ECOTOURISM IN AMAZONIAN ECUADOR – BOSQUE MEDICINAL PROJECT

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https://doi.org/10.11118/978-80-7509-904-4-0039

Abstract
Bosque Medicinal was established in Ecuador to protect the rainforest. Its founder, Roman Kollar, who lives in Ecuador, set it up in 2018 and has since been raising money to save the tropical forests there. His organisation and its Czech partners, Forest Ink, buy up former farms with remnants of rainforest. The aim is to turn the pastureland back into a high-quality forest, and to protect forests that have not yet been damaged by cattle ranching. Although the organisation has an international focus, most of the volunteers who come to help are from the Czech Republic. Their holidays mean buying tickets to Ecuador and working for free on the farms they buy, restoring forest to the slopes of the Ecuadorian Amazon. In 2019, the UNIDA Consortium was formed, bringing together universities and associations in Europe and Latin America to to share knowledge about the Amazon and contribute to the conservation of the region's nature and traditions. Mendel University is a founding member, and the first group of students travelled to the Amazon in 2021 with the aim of collecting the basic data needed for the reforestation of farmland.

Key words: land trust, Bosque Medicinal, biodiversity, deforestation, UNIDA

Introduction

Ecuador is a country in tropical Latin America. The eastern part slopes down from the Andes into the Amazon basin and is still covered by vast and diverse forest ecosystems. Part of these tropical forests are protected in a system of protected areas managed by the Ministry of Environment, Water and Ecological Transition (Ministerio del Ambiente, Agua y Transición Ecológica), in 67 areas with different categories of protection (MAE, 2022). According to the IUCN (2023), these areas account for 23% of Ecuador. Our area of interest is located near the town of Gualaquiza in the eastern part of Ecuador. The regional government has designated several regional protected areas here, including the El Paraiso Reserve, which is part of the larger Área de Conservación Municipal Runahurco (GAD minicipal de Galaquiza, 2014).
This area is in the Amazon region, but on the slopes of Andes, originally covered by montane tropical rainforest. Here, the Bosque Medicinal Land Trust started to buy former farms to reforest them. Decades ago farmers from the lowlands began to convert forest into pasture for cows. The rapid deforestation of the area is a problem not only for biodiversity, which is very high here, but also for the climate, as the carbon trapped in the trees is released into the atmosphere. For local farmers, logging used to get legal ownership of the land, as local governments had a strategy of certifying their property if farming took place over a long enough period.

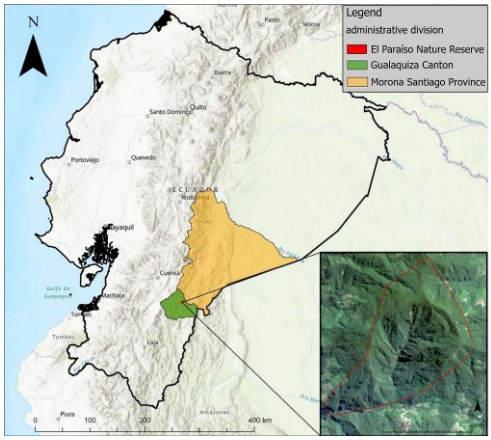

Fig. 1: Region of study area (INEC, 2019)

The diversity of the forest is still very high and has not been sufficiently studied so scientists from the international community are invited to conduct research here. Bosque Medicinal, an Ecuadorian

foundation, started its activity here in 2018. Several groups of volunteers from many countries but mainly from the Czech Republic come here every year to plant forest in the newly-purchased land as well as to build the field station for further research. Bosque Medicinal, together with its partner association Forest Ink from the Czech Republic, raised money to buy former farms. Later in the UNIDA (United for the Development of the Amazon) project was launched as a consortium of universities, NGOs and private companies from the Amazon countries and the Czech Republic with the aim of working together to protect the Amazon. The first group of students from Mendel University travelled to Gualaquiza in September 2021 to begin the basic biological research necessary for the reforestation of former farms there.

Materials and methods

The El Paraiso Nature Reserve (Figure 1) is part of a diverse system of protected areas in Ecuador - specifically it is a regional protected area. It has about 500 ha and is located 20 km north of Gualaquiza at an elevation of 1300–2157 m covered by diverse mountain rainforest. The area is in the eastern part of Ecuador, in the province of Morona Santiago Province and the canton of Gualaquiza (INEC, 2019). Part of the nature reserve is privately owned by farmers who also own the land around the reserve (Nugra et al., 2011).

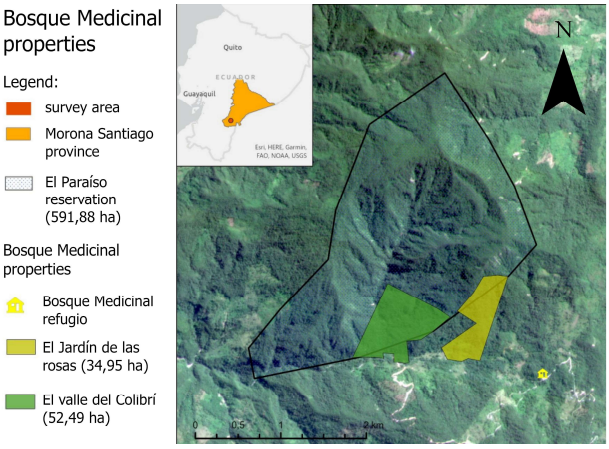

Fig. 2: Study area location with Bosque Medicinal Land Trust

The nature reserve consists of three ecosystems (Nugra et al., 2011; MAE, 2013), which are shown in Figure 2. The lower part of the reserve forms low mountain rainforest with the Lauraceae family (up to 1400 m above sea level). The higher part (1400–1800 m) is formed by low mountain rainforest with Ocotea and Podocarpus species (up to 1400 m above sea level). The highest part of the reserve is Mountain rainforest with Miconia species.

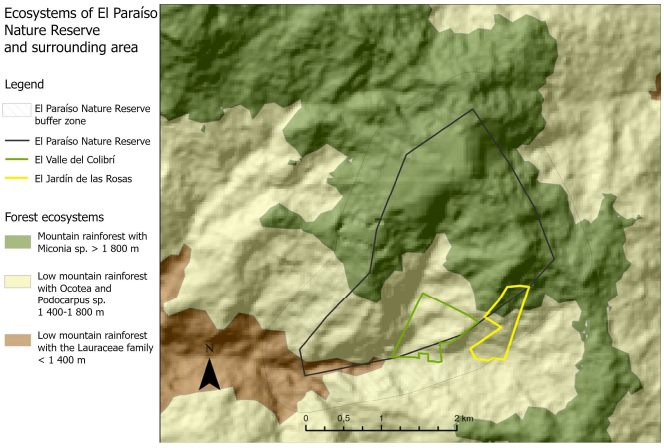

Fig. 3: Ecosystems of the El Paraiso Nature Reserve and the surrounding area

Research on tree species of the Bosque Medicinal Land Trust on deforested pastures was carried out in September 2021 by the team from Mendel University, the Czech Republic, with a local expert from

Azuay University. The team also used the knowledge of farmers and guides from the Shuar minority. The tree atlas of Minga et al. (2019) was used for basic tree identification. Translation from local languages was carried out with the help of R. Kollar, director of the Bosque Medicinal Land Trust.
The task of identifying species and ways to reforest the former pastures led us to decide if there were enough natural tree regeneration in the area and what species of adult trees were left on the pastures. All trees taller than 15 metres were measured and identified. Long telescopic scissors (1.5 to 11.5 m) were used to cut off tree branches, preferably with flowers or fruits. GPS data and mobile phone photos were archived and ArcGIS was used to create images of tree distribution.
Another task was to consider the abundance of tree seedlings. For this purpose a network of 50 x 50 m was inserted into the mobile phone application and12 research plots of 2 x 2 m were established. Each seedling was described and at least the family name was identified.

The results
First of all, a digital map of properties of the Bosque Medicinal was made as shown in Figure 4. Two farms were acquired in the southern part of the El Paraiso Nature Reserve, later named “El Jardin de las Rosas” and “El valle del Colibri” (Figure 4). As the reserve El Paraiso has 591 hectares, the new land trust of Bosque Medicinal is much smaller, El Jardin de las Rosas has 35 ha and El valle de Colibri 52 ha. Both were paid for by international donors, mainly from the Czech Republic. Volunteer camps, which are held four times a year, pay for their stay to cover food and basic accommodation, so international donations flow into the land trust for new land purchase projects. At the field station called El Refugio (see Figure 4), there is a basic camp for their activities as well as being offered for research and education. This area of about one hectare is much smaller and was purchased earlier.

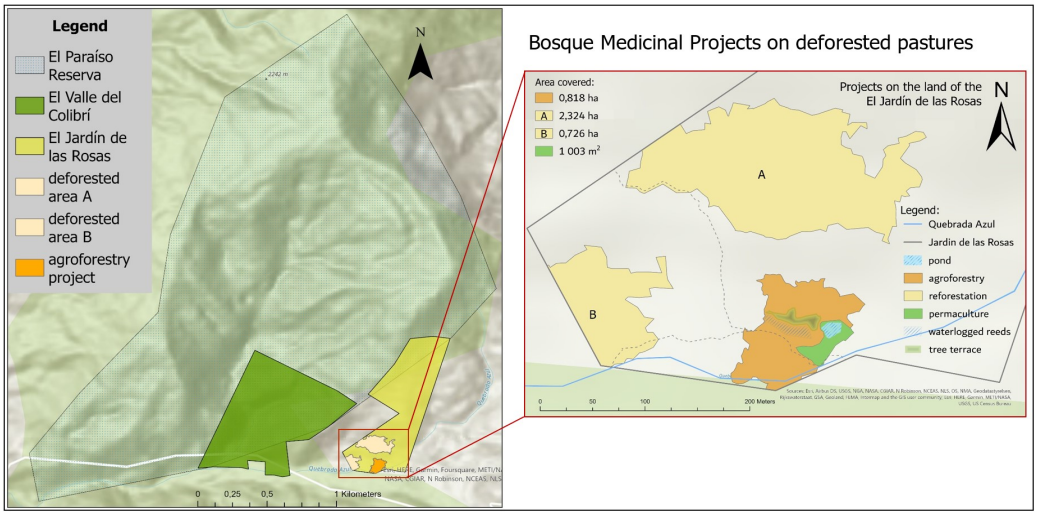

Fig. 4: Plan for agroforestry and gardens on the deforested pastures of Bosque Medicinal

El Jardin de la Rosas has several hectares of pasture used by former farmers for grazing cattle and is partly formed from forest slightly damaged by logging by the farmer. The presence of solitary natural and planted trees was studied as well as the presence of seedlings. The pastures were mapped using GPS data. Four parts of nearly four hectares were defined (Figures 5 and 6). Dots on the map mean trees either from the original rainforest and some planted fruit or ornamental trees in the southern part (všude změnit odkazy na mapu!!). Yellow parts A and B are meant for reforestation, where natural forest will be supported. The orange part of 0.8 ha was chosen for agroforestry, for products needed for the volunteer kitchen and local environmental school education, while the green part of 0.1 ha is for a future permaculture garden. This area has the highest number of planted trees as it was the most intensive part of the former farm, with fruit trees, rose bushes and even some building ruins.
In plots A and B, 74 trees were found that were over 15 metres tall. The trees belong to 13 families (mainly the Lauraceae, Meliaceae, Arecaceae and Fabaceae families). Here 25 tree species were identified. All the native trees will be used for the reforestation of the area. In the southern agroforestry plots, most of the native trees will be used as shade-giving trees forming an agroforestry culture.
Another task was to identify right tree species and number of trees to have in the reforested area. Figure 6 shows network of 12 plots of detailed research into seedlings from natural regeneration. Calculating the plots of 4 square metres (2 x 2 m each) for each hectare, 11 879 seedlings per hectare

in area A were obtained and 3 750 seedlings per hectare in area B, which is sufficient for natural regeneration.

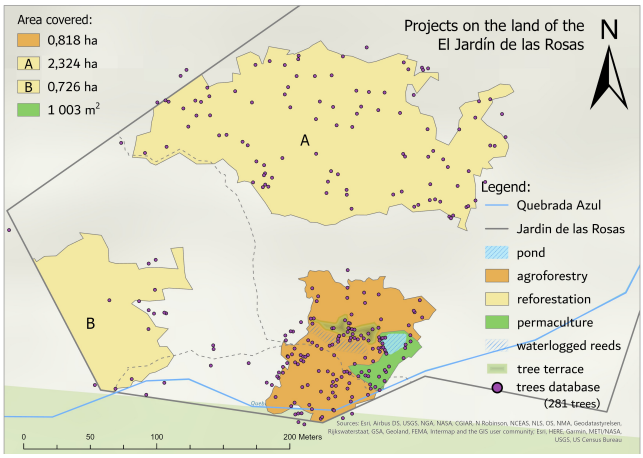

Fig. 5: Trees of natural or planted origin on the pastures of the Bosque Medicinal Land Trust

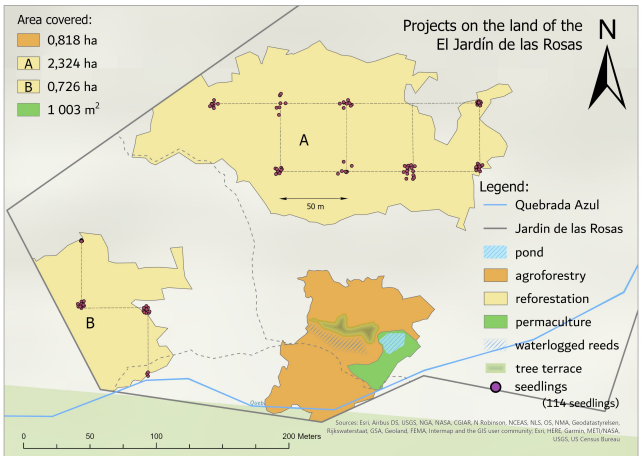

Fig. 6: Natural regeneration on research plots on Bosque Medicinal Land Trust *pastures*

This could be supported by planting native tree species in gaps, but good protection from cows from surrounding farms must be assured.

Discussion

The question for our research is that of what methods to choose for restoring montane rainforest. In acquired areas there are still montane rainforest trees, for example *Cedrela* from the *Melicaceae* family or species from *Lauraceae* such as the *Ocotea* or *Endlicheria* genus which can form umbrella for other species from natural regeneration in the future. Leaving the land to natural regeneration is also supported by our research in Valle de Colibri (eastern plot on Figure 4), which was abandoned by cows about 15 years ago. A density of 425 trees over 10 cm in DBH per hectare was found here after the former farmer abandoned the pasture. Although not all plants in the 400 m^2 study area were identified here, we counted 10 tree species from 7 families in this small plot and the site will need more detailed research in the future.

Further research could also answer the question of how much overseas ecotourism is affecting local diversity. About 60 volunteers a year come to the Bosque Medicinal field station willing to help. Their ecological footprint is largely made up by air travel to and from Ecuador, since the life in the field station is simple and environmentally friendly (Forest Ink, 2022). On the one hand, there is a clear support for nature's return to newly-acquired land, formerly grazed pastures. Bosque Medicinal Land Trust has purchased about 100 hectares of agricultural land to convert into a close-to-natural forest and expand the existing El Paraiso reserve. According to Hora, Marchant, Borsdorf (2018), there are hundreds of private protected areas in South and Central America, up to 5% in Costa Rica. In Ecuador private and community owned protected areas make up 0.78% of the country´s territory (MAE, 2018).

The Bosque Medicinal organisation also hopes to influence some of the farmers and residents of the nearby valley town of Gualaquiza, from where high school and university students have recently been starting to come. Education is provided by teachers from the Universidad de Azuay, as well as lectures in the natural environment, in the El Paraiso reserve, which are organised by Bosque Medicinal and guided by indigenous Shuar people. Another aim is to influence some farming families by establishing and running agroforestry land and permaculture gardens. We were able to see the impact on the farmers during our stay - the neighbouring farm owner not only guided us and named the trees around the farm for our research, but he also no longer wants to cut down the natural forest. There are more and more such owners here, so while deforestation is happening in one part of the province, the opposite process is also happening, with some nature returning to the damaged farms.

Conclusion

The research carried out in the El Paraiso area of the Morona Santiago province, Gualaquiza canton, Ecuador, was aimed at determining methods for reforestation of the land purchased by Bosque Medicinal. A team from Mendel University, within the framework of the UNIDA project, collected the basic biological data needed to return good forest to the deforested pastures that have been bought. Bosque Medicinal buys deforested land from farmers who usually keep cows there. Groups of volunteers who spend their holidays here are willing to plant trees and help the restore the natural forest. Our research has shown that due to the proximity of the El Paraiso reserve with high-quality montane rainforest, hundreds of seedlings of forest trees are appearing in the pasture, not to mention the solitary native forest trees that the farmers have left standing for various reasons. In total, the inventoried areas contain 25 tree species from 13 families, providing a solid foundation for a diverse natural forest in the future, mostly without planting. In areas where natural regeneration is lacking, only trees of local origin will be planted.

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Acknowledgement

Thanks to our partners from the Ecuadorian Universidad del Azuay F. Nugra, as well from Bosque Medicinal R. Kollar and local farmer Hugo and the guide from indigenous Shuar.

Souhrn
Organizace Bosque Medicinal vznikla v Ekvádoru kvůli ochraně pralesa. Její zakladatel Roman Kollar, který v Ekvádoru žije, ji založil v roce 2018 a od té doby zde shání peníze na záchranu tropických lesů. Jeho organizace i čeští partneři z Forest Ink vykupují zbytky původního pralesa i pastviny od farmářů. Cílem je z pastviny opět učinit kvalitní les a lesy, které dosud nebyly poničeny, před pastvou ochránit. I když má organizace mezinárodní zaměření, většina dobrovolníků, kteří sem jezdí pomáhat, jsou z České republiky. Jejich dovolená znamená zakoupit si lístky do Ekvádoru a zdarma pracovat na vykoupených farmách, vrací zpět les na svahy ekvádorské Amazonie. Rovněž většina peněz na výkup pozemků plyne z České republiky. U nás se podobným organizacím říká pozemkové spolky a jejich hlavním cílem je ochrana přírody a kulturních památek. V roce 2019 vzniklo konsorcium UNIDA, které sdružuje univerzity a sdružení v Evropě a Latinské Americe, jehož cílem je spolupráce na výměně znalostí o Amazonii a přispění k ochraně přírody i tradic v oblasti. Zakládajícím členem je i Mendelova univerzita a první skupina studentů do Amazonie vyjela v roce 2021 s cílem vytvořit přírodovědné podklady pro další skupiny studentů a dobrovolníků.

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