

Not without the poison dart frog

A research group headed by Professor Nico Blüthgen at TU Darmstadt is investigating how nature returns to recovering rainforest. The comeback of key species and interactions indicates successful regeneration.

—By Hildegard Kaulen

Stop! The poison dart frog's bright colouring clearly indicates to its enemies that it will not be enjoyable prey. It produces its poison from the ants and mites that it eats. "When we encounter the poison dart frog in the tropical rainforest in Ecuador, we know that we have found a complex ecosystem", says Nico Blüthgen, Professor of Ecological Networks at TU Darmstadt. "The threatening mix of its garish colouring and accumulated poison indicates a highly specialised predator-prey relationship that can only function in a complex and closely meshed ecosystem. The more complex this type of ecosystem is, the more resilient it will be. And this is precisely what we want to see in the natural regeneration of barren land."

Blüthgen heads a consortium consisting of twelve universities and foundations that want to find out how natural forests returns to fallow land in the rainforest. Which species are the first ones to come back? How long does the natural regeneration take?

Will the old biodiversity be restored? Will all of the complex inter-relationships be re-established? How close will the new ecosystem come to the functionality of the old one? Blüthgen and the members of his team do not want to simply take an inventory but rather to measure the level of complexity found deep within the resurgent ecosystem. This is actually a natural process because areas of the forest are constantly being destroyed by natural catastrophes and then recover again. But nobody knows precisely how close to their original condition they come after this regeneration.

A lot of things are different today Ecosystems are disappearing at a rapid pace in large deforestation events. An area the size of ten football pitches is lost every minute in the tropical rainforest. And the rate at which living creatures are becoming extinct has tripled over the last hundred years. "We still don't understand enough about how an ecosystem works in order to be able to easily rebuild it", says Blüthgen. "We don't have a playbook for how to quickly repair the damage and we also need to better understand how nature regenerates itself and what

happens during this process. It is only then that we can make targeted interventions", according to Blüthgen. "If you were to ask me whether we are prepared for the challenges we will face in re-naturalising our planet then my answer is currently no. We simply know too little." Reforestation alone is not sufficient for Blüthgen. He is interested in restoring the complexity and thus the resilience of an ecosystem – so that it can also cope with climate change. The United Nations are also increasingly following this approach and have designated the next ten years as the "Decade on Ecosystem Restoration".

What exactly are Blüthgen and the international team planning to do? The researchers will be studying 62 areas of the Chocó lowland rainforest in the northwest of Ecuador over the next four to eight years. These areas of land had been used for some time for

grazing animals or for cocoa farming but have now been abandoned. Some of these areas have already been regenerating for twenty or thirty years without any external influences, while others have only just started the regeneration process. The researchers will focus on some important processes: the relationships between predator and prey, trees and pollinators, mammals, seeds and dung beetles, and ants, termites and deadwood – to name just a few.

The "REASSEMBLY" research group is being funded by the German Research Foundation. It is also being supported in Ecuador by a consortium consisting of the Jocotoco Foundation and two universities in the country. The foundation has been buying up land in the region for 20 years, which is then left to develop on its own. Some of the funding will also be used to train Ecuadorian students and set up local structures.

The research group chose Ecuador for a number of reasons: "The conditions there are excellent", says Blüthgen. "The areas of land are located directly next to a rainforest, which acts as a good reservoir for the natural regeneration of the land. The rainforest in the Chocó lowland region is also especially productive. Everything grows extremely quickly and there are numerous animals to redistribute seeds from the trees. There is thus a good chance that we will actually be able to answer many of our questions within a few years. By observing the different stages of regeneration in which the areas of land find themselves, we should also be able to draw some conclusions about the speed of the process."

Die Anwesenheit des Pfeilgiftfroschs the presence of the poison dart frog is an important indicator for the complexity of the restored rainforest. Dung beetles are another indicator. They bury dung and the seeds within it and these seeds then germinate. However, dung beetles only bury mammal dung. If there are a lot of dung beetles in an ecosystem, it must also have a sufficiently large number of mammals that excrete



Photo: Kathrin Binner

seeds in their dung. The researchers can find out precisely which mammals are present in the forest by analysing DNA from the stomachs of the dung beetles. It could come from, for example, fruit-eating howler monkeys or marmosets but also from a puma or jaguar. The latter play an important role as predators, especially at night. The stomachs of poison dart frogs will also be analysed in the same way. The resulting DNA can be used to identify a whole network of predator-prey relationships because the presence of one species is always dependent on the existence of another.

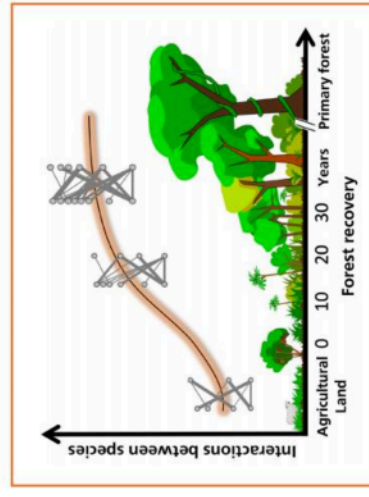
Pollination is another important process. To learn more about pollination processes, Blüthgen and his research group will trap animals using a light trap and analyse the pollen stuck to them. A DNA test will once again provide information on the identity of the individual pollens and the researchers can use this information to find out which animals have pollinated the respective plants. It is thus not necessary to climb to the top of the trees in the rainforest to find out. The answers can simply be found on the ground.

Disturbance experiments will also be carried out on areas of land at different stages of regeneration to test the stability of the newly developed networks. For this purpose, the researchers will clear an eight by eight meter area at ground level and only leave the trees standing. They will then monitor how nature regenerates in these areas. "We

The rainforest is regenerating in selected areas of land in Ecuador and this process is being observed by, among others, Prof. Nico Blüthgen and his working group.

suspect that this process will be quicker in those areas where the natural regeneration process in the surrounding land is at a very advanced stage and not just in its early stages", says Blüthgen. "We won't only be looking at the complexity of the revived ecosystem itself during these experiments, but also at the interplay between regeneration that has taken place over decades with its increasingly complex networks and the short-term recovery of small areas of disturbance." Blüthgen and the team are acutely aware of the significance of their experiments. "Our own survival ultimately depends on the survival of the global ecosystem. We have no more time to lose if we want to support natural regeneration processes in a targeted way."

The author is a science writer and holds a doctorate in Biology.



Graphic: Arbeitsgruppe Blüthgen

How long does land that was previously used for agriculture take to regenerate in the rainforest? The working group headed by Prof. Blüthgen is also investigating how the entire ecosystem interacts.

Information

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