

# Ants plant tomorrow's rainforest

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Many tropical montane forests in the Andes have been destroyed by anthropogenic fires and are confined to forest fragments surrounded by degraded areas. Credit: S. Gallegos

Tropical montane rain forests are highly threatened and their remnants are often surrounded by deforested landscapes. For the regeneration of these degraded areas, seed dispersal of forest trees plays a crucial role but is still poorly understood. Most tree species are dispersed by birds

and mammals, but also by ants. A study published today in the *Journal of Ecology* by a team from the LOEWE Biodiversity and Climate Research Centre and the University of Halle-Wittenberg proves the importance of this hitherto neglected ecosystem function for the restoration of montane rain forests. Ants promote the regeneration of these forests by dispersing seeds to safe sites for tree establishment.

The Yungas, a region on the eastern slopes of the Bolivian Andes near La Paz, are marked by elongated valleys with relicts of the original mountain [rain forest](#). Due to land-use practices like slash-and-burn agriculture and the extension of coca plantations, the forests are highly fragmented. The forest relicts are surrounded by an open, largely degraded cultural landscape. In this context, the team conducted experiments to find out to what extent [ants](#) contribute to the dispersal of a widespread, primarily bird-dispersed tree (*Clusia trochiformis*) and tested whether this ecosystem function may contribute to the restoration of [deforested areas](#).

The red, lipid-rich aril, a fleshy pulp surrounding the [seeds](#) of *Clusia*, is highly attractive to many animals. Birds are the primary dispersers. They feed on the nutritious part of the fruits, the fleshy aril, and defecate the seeds. Ants haul seeds, which have fallen to the ground, to their nests or leave them intact on their way. Research has already been conducted on the influence of this so-called secondary [seed dispersal](#), but very little is known about its impact in degraded forest ecosystems. The study reveals that ants reduce seed predation by rodents and increase germination success – which confirms the importance of this ecosystem function for forest regeneration.

The study has been carried out in two 3,000 ha islands of natural mountain rain forest, which are surrounded by coca fields and degraded fallows, covered with fern and shrub vegetation. The microclimate in the deforested areas is characterized by harsh abiotic conditions that limit

seed germination and recruitment, and hence inhibit the re-establishment of forest trees. The researchers deposited 1,440 *Clusia* seeds in 72 depots at six sites. At each site, they studied three habitat types: forest interior, degraded habitat close to the forest and degraded habitat far from the forest edge.

To quantify the effect of rodents in addition to the impact of ants, half of the depots were equipped with wire exclusion cages.



Harsh abiotic conditions in the de-graded habitats hinder tree recruitment that is restricted to specific microsites protected by litter. Credit: S. Gallegos

**Well-concealed: ants reduce predation and increase germination**

"Ants readily approached and hauled away about 60 percent of all seeds," says Silvia Gallegos, lead author of the study and a doctoral student at the Biodiversity and Climate Research Centre (BiK-F) and the University of Halle-Wittenberg. 48 hours and again one month after establishing the depots, the team searched for the seeds within a 2.5 meter radius. More than 80 percent of the seeds transported away could be relocated. In most cases, the ants removed the aril, which is a benefit for the plants, due to a lower risk of fungal infestation and a higher germination rate.

But there are more positive effects of ants: "Especially in the degraded habitats, we found that seeds which had been removed by ants were predated less often and germinated more frequently than the unmoved seeds," explains Dr. Matthias Schleuning, co-author and scientist at BiK-F. Quite often, the ants removed the seed aril only in their nests or on the way there – often leaving the seeds protected by the litter layer. Under the leaf litter, the seeds were less likely to be detected by rodents or other seed predators and benefited from the humid conditions, favorable for germination. The effect in the deforested habitats was clearly visible: one month after the experiment had started, establishment of seedlings was about five times higher for dispersed than for non-dispersed seeds. Dispersal distance had a positive effect as well: The farther the ants had transported the seeds, the higher was the chance that *Clusia* seedlings had established.





Ants are attracted by the lipid-rich aril of *Clusia* seeds and move the seeds to safe microsites for germination. Credit: S. Gallegos

### **Even more important services by ants in the future**

Ants have a clearly positive impact on the dispersal and establishment of the investigated tree species. This is particularly relevant as other animal and plant species may follow the species that facilitates the establishment of others. "We may use our knowledge to stimulate the establishment of *Clusia* in degraded habitats and enhance the regeneration of deforested areas" says Silvia Gallegos. Due to the ecosystem service provided by ants in the degraded areas, a faster and sustainable establishment of tree seedlings like *Clusia* may be expected. In the medium term, this will enhance living conditions for a number of

other animal and plant species and accelerate the regeneration of the mountain rain [forest](#) ecosystem. Schleuning concludes: "Drought frequencies in the Andes are likely to increase in the future. Under this scenario, the dispersal function of ants may further increase in importance for the restoration of tropical mountain forests."

**More information:** Gallegos, S. C., Hensen, I., & M. Schleuning: "Secondary dispersal by ants promotes forest regeneration after deforestation." *Journal of Ecology*, [DOI: 10.1111/1365-2745.12226](https://doi.org/10.1111/1365-2745.12226)

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