appears that smell alerts elephants to avoid trees that are occupied by ants, it raises the question of whether ant odors might be applied to crops to deter elephants from feeding on them, just as DEET helps repel mosquitoes from people, he said.

"A big issue in east Africa is elephants damaging crops, which is one reason elephants have been harassed and sometimes killed," he said. "There's been a lot of interest in the conservation world about how to minimize the conflict elephants have with humans and particularly how to keep elephants from raiding agricultural fields."

One predicted outcome of global warming is more frequent and intense droughts, which will force desperate elephants to eat everything they can to survive, Palmer said "With more droughts, the extent to which elephants destroy and remove trees may increase and potentially shift the ecosystems back to grasslands," he said.

Ants' role in saving trees is critical with the interest in slowing the accumulation of greenhouse gasses since trees absorb carbon dioxide from the atmosphere, Palmer said.

"These 'ant plants' don't cover just a few hundred acres but are distributed throughout east Africa from southern Sudan all the way over to eastern Zaire and down through the horn of Africa and Tanzania," he said. "So they potentially play a big role in terms of regulating carbon dynamics in these ecosystems."

Provided by University of Florida