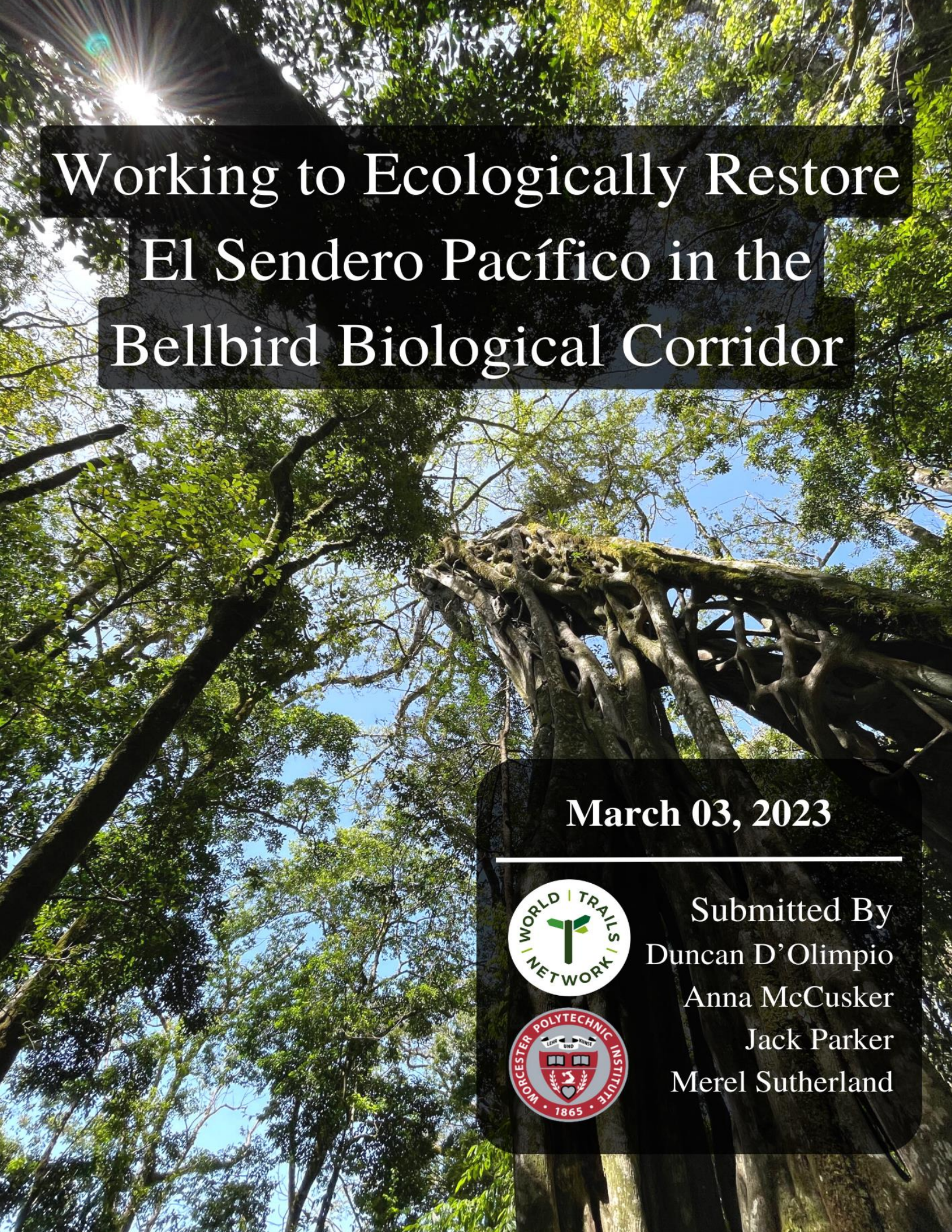

Working to Ecologically Restore El Sendero Pacífico in the Bellbird Biological Corridor

March 03, 2023

Submitted By
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Working to Ecologically Restore El Sendero Pacífico

An Interactive Qualifying Project Report
Submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillment of the requirements for the
degree of Bachelor in Science

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Date:
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Report Submitted to:

Nat Scrimshaw
World Trails Network - Hub for the Americas

Professor CL Stimmel, PhD
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Abstract

The Sendero Pacífico trail stretches 60 km from Monteverde to the Gulf of Nicoya. Due to longtime farming practices, deforestation is common along the trail. We worked with the World Trails Network to identify opportunities for landowners to participate in reforestation and to expand its funding sources. By interviewing landowners, restoration representatives, local trail ambassadors, and hiking the trail, we identified inhibitors to reforestation efforts. We recommend a land title assistance program and the increase of non-governmental programs to improve outcomes.

Acknowledgements

We would like to thank everyone for their assistance in our project. Without these following individuals, who provided their expertise and time, our project would not have been possible. First, we would like to thank our sponsor and sponsoring company, Nat Scrimshaw, and the World Trails Network, for their guidance and collaboration. We would also like to thank our advisor and professor, Dr. CL Stimmel for her feedback and gratitude for our efforts. She provided us endless support and advice as we were completing our project. Lastly, we would like to thank all the interviewees and community members of the Bellbird Biological Corridor for giving us their time and perspective, whose information was crucial in making this project successful.

Authorship

The following was written by four authors. Duncan D'Dolimpio (DD), Anna McCusker (AM), Jack Parker (JP), and Merel Sutherland (MS).

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Meet The team:

We are four students attending Worcester Polytechnic Institute (WPI). From left to right we are Duncan D'Olimpio, Jack Parker, Merel Sutherland, and Anna McCusker. Duncan is from Vermont studying Environmental Engineering, Jack is from Maine studying Mechanical Engineering, Merel is from Connecticut studying Mechanical Engineering and Environmental & Sustainability Studies, and Anna is also from Connecticut studying Biomedical Engineering. The four of us grew up hiking in the Northeast and were eager to get the chance to hike in Costa Rica. In our free time, we enjoy extracurricular activities such as Greek Life, Club Hockey, Varsity Rowing, Ultimate Frisbee, and the Outdoors Club.

Executive Summary

Background

Deforestation from agriculture and timber farming has led to ecological degradation, poor soil conditions, habitat disconnection, and a loss of biodiversity in Costa Rica. Despite efforts to reverse the effects, including environmental education and establishing biological reserves, more progress is needed (Castro, 2022). In 1996, the government implemented the Law of Forestry to conserve remaining forests, manage deforestation, and reforest land. Payments for Environmental Services (PES) were offered to incentivize landowners to protect their land. However, some landowners resist PES programs, which has hindered progress. The culture of farming has shifted to rely more on ecotourism, and efforts are being made to identify opportunities for landowners to participate in reforestation efforts and expand funding sources for these programs.

Deforestation is a major problem worldwide, particularly in tropical regions that rely on their climate for year-round growing seasons. Tropical rainforests are home to a great range of biodiversity represented on Earth and deforestation is the greatest threat to these unique ecosystems (FAO, 2022). Agriculture is the primary driver of deforestation in developing countries with rainforests (Gardner, 2022). Deforestation causes soil erosion, flooding, desertification, and greenhouse gas emissions, and it can lead to the transformation of rainforests into savannas (Fiolhais, 2022). Costa Rica, a developing country with a significant ecotourism industry, has struggled with deforestation in the past, but recent efforts to protect its rainforests have been fruitful. Ecotourism has helped promote conservation and reforestation, and the government has implemented policies to protect the environment. Deforestation is harmful to the environment and the economy, but several initiatives have been successful in promoting conservation and sustainable business practices.

Inside Costa Rica’s Bellbird Biological Corridor (CBPC) is a trail called El Sendero Pacífico, which starts in the cloud forest and ends on the gulf of Nicoya. Towns like Monteverde, Guacimal, and Sardinal are linked by this trail as part of a 1977 effort to prioritize ecological restoration and conservation to preserve the environment around these communities (Castro, 2022). The CBPC is a crucial area of high biodiversity, with three major towns located within the corridor. The corridor is home to the three-wattled bellbird, among other species, and is a popular destination for tourists due to its beauty and trail networks. Deforestation has led to the fragmentation of forested areas, which has negatively impacted the habitat of wildlife. Therefore, the government and wildlife protection groups have implemented programs to promote habitat connectivity. Along with the area's biodiversity, the corridor is also a place of rich culture and has defining features of Costa Rican food, religion, sports, work, and clothes. Food culture in Monteverde is especially significant, with dishes such as Gallo Pinto and Casado being popular among tourists (Penland, 2008).

Ecological restoration is important for mitigating biodiversity loss and deforestation but requires investment to remain viable. Generating carbon offsetting credits, which involve removing carbon dioxide from the atmosphere through reforestation and conservation efforts to offset greenhouse gas emissions, are a potential solution to combat climate change, but have come under scrutiny due to fraud and questionable practices (Greenfield, 2023). Restor is a non-profit organization that connects ecological restoration projects, experts, and companies around

the world to increase the impact, scale, and sustainability of these efforts. It allows members to observe data, monitor current restoration projects, and find funding opportunities to combat carbon emissions. Restor aligns with the goal of identifying ways for landowners to participate in reforestation initiatives and expand sources of funding.

Approach

The goal of this project was to identify opportunities for landowners to participate in reforestation efforts and expand the WTN's sources of funding. We planned to carry out the following objectives to complete our project goal, although we found that our fourth objective was not necessary for the completion of our goal.

1. Identify the motivations and inhibitors for enrollment in the PES program.
2. Identify alternative opportunities for smaller landowners that address inhibitors to PES enrollment.
3. Organize educational materials that are inclusive of all landowners in the corridor.
4. Planned to conduct the outreach program along El Sendero Pacífico using newly developed educational materials.
5. Develop a supplementary brief detailing funding sources for ecological restoration in the CBPC.

The first objective was to identify the motivators and inhibitors for landowners to participate in the PES program. Data was collected through informal semi-structured interviews with landowners. The second objective was to identify alternative opportunities for landowners that address the inhibitors to PES enrollment. Semi-structured interviews were held with local and global experts in reforestation practices. The third objective was to organize educational materials that are inclusive of all landowners in the corridor. An infographic was created to highlight reforestation efforts in the area. The fourth objective was to conduct the outreach program along El Sendero Pacífico using the infographic, but this objective was not a priority The fifth objective was to develop a supplementary brief detailing funding sources for ecological restoration in the CBPC, which was delivered to the World Trails Network.

Results

Within our interviews from objectives one and two, we acquired information from two different groups, conservation experts and landowners. Our key finding from the completion of the first objective is that most landowners do not have a land title which prevents them from joining PES. In objective two we found that there are several other government-funded programs other than PES for landowners that were preferable due to more relaxed requirements and lack of a contract. From objectives three and four we found that awareness of PES is not the primary inhibitor to working with the program, but rather program scope and administration are not a good fit for many landowners.

We interviewed ten landowners who live in the CBPC and are aware of PES, but several reasons exist for non-participation. A land title is a requirement for enrollment and can be expensive and complicated to obtain, especially for larger properties because surveying costs are more expensive for larger landowners. We found that there are more smaller landowners that have land titles than larger landowners with land tiles. Another inhibitor was that smaller

properties may not yield considerable profit, making it not worth the commitment to join PES through a binding contract. Larger landowners may benefit more from the PES program as they would receive more monetary compensation.

There are also many other sustainability/reforestation opportunities in the CBPC. More sustainable methods of agriculture like no-till farming, apiculture, and bean slinging are becoming more popular in the corridor. They disturb the soil less and are more environmentally conscious because large plots of land are not necessary compared to cattle and timber farming. Non-government funded programs like Restor and Astillero Verde, which is a program based in Puntarenas, Costa Rica contributing to environmental restoration may be more suitable for smaller landowners, as PES is too complex. Our analysis led us to conclude that educational outreach programs designed to promote PES would have minimal impact, as our participants indicated widespread knowledge of the available opportunities offered by PES and other conservation programs in the area.

Recommendations

We primarily recommend that a land title funding program be created by Costa Rica's PES program to help landowners pay for land titles who desire them. This will relieve the financial burden on farmers and increase protected land for biodiversity connectivity. Larger landowners would benefit from this program because it is harder for them to obtain a land title.

We also suggest increased involvement with non-governmental programs in the corridor because these programs have fewer obstacles to joining. Our research indicated that programs like Restor, can connect environmental programs with the land. These should be used more in the CBPC, especially for smaller landowners who do not benefit from joining the PES program. Utilizing Restor's Costa Rican representatives to connect landowners to programs would also aid in connecting local projects to resources.

Our third recommendation is to conduct a study on landowner hesitation to reforest or not reforest their land. We believe this would be a beneficial project for a future student group to conduct as the results would help the WTN gauge how to move forward with finding a way to keep building the trail and reforesting the areas around it while addressing the landowner's needs.

To attract travelers to the trail we recommend a marketing campaign for WTN. The campaign would focus on effective marketing strategies to promote the trail and its educational opportunities. While reforestation is important, improving trail quality is a more immediate priority in terms of encouraging people to hike the trail. Targeting student groups and promoting the trail on social media would generate interest and increase the number of trekkers. Live updates of student hikes can be shared online to generate more interest and contact information for available lodging could also be provided on the Sendero Pacífico website.

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Glossary

Acronym	Definition
CBPC	Bellbird Biological Corridor
GEF	Global Environment Facility
GHG	Greenhouse Gasses
GIS	Geographic Information System
FONAFIFO	National Forestry Financing Fund
MCL	Monteverde Conservation League
MVI	Monteverde Institute
MCF	Monteverde Community Fund
PanATN	Pan American Trail Network
PES	Payment for Environmental Services
PSA	Pagos por servicios ambientales
TSC	Tropical Science Center
WTN	World Trails Network
WTN-Americas	World Trails Network-Hub For the Americas

1.0 Introduction

Deforestation from agriculture and timber farming has damaged the environment and negatively affected the people in Costa Rica's livelihoods since the 1940s (Sader, 1988). These environmental effects include ecological degradation, poor soil conditions, habitat disconnection, and a loss of biodiversity. Although there have been recent efforts to reverse the effects, including environmental education starting at the elementary level, there is still a need for substantial progress (Castro, 2022). Deforestation for agriculture in tropical regions uses the slash-and-burn method in which the fires often grow out of control and unintentionally destroy more forests (Fiolhais, 2022). Among these deforested areas, the old-growth forests - like tropical rainforests - are being deforested at the most alarming rates (FAO, 2022).

Tropical rainforests are home to a great range of biodiversity represented on Earth and deforestation is the greatest threat to these unique ecosystems (FAO, 2022). Between 2000 and 2010 alone, a total area of tropical rainforest approximately the size of Egypt was deforested globally (Norris, 2016). In Costa Rica alone, more than half the forest cover was cleared in the 40 years between 1940 and 1980 (Rosero-Bixby & Palloni, 1998). A dramatic 275% population spike post-World War II led to a stark increase in deforestation in Costa Rica because the spike created a greater demand for resources (Rosero-Bixbforestslloni, 1998). With the increase in population came increased agricultural requirements, including cattle ranching, banana exports, land tenure institutions, and wasteful logging technologies. The long-term consequences of these practices include soil erosion, soil infertility, water quality depletion, and loss of biodiversity. Taken together, these practices continue to have an adverse effect on one of the country's main economic outlets, ecotourism, which is 12.5% of Costa Rica's gross national product (McNall et al., 2016).

Biological reserves, such as the Bellbird Biological Corridor (CBPC), were established to conserve the environment and biodiversity, as well as support communities that rely on ecotourism (Brownson et al., 2020). Inside the CBPC is a trail called El Sendero Pacífico (as seen in Figure 1), which starts in the cloud forest and ends in the gulf of Nicoya. Towns like Monteverde, Guacimal, and Sardinal are linked by this trail as part of a 1977 effort to prioritize ecological restoration and conservation to preserve the environment around these communities (Castro, 2022). To ensure this connection persists, a variety of laws and programs were put in place at a national and local level. In 1996, the Law of Forestry [*Ley 7575*] was implemented across the country to conserve remaining native forests, manage deforestation, and reforest land with help from the communities. Additionally, Payments for Ecosystem Services (PES) or pagos por servicios ambientales (PSA) are offered to landowners as an incentive to protect their land. Costa Rica's PSA program is implemented by the National Forestry Financing Fund (FONAFIFO). There are various elements inherent in these government-run programs that both encourage and discourage participation.

Figure 1

Map of El Sendero Pacífico (The Pacific Trail)

Note. By D. Villalobos, 2022, photograph, located in WTN - Americas. Permission Granted 2/16/23 (translated by author)

Reforestation and conservation efforts have been used in Monteverde to create communities that are more sustainable and rely more on ecotourism than deforestation. The Monteverde Institute (MVI), Monteverde Conservation League (MCL), Tropical Science Center (TSC), GEF small grants program, and the PES program are organizations and programs that were formed to reverse the effects of deforestation. However, many Costa Rican landowners are resistant to these new programs because the monetary compensation does not cover the value of the land or aligns well with their personal beliefs about land use (Cortés-Capano et al., 2021). There are many methods to help increase participation in conservation programs within the CBPC. But one of the key inhibitors to realizing the full impact of the program is finding landowners who would benefit most, based on the size of the land and uses of the land. These programs have proven to be effective in promoting sustainable communities and a shift towards ecotourism, yet it has been difficult to engage a broad range of landowners to increase participation.

There has been a shift in the culture of farming in the past century within the CBPC. Thirty years ago, farming was a vital source of income for those living in the CBPC, but in recent years the benefits of tourism have overtaken it (Castro, 2022). Along with educational efforts related to the local ecosystem, long-standing farms are being reverted to forests by people who have lived and seen the effects of deforestation. Although there have been changes in people's beliefs towards agriculture, the culture of art, clothes, food, music, and sports have remained vital and important (Costa Rican Culture, 2004). Yet, while the Costa Rican community values reforestation programs, these local programs are largely non-profit, and therefore need some source of funding in order to be viable and effect systemic change.

The goal of this project is to identify opportunities for landowners to participate in reforestation efforts and expand the sources of funding available for the WTN. Our first objective to complete this goal was to identify the motivations and inhibitors for enrollment in the PES program along the corridor. Our next objective was to identify alternative opportunities for smaller landowners that address inhibitors to PES enrollment to develop strategies to encourage their participation. Based on objectives one and two, we organized educational materials that are inclusive of all landowners in the corridor. Using this material, we planned to conduct an outreach program along El Sendero Pacífico but found it was not necessary from the results found in earlier objectives. Our last objective was to develop a supplementary brief detailing funding sources for ecological restoration in the CBPC, using information gathered throughout the course of our research project.

2.0 Background

In this chapter, we cover the effects of deforestation on the land and the people living in Costa Rica, specifically in the CBPC. Next, we explain different policies and programs designed to mitigate the effects of excess deforestation. We then expand on the CBPC, which is home to Monteverde and is known for its brilliant biodiversity. Lastly, we describe different sources of funding that are available within the corridor.

2.1 Deforestation and its Impacts on Tropical Regions

Deforestation is particularly detrimental in tropical regions close to the equator and primarily impacts developing nations that rely on tropical weather for the year-round growing and harvesting seasons. The tropical climate is vital to increased yields of both fruits and vegetables, yet, agriculture is the leading reason for rainforest deforestation worldwide (WWF, 2018). Indonesia, for example, is the world's leading producer of palm oil, owning 58% of the market (Gardner, 2022). Palm oil's increase in popularity in recent decades has also made it the leading contributor to deforestation in Indonesia's old-growth rainforest (Gardner, 2022). The problem is as severe in other areas of the globe.

2.1.1: Deforestation Globally and Within Costa Rica

Rainforest deforestation, such as that found in Costa Rica, comes with catastrophic environmental repercussions. Soil erosion, flooding, desertification, and increased greenhouse gasses are all major problems that follow the removal of rainforest vegetation. Around 77 million acres are deforested and destroyed every year globally (Zamora, 2018). When trees are uprooted to make way for pastureland, the land becomes weak and is easily impacted by rain. An eroded soil ripple effect can even end up harming coral reefs in the ocean (Cho, 2011). Desertification is one example of the effects of rapid climate change occurring in many tropical regions. The

country of Cambodia has deforested 25% of its forests in just the last two decades and in this time has also seen the worst drought in a century (WA, 2018). The removal of trees eliminates the water content that the tree would release into the atmosphere, which decreases cloud coverage in the area (WA, 2018). Many tropical regions are facing tipping points where if the rate of deforestation continues the rainforest will transition into a savannah (Fiolhais, 2022).

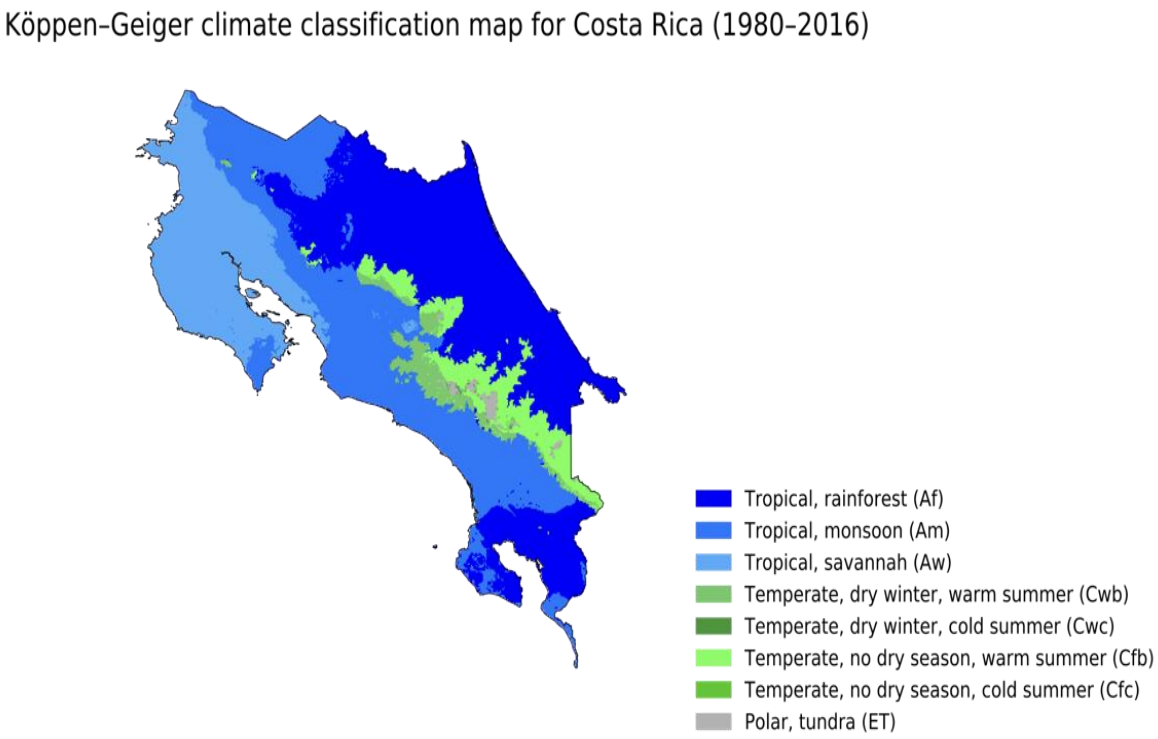
Costa Rica, a developing equatorial country, has been struggling with deforestation for decades in which its rates peaked in the 1960s, and by the 1990s it had one of the worst deforestation rates in Central America (Zamora, 2018). During the period from 1940 to 1986, Costa Rica lost up to 50% of its forest because the land was ideal for cattle ranching and clearing (Broadbent et al., 2012). This acceleration was largely because the United States offered Costa Rican ranchers millions of dollars over those decades for beef production (Zamora, 2018). Although their deforestation rates have been extremely high, recent efforts have worked to reduce the continued land clearing. The move towards ecotourism has helped promote reforestation and conservation. In 2014 Costa Rica had around 2.5 million visitors and this ecotourism contributed to 12.5 percent of the country's gross national product (McNall et al., 2016). Tourism within Costa Rica is a huge business and has provided thousands of jobs for people within the country. Positive ecotourism is reliant on government policy promoting sustainability as well as visiting tourists seeking out these experiences.

The Costa Rican ecotourism industry relies on the protection of its rainforests to maintain its national identity. Costa Rica's economy is in large part based on eco-tourism (Broadbent et al., 2012). Conserving the Costa Rican environment is particularly important because their identity relies on protecting the natural environment. As shown in Figure 2, Costa Rica holds five percent of the world's biodiversity and twenty separate ecological life zones (McNall et al.,

2016). Monteverde, for example, is known for its diverse ecosystems and lush rainforest, which has become a major ecotourism destination for Costa Rica and draws in many tourists, bringing in 250,000 tourists annually before COVID-19 (Shah, 2020). Ecotourism has helped build over 70 new national parks in Costa Rica and protected areas that have become learning centers for community members and tourists (McNall et al., 2016). Tourism focuses its resources on endangered environments while promoting responsible travel and ecosystem sustainability.

Figure 2.

Costa Rica's Climatological Zones



Note. File: Koppen-Geiger Map CRI present.svg., By H.E. Beck, N. E. Zimmermann, T. R. McVicar, N. Vergopolan, A. Berg, & E. F. Wood, 2018, Wikimedia https://commons.wikimedia.org/w/index.php?title=File:Koppen-Geiger_Map_CRI_present.svg&oldid=668114233. This file is licensed under the Creative Commons Attribution 4.0 International License.

Limiting deforestation is particularly important because it has been linked to environmental degradation including erosion, climate change, loss of biodiversity, air pollution, and a decline in watershed functions (Rosero-Bixby & Palloni, 1998). Farming has made land infertile, and farmers have had to find other uses for their land (Zamora, 2018). Some farmers have found relief from private local groups, the government, or even foreign organizations. And

while not universal, these groups have had a significant positive effect on reforesting small, protected areas and other biodiverse zones.

2.1.2: Policy in Costa Rica is Designed to Slow Deforestation

Deforestation has hurt the country in several ways and the nation has put in substantial work to prevent it and restore the forests. Costa Rica has faced some of the highest rates of deforestation worldwide since the 1970s, which continues to compromise the green reputation that Costa Rica holds (UNFCCC, 2020). Both the environment and economy are negatively affected by the consequences of deforestation. These include infertile soil, pollution, and lost natural land which has attracted millions of tourists to visit (Irazábal, 2018).

There have been many efforts made to slow down deforestation and protect the green and natural environment. The Costa Rican national government passed the National Forestry Law of 1996 which founded FONAFIFO and other programs (*Ley Nº 7575 - Ley Forestal. | FAOLEX*, n.d.). FONAFIFO represents the communities and the private sectors of Costa Rica with funding for projects to help protect the public, the environment, and businesses. FONAFIFO is known for being a facilitator of knowledge by informing people of money they could be earning through the PES program (UNFCCC, 2020). The 1996 law has been credited with financing reforestation projects and helping reverse the effects of deforestation (*Ley Nº 7575 - Ley Forestal. | FAOLEX*, n.d.).

Two examples of the FONAFIFO program are PES, which is focused nationally, and the Global Environment Facility (GEF) which operates on a local level. GEF has funded local projects in Monteverde for example. Legislation was made to protect the country from further deforestation in a way that will benefit both the people and the private sector.

The PES program offers three different types of payments for preventing further deforestation which can be found below in Table 1. Each distributes the money differently for each year of the contract. For reforesting land, landowners get $537/hectare for a twenty-year contract with a 50%, 20%, 15%, 10%, and 5% distribution per year. For conserving land, landowners get $210/ hectare for a five-year contract with an even distribution of 20% a year. For sustainable forest management, landowners receive $327/ hectare with a 50%, 20%, 10%, 10%, and 10% a year (Malavasi & Kellenberg, n.d.). This program has existed for 26 years in Costa Rica at a national level but has not been proven to be the most effective, because it does not help the smaller landowners who may not benefit financially (N. Scrimshaw, personal communication, November 21, 2022). Other attempts like conservation programs are described in more detail in the next section.

Table 1

Different Payments to Landowners Over a Five-Year Distribution

Contract Type	Total Payment (US$)	Distribution by year				
		1	2	3	4	5
Forest Conservation Easements	210	20%	20%	20%	20%	20%
Sustainable Forest Management	327	50%	20%	10%	10%	10%
Reforestation	537	50%	20%	15%	10%	5%

Note. Authors' own work. (Malavasi & Kellenberg, n.d.)

2.1.3: Conservation Efforts Within the CBPC

While the national programs do have a meaningful impact, it is the personal connection between local programs and community members within the CBPC that increases participation towards conservation (Powlen & Jones, 2019). The 1996 Forestry Law's National PES Program tends to target landowners with large properties, a higher income, and a higher education. This makes up only a small percentage of the landowners in the CBPC (Powlen & Jones, 2019). One survey taken of 81 landowners reported only one individual participating in the national PES program. However, of those 81 landowners, 65 of them reported participating in reforestation efforts, and 60% of them did this through local conservation programs (Powlen & Jones, 2019). These local programs focus on quality-of-life for their communities and emphasize reforestation and conservation.

There are several local programs in Monteverde and within the CBPC that promote conservation and reforestation. Two that are specific to Monteverde are the MCL and the Monteverde Cloud Forest Reserve (as seen in Table 2). The MCL is a community-run non-profit organization whose mission is to "preserve, conserve, and rehabilitate tropical ecosystems and their biodiversity" (Monteverde Conservation League Costa Rica, n.d.). They organize educational opportunities, reforestation projects, scientific research, ecotourism, and sustainable development (Monteverde Conservation League Costa Rica, n.d.). Costa Rica's largest private nature reserve, the Children's Eternal Rainforest, was partly established by the MCL through land acquisition. Fifty percent of the MCL's income comes from PES contracts with the Costa Rican government and private hydroelectric companies that use their land (Monteverde Conservation League Costa Rica, n.d.).

The Monteverde Cloud Forest Reserve was established in 1972 when nearby landowners threatened to expand their farms into nearby forests. Two visiting scientists and a Monteverde resident joined forces to promote the establishment of a nature preserve in that area (Monteverde's Cloud Forest, n.d.). They worked with an organization called the Tropical Science Center that took ownership of the original 810 acres and established the core of the Monteverde Cloud Forest Reserve (Monteverde's Cloud Forest, n.d.).

2.1.3.1 Costa Rican Non-Profits

Two programs that have done conservation work all over Costa Rica, including the CBPC, are the Tropical Science Center and the GEF Small Grants Program (as seen in Table 2). The Tropical Science Center is an independent organization whose goal is to promote coexistence between human beings and tropical rainforests. They “lead the conservationist focus that today distinguishes Costa Rica" (*TSC Costa Rica |Investigation*, n.d.). Besides establishing and owning the Monteverde Cloud Forest Reserve, other efforts they have accomplished include creating a system that predicts the consequences of climate change due to land use, developing the first environmental profile of Costa Rica, and contributing studies and calculating land costs for the national PES program (*TSC Costa Rica |Investigation*, n.d.). The GEF Small Grants Program emphasizes the need for community action by providing financial and technical support to local conservation and restoration efforts (*Welcome to The GEF Small Grants Programme*, n.d.).

Within the CBPC, one program GEF has helped support is the MVI. The MVI is a non-profit organization founded on the belief that educational opportunities are essential to a sustainable future. This program also acts as an overarching initiative, as many other programs in

Monteverde or the CBPC were either founded under or worked in collaboration with the MVI (*What We Do*, n.d.).

A summary of the aforementioned programs that have played a role in preserving the CBPC can be found in Table 2.

Table 2

Different Conservation Programs Mentioned Throughout the Background

Program	Scale of Impact	Purpose	Year Established
PES	National	Provides financial compensation for conserving land with forest.	1996
MCL	Local	Organizes and promotes educational opportunities, reforestation projects, scientific research, and ecotourism	1986
Monteverde Cloud Forest Reserve	Local	Established to prevent local farmers from expanding their farmstead into certain areas of forest, land was bought off them.	1972
TSC	Global	Promotes coexistence between humans and tropical rainforest, established and owns Monteverde Cloud Forest Reserve.	1962
The GEF Small Grants Programme	Global	Provides financial and technical support to local conservation and restoration programs to promote community action.	1992

Note. References in order

Note. (Sánchez-Azofeifa et al., 2007)

Note. (Monteverde Conservation League Costa Rica, n.d.)

Note. (Monteverde's Cloud Forest, n.d.)

Note. (TSC Costa Rica |Investigation, n.d.)

Note. (Welcome to The GEF Small Grants Programme, n.d.)

2.1.4: The World Trails Network

The World Trails Network – Hub for the Americas (WTN Americas) works with trail organizations in South, Central and North America and the Caribbean, coordinating the Pan

American Trail Network (PanATN). The PanATN links long trails from Alaska to Patagonia, the most southern end of South America governed by Argentina and Chile. This trail connects protected areas, cities, and rural communities, promoting the role of trails in conservation, ecological restoration, sustainable development, cultural heritage, and promoting human health and well-being (N. Scrimshaw, personal communication, December 9, 2022). WTN Americas is affiliated with WTN, a representative body of the world's leading trails organizations. WTN International is a non-profit association registered in Switzerland and WTN Americas is a 501(c)(3) registered nonprofit in the United States (*Regional Hubs – World Trails Network*, n.d.). Within the WTN-Americas, Nat Scrimshaw, our sponsor, works closely with the local community in Monteverde. He is the co-chair of Trails and Sustainability for the WTN and the WTN chair. Mr. Scrimshaw spends time in both the CBPC in Costa Rica and in the White Mountains of New Hampshire USA. His personal mission is to connect communities in the corridor through a network of trails, consistent with the mission of the creation of the CBPC.

2.2: Background on the CBPC

The CBPC is home to the three-wattled bellbird and to a zone of high biodiversity in Costa Rica. A unique set of geography and culture is found in the CBPC but the corridor has faced the threat and effects of deforestation.

2.2.1 Geography in the CBPC

The CBPC is in the western part of the country and stretches to the Pacific coast. As shown in Figure 3, the corridor encompasses an area of 66,416 hectares (164,048 acres) and follows three parallel watersheds: Río Aranjuez, Río Guacimal, and Río Lagartos" (Three-Wattled Bellbird Biological Corridor Council, n.d.). Three major towns are located within the

corridor, Monteverde is located in the northmost part of the corridor, Guacimal is located southwest of Monteverde, and Sardinal is south and slightly east of Guacimal as seen in Figure 3. The Pan-American Highway; which starts in Alaska and ends in Argentina, cuts through the corridor just below Sardinal.

Figure 3

Map of the CBPC

'Maps throughout this book were created using ArcGIS® software by Esri. ArcGIS® and ArcMap™ are the intellectual property of Esri and are used herein under license. Copyright © Esri. All rights reserved. For more information about Esri® software, please visit www.esri.com.

Note. Esri. "CBPC" [basemap]. Scale Not Given. "World Topographic Map". February 15, 2023. https://www.arcgis.com/apps/mapviewer/index.html

Water is a vital part of life in the corridor and major towns and communities have developed around its watersheds and are connected to each other by a series of trails between the watersheds. Trail networks, including El Sendero Pacífico, are fundamental to Costa Rican ecotourism and local communities along them (*Our Commitment to Sustainability*, n.d.). Being a tropical forest in the equatorial zone, the corridor experiences intense wet and dry seasons. Precipitation can range between 1500-3500 millimeters per year in the corridor, with the Monteverde cloud forest receiving more precipitation than the arid farmland to the west (CBPC Plan Estrategico 2011). One result of the intense wet and dry season is the occasional but difficult hiking terrain for tourists who are exploring the biological corridor and community members who use it for walking transit. The CBPC is a crucial part of the motivation and inspiration for Costa Rican tourist companies, the government, and activists to preserve and work to reforest the corridor, due to its beauty and biodiversity.

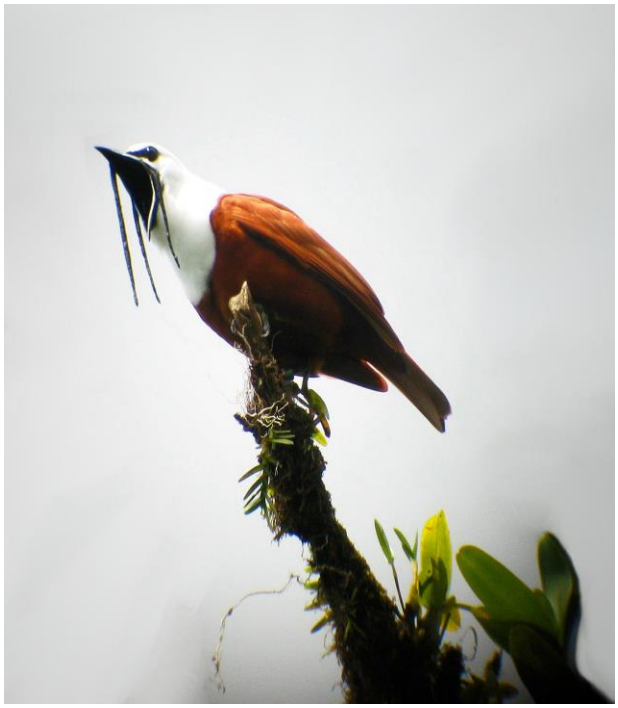
2.2.2 Deforestation in the CBPC

Large patches of the CBPC have been deforested, along El Sendero Pacífico especially, with patches of deforestation breaking up forested sections along the corridor. In Costa Rica, the corridor is commonly described as “a puente de vida, “a bridge of life” since it connects the mountainous Monteverde Cloud Forest Reserve at the continental divide to the coastal mangrove forest of the Gulf of Nicoya” (Vasquez, n.d.). The corridor cannot serve its purpose of connecting the cloud forest to the pacific coast with patches of deforestation. The country and local programs work to conserve the corridor because it serves a very important purpose to the people and the wildlife of Costa Rica, but also the economy.

Species such as the three-wattled bellbird and quetzal birds live within the corridor (see Figure 4). Deforestation effects since the mid-1900s have reduced the corridor to exist in forest patches which makes it hard for birds returning from migration since their habitat was split apart (Rosero-Bixby & Palloni, 1998). Due to the threats of habitat eradication, the government and wildlife protection groups have implemented programs to promote habitat connectivity. Habitat connectivity works to connect separate patches of the environment through forest regeneration. This effort will "increase effective population sizes and genetic diversity for evolutionary adaptation within species' ranges" (Davis and Shaw 2001). The CBPC is part of a much larger project to promote habitat connectivity through the 44 biological corridors throughout Costa Rica (*Biological Corridors*, n.d.). As well as being a place of biodiversity, the corridor is a place of rich culture for several communities along the trails.

Figure 4

The Three-Wattled Bellbird, found in the CBPC



Note. File: Procnias tricarunculata -Costa Rica -male-8-4c.jpg. By R. Kozie and Snowmanradio, 2010, Wikimedia Commons. This file is licensed under the Creative Commons Attribution 2.0 Generic license.

2.2.3 Culture in the CBPC

There are several key defining features to Costa Rican culture also found along the corridor. Food, religion, sports, work, and clothes each play an important role in the country's way of life. Within the CBPC, Monteverde is a, "Semi-rural region in Costa Rica's Tilarán mountain range that has a local population of approximately 6,000 inhabitants" (Society, Culture, and Youth | Monteverde Community Fund, n.d.). Within the town of Monteverde,

culture plays an important role, specifically, in food, coffee, and sports. Food plays an important role in many Latin American countries and the CBPC is no exception.

2.2.3.1 Cuisine

Simple yet nutritious and bountiful ingredients are integral to Costa Rican cuisine. A common food found throughout Costa Rica is Gallo Pinto, which is made of beans and rice. The dish can be found at most meals because it can be easily customized (*Culture | Embajada de Costa Rica En DC*, n.d.). The dish is easily modified to whatever ingredients are available which is what makes the dish so common and popular because many variations are made depending on the region. Beans and rice are both staples to any Costa Rican dish because their combined nutritional values make beans and rice a complete nutritional protein (Sumargo et al., 2016). A typical dish in Monteverde is *Casado* (as seen below in Figure 5) and is popular among visiting tourists. The dish combines beans, rice, and an additional form of protein, such as chicken, fish, or meat. In Spanish, *Casado* means married and the dish gets its name because the components of the dish work very well together (Penland, 2008).

Figure 5

Traditional meal we had with landowners at a conference in Guacimal

Note. Authors' own photograph. February 11th, 2023.

Coffee is also a big part of the food culture in Costa Rica and an industry that is of interest to tourists. Costa Rica is a world leader in sustainably grown coffee with over 70,000 farmers growing coffee on an average land size of five hectares (Embassy of RCR). Coffee plantations have become popular tourist attractions in Costa Rica and Monteverde and have had a positive effect on the local economies (Lazo, 2017). As shown in Figure 6, the golden beans at the foundation of the national emblem show the importance of coffee beans to national pride.

Figure 6

The Emblem of Costa Rica shows the importance of the coffee bean to the national identity

Note. File: Coat of arms of Costa Rica (1848-1906), HansenBCN, 2022. This file is licensed under the Creative Commons Attribution-Share Alike 4.0 International, 3.0 Unported, 2.5 Generic, 2.0 Generic and 1.0 Generic license.

2.2.3.2 Sports

Sports, like soccer, are an important component of Costa Rican identity. Not only is it a nationally loved sport; the youth of the CBPC have received many benefits from soccer. Studies have shown that soccer is a positive activity for kids to spend time together in the community (Schmidt et al., n.d.). For example, in Santa Elena; a town in the CBPC, sports have brought the youth together and have held a positive influence on the culture (Schmidt et al., n.d.). In the Plaza of Santa Elena, there is a large field where soccer is played, a basketball court, and a smaller multipurpose cement court where kids from the community come to play. Sports hold an

important role in bringing the people together in Santa Elena as well as other communities of the CBPC. Soccer is a way for community members to play together on a team and more importantly, watching the games bring families and communities together as they cheer on their teams.

Although deforestation has affected all those living in the CBPC, the corridor has stayed a place of rich culture, biodiversity, and community that has attracted many tourists. Both social and technical approaches are being used to conserve the beautiful native forest and protect the species living in the corridor.

2.3 Funding Opportunities for Ecological Restoration

Ecological restoration helps mitigate the loss of biodiversity, and deforestation, and requires investment to remain viable.

2.3.1 Carbon Offsetting Credits

Carbon offsetting credits, also referred to as “carbon offsets”, are at the forefront of the sustainable fight against greenhouse gasses, however, these must be done carefully to ensure a true reduction in emissions. Carbon offsetting is the removal of carbon dioxide from the atmosphere through reforestation and conservation efforts to offset the production of greenhouse gasses (GHG) elsewhere (Pierce, 2021). For example, this might include a Canadian company investing in a wind farm in China or reforestation efforts in Costa Rica. First introduced with the 1997 Kyoto Protocol, the first global agreement to reduce emissions, carbon credits were shown as a cheaper alternative to reducing emissions (Pierce, 2021). These programs allow companies to increase their green image and become carbon neutral by purchasing credits which are measured in carbon per metric ton (Wolf, 2022).

Despite its intention to reduce a carbon footprint and mitigate climate change, carbon offsetting has come under scrutiny due to rampant issues of fraud and questionable practices, leading to a decrease in public trust and confidence in its effectiveness. In recent years the method has been viewed as greenwashing or a public relations stunt for companies to appear as carbon-neutral or eco-conscious (Greenfield, 2023). A nine-month investigation was performed by the Guardian newspaper (Greenfield, 2023) to research critiques on carbon offsetting. The study found that "more than 90% of their rainforest offset credits – among the most commonly used by companies – are likely to be "phantom credits" and do not represent genuine carbon reductions" (Greenfield, 2023). Still, although there have been substantial critiques of carbon credits, the program holds the potential to be a promising method for ecological restoration if implemented and verified effectively.

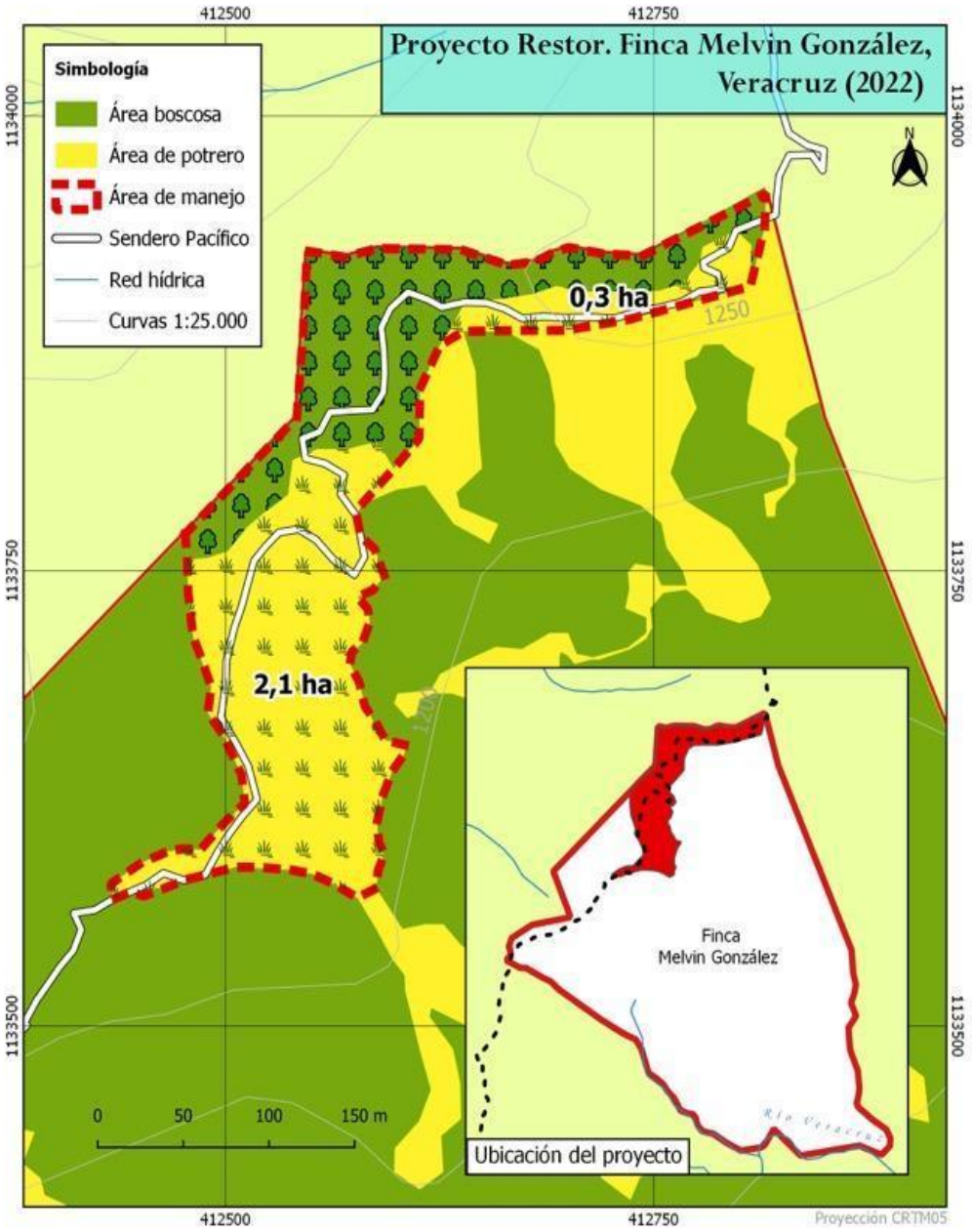
2.3.2 The Restor Restoration Program

Restor is a non-profit based in Zurich, Switzerland, that connects ecological restoration projects, experts, and companies around the world. Restor's current mission is "accelerating the conservation and restoration of nature for the benefit of people, biodiversity, and climate as well as connecting people and projects to scientific data, monitoring tools, and funding to increase the impact, scale, and sustainability of these efforts'" (*Global Hub for Nature Restoration and Conservation*, n.d.). Anyone is able to join this program and it allows its members to observe data about local biodiversity, soil carbon, land cover patterns, soil pH, and annual rainfall. You can also monitor current restoration projects as well as publish your own. Restor also has experience in connecting local projects with funding. One example of this is through the Bühler company. In 2022 the Bühler company hosted a conference and decided to offset the carbon emissions from the transportation of employees. Through Restor, they were able to find

trustworthy projects and programs, such as the WTN, to provide funding for reforestation to combat their carbon emissions. As seen below in Figure 7, Restor funded a reforestation project called Cerro De Melvin which protects part of El Sendero Pacífico. Restor is a valuable platform for those interested in ecological restoration, connecting experts, and funding opportunities to increase the impact and sustainability of conservation efforts. The objective of this program aligns with our goal, as it seeks to identify ways for landowners to participate in reforestation initiatives and expand its sources of funding.

Figure 7

Map of a current Restor reforestation project



Note. By D. Villalobos, 2022, photograph, located in WTN - Americas. Permission Granted 2/16/23 (translated by author)

2.4 Spatial Analysis and GIS Mapping: Exploring Geographical Relationships and Patterns

Spatial Analytics, and the use of Geographic Information Systems (GIS), are useful for describing geographic projects, particularly when they have multiple features which include human communities.

2.4.1 Spatial Analytics

Spatial analytics is the ability to understand the world around us and put it into context (Bennet and Calkins, 2013). More technically, it is "the process of examining the locations, attributes, and relationships of features in spatial data through overlay and other analytical techniques in order to address a question or gain useful knowledge" (Libraries, n.d.). There are six major categories that all descriptive and interpretive questions fall into. These categories are: understanding where; measuring shape, size, and distribution; determining how places are related; discovering the best locations/paths; detecting/quantifying patterns; and making predictions (Bennett and Calkins, 2013). Spatial attributes can be described in the following ways: topology, geometry, and geography. Topology describes land arrangement, geometry involves sizes, shapes, dimensions, and geography focuses on features of the land, its inhabitants, and potentially how it changed over time. For example, topology and geometry can be used to create a map of a region, while geography can be used to analyze the effects of population growth, climate change, and development on the land. Spatial analytics is a broad domain, GIS is a very important tool for the analysis and communication of findings.

2.4.2 GIS Mapping

GIS is a tool used to capture, process, and display data based on a geographical location, or its relative location. GIS is important in relating data that otherwise cannot be related. These systems can then allow people to better understand spatial patterns and relationships (Martindale,

n.d.). The geographical data, which can be latitudes and longitudes, zip codes, and countries, is coupled with attribute data. Attribute data is best defined as “additional information about each of the spatial features” (Martindale, n.d.). Topographical data can be coupled with other attribute data, such as demographic data.

3.0 Methodology

The goal of this project is to identify opportunities for landowners to participate in reforestation efforts and expand the WTN's sources of funding. Four of the following five objectives were carried out to complete our project goal. We found that the completion of our fourth objective was not necessary for our research.

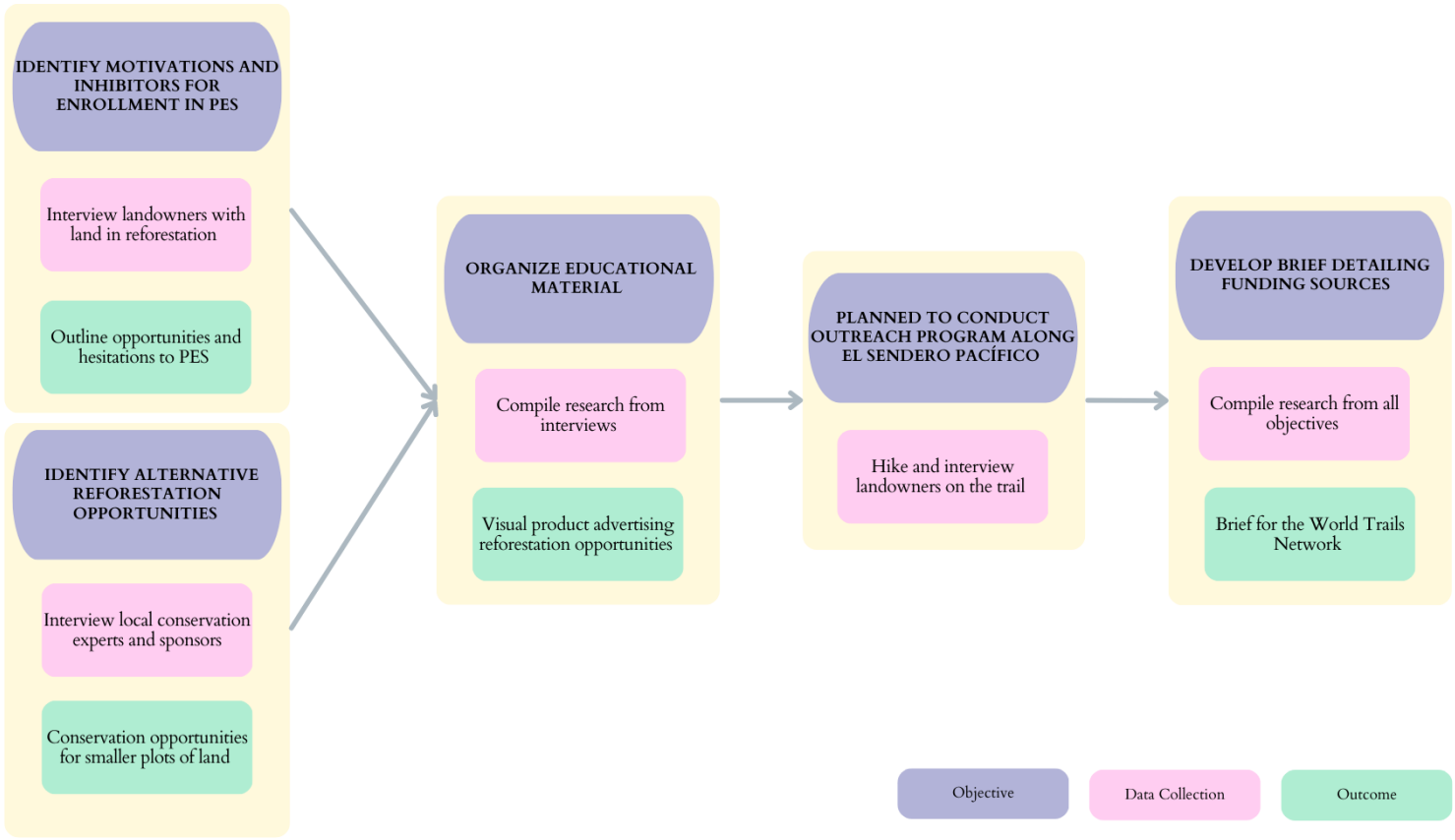
1. Identify the motivations and inhibitors for enrollment in the PES program.
2. Identify alternative opportunities for smaller landowners that address inhibitors to PES enrollment.
3. Organize educational materials that are inclusive of all landowners in the corridor.
4. Planned to conduct the outreach program along El Sendero Pacífico using newly developed educational materials.
5. Develop a supplementary brief detailing funding sources for ecological restoration in the CBPC.

The methodology section describes the specific path that will be used to solve our objectives. We explain why each objective was chosen and how each helped us work toward our final goal. Objectives one and two compile data found as seen in our visual methodology in Figure 8. Our first objective to complete this goal was to identify the motivations and inhibitors for enrollment in the PES program. Our next objective was to identify alternative opportunities for smaller landowners that address inhibitors to PES enrollment. Based on objectives one and two, we organized educational materials that are inclusive of all landowners in the corridor. Using this material, we planned to conduct an outreach program along El Sendero Pacífico so other communities could have access to the information we acquired but found it was not

necessary after completing prior objectives. Our last objective was to develop a supplementary brief detailing funding sources for ecological restoration in the CBPC.

Figure 8

A map of our visual methodology



3.1 Objective 1: Identify the motivations and inhibitors for enrollment in the PES program

The purpose of this objective was to compile information on what motivates and discourages landowners from participating in the PES program. This helped our team gain a better understanding of what prompts landowners to get involved with ecological restoration. Completion of this objective worked towards our goal of identifying opportunities for landowner reforestation.

After verbal consent was gained (consent is shown Appendix A), data was collected through informal semi-structured interviews with landowners (see Appendix B for our interview questions) in the CBPC. We opted for a more informal approach to these interviews because they allowed for open-ended questions and an opportunity for our participants to describe their experiences in their own words. However, by using a more informal approach, the interviews were difficult to transcribe for analysis due to the lack of predictable structure. We were also limited by the total pool of landowner participants and a language barrier between the primarily American English-speaking interview and the Spanish-speaking participants.

Our analysis of the interview data provided us with an understanding of the inhibitors and motivations of landowners for participation, which forms the basis of our analysis in subsequent objectives. We analyzed the transcripts from the semi-structured interviews using selective coding (see Appendix D for our codebook) to organize the similarities and differences between landowner motivations.

3.2 Objective 2: Identify alternative opportunities for landowners that address inhibitors to PES enrollment

The purpose of objective two was to address barriers for landowners to joining the national PES program and use them to identify other opportunities with more inclusive requirements. This objective directly addresses our need to understand the reasons behind the lack of participation of landowners in reforestation and conservation programs.

Semi-structured interviews (see Appendix C) were held with local and global experts in reforestation practices in order to gain a different perspective of ecological restoration after obtaining verbal consent. These interviews aimed to gather insights and knowledge from individuals who have a deep understanding and experience in the area of reforestation and ecological restoration. The organizations with whom the experts were affiliated included Restor, Astillero Verde, and the Monteverde Community Fund (MCF). We found it was difficult to schedule local experts which limited the breadth of our findings due to time constraints. However, the interviews we did carry out were wide-ranging which helped mitigate this shortcoming.

The analysis was designed to help us develop our infographic with key information in objective three as well as provide key insights for our brief in objective five.

3.3 Objective 3: Organize educational materials that are inclusive of all landowners in the corridor

Knowledge developed in objectives one and two were synthesized and analyzed to clarify which reforestation programs were available to non-participating landowners to effectively communicate this information.

We decided not to distribute the infographic because we prioritized interviewing more within objective two. We did not find any limitations to the completion of this objective since it was found not necessary.

3.4 Objective 4: Conduct the outreach program along El Sendero Pacífico using newly developed educational materials

The purpose of this objective was to distribute and gather feedback on the effectiveness of the infographic made in objective three to community members El Sendero Pacífico. The goal of these outreach programs was to effectively communicate with the target audience and educate, raise awareness, and encourage participation in the various conservation programs. From hiking the trail and selectively coding landowner interviews from objective 1 (See Appendix E) we found that an outreach program that broadcasts the educational materials we gathered is not necessary since landowners in the CBPC are well versed in the PES program and the others we mentioned.

3.5 Objective 5: Develop a supplementary brief detailing funding sources for ecological restoration in the CBPC

The goal of this objective was to outline additional and existing funding sources to deliver to the WTN (Appendix F). This brief was a comprehensive overview of the various sources of funding available for landowners to participate in reforestation efforts. It served as a reference guide that was used by the WTN to display valuable information and resources to help landowners participate in reforestation efforts and support conservation efforts. Most of the conservation programs working in Monteverde and the CBPC are non-profit and therefore are

looking for sources of funding. These programs are essential to assisting landowners in the reforestation process. They also purchase parcels of land for conservation.

The format of the brief will be an organized chart between 1-2 pages (Appendix F) with the topic of consolidating information on funding into one location. This consisted of a detailed list of programs we researched as well as interviews in objective two. The headings we used in the supplementary brief were “grant options” and “funding opportunities”. These headings helped to categorize the information in a way that made it clear and concise for the WTN. The shortcomings of this brief were that funding and grants were not in our area of expertise, and we may struggle to convey our recommendations. The brief was only distributed to WTN so our audience is limited although they will be able to distribute themselves to further the outreach and effectiveness of our project.

4.0 Findings

The first part of the findings section explains the results of our analyses from our interviews with participants completed in objectives one and two, as well as the deliverables produced for the WTN. During our interviews, we acquired information from two different groups, conservation experts and landowners. The second section discusses our findings in detail and discusses our research results.

4.1 Results

4.1.1 Objective 1: Motivators and inhibitors for enrollment in PES

We identified two key findings during our work on objective one, one related to owners who do not have land titles and the second relating to new sustainable forms of agriculture.

4.1.1.1 Landowners Without Land Titles

Key Finding: The primary obstacle preventing landowners from participating with the PES program is that they do not have a land title which is a requirement for enrollment.

We spoke with ten landowners who live in the CBPC and held interviews that ranged from 20 minutes to an hour. These interviewees were selected because they own land in the CBPC, eight of them are also trail ambassadors for El Sendero Pacífico, and they are considered as representatives for their respective communities. They have knowledge not only about their own experiences but their community members, and they all have varying levels of participation in PES and other reforestation projects. To analyze each interview, we created a matrix and used selective coding to categorize each question (Appendix D and E). Of the ten participants, five

noted that they have a land title (Table 3). As described, two landowners are in the process of getting one, two do not have one, and one does not have land.

We attended a conference in Guacimal on February 11th where the updates and future of El Sendero Pacífico were discussed. Afterwards we interviewed the trail ambassadors, which included 8 landowners who represent communities along the trail, with an identical set of interview questions which can be found in Appendix B.

Table 3:

Findings from a focus group interview conducted with 8 Trail Ambassadors who live along El Sendero Pacífico

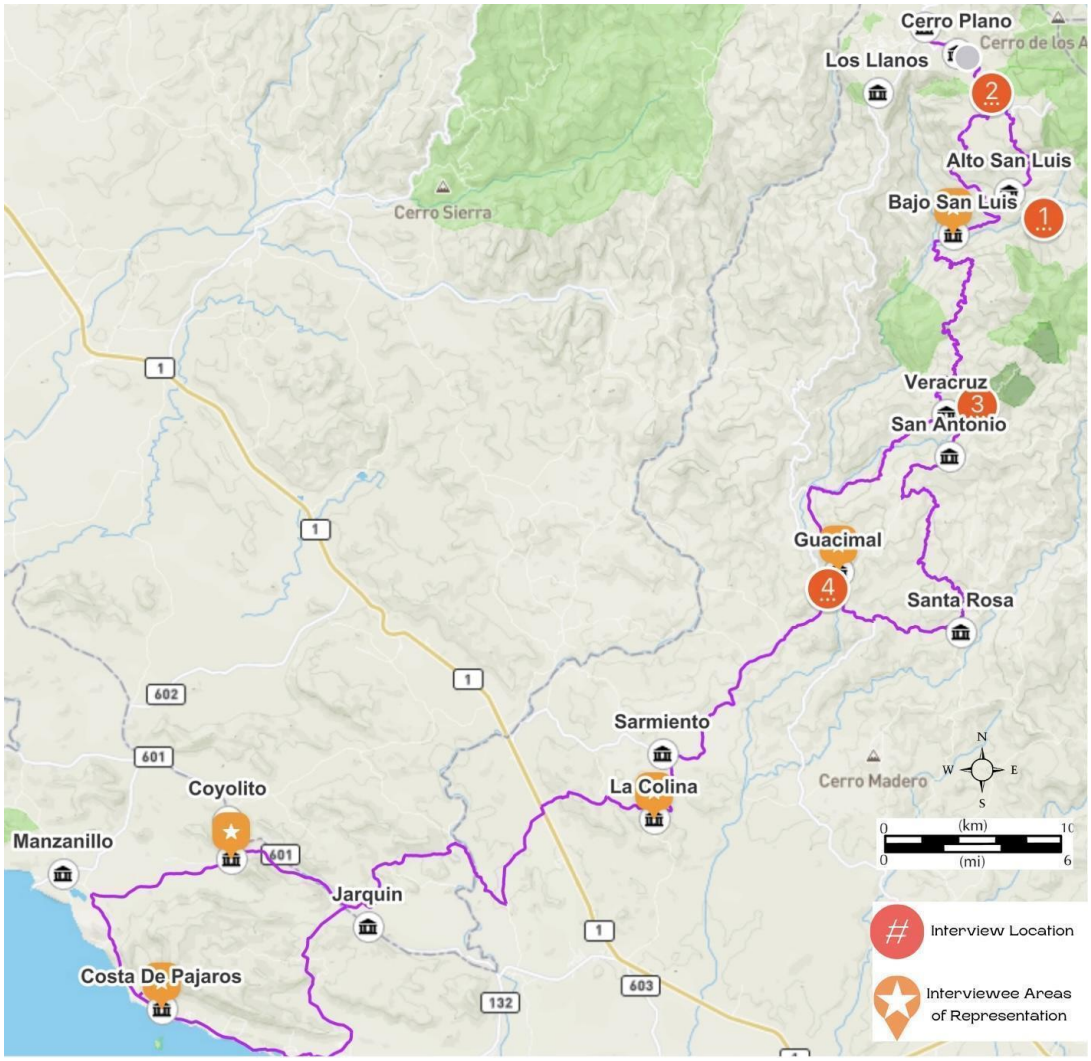
Names	Do you Have Land You're Reforesting	Do you have a Land Title	Do you participate in PES?
David Villalobos	Yes	Land Title	Doesn't participate in PES
Adan Rodriguez	No	Land Title	Participates in PES - on other land
Esther Ledezma	Yes	Process of Getting Land Title	Doesn't participate in PES
Mayra Cortez Aguilar	Yes	Process of Getting Land Title	Doesn't participate in PES
Aurora Morales	Yes	Land Title	Doesn't participate in PES
Dany Villalobos	No	N/A	N/A
Rogelio Gonzales	Yes	No Land Title	Doesn't participate in PES
Dionisio Gonzales	Yes	No Land Title	Doesn't participate in PES

Our analysis indicated that landowners are aware of the PES program, but that there are several key reasons why they or the others they represent would not participate. The first and most important reason is that a land title is a requirement for enrollment in the program. Many landowners have land that was established at a time where these were not needed to be legally recognized, and now they can be very expensive and complicated to obtain. With larger land properties comes an increase in surveying costs which is a large burden for many of these landowners. Another common inhibitor was that their property was not large enough to gain a considerable profit through the program's financial compensation, so it would not necessarily be worth the paperwork or commitment required to join PES.

The three longer semi-structured interviews were, in order, with Virgilio Brenes, Patrick (Pato) Moore, and Dionisio and Rogelio Gonzales. In figure 9 we identify the location where we interviewed each landowner as well as the communities the conference attendees represent.

Figure 9:

GIS Map of Interviews and Trail Ambassadors Along El Sendero Pacífico



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Note. Esri. "National Geographic" [basemap]. Scale Not Given. "World Topographic Map". February 20, 2023. https://fieldmaps.arcgis.app?referenceContext=center&itemID=d1f4448c5e9549b8a306d83adfb58341&center=10.206678872953086,-84.91801129647173&scale=143660.79920494312

Virgilio Brenes, owner of Finca Virdana in San Luis, which is number 1 in Figure 9, participated in a semi-structured interview on January 17, 2023. We were put in contact with Virgilio through our sponsor, who is a co-owner of the land. His farm consists of 27 hectares of land and has been reforested using both passive and active techniques since 1995. Finca Virdana has been a part of the national PES program for three years, under a five-year contract. Although Brenes participates and benefits from PES, we learned from him that there are larger landowners near him who do not have land titles because it is too expensive as the cost for the land survey is more for larger properties.

Pato Moore, the director of Riochante and co-owner of Finca Buen Amigo, was interviewed on January 26th, 2023, as shown above as number 2 in Figure 9. Riochante is a 70-year-old community cultural center in Monteverde that offers a variety of classes, youth projects, and recreational activities. Outside of RioChante, Moore shares about 40.5 hectares of land with 17 other landowners with the goal of reforesting the land. It was difficult in the early years due to the upkeep required for young forests and maintenance. However, Moore chose not to participate in the PES program since the land is shared between 18 people and the payment would not be worth the contract.

We interviewed Dionisio and Rogelio Gonzales on February 9th, 2023, in Vera Cruz during our 3-day hike, as shown above as number 3 in Figure 9. The Gonzales' own 60 hectares of land that is in passive reforestation with a hiking lodge on the property. The land doesn't have a land title even though they have been in the process of acquiring one. Ten years ago, the brothers hired an engineer to survey the land to get the land title but they have kept telling them it's almost ready enough times that they lost hope. Not having a land title means they cannot participate in PES but they have reforested on their own, rather successfully.

4.1.1.2 Sustainable Forms of Agriculture

Key Finding Two: More sustainable forms of agriculture are becoming popular in the CBPC which are less detrimental to the soil.

Our second key finding, that more sustainable forms of agriculture are becoming more popular in the CBPC, was discovered during our analysis of our interviews with Dionisio and Rogelio Gonzales. They introduced us to three forms of agriculture: no-till farming, apiculture, and bean slinging. No-till farming doesn't disturb the soil which gives the earth a chance to strengthen and prevent erosion which is a large risk in cattle farming and agriculture in Costa Rica. D. Gonzales practices no-till farming on his land. Apiculture, or beekeeping, is becoming a more popular method of agriculture for landowners because it requires less space than cattle, it's better for the environment, and there is a growing market for bee products (R. Gonzalez, personal communication, February 9th, 2023). Bean slinging is a form of agriculture derived from indigenous practices which have existed longer than no-till and apiculture and has the advantage of growing with less maintenance (R. Gonzales, personal communication, February 9th, 2023).

4.1.2 Objective 2: Opportunities for landowners that address inhibitors to PES enrollment

Key Finding: The PES program is too complex to accommodate smaller landowners. Non-government-funded programs, as well as independent reforestation efforts, are preferred.

We interviewed the Restor Costa Rican Representative; Estefania Morales, and Restor's community engagement officer; Simeon Max, for 30 minutes each using an online semi-structured interview. We also interviewed Astillero Verde; Ros Strang, using a structured

interview through email, and CORCLIMA/MCF's Katy VanDusen through WhatsApp messaging (Appendix C). CORCLIMA is the Monteverde Commission for Resilience to Climate Change, and the MCF is a non-profit fund with the goal of promoting sustainable practices within Monteverde. We asked them about their involvement with landowners in the CBPC and the reforestation efforts.

From interviewing Simeon Max we found that the company connects projects to organizations that have funding and technical support. Their focus is building the database contributed to their website which connects data from around the world important to reforestation efforts. Restor is a public resource for people around the world that does not include the restrictions, regulations, and contracts that come with participating in the government-funded program PES. However, from the Costa Rican Restor representative, we discovered that there is a disconnect between Restor and its representatives. There is also a disconnect between the representative and reforestation projects within the CBPC.

From interviewing Ros Strang we learned that Astillero Verde works with local landowners "who are dedicated to reforestation of sections of their land" (R. Strang, personal communication, February 13, 2023). The program is partnered with SailCargo, a restoration organization that does projects throughout the corridor, and they are working together to reforest and improve the biological connectivity through the CBPC. According to Strang, because PES is too complex to accommodate smaller landowners, Astillero Verde is helpful because the landowner can reforest their land without the regulations that come with PES contracts.

From interviewing Katy VanDusen we learned that the majority of funding/donations for the MCF comes from the Inter American Foundation, the Global Fund for Community

Foundation, and from local individuals and businesses such as an alliance for the coffee tours. CORCLIMA gets funding/donations from individual donations, and grants from the Costa Rica USA Foundation, MCF, and Guanacaste Community Fund. The MCF also runs the Offset Your Footprint donation program, which is a website that calculates your donation to offset your carbon footprint. We learned that the donations from this program go towards reforestation, specifically with the MVI. According to VanDusen, the MVI has the longest and most documented history of reforestation in the area. Currently, the MCF has $5,000 they are planning on giving out as grants. CORCLIMA is currently helping support a former dump diver, who now runs a nursery that has recently donated 430 trees to the reforestation program SailCargo.

4.1.3 Objectives 3 and 4: Designing an Infographic and Outreach Program

Key Finding: Educational Resources and an Outreach Program outlining PES are not necessary in the CBPC.

Landowners in the CBPC know and recognize PES, MVI, and MCL, but still do not participate in them because their land is too small, and it is difficult to either contact project organizations or the PES process is too expensive.

From February 9th-11th we hiked with our sponsor for twenty miles to attend the Sendero Pacífico Conference in Guacimal on the 11th where 8 landowners came to represent their community in the discussion on the future of the trail. Afterwards, we interviewed all 8 by using semi-structured interviews with identical interview questions, as seen below in Figure 10. All responses were coded using selective coding and can be found below in Table 3. We found that three had land titles, two were in the process of obtaining one, and three did not have land titles. Of those attending, all knew about PES but none directly participated. Awareness of

programs like PES was found not to be widespread, but many participants stated directly that they had no contact with the programs, or it was too difficult to participate (M. Aguilar, personal communication, February 11th, 2023). Alternatively, as in the case of Esther Ledezma and Mayra Cortez Aguilar, some landowners do not participate in PES but choose to work with smaller non-government-funded programs like Astillero Verde, or by partnering with others in the community to reforest their land (E. Ledezma, personal communication, February 11th, 2023).

Figure 10:

Our team attending a conference in Guacimal

Note. Authors' own photograph, February 11th, 2023

Notably, in our methodology, we had planned to do conversational walking interviews with landowners along El Sendero Pacífico, but with this key finding as well as with time constraints due to a delay in our hiking departure, we instead decided to use semi-structured interviews with eight landowners participating in the conference in order to learn their involvement with reforestation and PES.

After we completed the general group interviews, we requested a short meeting with Adan Rodriguez for approximately 10 extra minutes so he could elaborate on some of his answers. He explained that it is easy to work with FONAFIFO, more people have land titles than not, and "people here don't care" (A. Rodriguez, personal communication, February 11th, 2023) since reforestation is not their first priority. Reforestation is not the main priority for landowners in the CBPC because other priorities such as providing for their families come first. He did acknowledge that of the people who want to participate in PES, not having a land title was the biggest barrier.

4.1.4 Additional Findings

4.1.4.1 Passive and Active Reforestation

Key Finding: People prefer funding active reforestation but passive is more effective

From interviewing Virgilio Brenes, Rogelio Gonzales, and conversation with our sponsor, we found that passive reforestation is cheaper and easier in the CBPC. When funding reforestation, active reforestation is preferred because it is the physical act of planting trees, which people like to do, and companies like to fund because it looks good and makes people feel good (N. Scrimshaw, personal communication, February 23rd, 2023). Active reforestation is a method used by corporations in order to make them seem more green, also known as

greenwashing. Both Virgilio and Rogelio Gonzales use passive reforestation because it works better in the corridor and all they must do is leave the land alone (V. Brenes, personal communication, January 17, 2023).

4.1.4.2 Trail Advertisement

Key Finding: El Sendero Pacífico is not a widely used trail, nor is it well known

From hiking the trail and speaking with Dionisio and Rogelio Gonzales, we found that the trail is not widely used nor is it well known. The Gonzales' said they only get a handful of visitors each year at their lodging hut (D. Rogelio, personal communication, February 9th, 2023). Scrimshaw mentioned, "Landowners supporting the trail do what they know which is student groups and organizations like WTN but they don't have the information or resources to cater to the trekking market" (N. Scrimshaw, personal communication, February 9th, 2023). Since the trail is catered to sponsored groups it does not attract the international trekking market that the founders of the trail hoped it would. Scrimshaw also mentioned that the trail has trouble competing with larger reserves such as the Children's Eternal Rainforest and the Monteverde Cloud Forest Reserve. The larger reserves are very well known in the area and well-advertised and attract many visitors each year.

We noticed that only a few trail signs were intact and updated and that there was little information to find online about the trail. We also found that the trail is not maintained frequently as we came across fallen trees and overgrown sections blocking the path. As we hiked, we noted sections that were difficult to traverse. These included rough cow paths, windy ridge crossings, river crossings, as well as a long section on a paved road.

4.2 Discussion

4.2.1 The land title process for PES is too expensive for larger landowners

Through our analysis, our group observed that smaller landowners have or are trying to get land titles, but larger landowners have trouble obtaining them even though they may benefit more. Larger landowners may benefit more because their larger properties would get more financial compensation from PES. To obtain a land title, a landowner must hire a land surveyor to determine the boundaries of their land which is more expensive with bigger properties. Based on what we had learned in our preliminary research, we found it surprising that the land surveying process costs upwards of $5000 USD and some landowners still have not received land titles even after paying the fee. It could take large landowner years to pay off the expense of obtaining a land title, which proved to be one of the greatest inhibitors for the PES program among our participants. On the other hand, Rogelio and Dionisio Gonzales who own over 60 hectares, were much keener on obtaining a land title to be a part of PES because they could have received more than $3000 a year. Since starting the process 10 years ago, Dionisio and Rogelio Gonzales still do not have a land title due to the inconsistency of the process.

4.2.2 PES is too complex to accommodate smaller landowners

From interviews with ecological restoration representatives and reforestation program representatives, the findings suggest that the PES process is too complex to accommodate smaller landowners and that non-government-funded programs such as Restor and Astillero Verde, as well as independent reforestation efforts, may be more suitable for smaller landowners. For example, MVI, SailCargo, Restor, and Astillero Verde do not require land titles, and aim to support landowners by connecting them with funding and technical support, while also

promoting reforestation and biodiversity conservation efforts. One resource that could benefit smaller landowners interested in reforestation is Estefania Morales. Despite the disconnect with Restor, she was eager to express her excitement to connect landowners with funding and reforestation programs and support the project. Morales knows that PES is too complex for smaller landowners and is a useful resource for those wanting to reforest their properties in the corridor. Katy VanDusen also has many connections to non-governmental organizations within the CBPC, for example, the MVI, SailCargo, and the MCF's Offset Your Footprint program, all of which can benefit landowners either financially or technically through planting trees.

If there were policies in place that allowed landowners to get compensation or coverage for land surveying then it may increase the amount of participation in the PES program (A. Rodriguez, personal communication, February 11, 2023). There are properties in the corridor that would benefit from joining PES because the land is not actively being used and the landowners would be able to use it as an additional source of income. This has worked well for the Finca Virdana because the land is not Brenes' primary property, and he is getting payment for letting the land reforest passively.

4.2.3 Educational resources and an outreach program outlining PES are not necessary in the CBPC

Our research showed that designing and presenting an infographic outlining program opportunities and conducting an outreach program is not beneficial to the landowners within the CBPC (Appendix G). It was not an issue with education within the corridor, it was an issue with the limitations of PES and other programs. Even with knowledge of these programs, most of the

people we interviewed did not participate in them because their land was too small, there was a lack of response from programs, or the land title process was too costly and time-consuming.

From our ten interviews with landowners throughout the corridor, it became very clear that people are well-versed in the bigger reforestation/conservation programs in the area such as the MVI, MCL, and PES programs (D. Villalobos, personal communication, 1/26/23). Because of this, we concluded that the impact of distributing educational materials through an outreach program along the CBPC would be minimal. After interviewing Adan Rodriguez, it became apparent that most people do not currently care about reforestation in the CBPC because the priority of providing for themselves persists (A. Rodriguez, personal communication, 2/11/23). In fact, most of the smaller landowners down the corridor already have a land title and still do not participate in PES or other programs. If they do decide to reforest, they either let the land develop on their own or plant trees that could benefit business, for example, Aurora Morales who we interviewed at the Guacimal conference chose to plant cashew trees. Since landowners are already aware of opportunities in the corridor, there seemed to be little to be gained by a small group of students from the United States from passing out information with which they already have extensive familiarity.

4.2.4 More sustainable methods of agriculture are becoming increasingly popular

From our interview with Dionisio and Rogelio Gonzales, we found that there are more sustainable methods of agriculture that are becoming more popular in the CBPC. No-till farming, apiculture, and bean slinging are the safer alternative to cattle and timber farming which are commonly practiced in the corridor. The three options disrupt the soil less and are still viable forms of agriculture for landowners in the corridor to make a profit from (D. Gonzales, personal

communication, 2/9/23). There was low participation in these alternative methods 40 years ago, but in recent years more landowners are practicing them. With more landowners practicing more sustainable forms of agriculture, the soil will erode less and remain healthier for the plants, animals, and people living on it.

4.2.5 El Sendero Pacífico is not a well known trail

From our interview with Dionisio and Rogelio Gonzales and several personal communications with our sponsor Nat Scrimshaw, it was apparent that El Sendero Pacífico was not frequently traveled. In addition to this, you cannot easily find the trail online, even in public trail forums such as AllTrails. Since the trail is not frequently traveled, large sections of the trail are missing erosion protection, which is a means of increasing trail stability. With the potential of increased visitors, the trail instability could become dangerous for those hiking. With the trail not being currently well known, trail maintenance and upkeep are not a priority. All of this makes it difficult for El Sendero Pacífico to compete with the many popular trails and reserves in the area, especially since they are much more advertised. Advertising the trail to more experienced hikers would in turn raise more funds, which can be put towards trail maintenance and increased signage and available emergency response/first aid.

5.0 Recommendations

5.1 Create a funding program for land titles to help larger landowners

For Costa Rica's PES program to create substantial reforestation impacts, a program to aid in funding the land title process should be created for those who wish to engage. Financially it is not viable for many farmers to pay for the land title themselves because reforestation is not their first priority. A fund would help alleviate the stress of getting a land title on landowners as well as increase the amount of protected land for biodiversity connectivity. This program can be implemented alongside the PES program and would assist landowners in acquiring land titles enabling them to join the PES program if they desire. This strategy aids Costa Rica in reaching carbon reduction targets because it helps decrease both carbon and methane emissions by eliminating the amount of cattle and replacing that with forest.

5.2 Increase landowner involvement with non-governmental organizations

Restor's ability for bridging the gap between environmental programs and land needs to be utilized more frequently in the CBPC. Landowners who are not a part of any program would benefit from these connections most, especially landowners who cannot reforest because they need their land for financial stability. Non-governmental programs exist for both conservation and reforestation projects. The excitement from Restor's Costa Rican representative, Estefania Morales, demonstrates the potential for landowners without land titles to be connected to ecological restoration programs. This could be further explored. A Costa Rican Restor representative could conceivably connect with the landowners better because of their personal connection to the corridor. A project working with Restor in this region to increase biodiversity connectivity would likely be more beneficial for the WTN and landowners in the future. It may

also be beneficial to increase relations with organizations that CORCLIMA works with, such as SailCargo and the MVI, which have aided landowners with reforestation in the past. The MCF is planning on giving out $5,000 as grants, which could benefit the WTN financially in terms of reforesting areas along El Sendero Pacífico and trail maintenance.

5.3 Conduct a broader study on landowner hesitation to reforestation

We recommend that the WTN conduct a study in the CBPC on people's feelings and opinions towards the trail, reforestation programs, and reforestation in general. Our project started to do this with us asking each landowner why they do or do not participate in PES in our interviews, but since most of our participants were not enrolled, it was not an effective approach to support this learning. From discussion with landowners and our sponsor, we believe that determining what people believe about reforestation efforts would be a beneficial place to start in the goal of reforesting the corridor and promoting the trail. Finding out what landowners think about reforestation is important because then the WTN can move forward with finding a way to keep building the trail and reforesting the areas around it. It would be especially helpful to learn the opinions of the people who live by the trail or whose land has parts of the trail on it in order to avoid miscommunication and doubts.

5.4 Develop an effective marketing campaign

Our final recommendation for the WTN is to focus on developing an effective marketing campaign to advertise the trail and its educational opportunities. Our project of finding reforestation opportunities is important but may not be an immediate priority for WTN due to the need for improved trail quality on El Sendero Pacífico. The trail is not publicized nor is it traveled frequently, but we think with some marketing and social media outreach that it can be

successful because more relevant groups, like ours, could be reached. Science, research, and other student groups would be great to target with marketing because they have already been working to improve the trail and learn about the network itself. This can be done by following a group of student hikers down El Sendero Pacífico to document their journey. Live updates and information on these hikes could be followed on a website or social media page to generate interest and a following online of people interested in the hikers and the trail. The simple addition of adding the trail to the app AllTrails would attract many hikers. The proper contact information listed on the WTN network for the available lodging should also be listed.

6.0 Conclusion

While we completed our goal of identifying opportunities for landowners to participate in reforestation efforts and expand the sources of funding available for our sponsor, our findings were surprising to us based on our preliminary research. We found that the land titling process is costly and time-consuming, which discourages smaller landowners from applying for PES because their profits would not be worth the commitment to the program. Although during our research we found that there are other reasons, such as personal beliefs, that could encourage landowners to apply, we did not find any information that discussed the difficult process of acquiring a land title. All the landowners and ambassadors we interviewed were familiar with the PES program and many had already tried to participate but were not successful or determined the payoff was not sufficient for their conditions. Our information could be useful in reshaping or defining new reforestation efforts across the CBPC as well as assisting landowners in receiving adequate compensation for land conservation. This allows for future expansion upon government programs and policies, local reforestation efforts, and work towards supporting landowner needs.

A greater connectivity between programs and landowners promises larger reforestation projects. Large-scale reforestation projects have the potential to combat climate change by capturing carbon, providing habitat for wildlife, and protecting watersheds. Reforestation projects that connect students, programs, and landowners are already showing promise and if successful, could provide economic benefits to landowners, such as increased property values and revenue from environmental services payments. Improving the ecological connectivity of the trail and increasing its advertisement would greatly increase its popularity, which in turn would

not only benefit the CBPC economically within the tourism industry and encourage sustainable practices, but it would also protect biodiversity and Costa Rica's green reputation.

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Appendix

Appendix A: Informed Consent Agreement for Participation in a Research Study

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Title of Research Study: Ecological restoration of El Sendero Pacífico's trail network in the Bellbird Biological Corridor

Sponsor: Nathaniel Scrimshaw, co-chair of Trails and Sustainability for the World Trails Network (WTN) and the WTN chair.

Introduction

You are being asked to participate in a research study. Before you agree, however, you must be fully informed about the purpose of the study, the procedures to be followed, and any benefits, risks or discomfort that you may experience as a result of your participation. This form presents information about the study so that you may make a fully informed decision regarding your participation.

Purpose of the study: The goal of this project is to identify opportunities for landowners to participate in reforestation efforts and expand the sources of funding available for our sponsor, the WTN.

Procedures to be followed: We will be conducting three forms of procedures. For the semi-structured interview, the duration will vary but can be between 5 to 15 minutes. The structured interview can last between 10-30 minutes but again, time will vary. The workshop can last between 30 minutes to over an hour depending on the attendance. Participation is completely voluntary, and this will be stressed ahead of time.

Risks to study participants: Both parties may become uncomfortable with questions asked and responses received. Risk of accidentally offending subjects due to differences in cultures and customs.

Benefits to research participants and others: Possible benefits to the subject include information being used to better Costa Rica's conservation efforts and increased ecological restoration. There are no direct monetary benefits.

Record keeping and confidentiality: The way we will be recording these interviews is by using

the codebook found in Appendix D and taking notes. No personal information will be released that can identify the subject. Town or community may be recorded for organizing research. Records of your participation in this study will be held confidential so far as permitted by law. However, the study investigators, the sponsor or its designee and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of the data will not identify you.

Compensation or treatment in the event of injury: There is no risk of injury or harm nor is medical treatment involved in this study because no there is no scenario where injury may take place during data collection. You do not give up any of your legal rights by signing this statement.

For more information about this research or about the rights of research participants, or in case of research-related injury, contact: Contact information can be found at the top of this form. In addition the contact information for the IRB Manager is Ruth McKeogh, Tel. 508 831- 6699, Email: irb@wpi.edu , and the Human Protection Administratoris Gabriel Johnson, Tel. 508-831-4989, Email: gjohnson@wpi.edu.

Your participation in this research is voluntary. Your refusal to participate will not result in any penalty to you or any loss of benefits to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit.

By signing below, you acknowledge that you have been informed about and consent to be a participant in the study described above. Make sure that your questions are answered to your satisfaction before signing. You are entitled to retain a copy of this consent agreement.

_____ Date: _____ Study Participant Signature

_____

Study Participant Name (Please print)

_____ Date: _____ Signature of Person who explained this study

Additional clauses to add to Consent Agreements, as appropriate:

Significant new findings or information, developed during the course of the research, may alter the subject's willingness to participate in the study. Any such findings will be promptly communicated to all research participants.

Should a participant wish to withdraw from the study after it has begun, the following procedures should be followed: the notes taken will be discarded and there will be no note that the interview took place.

There are no consequences for early withdrawal for the subject and the research.

Special Exceptions: Under certain circumstances**,** an IRB may approve a consent procedure which differs from some of the elements of informed consent set forth above. Before doing so, however, the IRB must make findings regarding the research justification for different procedures (i.e. a waiver of some of the informed consent requirements must be necessary for the research is to be "practicably carried out.") The IRB must also find that the research involves "no more than minimal risk to the subjects." Other requirements are found at 45 C.F.R. §46.116.

Appendix B: Landowners Interviews

Below are our interview questions to landowners in the CBPC in the informal semi-structured format used in objective one.

Finca Virdana - Virgilio Brenes

1. What was your experience in getting involved with the PES program? In your opinion, is there anything about getting involved that may make it difficult for a smaller landowner?
2. Do you earn money from the trails on your land?
3. How is the reforestation getting done/ who is doing it?
    a. Is it you or the government?
    b. How much revenue do you get from the government for reforestation?
4. Does the financial compensation offset potential revenue from the farmland?
5. If not, is the compensation close to the revenue?
6. What was your motivation to get involved with the PES program?

RioChante - Patrick Moore

1. Can you tell us a little bit about what RioChante is and what it does?
2. What is your most effective method of reaching out to people in the community?
3. Can you speak on other community centers in BBC and how they work with the community?

4. What role do you think community centers could play in ecological restoration?
5. Through what program are you doing your reforestation efforts, or are you doing it independently?
    a. If part of a program, how did you hear about it and how did you first get involved?
    b. Are you under some kind of contract, if so what are the requirements?
    c. Was it an easy process?
    d. What challenges did you face when getting involved?
    e. If independently, is it costly?
6. What were your motivations to get involved with reforestation?

Rogelio and Dionisio Gonzales

[ENGLISH]

1. Can we record this interview and use your name in our project?
2. Can you share the history of this farm?
3. Why don't you participate in the environmental services program?
4. Do you have a title for this farm?
    a. How much does a title cost for you?
5. What is the size of this farm?
6. Do you receive reforestation assistance from other organizations?
    a. If not, what is your method of reforestation, passive or active?

7. Why did you make the decision to reforest your farm?
8. How many visitors does it receive each year?
    a. Do you want more visitors?
9. Do you have any work unrelated to the Albergue?

[ESPAÑOL]

1. ¿Podemos grabar esta entrevista y podemos usar su nombre en nuestra proyecto?
2. ¿Puede compartir la historia de esta finca?
3. ¿Por qué no participa en el programa de servicios ambientales?
4. ¿Tiene una escritura por esta finca?
    a. ¿Cuánto cuesta una escritura para ustedes?
5. ¿Cuál es el tamaño de esta finca?
6. ¿Recibe ayuda de reforestación de otras organizaciones?
    a. ¿Si no, cual es su métoda de reforestación, pasivo o activo?
7. ¿Por qué tomaron la decisión de reforestar su finca?
8. ¿Cuántos visitantes recibe cada año?
    a. ¿Quiere más visitantes?
9. ¿Tiene trabajo no relacionado con el Albergue?

Focus Group Interview With Trail Ambassadors

[ESPAÑOL] *

1. ¿Puedo tener su permisión para preguntar y tomar apuntes?
2. ¿Tiene propiedad que está reforestando?
3. ¿Cuantos acres o hectáreas

4. ¿Tiene una escritura de su propiedad?
5. ¿Participa en el programa de servicios ambientales?
    a. Porque sí o porque no
6. ¿Si no, participa en otros programas de reforestación? Como el instituto de Monteverde or la liga conservacionista de monteverde …

[ENGLISH]

1. Can I have your permission to ask questions and take notes?
2. Do you have property that you're reforesting?
3. How many acres or hectares?
4. Do you have a land title?
5. Do you participate in PES?
    a. Why do you or do you not
6. If not, do you participate in other programs of reforestation? Like MVI or MCL …

Appendix C: Program Interviews

Below is the list of questions we used when interviewing local and global experts in the semi-structured format used in objective two.

Restor - Simeon Max

1. What is Restor's mission?
2. Where does Restor get its funding?
3. How do you choose your partners?
4. Can you tell us more about the carbon offset program funding you obtained for WTN?
5. Why did you choose WTN for the Bühler Funding?
6. Do you foresee more funding opportunities for carbon offsets facilitated through Restor?
7. Are you aware of other organizations that are doing what you're doing?

Restor - Estefania

1. Can you tell us about what your role is with Restor?
2. How did you get involved with Restor?
3. What projects are Restor a part of in the Bellbird Biological Corridor?
4. What has Restor done for these projects?
5. Has there been an increase in these projects within the corridor?
6. Is it possible for a landowner to reach out to Restor to be connected with a reforestation program?

Astillero Verde - Ros Strang

1. How did you acquire the land that you are reforesting?
2. Do you partner with local landowners?
3. Where do you receive the funding for your reforestation process?
4. Are you looking to expand the area you are reforesting?
5. What does Restor do for your organization?

MCF - Katy VanDusen

1. Where does CORCLIMA/ the Monteverde Community Fund get its funding?
2. How is the money donated to Offset Your Footprint used to offset carbon emissions?
3. On the Offset Your Footprint website it says that donations will plant and protect trees, what land is being reforested/conserved?
4. What organizations/projects is CORCLIMA actively working with?
5. What is CORCLIMA's connection to SailCargo?
6. Do you believe carbon offset programs from large commercial companies are effective?
7. What makes the Offset Your Footprint program different?

Appendix D: Codebook

Code	Definition	Example (found in transcriptions)
YAR	Has land in reforestation	YAR - Virgilio has land in reforestation
NAR	Does not have land in reforestation	NAR - Dany isn't reforesting
PR	Participates in program (insert program name in front)	PES PR - Virgilio participates in PES
NPR	Does not participate in program (insert program name in front)	PES NPR - Pato doesn't participate in PES
$✓	(for participating in PES) landowner economically benefits	$✓ - Virgilio is benefiting financially from PES
$X	Not enough money from PES	$X - Pato doesn't participate because not enough money offered
LT	Landowner has a land title	LT - Pato has a land title
DLT	Landowner does not have a land title	DLT - Rogelio and Dionisio do not have a land title
PLT	Landowner in process of getting a land title	PLT - Esther and Mayra are in the process of getting a land title

Appendix E: Focus Group Interview Responses

Findings from a focus group interview conducted with 8 Trail Ambassadors who live along El Sendero Pacífico

Names	(1)	(2)		(3)	(4)	(5)
David Villalobos	YAR	0.5 HA	LT	NPR	Land very small, not worth it	No, it's his personal land - small
Adan Rodriguez	NAR	A few	LT	PR-PES	Very small	PR - MVI but for other land he works on
Esther Ledezma	YAR	No #	PLT	NPR-PES	No contact, doesn't own land	PR - Astillero Verde + organization that reforests islands
Mayra Cortez Aguilar	YAR	No #	PLT	NPR-PES	No contact, doesn't own land	PR & NPR works with people not organizations
Aurora Morales	YAR	3 HA	LT	NPR-PES	-	NPR - all
Dany Villalobos	NAR	N/A	N/A	N/A	N/A (has no land)	N/A
Rogelio Gonzales	YAR	60 HA	DLT	NPR-PES	$X lost money trying to get land title	NPR - all
Dionisio Gonzales	YAR	60 HA	DLT	NPR-PES	$X lost money trying to get land title	NPR - all

Note. References in order (David Villalobos, cont.) from 2/11/23 Interviews (Code explained in Appendix D)

Appendix F: Supplementary Brief

Ideas for WTN to expand El Sendero Pacífico's sources of funding

Opportunity	Description
Lodging Contributions	This idea involves financial contributions from the owners who provide lodging along El Sendero Pacífico. A specific portion of their lodging income, say 5%, would be put towards the trail. This could be used for trail maintenance and advertising. In turn, these actions would bring more hikers to the trail, and therefore more customers for the cabins.
Hiking Itineraries	Similar to resorts and other tourist areas, people are absolutely willing to pay extra if their day/trip was completely organized by someone who knows the area. This would be similar to how The Beach of Dreams project was planned out. A trip similar to that could be sold as a package with everything booked, and then extra fees/charges that go towards the sale.
Product Campaign	Some programs and larger companies have a specific product from which all the proceeds are donated to a cause. This may be difficult to pull off given the current lack of funding, however if there is a passionate landowner with an excess of a certain product, for example honey, it could possibly become the face of El Sendero Pacífico. This may be more helpful of a funding opportunity later on, once the trail becomes more established and more funds sre available.
PES Registration Aid Program	The PES program can be a very long and complicated process, especially if the landowner does not have a land title. If the team working with El Sendero Pacífico becomes well versed in the process and can aid in registration for landowners along the corridor, they could potentially charge a small percentage of the income from the program (could not be helpful at all depending on the size of the land).
Donation Crowdfunding Program/Website	Many nonprofits have some form of donation program, for example the Monteverde Community Fund and their Offset Your Footprint program. Like the Offset Your Footprint program, El Sendero Pacífico could have a website with its main focus being donations through a clever hook, but it could also contain trail information and maps, news and updates about the trail, a frequently asked questions page, information about attractions and tours throughout the communities, and fundraising events. While there are pros and cons based on the type of project/organization, crowdfunding can be a great way for

	startups to acquire that first bit of funding that sets things in motion. Websites such as GoFundMe can be easily connected to a website and distributed on social media.
Fundraising Events	Another common way for nonprofits to raise funds is through fundraising events. This is a very broad category and can be done a variety of ways. An example of this could be a trail race. People can sign up and the proceeds from a sign-up fee could go towards the trail's development. The winner could have part of the trail named after them or a trophy (or money/gift cards depending on where the trail is with funds).

Possible grants this project may qualify for

Grant Name	Description	Link
Mitsubishi Corporation Foundation for the Americas — Grants for Environmental Conservation	This grant program limits its recipients to nonprofit organizations in Canada, the United States, and Latin America. These nonprofits focus on biodiversity conservation, sustainable development, environmental justice, and environmental education. Most recent grants are for 2-4 years, in between $30k and $1 million.	https://terravivagrants.org/grants-for-environmental-conservation-latin-america/
World Land Trust	The WLT mainly supports projects that have the goal of creating protected areas and the protection and restoration of threatened areas. This can include land acquisition, on the ground habitat and biodiversity protection, community support projects, and conservation investments. They typically partner with nongovernmental organizations and aims to create long-term and sustainable support	https://www.worldlandtrust.org/project-proposal-guidelines/

The Waterloo Foundation	Supports both local and strategic projects. For local projects they focus on management of a specified area, sustainable livelihoods for forest-dependent communities, securing land rights or management rights for land dependent communities, etc. (although they do generally focus on areas over 10,000 hectares). Strategic projects include innovative ways of reducing deforestation or financial systems and solutions.	http://www.waterloofoundation.org.uk/EnvironmentTropicalRainforests.html
GEF Small Grants Programme	This program provides grants of up to $50,000 in financial and technical support to "projects that conserve and restore the environment while enhancing people's well-being and livelihoods" *(Welcome to The GEF Small Grants Programme, n.d.)*. These projects are specifically in biodiversity, climate change mitigation and adaptation, land degradation and sustainable forest management, international waters and chemicals. Has worked with MVI.	https://sgp.undp.org/about-us-157/how-to-apply.html

Note. Citations in order:

(Mitsubishi Corporation Foundation for the Americas - Grants for Environmental Conservation - Terra Viva Grants, 2022)

(Farrows, n.d.)

(The Waterloo Foundation - Environment - Tropical Forests, n.d.)

(Welcome to The GEF Small Grants Programme, n.d.)

Appendix G: Infographic

Program Opportunities

Payments for Environmental Services (PES)

- Government funded (FONAFIFO)
- Land title required for PES
- http://www.fonafifo.go.cr/en/servicios/requisitos-para-inscribirse-en-psa/

Monteverde Institute (MVI)

- Trees and guidance provided
- http://monteverde-institute-blog.org/environmental/reforestation-program-at-the-mvi

Monteverde Conservation League (MCL)

- *Bosque en Fincas* Project to help landowners reforest their land
- https://acmcr.org/content/programs/

Reforestation Projects

- **Palo Vivo**: reforestation and education program for kids and community members in Costa Rica. As well as a podcast on the subjects of tree climbing and protecting the environment. https://www.palovivo.org
- **Sail Cargo**: zero emission ship based in Puntarenas with the goal of a fleet of carbon neutral shipping vessels. https://www.sailcargo.inc

World Trails Network:
https://worldtrailsnetwork.org/
Sendero Pacifico