

Agriculture expansion in Tanzania may greatly increase human plague risk

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The push to boost food production in East Africa that is accelerating the conversion of natural lands into croplands may be significantly increasing the risk of plague according to a new study published online today in the *American Journal of Tropical Medicine and Hygiene* (AJTMH).

Researchers studied rodents in northern Tanzania, where over the last few decades croplands have expanded by 70 percent. They found that in areas where maize production has been introduced, the number of rodents infested with [plague](#)-carrying fleas that can cause human infections nearly doubled compared to numbers in neighboring wilderness areas. Scientists also linked the maize fields to a 20-fold increase in the population of the African rat (*Mastomys natalensis*) that is a major conduit for plague and a number of other diseases, including deadly Lassa fever—an affliction often mistaken for Ebola—that has become a growing concern in West Africa.

"We found that introducing maize production in natural areas appears to create a perfect storm for plague transmission," said Hillary Young, PhD, a community ecologist at the University of California, Santa Barbara, and one of the lead authors of the study. "The presence of the crop as a food source caused a surge in the population of a rat species known to carry plague. Local farmers often then store this harvested corn next to or inside their homes—baiting in the hungry field rats and increasing opportunities for human infection."

"These kinds of conditions are what breed outbreaks," Young said.

Plague is an ancient disease caused by the bacterium *Yersinia pestis* that continues to sicken and kill people even in the 21st century. Since 2000, most of the outbreaks of plague have occurred in Africa, particularly the Democratic Republic of Congo and Madagascar, an island nation off the coast of Mozambique [In 2013, ASTMH published a [series of infographics](#) about plague in the first decade of the 21st century.] Just since last September, an outbreak in Madagascar led to 263 infections and 71 deaths. Plague [also occurs in the USA](#), with a small number of cases reported annually in western states.

Plague has long been a threat in Tanzania and continues to emerge in sporadic outbreaks. From 1980 to 2011, for example, there were about 8490 cases and 675 deaths reported in the country.

According to the World Health Organization (WHO), [plague is treatable](#) with antibiotics and supportive therapy but, left untreated, it is fatal 30 to 60 percent of the time.

Rats and Expansion of Agriculture

In June and July of 2011, shortly after the typical annual peak in human plague cases, investigators studied three areas in northern Tanzania. In these areas, plague outbreaks have been documented in the past, and maize production has expanded and now abuts the boundaries of protected lands.

Young said the area of Tanzania where the study was conducted is a historic hotspot for plague, though so far there has not been an uptick in infections documented in the farming communities studied. But the researchers, which included investigators from Stanford University, Colorado State University, the Smithsonian Institution, and Tanzania's

Sokoine University of Agriculture, believe all of the factors that could cause an outbreak are now in place: a population surge in rodents carrying plague and fleas capable of transmitting plague to humans, coupled with crop storage practices and rat behaviors that could increase contact with humans.

"People in these communities tend to store their maize in their houses, to protect it, but that also has the effect of attracting these rats," Young said. "The rats that persist in human areas are also particularly competent hosts for plague, as well as likely to interact with humans. Together, these changes increase the opportunities for humans to be bitten by plague-infected fleas."

Curious Findings

One curious finding from the study was that the African rats living in the agriculture areas played host to a larger number of plague-carrying fleas than their relatives in the forest and even carried a species of plague-infected flea that is completely absent in forest rats.

The researchers also noted that the African rat, with its capacity to support large litters—the female of the species can nurse up to 14 pups at a time—is well suited to take advantage of a crop production cycle that offers opportunities for rodent populations to surge as crops mature.

"Lessons learned from this case are also broadly important for understanding the dynamics of other zoonotic diseases in this era of rapid landscape change," the authors state.

Indeed, across sub-Saharan Africa, which possesses 60 percent of the world's arable and significant food security challenges, efforts are underway to rapidly and widely increase agriculture production as a way to address both economic and food security concerns. Among the more

ambitious projects is one [underway in Kenya](#) that aims to convert one million acres (about 400,000 hectares) into irrigated farmlands.

"This result gives us another example—as if we need another example after Ebola—of the connected world we live in. Although it's not as infectious as the Ebola virus, plague can be transmitted through human contact as well as flea bites, and we had this kind of transmission in the United States in the last century. Researching the impact of land use on both animals and humans is important for preventing and dealing with outbreaks of transmissible diseases like plague," said ASTMH President Christopher Plowe, MD, MPH, FASTMH. "In Africa in particular, food production is a critical issue. This is an opportunity for agriculture and tropical medicine to work together with local communities to benefit us all."

Provided by Burness Communications

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