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June 19, 2020

Earth & Space

Of pig-tails and palm oil: How rat-eating macaques increase oil palm sustainability

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This Break was edited by Max Caine, *Editor-in-chief* - TheScienceBreaker

ABSTRACT

Conversion of tropical forests into agriculture reduces wildlife habitats and leads to biodiversity losses and human-wildlife conflicts. Here, we present an example on how is possible to enhance sustainable plantation management and create a win-win situation for oil palm planters and biodiversity.

Male pig-tailed macaques munching on a rat.
Image credit: Anna Holzner

African oil palm is the world's most efficient oil crop yielding 5-10 times more oil per hectare than other oil crops. However, the establishment of large monocultures has driven deforestation and habitat loss for local wildlife in producer countries. Malaysia supplies ca. 30% for the global demand of this versatile vegetable oil that is used in almost all processed foods, detergents and cosmetics that line our supermarket shelves. International calls to increase the sustainability of the industry have led to the establishment of local and international certification agencies that work to achieve environmental and social welfare in their member plantations.

However, conventional plantation management still requires the extensive use of chemicals such as herbicides, insecticides, fertilizers and rat poisons. Rats are considered the main pest for oil palm fruits and can cause yield losses of up to 10%. This result translates into USD$930 million per year in Malaysia alone. Still, chemical rat poisons are expensive and may negatively impact other species and the

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environment. Certified sustainable plantations have been rearing rodent-predating barn owls to control rat populations.

Recently, we have identified a new ally in controlling pest rodents in oil palm plantations in a natural way: the Southern pig-tailed macaque, a primate native to the world's largest palm oil producers, Malaysia and Indonesia.

These macaques have been perceived as crop pests themselves. Oil palm planters have reported macaques "invading" their plantations from nearby forests in search of the nutritious oil palm fruits. To prevent feared yield losses, smallholders have been chasing or trapping macaques, sometimes harming the animals. To answer the question of whether macaques are indeed pests themselves or even are useful pest control agents, we compared the costs and benefits of macaques foraging in oil palm plantations.

From 2016 to 2018, we observed the foraging behaviour and diet of two groups (ca. 40 individuals each) of wild and habituated pig-tailed macaques (*Macaca nemestrina*) in oil palm plantations bordering a rainforest reserve at the west coast of Peninsular Malaysia. Following the macaques through the plantation, we recorded the amount of consumed oil palm fruitlets and rats. These observations gave us estimates of the macaques' net damage on the oil palm harvest and their annual rat consumption.

To further assess the macaques' impact on rat populations and their potential utility as pest control agents, we used an experimental approach. By setting up wire-mesh live traps for small rodents in different areas of the plantation, we estimated the abundance of rats and related rat numbers to the presence of macaques in the respective areas.

We showed that macaques consumed less than 0.6% of the overall oil palm harvest in their foraging area. Thus, their impact on yield is minor. More importantly, these wild primates devoured large numbers of rats in plantations, with around 3,000 individuals per year per macaque group. This – for a primate unusual - culinary activity significantly reduced rat numbers (by 75% in their foraging area). It hence can mitigate annual oil palm yield losses through rats by ca. 112 USD per hectare.

Wild macaques perfectly complement barn owls as biological pest control as the way they hunt for rats is very different from owls. While barn owls are night-active and fly close to the ground to catch rats running between palms, macaques actively search for rats that sleep on the palms during the day.

Consuming large numbers of rats, macaques have the potential to act as biological pest control agents and thus provide an effective and environmentally friendly alternative for the conventional use of poison in oil palm plantations. Our results also provide an important chance to mitigate human-wildlife conflicts. The considerable yield increase through macaques and opportunity to save cost on rat poison constitutes a crucial argument to convince oil palm planters to not only tolerate these macaques at their plantations but actively increase the plantations' attractiveness for this primate species by (re-)planting green wildlife corridors. These small forest patches should be established around and through oil palm plantations. This design can connect fragmented habitats to larger forests and thus allow wild animals to disperse naturally, which is crucial to maintain the genetic diversity of populations.

Our study provides a strong argument for conserving rainforest habitat near oil palm plantations. Allowing forest-dwelling macaques to live alongside oil palm would not only protect these vulnerable primates among other species but can also bring significant economic benefits to oil palm planters and increase the sustainability of plantations.