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Sika Deer Overpopulation Endangers Beech Forests in Southern Kyushu, Japan

A new study reveals how soil erosion caused by sika deer foraging reduces the growth of the beech trees.

Fukuoka, Japan—Kyushu University researchers have found that beech trees in the forests of southern Kyushu have seen reduced growth, due to soil erosion caused by the overpopulation of sika deer (*Cervus nippon*). Their findings, which were published in the journal *Catena*, could help in the development of new strategies for forest conservation.

Conservation is more than just preserving forests; it's about protecting the diverse web of life. One area where conservation has become critical is a beech forest in Shiiba Village, in the remote mountains of Southern Kyushu. The Japanese beech tree (*Fagus crenata*) is a prominent and iconic species in Japan's cool-temperate forests, spanning all across Japan from Honshu to Southern Kyushu.

However, in recent years, the beech forest in Shiiba Village has been on the decline, believed to be driven by the rapid growth of the sika deer population between the 1980s to the early 2000s.

"Due to their overpopulation and subsequent foraging, dwarf bamboo (*Sasamorpha borealis*)—the dominant understory vegetation in this area—was lost. This destabilized the soil and led to soil erosion, exposing the roots of the beech trees," explains [Hayato Abe](#) a Ph.D. student in Kyushu University's Graduate School of Agriculture and first author of the study. "We wanted to see if soil erosion was playing a role in the decline of the beech forest."

Abe and his team conducted an ecological survey on 12 beech trees at a research site in Shiiba Forest, established by Kyushu University in 1939. They investigated tree growth by measuring the production of leaves, stems, and roots. Tree ring samples were also obtained and used to compare the growth of the trees throughout the years. Their analysis revealed a concerning decline in tree growth since 1997 – around the same time that the understory vegetation has been lost due to deer foraging.

Suspecting soil erosion as the primary driver for reduced tree growth, the team looked for a link by measuring the length of the exposed beech tree roots. They found that trees with more exposed roots showed lower growth rates and produced fewer new leaves.

To understand this link, the researchers also investigated how the trees use water. They found that trees that struggled to take up water were growing at a slower pace. A likely explanation, Abe says, is that the parts of the roots that remain in the soil retain water better, as they are exposed to less extreme temperatures. In contrast, the exposed roots are vulnerable to water loss due to freezing or drought and are unable to transport water efficiently.

"Our results suggest that soil erosion possibly leads to water stress in the trees, affecting

their growth and health. These trees are also more vulnerable to damage from strong winds, climate change, and pests, which means they are also more likely to wither or die," says Abe.

The scientists also fear that due to fewer leaves growing, the leaf litter on the forest floor will also decrease, further exacerbating soil erosion and leading to a negative spiral. Ultimately, the study highlights the delicate relationship between forests and the wildlife that inhabit them, and the cascading impacts that occur when the ecosystem is out of balance.

"The Japanese government has been taking steps to reduce the local deer population. Up until the 1980s, the hunting tradition in Shiiba Village had a key role in controlling the sika deer population. But as time went on, the number of hunters decreased. Compounded by the lack of natural predators in the area, the deer population exploded, leading to the situation today," continues Abe. "The government is supporting local hunters but it's a short-term solution. They have also considered exclusion fences to restrict deer to a limited region. Unfortunately, due to the remoteness of Shiiba Village, setting up such facilities can be costly and time-consuming."

Solving problems in conservation is never an easy task and requires multifaceted and multidisciplinary approaches.

"As scientists, we can work to find the root causes of the problems and even develop solutions. But implementation will require working with other researchers and with the larger community," concludes Abe.

(By Negar Khalili)

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For more information about this research, see "Soil erosion under forest hampers beech growth: Impacts of understory vegetation degradation by sika deer," Hayato Abe, Tomonori Kume, Fujio Hyodo, Mimori Oyamada, Ayumi Katayama, *Catena*, <https://doi.org/10.1016/j.catena.2023.107559>

About Kyushu University

[Kyushu University](#) is one of Japan's leading research-oriented institutes of higher education since its founding in 1911. Home to around 19,000 students and 8,000 faculty and staff, Kyushu U's world-class research centers cover a wide range of study areas and research fields, from the humanities and arts to engineering and medical sciences. Its multiple campuses—including one of the largest in Japan—are located around Fukuoka City, a coastal metropolis on the southwestern Japanese island of Kyushu that is frequently ranked among the world's most livable cities and historically known as Japan's gateway to Asia. Through its [Vision 2030](#), Kyushu U will 'Drive Social Change with Integrative Knowledge.' Its synergistic application of knowledge will encompass all of academia and solve issues in society while innovating new systems for a better future.



Fig. 1. Increase in sika deer population damages the environment. Researchers found that the increase in sika deer population led to soil erosion and subsequent reduction in beech tree growth. (Kyushu University/Samantha Sastrawidjaja)

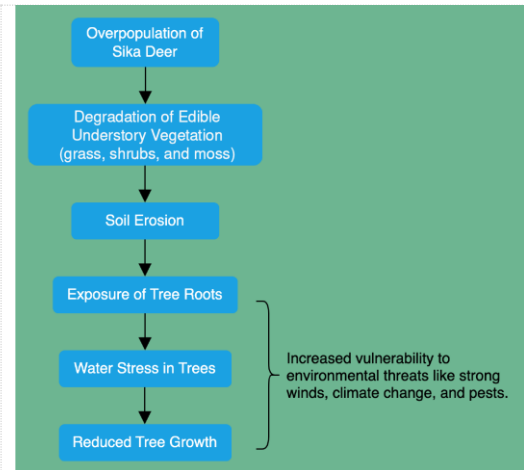


Fig. 2. How Sika Deer overpopulation leads to reduced tree growth. Outline on how Sika Deer overpopulation leads to reduced tree growth. Sika Deer overpopulation leads to the degradation of understory vegetation, which in turn leads to soil erosion. This causes the tree roots to be exposed leading to water stress in trees and eventual reduction of tree growth. (Kyushu University/Samantha Sastrawidjaja)

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