

Mémoire

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ULiège - Faculté des Sciences - Département des Sciences et Gestion de l'Environnement

HOW EFFECTIVELY DOES CLOUDBRIDGE NATURE RESERVE COMMUNICATE ITS MESSAGE TO ITS DAY VISITORS AND SUCCESSFULLY ENGAGE THEM IN LEARNING DURING THEIR HIKE THROUGH THE RESERVE?

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Table of Contents

1	Abstract.....	1
2	Introduction.....	2
3	Methodology	3
3.1	Contextual Analysis and Problem Identification	3
3.2	Data Collection and Analysis	3
3.3	Findings Interpretation and Recommendations.....	4
4	Context.....	7
4.1	Costa Rica	7
4.1.1	Geography	7
4.1.2	Fauna and flora.....	8
4.1.3	Politics.....	10
4.1.4	Economy.....	10
4.2	Cloud Forest in Costa Rica.....	10
4.2.1	Definition	10
4.2.2	General state.....	11
4.2.3	Environmental issues.....	11
4.2.4	Restoration and Conservation	14
5	Cloudbridge Nature Reserve	17
5.1	Context	17
5.1.1	Geography	17
5.1.2	Climate	19
5.1.3	Forest types, biodiversity, and distribution in the reserve.....	21
5.1.4	Terrain features	22
5.1.5	Conclusion.....	26
5.2	Management of the Reserve	27
5.2.1	Creation, Mission, Goal, and Evolution	27
5.2.2	Funding model.....	30
5.2.3	Communication strategies (see Appendix 10)	31
6	Ecotourism in Costa Rica	36
6.1	Concept of Ecotourism.....	36
6.2	Ecotourism in Cloudbridge Nature Reserve.....	38
7	Identifying Cloudbridge’s Problem.....	40
7.1	Logical Framework Approach (LFA)	40
7.1.1	Problem Tree	41
7.1.2	Objective Tree	44

7.1.3	Logical Framework Intervention Plan.....	45
7.2	Calendar of activities (see Appendix 11)	46
8	Communication and information within the reserve	49
8.1	Why is it that important?.....	49
8.2	Welcome Center (see Appendix 12)	50
8.3	Hiking trails in Cloudbridge (see Appendix 13)	51
8.3.1	The Main Trail	51
8.3.2	The Waterfall Trail (see Figure 47).....	53
8.3.3	The River Trail (see Figure 48).....	55
8.3.4	The Ridge Trail (see Figure 49)	55
8.3.5	The Cloudbridge North Loop (see Figure 50).....	55
8.4	Conclusion from field observation of the educational panels	56
9	Results of the Questionnaire (see Appendix 1): Evaluating the effectiveness of informative panels in comparison with the Waterfall Trail.....	57
9.1	Methodology	57
9.2	Limitation of the Methodology	58
9.3	Discussion of the questionnaire's results	60
9.3.1	Day visitors' profile (see Appendix 17).....	60
9.3.2	Global analysis of tendencies based on visitor responses	63
9.3.3	Discussion of the Educational Panels along the Waterfall Trail (see Appendix 17) 65	
9.3.4	Visitor Feedback Analysis	68
10	Discussion with Cloudbridge's staff members	71
11	Proposition for new panels focused on the River Trail	75
11.1	Methodology	75
11.1.1	Choice of the trail.....	75
11.1.2	Choosing a placement (see Appendix 18).....	75
11.1.3	Types of information.....	77
11.1.4	Characterizing the diverse choice of placement.....	78
11.2	Developed panels for River Trail	84
11.2.1	Location n°Y	85
11.2.2	Location n°2	86
11.2.3	Location n°3	86
11.2.4	Location n°5	87
11.2.5	Location n°7	87
11.2.6	Location n°8	88
12	Conclusion	90

13	References	95
14	Annex	102
14.1	Appendix 1: Questionnaire form	102
14.2	Appendix 2: Interviews	111
14.2.1	Interview with Casey McConnell.....	111
14.2.2	Interview with Madelyn Peterson.....	125
14.2.3	Interview with Maximilian King.....	133
14.2.4	Interview with Tom Gode	137
14.3	Appendix 3: Cloudbridge's hiking trails map	142
14.4	Appendix 4: Biological corridors	143
14.5	Appendix 5: Cloudbridge Elevation Contours	144
14.1	Appendix 6: Geological Map of Costa Rica	145
14.2	Appendix 7: Geologic Time Scale	146
14.3	Appendix 8: Soil Horizons, Types and Map	147
14.4	Appendix 9: Forest types in CNR	149
14.5	Appendix 10: Types of communication developed by CNR	150
14.5.1	Formal communication by e-mail	150
14.5.2	Informal communication with Facebook and Instagram.....	151
14.5.3	Online communication on their website (Blog)	152
14.6	Appendix 11: Calendar of activities.....	153
14.7	Appendix 12: Welcome Center of CNR	154
14.8	Appendix 13: Trails in Cloudbridge.....	156
14.8.1	Waterfall Trail	156
14.8.2	River Trail	157
14.8.3	Ridge Trail.....	158
14.8.4	Cloudbridge North Trail.....	159
14.9	Appendix 14: Characterizing Cloudbridge's Trails.....	160
14.10	Appendix 15: Types of panels within the reserve	161
14.10.1	Along the Main Trail.....	161
14.10.2	Along the Waterfall Trail	163
14.11	Appendix 16: Limit of verification and questionnaire to visitors	166
14.12	Appendix 17: Excel document of the questionnaire's responses	168
14.13	Appendix 18: Panels' Placement on the River Trail.....	174

Table of Figures

FIGURE 1 – MAP OF COSTA RICA PROVINCES (GEOLOGY.COM, N.D.)	7
FIGURE 2 - GEOGRAPHIC LOCATION OF CLOUDBRIDGE (GOOGLE EARTH, N.D.)	17
FIGURE 3 - CLOUDBRIDGE ZONING ACCORDING TO FOREST TYPE, WITH THE PRECISE LOCATION OF THE RESERVE INDICATED BY A COORDINATE POINT (CONCEIVED MAP WITH QGIS)	18
FIGURE 4 - DIAGRAM OF RIVAS (CLIMAT RIVAS: PLUVIOMÉTRIE ET TEMPÉRATURE MOYENNE RIVAS, DIAGRAMME OMBROTHERMIQUE POUR RIVAS, N.D.).....	20
FIGURE 5 - A REFORESTATION PHOTOGRAPHIC TIMELINE (CLOUDBRIDGE NATURE RESERVE, 2024B; EVRARD OLIVIA, 2024).....	28
FIGURE 6- QUETZAL (CLOUDBRIDGE NATURE RESERVE, 2024)	29
FIGURE 7 - PROBLEM TREE DEVELOPED FOR CLOUDBRIDGE NATURE RESERVE.....	43
FIGURE 8- OBJECTIVE TREE DEVELOPED FOR CLOUDBRIDGE NATURE RESERVE.....	44
FIGURE 9 - RELATIONS BETWEEN PROBLEM TREE AND OBJECTIVE TREE (TYCHON B., 2023).....	45
FIGURE 10 – MAP OF THE PUBLIC HIKING TRAILS INSTALLED IN CLOUDBRIDGE (CLOUDBRIDGE NATURE RESERVE, 2024A).....	51
FIGURE 11 - DIAGRAM OF PARTICIPANTS' SAMPLE GENDER	60
FIGURE 12 – DIAGRAM OF PARTICIPANTS' AGE RANGE	61
FIGURE 13 - DIAGRAM OF PARTICIPANTS' COUNTRY OF ORIGIN	61
FIGURE 14 - DIAGRAM OF PARTICIPANTS' OCCUPATION	62
FIGURE 15 - DIAGRAM OF PARTICIPANTS' MOTIVATION TO COME TO CLOUDBRIDGE	62
FIGURE 16 - DIAGRAM OF PARTICIPANTS' HIKING COMPANIONS	63
FIGURE 17 - COMPARATIVE TENDENCY OF LEARNING ON TRAIL WITH OR WITHOUT EDUCATIONAL PANELS	65
FIGURE 18 - DIAGRAM OF THE NUMBER OF PANELS READ.....	66
FIGURE 19 – DIAGRAM OF PARTICIPANT SCALING THE CONTENT OF EDUCATIONAL PANELS	67
FIGURE 20 - CONSERVED PANEL'S LOCATION ON THE RIVER TRAIL (CONCEIVED WITH QGIS)	84
FIGURE 21- EDUCATIONAL PANEL DEVELOPED FOR THE LOCATION N°Y ON QGIS'S MAP.....	85
FIGURE 22 - EDUCATIONAL PANEL DEVELOPED FOR THE LOCATION N°2 ON QGIS'S MAP.....	86
FIGURE 23- EDUCATIONAL PANEL DEVELOPED FOR THE LOCATION N°3 ON QGIS'S MAP.....	86
FIGURE 24 - EDUCATIONAL PANEL DEVELOPED FOR THE LOCATION N°5 ON QGIS'S MAP.....	87
FIGURE 25- EDUCATIONAL PANEL DEVELOPED FOR THE LOCATION N°7 ON QGIS'S MAP.....	87
FIGURE 26 - EDUCATIONAL PANEL DEVELOPED FOR THE LOCATION N°8 ON QGIS'S MAP.....	88
FIGURE 27 - SIGNAGE DISPLAYED AT THE WELCOME CENTER.....	102
FIGURE 28 - QUESTIONNAIRE FORM.....	110
FIGURE 29 - PRIVATE AND PUBLIC MAP OF CNR.....	142
FIGURE 30 - MAP OF BIOLOGICAL CORRIDORS (SINAC, 2017)	143
FIGURE 31 - CLOUDBRIDGE ELEVATION CONTOURS (TINGERTHAL ET AL., 2007)	144
FIGURE 32- DIFFERENT SIMPLIFIED TYPES OF GEOLOGICAL MAPS OF COSTA RICA: (A) MAJOR TECTONIC FEATURES, (B) MARINE BASINS, (C) GEOMORPHOLOGIC MAP, (D) GEOLOGICAL MAP (GUILLERMO ET AL., 2017)	145
FIGURE 33- THE GEOLOGIC TIME SCALE (EARTH@HOME, 2024).....	146
FIGURE 34- SOIL HORIZONS AND TEXTURE TRIANGLE (AUSTRALIAN ENVIRONMENTAL EDUCATION, N.D.)	147
FIGURE 35- SOIL HORIZON IN CNR(DAVIS, 2009).....	147
FIGURE 36 - SOIL MAP OF COSTA RICA (UNIVERSIDAD DE COSTA RICA, N.D.)	148
FIGURE 37- PRIMARY FOREST IN CNR.....	149
FIGURE 38- DEGRADED LAND IN CNR THAT IS BEING PLANTED	149
FIGURE 39 - REPLANTED FOREST IN CNR	149
FIGURE 40 - NATURAL REGROWTH FOREST IN CNR.....	149
FIGURE 41 – EMAIL RECEIVED FROM CNR	150
FIGURE 42 - FACEBOOK POST FROM CNR	151
FIGURE 43 - INSTAGRAM POST FROM CNR	151
FIGURE 44- CLOUDBRIDGE'S WEBSITE	152
FIGURE 45- WELCOME CENTER ENTRANCE	154
FIGURE 46- INSIDE OF THE WELCOME CENTER.....	155
FIGURE 47 – WATERFALL TRAIL (CLOUDBRIDGE NATURE RESERVE, 2024A)	156
FIGURE 48- RIVER TRAIL (CLOUDBRIDGE NATURE RESERVE, 2024A).....	157
FIGURE 49- RIDGE TRAIL (CLOUDBRIDGE NATURE RESERVE, 2024A)	158
FIGURE 50 - CLOUDBRIDGE NORTH TRAIL (CLOUDBRIDGE NATURE RESERVE, 2024A)	159
FIGURE 51 – INFORMATIVE PANEL ALONG THE MAIN TRAIL WITH A MAP AND CLOUDBRIDGE'S STORY.....	161
FIGURE 52- INDICATIVE PANELS WITH DIRECTIONS OR MAP ALONG THE MAIN TRAIL	161

FIGURE 53 – PROMOTIONAL PANEL WITH CLOUDBRIDGE'S SOCIAL ACCOUNTS	162
FIGURE 54 - EDUCATIONAL PANEL ALONG THE WATERFALL TRAIL WITH A MAP AND ECOLOGICAL EXPLANATIONS	163
FIGURE 55 - EDUCATIONAL PANELS WITH DESCRIPTIONS.....	164
FIGURE 56- EDUCATIONAL PANELS WITH SPECIES EXPLANATION	165
FIGURE 57 - EDUCATIONAL PANELS WITH SPECIES IDENTIFICATION	165
FIGURE 58 - FAILED EMAIL DELIVERY TO TOURISTS.....	166
FIGURE 59 - PAGE OF THE NOTEBOOK WITH INFORMATION OF DAY VISITOR	167
FIGURE 60 - PANEL'S POTENTIAL PLACEMENT ON THE RIVER TRAIL (CONCEIVED WITH QGIS).....	174

TABLE 1- RIVAS CLIMATE (CLIMAT RIVAS: PLUVIOMÉTRIE ET TEMPÉRATURE MOYENNE RIVAS, DIAGRAMME OMBROTHERMIQUE POUR RIVAS, N.D.).....	20
TABLE 2- FORM OF COMMUNICATION USED BY CLOUDBRIDGE NATURE RESERVE.....	31
TABLE 3 - PROJECT SUMMARY.....	46
TABLE 4 - GLOBAL ANALYSIS OF TENDENCIES PER GROUP OF SAMPLES.....	63
TABLE 5 - DISTRIBUTION OF TRAIL USAGE	66
TABLE 6 - DESCRIPTION OF CLOUDBRIDGE'S STAFF INTERVIEWED	71
TABLE 7- DEVELOPED TABLE CHARACTERIZING THE DIVERSE CHOICE OF PLACEMENT.....	83
TABLE 8 - CONSERVED PANEL'S LOCATION	84
TABLE 9 - CALENDAR OF ACTIVITIES.....	153
TABLE 10 - CHARACTERIZING THE TRAILS.....	160
TABLE 11 - EXCEL DOCUMENT OF THE QUESTIONNAIRE'S RESPONSES	173

Acronyms and abbreviations

CFCA: Cloud Forest Conservation Alliance

CNR: Cloudbridge Nature Reserve

GIS: Geographic Information System

ICT : Instituto Costarricense de Turismo (Costa Rican Tourism Board)

LFA: Logical Framework Approach

NFTP: Non-Timber Forest Products

NSCA: National System of Conservation Areas

OMT: Mondial Organisation for Tourisme

PCB: Programa de Conservación de la Biodiversidad (Biodiversity Conservation Program)

SINAC: Sistema Nacional de Áreas de Conservación (National System of Conservation Areas)

TIES : The International Ecotourism Society

UNEP : United Nations Environment Programme

UN-IPCC: United Nations International Panel on Climate Change

1 Abstract

As part of my thesis, the opportunity was presented to carry out this internship at the Cloudbridge Nature Reserve, located in Costa Rica.

In this study, we will explore the effectiveness of communication strategies employed by Cloudbridge Nature Reserve to reach its target audience: tourists. With ecotourism gaining more importance as a means of promoting nature conservation and environmental awareness, understanding how nature reserves communicate their messages to visitors is crucial.

The study employs a rigorous methodological approach, including a thorough analysis of communication materials, visitor perceptions, and behavioral responses. Through surveys during my internship at the reserve, field observations, data analysis, and interviews, the study aims to identify strengths and weaknesses in Cloudbridge's communication strategy and propose recommendations for improvement.

By enhancing communication with tourists, Cloudbridge can amplify its impact on environmental awareness, promote sustainable tourism practices, and be able to develop educational materials to transmit additional important information.

Keywords: Cloud forest, Cloudbridge Nature Reserve, Costa Rica, Social experience, Educational communication, Hiking trails, Ecotourism, Environment

2 Introduction

Within the scope of my thesis, which is directly tied to my internship at Cloudbridge Nature Reserve (CNR) in Costa Rica, this study will be structured following the Logical Framework Approach. Employing this methodology will facilitate comprehensive methodological planning and detailed study design, integrating essential elements for an in-depth understanding of the context, objectives, activities, expected results, resources, and monitoring and evaluation mechanisms.

Ecotourism has emerged as a driving force in nature conservation and environmental awareness. In this context, natural reserves such as Cloudbridge Nature Reserve play a crucial role by offering visitors an immersion into preserved ecosystems and raising awareness about the importance of biodiversity and environmental protection. However, the effectiveness of communicating these messages to tourists remains a central question.

This study aims to assess the relevance and effectiveness of Cloudbridge's communication with its target audience: tourists. By focusing on understanding visitor's expectations, perceptions, and reactions to the reserve's awareness initiatives, we seek to identify the strengths and weaknesses of the current communication strategy.

Through a rigorous methodological approach, we will explore the various aspects of Cloudbridge's communication, analyzing the materials used, the messages conveyed, and their reception by tourists. We will also examine the implications of this communication on visitors' behavior, level of engagement, and understanding of environmental issues.

Furthermore, this study aims to provide strategic recommendations for improving Cloudbridge's communication with its visitors, thereby enhancing the impact of its awareness initiatives and contributing to the promotion of sustainable and environmentally friendly tourism.

Ultimately, an educational strategy is under consideration, particularly in the form of informational panels. This approach seeks to raise visitor's awareness of significant elements that may have been overlooked. These informative panels are designed to furnish additional insights into the reserve's environment and biodiversity, alongside ongoing conservation efforts and restoration initiatives. The overarching objective is to fortify visitors' environmental literacy and foster a deeper comprehension and appreciation of Cloudbridge's delicate ecosystem.

3 Methodology

Hiking is quite popular and the hiking trails at Cloudbridge Nature Reserve (CNR) in Costa Rica are among the best for offering exceptional experiences. Despite their popularity, however, there remains a lack of information concerning the social dynamics along these trails and the effectiveness of Cloudbridge's messaging to its visitors.

The methodology adopted in this study can be organized into three distinct sections, aligning with the overarching objectives and structural framework of the research:

3.1 Contextual Analysis and Problem Identification

To address this gap, the study initiates an in-depth contextual analysis of Cloudbridge Nature Reserve, focusing on its environmental challenges, conservation imperatives, and overarching goals. This analysis aims to shed light on the complex dynamics of the reserve's ecosystem and the broader context within which it operates. Employing the Logical Framework Approach (LFA), both overarching and specific objectives will be delineated, alongside anticipated outcomes, and corresponding actions. This structured methodology not only serves as a roadmap for the study but also ensures clarity and coherence in project planning and explanations, while also facilitating progress monitoring throughout the research endeavor.

Moreover, as the primary objective of this study is to methodically verify the effectiveness of CNR's communication efforts with its visitors, a comprehensive problem tree analysis will be conducted. This method is intended to identify and examine key questions and challenges associated with communication within the reserve, particularly regarding the dissemination of information about conservation initiatives and visitor engagement. By visually delineating the interconnected factors that impact conservation endeavors, this analytical tool offers a nuanced understanding of the complexities involved. Through this meticulous process, the root causes of environmental degradation and barriers to successful conservation initiatives will be elucidated, thereby providing insights to inform successive research directions and propose concrete solutions.

3.2 Data Collection and Analysis

In this phase, data collection and analysis methods will be employed to delve deeper into the social dynamics along the hiking trails of the reserve. The methodology entails conducting scrupulous documentary research and synthesizing existing literature on relevant topics such as Costa Rica, cloud forests, tourism, hiking trails, and social experience. By synthesizing

information from articles, reports, and other sources, this thesis will provide a foundational understanding of the context within which the study is situated.

Furthermore, field experience plays a crucial role in this study's methodology. As an indispensable component of the research process, firsthand exploration of the trails frequented by visitors within the reserve will provide valuable insights. This immersive approach ensures the acquisition of comprehensive information on the terrain of the reserve. Consequently, detailed field notes will be taken of the trail characteristics, encompassing terrain nuances, biodiversity richness, and overarching natural features. These notes will be precisely recorded, capturing nuanced observations and facilitating a profound understanding of the reserve's ecological landscape.

As the research process involves gathering data from visitors after their hike, the next step consists in designing and administering a comprehensive survey to collect data directly from visitors. The survey questionnaire will be carefully conceived to capture various aspects of the hiker's social experience, including their expectations, satisfaction levels, preferences, and suggestions for improvement.

3.3 Findings Interpretation and Recommendations

In the concluding phase of the study, collected data from survey responses and field notes will undergo comprehensive analysis to extract meaningful insights. Statistical techniques will be employed to identify patterns, trends, and correlations, while qualitative methods will be utilized to further explore open-ended survey responses and qualitative field observations.

This multifaceted investigation aims to evaluate the extent to which visitors to Cloudbridge Nature Reserve acquire new knowledge, serving as a vital instrument of the efficacy of the reserve's communication strategies. Specifically, the study offers a holistic assessment of the impact of CNR's communication on visitor experiences and environmental awareness. By examining whether visitors indeed gain novel insights, the analysis seeks to validate the effectiveness of CNR's messaging efforts, thereby contributing significantly to discussions on optimizing visitor engagement and fostering environmental consciousness within ecotourism settings.

Based on the insights gathered from the data analysis, potential educational approaches may be developed to enrich the social experience of hikers within the reserve. These approaches could include the creation of more informative panels, interpretive signage, or enhancements

to digital media platforms, providing visitors with pertinent information about the reserve's natural attributes, trail characteristics, and conservation efforts.

In the final phase of the study, the methodology employed will be subjected to a conscientious examination, encompassing a critical analysis of its strengths, limitations, and implications for future research in areas such as ecotourism, nature conservation, and social experience. Additionally, research findings will be synthesized, leading to conclusions drawn from the analysis.

Chapter I: Context

4 Context

4.1 Costa Rica

4.1.1 Geography



Figure 1 – Map of Costa Rica Provinces (Geology.com, n.d.)

Costa Rica, located in Central America and nestled between Nicaragua to the north and Panama to the south, is characterized by its diverse geography and climate. The country is divided into seven provinces: San José, Heredia, Alajuela, Cartago, Limón, Puntarenas, and Guanacaste (Brodeur, 2019). Its population of approximately 3.5 million is concentrated in its capital's metropolitan area, with San José being the largest city (Beletsky, 2007).

Covering an area of 51,100 square kilometers, the country stretches 380 kilometers in length, with its narrowest point between the Caribbean Sea (Atlantic) and the Pacific measuring 120 kilometers. With numerous bays, coves, and two peninsulas (Nicoya and Osa), the Pacific coast extends for 1,016 kilometers while the Atlantic coast spans 212 kilometers (Brodeur, 2019).

Costa Rica's geography can be summarized by a backbone-like central mountain range running from northwest to southeast, the Cordillera de Talamanca, separating the eastern

(Caribbean, or Atlantic) and western (Pacific) coastal lowlands. The country's land area is evenly divided between lowland regions and middle and higher-elevation mountainous regions (Beletsky, 2007).

The mountain ranges consist of four chains: the Guanacaste Range, the Tilarán Range, the Central Range, and the Talamanca Range. Several volcanoes are located in the northern region, including Orosi, Rincón de la Vieja, Santa María, Miravalles, and Arenal, among others. The Central Range encloses the Central Valley, housing the country's highest volcanoes like Poás, Barva, Irazú, and Turrialba (Beletsky, 2007; Brodeur, 2019).

Approximately two-thirds of Costa Rica's population resides in the Central Valley, with altitudes ranging from 800 to 1,600 meters and a temperate climate. The largest expanse of plains lies in the northeast along the Caribbean Sea, covering 20% of the country's land area. Costa Rica also features numerous rivers and waterways, with Lake Arenal being the most significant (Beletsky, 2007; Brodeur, 2019).

In summary, Costa Rica's geography is characterized by mountainous terrain, volcanic activity, diverse coastal regions, and extensive river systems, contributing to its rich biodiversity and varied ecosystems.

4.1.2 Fauna and flora

Renowned for its vast and rich spectrum of biodiversity and stunning landscapes, this country stands as a model for environmental conservation in Central America. Despite its small size covering only 0.03 percent of the Earth's surface, its strategic location, lodged between the Pacific Ocean and the Caribbean Sea, fosters remarkable ecological diversity. This small nation harbors nearly 5 percent of the world's known species, including a diverse array of species, from mammals and reptiles to birds and butterflies. A testament to its commitment to environmental preservation, Costa Rica allocates 26 percent of its land to conservation and protected areas (Costa Rica Tourism Board, 2024; Eyewitness, 2005; Firestone et al., 2010).

Costa Rica owes its remarkable biodiversity to its varied topography and climates, ranging from lowland wetlands to mist-shrouded mountains. The country's terrain and flora display significant variations across regions, giving rise to a multitude of ecosystems. Influenced by factors such as rainfall distribution and elevation, these ecosystems are classified into 12 distinct life zones, with six principal zones described below. They range from dry deciduous forests in the northwest to lush rainforests in the lowlands and cloud forests in the high mountains. Each ecosystem boasts its unique microclimate, flora, and fauna, with a

concentration of species primarily found at higher elevations (Beletsky, 2007; Brodeur, 2019; Eyewitness, 2005; Haber et al., 2000; Reid et al., 2010):

- Lowland Rainforests – swamps and marshes-: These ecosystems provide a habitat for a variety of species, such as tapirs, jaguars, monkeys, and numerous bird species. Additionally, the northern Caribbean lowlands boast vast swamp forests dominated by *Raphia* palms, characterized by flooded conditions and dark waters from decaying leaves.
- Montane and Cloud Forests - this part will be discussed further in the next part talking about Cloud Forest-: At higher elevations, both in the Atlantic and Pacific regions, Costa Rica boasts montane and cloud forests. These unique ecosystems feature vegetation adapted to misty conditions and receive abundant rainfall, supporting a wide range of plant species, and high endemism.
- Tropical dry Forests - also known as lowland tropical deciduous forests-: Once widespread in the northwest and the country's bottomlands, these forests have diminished but remain vital for wildlife observation. Found in areas with a pronounced dry season, they feature characteristic species like the Guanacaste tree. Many of the original dry forest areas have been converted to pastures.
- Wetlands and Mangroves: Mainly along the Pacific and northern Caribbean coasts, these areas play a crucial role in supporting and nurturing diverse marine ecosystems. Dominated by a variety of tree species, notably *Rhizophora*, their unique aerial roots enable survival in saltwater-saturated soil, providing habitat for marine creatures.
- Páramo Ecosystems: Above the forest line, it consists of grasslands and scrublands, providing habitats for various species of rodents, lizards, and snakes.
- Marine Environments: Costa Rica's marine environments, including coral reefs and nesting grounds for turtles, contribute significantly to its rich biodiversity. Coastal areas attract four species of marine turtles for nesting, in addition to numerous shorebird species.
- Disturbed habitats: Altered environments resulting from human activities or natural events, including forests, woodlands, savannas, farms, and parks. Despite ecological concerns, such areas still provide opportunities for wildlife observation. Notably, damaged forests can regenerate and eventually become healthy forests again.

Overall, Costa Rica's terrain and flora exhibit a rich ecological diversity, providing habitats for a multitude of species and contributing to its status as a global biodiversity hotspot.

4.1.3 Politics

Costa Rica is nominated as the most peaceful and democratic country in Latin America, boasting low crime rates, which have facilitated its development (Kaiser, 2024).

Despite its colonial past, the nation has managed to achieve a lasting democracy, unlike many of its neighbors. In particular, since the abolition of its military in 1948, the country has pursued a path of peace, which has fortified remarkable political stability and facilitated significant social and economic progress. The country's commitment to democratic principles is evident in its regular free and fair elections, robust institutions, and unwavering dedication to human rights and environmental conservation (Beletsky, 2007; Firestone et al., 2010; Love & Gabett, 2017).

4.1.4 Economy

Costa Rica is designated as one of the most equitable nations in Latin America, benefiting from a well-developed and stable social security system (World Bank Group, n.d.).

Each region specializes in specific economic activities. For instance, coffee production thrives in the Central Valley, while pineapples are cultivated in Talamanca, bananas along the Caribbean coast, cattle farming in Guanacaste, and palm oil in the southern Pacific region. Although large multinational companies dominate certain sectors like bananas, the majority of coffee production comes from small-scale farmers (Brodeur, 2019).

Moreover, the increasing environmental consciousness has led to significant preservation efforts, promoting the development of ecotourism, a topic to be further explored in the next chapter on the Concept of Ecotourism. This eco-awareness has spurred the country to embark on a transition to a green and sustainable economy since 2018, aiming to become the world's first carbon-neutral nation by 2050 through appropriate legislation (The Climate Reality Project, 2023).

4.2 Cloud Forest in Costa Rica

4.2.1 Definition

A cloud forest, also referred to as a fog forest or montane forest, is a unique type of tropical or subtropical forest characterized by persistent low-level cloud cover, typically at the canopy level. These forests are found in mountainous regions where high altitude, combined with moisture from the clouds, creates a consistently humid and misty environment. Renowned for

their biodiversity, cloud forests harbor a wide variety of plant and animal species adapted to the cool, moist conditions (Eyewitness, 2005). Cloud forest ecosystems are relatively rare on a global scale due to their sensitivity to local climatic conditions, elevation, and proximity to the sea. These unique ecosystems are primarily found in regions such as Central and South America, southern Mexico, parts of the Caribbean, Southeast Asia, eastern Africa, and New Guinea (The Editors of Encyclopaedia Britannica, 2024).

4.2.2 General state

Named for the ephemeral mists that envelop them, Costa Rica's cloud forests are typically situated at elevations of 1,000 m above sea level, encompassing more than half of the country's terrain. These areas exhibit extreme local variations in flora, ranging from wind-swept exposed ridges with low-lying trees and shrubs closer to the ground, to shelter areas boasting taller vegetation. The unique vegetation of cloud forests, shaped by the prevailing high humidity and constant cloud cover, features shorter and more contorted trees compared to adjacent drier forests (The Editors of Encyclopaedia Britannica, 2024). Epiphytic plants such as orchids and bromeliads adorn branches, contributing to the forests' remarkable diversity. While fauna is abundant in these ecosystems, misty conditions and dense foliage can hinder sightings (Eyewitness, 2005). Cloud forests are vital habitats for numerous endemic species, crucial for their survival even in dry seasons, underscoring their ecological importance (Cloudbridge Nature Reserve, 2024a)

Playing a crucial role in global biodiversity, cloud forests operate as "habitat islands" demarcated not by water but by altitude, which makes them vulnerable to human encroachment and deforestation (Hance, 2023). These ecosystems, constituting 2.5 percent of the total tropical forest area worldwide, are renowned for their rich biodiversity and provision of vital ecosystem services such as carbon storage and freshwater production (Bubb et al., 2004; Toledo-Aceves et al., 2011).

4.2.3 Environmental issues

The cloud forests of Costa Rica stand as critical ecosystems facing significant environmental challenges. With only an estimated 1 percent of the world's woodlands classified as cloud forests in 2022, compared to 11 percent in the 1970s, their decline is attributed to various factors including global warming, deforestation, and other human-related activities (The Editors of Encyclopaedia Britannica, 2024). Despite Costa Rica's reputation for environmental conservation, the country fights against the challenges of human encroachment

and deforestation, posing imminent threats to its cloud forests (Firestone et al., 2010; Hance, 2023)

Despite, their critical role in supporting endemic species and maintaining ecosystem functioning, cloud forests face the risk of species loss and habitat degradation due to their vulnerability to ongoing fragmentation caused by land clearance for agriculture and forestry, as well as climatic changes (Bubb et al., 2004; DeLyser, 2015; Fleer, 2017; Martínez et al., 2009). Described as "habitat islands" shaped by altitude, these forests are particularly susceptible to environmental threats, emphasizing the urgent need for conservation efforts (Hance, 2023).

Renowned for their ability to intercept moisture from clouds, cloud forests are exceptionally susceptible to climate change-induced disruptions. As global temperatures rise and weather patterns undergo significant alterations, these forests face unprecedented challenges, including disruptions in their delicate ecological balance (DeLyser, 2015). Compounding these threats is the relentless fragmentation triggered by land clearance practices, intensifying the strain on their ecological integrity and biodiversity (Fleer, 2017; Giddy, n.d.; Martínez et al., 2009).

Recognizing the paramount importance of cloud forests in global biodiversity necessitates acknowledging their significance as critical habitats within the context of island biogeography (Hance, 2023). Notwithstanding their limited global extent, these ecosystems play a pivotal role in supporting diverse plant and animal species (Bubb et al., 2004). Consequently, safeguarding Costa Rica's cloud forests and implementing effective conservation strategies are not only essential for the preservation of its rich natural heritage but also for promoting environmental sustainability worldwide.

4.2.3.1 Deforestation

Deforestation poses a significant threat to cloud forests, even though their wood is generally unsuitable for commercial exploitation due to their slow growth, contorted tree shapes, and rugged terrain making logging difficult (Bruijnzeel & Scatena, 2011; Bubb et al., 2004). However, in regions like the Cordillera de Talamanca in Costa Rica, where cloud forests are dominated by oaks, sustainable timber production is possible (Herrera & Chaverri, 2006). Additionally, these forests are often targeted for charcoal production near urban centers, further exacerbating deforestation pressures (Bubb et al., 2004).

The exploitation of non-timber forest products (NTFPs) further aggravates the threat to cloud forest flora in countries like Costa Rica. These products, including medicinal plants, fruits, herbs, and game meat, are harvested for local markets and exported to Europe and North America. Moreover, tree ferns and abundant epiphytes such as orchids and bromeliads are extracted for horticultural markets, compounding the challenges faced by cloud forest ecosystems (Anderson & Ashe, 2000; Bubb et al., 2004).

The existence of many cloud forests depends more on their inaccessibility for conversion to agricultural land than on conservation measures (Bode, 2024). Pressures for clearing new farmland increase due to population growth, degradation of existing farmland, and socio-economic processes involving highland and lowland economies. The construction of roads in mountainous areas also intensifies these pressures (Bubb et al., 2004).

Cloud forests, existing as natural forest islands in human-modified landscapes, serve as vital sources of forest products and services for local communities. However, habitat fragmentation is a common feature, threatening endemic species found nowhere else. Protected areas, including nature reserves, national parks, and biosphere reserves, play a central role in cloud forest conservation efforts (Bubb et al., 2004; Hance, 2023).

Costa Rica, known for its rich biodiversity and ecotourism, has a long history of deforestation driven primarily by agricultural expansion and leading to the loss of vast forested areas. (Anchukaitis & Horn, 2005; DeLyser, 2015; Evans, 1997). From 1950 to 1990, the country lost a staggering 65% of its forest cover. Therefore, policies promoting agricultural colonization further accelerated deforestation, particularly in mountainous regions (Evans, 1997)

Today, efforts to combat deforestation through forest protection and reforestation programs have yielded positive results, with forest cover now restored close to 60% of the country's land area (Firestone et al., 2010; Konyn, 2021). However, deforestation persists, fuelled by activities such as logging, agriculture, and plantation, resulting in severe environmental consequences such as soil erosion and habitat loss (Brodeur, 2019; Costa Rica Guide, 2024).

4.2.3.2 Climate change

Climate change presents a significant threat to cloud forests in Costa Rica, exacerbating existing challenges and placing these unique ecosystems at risk. According to the United Nations International Panel on Climate Change, human-induced climate change has led to

widespread adverse impacts on nature and people, with irreversible consequences already evident (IPCC et al., 2023). Forests, which cover approximately one-third of the Earth's land, play a crucial role in mitigating climate change by sequestering carbon through photosynthesis (Bode, 2024; UNEP, 2017).

The effects of climate change on Costa Rica's cloud forests are complex and varied. Events like El Niño, characterized by droughts and heatwaves, particularly on the Pacific side, and La Niña, which brings drought to the Atlantic side and increased precipitation to the Pacific, along with the ENSO phenomenon, which extends dry conditions into the rainy season, contribute to alterations in precipitation patterns. These phenomena exacerbate water scarcity and biodiversity loss, posing significant challenges to the delicate ecosystems of the cloud forests (Brodeur, 2019; Haber et al., 2000). Additionally, rising temperatures and altered moisture availability affect seedling survival and forest dynamics, disrupting natural regeneration processes (Bode, 2024; De Frenne et al., 2021; Haber et al., 2000).

The cloud forest's vulnerability to climate change is further compounded by its isolation and altitude-dependent climate. As temperatures rise and precipitation patterns shift, suitable habitats for high-altitude-adapted species diminish, forcing species to compete for limited resources and potentially leading to extinctions (Hance, 2023; Spek, 2011).

Moreover, climate change threatens the cloud forest's ability to act as a carbon sink. Changes in forest dynamics, such as the decline of densely wooded sub-canopy trees, reduce the forest's capacity to sequester carbon, exacerbating greenhouse gas emissions (Bubb et al., 2004; Firestone et al., 2010; Fler, 2017).

4.2.4 Restoration and Conservation

Reforestation and conservation efforts in the cloud forests of Costa Rica are essential for safeguarding ecosystem services and biodiversity in these critical landscapes. Recognizing the importance of protected areas within cloud forests, Costa Rica prioritizes the identification and distribution of lessons learned, particularly regarding revenues from ecotourism and payments for environmental services (Bubb et al., 2004; Costa Rica Tourism Board, 2024).

Restoration initiatives are integral to maintaining ecosystem integrity and promoting biological connectivity in tropical montane landscapes (Sarmiento, 2000). Cloud forest restoration is part of broader programs aimed at establishing biological corridors between highland and lowland forests, facilitating species migration, and promoting biodiversity

conservation (Bubb et al., 2004; Cloudbridge Nature Reserve, 2024a; SINAC, 2017; Toledo-Aceves et al., 2011).

Studies in Latin America highlight the potential for forest regeneration if seed sources are nearby and land-use intensity is not severe (Guariguata & Ostertag, 2001). However, challenges such as fire-induced grasslands and fragmented landscapes hinder natural regeneration in some areas (Sarmiento, 1997).

To facilitate forest regeneration, it is crucial to preserve tree survivors, which enhance seed dispersal and provide shade for seedlings (DeVito, 2012; Fler, 2017; Sarmiento, 1997). The key role of frugivorous birds in seed dispersal and forest regeneration underscores the importance of maintaining ecological processes (Bubb et al., 2004; Kappelle, 2006).

Costa Rica has made significant strides in conservation efforts, with over 27% of its territory now protected through national parks and reserves (Brodeur, 2019). The country has emerged as a leader in ecotourism, demonstrating the economic value of nature conservation while engaging local communities in sustainable development practices (Cloudbridge Nature Reserve, 2024a; Love & Gabett, 2017; Mondiale, 2022).

Furthermore, Costa Rica's commitment to environmental protection is evident in its goal to become the world's first carbon-neutral country by 2050 (Brodeur, 2019; The Climate Reality Project, 2023). With 99% of its electricity already sourced from renewable energy (Brodeur, 2019), and increasing efforts in carbon offsetting measures such as reforestation, Costa Rica exemplifies a holistic approach to environmental stewardship.

In summary, reforestation and conservation efforts in Costa Rica's cloud forests are vital for preserving biodiversity, maintaining ecosystem services, and mitigating climate change impacts. By integrating ecological restoration with sustainable development practices, Costa Rica sets a model for global conservation initiatives.

Chapter II : Cloudbridge Nature Reserve

5 Cloudbridge Nature Reserve

5.1 Context

5.1.1 Geography

Cloudbridge is a reserve located in Costa Rica, specifically in the region of San Gerardo de Rivas in the heart of Central America (Figure 2).



Figure 2 - Geographic location of Cloudbridge (Google Earth, n.d.)

This non-profit organization is dedicated to the conservation of tropical forest ecosystems and the restoration of degraded lands. Covering approximately 300 hectares, the reserve encompasses significant biodiversity comprising three main types of habitats: primary forest, naturally regenerating secondary forest, and actively planted secondary forest (reforested) as defined by the reserve (Figure 3)(Cloudbridge Nature Reserve, 2024a).

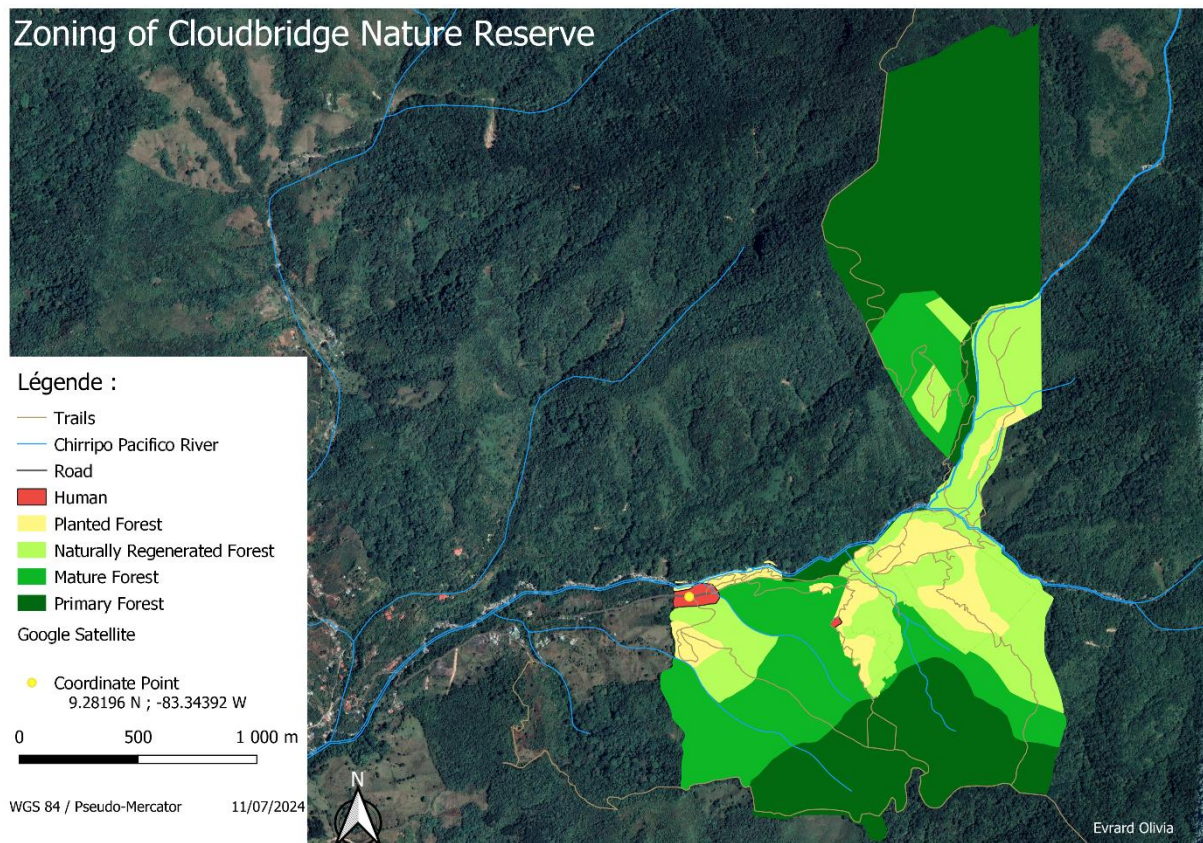


Figure 3 - Cloudbridge zoning according to forest type, with the precise location of the reserve indicated by a coordinate point (conceived map with QGIS)

Strategically positioned on the border of the Chirripó National Park - a UNESCO World Heritage Site (UNESCO World Heritage Centre, n.d.-b)- and surrounding human communities, the reserve serves to expand the forests of Chirripó Park to the east and connect to other reserves and wooded areas to the west (Cloudbridge Nature Reserve, 2024a). The reserve encompasses the valleys of the Chirripó Pacifico and Uran rivers, creating a crucial biological corridor for diverse wildlife, including the iconic Quetzal, mammals such as Tapir, Puma, and Jaguar, as well as a variety of birds, amphibians, and reptiles (DeVito, 2012; Hance, 2023).

Situated between 1 500 and 2 600 meters above sea level in the Talamanca Mountains, the reserve offers diverse landscapes ranging from lush green valleys to mountain ridges offering panoramic views due to its immersion in the clouds (Cloudbridge Nature Reserve, 2024a). Similarly, housing endemic species and towering trees such as oaks and cedars, the cloud forest has the ability to capture moisture from the air, ensuring the survival of many organisms during the dry season (Loveriot, 2017).

5.1.2 Climate

Costa Rica, and San José specifically, enjoys a tropical climate classified as "Am" according to Köppen and Geiger (*Climat San José: Pluviométrie et Température Moyenne San José, Diagramme Ombrothermique Pour San José*, n.d.). The "Am" climate represents the tropical monsoon climate, which is characterized by consistently high temperatures throughout the year, with monthly average temperatures remaining above 18°C and minimal seasonal variations. Accordingly, this climate classification is characterized by wet and dry seasons. (Arnfield, 2024; National Geographic Society, 2023)

However, it is important to note that the Cloudbridge Nature Reserve, located in the Rivas region, has a tropical climate classified according to Köppen-Geiger as category "Af". This is due to its varied altitude, as the Af range is from 800 meters to 3,500 meters above sea level. The average temperature of the city of Rivas is recorded at 20.4°C. The rainy season extends from May to November, while the warmer dry season, with little precipitation, occurs from December to April (Figure 4 and Table 1) (*Climat Rivas: Pluviométrie et Température Moyenne Rivas, Diagramme Ombrothermique Pour Rivas*, n.d.). The "Af" climate, classified as a tropical rainforest climate, shares the same temperature range as the "Am" climate. However, the main distinguishing feature of the "Af" climate is the complete absence of a dry season, due to its significant and consistent rainfall exceeding 60 mm monthly¹. These conditions support an evergreen tropical rainforest (Arnfield, 2024; National Geographic Society, 2023).

¹ Note: Although CNR is classified as "Af," the effects of climate change have introduced a distinct dry season at Cloudbridge, with periods potentially extending up to eight weeks without rain.

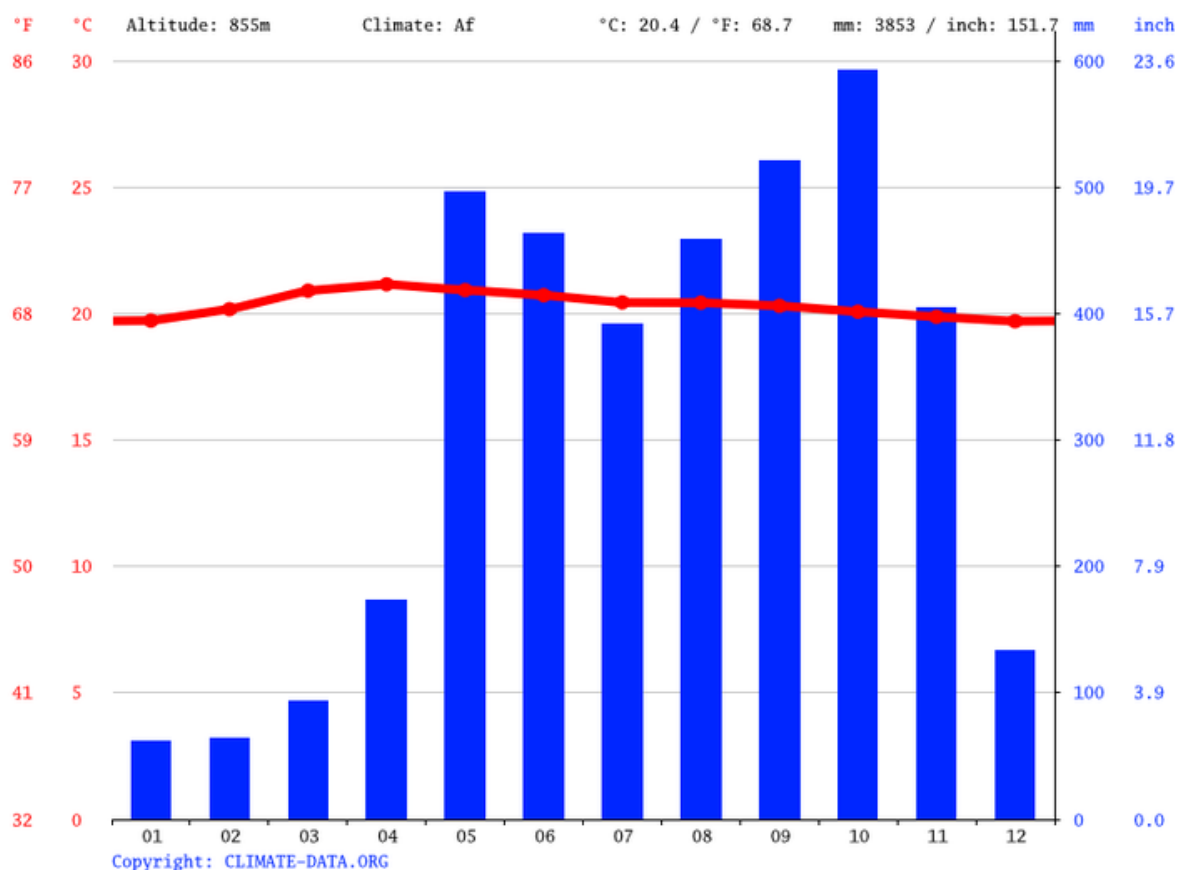


Figure 4 - Diagram of Rivas (Climat Rivas: Pluviométrie et Température Moyenne Rivas, Diagramme Ombrothermique Pour Rivas, *n.d.*)

	January	February	March	April	May	June	July	August	September	October	November	December
Average temperature (°C)	19.7	20.2	20.9	21.2	20.9	20.7	20.4	20.4	20.3	20.1	19.9	19.7
Average minimal temperature (°C)	15.3	15.4	16.2	16.9	17.4	17.3	16.8	16.8	16.8	16.9	16.4	15.6
Maximum temperature (°C)	24.6	25.2	25.7	25.4	24.6	24.4	24.2	24.2	24	23.6	23.6	24
Precipitation (mm)	62	64	93	173	495	463	392	459	521	592	405	133
Humidity (%)	83	80	80	83	90	92	91	91	92	93	91	87
Rainy day (day)	16	15	18	21	22	21	22	22	21	22	21	20
Hours of sunlight (h)	7.7	8.0	7.9	7.4	5.8	5.5	6.3	5.8	5.0	4.4	5.3	6.6

Table 1- Rivas Climate (Climat Rivas: Pluviométrie et Température Moyenne Rivas, Diagramme Ombrothermique Pour Rivas, *n.d.*)

It is crucial to acknowledge that the climatic conditions in San José and San Rivas differ significantly from those of the reserve, located at an altitude range of 1,500 to 2,600 meters. The stations were selected for their proximity to the reserve, but the higher elevation of CNR results in a cooler temperature dropping of 3 to 5 degrees Celsius, particularly noticeable during the night when temperatures may fall below 10 degrees Celsius. Additionally, the reserve's location within a cloud forest likely contributes to higher precipitation levels compared to the lower altitudes of San Rivas. This results in nearly 100% humidity for the majority of the year in the highland forest (Cloudbridge Nature Reserve, 2024a).

5.1.3 Forest types, biodiversity, and distribution in the reserve

The upper montane forest encompasses a diverse array of ecosystems, each characterized by unique ecological niches and biodiversity patterns in varied elevations above 1500 meters. At elevations exceeding 2000 meters, the forest transitions to a temperate-like environment reminiscent of North American forests, featuring prominent species such as oak (*Quercus*) and alder (*Alnus*) (Beletsky, 2007; Kappelle, 2006).

Despite challenging conditions, these forests support a diverse array of flora, including abundant vines, herbaceous climbers, large-leaved herbs, and numerous epiphytic species such as orchids, bromeliads, mosses, and ferns, contributing to their rich biodiversity (Beletsky, 2007; Cloudbridge Nature Reserve, 2024a). The cloud forests of the reserve, found at elevations above 1500 meters on the upper Pacific slope are characterized by dense vegetation, lower canopy heights, and persistent cloud and fog cover (Beletsky, 2007). Enveloping the mountain peaks at higher elevations, these evergreen habitats provide a fertile ground for a wide variety of species uniquely adapted to the prevailing environmental conditions (Bubb et al., 2004; Luteyn, n.d.).

The distribution, abundance, and diversity of tree species within CNR's forest types exhibit intriguing patterns (see Appendix 9: Forest types in CNR). Endemic species unique to specific forest zones contribute to the region's overall biodiversity, with approximately 20% of species shared between neighboring zones. Successional species, such as *Hampea appendiculata* and *Heliocarpus americanus*, are prevalent across multiple zones, contributing to the region's high tree diversity. The variation of altitude (Figure 31) and varied climatic conditions (Figure 4) further influence species distributions, with some species exhibiting disjunct distributions across different slopes and elevations (Haber et al., 2000).

Upper montane oak forests, found at elevations above 1700 meters, constitute a distinctive forest type within CNR. Characterized by bamboo-dominated understories and a canopy featuring oak (*Quercus costaricensis*) and schefflera rodriguesiana, these forests support a diverse array of flora, including ericads, subcanopy trees, and ground cover herbs and ferns (Kappelle, 2006).

These forests exhibit a distinctive blend of temperate species like oak and alder alongside a myriad of tropical taxa, creating a unique ecological tapestry (Spek, 2011). Characterized by heights generally under 20 meters, the upper montane forests transition gradually across zones, confronting strict categorization and demonstrating a cohesive integration of diverse vegetation (Fleer, 2017) (refer to the annex on Appendix 9: Forest types in CNR). Human activities, such as forest clearing, have altered the landscape in the San Gerardo de Rivas area, potentially facilitating the colonization of lowland species due to changes in environmental variables. Furthermore, global climate change may contribute to species migration into higher elevations, a phenomenon that could be exacerbated by anthropogenic factors (Bubb et al., 2004; Michelsohn et al., 2007).

Studies conducted within the reserve shed light on the complex dynamics of forest regeneration. Natural regrowth processes, stimulated by canopy openings, highlight the vital role of pioneer species in facilitating forest recovery. These species play a crucial role in accelerating colonization and creating favorable microclimate conditions for the establishment of climax species (Spek, 2011). Conversely, replanted areas within the reserve exhibit advanced forest structure, attributed in part to the establishment of pioneer species and natural regeneration processes. However, challenges persist, with exotic grasses hindering natural regeneration in certain areas, necessitating human intervention to expedite forest formation (Fleer, 2017; Spek, 2011).

5.1.4 Terrain features

The montane forest system within the Cordillera de Talamanca presents an elaborate tapestry of topographical elements that contribute to the unique landscape and microclimate diversity of Cloudbridge Nature Reserve. Surrounded by towering peaks are deep valleys and ravines, carved over millennia by the relentless flow of rivers and streams that meander through the reserve's expanse. These features not only define the physical landscape but also play crucial roles in shaping ecological processes and hydrological dynamics (Cloudbridge Nature Reserve, 2024a; UNESCO World Heritage Centre, n.d.-a).

At the topographical highs of local watersheds, highland swamps are notable components of the reserve. Formed by cloud water and precipitation inputs driven by high-altitude winds, these swamps serve as vital recharge zones for aquifers. They are characterized by permanent puddles filled with soft organic material, facilitating water filtration and infiltration into the ground (Davis, 2009; Redman, 2019).

Descending from the peaks, lower-elevation swamps emerge in forested areas, further contributing to the reserve's hydrological network and supporting the unique ecosystems within the montane forest. Microtopographical variations across the forest floor are influenced by a dynamic interplay of biotic and abiotic forces. Biotic processes, such as leaf litter deposits and animal activity, interact with abiotic phenomena like water flow and erosion to sculpt diverse terrain features (Bubb et al., 2004; Davis, 2009; Redman, 2019).

Spring and stream incision processes within the reserve are strongly influenced by soil structure (see Appendix 8). The porous A horizon facilitates water infiltration, which then migrates laterally along deeper horizons. As this lateral flow converges at depressions in the head of primary watersheds, it emerges as springs at the boundary between the A and B horizons (Australian Environmental Education, n.d.; Davis, 2009). These springs, as highlighted by Schembre (2009) exert a profound influence on shaping the trajectories of streams and rivers throughout the reserve.

Moreover, landslides represent a significant geomorphological process in montane tropical forests. Triggered by heavy rainfall and occasional seismic events, landslides range in scale from minor slumps to large-scale events that reshape the terrain. Geological substrate, soil development, vegetation structure, and human activities all influence the occurrence and extent of landslides across different terrain types within the reserve (Schembre, 2009).

Understanding the intricate terrain features of CNR is essential for comprehending its ecological complexity and the interconnectedness of its ecosystems. By studying these features, researchers can gain insights into hydrological processes, biodiversity distribution, and landscape evolution, thereby contributing to the effective management and conservation efforts aimed at preserving this unique montane forest ecosystem.

5.1.4.1 Geology (see Appendix 6: Geological Map of Costa Rica)

The geological history of CNR offers a fascinating glimpse into the dynamic forces that have shaped its landscape over millions of years. Situated within the Cordillera de Talamanca,

CNR primarily consists of andesite and rhyolite formations, products of volcanic eruptions during the Tertiary period approximately 2-5 million years ago (Schembre, 2009). These relatively young surface rocks, characterized by their volcanic origins, contribute significantly to the region's topography and soil composition (Davis, 2009).

The geological characteristics of Costa Rica are quite young, including those of CNR, spanning from the Jurassic to the Quaternary period (Figure 33), reflecting a complex history of geological activity. The Cordillera de Talamanca, where the reserve is located, hosts various geological formations, including tertiary, sedimentary, and volcanic rocks. These formations, aligned with the Mesoamerican trench, testify to a variety of geological processes that have shaped the region's relief over time (Schembre, 2009).

As a result, glacial deposits from the Pleistocene epoch further attest to CNR's geological heritage, leaving behind distinct features such as U-shaped valleys and lakes. Evidence of past glacial events adds layers of complexity to CNR's geological narrative, highlighting the interaction between geological forces and climatic fluctuations over time. The tertiary intrusive rocks, predominant within CNR, represent an important chapter in the geological history of the region. Additionally, composed of granodiorite, gabbros, and granites, these rocks formed during a period of intense orogenic activity in the Miocene. The Talamanca Comagmatic Series, dominated by granodiorite, bears witness to the geological processes that have shaped CNR's landscape for millions of years (Davis, 2009; Schembre, 2009; Uffelen, 1991).

Overall, the geological history of Cloudbridge Nature Reserve offers a window into the Earth's dynamic past, showcasing the enduring legacy of volcanic activity, tectonic forces, and glacial processes that have sculpted its rugged terrain.

5.1.4.2 Soils (see Appendix 8: Soil Horizons, Types)

Soils within the Monteverde area, another cloud forest within the northwest of Costa Rica, derived from weathered volcanic rock and ash deposits, exhibit considerable variation based on erosion and terrain steepness. Areas with moderate erosion are characterized by deep and dark-colored soils that are rich in organic matter, whereas heavily eroded regions display shallow, reddish soils with low fertility (Schembre, 2009). Soil genesis and classification reveal a complex interplay between parent rock type, terrain steepness, and drainage patterns, resulting in distinct soil profiles across different elevations and slopes (Haber et al., 2000).

The distribution and characteristics of soils vary significantly along elevational gradients and between slopes within the reserve. While topsoil properties exhibit minimal differences between lower and upper montane oak forests, soils on the Atlantic slope tend to be slightly more clayey with thicker organic horizons compared to those on the Pacific slope (Kappelle, 2006).

A soil analysis conducted at Cloudbridge by previous interns revealed that the soil is primarily composed of silty loam, loam, sandy loam, and sandy clay loam textures in the A and B-horizons, while the C-horizon display silty loam, sandy loam, loamy sand, and sand with common rock fragments. Clay composition varies across horizons but shows no correlation with site characteristics. Soil structure ranges from moderate subangular blocky to weak subangular blocky, influenced by clay and organic colloids. These soil characteristics promote good porosity, drainage, and aeration, crucial for ecosystem and hydrological functions. Furthermore, comparisons between old-growth and secondary-growth soils indicate differences in O-horizon thickness, attributed to vegetation age and decomposition rates (Pfammatter, 2017; Schembre, 2009).

Two soil types dominate Cloudbridge South, with variations including Typic Dystrudepts and Humic Dystrudepts. Soil temperature trends across different habitats and the influence of slope on moisture content highlight the complex interplay between environmental factors and soil characteristics. Moreover, soil color, texture, and A-horizon thickness vary between primary forest, planted, and naturally regenerated areas, suggesting anthropogenic impacts on soil properties (Pfammatter, 2017).

Land use practices surrounding the reserve profoundly influence the local environment. Four distinct land use types prevail: undeveloped forested areas, developed residential zones, cattle pasturelands, and agricultural fields. However, statistical analysis reveals no significant results, underscoring the need for further research to elucidate the long-term effects of deforestation and land use changes on soil health and ecosystem resilience (Pfammatter, 2017).

5.1.4.3 Hydrology

The hydrological dynamics within Cloudbridge Nature Reserve are intricately linked to its geological formations and soil properties, ultimately shaping its ecosystem. Therefore, a holistic understanding of the reserve's hydrology is possible, through analysis encompassing particle size, physical hydraulic properties, and chemical composition.

As previously stated in the paragraph above, the soil analysis reveals a predominance of clay, particularly in deeper layers, which influences water conduction and retention (Pfammatter, 2017). This phenomenon is the result of heightened plant competition and limited vertical water infiltration which makes the surface soils more favorable to water conductivity. However, the porosity and hydraulic conductivity decrease with depth, leading to drier conditions below 50 cm. Moreover, chemical analysis highlights acidic soil pH, accompanied by a decreasing trend with depth, alongside nutrient concentration peaks within the top 20 cm (Davis, 2009; Schembre, 2009).

The dominating water source within the reserve is the Río Chirripó, an expansive river that begins within the Chirripó National Park. As it flows downstream and reflects changing land uses, Río Chirripó serves as a crucial indicator of environmental health, with monthly water quality assessments conducted at nine sites along the river. Consequently, although remaining within EPA drinking water standards, there has been a discernible and gradual increase of nitrate and phosphate concentrations downstream due to human impact from pasturelands and agricultural areas, renowned for intensive chemical usage. This has resulted in a significant degradation of water quality. The inadequate residential drainage systems and agricultural overflow contribute to nutrient pollution, necessitating community awareness, and proactive measures to preserve water quality and ecosystem integrity (Davis, 2009; Schembre, 2009).

Due to limited geological data, the identification of aquifers within Cloudbridge poses challenges. Nevertheless, groundwater sampling from known springs could provide insights into temperature variations, indicating that way potential aquifer distinctions. Therefore, although the study yielded limited ion concentration data, the temperature trends and topographic analysis have offered valuable insights, thereby confirming the presence of at least three aquifers within the zone, which vary in size and likely originate from regional and local sources (Davis, 2009).

5.1.5 Conclusion

In conclusion, the investigation focused on the ecosystem dynamics within Cloudbridge, underscoring the profound influence of climate factors and soil properties on the structure, composition, and diversity of montane forests.

The findings of previous research, indicate that temperature is a primary factor determining the distribution of montane forest, aligning with the findings from studies conducted across tropical mountain regions. Additionally, the distribution of water vapor, the availability of

nutrients, and the light regime contribute significantly to the structure and composition of forests (Pfammatter, 2017).

Moreover, the intricate relationship between soil properties and climate shapes montane forest ecosystems and community distribution. Indeed, the influence of soil properties on nutrient cycling and root respiration dynamics, as well as the characteristics of soil organic-rich, waterlogged soils on wetter slopes, is observed to exhibit distinct traits throughout the territory (Schembre, 2009).

Finally, soil and water quality assessments serve as vital indicators, with forested regions acting as controls and developed areas as variables. Unfortunately, the utilization of land by humans contributes to the loss of resilience and vulnerability of the ecosystem, which is further exacerbated by the clay-dominated soils with varying aquifer characteristics (Davis, 2009; Schembre, 2009).

5.2 Management of the Reserve

5.2.1 Creation, Mission, Goal, and Evolution

“The non-profit Cloud Forest Conservation Alliance (CFCA) supports and guides the operations of the Cloudbridge Nature Reserve and seeks to expand the knowledge, skills, tools, practices and physical facilities available there. The CFCA collaborates with individuals, educational institutions, non-governmental and governmental organizations that hold similar values toward education, conservation and sustainability. Its vision is that the Cloudbridge campus will become an international destination known for its thriving, learning laboratory and variety of life-shaping, immersive experiences in the cloud forest.” - Cloudbridge Nature Reserve, 2024b

Founded in 2002, Cloudbridge Nature Reserve (CNR) is supported by a non-profit American organization named Cloud Forest Conservation Alliance (CFCA), which is legally recognized in Costa Rica (Cloudbridge Nature Reserve, 2024a). Situated amidst the heart of Central America, CNR emerges against the backdrop of Costa Rica's national priorities, emphasizing biodiversity preservation and climate change mitigation through the establishment of protected areas (Mondiale, 2022). It was created in response to environmental degradation and the need to protect forest ecosystems in the San Gerardo de Rivas region, near the Chirripó mountain (DeVito, 2012; Hance, 2023).

The history of CNR reflects the multiple challenges and successes of ecological restoration in a crucial habitat, particularly within the delicate ecosystem of the cloud forest (Hance, 2023).

As documented on the Cloudbridge Nature Reserve website, initial conservation efforts began in the 90s with founders Ian and Genevieve Giddy initially acquiring a small farm on the border of Chirripó National Park. Over the years, they purchased six additional farms, expanding the reserve to about 283 hectares and serving as a vital bridge between the national park and the neighboring human communities (Circular Odyssey, n.d.; DeVito, 2012) .

The primary objectives of Cloudbridge Nature Reserve encompass the preservation of biodiversity, the protection of watersheds, and the promotion of scientific research and environmental education. Through these endeavors, the reserve aims to restore areas adversely affected by agricultural practices and other human activities, thereby fostering the regeneration of natural ecosystems (Cloudbridge Nature Reserve, 2024a).

In the initial stages of the project, the reserve encountered numerous challenges, in its reforestation efforts, with an alarming 90% loss of planted trees primarily due to intense competition among plants. As elucidated by Maximilian King in a Circular Odyssey podcast, the insufficient support for young trees led to them being outcompeted. Consequently, prompted by insights from a researcher, the reserve recalibrated its reforestation approach. It was determined that while the existing methods were not fundamentally flawed, they could be substantially enhanced by transitioning to the direct procurement of seeds from natural ecosystems, rather than acquiring trees from nurseries (DeVito, 2012).

This strategic shift yielded remarkable results, elevating the tree survival rate from a meager 50% to an impressive 90%, thus validating the efficacy of the revised methodology (Hance, 2023). Having planted over 50,000 native trees within the reserve, the project's achievements have exceeded initial expectations, reaching a point where available land for further tree planting has been fully utilized (Figure 3 and Figure 5), necessitating a redirection of focus. However, this circumstance has spurred a redirection of efforts towards leveraging their accumulated expertise and insights from two decades of work to support others in their reforestation initiatives (Circular Odyssey, n.d.; Cloudbridge Nature Reserve, 2024b).



Figure 5 - A Reforestation photographic timeline (Cloudbridge Nature Reserve, 2024b; Evrard Olivia, 2024)



Figure 6- Quetzal (Cloudbridge Nature Reserve, 2024)

Thus, thanks to this initial successful restoration effort, the biodiversity of Cloudbridge Reserve has increased significantly. Indeed, the number of bird species has risen from just a few to hundreds of different species in less than 20 years. Iconic species such as the quetzal (Figure 6) have been able to return to the once greatly degraded and uninhabitable region (Cloudbridge Nature Reserve, 2024a).

While it is possible to spot multiple bird species, the reserve also hosts various species of felines that coexist, including the ocelot and the oncilla, despite similar ecological niches. The occasional presence of the Baird's tapir, a large terrestrial mammal, demonstrates the reserve's ability to support keystone species (Cloudbridge Nature Reserve, 2024a).

In the meantime, despite making significant strides in restoration and reforestation strategies, CNR must notably contend with the challenge of climate change exacerbated by edge effects resulting from proximity to continuously degraded areas. To address these challenges, the Cloudbridge teams continually adapt their restoration approach, for example, by opting for more randomized planting, thereby allowing nature to favor species best suited to changing conditions. Among other things, they rely on natural selection (Bubb et al., 2004; Hance, 2023).

Cloudbridge Nature Reserve is visited by thousands of people each year, offering opportunities for researchers, students, and volunteers to engage in conservation projects, collect data, and develop a better understanding of the reserve's ecology. Moreover, the newly gained knowledge contributes to the development of educational programs and initiatives focused on environmental sustainability for both visitors and external individuals (Circular Odyssey, n.d.; Cloudbridge Nature Reserve, 2024a). This helps raise awareness among the public about the threats posed by climate change to cloud forests and the consequences of land degradation if they are overexploited or left unrehabilitated. Therefore, the environmental education advocated by the reserve plays a crucial role in its mission (Circular Odyssey, n.d.; Cloudbridge Nature Reserve, 2024a; Hance, 2023).

Although the reserve has succeeded in restoring much of its territory (Figure 3), it still faces ongoing challenges, as mentioned earlier, including edge effects and climate change (Bubb et

al., 2004; Hance, 2023). Therefore, one of Cloudbridge's efforts is now focused on collaborating with local landowners to expand restoration efforts and expand biological corridors for wildlife (Figure 30) (Circular Odyssey, n.d.; Cloudbridge Nature Reserve, 2024a; SINAC, 2017).

In summary, Cloudbridge Nature Reserve, spanning approximately 300 hectares today, is dedicated to the conservation of forest ecosystems and the restoration of degraded lands, aligning its objectives with this national vision. Through adaptive approaches and steadfast commitment, it has successfully restored vital habitat, demonstrating the importance of ecological restoration and communication in raising public awareness and mobilizing additional efforts for cloud forest conservation.

5.2.2 Funding model

Cloudbridge employs a multifaceted funding model to ensure its sustainability. This model maintains a balance between revenue from service sales and the occasional donation. The primary sources of revenue are accommodation fees from interns and volunteers, followed by income generated from the Welcome Center and rentals of casitas to visitors. These revenues guarantee the coverage of expenses, including salaries for personnel, utilities, and maintenance (C. E. McConnell, personal communication, 23 March 2024).

Consequently, despite its non-profit status, the reserve has managed to maintain financial viability by relying on service sales rather than relying excessively on donations. By imposing fees for entrance into the reserve or staying for research activities, the institution is able to provide financial support for CNR's core mission objectives, which are dedicated to conservation, education, and research. of conservation, education, and research. This approach helps to maintain affordable accommodation charges at low levels, thereby ensuring accessibility for scholars from diverse socio-economic backgrounds.

Furthermore, certain strategic partnerships benefit Cloudbridge. For instance, the organization has formed a partnership with a US-based science school that provides substantial support during its short-term programs. In addition to providing financial assistance, these networks serve to reinforce the reserve's educational objectives (M. Peterson, personal communication, 9 April 2024)

Donations are typically earmarked for specific projects, such as the construction of new facilities or the purchase of additional land for conservation purposes. Indeed, the most recent donation has been directed toward the construction of a research laboratory and the

acquisition of a new plot of land, thereby expanding the reserve's territorial boundaries (C. E. McConnell, personal communication, 23 March 2024; M. Peterson, personal communication, 9 April 2024).

Cloudbridge's financial management is challenged especially on maintaining a consistent inflow of visitors and participants. To be able to keep running with the financial sustainability of the reserve, it is essential to implement effective marketing strategies on websites, job boards, and social media platforms to ensure a steady influx of visitors (C. E. McConnell, personal communication, 23 March 2024).

Nevertheless, regardless of its current financial stability, it is essential to ensure a consistent inflow of visitors and researchers to guarantee the reserve's operational viability and the fulfillment of its mission objectives.

5.2.3 Communication strategies (see Appendix 10)

	Online Communication	Formal Communication	Informal Communication
Intern	<ul style="list-style-type: none"> • Intranet • Intern newsletter • Mail • Pop up • Forum 	<ul style="list-style-type: none"> • Team meetings • Events • Teleconferences • Chat 	<ul style="list-style-type: none"> • Cultural activities • From mouth to ear • Telephone contacts • Instant messaging (Whatsapp, Messenger,...)
Extern	<ul style="list-style-type: none"> • Website • Newsletter • Publication • Media campaigns • Facebook page • Official account • Twitter • Instagram • Youtube 	<ul style="list-style-type: none"> • Partner meetings • Letters • Emails • Events 	<ul style="list-style-type: none"> • Facebook • Blog • Report • Datasheets

Table 2- Form of communication used by Cloudbridge Nature Reserve

A variety of communication strategies are employed with the objective of engaging diverse audiences, from university students to local communities, each with specific goals and challenges. A critical analysis of these actions reveals the intricacies of balancing educational objectives, financial sustainability, and community engagement.

One of the fundamental pillars of Cloudbridge's communication strategy is to engage and educate young professionals in the field of science. Tom Gode, the president of the CFCA Board of Directors, explains that the reserve primarily focuses on university and graduate students, with the objective of providing them with a comprehensive field research

experience. This approach emphasizes profound learning, whereby it is hoped that, upon departing from the reserve, students will not only be knowledgeable about cloud forests in general but will also be aware of their role in global environmental concerns (T. Gode, personal communication, 23 May 2024). Nevertheless, this focus raises doubts over whether day visitors, defined as short-term tourists who come to explore the reserve, are being adequately served. The current engagement with day tourists appears to be largely superficial, offering rudimentary information on reforestation history and expectations regarding forest conservation. This indicates a deficiency in the educational outreach programs for these tourists, presenting an opportunity for improvement in Cloudbridge's communication strategies.

Regarding finance, Cloudbridge relies significantly on the income generated from its international internship program to subsidize community programs and other conservation activities. This financial model demonstrates the dual role of communication at the reserve: on the one hand, it serves as an educating function, and on the other, it is a means of sustaining CNR's operations costs. For instance, Casey McConnell, Cloudbridge's marketing manager and development officer, talks about maintaining consistent communication with past donors through periodic updates about the reserve's needs as a strategic approach aimed at strengthening existing financial resources and potentially increasing future funding (C. E. McConnell, personal communication, 23 March 2024).

Madelyn Peterson, the scientific officer at Cloudbridge, emphasizes the importance of implementing effective marketing strategies on websites, job boards, and social media platforms to ensure visibility among potential visitors. She argues that this would significantly contribute to the financial stability of the reserve. The reserve's lack of visibility is a significant issue, particularly in comparison to more prominent attractions like Chirripó National Park, which is situated directly adjacent to CNR (M. Peterson, personal communication, 9 April 2024). This approach underscores the reserve's dependency on links with certain schools and the use of job boards to attract potential interns and volunteers for external financial resources to sustain its activities, indicating a crucial connection between education and business practices.

The reserve's engagement with local communities and organizations provides further evidence of the multifaceted nature of its communication efforts. Cloudbridge demonstrates a strong commitment to local environmental education through its collaborative endeavors with

local schools and conservation organizations, such as ASANA and Los Cusingos. These environmental education programs, initiated through partnerships and grants, are designed to foster a deeper comprehension and appreciation of biodiversity among local youth. The anecdotal evidence provided by McConnell highlights the transformative experiences of children participating in these programs, underscoring the potential long-term impact of such initiatives (C. E. McConnell, personal communication, 23 March 2024). Nevertheless, the reserve's capacity to maintain and expand these initiatives is constrained by the absence of designated staff for community outreach, which reveals a further limitation in its ability to sustain and expand these efforts. This constraint is further exacerbated by the reliance on intermittent funding, making it challenging to ensure the continuity and growth of these essential educational programs.

Cloudbridge's relationship with local and regional conservation authorities, such as Chirripó National Park and SINAC, further emphasizes its integrated approach to conservation communication. These partnerships facilitate collaborative projects, such as the camera trap initiative with Dr. Mike Mooring, that enhance the reserve's research capabilities and conservation impact. In addition, the reserve's involvement in community-based tourism initiatives, such as those promoted by the San Gerardo Chamber of Tourism, reflects an effort to embed conservation education within broader economic and social contexts (M. Peterson, personal communication, 9 April 2024).

Furthermore, CNR is attempting to determine the most effective methodology for evaluating the impact of its communication strategies. Standard methods for collecting feedback from interns and visitors, including evaluation forms, suggestion boxes, and personal contacts are gathered at the Welcome Center. This ongoing process is designed to enhance both the infrastructure and educational content at Cloudbridge. Additionally, informal feedback collection by Linda Moskalyk, a member of the CFCA Board of Directors, and other staff members who interact with guests play a crucial role in incorporating visitor insights (T. Gode, personal communication, 23 May 2024). However, the lack of a more organized and comprehensive evaluation system tends to restrict the validation and generalizability of these feedback mechanisms.

Regarding onsite educational tools, CNR employs interpretive signage to disseminate conservation messages and provide visitors with information about the biodiversity they will encounter during their hike. Currently, only one of the five public trails within the reserve is

equipped with educational panels. Therefore, this limited implementation may limit the overall educational potential for day visitors who visit for the day and don't participate in guided tours. Expanding the use of signage to other trails could enhance visitor engagement and learning opportunities (C. E. McConnell, personal communication, 23 March 2024; M. Peterson, personal communication, 9 April 2024). However, this proposition necessitates careful consideration of how to balance between maintaining the trails's natural aesthetic and providing educational content² (T. Gode, personal communication, 23 May 2024).

² Note: This paragraph will have a deeper analysis in the following chapters.

Chapter III: Mission/Project

6 Ecotourism in Costa Rica

Costa Rica stands as a guiding light of ecotourism, celebrated globally for its commitment to environmental conservation and sustainability. The country's lush landscapes, crowded with diverse flora and fauna, attract nature enthusiasts from around the world, eager to explore its unspoiled natural wonders (Bubb et al., 2004; Costa Rica Tourism Board, 2024).

Since pioneering the ban on hunting in 2012, Costa Rica has emerged as a leader in responsible tourism, setting an example for other nations to follow. The exponential growth of tourism has driven significant changes in the country's economy, with ecotourism playing a pivotal role in driving economic development while preserving the environment (Love & Gabett, 2017).

However, this rapid expansion has brought its own set of challenges. Indeed, balancing the demands of tourism development with environmental protection has led to bureaucratic tensions between government bodies responsible for conservation and tourism promotion. Furthermore, the delicate ecosystem of Costa Rica's rainforests faces increasing pressure from tourist-driven infrastructure, highlighting the need for sustainable tourism management practices (Firestone et al., 2010).

Despite these challenges, the country remains persistent in its commitment to environmental stewardship. The Costa Rican Tourism Institute (ICT) actively promotes sustainable tourism practices, encouraging visitors to explore the country's natural wonders responsibly (ICT, 2024). By prioritizing the preservation of natural and cultural resources, fostering community engagement, and promoting sustainable economic growth, Costa Rica continues to lead the way in ecotourism, ensuring a brighter and greener future for generations to come (CST, 2024).

6.1 Concept of Ecotourism

"Ecotourism," a term that emerged in the 1970s, is a form of tourism focused on discovering and preserving natural and cultural environments. Unlike mass or consumptive tourism, ecotourism emphasizes environmental sustainability, cultural awareness, and social responsibility. It aims to minimize negative impacts on local ecosystems while respecting local communities and their way of life, notably by involving them in development planning (Label Tourisme Equitable, 2023).

Ecotourism activities often include guided tours in preserved natural areas such as national parks, nature reserves, and World Heritage sites. Ethically, this tourism model allows travelers to observe indigenous flora and fauna while avoiding habitat degradation during visits. It also serves as an educational platform for biodiversity, conservation, and sustainable practices (Vincent, 2021).

The International Ecotourism Society (TIES) defines ecotourism as "a responsible travel to natural areas that conserves the environment and improves the well-being of local people" ('The International Institute for Industrial Environmental Economics', 1994). The World Tourism Organization (UNWTO), active in ecotourism since the early 1990s, adds that "ecotourism encompasses all forms of nature-based tourism in which the primary motivation of the tourist is to observe and appreciate nature and traditional cultures. It promotes the protection of natural areas and ensures the well-being of local populations" (UN Tourism, n.d.)

Frequently associated with responsible travel practices, ecotourism involves staying in environmentally friendly accommodations, supporting local businesses, and participating in community conservation projects; and contributing to the economic development of local communities. Ecotourists aim to minimize their carbon footprint and respect local flora and fauna while also contributing to the economic development of local communities. (Vincent, 2021). The purpose of ecotravel is also to help conserve the places – habitat and wildlife - that they visit. In this case, in addition to its environmental and social benefits, ecotourism can have positive economic impacts on visited regions by boosting the local economy, creating jobs in the tourism sector, and generating revenue for conservation initiatives simply by paying for the park admission. Therefore, in some ways, ecotourists help to preserve natural areas (Beletsky, 2007).

While ecotourism may be seen as the ultimate way to travel without degrading habitats on many fronts, it still presents challenges. Overuse of tourist sites can lead to environmental degradation, disrupt fragile ecosystems, and disturb local cultures. Therefore, it is essential to establish sustainable tourism management involving local communities, implement responsible travel practices, and regulate tourist activities to ensure the long-term preservation of natural and cultural resources.

In Costa Rica, the rise of ecotourism has led to substantial progress in conservation efforts. Economic incentives now favor the preservation of local flora and fauna, marking a

significant shift away from past practices of exploitation. Moreover, heightened ecological awareness has empowered Costa Ricans to effectively oppose destructive ventures such as proposed gold mining and offshore oil drilling projects (Eyewitness, 2005).

6.2 Ecotourism in Cloudbridge Nature Reserve

Nestled within the verdant expanse of Costa Rica's conservation landscape, Cloudbridge Nature Reserve stands as a beacon of ecological preservation and sustainable tourism practices (Circular Odyssey, n.d.). Expanded on approximately 300 hectares in the region of San Gerardo de Rivas, adjacent to the renowned Chirripó National Park, Cloudbridge serves as a vital link in the Talamanca Mountain Range, facilitating crucial wildlife movement and preserving essential ecological corridors (Cloudbridge Nature Reserve, 2024a; DeVito, 2012; SINAC, 2017).

Continuing in the delicate heritage biodiversity of the country, Cloudbridge assumes a pivotal role in biodiversity conservation and environmental education. Its diverse habitats, ranging from primary and secondary forests to planted zones and high-elevation cloud forests, teem with a rich tapestry of plant and animal life. Visitors to Cloudbridge immerse themselves in a part of newly generated nature while imbibing invaluable lessons on conservation and sustainable land management practices (Cloudbridge Nature Reserve, 2024a; Loveriot, 2017).

To safeguard its lands from the adverse effects of tourism, Cloudbridge has embraced an ecotourism philosophy, prioritizing environmental conservation over mass tourism profits and commercial gain. Thus, through strategic initiatives, the reserve is currently estimating the optimal number of visitors to ensure minimal impact on the delicate ecosystem. Consequently, after obtaining the final results of the research, if considered necessary, Cloudbridge may need to regulate visitor flow by implementing access controls and visitation quotas. Furthermore, designated hiking trails are meticulously planned to minimize direct impacts on the delicate ecosystem, with private trails reserved exclusively for researchers and staff, while public trails are open to tourists. This approach fosters a harmonious coexistence between humans and nature, ensuring the preservation of the environment for future generations (see Appendix 3: Cloudbridge's hiking trails map)(C. E. McConnell, personal communication, 23 March 2024).

However, throughout field surveys, it became evident that while Cloudbridge boasts designated hiking trails, there is a lack of educational infrastructure within the reserve for self-guided visitors, as evidenced by the limited number of informative panels located on only one

of the hiking trails, the Waterfall trail (refer to the section on Hiking trails in Cloudbridge). This insufficiency of educational resources may hinder the effectiveness of the communication efforts to increase visitor awareness about the reserve's ecological significance and conservation initiatives.

Beyond the confines of the reserve, Cloudbridge implements awareness-raising and educational programs, such as CONUBI, aiming to instill the importance of nature conservation and responsible behavior from a young age (Cloudbridge Nature Reserve, 2024b; C. E. McConnell, personal communication, 23 March 2024). Additionally, researchers and scientists actively monitor the environment, addressing potential threats and leading ecological restoration efforts. These initiatives encompass replanting indigenous species to restore wildlife and keeping track of the impact of human activities as tourism on the ecosystem sheltered in the reserve (Cloudbridge Nature Reserve, 2024a).

Finally, Cloudbridge fosters strong partnerships with local communities, actively engaging residents in conservation awareness through various manners. These initiatives promote participation in community festivals and events, where the reserve staff is engaging towards attendees in discussions about the significance and ongoing endeavors in conservation. Collaborative community tourism initiatives empower locals while promoting balanced, environmentally conscious economic development (Cloudbridge Nature Reserve, 2024a; C. E. McConnell, personal communication, 23 March 2024; M. Peterson, personal communication, 9 April 2024).

7 Identifying Cloudbridge's Problem

7.1 Logical Framework Approach (LFA)

The Cloudbridge Nature Reserve (CNR) project operates within a political landscape where biodiversity preservation and combating climate change are national priorities in Costa Rica (Mondiale, 2022). Consequently, the Cloudbridge program aligns its objectives with this overarching vision by actively restoring cloud forests, conserving endemic species, and implementing sustainable practices (Cloudbridge Nature Reserve, 2024a).

The main question that will guide this research will be: *“How effectively does Cloudbridge Nature Reserve communicate its message to its day visitors and successfully engage them in learning during their hike through the reserve?”*

Sub questions that can assist in answering the main question are:

- What is the primary method utilized by Cloudbridge to disseminate its message within the reserve?
- What challenge(s) or barrier(s) does Cloudbridge face with its primary method utilized in effectively communicating its message within the reserve?
- Is the primary method of communication employed by Cloudbridge within the reserve effective or not?
- What strategies or recommendations can be proposed to optimize Cloudbridge's communication efforts within the reserve?

Environmental interpretation of trails is a crucial aspect of managing natural areas such as the Cloudbridge Nature Reserve. This approach involves designing pathways that integrate educational elements such as interpretive signage, guided tours, and interactive exhibits to communicate the ecological and historical significance of the area. By offering direct, engaging experiences, this method transforms trails into dynamic learning environments that contribute to broader environmental education and stewardship. As a result, visitors who receive accurate and engaging information about the ecological significance of the reserve, its biodiversity, conservation efforts, and the importance of sustainable practices develop a deeper appreciation for the environment and become more engaged in conservation efforts (MBRS, 2005).

Simultaneously, it is imperative to examine the reserve's evolution, assessing visible changes resulting from conservation and restoration efforts, including the use of satellite data. A

particular focus is placed on ecotourism (see paragraph on the Concept of Ecotourism), involving a comprehensive analysis of the principles and practices implemented in the region of San Gerardo de Rivas.

To enhance my work efficiency, I will employ the Logical Framework Approach (LFA), an analytical method and toolkit tailored to streamline the planning and management of objective-centered projects (Tychon B., 2023). To accomplish this, we will first create a problem and objective tree, which will enable us to construct hypotheses effectively within the logical framework.

The methodology adopted for this study should maintain both social and scientific elements, involving interviews and literature reviews. Ultimately, the goal is to generate practical recommendations to enhance communication by ensuring the accurate and meaningful transmission of the reserve's core message to its visitors. This message, centered on the dual objectives of biodiversity preservation and sustainable tourism promotion, forms the cornerstone of CNR's mission. By refining communication methodologies, the study seeks to bridge the gap between the reserve's conservation goals and visitor engagement, thereby fostering a deeper understanding and appreciation of the reserve's initiatives among its diverse audience.

Through the synthesis of findings and analysis, the study endeavors to provide practical insights that can inform the development of tailored communication approaches, ultimately contributing to the principal objectives of biodiversity conservation and sustainable tourism within the reserve. As an example, one effective strategy involves the installation of interpretive signs along the trails. These signs serve to enhance visitors' experiences by providing relevant information about the local ecosystem, including details about the flora, fauna, geological features, and conservation efforts within the area.

7.1.1 Problem Tree

The problem tree analysis serves as a valuable tool for identifying and understanding the root causes of issues or challenges related to communication effectiveness. By visually mapping out these causes and their effects, it allows for a systematic exploration of the underlying factors contributing to the perceived problem (Wageningenportals, 2022; Tychon B., 2023).

In the context of evaluating Cloudbridge's effectiveness in conveying its mission to visitors, the problem tree analysis will help uncover key obstacles or deficiencies in communication

strategies. Each branch of the tree represents a distinct issue or challenge, ranging from lack of clarity in messaging to insufficient communication channels or engagement opportunities³.

During the final evaluation, the problem tree analysis will inform the identification of priority areas for improvement. By examining the causes outlined in the problem tree, we will be able to determine which factors have the most significant impact on the effectiveness of Cloudbridge's communication efforts. This analysis will guide the selection of specific parameters or criteria for evaluating the success of the reserve's messaging strategy.

Additionally, the proposed solutions will be developed based on the insights gained from the problem tree analysis. Each branch of the tree will inform potential strategies or interventions aimed at addressing the underlying causes of communication challenges. These solutions may range from enhancing signage and interpretive materials to implementing interactive educational programs or leveraging digital media platforms.

By systematically linking the identified problems to their root causes and proposing targeted solutions, the problem tree analysis ensures a comprehensive approach to evaluating and improving Cloudbridge's communication effectiveness.

Therefore, the problem tree developed (Figure 7) allows us to have a better understanding in advance of the problem.

³ Note: In the course of conducting the problem tree analysis, it is imperative to acknowledge the possibility of divergences between the issues identified therein and the actual findings derived from field surveys and visitor questionnaires. It is anticipated that some of the issues highlighted in the problem tree may not align with the realities uncovered during data collection. In the Results of the Questionnaire (see Appendix 1): Evaluating the effectiveness of informative panels in comparison with the Waterfall Trail and Conclusion chapters, meticulous attention will be devoted to identifying and rectifying these discrepancies. The focus will be on refining the research focus and ensuring that the conclusions drawn accurately reflect the empirical evidence obtained from the field surveys and questionnaire responses.

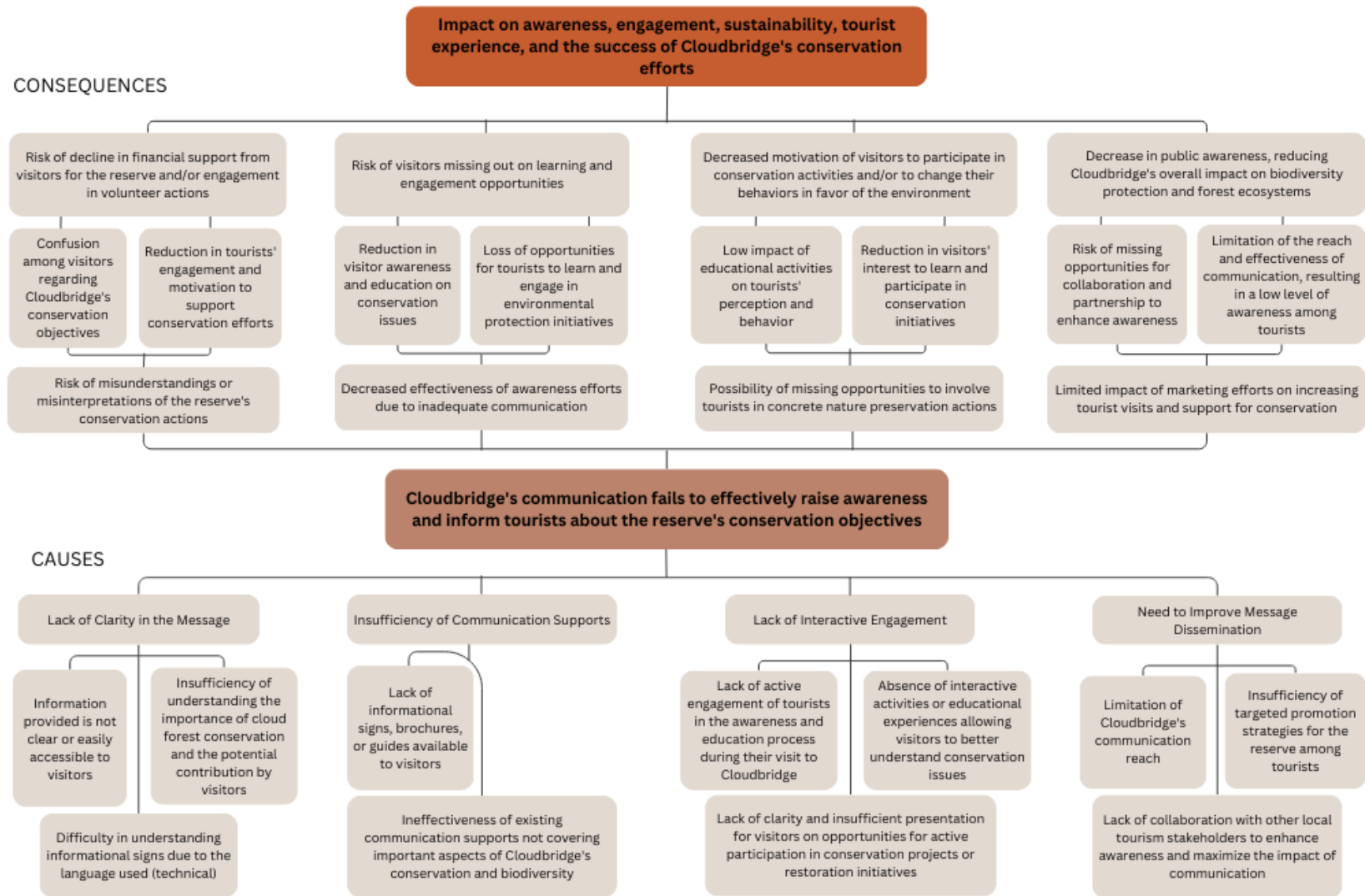


Figure 7 - Problem Tree developed for Cloudbridge Nature Reserve

7.1.2 Objective Tree

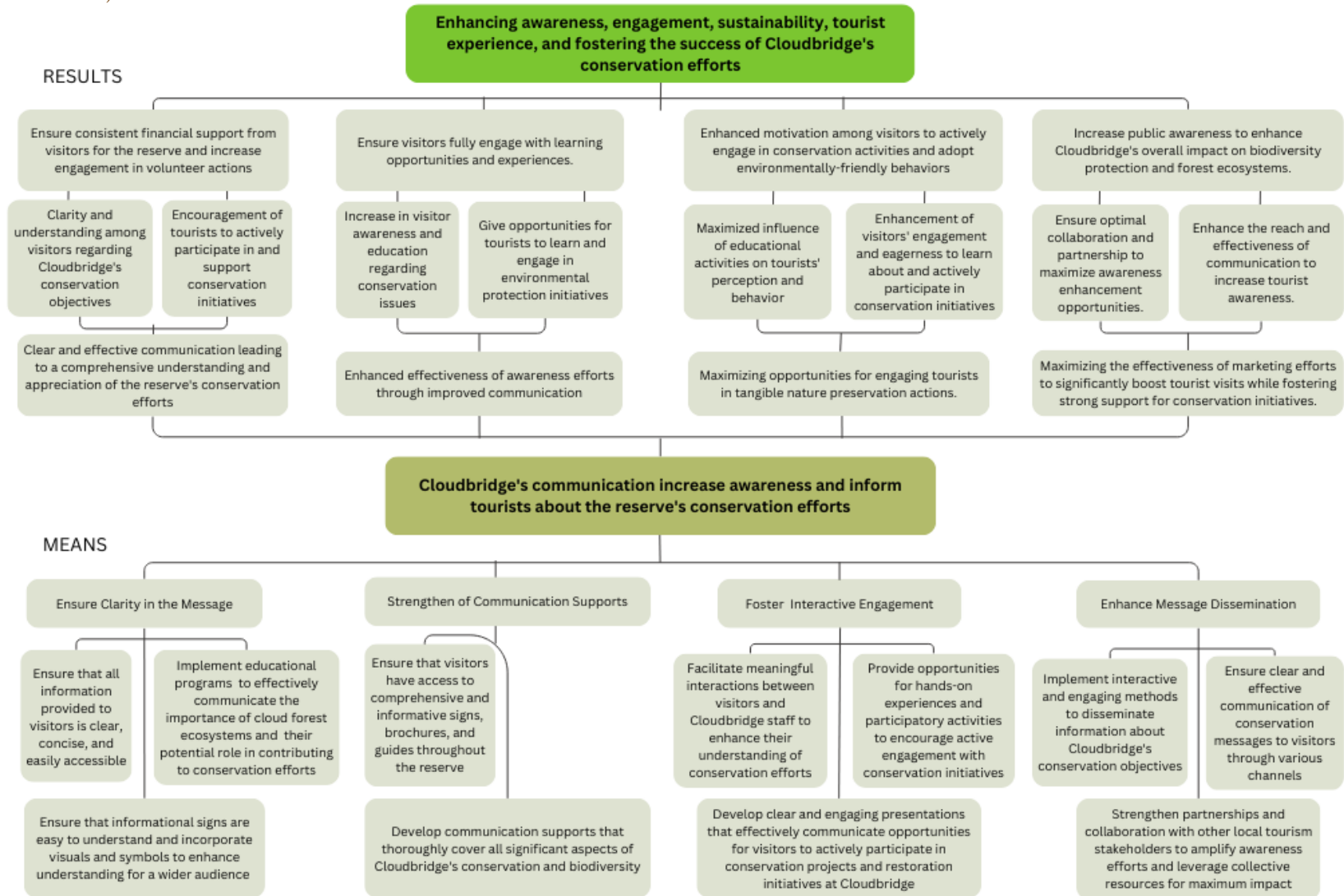


Figure 8- Objective Tree developed for Cloudbridge Nature Reserve

The problem tree and objective tree serve as complementary tools within the LFA methodology as illustrated in the diagram below:

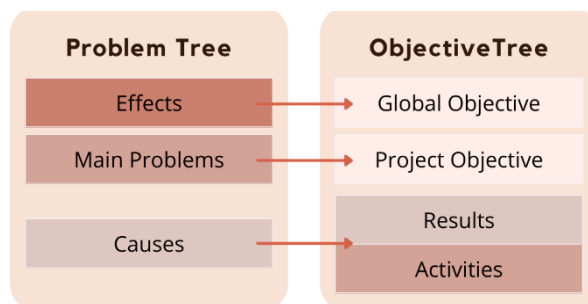


Figure 9 - Relations between Problem Tree and Objective Tree (Tychon B., 2023)

Following the problem tree analysis, which is the initial step in understanding the root causes of communication deficiencies within the reserve, the objective tree (Figure 8) represents a logical progression toward addressing the identified issues. It outlines the desired outcomes and goals of interventions in order to resolve the communication challenges identified in the problem tree. By breaking down the overarching goal into specific objectives and activities, the objective tree provides a well-organized framework for strategic planning and effective implementation.

The combination of both problem tree and objective tree analyses offers several benefits. Firstly, it fosters a systematic and structured approach to problem-solving, ensuring that research efforts are directed toward addressing the most pertinent challenges faced by Cloudbridge. Secondly, it aids in establishing clear goals and objectives, thereby guiding the development of strategies and interventions designed to improve communication within the reserve. Lastly, it furnishes a structured framework for evaluating the effectiveness of interventions by defining measurable outcomes against which progress can be assessed. Overall, the problem tree and objective tree analyses play a crucial role in guiding the research process and contribute to a comprehensive and evidence-based approach to addressing communication challenges.

7.1.3 Logical Framework Intervention Plan

The project will operate throughout the Cloudbridge Reserve territory (283 ha) in the Talamanca Mountains of Costa Rica for operational research activities while relying on the three main types of habitats: primary forest, naturally regenerating secondary forest and actively planted (reforested) secondary forest as defined by the reserve.

Key stakeholders include the Cloud Forest Conservation Alliance (CFCA) in collaboration with the National System of Conservation Areas (SINAC), the Costa Rican government, as well as individuals (volunteers, researchers, visitors, local communities), educational institutions, and environmental NGOs.

PROJECT SUMMARY	
Final Beneficiaries:	Local communities, visitors, students, volunteers, researchers, and scientists.
Project Duration	3-4 months
Funding Organizations:	Cloud Forest Conservation Alliance (CFCA), the National System of Conservation Areas (SINAC), the Costa Rican government, and donors.
Total Project Budget:	3 000 EUR

Table 3 - Project Summary

7.2 Calendar of activities (see Appendix 11)

During the internship at Cloudbridge Nature Reserve spanning from February to June, a structured calendar of activities is essential. Serving as a strategic instrument, it guides the implementation of various tasks, while also ensuring alignment with the anticipated objectives throughout the project's duration. Consequently, this calendar will delineate the scheduled activities alongside their corresponding timelines within the context of the internship's objectives and methodologies.

The initial phase of the internship focuses on laying the groundwork for the research endeavor. This involves creating a comprehensive plan that delineates the overarching objectives, methodologies, and timelines for the internship. Additionally, efforts are directed toward conducting a contextual analysis and problem identification, which entails researching and analyzing existing literature on topics related to Costa Rica, CNR and ecotourism.

As the internship progresses into March, the focus shifts towards initiating field experience and data collection. This involves conducting fieldwork in the reserve's hiking trails to gain firsthand experience and document observations related to visitor experiences, and perceptions.

In April, the internship enters a crucial phase of data collection and analysis. A survey is designed and administered to visitors to gather quantitative data regarding their opinions on

CNR. Subsequently, findings from the survey and field observations are analyzed to identify trends, patterns, and insights.

The focus in May is on aligning strategies with the mission of CNR and objectives identified in the Logical Framework Approach (LFA). Based on the analysis conducted in the previous phase, strategies and recommendations are formulated with the objective of enhancing communication and visitor engagement at the reserve.

The final phase of the internship is devoted to the implementation of selected recommendations. Educational strategies and interventions, such as the creation of interpretive panels or digital media content, are developed and implemented to boost visitor understanding of the reserve's environment and conservation efforts.

This calendar outlines a structured approach to conducting research and implementing recommendations to enhance communication strategies at Cloudbridge Nature Reserve. The project is executed systematically, from the initial problem identification to the final evaluation and reporting, following the principles of the Logical Framework Approach.

Chapter IV: Presentation and Analysis of the Results from Field Observations, Questionnaire, and Interviews

8 Communication and information within the reserve

In the preceding paragraph titled Communication strategies (see Appendix 10), the diverse forms of communication both within and outside the reserve have been discussed. This section aims to provide a deeper analysis of the specific communication strategies employed within the reserve, with a particular focus on the transmission of messages and communication support as shown in the developed Problem Tree.

8.1 Why is it that important?

There are several reasons why effective communication and dissemination of messages are important, particularly for Cloudbridge Nature Reserve given one of its primary goals is education.

Clear and comprehensible communication plays a significant role in fostering awareness about the value of biodiversity conservation, and the ecological significance of such endeavors. This educational process enlightens visitors, volunteers, and local communities about the reserve's mission and activities. Secondly, effective communication strategies facilitate engagement and involvement among various stakeholders, including tourists, researchers, volunteers, and residents.

Effective information dispersal is also pivotal in promoting responsible conservation behavior. By influencing the actions of groups and individuals, it leads to positive environmental outcomes both within and beyond the reserve's boundaries. In addition, it helps build a sense of community among the people associated with the reserve, thereby fostering a common purpose among individuals advocating for eco-conservation around them, making it a sustainable reserve.

A common method of communicating with visitors in various parks and reserves is through the use of educational panels placed along hiking trails. During an interview with Tom Gode, he asserted that these panels can facilitate a self-guided educational experience within the natural environment (T. Gode, personal communication, 23 May 2024). Consequently within the reserve, aside from the guided tours, the educational panels written in both Spanish and English have been established as the primary method of educating day visitors through exposure. However, as previously discussed in the chapter on Ecotourism in Cloudbridge Nature Reserve, there is a notable deficiency of such educational panels within the reserve, with only one trail, named the Waterfall Trail, having been equipped with them. As illustrated in the problem tree (see Figure 7), this can impact tourist satisfaction, experience,

and engagement with the natural environment. Therefore, these essential tools are crucial for enhancing visitor experiences and raising awareness of the environment in which they are walking in, as they educate tourists about the biodiversity within a reserve, ongoing conservation efforts, and the ecological importance of preserving natural habitats.

By providing information on the local flora and fauna, as well as conservation initiatives, educational panels allow visitors to develop a deeper appreciation for nature. Therefore, well-informed individuals are more likely to support and participate in the activities undertaken by CNR. By ensuring stakeholders possess sufficient information, the reserve can cultivate a network of engaged and supportive individuals who contribute to its conservation objectives.

8.2 Welcome Center (see Appendix 12)

Before embarking on the reserve's hiking trails, it is essential to consider the primary point of contact for visitors: the Welcome Center. It plays a crucial role in offering general recommendations, advice, initial orientation, and helping visitors understand the layout of the reserve, available trails, and key points of interest. Therefore, maps and staff assistance ensure that tourists are well-informed and can navigate the reserve efficiently.

Staff members engage with tourists, answering questions and offering detailed explanations about the reserve's mission and activities, deepening visitors' understanding and connection to the environment. Additionally, The Welcome Center shelters some educational resources about the reserve's biodiversity, including displays of insects and snakes as well as information on ongoing research on the secretive mammalian life of the cloud forest.

However, field observations have indicated that only a small number of visitors actually enter inside the Welcome Center, and the information presented is not sufficiently developed. The current exhibits tend to be more visual displays rather than comprehensive educational tools that enhance understanding of the natural environment. Therefore, to improve visitor engagement and education, there is a need for more in-depth and interactive exhibits that effectively communicate the significance of the reserve's biodiversity and conservation efforts.

8.3 Hiking trails in Cloudbridge (see Appendix 13)

Reserva Cloudbridge

San Gerardo de Rivas, P.Z., Costa Rica

Senderos / Trails

Distancias de ida de la entrada

Distances one way from entrance

Catarata Pacifica	300m
Mirador del Valle	650m
Vivero	1.2km
Catarata Caldera	1.4km
Puente Cubierta	1.6km
Puente Colgante	1.9km
Rancho Don Victor	2.5km
Piedra del Zopilote	3.5km
Catarata Don Victor	3.2km

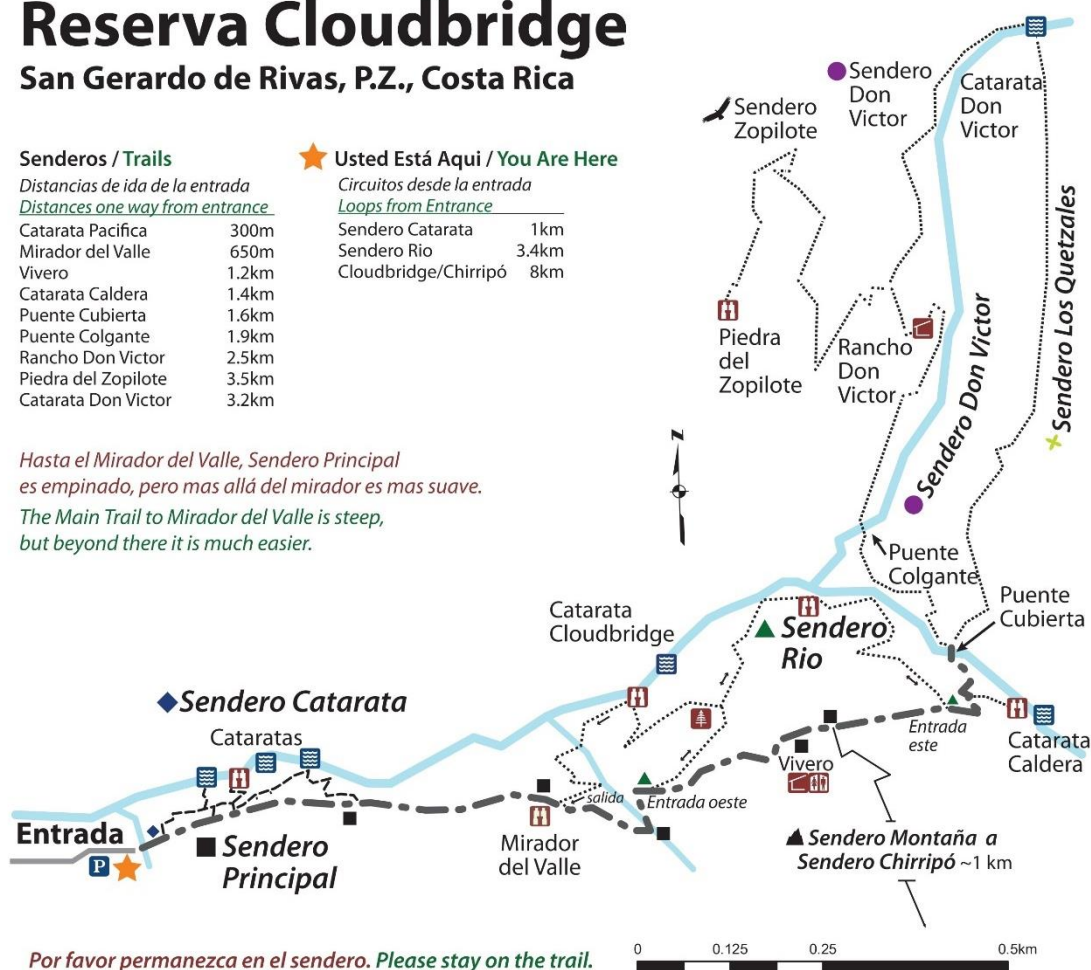
★ Usted Está Aquí / You Are Here

Circuitos desde la entrada

Loops from Entrance

Sendero Catarata	1km
Sendero Río	3.4km
Cloudbridge/Chirripó	8km

Hasta el Mirador del Valle, Sendero Principal es empinado, pero mas allá del mirador es mas suave.
The Main Trail to Mirador del Valle is steep, but beyond there it is much easier.



Cloudbridge Nature Reserve ~ cloudbridge.org

CLOUDBRIDGE
NATURE RESERVE

Figure 10 – Map of the Public hiking trails installed in Cloudbridge (Cloudbridge Nature Reserve, 2024a)

Cloudbridge Nature Reserve offers a variety of well-maintained hiking trails that cater to different levels of difficulty and hiking times, providing visitors with a diverse range of options to suit their preferences and abilities. Each trail offers a unique opportunity to appreciate the reserve's natural beauty and ecological significance (see Appendix 14).

8.3.1 The Main Trail

The Main Trail features an elevation gain of 256 meters and traverses through both planted and naturally regrown forest areas. It is a public trail belonging to the government, and is a connecting trail that serves all the five distinct trails within Cloudbridge: the Waterfall Trail, the River Trail, the Ridge Trail, and the Cloudbridge North Loop—which includes Don Victor and Los Quetzales-. As it serves as a connecting pathway to the other trails of the reserve, it is heavily utilized by tourists who come hiking.

8.3.1.1 Categories of panels on the Main Trail (see Appendix 15- Along the Main Trail)

There are three different types of panels that we can categorize based on their content and purpose:

- Foundation map panel (see Figure 51): The panel provides a map of the reserve accompanied by a detailed story about the foundation and history of CNR. It serves as an initial resource for visitors, offering background context concerning the creation of the reserve, its mission, and its founders Ian and Genevieve Giddy. This historical perspective allows visitors to contextualize this nature conservation effort against the degradation of farmland.
- Indicative panels (see Figure 52): This category includes maps and directional signs which are essential for navigation within the reserve. The maps delineate trails, and points of interest, as well as indicating the locations of visitors. Directional signages are strategically placed at the intersection with another path to prevent visitors from getting lost. These panels ensure that visitors can easily find their way and are guided correctly, thus enhancing their overall experience and safety within the reserve.
- Promotional panel (see Figure 53): The board serves to display the social media handles of CNR, thereby acting as a device for promoting the reserve's online presence and encouraging visitors to engage with the reserve digitally. While this panel does not directly contribute to the development of educational content regarding the reserve's biodiversity or conservation efforts, it helps build a community of supporters who read information about the reserve's initiatives through social media.

8.3.1.2 Critical Analysis of the Educational Panels along the Main Trail

The foundation map panel helps visitors develop a deeper connection to the place and its conservation goals by understanding the story behind the reserve.

Although the indicative panels have a primary functional purpose of guiding visitors safely and efficiently through the reserve, their educational potential is currently underutilized. Indeed, their strategic placement could be better utilized beyond the simple indication of a path and could be enriched with ecological information about the areas to which they point, such as key species or habitats, thus transforming them from a simple aid into a valuable educational tool.

The third type of panel lacks direct relevance to the immediate biodiversity or educational content of the reserve. While these panels may be effective at encouraging community

engagement and support on the reserve's social media platforms, the size of the panel – 90 centimeters on 1.20 meters- is excessive for the simple information it displays. Therefore, to avoid distracting from the educational experience, these panels should be strategically placed at visitor centers or entry points rather than along the trails and could be utilized for displaying more intriguing information about the reserve and its biodiversity, fauna and flora.

8.3.2 The Waterfall Trail (see Figure 47)

One of the most popular trails is the Waterfall Trail, which is an easy hike characterized by an elevation gain of 56 meters and runs through areas of natural regrowth. This trail leads visitors to one of the reserve's most spectacular waterfalls within just a 10-minute walk from the Welcome Center. This trail allows hikers to experience the serene environment and stunning views. The trail also features a Memorial Garden, which honors Ian Giddy, the founder of Cloudbridge Nature Reserve. The garden boasts a diverse array of plant species, showcasing the rich biodiversity of exotic species (Cloudbridge Nature Reserve, 2024a).

Additionally, the Waterfall Trail is also the only trail in the reserve to contain educational panels along the trail. This signage facilitates visitor's comprehension of the surrounding environment and encourages them to engage in reflective learning during their hike. According to a discussion with Tom Gode and other staff members, the Waterfall Trail is an ideal location for educational panels because nearly all visitors use this trail which allows it to reach the largest audience due to its foot traffic and accessibility (T. Gode, personal communication, 23 May 2024). This systematic approach not only informs visitors about the biodiversity and ecological significance of the reserve but also promotes environmental stewardship by raising awareness and curiosity about the natural surroundings. Therefore, this methodology aligns with Cloudbridge's mission to educate day visitors, ensuring that educational resources are accessible and impactful.

8.3.2.1 Categories of panels on the Waterfall trail (see Appendix 15- Along the Waterfall Trail)

We can categorize these panels into four distinct types, each serving a unique educational purpose:

- Map and ecological explanation (see Figure 54): The first type of panel is a detailed map of the trail. These panels serve to guide visitors along the trail and illustrate the configuration of the reserve. The panels serve to represent the pathways, main features, and points of interest, thereby enabling travelers to position themselves effectively and plan their walking tours.

- **Brief Descriptions of the Environment** (see Figure 55): The second group of signs presents general information related to the natural environment. These informative panels provide an in-depth insight into the ecological significance of cloud forest ecosystems. They address a number of key issues, including the role of the plant in this type of forest and the impact they have.
- **Species Explanations** (see Figure 56): The third category includes panels that focus on specific species found within the reserve. The boards give brief descriptions of various flora. The information provided through these panels enables tourists to gain an understanding of the unique attributes, behaviors, and habitats associated with these organisms, thereby facilitating the identification of wildlife they encounter during hiking.
- **Species Identification** (see Figure 57): The final category involves the identification of specific tree species and diverse plant life encountered along the trail. Although only the species name and their common name are provided, visitors are still allowed to recognize the species as they traverse the trail.

8.3.2.2 Critical analysis of the educational panels along the Waterfall Trail

The information presented by the panels along the Waterfall trail is undoubtedly pertinent to the biodiversity, and ecological information, which is accessible to a considerable number of day visitors. Nevertheless, the existing panels could be further enhanced by incorporating additional interactive and multimedia elements. For instance, QR codes that link to videos, audio guides, or augmented reality features could enrich the learning experience and accommodate diverse visitor preferences. Moreover, involving visitors in projects related to citizen science, such as recording species observed via an app, could foster a deeper connection to the reserve and its conservation efforts.

Furthermore, it is crucial to acknowledge that this is the only trail that is equipped with such signage, which consequently limits the potential for visitors to gain a deeper understanding of the reserve and the cloud forest ecosystem. To address this issue, it would be beneficial to expand other evolved educational signage to other trails within the reserve. This expansion would provide a more holistic educational experience, allowing visitors to learn about different aspects of the reserve's biodiversity and ecological processes across various trails. Therefore, this more balanced and dispersed strategy would increase the overall engagement

of visitors, promote diversified ecological education, and, in so doing, reinforce the conservation mission of Cloudbridge Nature Reserve.

8.3.3 The River Trail⁴ (see Figure 48)

Following the Main Trail, we come across the River Trail which have a path alongside the River Chirripó Pacifico. It features an elevation gain of 256 meters and traverses through both planted and naturally regrown forests. It is one of the trails where bird activity is common while the trail is moderately busy with human presence.

The trail is devoid of any form of signage, whether educational or indicative of directions. Nevertheless, the trail's diverse flora and fauna, along with the abundance of wildlife, provide an excellent opportunity to install educational panels that can engage visitors and enhance their understanding of the surrounding environment.

8.3.4 The Ridge Trail (see Figure 49)

This trail connects to the Chirripó National Park which is the direct neighbor of the reserve. It features an elevation gain of 485 meters and traverses planted, natural regrowth, and primary forest areas.

The trail is devoid of any form of signage, whether educational or indicative of directions. Nevertheless, the trail's diverse flora and fauna, along with the abundance of wildlife, provide an excellent opportunity to install educational panels that can engage visitors and enhance their understanding of the surrounding environment.

8.3.5 The Cloudbridge North Loop (see Figure 50)

The Cloudbridge North Loop Trail is divided into two distinct sections, designated as Don Victor and Los Quetzales, which converge to form a loop. It has the highest elevation gain at 634 meters and passes through natural regrowth and primary forest areas.

The trail has indicative panels for directions, but not any other educational panels. Nevertheless, the trail's diverse flora and fauna, along with the abundance of wildlife, provide an excellent opportunity to install educational panels that can engage visitors and enhance their understanding of the surrounding environment.

⁴ Note: This trail will have a deeper analysis of his environment in the chapter Proposition for new panels focused on the River Trail

8.4 Conclusion from field observation of the educational panels

Although the informative panels along the Waterfall Trail at Cloudbridge Nature Reserve are accessible to a considerable number of day visitors, a more balanced and dispersed strategy would increase the overall engagement of visitors, promote diversified ecological education, and, in so doing, reinforce the conservation mission of Cloudbridge Nature Reserve.

Indeed, choosing to place educational panels solely on one trail, the Waterfall Trail, restricts exposure to a more comprehensive educational and ecological perspective. This is even though it is an effective method of maximizing exposure by dissemination to a large number of visitors and has an impact as shown in the problem tree (see Figure 6).

Firstly, concentrating educational resources along one trail may overlook the diverse ecological zones and species present throughout the reserve. Interpretive panels on several different trails would introduce visitors to the biodiversity within the reserve. The other trails which come just after the Waterfall Trail, have a range of flora and fauna that remains unknown to many visitors due to the lack of educational signage.

Secondly, this could lead to an unequal distribution of visitors. Making the Waterfall Trail more attractive with the installation of education panels may result in visitors opting to skip other trails, thereby missing out on the diverse experiences the reserve has to offer. Simultaneously, this could lead to overcrowding on the Waterfall Trail, potentially leading to degradation of the trail's natural setting due to increased foot traffic and littering. Consequently, this could negatively impact visitor experiences and the natural habitat.

Furthermore, the educational panels on many of the trails could accommodate a much broader range of interests and learning styles. The Waterfall Trail incorporates general information on ecological issues and some types of species of plants, whereas other trails can focus on other specific themes, such as birds, nocturnal wildlife, historical reforestation, or other topics, thereby diversifying the educational content material available for various groups of visitors.

Nevertheless, the absence of educational panels on other trails limits the opportunity for visitors to gain new knowledge, enhance their awareness of environmental issues, and cultivate their curiosity. The communication of diverse ecological insights throughout the reserve has the potential to foster greater interest and investment in conservation among tourists, and local communities.

9 Results of the Questionnaire (see Appendix 1): Evaluating the effectiveness of informative panels in comparison with the Waterfall Trail

9.1 Methodology

To ensure scientific rigor, the methodology and results will undergo peer review, validating the evaluation process. Consequently, the effectiveness of installing informative panels within the reserve is assessed using a systematic and comparative approach. This methodology includes direct visitor feedback and comparative analysis between trails with and without informative panels. The main objectives are to verify the utility of the panels, determine if they help achieve the communication goals of Cloudbridge, and compare the effectiveness of the panels on trails.

To achieve these objectives, a comparative study is conducted between the Waterfall Trail, which is covered with informative panels, and the other trails that are not. This involves conducting visitor surveys on both types of trails to assess differences in visitor comprehension, behavior, and engagement. The survey implementation involves designing a detailed questionnaire (see Appendix 1), which plays a crucial role in gathering direct feedback regarding panels at the end of their hike. Therefore, this visitor survey focuses on key aspects of visitor interaction with the existing informative panels. It focuses on evaluating comprehension of the information provided, potential behavioral changes, or intentions such as increased awareness or intention to support conservation efforts, and engagement level.

The distribution of the survey went through various methods to maximize response rates, including:

1. Signage with QR Code (see Appendix 1): A sign was created and displayed on the bulletin board of the Welcome Center (see Figure 45). It explains the project's purpose, encourages visitors to participate, and includes a QR code that directs visitors to the online questionnaire, facilitating easy access to the survey through a simple scan.
2. Personal Interaction: As a researcher, I stationed myself at the Welcome Center to engage directly with returning visitors. This method allows them to conduct the questionnaire in person by recording their responses directly. This approach provided a personal contact, enhancing the social aspect of the survey and ensuring accurate

data collection. It also resulted in a higher response rate due to the immediate and interactive nature of the method.

3. Email Outreach: Email addresses were collected from the visitor notebook managed by Cloudbridge since my arrival at the end of February. The questionnaire was then sent to these visitors via the university email allowing them to complete the survey at their convenience. This method offered flexibility for visitors who might not have had the time to complete the survey on-site, thereby increasing the overall response rate.

The survey responses are analyzed to draw conclusions about the effectiveness of the panels. This data analysis encompasses both quantitative and qualitative methodologies, where quantitative analysis measures the level of comprehension and engagement reported by visitors, whereas qualitative analysis gathers detailed feedback on the influence of panels on visitor behavior and perceptions.

9.2 Limitation of the Methodology

Although there are numerous advantages to conducting a survey principally through visitor questionnaires and interviews to evaluate the effectiveness of informative panels, the methodology employed presents several limitations that must be considered as they can affect the reliability and validity (Andrade, 2020; Coughlan, 2017; Romm, 2013; Voxco, 2021).

Firstly, the reserve experiences a relatively low number of visitors compared to other well-known parks, such as the Chirripó National Park just next to it, which restricts the sample size and may affect the representativeness of the data collected.

Visitor bias is also important to consider whereby responses obtained may be skewed towards those visitors who are more interested in environmental conservation or who had particularly positive experiences. Consequently, these answers may not be representative of the broader visitor population. In light of this consideration, the subjectivity in responses is important to acknowledge given the potential for a diverse range of visitors with varying levels of prior knowledge, interest, and expectations, which can influence their perception of the panels' informativeness and engagement.

It has been observed that environmental variables influence the visitor experience and engagement with the panels. These variables include weather conditions, the presence of other visitors, and the time of day. For instance, visitors on a sunny day may have a different experience compared to those on a rainy day, which could influence their responses.

Meanwhile, it's imperative to take into consideration that the evaluation began at the start of the rainy season, resulting in fewer visitors, as it is no longer the high season for tourists in Costa Rica. Thereby, this seasonal shift may have influenced visitors' willingness to engage fully with the panels due to time constraints and weather conditions.

In addition, temporal constraints also play a major role, whether concerning the time frame of the survey or the time available to visitors. The time frame for data collection might not be sufficient to capture a representative sample of visitor experiences, particularly if conducted over a relatively short period or during a specific season. Therefore, this study conducted over a four-month period may not be sufficiently comprehensive to yield accurate results. A further challenge is that visitors often have limited time within the reserve and may prioritize avoiding rain over thoroughly engaging with the panels and reducing their likelihood of completing the questionnaire.

Another challenge to be addressed is the technological barriers. Firstly, not all visitors have access to smartphones or are comfortable using QR codes and online surveys, which can limit participation and bias the sample towards more technologically adept individuals.

Furthermore, the email collection method presents certain obstacles. The transcription of handwritten email addresses in the visitor log was occasionally illegible and challenging to decipher, as reported in the collected data (Appendix 16). Such issues can give rise to transcription errors and incorrect/undeliverable survey invitations, which can have a significant impact on the response rate and the overall reliability of the collected data.

Meanwhile, recall bias is also a concern, as visitors may not accurately remember or report their experiences, especially if they complete the survey a long time after their visit.

Finally, the design of the questionnaire itself can also introduce limitations, affecting the quality of the data collected. Incomplete or inaccurate data can result from poorly phrased questions, limited response options, or the overall length of the survey. Despite the best efforts to make the questionnaire engaging and concise, inherent biases or misunderstandings in the responses may still occur.

Overall, the methodology provides valuable insights, although the variability of constraints does present a challenge when attempting to draw definitive conclusions about the panels' effectiveness. To interpret the results more effectively, it is essential to have an in-depth knowledge of the inherent limitations. Acknowledging these limitations can refine the

evaluation methodology to provide a more accurate and comprehensive assessment. Furthermore, addressing these limitations in the context of potential methodological refinement in future studies will help ensure that the installation of informative panels is a valuable and effective tool in achieving the reserve's mission of conservation and education.

9.3 Discussion of the questionnaire's results

9.3.1 Day visitors' profile (see Appendix 17)

The data set includes responses from 45 participants collected from March 20th 2024 until August 28th 2024, which provide a glimpse into the visitor experience at Cloudbridge. This section of the thesis presents the demographic distribution, hiking companions, and reasons for coming to hike at Cloudbridge.

9.3.1.1 Gender

The number of males and females is equilibrated as shown below:

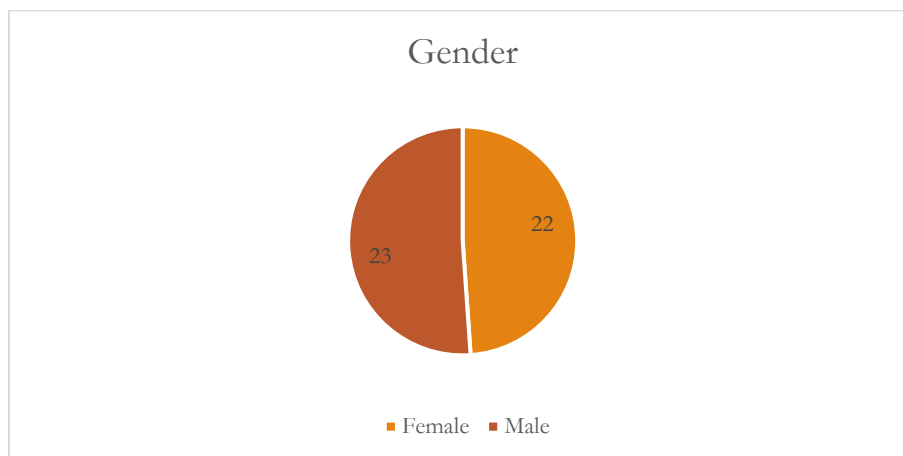


Figure 11 - Diagram of participants' sample gender

9.3.1.2 Age

In terms of the age range, it varies significantly, but the majority of visitors to the reserve are between 22 and 45 years old.

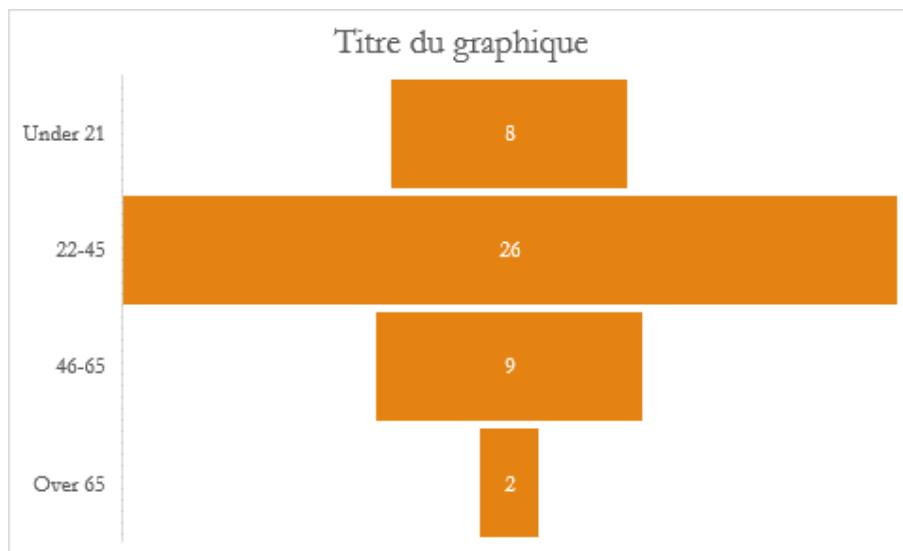


Figure 12 – Diagram of participants' age range

9.3.1.3 Country Origin

Regarding the country of origin, respondents are classified as foreigners or Costa Ricans to simplify and provide a clearer overview. The majority of questionnaire respondents are foreigners. This, combined with field observations, indicates that fewer Costa Ricans living nearby, visit the reserve.

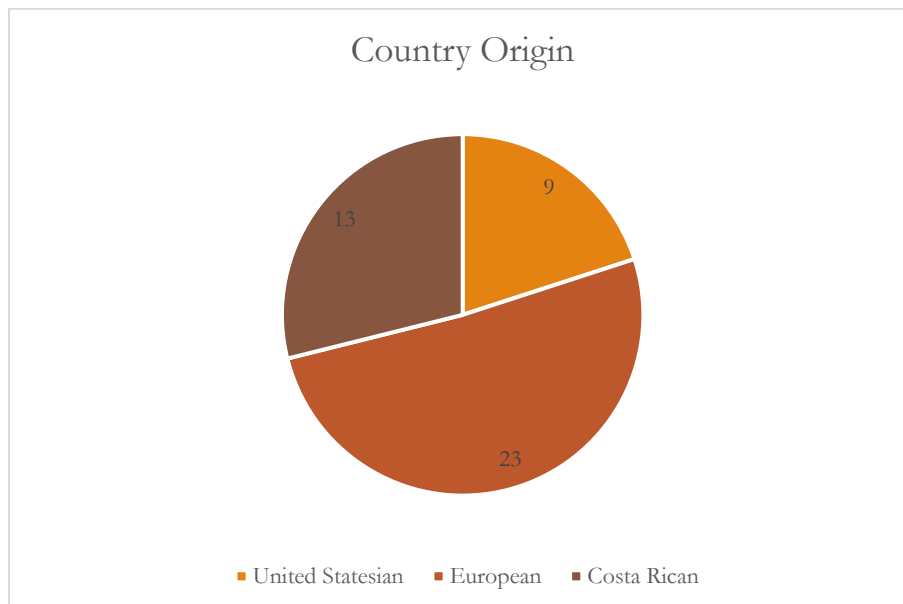


Figure 13 - Diagram of participants' country of origin

9.3.1.4 Occupation

Concerning their occupation, we can find mostly participants who are employed:

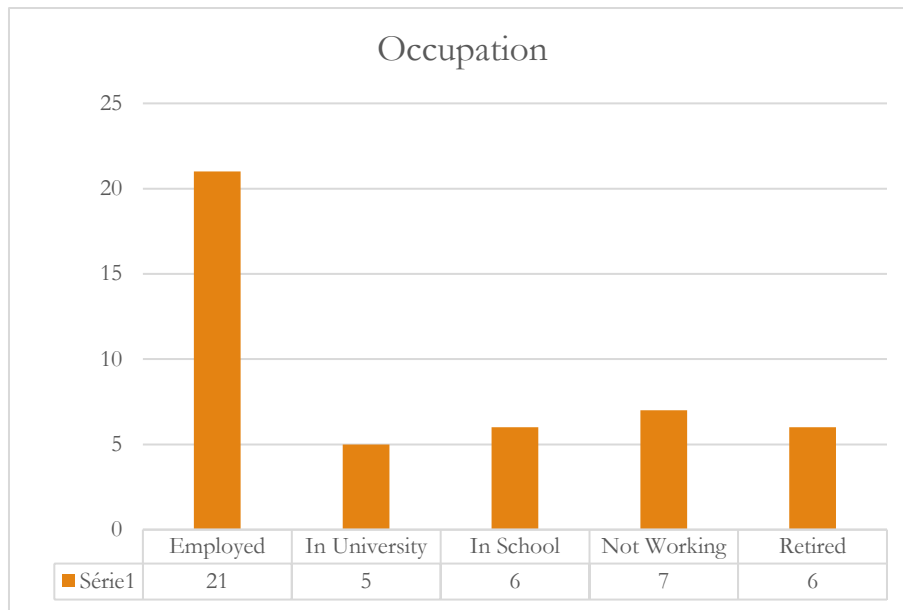


Figure 14 - Diagram of participants' occupation

9.3.1.5 Motivations

Even though visiting a reserve in another country can be primarily for tourism or sports, it has been shown that visitors come to Cloudbridge with the intention of learning:

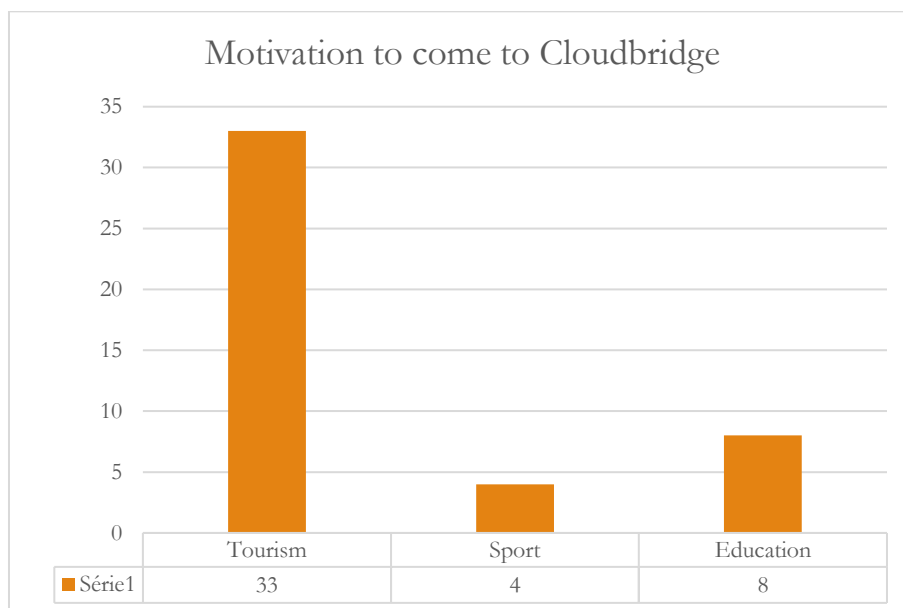


Figure 15 - Diagram of participants' motivation to come to Cloudbridge

9.3.1.6 Hiking companions

Finally, the majority of visitors to the reserve come with a partner to enjoy the natural surroundings.

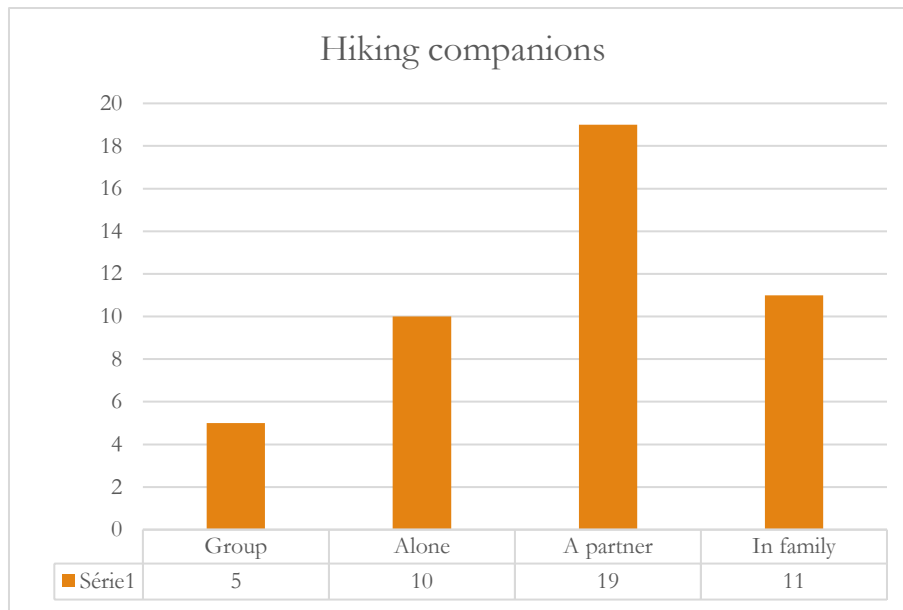


Figure 16 - Diagram of participants' hiking companions

9.3.2 Global analysis of tendencies based on visitor responses

To complete the analysis based on the 45 participants of the questionnaire, it is possible to construct a global data table illustrating tendencies among different groups regarding their learning experiences, species identification, and preferences for additional panels:

Total 100%		Percentage of people (%)		
		Learned something	Learned species name	Want more panels
22	Female	63,64	50	81,82
23	Male	69,57	26,09	78,26
4	In Group	100	75	75
10	Alone	70	70	80
19	With a Partner	73,68	26,32	78,95
11	In Family	45,45	18,18	90,91
8	Under 21	62,50	62,50	75
26	22-45	61,54	42,31	84,62
9	46-65	44,44	11,11	66,67
2	Over 65	100	0	50
33	Tourism	60,61	30,30	81,82
4	Sport	100	0	100
8	Education	75	87,50	75
6	In school	50	83,33	50
21	Employed	66,67	19,05	90,48
7	Unemployed	71,43	28,57	85,71
5	In University	60	100	80
6	Retired	83,33	16,67	66,67
23	European	56,52	47,83	86,96
9	United Statesian	77,78	22,22	77,78
13	Costa Rican	76,92	30,77	92,31

Table 4 - Global analysis of tendencies per group of samples

9.3.2.1 Gender-based tendencies

The female respondents demonstrated a similar level of interest in both learning new information and recognizing species names. Additionally, they exhibited high interest in more panels. In contrast, the male respondents showed a slightly higher percentage of interest in learning new information, but a lower level of interest in species identification. Both genders expressed a high interest in having additional panels.

9.3.2.2 Visit Group Dynamics

Visitors in groups were observed to have the highest percentages for learning something new and for the recognition of species, indicating that these individuals engaged in a more collaborative learning experience. Those who visited alone also manifested a high level of learning and recognition. Family visits stand at a lower level of learning and recognition but have the highest preference for additional panels, which suggest the necessity for more engaging content to accommodate younger children.

9.3.2.3 Age-Based Tendencies

Visitors under 21, and those aged 22-45, both expressed a notable interest in learning the names of species, and their interest in more panels was correspondingly strong. In visitors aged 46-65, interest in learning and recognition was less keen, perhaps indicating that information should be made more accessible. Those over the age of 65 were less likely to recognize any species names, and 50% wished that more panels had been available which represent the lowest percentage of any age group.

9.3.2.4 Purpose of Visit

While tourists, the largest category, demonstrated a balanced interest in learning and a strong preference for more panels, the sports visitors, despite 100% showing a learning rate, did not focus on species identification and thus utilized the panels differently. For those visitors whose primary interest was in education, high percentages of both learning and species recognition further underline the educational value of the panels.

9.3.2.5 Occupation-Based Tendencies

Both employed and unemployed visitors showed high levels of learning and a markedly strong preference for additional panels, whereas species recognition was comparatively lower. University students demonstrated high level of species recognition and a strong preference for more panels, reflecting their interest in educational content. The retired sample revealed high

rates of learning but lower species recognition, pointing to a potential need for more specialized educational materials.

9.3.2.6 Nationality-Based Tendencies

The European visitors were balanced in their interest in learning and species recognition, with notable preferences for incorporating more panels in their educational experience. The visitors from the United States had high rates of learning but exhibited lower levels of species recognition, a similar pattern to that observed among the Costa Ricans, who had very high learning rates and the strongest preference for more panels. This may suggest a general trend across nationalities for more educational content to enhance their experience.

9.3.3 Discussion of the Educational Panels along the Waterfall Trail (see Appendix 17)

The feedback from day visitors at Cloudbridge provides valuable insights into the effectiveness and areas for improvement regarding the informative panels on the reserve's various trails. This evaluation was based on a questionnaire (see Appendix 1) completed by 45 participants.

Of the total respondents since the beginning of the survey, 30 indicated that they learned something during their hike. Notably, 24 of these individuals hiked the Waterfall Trail, which features 16 informative panels (see Appendix 15). Therefore, it can be stated that 100% of the tourists who hiked the Waterfall Trail learned something about the conservation of the biodiversity of the cloud forest from the reserve. The remaining six individuals also acquired knowledge from their hike on the trails lacking any educational signage. As shown below, this indicates a huge educational gap between taking a trail equipped with or without any signage.

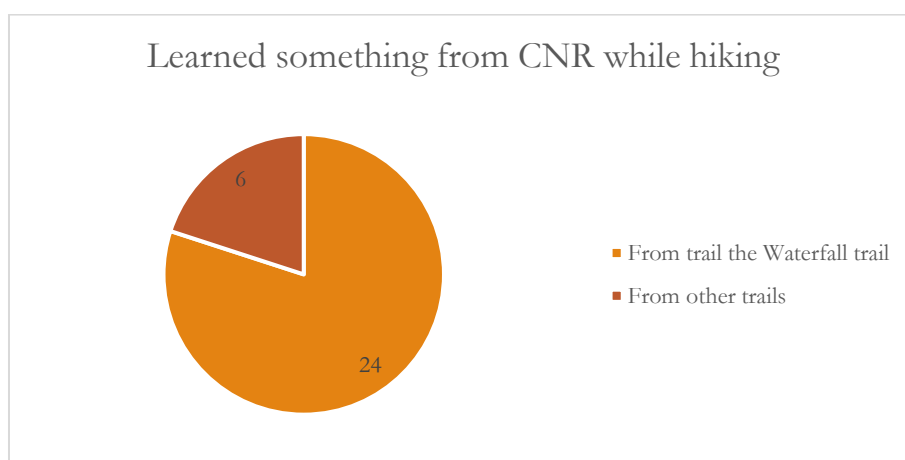


Figure 17 - Comparative tendency of learning on trail with or without educational panels

It is crucial to acknowledge that the questionnaire evolved during the survey period commencing on March 20th, and with the second part introduced on April 23rd. Consequently, the final sample consisted of 31 participants, 24 of whom hiked the Waterfall Trail. The distribution of trail usage among respondents was as follows below:

Trail name	Number of people	Percent of total respondents (%)
Waterfall	24	77,41935484
River	15	48,38709677
Montaña Loop	11	35,48387097
Cloudbridge North	11	35,48387097
Total Participants	31	100

Table 5 - Distribution of trail usage

This significant disparity in trail usage possibly limits the ability to compare educational outcomes between trails with and without panels, posing a challenge to accurately assess the panels' utility in meeting Cloudbridge's communication goals.

The placement and effectiveness of the panels on the Waterfall Trail were noteworthy, with 91.67% of participants noticing the panels, and 37.5% reading all the panels. However, three respondents cited rain and time constraints as barriers: “*It was gonna rain so didn't stop a lot to read anything*” “[...] *I could have read more panels, but I was afraid of the rain*” and “*When we say it starts to rain, it starts to rain*”.

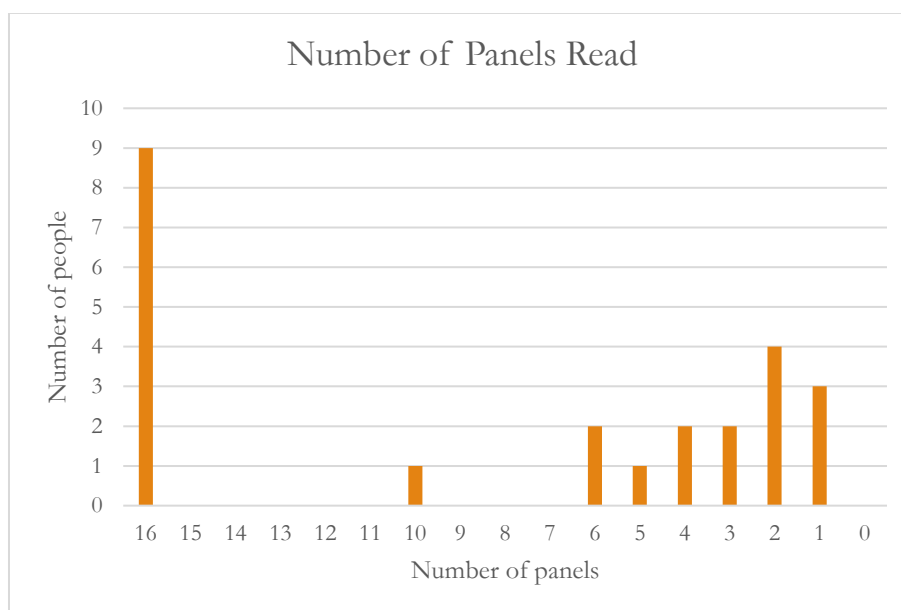


Figure 18 - Diagram of the number of panels read

Most participants rated the content above three on a scale of five, with 62.5% giving it a rating of four out of five (see Figure 19). Additionally, 87.5% of respondents agreed that the educational panels engaged their interest and held their attention.

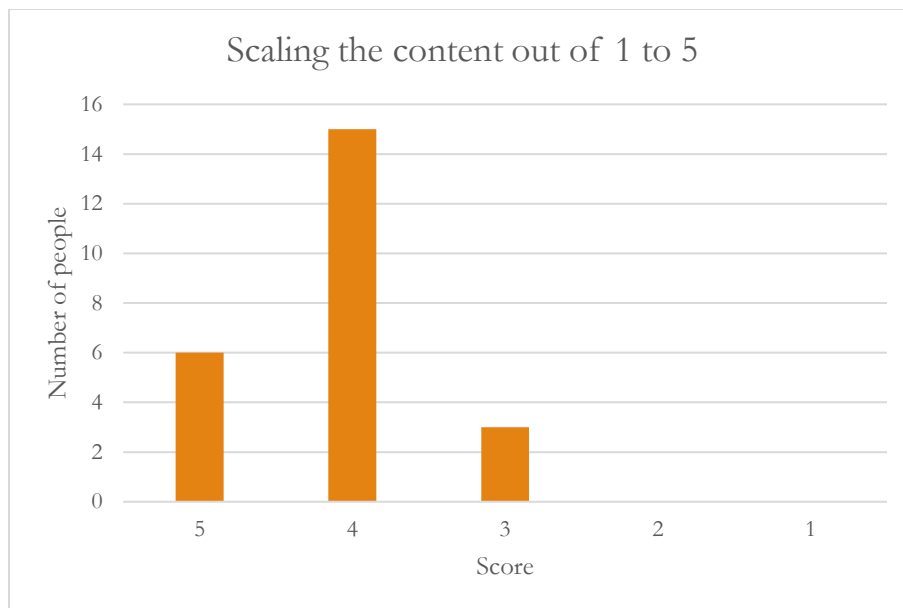


Figure 19 – Diagram of participant scaling the content of educational panels

The analysis of the questionnaire data reveals that all participants (100%) reported that the informative panels facilitated an enhanced comprehension of the reserve and conservation initiatives. Furthermore, 95.83% of participants indicated that the signage increased their appreciation for the natural environment.

This understanding influenced the behavior of 58.33% of the participants during their hike, demonstrating the panels' significant impact on visitor engagement and conservation awareness. The panels were mostly evaluated as effective educational devices by the participants. One participant, for instance, indicated that the panels “[...] *are really beneficial and help me learn and appreciate what I am seeing as I hike, and how important this ecosystem is!*”. This illustrates that such panels serve as indispensable sources of contextual information and narratives, thereby enriching the hiking experience. Furthermore, the panels were also praised for their clarity and conciseness. One family commented that the approach was “*pretty effective because it's clear, and goes to the point, [moreover, it is] easy to adjust even if not familiar with some terms*”. Therefore, information must be made accessible and comprehensible even to those lacking familiarity with specific scientific terminology.

Nevertheless, 91.67% of respondents were unable to identify specific animal species they encountered, suggesting a gap in the panels' effectiveness as the panels focus on tree and plant species in that area. Despite the panels' overall positive reception, 87,5% of participants recommended adding more informative panels along the trails, indicating a need for more comprehensive coverage to further enhance the hiking experience and promote awareness of conservation issues. There is an explicit desire for more panels as one respondent stated, it is *“always interesting to learn more about the biodiversity and definitely need more panels!”*. Therefore, expanding the number of panels could improve visitors' educational experiences.

9.3.4 Visitor Feedback Analysis

The perception of day visitors regarding the communication facilitated by educational panels at Cloudbridge is multifaceted, reflecting both appreciation and suggestions for improvement. While the existing panels contribute significantly to visitor education and engagement, there are several critical observations and recommendations for enhancing their effectiveness based on the 45-visitor feedback.

Respondents stated the importance of strategic location placement, with clear and concise content for the panels. Several of them highlighted the necessity for more diverse and targeted content on the informative panels, such as one commented: *“Good to have a good placement, people would like to see distribution map of the species and know what species live in what part of the country. I could have read more panels, but I was afraid of the rain”*. This suggests that while the content is beneficial, weather conditions can hinder engagement, emphasizing the need for sheltered or strategically placed panels to optimize visibility and ensure they are easily accessible to visitors. Consequently, consideration should be given to areas where visitors tend to stop or gather.

Additionally, some visitors recommended reducing text density to increase readability. For instance, someone noted: *“Maybe more panel but not too much text and or space and clear as possible to increase the chances that people read it entirely”*, whereas another one added: *“More images possibly, less reliance on sentences”*. This indicates a preference for information that is more visually engaging and concise, which can be rapidly assimilated during a hike.

Others suggestions were provided by visitors regarding the content to be included in the panels. One individual noted the need for altitude-related information at the waterfalls: *“Understand a little more about altitude with the waterfalls [translated from French].”* Others

suggested including practical information such as distances, estimated travel times, and floral variety. Furthermore, there is a call for more educational content related to local species and ecosystems. Comments included: *“More educational signs, they don't have to be big. Maybe about the importance of some ecosystems etc. Or signs with info about certain species, for example keystone species, or the apex predators that are around here and the importance of them”*. This reflects a desire among visitors for a more profound comprehension of the reserve’s biodiversity.

However, there are still some participants who expressed mixed feelings about the installation of more informative panels along the other hiking trails within Cloudbridge. One respondent highlighted a practical concern, noting that *“it was gonna rain so didn't stop a lot to read anything. But it was good. liked to have the trails more wild so the memorial garden were a great place to put the panels because it was convenient but maybe keep the wildness on the trails will be better”*. Other visitors expressed concern: *“More signs make it dangerous because we don't look at the landscape. But that's okay that's what we like”*, and an expert commented: *“As a biologist, I prefer the ecosystem to look as natural as possible, but information regarding likely species at the Welcome Center, perhaps something intended to be photographed and referenced throughout the hike or just a pamphlet, can enhance the experience. I prefer clearly marked trails with minimalist signage”*. These feedbacks are the balance between providing educational content that is appreciated and preserving the natural hiking experience, which is crucial for them. Visitors value the natural characteristics of the reserve and, therefore prefer panels to be strategically located in areas where they do not intrude on the wilderness experience, such as the Memorial Garden -which is on the Waterfall Trail-, or the Welcome Center.

Comparative suggestions and additional ideas inspired by other locations were offered by visitors. One comment mentioned, *“For the Memorial Garden, it will be nice to have more panels for the species of flowers. If thinking about adding signs it'll be good to do as in Ecuador where they have a garden with medicinal plants with the description of it just in front. That way, it helps people to appreciate, connect and be more appreciative”*. Identifying effective practices in other contexts could be a helpful adaptation by Cloudbridge.

Additional recommendations included: *“Label trees and animals that can be seen in the area. Promote an app that helps us identify the name of the bird we see [translated from Spanish]”*, and *“The Welcome Center could have a wall of photos taken by visitors and interns, similar to*

the camera trap wall. This might motivate guests to take more photos and feel connected to the reserve." These suggestions emphasize interactive and technologically integrated methods to enhance visitor engagement and education.

In conclusion, the feedback from day visitors indicates a strong appreciation for the existing educational panels, while also offering constructive criticism and suggestions for improvement. The key recommendations include strategic placement, concise and visually engaging content, inclusion of practical and ecological information, and a balance between educational content and natural trail experience. Implementing these suggestions could significantly enhance the educational impact and overall visitor experience at Cloudbridge, fostering a deeper connection to the reserve's conservation efforts and natural beauty.

10 Discussion with Cloudbridge's staff members

	Name	Position	Source of the data collected	Interview n° & Transcripts in Confidential Appendix
1	Casey Ella McConnell Smith	Marketing manager and Development officer	Face to face 29/03/2024 – 41 min Online call 08/04/2024 – 25 min	14.2.1
2	Madelyn Peterson	Scientific Officer	Face to face 09/04/2024 – 29 min	14.2.2
3	Maximilian King	Operational Manager	Face to face 17/04/2024 – 10 min	14.2.3
4	Tom Gode	President of the CFCA Board of Directors	Online call 23/05/2024 – 27 min	14.2.4

Table 6 - Description of Cloudbridge's staff interviewed

In the course of my interviews with various staff members, a prevailing enthusiasm for developing and installing new panels along the other trails was evident. This was particularly notable in the case of the Operational Manager, Maximilian King, who collaborated with me and provided valuable insights into the design of the new educational panels, which are still in development (M. King, personal communication, 17 April 2024).

Furthermore, Madelyn Peterson highlighted the importance of installing more interpretive signs for individuals who want to explore Cloudbridge without a guided tour. She noted that while large groups often opt for guided tours to receive detailed explanations, individual visitors could benefit significantly from additional signage. She stated that when individuals come, having more signage on the trails would help them learn more about the environment and engage more deeply with the reserve. Therefore, informative panels could transform a simple hike into an educational experience changing passive appreciation into active learning. An example she gave was: *“Let's say there's a couple that come and they just take a walk in the forest and they're like: ‘oh, that was really pretty’. And then it's over. Yeah, it's not very engaging. Whereas if there was like signage or something interactive while they were out there, they could look more into it after they came back”*. She believes that such panels can inspire visitors, even those who work in similar fields, to take action or seek new knowledge opportunities (M. Peterson, personal communication, 9 April 2024).

Casey McConnell also supports the idea of increasing the number of informative panels at Cloudbridge, especially to benefit day visitors who do not interact extensively with the staff. She explained, *"we try and reach all visitors to Cloudbridge. For example, people that are*

taking a guided tour or, for example, researchers such as yourself, have many more opportunities for conversation and for talking about climate change and ecosystem services and awareness of the importance of conservation". McConnel pointed out that currently, there are signs along the Waterfall Trail, but not on other trails like the North Cloudbridge Loop and the Ridge Trail. She acknowledged this as an area for improvement, suggesting that future projects could involve installing more signs on these lesser-equipped trails. She shared a vision for more durable and informative signs: *"For example, you've noticed probably how there's a sign that's in very bad shape right near the Sentinel Creek, like where the turnoff to Sentinel is. So the idea is to have a very nice kind of metal sign there. It's not only about the trails and the map of Cloudbridge, but also about how amazing this area is and this ecosystem and why is biodiversity important".* She praised the work of past students who created existing signs and expressed hope that future students might continue this work by developing additional signs for other trails. Therefore, she believes that this continuous improvement would enhance the educational experience for all visitors (C. E. McConnell, personal communication, 23 March 2024).

In an interview with the president of the board director of CFCA, he emphasized the importance of a systematic approach to installing informative panels. He stated, *"I'm not a big fan of a lot of panels on the trail, but the Waterfall Trail is a heavily used trail and it's a great opportunity as an educational tour area because everybody walks the water. I'm guessing less than half the people who come go up to the Mirador and beyond to Rio or wherever. And so, personally, I would tend to focus and put it onto the Waterfall Trail. I think we're able to access the most people there."* Therefore, Tom Gode recognizes the educational value of the panels, particularly on the Waterfall Trail which has the highest foot traffic, and suggests that focusing educational efforts on this trail would maximize the reach and impact of the panels. Despite reservations about the abundance of signage on the other trails, Gode acknowledges their role in enhancing the educational impact of Cloudbridge and said *"in the past, traditionally, we've inventoried butterflies, we've inventoried beetles... But like what you're doing is totally different and offers us the opportunity to really become more effective at the education. And hopefully, the long-term impact that Cloudbridge can have will come out of people like you, who can take the time and evaluate what we do and look at how we can do it better".* Moreover, he suggested working on an underutilized billboard on the Main

Trail (see Characterizing the diverse choice of placement and Location n°Y) as another ideal location for educational content: *“it's a place people tend to stop and spend a little bit of time after they've gone across the Bamboo Bridge and would be a great spot for an educational piece”* (T. Gode, personal communication, 23 May 2024).

Chapter V: Improvement of the Communication within the CNR

11 Proposition for new panels focused on the River Trail

11.1 Methodology

11.1.1 Choice of the trail

The selection of the River Trail over the others for the placement of informative panels was predicated upon a comprehensive assessment of various factors pertinent to Cloudbridge Nature Reserve's trail network. This decision reflects a strategic consideration aimed at optimizing the dissemination of educational content while aligning with visitor behavior and trail connectivity within the reserve.

Primarily, the River Trail was chosen due to its strategic location, as being the second trail in proximity to the reserve's entrance, which serves as an entry point for many visitors embarking on hiking excursions within the reserve. This logistical advantage ensures that the informative panel placed along the River Trail receives ample exposure to a diverse range of visitors, thereby maximizing its educational impact.

Furthermore, the decision to focus on the River Trail was influenced by its sequential position relative to the Waterfall Trail, the only trail currently integrating informative panels. The Waterfall trail attracts a significant volume of visitors who enjoy the stunning viewpoints and discover the diverse flora of the Memorial Garden. By strategically placing the informative panel along the River Trail, immediately following the Waterfall Trail, visitors are intuitively guided towards continued engagement with educational content. Therefore, by building on visitors' experiences from the previous trail, this sequential placement promotes a cohesive and immersive educational experience for visitors as they traverse through different sections of the reserve.

In summary, the choice of the River Trail for the placement of the informative panel exemplifies a strategic and purposeful approach aimed at optimizing educational outreach within the reserve. By leveraging its proximity to the reserve's base, its sequential position relative to the Waterfall Trail, and its alignment with visitor flow patterns, the River Trail emerges as an ideal conduit for the propagation of educational content, thereby enriching the visitor experience and fostering a deeper appreciation for the surroundings.

11.1.2 Choosing a placement (see Appendix 18)

Choosing the optimal location for an informative panel on the River Trail requires a methodical and strategic approach to ensure that the panel not only serves its educational purpose but also enhances the overall visitor experience without compromising the integrity

of the natural environment. Therefore, the placement of the panel needs to consider several factors.

The selection process for the placement of the informative panel involved conducting a thorough field survey within the reserve. To achieve optimal strategic placement, the trail was taken multiple times, both independently and in the company of Greilin, the scientific coordinator of the reserve. During these hikes, photos and notes were taken to document potential sites, ensuring sufficient space and suitability for the panel following those factors:

- Firstly, it is imperative to identify places along the trail where visitors naturally would stop such as intersections, or scenic viewpoints, to ensure maximum visibility and engagement. The panel must be situated so it is easily visible to visitors without obstructing the natural landscape or the trail itself.
- Furthermore, proximity to key elements such as particular plant species, remarkable geological formations, or diverse wildlife habitats provides immediate educational context and enhances the interpretative value of the panel.
- Accessibility and safety are also crucial. The chosen spot must be easily reachable by all visitors and preferably following the trail. That way, the placement should allow visitors to stop and read the panel without disrupting the flow of the trail or risking accidents.
- Minimizing environmental impact is another key consideration. The location should not disturb fragile ecosystems or sensitive wildlife. Additionally, the spot should support the panel structure without causing erosion or other environmental damage.
- Engagement potential can be maximized by selecting natural stopping points, such as benches, rest areas, or breaks in the trail, where visitors are likely to pause. Incorporating interactive elements, such as QR codes for additional information or visual images, can further enhance visitor engagement.
- Finally, the panel should be placed in a location that offers some protection from extreme weather conditions, such as under tree cover. The use of weather-resistant materials for the panel can ensure its durability and longevity in the face of local climate conditions.

Additionally, the app “*OsmAndMaps*” was employed to mark potential locations along the River Trail that could serve as landmarks for pinpointing location points, measuring the potential distances between panels, and crafting a detailed map of their placement.

11.1.3 Types of information

The selection process for information presented on the informative panels along the River Trail involved a meticulous approach aimed at providing engaging and educational content for visitors.

This process began with a comprehensive field survey, which entailed analyzing the surrounding environment to identify the diverse array of flora and fauna present along the trail. By conducting this survey, we aimed to gain insight into the species commonly encountered by visitors, thus ensuring that the information presented on the panels accurately reflected the biodiversity of the area.

In addition to the field survey, a considerable amount of supplementary documentation was consulted to provide further insight and context to our observations. This involved reviewing previous reports and research related to the trail in Cloudbridge and consulting authoritative books on various aspects of wildlife and vegetation. References such as Beletsky (2007), Reid et al. (2010), Modrok (2023), Powell et al. (2022), Tovar Heid (2023), Grobben (2022), and Leenders (2016) provided valuable insights into the characteristics and behaviors of different species inhabiting the area.


The selection of specimens highlighted on the panels should be guided by three main criteria: commonality, significance, and appeal. Selecting species frequently observed along the trail is crucial to encourage visitors' curiosity and foster a desire to engage further by reading informational panels. Additionally, species that held particular importance for the ecosystem or were significant to the reserve's conservation efforts should also be included. It is also highly recommended that species that are visually outstanding to look at or that exhibit interesting behaviors be prioritized in order to capture the attention of visitors and enhance their overall experience.



Each panel should focus on one to three specific species, providing information on why they are interesting or important within the context of the ecosystem. To accommodate a diverse range of interests, as exemplified by the panels encountered on the Waterfall trail, some panels can cover broader ecological topics, explaining various aspects of the ecosystem to provide a holistic understanding of the environment along the trail.






Finally, special attention must be devoted to crafting panels tailored to diverse audiences. This involves designing panels that feature simplified information complemented by captivating visuals to capture the interest of younger visitors. Furthermore, QR codes can be introduced in

pursuit of modernizing the panels and embracing contemporary communication and information dissemination. These QR codes will enhance visitor engagement and cater to their curiosity by linking to accessible, science-based websites, offering additional information for those who wish to delve deeper into the topics discussed.

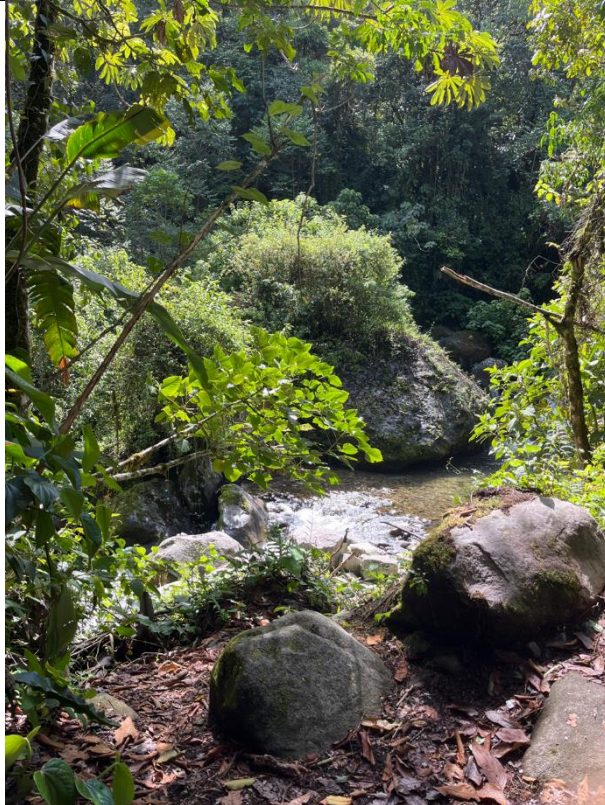
11.1.4 Characterizing the diverse choice of placement

PANEL N°	CHARACTERISTICS OF THE PLACEMENT	RECOMMENDATION OF INFORMATION ON THE PANEL
X	 <ul style="list-style-type: none"> - Existing panel along the Mirador del Valle resting point on the main trail, at the crosspoint of the end of the River Trail - Scenic viewpoints - After a big steep climb - Natural stopping point with the presence of a bench 	<ul style="list-style-type: none"> - A relief map of the surrounding mountains, which would show the names of the mountains and their altitude

<p>Y</p>	 <p>- Existing panel along the main trail</p>	<p>An existing panel that is not utilized in an optimal manner.</p> <p>→ To enhance the effectiveness of the placement: cover the green panel with another panel where topics such as the mission, cloud forest, and common species within the reserve are discussed.</p>
<p>1</p>	 <p>- Existing panels along the main trail and at the cross of the middle of River trail</p> <p>- Natural stopping point with the presence of a bench</p>	<p>- Talk about the native and non-native trees of the cloud forest</p>

<p>2</p>	 <ul style="list-style-type: none"> - Existing panel along the Main trail and at the entrance of River trail 	<p>Based on the surroundings:</p>  <p><i>Quercus salicifolia:</i></p> <ul style="list-style-type: none"> - Planted 15 years old - Common in Cloudbridge  <p><i>Siparouna or limoncillo</i></p>
<p>3</p>		<ul style="list-style-type: none"> - Common birds (behavior, features...)  <p><i>Heliconias:</i></p> <ul style="list-style-type: none"> - Native from Cloudbridge

4



- Scenic viewpoints
- Following a downhill run
- Natural stopping point

Talk about the **waterfall and water cycle** and how important it is

5



- Scenic viewpoints
- After a big steep climb
- Natural stopping point with the presence of

- Palms



- Talk about the Río Chirripó Pacífico and Río Urán which are a massive river that runs through the reserve → They meet along River trail and turn into one big river

	a bench	
6	 <p>- Large area</p>	<ul style="list-style-type: none"> - Explain the Geology and the types of rocks that appears along the trail - Epiphytes 
7	 <p>- Existing panel along the main trail and at a cross on the River trail</p>	 <p>Cecropia</p>




<p>8</p>	 <ul style="list-style-type: none"> - Existing panel along the main trail and at the cross of the end of River trail - Scenic viewpoints - Natural stopping point with the presence of a bench 	<ul style="list-style-type: none"> - Fasciated tiger heron and the otter (which people can potentially see on that trail) - Talk about the reforested area that's on the River trail → when it was planted, what type of species, and how long it'll take to grow up into a forest 
<p>9</p>	 <ul style="list-style-type: none"> - Before a big steep climb - Natural stopping point with the bridge 	<ul style="list-style-type: none"> - Talk about the bridges

Table 7- Developed table characterizing the diverse choice of placement

11.2 Developed panels for River Trail

Following the different conserved locations localized on the map below, for the development of the new panels along the River trail. Here are the panels developed for Cloudbridge Nature Reserve for the improvement of their communication about their role, transmit their message, and some knowledge about the biodiversity they can encounter within the reserve⁵.

Conserved Panel's Location on River Trail

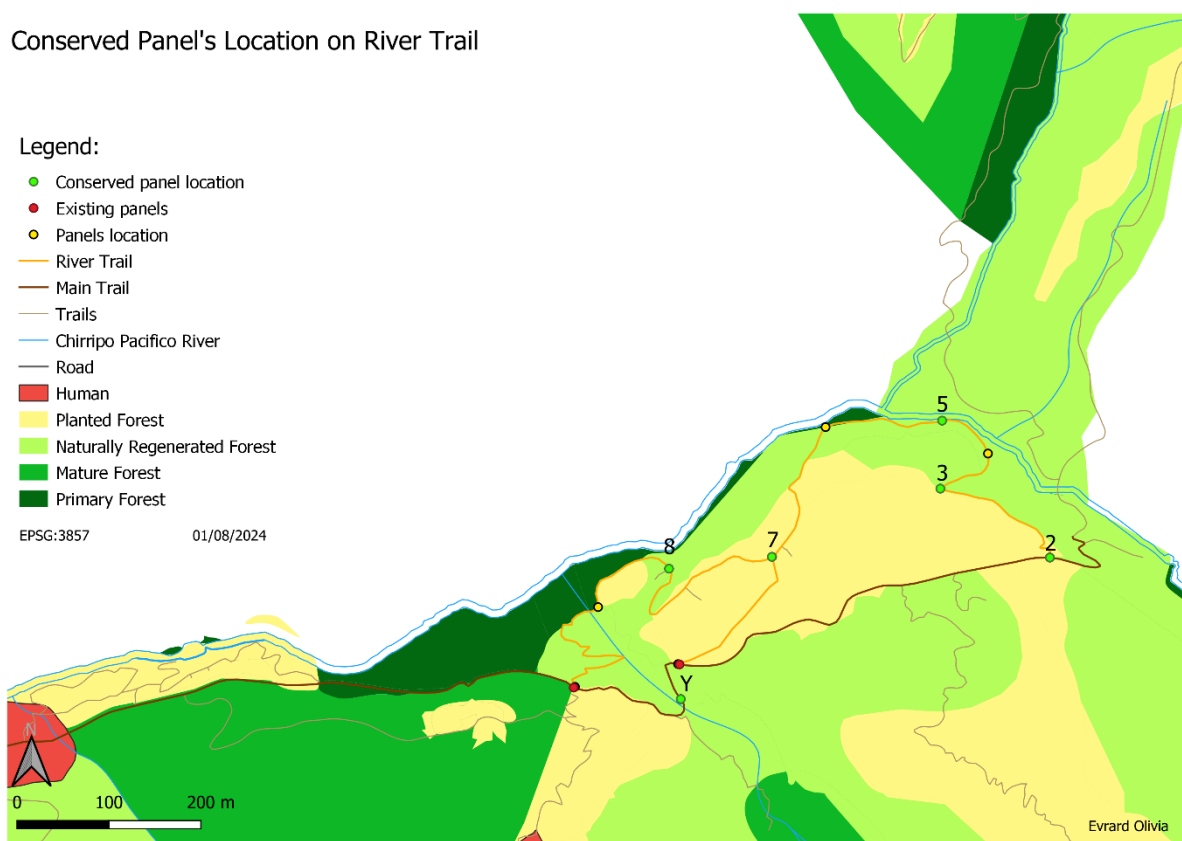


Figure 20 - Conserved panel's location on the River Trail (conceived with QGIS)

Panels Numbers	X (latitude)	Y (longitude)
2	9.47390°N	83.56755°W
3	9.47464°N	83.56864°W
5	9.47528°N	83.56845°W
7	9.47390°N	83.57032°W
8	9.47376°N	83.57141°W
Y	9.47241°N	83.57126°W

Table 8 - Conserved panel's location

⁵ Note: These developed panels are still in the process of being finalized in terms of design and text. In collaboration with the Cloudbridge staff, we are currently refining the content to ensure its quality before installation within the reserve.

11.2.1 Location n°Y

Figure 21- Educational panel developed for the location n°Y on QGIS's map

11.2.2 Location n°2

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¿ Lo sabia ? | Did you know ?

¿En Qué Tipo de Bosque Estás Haciendo Senderismo?

¡Estás caminando en un bosque mayormente recién plantado!

Después de haber sido degradado por prácticas agrícolas, este bosque ha renacido gracias a los esfuerzos de reforestación iniciados en 2002. Esta vibrante área es un testimonio de nuestro compromiso de devolver la vida a la tierra.

En este bosque revitalizado, encontrarás muchos árboles que han vuelto a crecer de forma natural, incluyendo algunos tipos de robles como el majestuoso *Quercus insignis*, un habitante icónico de los bosques nubosos.

Entre estos gigantes imponentes, puedes encontrar fácilmente un compañero útil: el Limoncillo (*Siparuna grandiflora*). Si los insectos te molestan, esta planta es tu salvación. Simplemente frota su fruto con aroma a limón en tu piel y naturalmente ahuyentará a los insectos.

Además, siguiendo algunas investigaciones sobre la evolución del cambio climático, también se ayudó un poco plantando varias especies, como el resistente *Quercus salicifolia*, que ahora prospera dentro de la reserva.

También descubrirás la *Myrsine coriacea*, una especie que crece de forma natural. Tras detener la intervención humana y permitir que el bosque se regenerara, esta especie ha experimentado un resurgimiento, floreciendo de nuevo en su hábitat nativo.

Which Type of Forest Are You Hiking In?

You're walking in a mostly newly planted forest!





After being degraded due to farm practices, this forest is reborn through reforestation efforts initiated in 2002. This vibrant area is a testament to our commitment to nurturing the land back to life.

In this revitalized forest, you'll encounter many naturally regrown trees, including some types of oaks such as the majestic *Quercus insignis*, an iconic inhabitant of cloud forests.

Amidst these towering giants, you can easily find a handy companion: the Limoncillo (*Siparuna grandiflora*). If you're troubled by bugs, this plant is your savior. Simply rub its lemon-scented fruit on your skin, and it will naturally repel pests.

Moreover, following some research on the evolution of climate change, a little help was also given by planting various species, such as the resilient *Quercus salicifolia*, now thriving within the reserve.

You will also discover *Myrsine coriacea*, a species that grows naturally. After halting human intervention and allowing the forest to regenerate, this species has seen a resurgence, flourishing once again in its native habitat.

RESERVA
CLOUDBRIDGE
NATURE RESERVE

Figure 22 - Educational panel developed for the location n°2 on QGIS's map

11.2.3 Location n°3

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Heliconias y colibríes | Heliconias and Hummingbirds

Una asociación extraordinaria

Una extraordinaria asociación próspera entre las heliconias y los colibríes en las selvas tropicales de América y el Pacífico Sur. Las heliconias, conocidas por sus floraciones extravagantes, son populares por sus colores que van del rojo al fucsia, pasando por el amarillo, entre otros, y dependen exclusivamente de los colibríes para su polinización. Estas plantas, pertenecientes a la familia Heliconiaceae, ofrecen un rico néctar oculto dentro de brillantes brácteas que atraen a los pájaros con su color más que con su olor.

Los colibríes, incluidos el ermitaño verde y el brillante de corona verde, están perfectamente adaptados con sus largos picos curvados para alcanzar el néctar de estas flores, mientras que las lenguas se extienden hacia el interior de las mismas. Mientras se alimentan, transfieren el polen de una flor a otra, asegurando así la propagación de las especies de heliconia. Esta relación mutua muestra una coevolución en la que los tubos de las flores de heliconia coinciden con la longitud de los picos de determinadas especies de aves, lo que mejora la extracción de néctar y la transferencia de polen.



Esta relación bilateral funciona bien para ambas partes: las heliconias adquieren polinizadores fiables, mientras que los colibríes proporcionan fuentes de alimento ricas en energía. Así pues, los entresijos de la naturaleza se ejemplifican a través de estos vínculos especializados que indican un delicado equilibrio en el que cada especie florece entre las demás.

A Remarkable Partnership

An extraordinary partnership is thriving between heliconias and hummingbirds in the tropical rainforests of the Americas and South Pacific. Heliconias, known for their flamboyant blooms are popular for their colors going from red, fuchsia to yellow among others, and depend exclusively on hummingbirds for pollination. These plants, belonging to the Heliconiaceae family, offer rich nectar concealed within bright bracts that attract birds with their color rather than scent.

Hummingbirds, including the Green Hermit and the Green-crowned Brilliant, are perfectly adapted with their long curved bills to reach into these flowers' nectar, while tongues extend up inside them. As they feed, they transfer pollen from one flower to another thus ensuring the propagation of heliconia species. This mutualistic relationship exhibits co-evolution whereby heliconia flower tubes agree closely with the bill lengths of specific bird species enhancing nectar extraction and pollen transfer.

This bilateral relationship works well for both parties: reliable pollinators are acquired by heliconias while consistent energy-rich food sources are provided by hummingbirds. Therefore, nature's intricacies is exemplified through such specialized bonds indicating a delicate balance where each species flourishes among others.

RESERVA
CLOUDBRIDGE
NATURE RESERVE

Figure 23- Educational panel developed for the location n°3 on QGIS's map

11.2.4 Location n°5

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Tesoros Ocultos Del Río | River Hidden Treasures

El encantador mundo de las epífitas

Las epífitas son plantas que crecen sobre otras especies sin dañar a sus huéspedes. Este fascinante flora, a menudo llamadas «plantas del aire», prosperan en las neblinosas alturas de los bosques nubosos, añadiendo una vibrante vida a las copas de los árboles.

Entre las epífitas más cautivadoras se encuentra la familia *Bromeliaceae*, que cuenta con más de 2.000 especies en Costa Rica. Con flores brillantes y hojas puntiagudas que suelen posarse en lo alto de los árboles, las bromeliáceas pueden crear un ecosistema en miniatura que sustenta insectos y ranas diminutas al absorber la humedad y los nutrientes del aire a través de sus hojas.

Las orquídeas, otra importante familia de epífitas, abundan en Cloudbridge. Estas delicadas plantas, que se alimentan de agua, polvo y nutrientes acumulados alrededor de sus raíces, añaden un toque de elegancia al bosque. Los bosques nubosos ofrecen condiciones ideales para orquídeas como las *Genus Oncidium*. A medida que ascienda a mayores altitudes, notará cambios en la estructura del bosque y en la variedad de epífitas, encontrándose las poblaciones más densas hasta los 1.700 metros.

Una garza tigre

Si tiene suerte, podrá ver una garza real a lo largo del río. Caza permaneciendo inmóvil en una orilla o en aguas poco profundas hasta que una presa pasa a su alcance, momento en el que endereza rápidamente el cuello en dirección a la víctima. Los peces y otras presas son picados por el afilado pico de la garza y tragados de una sola pieza.

The Enchanting World of Epiphytes




Epiphytes are plants that grow on other plants without harming their hosts. These fascinating plants, often called "air plants," thrive in the misty heights of cloud forests, adding vibrant life to the forest canopy.

Among the most captivating epiphytes you'll encounter the *Bromeliaceae* family which have over 2,000 species in Costa Rica. With bright-flowered, spiky-leaved plants that are often perch high in the trees, bromeliads can create a miniature ecosystems that support insects and tiny frog by absorbing moisture and nutrients from the air through their leaves.

Orchids, another prominent family of epiphytes, abound in Cloudbridge. These delicate plants, which feed on water, dust, and nutrients accumulated around their roots, add a touch of elegance to the forest. The cloud forests provides ideal conditions for orchids such as *Genus Oncidium*. As you ascend to higher altitudes, you'll notice changes in the forest structure and the variety of epiphytes, with the densest populations found up to 1,700 meters.

A river hunter

If you're lucky you may be able to see a Fasciated Heron along the river. They hunt by standing in a motionless posture on an edge or in shallow water until prey comes within range, then quickly straighten their neck toward the victim. Fish and other prey are stabbed with the heron's sharp bill and swallowed in one piece.

Epiphyte covered branch showing bromeliads, ferns, orchids, mosses

Genus Oncidium

Fasciated Tiger Heron
(*Tigrisoma fasciatum*)






Figure 24 - Educational panel developed for the location n°5 on QGIS's map

11.2.5 Location n°7

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Tesoros Ocultos Del Río | Surrounded by lovely birds

Saltón de Muslos Amarillos (*Atlapetes tibialis*)

En su viaje por las tierras altas, debería tener la oportunidad de ver a este inusual y bello pinzón, conocido por su animado comportamiento. Si se fija bien, le sorprenderá el contraste de colores de sus patas amarillas con su plumaje oscuro, que parece llevar un par de pantalones amarillo brillante.

Sargento (*Ramphocelus passerinii*)

Los machos son fácilmente reconocibles por su brillante rabadilla roja y su cuerpo negro, que contrasta con el de las hembras, de plumaje pardo oliváceo y un ligero tinte rojizo. Más allá de su llamativo aspecto, estas aves también son conocidas por sus encantadores y melódicos llamadas.

Estas aves sociales se encuentran sobre todo en torno a los árboles frutales, donde a menudo se agrupan en pequeños grupos que constituyen un espectáculo muy brillante sobre el fondo de follaje verde.

Carpintero Oliváceo (*Campephilus guatemalensis*)

Estos pájaros carpinteros son conocidos por sus fuertes golpes en los árboles, que les ayudan a recoger insectos bajo la corteza. El bosque resuena con su fuerte tamborileo, que no sólo es una forma de conseguir comida, sino que también sirve de comunicación entre ellos. Además, suelen hacer grandes cavidades en los troncos de los árboles para que otras aves puedan anidar allí.

Desempeñan un importante papel en el mantenimiento del bienestar de los ecosistemas boscosos. Al controlar el número de insectos y generar hogares, mejoran la biodiversidad y la estabilidad de su ecosistema local

Yellow-thighed Brushfinch (*Atlapetes tibialis*)

As you journey through the highlands, you should get a chance to see this unusual and beautiful finch, known for its lively behavior. If you look closely, you'll amazed by the contrasting colors of their yellow legs against their dark plumage, which look as if wearing a pair bright yellow pants.

Scarlet-rumped Tanager (*Ramphocelus passerinii*)

Males are easily recognizable by their bright red rumps and black bodies, contrasting with those of females which are olive brownish plumage and a slight reddish tint. Beyond their striking looks, these birds are also known for their lovely and melodic calls.

Those social birds can mostly be found around fruiting trees where they often come in small groups making a very bright sight against the backdrop of green foliage.

Golden-olive Woodpecker (*Colaptes rubiginosus*)

These woodpeckers are known for their strong taps on trees, which help them gather insects under the bark. The forest echoes with their loud drumming, which is not only a way to get food but also acts as communication between them. In addition, they also usually make large cavities within tree trunks so that other birds can nest there.

They serve an important role in maintaining the well-being of woodland ecosystems. By controlling insect numbers and generating homes, they enhance biodiversity and stability in their local ecosystem.





Macho y Hembra | Male and Female




Figure 25- Educational panel developed for the location n°7 on QGIS's map

11.2.6 Location n°8



<h3 style="text-align: center;">Geología majestuosa y aguas vitales Majestic Geology and Vital Waters</h3>		<small>Evrard Olivia evrard.olivia@yahoo.fr</small>
<p>Enclavado en la Cordillera de Talamanca, este increíble paisaje dividido por los caudalosos ríos de montaña que bajan por los valles es conocido como Chirripó: la «Tierra de las Aguas Eternas».</p>		
<h4 style="text-align: center;">El viaje geológico</h4>		
<p>Millones de años han visto la formación de la historia geológica de la reserva comenzando con las Rocas Sedimentarias Terciarias formadas en antiguos ambientes marinos. Como arenas a través de un reloj de arena, estas rocas están diseminadas por toda la región, especialmente en el Valle de El General. Los espectaculares picos de la cordillera de Talamanca están formados en gran parte por rocas antiguas como las granodioritas.</p>		
<h4 style="text-align: center;">El Vital Río Chirripó Pacífico</h4>		
<p>El descenso por este sendero te lleva al valle del río para caminar junto a las rugientes y cristalinas aguas del Río Chirripó Pacífico. Originado cerca de la divisoria continental, el arroyo es absolutamente esencial para este bosque proporcionando agua para que prospere. Este río se alimenta de filtraciones y manantiales, lo que significa que tiene aguas puras y vivificantes que son esenciales para los líquenes y las epífitas, que florecen con las abundantes lluvias.</p>		
<h4 style="text-align: center;">Una sinfonía de agua y vida</h4>		
<p>En Cloudbridge, el agua está en todas partes, fluyendo a través de escarpados bosques montañosos, nutriendo el suelo y sosteniendo el frágil sistema del bosque nuboso. El clima de la región, caracterizado por lluvias frecuentes, garantiza que el bosque se mantenga exuberante y vibrante. La interacción entre la historia geológica y las siempre presentes fuentes de agua crea un entorno único en el que cada roca, arroyo y planta cuenta una historia del dinámico pasado de la Tierra y de la vida que sustenta.</p>		
<p>Nestled within the Cordillera de Talamanca, this incredible landscape divided by the rushing mountain rivers that flow down through the valleys is known as Chirripó: the "Land of Eternal Waters."</p>		
<h4 style="text-align: center;">The Geological Journey</h4>		
<p>Millions of years have seen the formation of the reserve's geological history beginning with the Tertiary Sedimentary Rocks formed in ancient marine environments. Like sands through an hourglass, these rocks are scattered throughout the region including particularly in the Valle de El General. The dramatic peaks of the Talamanca range consist largely of ancient rocks like granodiorites.</p>		
<h4 style="text-align: center;">The Vital Rio Chirripó Pacifico</h4>		
<p>This hike down on this trail leads you into the river valley to walk alongside the roaring, crystal-clear waters of the Rio Chirripó Pacifico. Originating near the continental divide, the stream is absolutely essential to this forest by providing water for it to thrive. This river is fed by seeps and springs, which means it has pure, life-giving waters which is essential for lichens and epiphytes, which flourish in the abundant rains.</p>		
<h4 style="text-align: center;">A Symphony of Water and Life</h4>		
<p>In Cloudbridge, water is everywhere, flowing through steep mountainous forests, nourishing the soil, and sustaining the fragile cloud forest system. The region's climate, characterized by frequent rains, ensures that the forest remains lush and vibrant. The interplay of geological history and the ever-present water sources creates a unique environment where every rock, stream, and plant tells a story of Earth's dynamic past and the life it supports.</p>		
 		

Figure 26 - Educational panel developed for the location n°8 on QGIS's map

Chapter VI: General Conclusion

12 Conclusion

Cloudbridge Nature Reserve (CNR), a nonprofit American organization, is situated in the Rivas region of Costa Rica. It encompasses valleys of the Chirripó Pacífico and Uran rivers, constituting a vital biological corridor for diverse wildlife within a cloud forest. These forests are renowned for their biodiversity, although they constitute a mere 1 percent of the global forest (Eyewitness, 2005). Cloudbridge provides shelter for a distinctive array of flora and fauna, which have evolved to adapt to the cool and moist conditions characteristic of a tropical climate (The Editors of Encyclopaedia Britannica, 2024) classified as "Af" according to the Köppen-Geiger classification system (*Climat Rivas: Pluviométrie et Température Moyenne Rivas, Diagramme Ombrothermique Pour Rivas*, n.d.). The primary objectives of the reserve encompass the preservation of biodiversity, the protection of watersheds, and the promotion of scientific research and environmental education

The objective of this study was to methodically verify the effectiveness of the reserve's communication efforts with its visitors, employing the Logical Framework Approach (LFA). The research sought to answer the overarching question: *"How effectively does Cloudbridge Nature Reserve communicate its message to its day visitors and successfully engage them in learning during their hike through the reserve?"*

In order to identify and visualize eventual problems, a problem tree analysis was initially constructed to help uncover key obstacles or deficiencies in communication strategies. Accordingly, the research explored various aspects of Cloudbridge's communication by employing a multifaceted methodology. This entailed the use of a comprehensive questionnaire (see Appendix 1), field observations, data analysis, and interviews, all of which were carried out during the internship at the reserve. This analysis focused on the channels utilized to convey messages and how tourists received and responded to them. This was demonstrated through their behavior, level of engagement, and understanding of environmental issues following the response of the gathered direct feedback from surveys regarding panels at the end of their hike. By addressing these aspects, the study aimed to verify the presented issues and provide strategic recommendations for improving Cloudbridge's communication with its visitors, thereby enhancing the impact of its awareness initiatives and contributing to the promotion of sustainable and environmentally friendly tourism.

Sub-questions that guided this evaluation can now be answered:

- *What is the primary method utilized by Cloudbridge to disseminate its message within the reserve?*

The communication strategy at Cloudbridge is based on a multifaceted approach, encompassing a range of channels, including panels, guide tours, information displayed within the Welcome Center, personal interactions with staff members, and digital content on the reserve's website. Nevertheless, field observations reveal that only a small percentage of visitors participate in guided tours and/or enter the Welcome Center, which has insufficiently developed information presented.

As a result, Cloudbridge primarily employs educational panels within the reserve as a tool for communicating its message and engaging its day visitors in learning about the diverse ecological environment of the cloud forest. These panels serve as an integral component of the communication strategy, which aims to disseminate the reserve's core message regarding fauna and flora, the importance of biodiversity conservation, sustainable practices, and the specific ecological significance of the cloud forest.

The educational panels, installed exclusively on the Waterfall Trail among the five existing trails, are designed to enhance visitor comprehension of the cloud forest ecosystem and its ecological significance. The diverse array of panels is designed to provide detailed maps, ecological explanations, brief descriptions of the environment, and specific species of plants or trees within the reserve. Therefore, these panels bridge the gap between the reserve's conservation and educational objectives, and visitor engagement, by fostering a deeper understanding and appreciation.

- *What challenge(s) or barrier(s) does Cloudbridge face with its primary method utilized in effectively communicating its message within the reserve?*

Regarding the challenges that lie beyond the reserve's control, factors like rain and time constraints from visitors, have been identified as a significant barrier to visitors from fully engaging with the panels and thereby reducing the overall efficacy of the reserve's communication efforts. The survey revealed that while the panels on the Waterfall were noted as highly visible -noticed by 91.67% of participants- only 37.5% read all of them. Additionally, most visitors could not identify specific animal species encountered, suggesting that the current focus on plant species may overlook opportunities to enhance ecological understanding and learn more about the fauna.

The study highlights the need for a more strategic distribution of panels along other trails than the Waterfall to avoid overcrowding, and to provide a comprehensive understanding of the reserve's flora and fauna. While large groups often benefit from guided tours, individual visitors would gain from additional panels, and by being more visually engaging and concise. Currently, some panels are underutilized, missing an opportunity to enrich visitors' understanding of the surrounding ecosystem.

However, the reserve's primary focus on university and graduate students raises concerns about whether day visitors, who are defined as short-term tourists, are being adequately provided with sufficient educational material. This indicates a gap in the educational outreach efforts, suggesting that Cloudbridge could improve its communication strategies to better serve all visitors.

- Is the primary method of communication employed by Cloudbridge within the reserve effective or not?

The research methodology included both social and scientific elements involving interviews and literature reviews, which permitted the classification of the educational panel as useful and necessary for several reasons. These resources contribute significantly to raising visitor awareness of environmental issues and conservation efforts, advocating for sustainability among visitors, and providing both structured and informative hiking experiences. Therefore, the benefits of these panels are multifaceted, impacting both visitors and the reserve itself as well-informed individuals are more likely to support and participate in CNR's conservation activities, thereby contributing to its objectives and conveying its values. This also aligns with the concept of ecotourism.

The results from visitors and staff members feedback, underlines that the panels do enrich visitor experience and behavior. For instance, Madelyn Peterson -scientific officer- and Casey McConnel -marketing manager and development officer- assert that the panels can transform a simple hike into an educational journey by stimulating curiosity, and the importance of reaching day visitors who may not interact with staff. Although the majority of respondents and staff members support the expansion of educational panels throughout CNR, it is important to consider more nuanced perspectives, such as those expressed by Tom Gode - president of the CFCA Board of Directors-, who pointed out that careful consideration should be given to balancing educational goals with the preservation of the reserve's natural aesthetics and the practical challenges posed by certain trails.

- *What strategies or recommendations can be proposed to optimize Cloudbridge's communication efforts within the reserve?*

Building on the insights gained from visitor feedback, the study recommends expanding panel installation on the four other trails to optimize the effectiveness of educational panels, thereby enabling them to cover a broader range of ecological zones and species. Accordingly, by making scientific research accessible and clear to non-experts, it suggests diversifying educational content to include various themes, such as specific wildlife, historical reforestation, or night-active animals, among others to align with the diverse interests and learning styles of the tourists. In light of these considerations, new panels have been developed for the River Trail, incorporating updated information, QR codes that link to more detailed online content, and more visually engaging features to facilitate the reserve's evolution in its design and information display. The panel placement process involved conducting a thorough field survey within the reserve, to identify natural stopping points along the trail, such as intersections, or scenic viewpoints, ensuring maximum visibility and engagement while preserving the natural environment. This strategic approach ensures to maintain the reserve's natural state, in response to concerns expressed by some visitors regarding the installation of new panels and the potential for further enhancements to the educational experience.

Overall, the methodology provided valuable insights, although the variability of constraints presented a challenge when attempting to draw definitive conclusions about the panels' effectiveness. Therefore, to interpret the results more effectively, it is essential to have an in-depth knowledge of the inherent limitations. Furthermore, addressing these limitations in the context of potential methodological refinement in future studies could help ensure that the installation of informative panels is a valuable and effective tool in achieving the reserve's mission of conservation and education.

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Appendices

14.1 Appendix 1: Questionnaire form

Google form used: <https://forms.gle/Jzt1dZmSfNe44cvT9>



Figure 27 - Signage displayed at the Welcome Center

Your experience in Cloudbridge Nature Reserve / Tu experiencia en la Reserva Natural de Cloudbridge

We thank you for your visit in Cloudbridge Nature Reserve. We hope you enjoyed the hike as much as we enjoyed welcoming you.

Your insights are invaluable for an exciting research project tied to the Cloudbridge Nature Reserve in Costa Rica! As part of a thesis and internship collaboration, we're investigating the effectiveness of communication strategies aimed at educating and engaging visitors like you.

By participating in our questionnaire, you'll directly contribute to my mission and help us understand what works and what can be improved in Cloudbridge's communication efforts.

Your opinions and experiences matter!

Agradecemos su visita al Reserva Natural Cloudbridge. Esperamos que haya disfrutado de la caminata tanto como nosotros disfrutamos darle la bienvenida.

¡Tus ideas son invaluable para un emocionante proyecto de investigación vinculado a la Reserva Natural Cloudbridge en Costa Rica! Como parte de una colaboración de tesis y pasantía, estamos investigando la efectividad de las estrategias de comunicación dirigidas a educar y comprometer a visitantes como tú.

Al participar en nuestro cuestionario, contribuirás directamente a mi misión y nos ayudarás a comprender qué funciona y qué se puede mejorar en los esfuerzos de comunicación de Cloudbridge.

¡Tus opiniones y experiencias son importantes!

* Indique une question obligatoire

1. What's your name ?
¿Cuál es tu nombre?

2. How many people came with you to Cloudbridge? *
¿Cuántas personas te acompañaron a Cloudbridge?

Une seule réponse possible.

- ☐ A group / grupo
☐ With a partner/ Con un compañero
☐ In family / Con familia
☐ Alone / Solo

3. What's your gender ? *
¿Cuál es tu género?

Une seule réponse possible.

- ☐ Male / Hombre
☐ Female / Mujer
☐ Not responding / No responde

4. How old are you ? *
¿Cuántos años tienes?

5. Where are you from ? *

¿De dónde eres ?

6. What's your occupation ? *

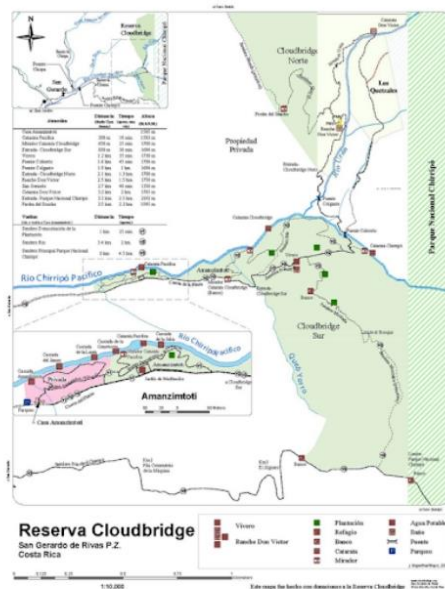
¿Cuál es tu ocupación?

Une seule réponse possible.

- ☐ Employed/ Empleado
- ☐ Not working/ Sin trabajar
- ☐ Retired / Jubilado
- ☐ In school / En la escuela
- ☐ Enrolled in University / Matriculado en la universidad
- ☐ Autre :

7. Which hiking trail did you take ? *

¿Qué sendero de excursionismo tomaste?



Plusieurs réponses possibles.

- ☐ Memorial Garden
- ☐ Waterfall / Catarata
- ☐ Sendero Montaña Loop
- ☐ Rio
- ☐ Cloudbridge North / Don Victor
- ☐ Sentinel trail (public)/ Principal

8. What was your motivation to go hiking ? *
- ¿Cuál fue tu motivación para ir de excursión?

Plusieurs réponses possibles.

- ☐ Tourism/ Turismo
- ☐ Escape/ Escapada
- ☐ Sport/Deporte
- ☐ Education/Educación
- ☐ Autre : _____

9. What was the highlight of your hike? *
- ¿Cuál fue el punto destacado de tu caminata?

10. Have you spotted any interesting animals during your hike ? (a bird, mammal, snake...) *
- ¿Has visto algún animal interesante durante tu caminata? (un pájaro, mamífero, serpiente...)

Une seule réponse possible.

- ☐ Yes
- ☐ No

11. What type of animal did you see ?
- ¿Qué tipo de animal viste?

12. Are you able to tell which species you saw ? *
- ¿Puedes decir qué especie viste?

Une seule réponse possible.

- ☐ Yes
- ☐ No

13. What have you learned from this hike in terms of nature, biodiversity, and environment? *
- ¿Qué has aprendido de esta caminata en términos de naturaleza, biodiversidad y medio ambiente?

14. Would you have liked to see more informative panels along the hiking paths, providing details about the environment? For instance, information about the various species you might encounter or the type of forest you're traversing could enhance your experience and deepen your understanding of the natural surroundings. *
¿Te habría gustado ver más paneles informativos a lo largo de los senderos de senderismo, proporcionando detalles sobre el entorno? Por ejemplo, información sobre las diversas especies que podrías encontrar o el tipo de bosque que estás atravesando podría mejorar tu experiencia y profundizar tu comprensión del entorno natural.

Une seule réponse possible.

- ☐ Yes
☐ No

15. Do you have any suggestion to improve the experience at Cloudbridge Nature Reserve ?/
¿Tienes alguna sugerencia para mejorar la experiencia en la Reserva Natural Cloudbridge?

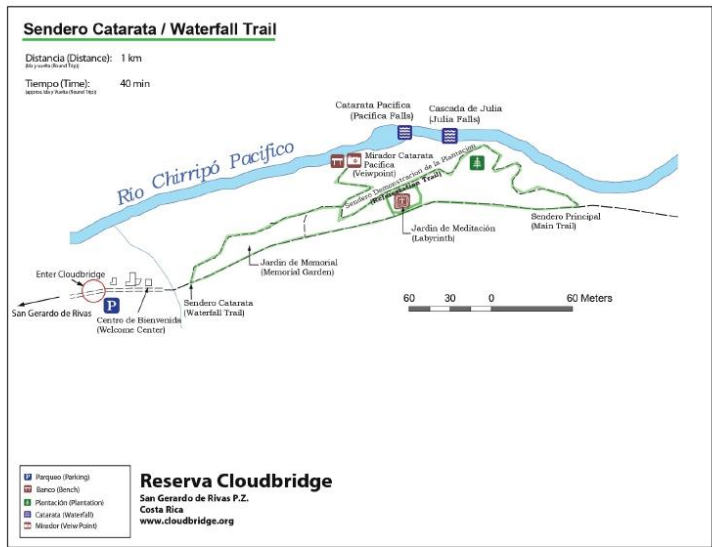
16. Did you took the Memorial garden/ Waterfall trail ? *

¿Tomaste el sendero del Jardín Memorial / Catarata ?

Une seule réponse possible.

- ☐ Yes *Passer à la question 17*
☐ No

Waterfall Trail /Sendero Catarata

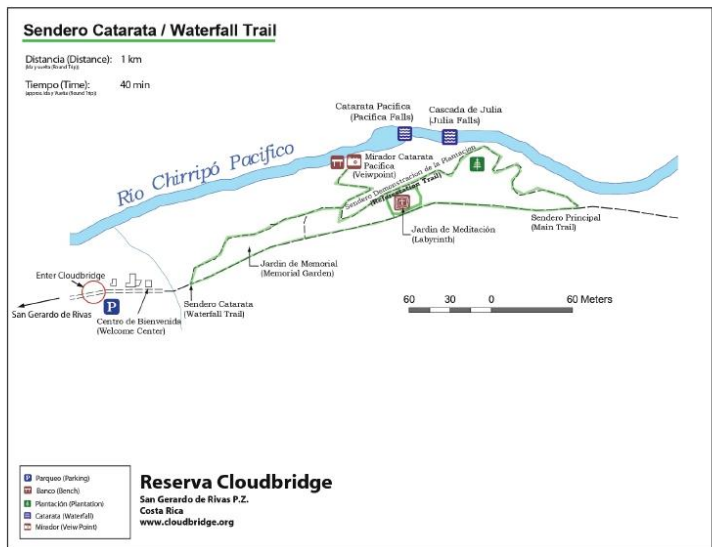


For the visitors of the Memorial Garden and Waterfall Trail / Por los visitantes del Jardín Memorial y del Sendero de la Cascada

If you have visited the Memorial Garden, I would appreciate a more detailed feedback for my project. The questions will only take a few extra minutes.

Si has pasado por el Jardín Memorial, agradecería una opinión más detallada para mi proyecto. Las preguntas solo tomarán unos minutos adicionales.

Waterfall Trail /Sendero Catarata



17. Did you notice the informative panels along the hiking trail? *
- ¿Notaste los paneles informativos a lo largo del sendero?

Une seule réponse possible.

- ☐ Yes
- ☐ No

18. How many informative panels did you stop to read? *
- ¿Cuántos paneles informativos detuviste para leer?

19. On a scale of 1 to 5, how informative did you find the content on the panels? *
- En una escala del 1 al 5, ¿qué tan informativo encontraste el contenido de los paneles?

Une seule réponse possible.

1 2 3 4 5

Not ☐ ☐ ☐ ☐ ☐ Great quantity / gran cantidad

20. Did the information on the panels enhance your understanding of the reserve and its conservation efforts? *
- ¿La información en los paneles mejoró tu comprensión de la reserva y sus esfuerzos de conservación?

Une seule réponse possible.

- ☐ Yes
- ☐ No

21. Did the informative panels influence your behavior or actions while hiking? *
- ¿Los paneles informativos influyeron en tu comportamiento o acciones mientras caminabas?

Une seule réponse possible.

- ☐ Yes
- ☐ No

22. Did the panels increase your appreciation for the natural environment and biodiversity of the reserve? *
- ¿Los paneles aumentaron tu aprecio por el entorno natural y la biodiversidad de la reserva?

Une seule réponse possible.

- ☐ Yes
- ☐ No

23. Did the informative panels engage your interest and hold your attention? *
- ¿Los paneles informativos captaron tu interés y mantuvieron tu atención?

Une seule réponse possible.

- ☐ Yes
- ☐ No

24. Do you feel that the content on the panels was presented in a clear and understandable manner? *
- ¿Sientes que el contenido de los paneles se presentó de manera clara y comprensible?

Une seule réponse possible.

- ☐ Yes
- ☐ No

25. Did the informative panels contribute to your overall enjoyment of the hiking experience? *
- ¿Contribuyeron los paneles informativos a tu disfrute general de la experiencia de senderismo?

Une seule réponse possible.

- ☐ Yes
- ☐ No

26. Would you recommend adding more informative panels along the hiking trail? *
- ¿Recomendarías agregar más paneles informativos a lo largo del sendero?

Une seule réponse possible.

- ☐ Yes
- ☐ No

27. Do you have any suggestions for improving the content or placement of the informative panels? *
- ¿Tienes alguna sugerencia para mejorar el contenido o la ubicación de los paneles informativos?

Une seule réponse possible.

- ☐ Yes
- ☐ No

28. Do you have any suggestions for improving the content or placement of the informative panels?
- ¿Tienes alguna sugerencia para mejorar el contenido o la ubicación de los paneles informativos?

25/07/2024 09:17

Your experience in Cloudbridge Nature Reserve / Tu experiencia en la Reserva Natural de Cloudbridge

29. Overall, how would you rate the effectiveness of the informative panels in enhancing your hiking experience and promoting awareness of conservation issues? *

En general, ¿cómo calificarías la efectividad de los paneles informativos en mejorar tu experiencia de senderismo y promover la conciencia sobre temas de conservación?

Une seule réponse possible.

1 2 3 4 5

Not ☐ ☐ ☐ ☐ ☐ Very effective/ Muy efectivo

Ce contenu n'est ni rédigé, ni cautionné par Google.

Google Forms

<https://docs.google.com/forms/d/1zefuGuL7DiDF1x1-xdNRUS7GCgViKiy3n0IFg2Np5k/edit>

8/8

Figure 28 - Questionnaire form

14.2 Appendix 2: Interviews

14.2.1 Interview with Casey McConnell

- **First interview on the 29th of March**

[C]: Can I record our discussion? Yes. Okay, perfect.

[O]: Thank you.

[C]: You're welcome.

[O]: So, at first, can you present yourself and your role?

[C]: So, my name is Casey, Casey McConnell-Smith, and I guess I've had a number of different roles here at CloudBridge, and I'm in a bit of a transition right now, so I'm not exactly sure. But yeah, like beginning in 2020 and up until very recently, then I was the director here at Cloudbridge, and I was in charge of... well at the beginning, I was more directly in charge with all the coordination of the casitas, and like pretty much all of it. But then over time we would have better staff, you know, dedicated to certain things, so then Anthony was the hospitality coordinator now, and so he's the one who answers emails and stuff, but that used to be me. And then, you know, answering for volunteer inquiries, and then of course research inquiries go to Greilin, but yeah, for some time now, like Max has been answering the volunteer inquiries. Like my role has shifted over time, and I think that the board wanted me to do more marketing, which is not something I'm so familiar with. So yeah, but I've been a friend of Clouddbidge since its inception in 2002, so it's really special to me to be able to see all that's happened here.

[O]: Yeah, and for that, can you give us like a general, like overview of all Clouddbidge, like has been born, and how it operates, and all that?

[C]: Sure, so Ian and Genevieve Giddy are a couple from South Africa, he has since passed away, but before 2002, I guess it must have been like the year 2000 or 2001, then they were hiking here in Costa Rica, they had gone up to Chirripo, and as they were hiking down, they observed that contrast that happens between when you exit the forest, and all of a sudden you're in a pasture, and they said: "wouldn't it be nice to do reforestation of like these types of pastures". And they weren't even thinking necessarily right next to Chirripo, they looked in many different places, but they ended up buying right here next to Chirripo, which is very nice. And they bought like a number of small farms, and in total they were able to reforest 255 hectares of land that had been in pasture, and then preserve another 23 hectares of primary forest.

[O]: Oh yeah.

[C]: Yeah, it's a very beautiful project. So right from the beginning, both Ian and Genevieve wanted to involve researchers and have research be part of it, and have environmental education be part of it, have the local community be involved, there's old pictures of school children planting trees here, you know, and now the trees are obviously quite large, so it's really been very rewarding, especially because in the tropics, forests grow so much quicker than they do in temperate climates, so 20, you know, now we're 22 years later, it's a very beautiful place where people like from Costa Ricans and also foreigners are able to enjoy nature, have that taste of like what it feels like to just be in nature.

[O]: Yeah, it's true. I saw like some pictures of it, like just on the signs and all, that I was like always so surprised, like how fast, it just like grew back.

[C]: It's amazing, it's very impressive and very beautiful.

[O]: Yeah, but I read some things that they had to change their strategies at first because it wasn't like effective ?

[C]: Exactly, so when they first began the reforestation, they didn't have very much experience, they didn't really have a nursery of trees like from this altitude, and they were very gung-ho, they were like: "yes, just let's get the trees in the ground, let's do it !". You know ? and so I think a lot of the trees were just planted in such a way that they weren't receiving enough maintenance. Some of the trees were not of this elevation, but rather like more lowland forestry trees, because a lot of the nurseries that sell forestry trees are located at lower elevations, and... yeah, I think it was just too much like "let's do this without ..." like, you know, thinking it through, and so over time different strategies were developed, especially in terms of like... for example, when we plant the trees, then we put cardboard around it, which helps kind of, it's a mulch to keep down weeds, for example, to keep the moisture in, and we also put like a stake with flagging tape right where that tree is, because... it's so unfortunate, but if you don't have that flagging tape when people are coming to chop it later, they might chop the tree. So I mean, it's so easy to lose a tree after it's been planted, so you really have to baby them for a while, and that's another thing that we kind of regularly schedule maintenance of the trees, so instead of letting it get to a point where the grass that's around it or the ferns are like out of control, then we go after like, I forget exactly what it is, but like after a number of months and chop it, and then chop it again, and make sure that it never gets too out of control right around those trees.

[O]: Yeah. What have been like the main challenges encountered over the years here?

[C]: That's an interesting question. I think that like my personal experience, of course, was that I began my position as director in January 2020. So like my personal experience, the main challenge has been COVID, which you know, we were basically shut down, even though it's an outdoor area.

[O]: Oh yeah ?

[C]: Oh yeah, like the government of Costa Rica, in an effort to kind of like not have people be traveling or moving throughout the country, they shut down all the national parks, all the beaches, all the kind of places where people might be able to go outside and enjoy fresh air and stuff. Which I think is very sad, you know, but it was, you know, it was very challenging for us, for sure. Of course, our, you know, internship and volunteer program involves people living together in close quarters.

[O]: Oh yeah. There were still like interns coming or not?

[C]: No, I mean everything shut down, there was no international traveling.

[O]: Oh yeah.

[C]: So what happened was ... everything kind of shut down like in March, right ? So... we had people that were already here, and so like people started hearing like, oh they might close international borders and stuff, and some people said: "I'm gonna get home right now", and they left even if their internship wasn't ended.

[O]: Yeah.

[C]: This poor woman from Australia had just traveled, you know, how many hours to get here, right, how many days to get here, and then she'd only been here like three or four days,

and then she had to leave. It was so sad, but you know, she obviously made the correct decision because Australia was closed for so long.

[O]: Yeah.

[C]: So, but then some of the students said, "oh my goodness, like if, you know, everything's happening, I don't want to go back to the UK and just be with my parents there, like I'd rather stay here". So some people extended their stay, and we had a group actually through until June, but then in June, then they decided that they would rather go and rent a beach house together, and so they all went off together. And then it was just, you know, I was here at the time, and the science coordinator that we had at that time was before Greilin, her name was Clara, she was from Spain, and we had a guy from the UK who was like the operations manager, like Max is now, and just the three of us were like, you know, here, Edgar and Oscar would still come, but very few days per week because we were trying to cut costs and not pay them as, you know, as much, and it was very challenging. I would go, we would have to go out and check the camera traps still.

[O]: I forgot about that. Was there like more animals coming and all that with... back then, like if tourists weren't bothering them?

[C]: I don't think necessarily here at Cloudbridge, but I know that in the Chirripo National Park. Because... I think you probably know that we have... we collaborate with a camera trap project that's in the park, and Enzo was showing me these images of like jaguars walking like on the main trail, which is not something that you usually see. So I think that our reserve is maybe not transited quite enough to make that big of an impact. But like for example, the Chirripo National Park for sure saw an improvement, you know, animals feeling more free. I mean, here we had, right like on these trees right here, at a time when we have volunteers here, you know, it wasn't right in the middle of COVID or anything, like after COVID we had put a camera trap there and we saw an ocelot a number of times.

[O]: Really?

[C]: Yeah, I mean it was before this research lab was here, so this building wasn't here, but like those buildings were there and there were people staying there and there were people staying here and stuff, and there was an ocelot going by here, you know, so... I don't think the animals mind us that much here at Cloud Bridge, but like I said, going up to Chirripo, there's like horses and so many people and people in the middle of the night and stuff, so I think that did make a difference.

[O]: Do we have here like a limit of tourists that can come, or... are we like, trying to find like the limits we have to do?

[C]: So that's one of the projects that Greilin and Maddy have been working on, like for, I guess I should ask them how that's going. But like defining what we call a carrying capacity is part of what we... you know, need to do. We haven't... I personally don't believe that we're, you know, approaching that number yet. But I had the opportunity to visit Monteverde Cloud Forest, which you may have heard of, I don't know if you visited there, but it's in private nature reserve as well, and oh my goodness ! It's like a really different scale, what they're working on. Like, you know, the amount of visitors that they receive, for example, so I don't ever want to like have us approach that scale.

[O]: Yeah.

[C]: I mean, they get like busloads of people, like there's a parking lot that's so huge, you know, and then like a shuttle service that brings the people from that parking lot up to the entrance.

[O]: Oh yeah.

[C]: And the trails were very short, like there's,... I did the whole thing in like an hour and a half, and they charged like \$35 to the entrance.

[O]: Was it like at Nauyaco... Nauyaca, Dominical?

[C]: So Monteverde is actually located... It's also kind of in the mountain range that divides Costa Rica, but it's further north, so they actually have the continental divide there, but it's like at 1,600 and something meters. Which is where we're at now, you know, the continental divide is up there... so they have the Quetzals, so it's very famous and everything, but it's like very different, it's more like on the way to Tilaran, but I haven't been to Nauyaca in a long time, but I've definitely kind of driven by when they have people going, and it's like so many people and so many cars, so I imagine that might be what you're saying. When I went, I had a wonderful experience at Nauyaca, but it was many years ago.

[O]: Yeah, so... Do you, in certain form, like want to explain like your... your, I don't know, your field and your lack of the tourists or not?

[C]: So because we don't want to kind of interrupt the wildlife and everything, like our main focus is of course on conservation, but also on education and research. So I think that what Cloudbridge is looking to do is to develop, not necessarily in like the amount of visitors that we receive, but in what kind of visitors we receive. So we would like to continue receiving more, for example, study abroad groups, groups that come up, like the group that you accompanied me with that time. Like groups that come to learn about the forest and to have like a more integrated experience, for example. Of course, our research and volunteer program is, I think, at the very heart of Cloudbridge. It definitely is kind of what... Cloudbridge staff focuses the most energy on. And I think that's, that's very good because it's really wonderful. Like I hope that you're having a good experience here, but I feel that it can be a very transformational experience. Like what we... hope happens, and I think that it does many times, is that people that have come here and done a three-month or four-month internship, when they go back to wherever they came from, they feel kind of a more... like personal, like connection to the environment that's there. Like because they got to learn how to see the environment, like through new eyes, you know ? So it's kind of like "oh not just the cloud forest of Costa Rica is valuable, but also the habitat that I have at home is amazing". And you know, and hopefully they'll be more curious. I mean, all of you come already. So you know about your habitat and stuff...

[O]: Yeah. So would you say like the main goal to Cloudbridge is to like educate people and sensitize ? not just like the researchers, but especially for this project, like especially like... even the tourists that come here, like they have... it's the main goal ?

[C]: Yeah. I mean, right now we have many tourists who just come as day visitors, so they don't really get that type of interactive experience quite as much. So to that end, we did put signs in, where I was pointing out when we did the tour the other day, like that's just an attempt for us to be able to... you know, make sure that even people that are coming just as casual visitors are still, like if they take the time to read, maybe learning something or going back with a little bit more awareness. But, and of course I can't speak for the board of directors, like what happens at Cloudbridge ultimately is the decision of a board of directors

that we have, of Cloud Forest Conservation Alliance, which is like the non-profit organization that owns and operates Cloudbridge. So... but my understanding from like my conversations with them is that as we mature and grow and kind of have to make decisions on what kind of tourists we want to have. That they would like to, like we said, we want to limit the amount of tourists so that we're not making a negative impact on wildlife and on the ecosystem. And probably focus more on, you know, people that are having more of an educational experience. So, I could envision even at some point in the future, a time when they might have much more limited day visitors and kind of much more focus on groups, for example. But I think that having day visitors or allowing day visitors is especially important for allowing access to nature to the local community. So, I would really hope that they never do like completely disrupt that. Yeah, yeah.

[O]: And plus the fees for the entrance go for all Cloudbridge, right?

[C]: Yeah, so any income that comes into Cloudbridge, which would include, for example, your accommodation fees, the fees from the welcome center, the fees when we receive visitors in our casitas, in our rental cabins. All of these income that comes into Cloudbridge is all invested directly into the operation of Cloudbridge. So, it's not like, you know "oh this is only for that and this is only for that". It's like every little bit goes into paying, you know, our workers and the health insurance and the... you know, different expenses that Cloudbridge has, all of the utilities and the things that we have going on. The car repairs and all of that.

[O]: Yeah, I see. And so, is it like... all the funding model is like?

[C]: What's that sorry?

[C]: So... my understanding is that, right from its beginning, CloudBridge has always had a focus on conservation, education and research. So right now, um, CloudBridge has a very nice kind of mission statement. In fact, I can maybe I'll look it up so I can just read it out loud to you if that sounds. Yeah, that's right. It's on our website as well. If you ever want to just see it.

[O]: Yeah, I looked for it like multiple times.

[C]: Really? And you weren't able to find it?

[O]: Well, yeah, kind of.

[C]: Would you want to open Cloudbridge website ? I can show you.

[O]: There.

[C]: So if you go to who we are, like right here, and then it says our mission, and if you click on that, did it not open?

[O]: Oh I don't know. Oh, here.

[C]: So it says here's the mission: "The nonprofit Cloud Forest Conservation Alliance supports and guides the operations of the CloudBridge Nature Reserve and seeks to expand the knowledge, skills, tools, practices and physical facilities available there. The CFCA collaborates with individuals, educational institutions, non-governmental and governmental organizations that hold similar values towards education, conservation and sustainability. Its vision is that the CloudBridge campus will become an international destination known for its thriving learning laboratory and variety of life-shaping immersive experiences in the Cloud Forest". So that mission statement was like all the words and stuff were worked over by the current board of directors. So that's kind of the more recent iteration. And then, of course, you

saw when you said who we are, then it has like conservation, education, research, all of that. So all of that is still a big part of all of it. But, um, but basically, like the mission statement, as they said, and you heard that they said like the vision in the long term is to kind of become an international destination. So... something that we might be able to do in the future is... Well, as I was saying, to host more study abroad groups, but also to maybe host specialty courses, for example. So last year, we were able to receive or to have a very renowned botanist come. Or even, you know, Hadiyah just recently came with the Moth Night and stuff. If we were to have experts to do kind of more involved things, last year we had a GIS course, we had the tropical hydrology course. If we started kind of advertising that earlier and kind of making it a place where even international researchers might want to say like, oh, I want to go do that course in Costa Rica, you know. And so that's, I think, more kind of the long term goal. But like I said, it all really kind of resides with the board of directors and their vision.

[O]: But like for the reforestation, all the land that we that in CloudBridge has now is all reforested. It's more like in the conservation, right?

[C]: So basically the conservation part, um, like we're not going to really be actively planting trees within our borders, but we do hope to continue planting trees in neighboring properties. So last year, for example, we were able to plant 500 trees at, you know, a piece of land that a man contracted us to do that. And so then the trees and stuff, which was a, you know, very exciting project to be able to do, and we hope to continue that. But I also see, for example, environmental education as directly contributing towards conservation, because, you know, we want, when you're planting one piece of land, and that's only so much, but if you plant seeds in people's mind of ideas and understanding, then all of those people will hopefully also be able to influence management decisions or make better management decisions to have more conservation.

[O]: Yeah. And do you have like some partnership with the locals? You talked about like you have cameras and all that. Who are they? Can you tell more about them?

[C]: Okay, so our biggest neighbor is, of course, Chirripo National Park. And we have a very good relationship with the management of Chirripo National Park. Both on the park level, and then also in Costa Rica, the management of national parks and conservation areas is done in like, there's certain conservation areas, you know. So here, we're part of the conservation area of Navistad Pacifico. And so like the regional office is down in San Isidro. So it's kind of a bit different from the administration of Chiripo National Park. It's the administration down there. And we also have a good relationship with the environmental educator from down there as well. So it's like, we have various venues of having collaboration with the SINAC, which is the Sistema Nacional de Áreas de Conservación. And then the camera trap project I mentioned there is with Chiripo National Park and with Dr. Mike Mooring from Point Loma Nazarene University. So he's been doing like camera trapping for many years. And we just really help with the logistics of it. We have... I mentioned that we do environmental education in schools. That environmental education program came about as part of a collaborative process that started with funding from the United Nations Development Program. But that funding has already ended. It was like a four-year program. So we do have materials and things, but now each organization is funding its own implementation of the program in schools. So those other environmental organizations include ASANA, which is the Asociación Amigos de la Naturaleza. Have you heard of them?

[O]: I read about them

[C]: So there's ASANA and then Los Cucingos, which is the... in fact, they're going to be having a like a mushroom workshop soon. I don't know if they mentioned it to you, but it's a very nice nature reserve, I guess, that was Alexander Stkutsch's, who's the very famous ornithologist. It was his farm and he donated it to the Tropical Science Center upon his death. And so, you know, it's kind of like the smaller cousin of the Tropical, because the Tropical Science Center, of course, operates Monteverde, which is a huge project in La Selva and like all of that. And then, yeah, Monteverde, which is an ecological association. And then, of course, the CRC, Chiripo, and Catacochi are kind of like what the Chamber of Tourism of San Gerardo, they administrate the services that are sold up at Chiripo National Park. So the lodging, the food, and the border services. So they're a huge employer, a huge economic force in the region. And they, of course, you know, have a very lucrative kind of business going on. And so they also kind of support other projects and things like that. And we're like part of, not that specifically, but like the Valle de Chiripo is where the Chamber of Tourism is trying to promote tourism also, like not in Chiripo National Park. So they're trying to make an online platform. And we're like part of that, we're a member of that Chamber of Tourism. Yeah, and with the Development Association of San Gerardo, for example, we have a collaborative relationship.

We try to have a good relationship with all of our neighbors.

[O]: Yeah, locals and all that. So you try to manage everything which you're surrounded.

[C]: Yeah, yeah, I mean, for us, or at least for me personally. There is nothing more rewarding than, for example, an experience that we had last year at the end of the school year when the children that had participated in the environmental education program, it had been implemented in six different schools that year amongst the different organizations. And so one child from each school who had done a good job and stuff with their parent were able to come and have an experience here at Cloudbridge and like spend the night here. Some of them spent the night down in Hotel Uran and we were able to do a night tour and we were able to go out birding in the morning and they were able to play games and stuff. And, you know, having seen the parents be with the children out in nature and everything, it was just such an experience, you know? A lot of the parents were saying: "wow, I'd never gone out like just me and this one child". Because in many families there's usually various children and it's very rare for like just one child to have the opportunity to go with one parent and like have an experience just for them. And like the kids were just saying the most beautiful things like: "oh, this is what I want to study when I grow up and this is so amazing". Like, it just felt so inspiring to me because these are the things that are experiences that like can be life-altering in a very positive way, you know? And now these kids are gonna be going back and transmitting that enthusiasm for the biodiversity and for all the things that are in the forest. And instead of seeing the forest at night as being something scary, they can see it as something really interesting and cool, you know? Like, I think that that makes a big difference. And like talking with Jenny Giddy, who I mentioned earlier is the founder, I think that she really values those types of things as well.

[O]: Yeah. So education is really important. I think even at the youngest age. And so do you have like some collaboration with universities or in scientific?

[C]: So we do have some kind of universities, like there's a regional campus of the UNA right here in Pérez Zeledón. And you saw at the moment we have three young men that are studying systemical tourism that are here with us for-

[O]: Los Ticos. Yeah. Oh, okay.

[C]: Yeah, they come from that university. I guess you had maybe-

[O]: Okay. Yeah, I didn't really know if it was just to help or to learn more.

[C]: So they're doing kind of like a small internship.

[O]: Okay.

[C]: It's a 70-hour internship. So they're, so yeah, like that's something that happens usually once a year. Usually at this time of year, because it's easier for them to come up here, to stay up here during like the Easter week. But, so that's like one university that we have a good relationship with. In addition to receiving students who want to do their internship, we also have one professor who always brings like his student groups up here as well. And so we're able to walk around and talk to them about ecosystem services and all those kind of things. And then the other kind of university that we have received students from and that we kind of like, for example, Hansa, who taught the GIS courses, works there at the university and stuff is with the Technological Institute of Costa Rica, which is where I studied actually as well, but I didn't study forestry. And the forestry department is like where we have a career, you know, very loose type of collaboration, but we do have, you know, it's very nice to have that relationship where we talk with them and stuff. And then also the UCR, which is the University of Costa Rica is where they even study. We received some students from there as well. But yeah, I guess, you know, it could be strengthened even more, but, and then in addition, we have like international universities that continuously send us people, for example, to find out how far Einstein from the Netherlands, we usually have some interns from them at any given time. Yeah, I don't know if at your university they mentioned us or...

[O]: I never... I had to really try to find it. I was like, no, I want to go like in Latin America. And, but I had to do all the things by myself and I was so happy to find something.

[C]: Ah. So that's very interesting. That's where we have the opportunity. Like, you know, maybe like if.... you were to give me the information of like the office that could have helped you, you know ? I don't think say like, why don't you have our information here for people, you know, that would be a very good strategy.

[O]: No, it was, it was hard actually it was really hard.

[C]: I'm so glad you did it

[O]: Yeah, me too. I wasn't sure if I would make it there. Even when I just like had the reply of... I think it was Greilin. And she was like, just saying back what I... what was possible to do and things like that. I was like: "am I taken or not? Do I still have to like try to find something?". And I didn't know if I was taken. And then we had a call and she was like: "yeah, no, you're already in it". And I was: "okay, thank you !"

[C]: I guess maybe that's something that we keep trying to do is make it be more clear. Like: "yes, you are accepted !".

[O]: Yeah, yeah, please. Because I was still like trying to find some other people. I had another one, like more at the Pacific Ocean. And it was like, I don't know, but it was really close to the sea. No, it was at the border of the sea. But it was like lost. And I was like, no, no, no.

[C]: Yeah, no, for us, like we kind of like say like, okay, this person is actually serious once they've paid their deposit, you know?

[O]: Yeah.

[C]: And so like once we invite people to like pay their deposit to confirm, like that's us kind of saying like, yes, if you pay your deposit, you are gonna be in. But you know, it does happen that people like, you know, don't.... they say that they're confirming, but if they don't pay a deposit, then it's like you're not sure. But I've noticed that sometimes with Greilin, like we'll have people that are confirmed that they're coming, they're gonna be here today. An I'm like: "but when did they pay their deposit?". And it's like: "oh no". So I mean, it does happen sometimes that people haven't paid their deposit yet or whatever, but yeah, people, I think that it's usually goes very well, you know?

[O]: Yeah. Like most of the time, and plus you're just here, you can't, you're blocked in the middle of the forest, so. So I have a question about the trails. So how cloud bridge ensure the maintenance of the trails, the buildings and all of the other structure ?

[C]: So we're very thankful that we have a very dedicated staff with Edgar and Oscar and Steven as well. And basically they're the ones that, you know, painting the trails and also do maintenance of the buildings.

[O]: Yeah. And like for the trails, how did you like establish them? Like, was it already?

[C]: Most of them were already pretty much established. So this main trail actually used to be the main trail up to Chirripo National Park. But that was, I mean, that was before it was a national park. So it was a long time ago. But that's why, like, for example, in the kind of maps of the government and stuff, this appears actually as a public road, the trail all the way up to Los Quetzales. So, you know, obviously the municipality is not maintaining it or anything. It's a trail, but it has origins from before cloud bridge. The same with the trail that Montaña joins up with. But for example, well, in Gavilan. So Gavilan already had like a little structure there before we bought it. But of course that structure wasn't as complete as the structure that's there now. So cloudbridge did kind of invest in that, but that kind of little trail already did exist. And then I think that you get also, I think that almost all of the trails were just kind of like continuing along the footpaths that other people were already using. Because you have to remember all of this wasn't just like untouched virgin land. This was land that people were doing agriculture in. There was like pasture. There were people living up here. Like I know some people that were probably living way up there. So most of the trails were already pretty well established.

[O]: So like the main problem to still like try to maintain for the bridges?

[C]: The bridges have been a challenge at times for sure. And yeah, I guess that would be the main thing. So there had been like where now what we call Shakti's Bridge, like the kind of building nicer new bridge. There had been previously a covered bridge, like a cement bridge. So I mean, just imagine that's how much people were living up there and stuff. So that bridge got washed away one year by a storm. So, and then there had been also like Ian and Jenny, like the founders of Cloudbridge had invested in a bridge, like a really nice suspension bridge over the Uran River. And we actually had a dispute with our neighbor, the Tarahumara where they destroyed that bridge. So that was-

[O]: Really? Oh no.

[C]: Yeah. Oh, I'm sorry, Olivia. It's already one and I have to meet with Tom.

[O]: Okay.

[C]: Would it be possible to do this interview in two parts?

[O]: Yeah, we can do that. Yeah, it's possible for me. Don't worry.

[C]: I'm glad that I just looked. I was like, it's like this been going on for a while.

[O]: Yeah.

- **Second interview with McConell on the 8th of April**

[O]: I'm fine, I'm fine. It's really tough to just try to do a meeting call.

[C]: Yeah, I apologize for the technical difficulties. I don't know why it's giving me so much trouble. But I hope that you can hear me smoothly here on WhatsApp.

[O]: Oh yes, from the moment it's going well. So I hope it will keep doing like that. So I will try to make it quick for you, because you've been like trying for 30 minutes now, and I don't want to let you like that.

[C]: Okay, sounds perfect. And yeah, I'm sorry that it wasn't working.

[O]: Don't worry. So it will take maybe like 30 to 40 minutes of talking, and it will be okay after.

[C]: Okay, sounds fine.

[O]: Perfect. So you... I had a question about like the visitor's awareness and education. What kind of efforts are made to raise visitor awareness of conservation and biodiversity during their stay at Cloudbridge? Is there any actually?

[C]: I'm sorry, I wasn't able to understand entirely the question because it was sounding a little bit garbled. Could you please repeat?

[O]: Oh yeah, sorry. So what kind of efforts are made to raise visitor's awareness of conservation and biodiversity during their stay at Cloudbridge?

[C]: Taking, for example, a guided tour. Are you able to hear me?

[O]: I didn't hear you. No. Were you speaking about guiding tour?

[C]: Can you hear me now? Maybe I have better internet now.

[O]: Yeah, I can hear you. Do you hear me?

[C]: So I'll try again, and I hope you can hear me. So that's a very good question. And we try and reach all visitors to Cloudbridge. For example, people that are taking a guided tour or, for example, researchers such as yourself, have many more opportunities for conversation and for talking about climate change and ecosystem services and awareness of the importance of conservation. But, for example, day visitors do not have as much opportunity to interact with staff of Cloudbridge. And so for those types of people, we do have signage. So we have signs that say very simple messages about conservation. I'm sure you've seen those signs like on the Sendero Catarata.

[O]: Yeah, I did. But I felt like it was just like for the memorial garden and not for the other trails.

[C]: Yeah, after the memorial garden, if you continue along that trail, then there's kind of six more signs. And the last one is at the monkey comb tree. So it's seven signs in total. And all of the signs talk about different aspects like ecology and things like that.

[O]: Yeah. But like for the other trails, as for the North Cloudbridge Trail and the Montana Trail, all that don't have the signage.

[C]: No, no. And that is something that, you know, we could improve over time. For example, you've noticed probably how there's a sign that's in very bad shape right near the Sentinel Creek, like where the turnoff to Sentinel is. So the idea is to have a very nice kind of metal sign there. It's not only about the trails and the map of Cloudbridge, but also about how amazing this area is and this ecosystem and why is biodiversity important. Maybe mention climate change. You know, I think it's very interesting. That possibility yet at Montana or at Cloudbridge North. And so hopefully at some point, maybe, you know, other students would want to take that on as a project. And I was very happy with the way that the students that produce the signs that we do have. I feel that they did a very good job in conveying it kind of in an easy to understand way, you know. So hopefully some other students might be able to come up with other signs.

[O]: Yeah, sure. Yeah.

[C]: And then also our website has. Sorry, just to finish answering the question.

[O]: Yeah, sure.

[C]: We have visitors and people that come, but also people that visit our website can also learn about conservation and just about like different aspects of reforestation and of the cloud forest. So those are different ways in which we do this type of education and awareness.

[O]: Yeah. And also you talked about like the education awareness programs. What was the name again? How much time actually gets to do some programs like that?

[C]: Are you talking maybe about CONUBI, which is a program that we do in the local schools? Yeah. So CONUBI is an acronym, which it means like kind of the first syllables of different words, you know. So it's from Spanish. And so CONUBI is a program that was created with a number of different environmental organizations, including Cloudbridge, and it's eight modules. And those modules are given to the same group of children throughout the year. And it's, you know... it's really a wonderful program. I've really enjoyed seeing the children respond to it and their parents as well. So, yeah, I'm very happy to be able to participate in that.

[O]: And do you see like an impact on the local and international person that you're working with, with this type of programs?

[C]: Yeah, I think so for sure. So I think I might have told you about the activity that we had, like kind of at the end of the school year. And so children that had participated in the program and CONUBI and had done all their homework and stuff, we selected one child from each school that could come and spend time at CloudBridge and spend a night. And some of them stayed at CloudBridge and some of them stayed at the Hotel Uran, and they were able to do a night hike and things like that. And that, of course, gave the opportunity for me to, you know, see, talk to the parents, for example, and talk to the children and see what kind of impact we've been able to have. And it was really, really nice. Like we got such amazing feedback of children saying that this has been a life changing experience for them. And like you've seen how it is at CloudBridge where people are excited for biodiversity.

[O]: Yeah.

[C]: And it's kind of like opening these children's eyes to that possibility. And so I think that's, you know, a very positive impact that we've had. And then I've also had the opportunity to just talk with people, you know, people that I see out and about in the community. And they'll mention to me, you know, like, oh, CloudBridge has been so cool because of this, you know? or, oh, you know, I heard about this that happened at CloudBridge. Is it true that there is a jaguar there? And, you know, just that type of I've heard of a term that's called eco-literacy. So it's like becoming literate about like the world around us, you know, and ecology. And I think that CloudBridge has actually been able to take a little bit of a role in teaching a little bit more of that eco literacy to the community at large.

[O]: And, yeah. So, yeah, you see a lot of change also in the local community and all that. And, yeah. What can I say? And do you think...

[C]: The interesting thing about the community. Oh, I'm sorry.

[O]: No, go on, please.

[C]: I just wanted to add to that, that the community kind of like of San Gerardo, because one of the main kind of drivers of industry and of tourism, of like the economy is the tourism that comes from Chiripo National Park. And so San Gerardo is especially prepared to be like a very ecologically minded and kind of eco tourism type of place. And I think because the park is such an important part of everybody's life, then the kind of like proper management, not only of the park, but of the buffers zones of the park is something that people are much more willing to kind of like work with and to say, this is our priority than they would if they didn't live right next to a big national park.

[O]: Yeah, that's true. You talked about like, are you helping each others with the collaboration you have as with like the Chirripo Park that is just like beside us?

[C]: I'm sorry. Could you please repeat the question?

[O]: So how do the collaboration you have with other institutions and organizations contribute to achieve the reserve goals?

[C]: Okay, thank you. That's a good question. So I just mentioned Chirripo National Park. So, for example, we have a very good relationship with the administration of that park. And that helps us to, you know, they're our biggest neighbors. So it's important to have kind of those boundaries and stuff or that kind of shared mission that we have of protecting biodiversity and stuff. So just that collaboration and that kind of location that we have right next to the park is a very important collaboration. I also mentioned kind of the other organizations that that together developed, for example, the environmental education program I just described. And so, for example, that activity that I described, it's kind of like each of those organizations was also represented by, you know, the women that are in charge of it. And so for me, it was also an opportunity to share with people in similar things that we are. And I think those types of collaborations are very important.

[O]: Yeah, sure. I actually just have like two questions left. So how do you collect visitor's feedback and use this information to improve your service?

[C]: Thank you. That's a very good question as well. And in fact, it's something that right now needs improvement because I'm sure that you've probably worked at the Welcome Center. And you've probably seen that we never have any of the little papers printed out. But like we

have a little box that says "feedback". And we have a template where like we could have a whole lot of little papers that are kind of small and say: "what did you like most about your visit? What would you recommend that we improve upon in any comments?". And it's very simple for people when they're exiting to write down like, oh, I like this and that. But we need to improve that system. And right now, Max was just gone and stuff. And as you know, CloudBridge is kind of going through a reorganization. So I'm sure that we'll get the system in place. But that's part of it. We also have a QR code there if people want to do it online. But that one is not something I'm really going to recommend to people as much like, oh, can you get out your phone and do this QR code? But I think that writing it down with a pencil is kind of really nice because we usually do get very nice verbal feedback from people. I'm sure you've experienced it when people will come out and say, oh, I had such a wonderful time.

[O]: Yeah, it's true.

[C]: We also send out an email to, for example, people that come and stay in our cabins or people that take a tour a little bit after, like the week after they do that. Then they will receive an email from us kind of saying: "thank you so much for coming, for your visit, for your stay with us. Do you have any feedback for us?" And so, yeah, not everybody takes the opportunity to give us that information. But we do try to listen to it and we do try our best to constantly be making improvements.

[O]: And do you think there's like future researchers, future research projects that should really be foreseen for the future of the reserve?

[C]: I envision a really kind of bright future for the reserve. I think that, you know, the mission that it has had from the beginning, which is of environmental education and conservation and research is more important now than ever. And so my vision would be for CloudBridge to kind of become like a really renowned center for learning about, I don't know, ecological systems and biodiversity and all of that. So, I don't know, I do think it's important to kind of dream big. Because, as you know, like CloudBridge not too long ago was able to acquire some land that, you know, up until then was out of CloudBridge's reach for financial reasons. And, for example, the land that is right kind of when you're arriving to CloudBridge on the right... I mean on the left, so it's like on the side of the river when you're driving up to CloudBridge. And there's like big bamboo and things.

So that is land that, for example, has been offered to CloudBridge at a price that, you know, is ridiculously expensive, but also, you know, relatively reasonable if donors have a lot of money, you know. I do feel that, you know, there are possibilities for CloudBridge to expand a little bit its kind of geographical footprint as well, which would of course be a benefit too.

[O]: Yeah, I hope it will be good also.

[C]: Yeah, thank you. I hope it works out. That's why it's good to be able to dream, you know? The research lab, for example, as well was just a dream. And then, you know, we were able to make it reality. So, you might as well keep on dreaming.

[O]: Well, it's still expanding. So, I think like everyone is just like going more and more and want to like... see the new research, the new things and see things just like the nature coming back. And it's like a benefit for everyone.

[C]: Yeah, I mean, yeah, it's very nice to see how much everything has come back in terms of nature. And in terms of like the infrastructure that CloudBridge has, you know, having more infrastructure means more maintenance and things like that. So also, we have to consider that

and not necessarily want to expand much infrastructure, but make the best of the infrastructure that we do have.

[O]: Yeah, that's true. So, it's already the last question that is not really a last question, but like, is there anything else you would like to share about CloudBridge Nature or about the research and or experience even?

[C]: I, no, I mean, I do want to kind of request, Olivia, because, you know, I've been very kind of honest with you... And as you know, like I just recently had a readjustment with my position and everything. So maybe, you know, don't, I don't want to come off as being like very like too critical of... the organization that runs CloudBridge, you know, Yeah.

[O]: No, don't worry.

[C]: So, yeah, that's, I guess, just a comment. But no, I think it was a very thorough interview. And I am so happy that you're spending some time at CloudBridge. And I really wish you the best with your research project.

[O]: Yeah. Thank you also for taking time for responding to my questions and all. And I assure you, most of the time, you're just like, like, praising for all the good things that is there in CloudBridge. And I know that you really love and we can feel all the love you have for this reserve. So, yeah.

[C]: Oh, that's very sweet.

[O]: Yeah, it's true. We can see, I think everyone can see how much, how much love you have for this. Like, even when we went on the tour... for the tour guide and you needed some help. And I was there with Kristen. I was like, yeah, she just knows everything. And she's really like attentive. She's there for it and all. And I was really appreciative. I had a good, I don't know the word. But like, really, it's like appreciation.

[C]: Yeah, appreciation.

[O]: Okay, I can't say the word, but you understood.

[C]: Thank you very much. I really appreciate you saying that, Olivia. I... like, I really did consider CloudBridge to be kind of almost my own project. So it's been a bit of a, like an emotional change for me to take, you know, so much of my attention, like at Cloudbridge, but I do think it's going to be better for me. And probably for CloudBridge too in the long run, but at least for me to have this kind of more work-life balance, you know, I think it will be very good.

[O]: Yeah, I think so too. I always say to myself that, like, even if things are just happening for a reason, like, even if we don't say that now, like, it will be better after. So yeah.

[C]: Yeah.

[O]: Thank you for everything, Casey. I will let you do your night.

[C]: Oh, thank you, Olivia. Yeah.

[O]: Thank you.

[C]: I hope you have a good evening and you enjoy, you know, your dinner and everything. And I'll be up on CloudBridge like probably Wednesday.

(C. E. McConnell, personal communication, 23 March 2024)

14.2.2 Interview with Madelyn Peterson

[O]: So, okay, first question. Can you present yourself and your role in Cloudbridge?

[M]: Sure, so my name is Madelyn Peterson and I work here at Cloudbridge as a scientific researcher, as you know, and so my role mainly is to be a mentor for the students that come here. It's very diverse, there's not really one single thing that I do. So sometimes I'm helping people with projects like yours, which is much different, these are quite unique projects. Or doing things with frogs or reptiles or birds, really whatever someone comes to me with, I can try to help them with that. So I'm pretty versed in a myriad of topics, which is nice. And then I also help out at the end with, um, I wouldn't say grading reports, but giving suggestions to the reports that you guys write to try to improve it, whether it be grammar, or maybe there's something that I feel is missing, or, you know, saying it's really great, because normally the reports are really nice. So that's pretty much what I do.

[O]: And so how would you define the main, the primary mission of Cloudbridge nature?

[M]: So I think it's in a transition period now. In the very beginning, the main goal was obviously to reforest the area, which has been really successful. So all of it was pasture land, and now most of it, if not all of it, is forest. And so now that we have access to a forest, like a special cloud forest, that is quite rare globally, I feel like the main IGNS focus is changing a little bit to really focus on the science and what can be done here, so the research that can be done.

Because some of the research wasn't possible before, because there wasn't a forest. So now that there is, we can really have detailed projects looking at different aspects of the forest, and the maturity, and the different succession, or the different climatic impacts.

[O]: Wait, wait, I'm going to... Guys, can you... Tom, can you let this slide do a little bit, please, because I work all day and I'm trying to do my interview, and I'm not concentrating here. Yeah, okay, thanks. I'm so distracted easily, I'm so sorry about it. So yeah.

[M]: Do you want to sit outside?

[O]: No, no, it's okay, because like... outside we'll have just more background, so it's just fine like that.

[M]: So yeah, so now I feel like we're more focused on finding specific projects that we can have here to research. Yeah, even more things. So now we can look at soil, or vertebrates, or macroinvertebrates, stuff like that. So the options have increased of what we can research. And also we can look at the change of species prior to the reforestation.

[O]: Yeah. And do you think there's a lot of changes in the climate change and all that?

[M]: Um, I would say so, yeah. I think it's a slow process, obviously, but I think the main impacts in an area like this, the biggest thing would be the precipitation. So, because obviously in the afternoons you can see the clouds, you know, they come through, right? That's going to change. So they're going to move up in altitude over time, which is a huge issue, because the mountain is so high. And once there's no more mountain, you know ?it's kind of messed up. So I think that's the biggest threat.

It hasn't really happened necessarily yet, like we still have nice cloud coverage. But also the time, like the seasonality of things blooming, or when the rain comes, when the rain stops, that's all changing. And that happens quite fast.

You know, every year it changes by like a few weeks, which is like over time could be a few months, and then it's all out. So it's stressful.

[O]: Yeah. And what are the main long-term goals for Cloudbridge ?

[M]: I think long term, having more associations with universities. So we have a couple of universities that we have a deep connection with, and I think the goal would be to increase that with other universities as well, especially with Costa Rican universities.

We don't really have strong connections with the local universities, which is a shame. And so I think establishing that relationship is a long-term goal that we have, to try to get more national researchers to come and do research here.

[O]: From Costa Rica?

[M]: Exactly, yeah.

[O]: It's true. And that's true, actually. It's just like from Europe and USA. And you really never did have a Costa Rican before, apart of the TICOs that came like for one week?

[M]: Yeah, we've had a couple, but they usually only stay for maybe a few weeks or like a month. At least from the time that I've been here, we haven't had a long-term Costa Rican researcher here doing this type of stuff that you guys are doing. So ideally we would have that in the future, because I also think that would contribute a lot to your guys' experience, because common feedback I hear is like: "oh, I didn't know it would be some English-speaking, or it would be such a European environment". I think people expect to have more local people up here, and there just really isn't, besides the staff. I mean, I'm not Costa Rican, but I think that would be ideal for the future.

[O]: What are the main sources of funding for the reserve?

[M]: So...I would say there's two big ones. The first one is an association we have with a school in the U.S., and it's a very short-term period. They're here for two weeks, but they do this really big program with this science school in the U.S., and they pay a significant amount of money while they're here. And then looking at the rest of the year, the rent that you guys essentially pay to be here is a huge source of the funding, which is why it's so important to have people doing research here.

One, because the research is important, but two, it becomes a self-sustaining system where the research is getting done, and you guys are paying for that experience as well. And then the casitas, I would say is number three, like the rentals that people can stay at for visitors. I think that's the third one, but mainly it's all from you guys, really.

[O]: I thought it was more for the donation and all that.

[M]: So, the donations have been usually project-specific. So, we had a donation to build this lab, for example. We had a donation to buy the newest property that's over on the Don Victor Trail, things like that. We've gotten really big donations, but on the day-to-day finances, like if we need to, I don't know, pay my salary, for example, or anyone's, or pay for reparations here, like the fridges that just got fixed, stuff like that. That all comes from you guys.

[O]: Okay, okay. Makes sense. What are the challenges related to the financial management?

[M]: Challenges of the financial management?

[O]: Yeah.

[M]: I think it's a tricky one... I mean, there's no immediate threat, which is nice. Obviously, tourism, in general, that needs to maintain a high level. Let's say, for some reason, we didn't have people coming. Let's say we only had like five people here for the whole year. That would be a big issue. So, the marketing of CloudBridge ties into the finances, because if CloudBridge isn't marketed well on websites, or like job boards, or on social media, people won't know about it, and then they won't come. And so, it's hard to say for sure. I mean, in this moment in time, there's not really an issue. It is a non-profit, so the money that we do have isn't for this like, you know, extraneous things. Everything goes back into the forest, or into the reserve. Yeah, I think, for the moment, everything is pretty okay.

[O]: And do you know, like, how the people just like found about CloudBridge? Because apart of Tamanca or Chiripo Park, you're not like as big as them. And like, even on the road, we don't see like "CloudBridge Reserves is that way", or something like that.

[M]: We have... we've posted on a few job boards. So, when people are searching like conservation internships, or ecology internships, like all those keywords, CloudBridge, we've like programmed our job boards to like show up if people are searching for that kind of thing. So, I think that's one way, and then also the affiliations through schools is another way. So, there's like three schools in particular that CloudBridge gets recommended to them as a potential study abroad place. And then, yeah, other ways, I guess, would just be looking if people are looking for a specific like cloud forest experience. There's only a few of those, and CloudBridge just happens to be in the cloud forest. So, you pop up if you're searching for that, I guess. It could be better marketing for that. It's kind of random, I think.

[O]: Yeah. And do you have like, when they come, like when the tourists come and all that, do you have like feedback? Do you... and be able to collect them?

[M]: It's a very short feedback, like three questions short, but we do have it down at the Welcome Center. So, after their stay, I think Anthony is probably the best at trying to get people to do it, because that's kind of his job. But there's a short questionnaire that's, you know "what did you like about your visit? What didn't you like about your visit? And any recommendations". Yeah. So, it's really short, just so it doesn't take too much time. And we, yeah, we can collect those and look over them, see if there's any feedback people have.

[O]: Yeah, I did see that. It's the thing where you put in the, yeah, it's not really cool. I was actually like thinking about like also the QR code and if it was used or not, because I never saw someone like really getting patient, even just like every time they're going to say "yeah, do you have a map? Or do you have like a Wi-Fi?" Because they never like... really look at the whole thing actually. So, what are the main measures taken to ensure a qualititc customer of the experience, like even for just the tourists?

[M]: It's a good question. To ensure good experience. I mean, I think, because the main experience people will have while coming is being in the forest. That's the whole thing. So, I think maintaining the trails nicely, that they're relatively accessible for everyone is really important.

But also maintaining it in such a way that it still feels quite wild. I think when people come to Costa Rica, especially if they're not from Costa Rica, or even if they are Costa Ricans, I think they're expecting something quite wild, like a jungle. And so, we try not to tamper with the forest too much besides planting the trees and making sure the bridges are safe. I think the forest really speaks for itself, which is quite nice. It makes it easier for us. It's beautiful. And so, as long as we can make sure the trails are clear, and people can walk anywhere they want to, that isn't a private trail. I think that ensures a pretty good time for most people. I think the

price is what makes people most upset, which is kind of annoying. Because, like I said earlier, any money that comes into Cloud Bridge goes back to Cloud Bridge. So, it's not for profit. We're not collecting money at all. So, things like paying the entrance fee would help to fix certain things, or to help pay the maintenance people to make the trails better, stuff like that. So, I think that's the biggest downfall. But usually, it's just people enjoying the forest, which is pretty nice.

[O]: And do you make some efforts to raise people's awareness of their surroundings and environments?

[M]: I think that's something that is lacking, actually. Yeah, I think that could be improved. The only time that an effort really would be made is if someone has a tour. So, if someone pays extra for a tour that a tour guide, Oscar, would give, or if we have someone like Nathan that was here that's solely here to give tours and do some other miscellaneous things, only then would you really learn about the in-depth process of the project, or the surroundings, or this environment, this ecosystem. But kind of like what you said earlier, there isn't really other opportunities when you're in the forest to learn about it. You can maybe take some pictures and read about it later on your own time. Or in the welcome center, there's some stuff as well. But once you go into the forest, there's really not that much support for that kind of stuff. I think that's something lacking a little bit.

[O]: Good for me. About the scientific... Wait, I'm just thinking about that. I have a lot of questions, actually, but I'm just trying to pick the good ones. For those scientific part, what main role would you say that they're really helping for CloudBridge?

[M]: So, I think having... Okay, well, it's hard to pick just one. But I think having a long-term data set and databases of information of this area is probably the most important thing long-term to help CloudBridge.

Because even when I started working here, for example, there were certain things that... There was information I didn't have, which makes it hard for me to do my job. Because then if someone asks me a question about a previous study, or if something has been done here in the past, I don't know. And so, a big change that me and Max made when we started working here was to have everything be really detailed, and have everything be shared information within the staff. Because a data set in a place like this, when you're trying to do science, having a data set that is cataloging everything you see, everything you do, inherently, it just helps the future projects. And it supports science in general. So, in my opinion, that's the most important thing, is to have a history of what has been done and what we did, so that you can continue to do it, or change it, or at least know what was going on in the past. Because that was really lacking a lot.

[O]: Yeah, I can also... Even me, I tried to find some map, but I didn't really know where it comes from, if it was really true or not. I was like, okay.

[M]: There's no methodology of how people did certain things. So, how the maps were made, I don't have a methodology of how they did that. I don't know how they did that. I don't know how qualified they were. It's kind of an issue, which is why we're trying to remake the maps this year. Or with certain data sets, there's some species where I'm like, did they actually see that? I don't know. There's no catalog of it. So, I think improving that and having that be a standard going forward is really helpful for really supporting the science of it in the future.

[O]: And what do you see as future projects that can be done here?

[M]: That's a good question. I mean, there's loads. I mean, everything that we're currently doing can continue. So, the really basic ones like the camera traps, the herping, the birds, that's pretty easy to continue. I think... I personally worry kind of what you asked earlier about the changes in the climate of the future. So, I think having more climatic studies, it might not be very exciting in the moment, but over time, collecting data about precipitation or about the river, the levels of the river, the temperature of the river, all that is going to be really important in like 15 years. Because then you can make comparisons as to what it should be versus maybe what it will be in the future. Yeah, we haven't really done that. So, I think that'll be important.

[O]: And that is going to be like really a long term, like for like 10 years at least. Yeah.

[M]: And there'll be multiple people would have to work on that, collect data. It may even be something the staff has to do, just because it might not be the most exciting for them to come here and like look at the rain, or look at the climate or whatever.

[O]: Yeah. Why do you think CloudBridge has an impact on the international public or even national?

[M]: Hmm. I mean, internationally, I think it gives an opportunity to be immersed in this environment. Especially in a place like Costa Rica, it's quite expensive. I'm not sure how much you've traveled other places in the country, but it's very expensive to do really anything, especially if you wanted to get like a guided tour. And I think comparatively, the prices we have are more affordable. So, on an international scale, I think CloudBridge is a good opportunity for people to be able to go and experience something like this. And also for the interns that come here, being a genuine research station where people are actually collecting data, doing science is pretty cool. Sometimes, I don't know, people might claim to be a research station, but they're not really. I personally have been to a few like that, not in Costa Rica, necessarily. But yeah, it's just not what you're expecting. So, internationally, I think that's like the biggest thing. It's like the tourism, it is really important in Costa Rica, whether for good or for worse. But yeah, I think that's probably the same thing.

[O]: Are you like, for CloudBridge, like trying to more concentrate on big groups than individuals coming here?

[M]: I've seen there's been a shift in that in the past year. So, we've had a lot of like school groups come where they get a guided tour through Casey or through Anthony and Steven or something like that. I think long term, that has a bigger impact. Because if you can have bigger groups come all at once, there's a higher chance that maybe there was two or three people in that group that were really inspired. And then they can go back to their countries and maybe implement something that they saw here that they thought was cool. Whereas if you have just like a family come, you know, maybe they're just coming for the experience, or maybe they're just coming because their kids think it will be cool or something like that. And they're not trying to take anything with them from that experience, if that makes sense. Yeah, I think the group, like the groups that come, I think that there's a higher chance that they will take something away from it that was beneficial.

[O]: Yeah.

[M]: Was that your question?

[O]: Sorry, what?

[M]: Was that your question?

[O]: Yeah, yeah, it is. And so do you think like..., so most of the time when they just come in big groups, they just take a guided tour because it's better to just like get some more explanation about it. But when they come in individuals, do you think like having like more signage on the trails, they will just like already learn more about it and think a little bit more?

[M]: Yeah, definitely. Because let's say there's a couple that come and they just take a walk in the forest and they're like: "*oh, that was really pretty*". And then it's over. Yeah, it's not very engaging. Whereas if there was like signage or something interactive while they were out there, they could look more into it after they came back. Or they could, you know, maybe, I don't know, maybe someone works in a similar field. Maybe they're also a biologist back in their own country. And they see something here and they're like: "oh, that's super cool". Like, that's something that I could do where I work as well.

Like the inspiration, I think, is the most important thing, like someone feeling inspired to take action or to learn something or be engaged. And I do think, yeah, that could be a good initiative on an individual level, for sure.

[O]: Yeah, that's good to know again. So, actually, I don't know have much more. Oh, yeah. Do you have any programs or initiatives that you implemented here to promote sustainability tourism or eco-tourism? And also with like the community engagement?

[M]: So, I wouldn't say Cloudbridge specifically has, at least not that I know of. It's important to keep in mind that I've only been working here for like a year and a half. I did research here for eight months before that as well. But there's been a lot that's happened before I got here.

[O]: Yeah.

[M]: But from what I understand, Cloudbridge is part of a couple of like community groups, I guess. One of them is called Frata Ritchie. I don't know what it stands for. But it's like an environmental coalition, essentially, where we, as Cloudbridge as a group, is part of the people that can help make decisions for what happens in the community. So, let's say, I don't know, there's going to be a community event that's happening. Maybe Cloudbridge will come and we'll have our stand there so we can help teach about sustainability. Or Casey, she's been really involved with going to local schools and teaching environmental education to young kids, Costa Rican kids, which is really great. So, I don't know if there's like one particular initiative or program that we've started necessarily that I can think of off top of my head. But we are involved in different community groups. And we do take part in community events where even at like the UNA, which is the National University of Costa Rica, we've had a few sustainability events there where we go, maybe we give a little talk, or we have a little stand where people can come and ask us questions and things like that. So, I think that's probably the closest thing that I know of that we've done.

[O]: Okay. Yeah. I kind of saw like on the website that you add like Ascona, but it's more like it's like to learn for the kids. That's one of the things where Casey went for like education. Yeah.

[M]: Yeah. So, she's been the biggest face for that. Like she's the one that does that the most. And that's, she's really good at doing that as well. She's very social and fluent in Spanish and just friendly in general. So, she's just a nice person to learn about that.

[O]: Yeah.

[M]: She has her own kids as well. So, she connects to kids pretty well. I'm sure like if you end up doing an interview with her, she would talk to you loads more about that. Oh, yeah.

[O]: I talk to her about her. Yeah. She talked about pretty much everything. Yeah.

[M]: Yeah. Okay, sweet. So, hopefully she mentioned something like that. I'm sure she did.

[O]: She didn't get into details because it was already two hours.

[M]: Yeah.

[O]: Actually, we had to do that in two parts. Yeah.

[M]: She is very involved in the community, which is great. But it would be nice. And that's something that maybe that's a good question. Maybe we could brainstorm for the future of Cloudbridge if there's some type of initiative or program that we could as coverage that we could create that people could get involved in. I don't know what it could be, but that'd be really interesting because I think it's nice that we can be involved in the community stuff. But it would be cool if we could be a leader in something, which would inspire maybe other organizations to do something as well. That would be really cool. Yeah.

[O]: So, it's just my last question. Is there anything else you wish to share about CloudBridge or like, I don't know, anything that just came to you?

[M]: I mean, I think an important aspect for me is not losing the community touch. I'm not going to work here forever. I'm a foreigner. And after I leave, I hope that the mission stays the way that it is. Because you never know who's going to come next, who's going to work here, what their plans are going to be. And so, the work that CloudBridge is doing right now, I think is really phenomenal and important and has made impacts. And so, I hope that that can continue and that we can hopefully stay engaged in a way that's actually beneficial for people that live in this country. So, not cater too much to like, I don't know, things that just don't matter anymore.

[O]: Oh, yeah. To be like a big thing, to just have more profit ?

[M]: Yeah. I hope it never turns into being about the money, which I don't think it would be. So, it's not the main point, right?

[O]: The main point is to have this beautiful area that we can protect and we can teach about.

[M]: So, hopefully, we can do that.

[O]: Yeah. Thank you.

[M]: Are you sure that's okay?

[O]: Yeah. I think, yeah, I did ask everything I had to ask because also, I had Casey before... for two parts. And so, she did more of the big questions. And here, I needed more like more scientific aspect and more like precise, which you did. So, yeah. Perfect. Thank you.

[M]: If you need anything else, just let me know. Yeah, it was perfect.

[O]: Yeah. 30 minutes. Because like that, I don't have to transcribe everything.

[M]: Yeah, you have to transcribe all of it

[O]: Actually, I kind of found out like an app that just like write back. But I still have to come back and see if it's really that and like to again, hear it and all that. Because I have to transcribe everything, send it to my teacher, and you say, yeah, okay.

[M]: That's pretty involved. That's a pretty involved process. I mean, it makes sense. I did something similar once in college, where I like it was interviewing certain generation immigrants that came from different parts of the world. It's a lot. Like doing interviews is a lot.

[O]: Yeah, it is.

[M]: Props to you for doing it.

[O]: Thanks.

[M]: Yeah, let me know if you need anything else. Or if there's something more.

[O]: Yeah, it's really good. Thank you for everything.

[M]: Yeah, of course. And then I can't remember exactly what it was called. Oh, I would like to see a trail characteristic.

[O]: Yeah, yeah. I'm working on that as well.

[M]: No rush. Once you have that, I would like to see that.

(M. Peterson, personal communication, 9 April 2024)

14.2.3 Interview with Maximilian King

[M]: Okay, you want me to start again talking about this one?

[O]: Yeah, you can already, yeah.

[M]: Okay, so if you're looking at the entrance of Sentinel, and then you look to your left, there's that little bamboo bridge, and then just beyond that bamboo bridge is a green wooden sign with like a small roof. The plan is to print out a big new metal sign and screw it over that wooden frame. And on this metal sign, we're going to have a description of a little bit of history of Cloud Bridge, what type of forest people are walking through, talk about a cloud forest, like what they are, how they work, that kind of thing, and then why are they important to conserve. So you can talk about things like high endemic species here in the Talamancas. We're part of a much larger biological corridor, those kind of things. And we have that both in English and in Spanish, like next to each other in columns or something. On the top part, or like one top corner or something like that. I'll leave the design up to you, however you feel.

[O]: I'll try.

[M]: And then in the bottom part, I would like to have pictures and short descriptions in English and in Spanish of common birds and common plants and trees, and then also some common insects that people can see. So like maybe some cool dragonflies, like the glasswing butterfly, for example, that kind of thing. And then for birds, we can have like the toucanet, the barbit, some of the hummingbirds and things like that. Exactly like you had in your presentation yesterday. I think the purpose of this sign is to inform people of where they are, inform people of what type of forest they're walking through, that kind of thing. And then also, like Lindsay said yesterday, like if you see a picture of a bird and then you see it in the forest as well, you're like, "WOW", you know? That's the idea. So that would be my idea for that first sign. And if you feel like there are other things you want to add to it, feel free. You know, if you want to be like, I really want to put this flower on it or this species, feel free. Like maybe some mammals or something, whatever you like. If you need help knowing what species to put on there, you can send me a message or Maddy or Greilin, whoever. So that's the first sign. The second idea I have is at the Mirador, you know, at the viewpoint.

[O]: Yeah.

[M]: And where you can see Cerro Urán. My idea is to have like a little signpost with like a silhouette of the mountain and then a description of what the mountain is. Because people often come and they're like, what is that mountain? You know, so if we talk about, because it has a lot of indigenous people's significance. And I think if we just name it, tell the elevation that is in the national park, that it's very well protected and things like that, that kind of thing. And just have that right there. So almost like in front of you when you're sitting on the bench, but like on the other side of the park. So people are like: "What's that mountain?" And then they look down and they see the sign that describes it.

[O]: Exactly. And can we like cut it so we can...

[M]: Exactly. Yeah. Put like the top edge is the mountain. Something like that.

[O]: Exactly.

[M]: So it's like aesthetic and it's like simple, but it gets that point across.

[O]: Yeah.

[M]: So that's the other sign. And then the other one is for these dots on the windows. So they exist to stop the birds flying into them.

[O]: Oh, that's why. I thought it was just like to make them beautiful

[M]: People don't know that.

[O]: Yeah.

[M]: So I think if we make a little sign, we can just put it at the welcome center, just like describing why these dots are on there. And we just like put that on the welcome center. Something simple. And then the final idea I have is about a boot brush, which is like when people enter protected areas, there's like a brush on the floor to like clean your shoes. And the idea is to... well, it's twofold. The first part is to stop bringing seeds from other parts of the country to this part because that can like bring invasive plants, invasive species and cause like a lot of damage. So that's one part. And then the other part is about there's this fungus that affects highland amphibian populations and it's like decimated population. It's called chytrid fungus. I can give you the information about this. You don't have to remember this. And the idea is to have like a little information booklet about that because these areas, these highlands of Costa Rica have been very badly affected by it. If you like look, if you ask, yeah, I'm sure Luke and people would know about it. But if you ask them and be like, what's chytrid fungus? It's also called BD because it has this very long Latin name.

[O]: I don't know.

[M]: But it affects highland frog and amphibian species and it like makes their skin thicker and then they suffocate because frogs do their gas exchange through their skin. So if we had like a little information sign about that, be like: "why is it important to clean your shoes when entering this reserve?" Something like that. And then I'll make a boot brush. But something simple. I think the big ones, if we can get that big one opposite Sentinel and then the one of Cerro Urán, those would be really sweet. And then we can, if you put some prototype designs together and stuff, we can work together to make it like the final design. And then, yeah, if we get it done, yeah. I don't want to like give you so much extra work, you know.

[O]: Yeah, but still it's more to have like more ideas than to not have it. Yeah, I love it.

[M]: Cool, I'm glad. If we can get some designs done maybe by the first week of May, I can send them to the shop and they can print them out.

[O]: Yeah, okay.

[M]: And it normally takes them one or two weeks to print stuff out.

[O]: Okay.

[M]: Yeah.

[O]: And do you know how big the framework is?

[M]: No. We need to measure it, that's the thing. But we have like the tape measures and stuff to measure.

[O]: And do you know like for the police how big it will be, like is it 14 or something like that?

[M]: For the font?

[O]: Yeah.

[M]: Like how big the writing is?

[O]: Yeah, yeah.

[M]: Yeah, let's, yeah, maybe we'll start like 16 because I think the sign is quite big, you know. It's like, yeah, maybe like one and a half meters by one and a half meters, so.

[O]: Yeah, I think it is.

[M]: It's something like that. So we can start maybe 14, I mean if it's bigger, that's better, right? Because then people can read it more easily. Like if it's lots of small writing.

[O]: Okay.

[M]: Yeah.

[O]: Thank you so much.

[M]: Yeah, of course. I think the things we need to be careful of is like where we get the pictures of the wildlife from. So like, I think the best stylistic would be if we can have like in the bird book, you know, those paintings.

[O]: Yeah.

[M]: I think that would be the best.

[O]: I saw it like in the wildlife of Costa Rica.

[M]: Exactly, yeah. If we can get, and just like, be like credit this or credit that.

[O]: Yeah, I didn't know if I had to do that and I was like: "I think I have to do that".

[M]: I wasn't that sure. But yeah, if we just credit the artists and stuff, I think that would be fine.

[O]: Do we have to say like we are using their photos when we do that?

[M]: We'll just put it on the sign. So be like, here's the bird. This is the name, photo by or picture by. Yeah ?

[O]: Yeah. That will be a lot of work, but I'm really happy because like even my teacher was like, what are you going to do and how are you going to place it and the signs and all that. And yeah, he was going to stay at first, like to concentrate on more of the real trail, for example, because I've been with that. And then like, if I had more time to do just more, more panels. But we didn't think I would have like the panels already done.

[M]: Yeah.

[O]: Like for June or something like that.

[M]: We could do, if you can get it done, that's great. Even if it's just on your computer and you can send me the file, I think that's great. I really, and then obviously we'll put your name on it and stuff like that. Yeah.

[O]: I'm gonna cry

[M]: I just saw your presentation yesterday and I was like, this is because it's been in my book to make them. And then I saw you doing that. I was like, "wait". If you can help with this, that would be really great.

[O]: Yeah.

[M]: And hopefully it will contribute to your research as well.

[O]: Yeah, it does. It does. It really does. And even just like to make this project contribute to my, it's not PhD.

[M]: Your degree?

[O]: To my degree. Yeah. So yeah, I'm so happy about it because I wasn't really, I wasn't sure, that sure that was like so good to do something like that. And I didn't know if CloudBridge really needed that. And then I was like, okay, just like do it and we'll see.

[M]: Yeah, we do really need it.

[O]: Yeah.

[M]: I think there's a bug in your coffee.

[O]: Oh no

(M. King, personal communication, 17 April 2024)

14.2.4 Interview with Tom Gode

[O]: The context of my project within CNR, is focused on improving communication to enhance ecotourism and convey the importance of environmental protection. Therefore, the following questions aim to explore into both the strategic and operational aspects of CFCA's communication efforts for CNR, focusing on how they align with the goals to enhance the communication towards ecotourists and promote continuous engagement in environmental conservation.

[T]: Okay.

[O]: Perfect. So, do you give me the permission to record our conversation?

[T]: Yes.

[O]: Perfect. Can you present yourself and your role?

[T]: Tom Gode, I'm the president of the Cloud Forest Conservation Alliance, which is the operator of Cloud Bridge Nature Reserve.

[O]: Good. What are the primary goals of CFCA's communications strategy?

[T]: So, CFCA has three main goals. One is conservation and preservation of the cloud forest. The second one would be education about the cloud forest and the changing climate and the impact it has. And the third would be research of the cloud forest and the unique flora and fauna.

[O]: Do you think that you're more focused on educating more young people or people that are paying to stay here than engaging tourists that come just like within to do their hikes?

[T]: Yeah, I think our primary focus is geared at young science professionals. Third, fourth year university students and grad students to give them the broad background on field research and the opportunities there, as well as... in a different approach, working with the day tourists. And there, it's more just exposure. Hopefully, in the future, we'll get to the point where we can increase the education geared towards our day tourists. But right now, our primary focus is on our young professionals.

[O]: How do you tailor the message to the different audience, like for the kids, the little kids and the ones, like the students that are just already coming here to study?

[T]: Um so... Again, I think for our day tourists, it's more just exposure, getting people out and comfortable in the wild. We do a little bit of education around the reforestation history and process that Cloudbridge has gone through. We'll hopefully increase people's awareness of the value of the reforestation and the maintaining of the forest, both locally there in Costa Rica, but also when they return home. With our internship and volunteer programs, I think our focus is more in-depth and more focused on the actual process of field research. Again, I think that's an area that we will see continue to develop as we start to weave in more parts around systems advocacy, how you work in a political world to change systems, in addition to the day-to-day research sort of approach.

[O]: I see. Do you think that the reports and the work and the project that people are doing here ever will impact more nationally than just within Cloudbridge?

[T]: Well, I believe so. I think Cloud Bridge is a unique area, but hopefully what people walk away with is a better understanding of their role in the world's scope of things. I think that's why we'll see an expansion of what we do to include more systems advocacy and public

policy work as a component to it. If all the people, when a researcher leaves, if the only thing they've learned is the specific flora or fauna of the cloud forest, then I think we've failed what we were trying to do. Hopefully when they leave, they leave energized, educated about the changing climate and their role and how they can impact that wherever they are. We don't want Cloudbridge to be a standalone outcome. Again, it's an education process. Hopefully when they leave, they take what they've learned, not so much the specifics, but the general knowledge of how to work to change the system and to improve it wherever they go.

[O]: Yes, I see. Do you have maybe a way to measure the effectiveness of the communication efforts? Just not with students, but I see that you're doing as well with the Hotel Uran thing where they planted the new... They reforested a new land that they have. Do you have a way to measure this effectiveness to promote environmental conservation?

[T]: Yeah, that's part of why we're planting outside of Cloudbridge now. After 20 years, we have an established process that's been successful and we can help people at the higher elevations to reforest and hopefully speed that reforestation process up and be more successful at it. We also have some of our... Like our forest we research is now 15 to 20 years old, so we have the opportunity that we have not capitalized on at this point to go back now and look at plantings that are 15 years old that actually were put in as a scientific plot. And we can now go in 15 years later and see of the four different approaches that we took in the planting, which ones were more successful and how those outcomes fit.

[O]: Sorry. So, as in my project... I'm trying to develop a new type of communication within the reserve, so like... which will be under the form of new panels that can be put maybe on the Rio trail. It's for my thesis, so I'm just trying to... It's just like an idea. But what do you think about putting more panels along the trail within CloudBridge?

[T]: I think as long as we do it in a systematic approach, I'm not a big fan of a lot of panels on the trail, but the Waterfall Trail is a heavily used trail and it's a great opportunity as an educational tour area because everybody walks the water. I'm guessing less than half the people who come go up to the Mirador and beyond to Rio or wherever. And so, personally, I would tend to focus and put it onto the Waterfall Trail. I think we're able to access the most people there. But, yeah, I mean, I think that's one of the ways that we can get an educational approach to our day visitors because we're seeing so many of them that we can't do it on a regular basis. So, educational panels, I think, play a nice role for that.

[O]: Yeah, okay. Good to know. Because I kind of saw, in some ways, and talking with tourists at the same time, that, yeah, the Waterfall Trail was really well informed on what type of species we could find and all. Which I think is really great. At the same time, I was like... having the choice to be able to... It's just, like, my opinion, so you know. But having the choice to be able to see if I want to read some panels that tell me what type of species or what type of forest I'm in, can also raise the awareness and the curiosity of tourists. Which is actually the goal of my thesis and what I'm trying to do to help Cloudbridge in some ways. So, yeah.

[T]: Yeah, I think, you know, like, right at the Sentinel Trail, Sentinel, and... there's a big billboard there that really doesn't say anything, which would be a great educational spot. It's a place people tend to stop and spend a little bit of time after they've gone across the Bamboo Bridge and would be a great spot for an educational piece.

[O]: Oh, yeah. I'm right now actually trying to work with Max on this, and I hope when I'll finish it, maybe you'll like it and see it and tell me about it. So, yeah.

[T]: Good.

[O]: It's a lot of work, but, like, I really love to do it because I'm also learning myself.

[T]: Great.

[O]: So, yeah. And how do you collaborate with local communities and organizations to amplify the conservation message?

[T]: CloudBridge has a long history of working with local schools, conservation organizations, and just the local communities. So, you know, we don't have... we haven't. I wouldn't say we had a specific plan to do it. It's just something that happens naturally. So, for a number of years, we worked with Bandera Azul, which is a certification process in Costa Rica for nature reserves and schools and community. And so that gave us the opportunity to work with all the hotels in the area, the schools... We actually had students who came up with their parents and planted trees, and we could do an educational program with them. Now we do a program that goes into the schools to do a curriculum. So it's um... like I say, it's always been a piece of what we do. But it also has limitations in the fact that we don't have designated staff just doing community outreach. So we do it as we can and when the opportunity comes up.

[O]: I see. And is that a way also to amplify your... Not amplify, I don't know, to just like be able to be more seen and to have more partnership with different local communities or international audience?

[T]: It's, well, I think our primary focus working with the community is community education about the changing climate and the values of trees and forests, but not so much as far as, you know, promoting to get people to come up to visit. We do bring groups in, groups to do educational programs with on site. But again, our primary role there is environmental education, not so much just generally trying to get people to come up to Cloudbridge as tourists. We haven't really put any effort in marketing local tourism. Our focus has been really towards environmental education.

[O]: I see. Yeah. That's really interesting. So you're more like for the international education parts. You think that doing that... like as you have more... how can I say that? The economic parts of just like having students coming in will be sustainable for Cloudbridge?

[T]: Yes. I mean, one of the advantages of our international internship program is that it does, it covers our expenses so that we can afford to do local community programming in areas where people can't afford to have that done. So when people will rent our cabin or when people who do just day hikes, those all subsidize not only our internship program, but they also subsidize our community outreach program.

[O]: I see. Do you have any feedbacks from the students that come here that you've utilized to improve the, I don't know, Cloud Bridge itself or like the spaces that you have in the infrastructure?

[T]: So feedback from our interns?

[O]: Yeah, interns or even visitors, from everyone actually.

[T]: It's an area that we continually work to see how we can improve. We... When interns, volunteers leave, they have an evaluation to fill out and part of that is how we can improve. We have suggestion box at the welcome center for our day tourists and the ability to leave comments on a QR code. The other thing that we do, I don't know... like when Linda is on site with her gallery open, she's probably our best way of getting feedback from the people who come here because she spends the time to talk with them about whatever they're interested in. So the conversation might start out about her painting, but she'll move it to climate change. She'll change to ask where they're staying. If they're staying at Cloud Bridge, how is their cabin working out? They have suggestions. She's a major quality improvement person for us. People who won't necessarily tell us that, you know,? "principle is too slippery of a trail. I really struggle going up it kind of thing". They might not offer that, but if they're asked perfectly, then we get their feedback. And I think people are much quicker to give her feedback because she's not perceived as, I don't know, part of the main...

[O]: I see. And when people, like the ones that are staying in Cloud Bridge in the cabins and all, do you have a continuous engagement with them, like any strategy to ensure that they are engaged or they have updates on Cloud Bridge?

[T]: Okay, ask me that one more time.

[O]: So what's the strategy if Cloud Bridge as to ensure a continuous engagement from the visitors that stay in Cloud Bridge, like in the cabins?

[T]: Well, any feedback that we receive goes into... gets fed into Max. So in the case of, well, let's say the cabins, we maintain a master list of items that need to be addressed. And so anything that comes up in the casual conversation ends up on that list, as well as anything that comes in through the official evaluation process ends up on that list. And then that list is constantly being monitored and addressed. So when I'm with Max on a monthly basis, one of the questions I'll ask him is: "what came off the list? What got taken care of this month that was on the list of maintenance items kind of thing?" So we're established more and more... more and more systematic approaches to address questions.

[O]: I see. So it'll be actually the last question that I have. Is there anything else you would like to share about Cloud Bridge or what you're doing, your experience yourself?

[T]: I could talk for hours. I think, you know, CloudBridge went through a rough period during COVID and I think we're seeing constant improvement over the last 18 months. And so the internship program has matured. And I think we're seeing the facilities are getting back on track to where they need to be. And I see a really bright future for CloudBridge. I think there's a lot of potential there. And again, I think when it comes back to our interns and our researchers, in the past, traditionally, we've inventoried butterflies, we've inventoried beetles... But like what you're doing is totally different and offers us the opportunity to really become more effective at the education. And hopefully, the long-term impact that Cloud Bridge can have will come out of people like you, who can take the time and evaluate what we do and look at how we can do it better.

[O]: Oh, thank you.

[T]: No, thank you. Like I say, I think it's allowing the staff to think broader than just inventorying butterflies. I mean, inventorying butterflies is a good thing to do. It gives us a broader base of understanding of what's in the cloud forest. But that can't be the only thing that we do. You know, it's people like you who will make the change. And it will be our ability to adapt the very basics of basic inventories to be able to help people realize the values

that we're trying to get across and how the public policies in their home countries limit that kind of thing and their role in securing a future for the environment.

[O]: Oh, thank you very much. I'm trying. I really love this reserve. I really love the time I had here. I will leave soon, but I really hope that my work will be helpful for CloudBridge and all. Yeah, I feel like you already add a lot of things that you did here, which is really important. People are really engaged to improve everything and to work in, because it's a great place to work and with a good environment. So, yeah, I hope it will continue like that.

[T]: Well, thank you. And when you get back to school, you'll be sure to send it to somebody else who thinks like you. And we'll take it to the next step.

[O]: Yeah, I'll do that, I promise.

[T]: There you go.

[O]: Yeah. Well, thank you a lot for your time and for doing this interview. I'm sorry, the network is not really working.

[T]: Yeah, we're breaking up.

[O]: Oh, yeah. Now it's good. So, what were you saying? I'm sorry.

[T]: When do you do your final presentation?

[O]: Next week.

[T]: Next week?

[O]: Yeah, on Thursday, actually, yeah.

[T]: Well, good luck with it.

[O]: Thank you very much. Thank you.

[T]: It's been fun having you.

[O]: I really liked to meet you and Linda. It was really great also. And to work here was really grateful.

[T]: Good. All right. Well, good luck with your final presentation and have a safe trip going home.

[O]: Thank you. Bye. And I hope everything is good in Canada.

[T]: Thanks. Bye-bye.

[O]: Bye.

(T. Gode, personal communication, 23 May 2024)

Appendix 3: Cloudbridge's hiking trails map

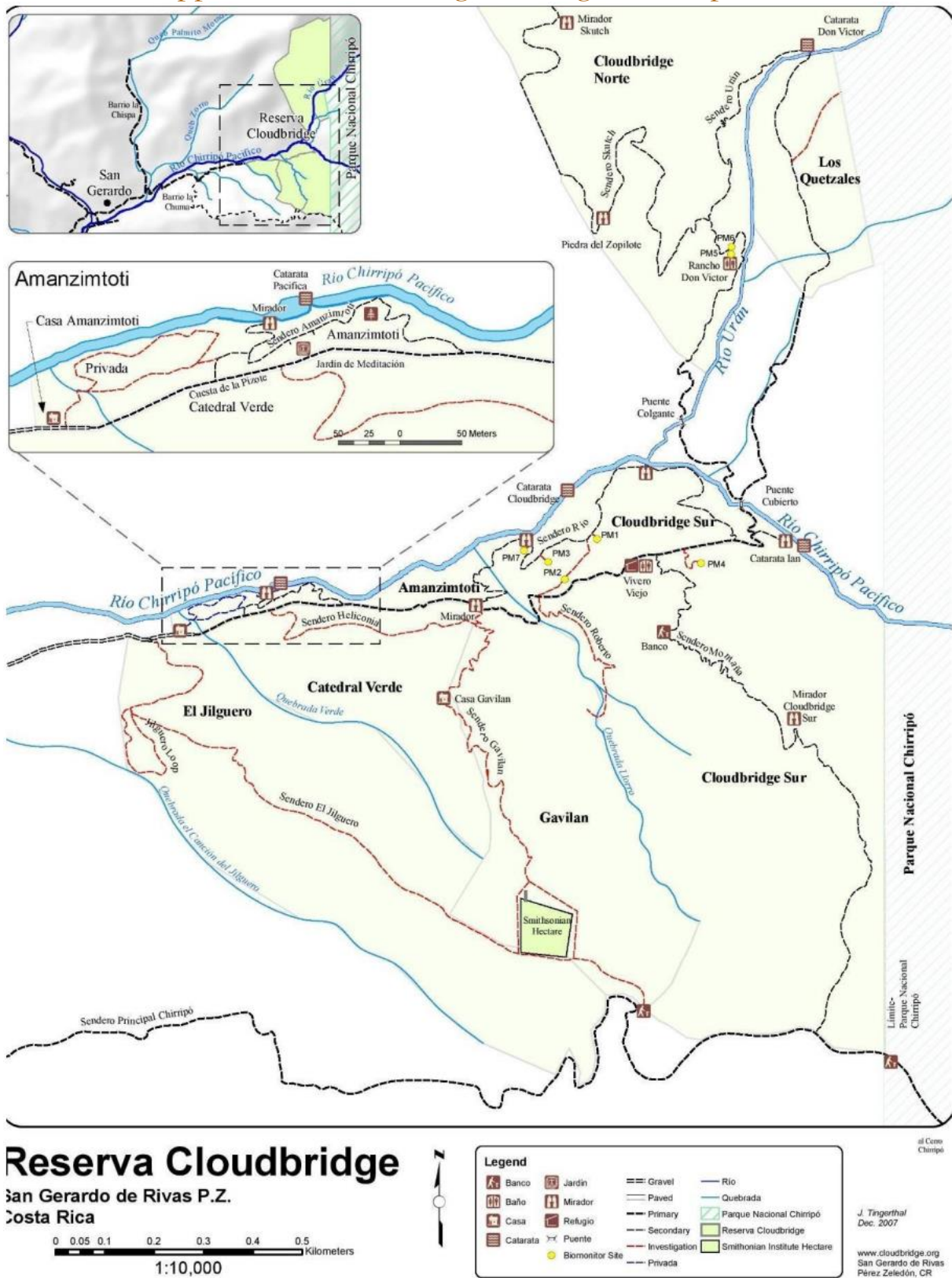


Figure 29 - Private and public map of CNR

14.4 Appendix 4: Biological corridors

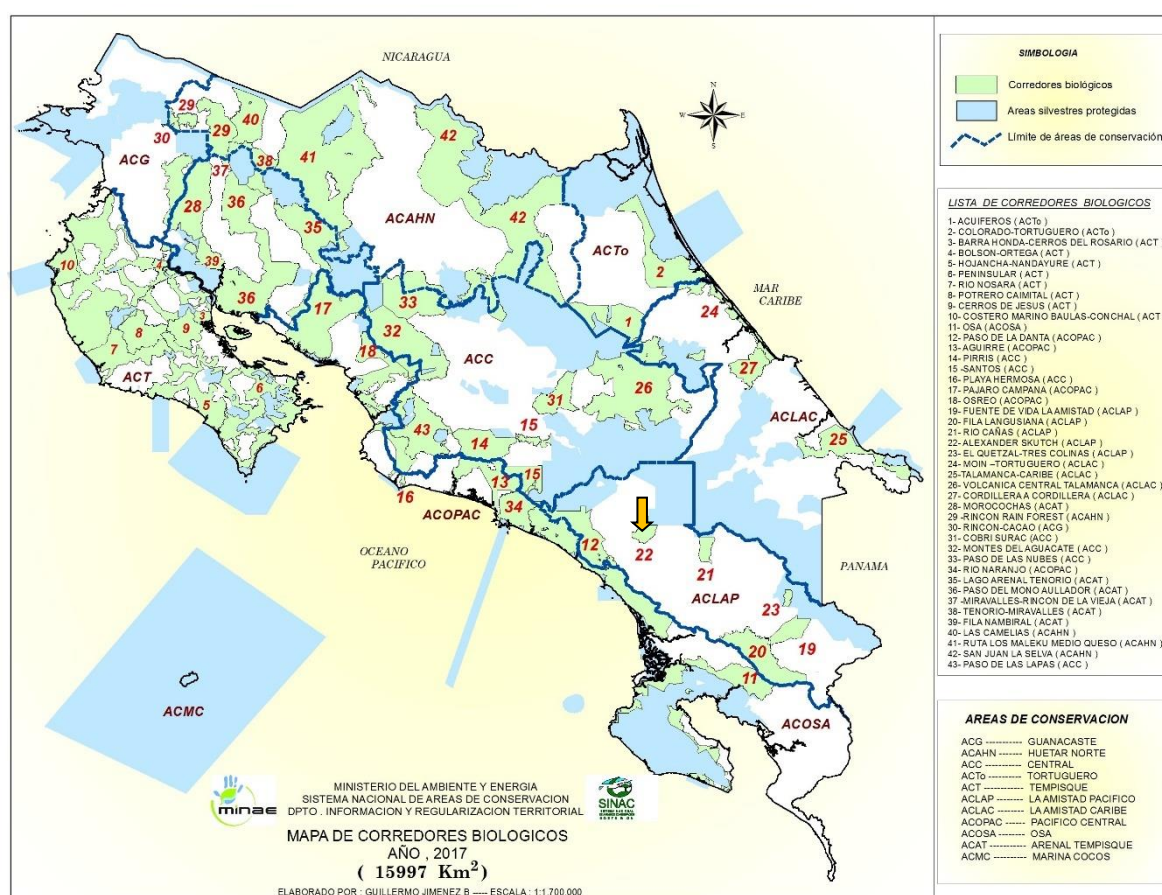


Figure 30 - Map of biological corridors (SINAC, 2017)⁶

⁶ Note: The orange arrow points to Cloudbridge zone

14.5 Appendix 5: Cloudbridge Elevation Contours

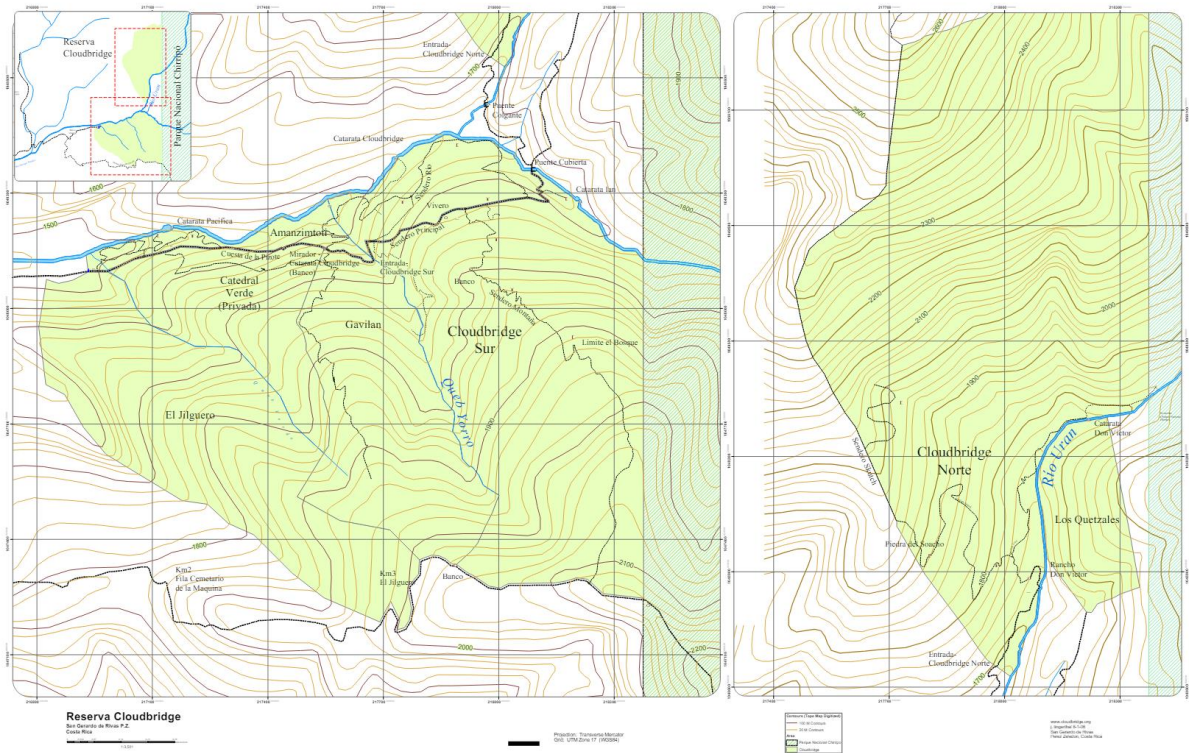


Figure 31 - Cloudbridge Elevation Contours (Tingerthal et al., 2007)

14.1 Appendix 6: Geological Map of Costa Rica

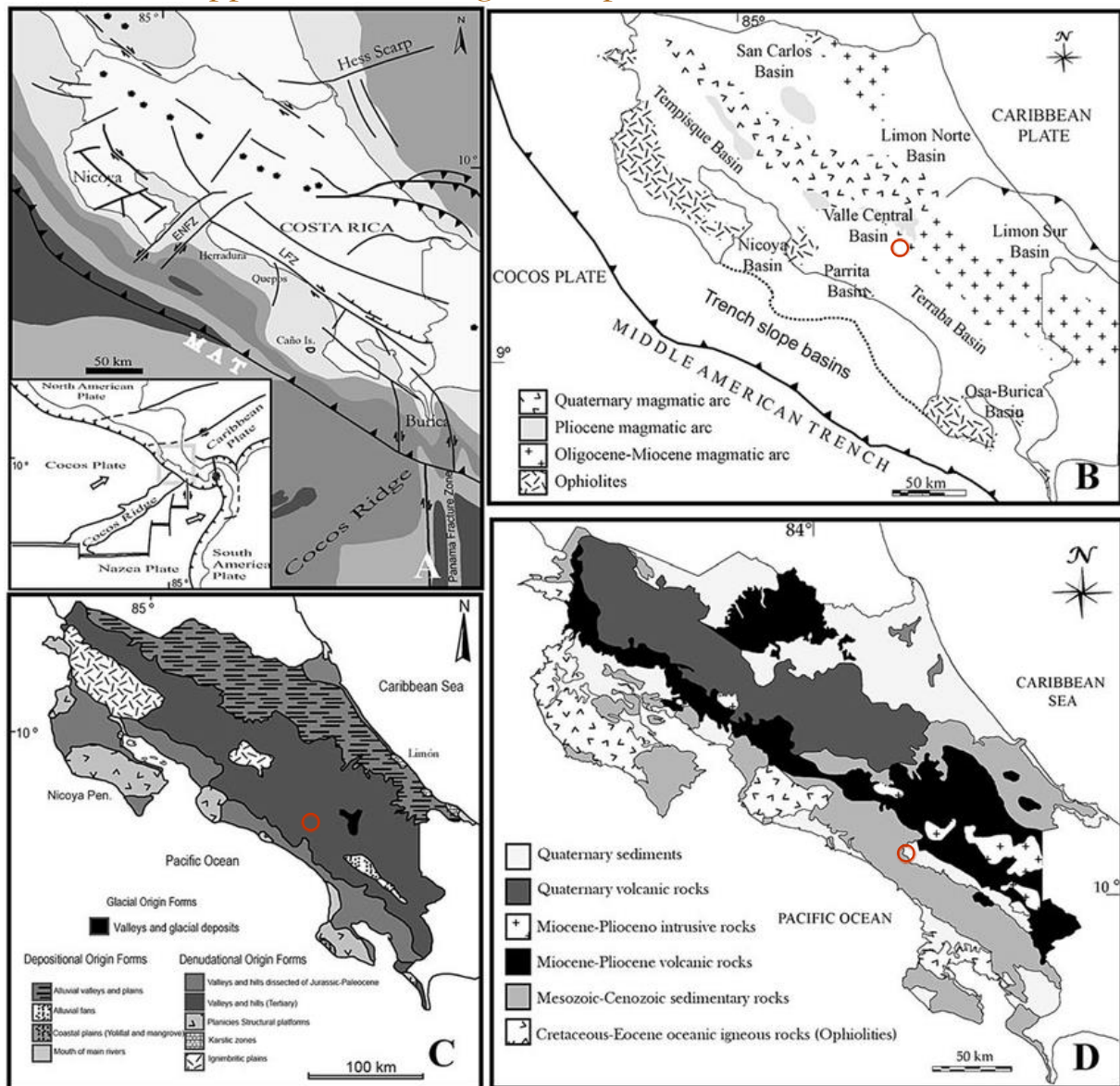


Figure 32- Different simplified types of geological maps of Costa Rica: (a) major tectonic features, (b) marine basins, (c) geomorphologic map, (d) geological map (Guillermo et al., 2017)⁷

⁷ Note: The red circle represents Cloudbridge Nature Reserve

14.2 Appendix 7: Geologic Time Scale

Younger ↑ Older ↓	Eon	Era	Period	Epoch	
Phanerozoic		Cenozoic	Quaternary	Holocene	← Today
				Pleistocene	← 11.8 Ka
			Neogene	Pliocene	
				Miocene	
			Paleogene	Oligocene	
				Eocene	
				Paleocene	← 66 Ma
		Mesozoic	Cretaceous	~	
			Jurassic	~	
			Triassic	~	
		Paleozoic	Permian	~	← 252 Ma
			Carboni-ferous	Pennsylvanian	~
				Mississippian	~
			Devonian	~	
			Silurian	~	
			Ordovician	~	
			Cambrian	~	← 541 Ma
	Proterozoic	~	~	~	← 2.5 Ga
	Archean	~	~	~	← 4.0 Ga
	Hadean	~	~	~	← 4.54 Ga

Figure 33- The geologic time scale (Earth@Home, 2024)

Abbreviations:

- **Ka:** "kilo anum," one-thousand years. Kya = thousand years ago
- **Ma:** "mega anum," one-million years. Mya = million years ago
- **Ga:** "giga anum," one-billion years. Bya = billion years ago

14.3 Appendix 8: Soil Horizons, Types and Map

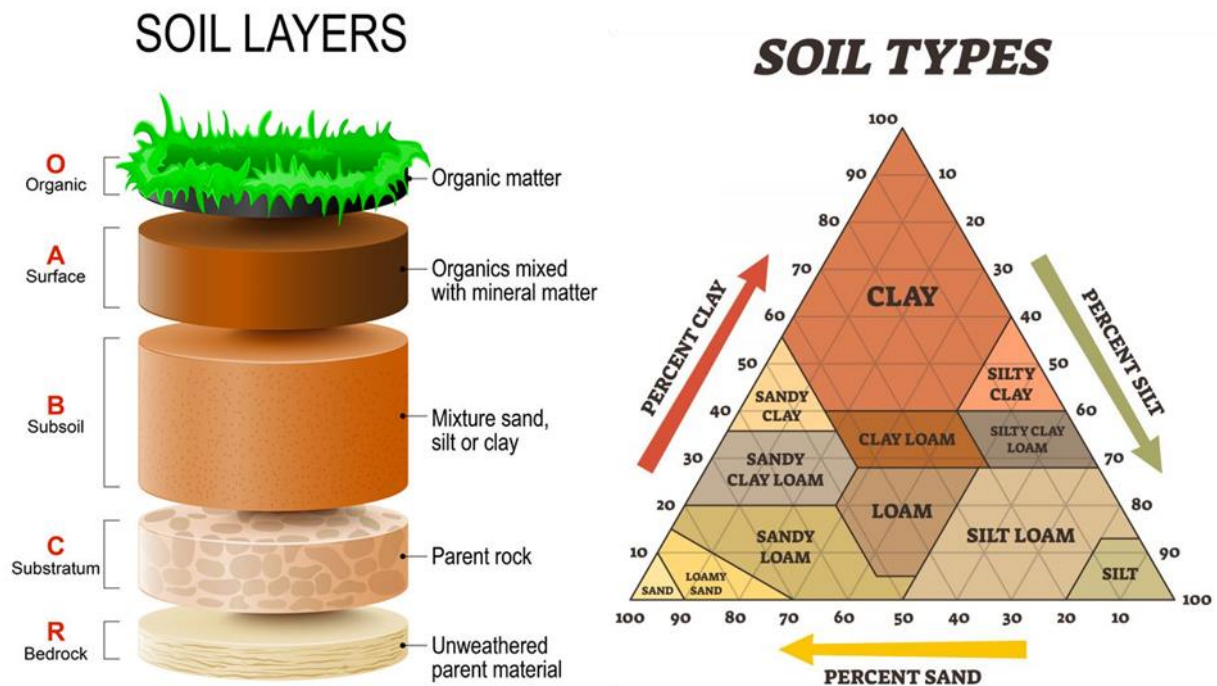


Figure 34- Soil horizons and texture triangle (Australian Environmental Education, n.d.)

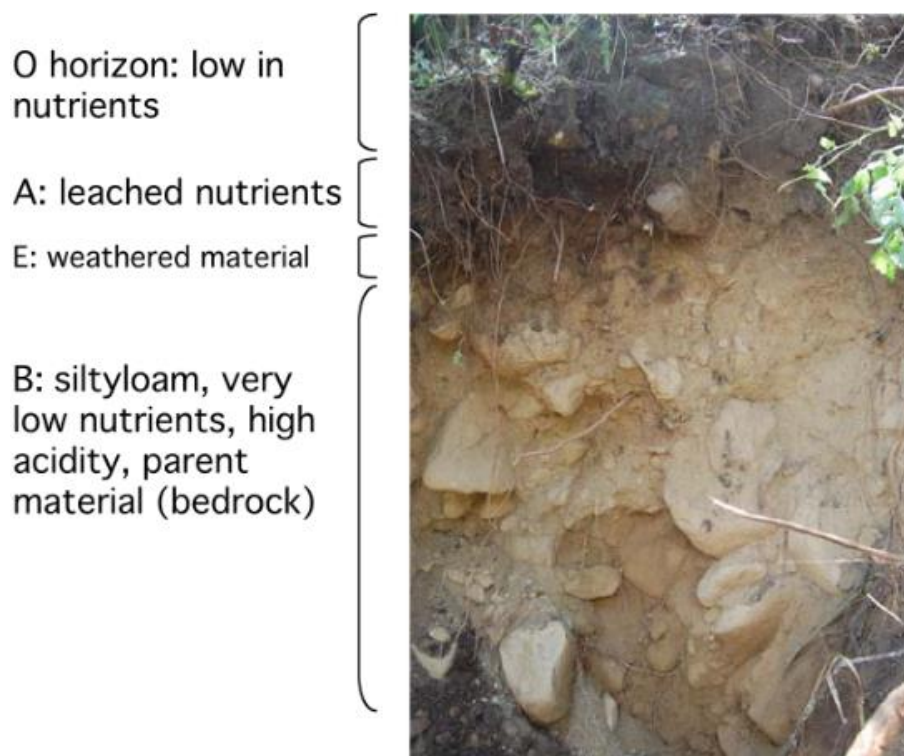


Figure 35- Soil Horizon in CNR(Davis, 2009)

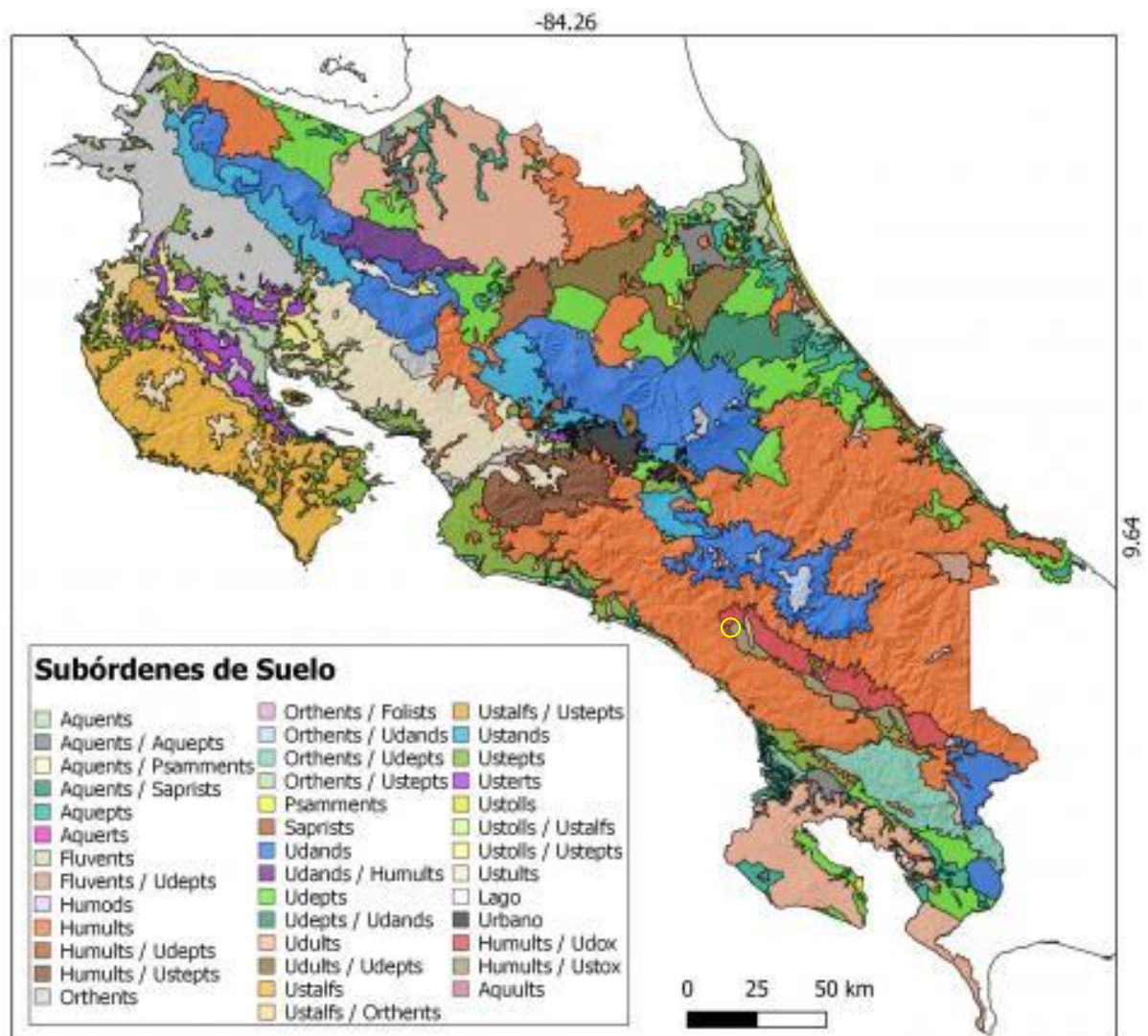


Figure 36 - Soil map of Costa Rica (Universidad de Costa Rica, n.d.)⁸

⁸ Note: The yellow circle represent Cloudbridge Nature Reserve

14.4 Appendix 9: Forest types in CNR

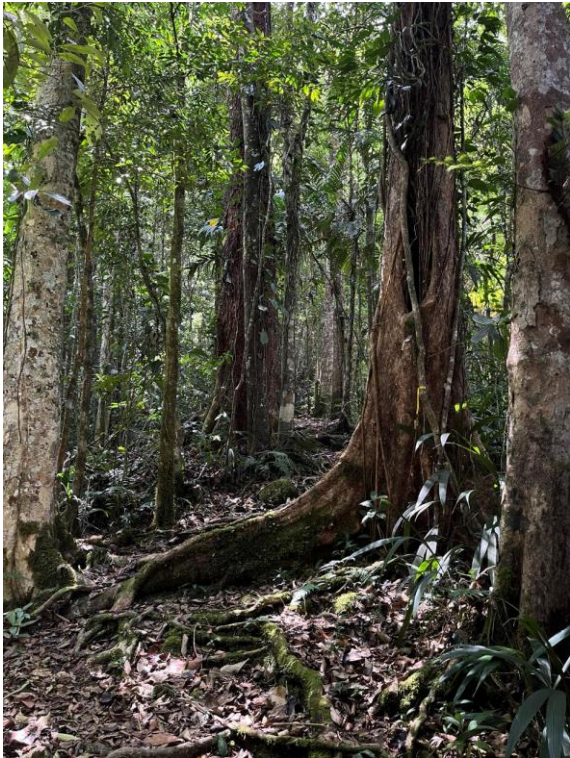


Figure 37- Primary Forest in CNR

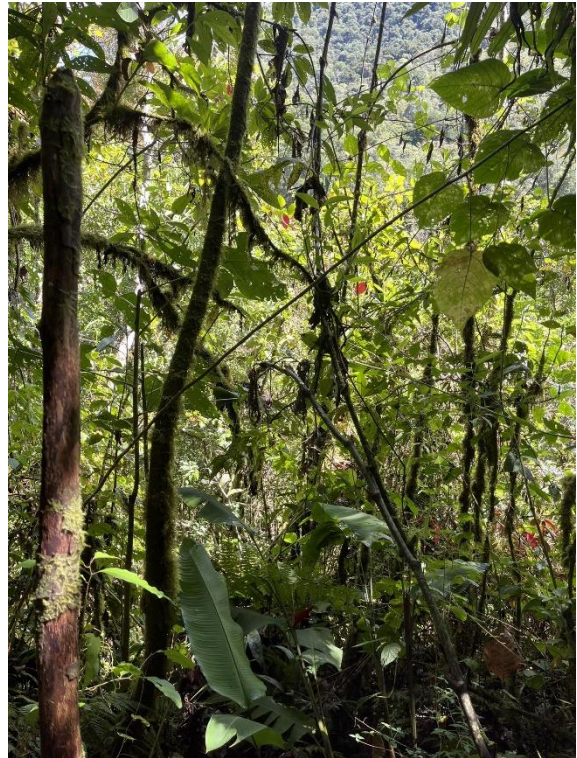


Figure 40 - Natural regrowth forest in CNR



Figure 38- Degraded land in CNR that is being planted

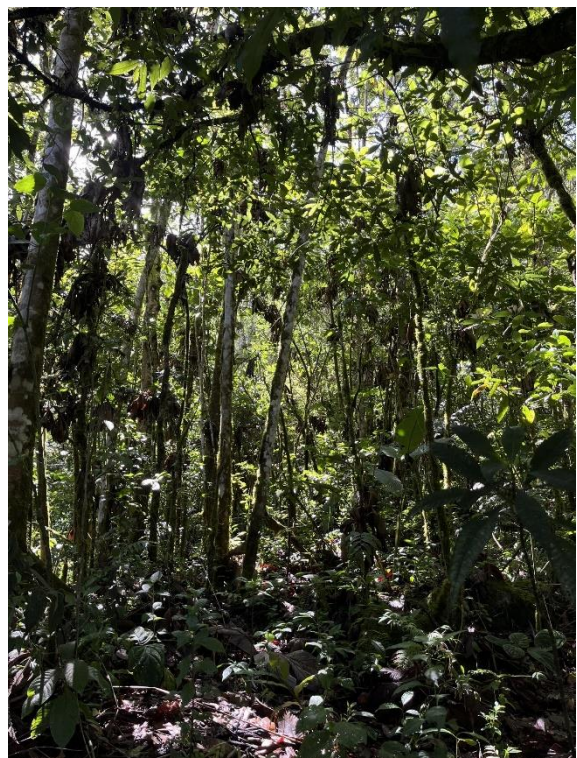


Figure 39 - Replanted forest in CNR

14.5 Appendix 10: Types of communication developed by CNR

14.5.1 Formal communication by e-mail

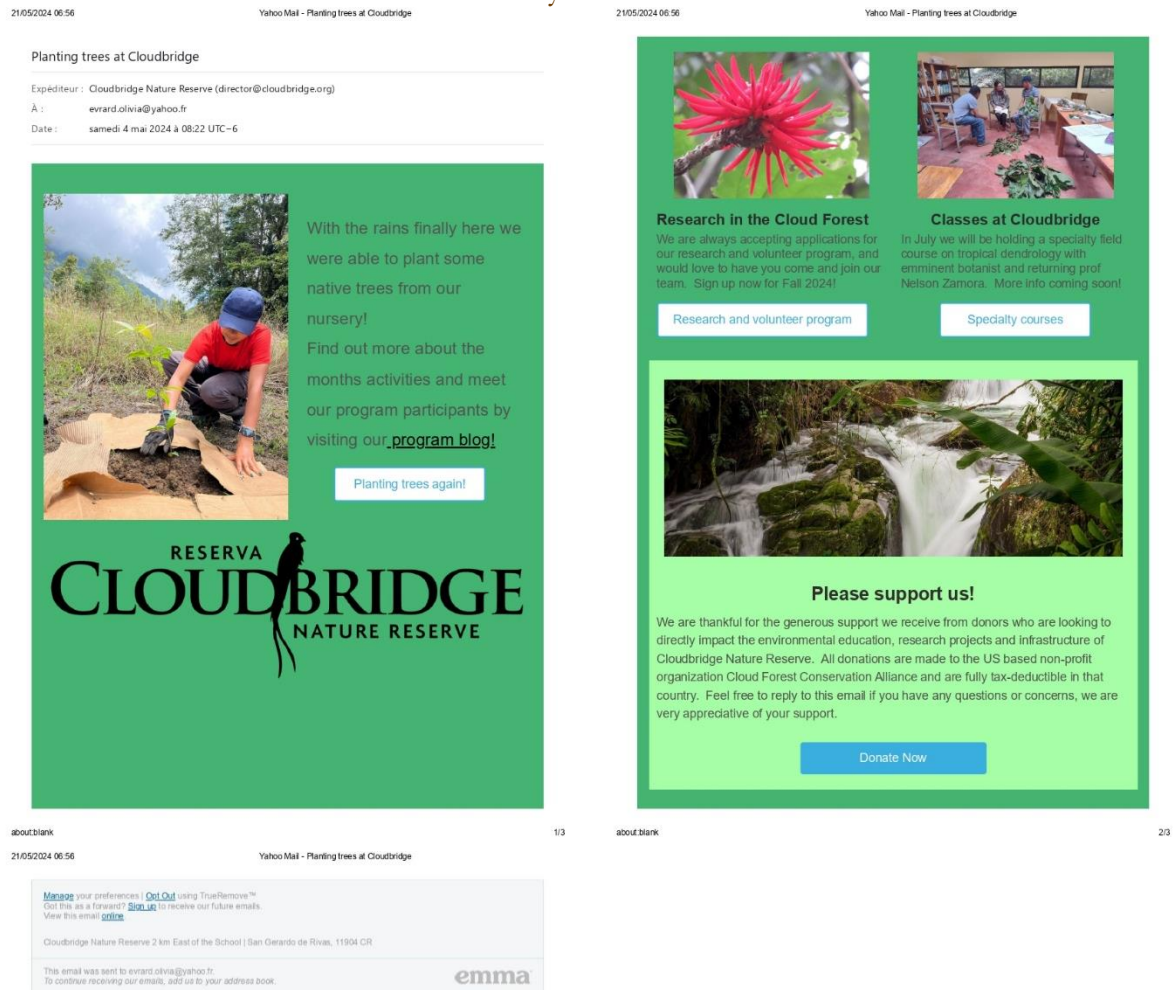


Figure 41 – Email received from CNR

14.5.2 Informal communication with Facebook and Instagram

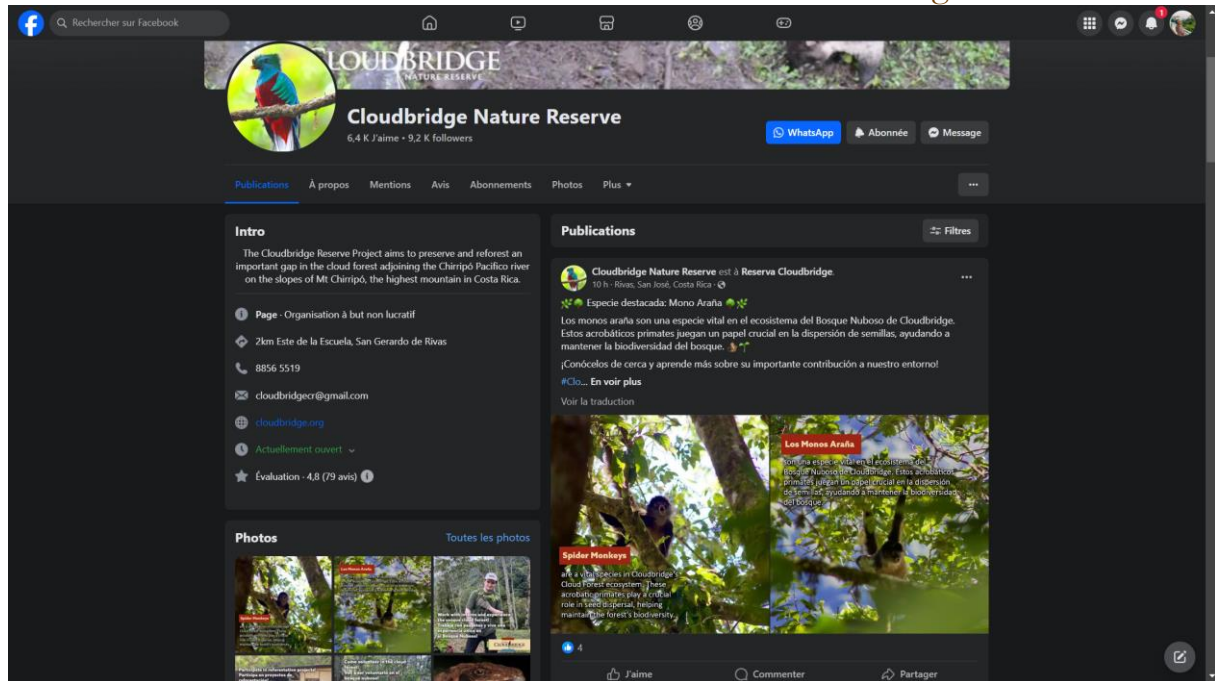


Figure 42 - Facebook post from CNR

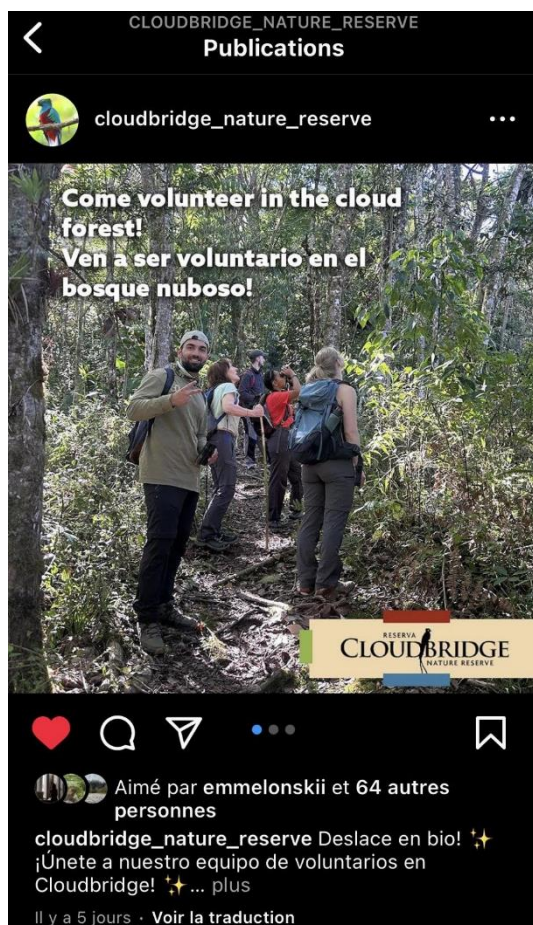


Figure 43 - Instagram post from CNR

14.5.3 Online communication on their website (Blog)

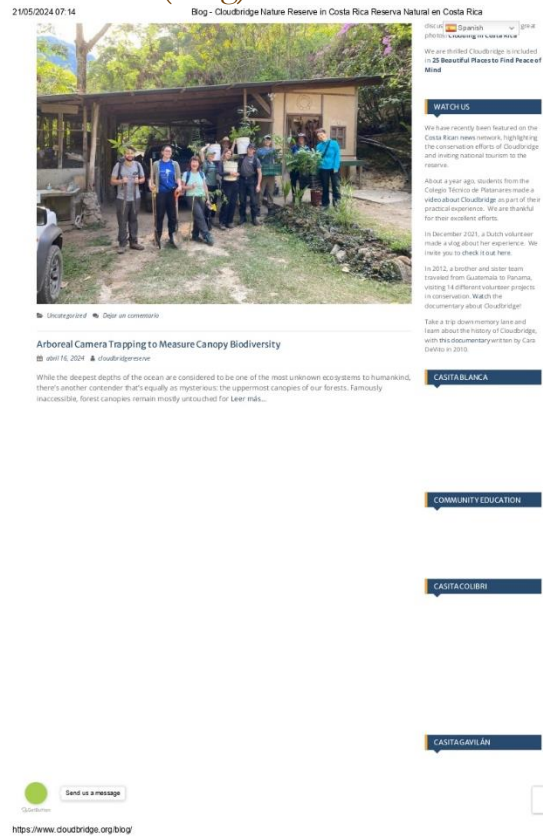
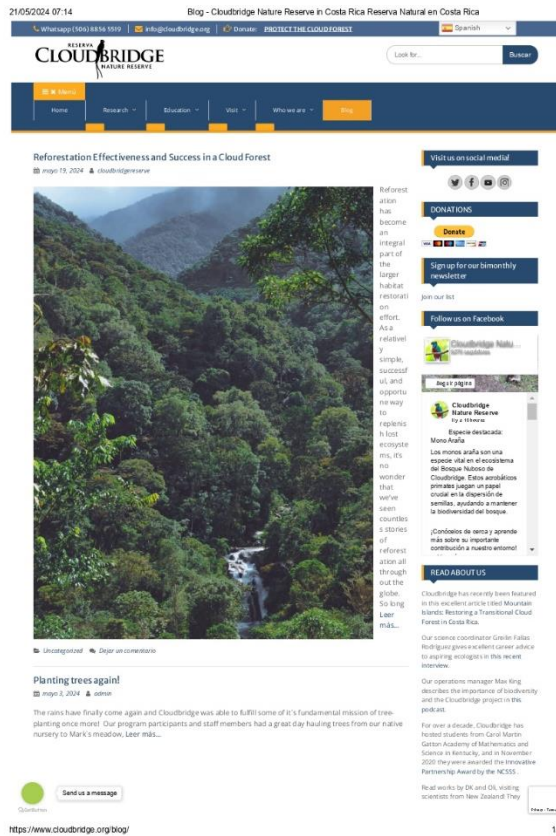


Figure 44- Cloudbridge's website

14.6 Appendix 11: Calendar of activities

N°	Activities	2024										BUDGET (in EUR)	Responsables
		February		March		April		May		June			
	Create a plan												
1	R1-A1: Conduct contextual analysis and problem identification											/	O. Evrard
2	R1-A2: Initiate field experience and data collection											/	O. Evrard and scientific officer
	Problem Identification												
3	R2-A1: Instore a survey to visitors											/	O. Evrard
4	R2-A2: Analyze findings and interpret results											/	O. Evrard
5	R2-A3: Align strategies with the mission of CNR and objectives identified in the LFA											/	O. Evrard
	Operating the changement												
6	R3-A1: Evaluate the effectiveness of implemented strategies based on visitor feedback and observations											/	O. Evrard and scientific staff
7	R3-A3: Development of educational strategies and interventions											/	O. Evrard and scientific officer
8	R3-A3: Implement selected recommendations											3 000	Cloudbridge Nature Reserve
Total												3 000	

Table 9 - Calendar of Activities

14.7 Appendix 12: Welcome Center of CNR



Figure 45- Welcome center entrance



Figure 46- Inside of the Welcome Center

14.8 Appendix 13: Trails in Cloudbridge

14.8.1 Waterfall Trail

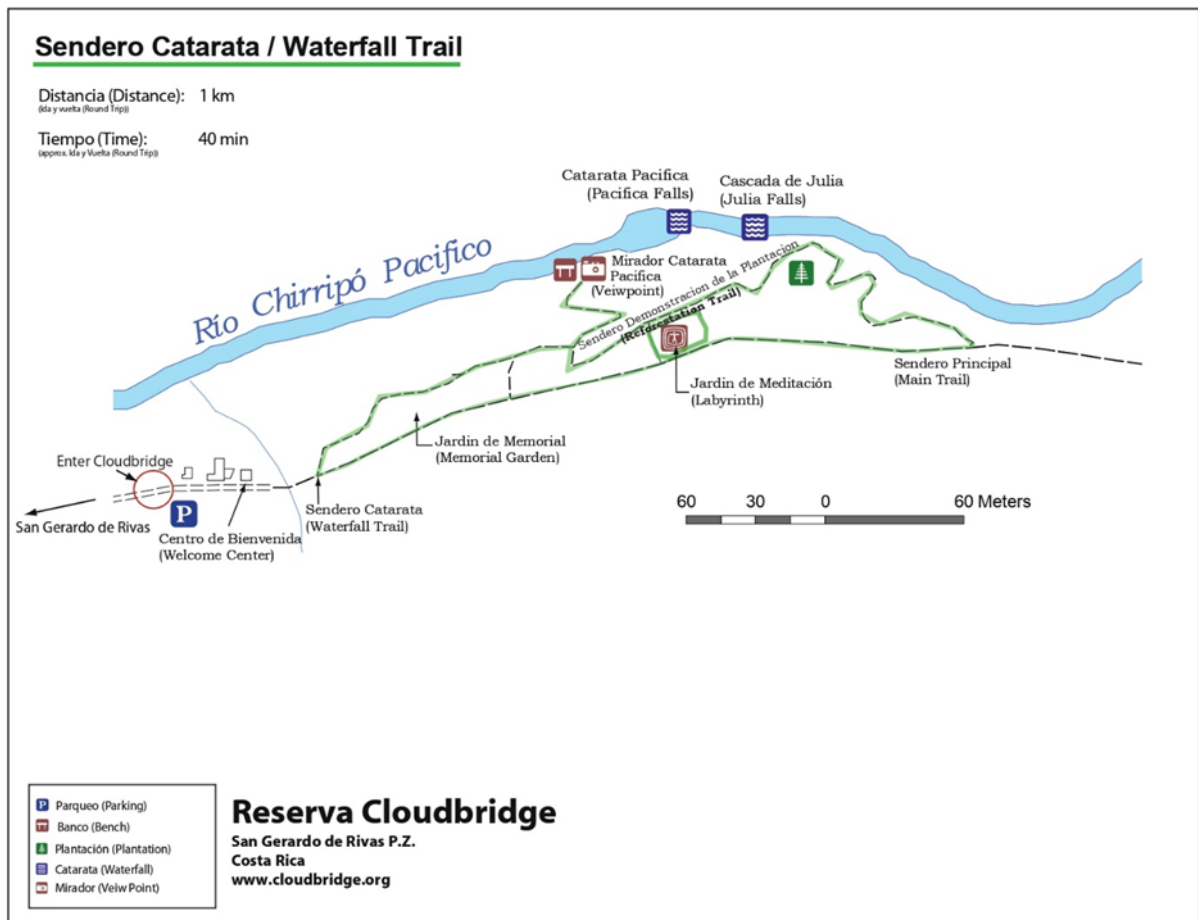


Figure 47 – Waterfall Trail (Cloudbridge Nature Reserve, 2024a)

14.8.2 River Trail

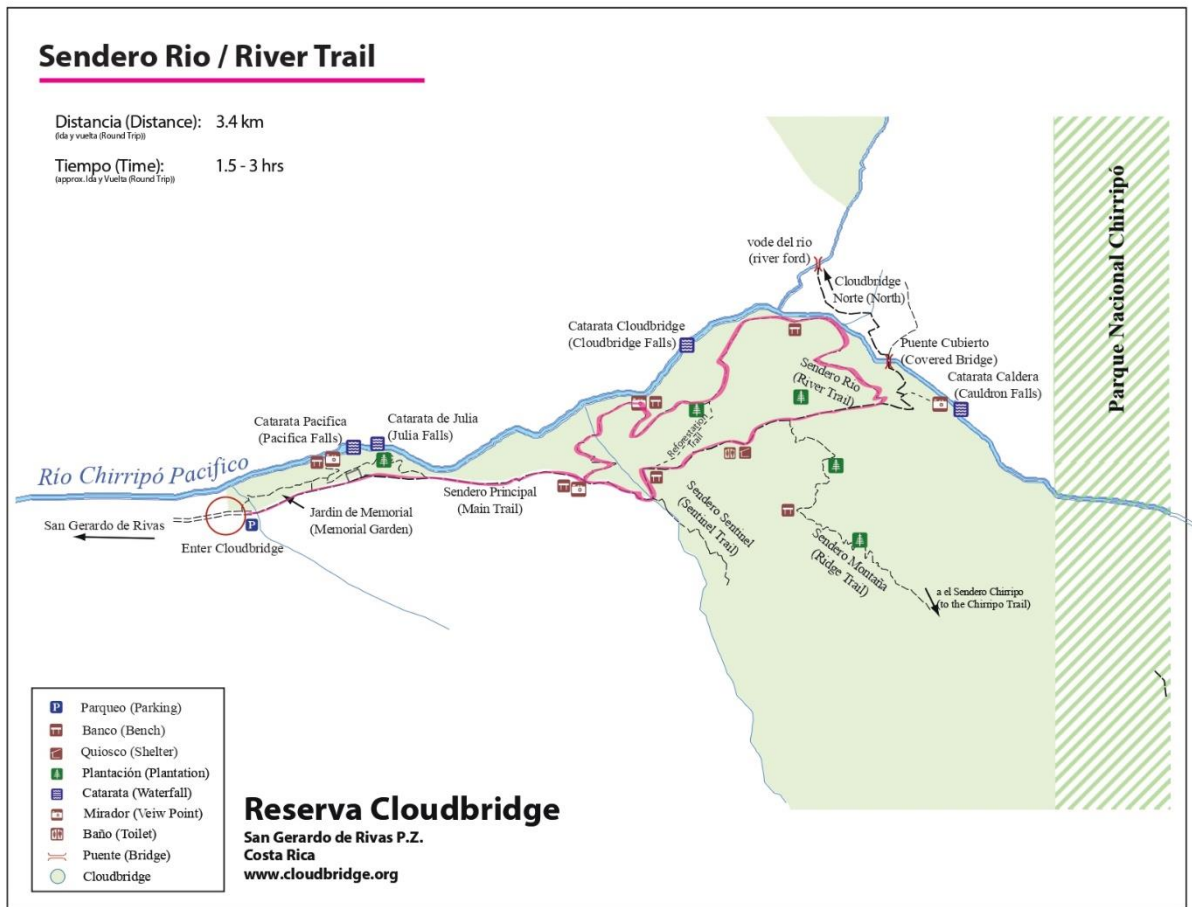


Figure 48- River Trail (Cloudbridge Nature Reserve, 2024a)

14.8.3 Ridge Trail

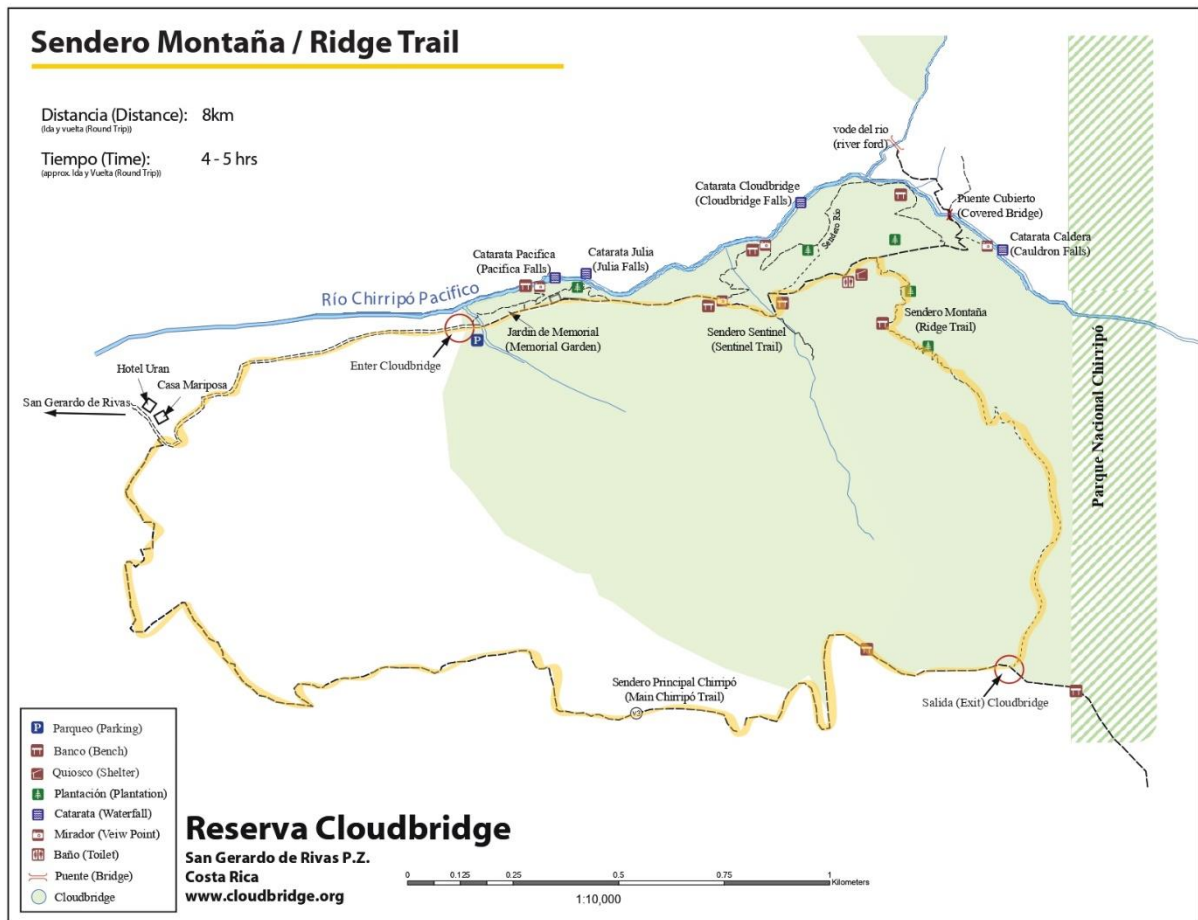


Figure 49- Ridge Trail (Cloudbridge Nature Reserve, 2024a)

14.8.4 Cloudbridge North Trail

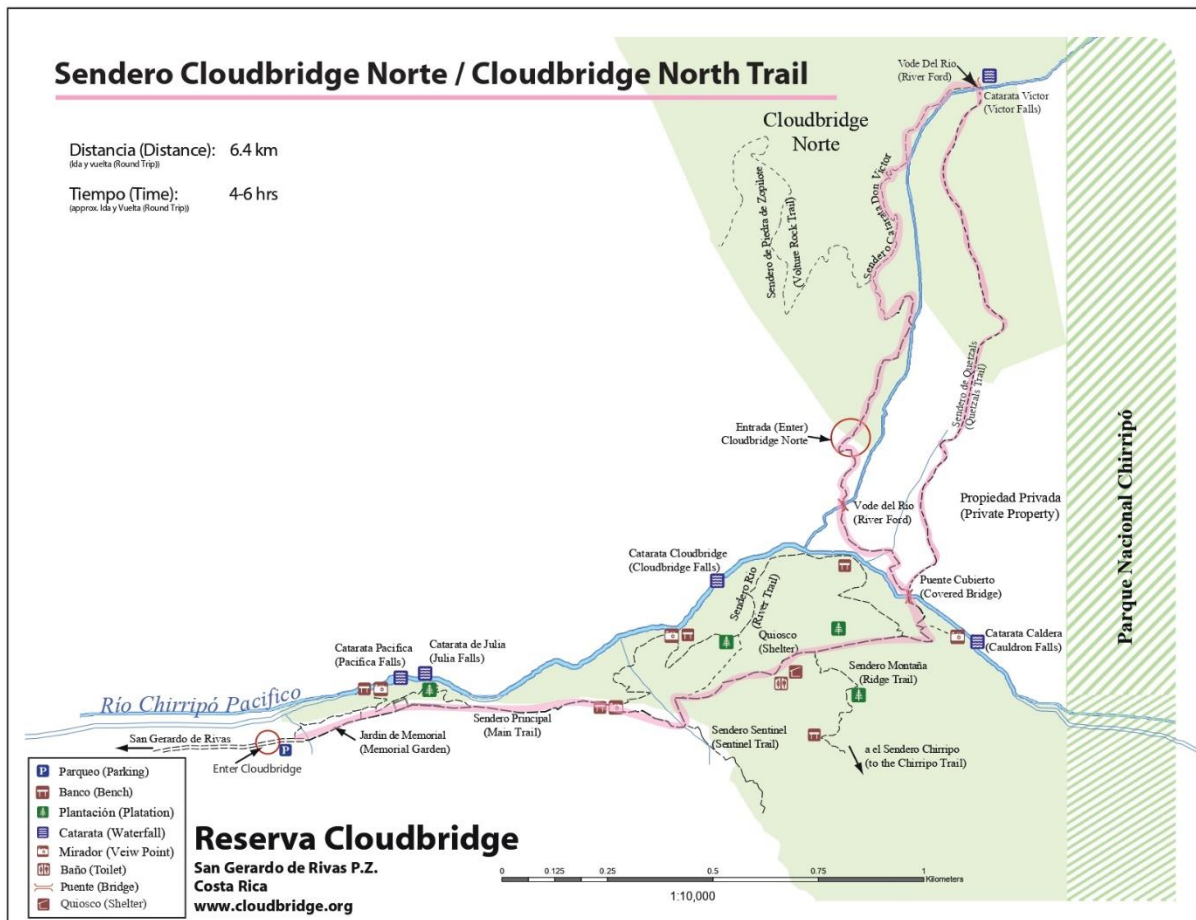


Figure 50 - Cloudbridge North Trail (Cloudbridge Nature Reserve, 2024a)

14.9 Appendix 14: Characterizing Cloudbridge's Trails

Trail's name	Physical components of the trail						Human experience		
	Elevation gain (m)	Forest	Wildlife activity	Steep	Viewpoints	Sitting places	Difficulty	Time	Busy
Main	256	Planted & Natural regrowth	Birds	++	1	3	Middle	20 min	+++
Waterfall	56	Natural regrowth	Birds, snakes	-	3	4	Easy	40 min	+++
River	256	Planted & Natural regrowth	Birds	+	3	1	Normal	3 hours	++
Cloudbridge North (including Don Victor and Los Quetzales)	485	Natural regrowth & Primary Forest	Birds, Big mammals, Koati, snakes	++	2	2	Middle	4 hours	+
Ridge	634	Planted, Natural regrowth & Primary Forest	Monkeys, Big mammals, birds, snakes	+++	1	1	Hard	4 hours	++

Table 10 - Characterizing the trails

14.10 Appendix 15: Types of panels within the reserve

14.10.1 Along the Main Trail

14.10.1.1 Foundation Map panel

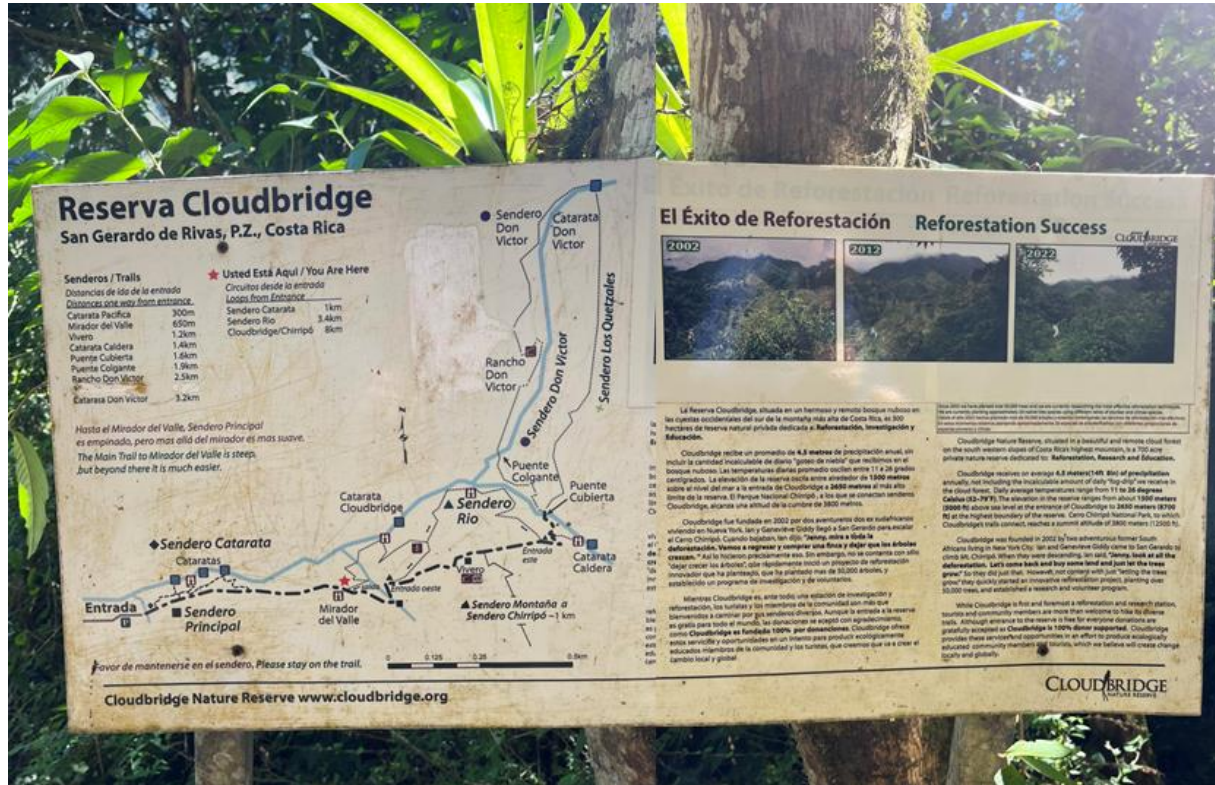


Figure 51 – Informative panel along the Main trail with a map and Cloudbridge's story

14.10.1.2 Indicative panels



Figure 52- Indicative panels with directions or map along the Main Trail

14.10.1.3 Promotion of the reserve's accounts on social media



Figure 53 – Promotional panel with Cloudbridge's social accounts

14.10.2 Along the Waterfall Trail

14.10.2.1 Trail maps and explanation



Figure 54 - Educational panel along the Waterfall Trail with a map and ecological explanations

14.10.2.2 Brief description of the environment



Figure 55 - Educational panels with descriptions

14.10.2.3 Species explanations

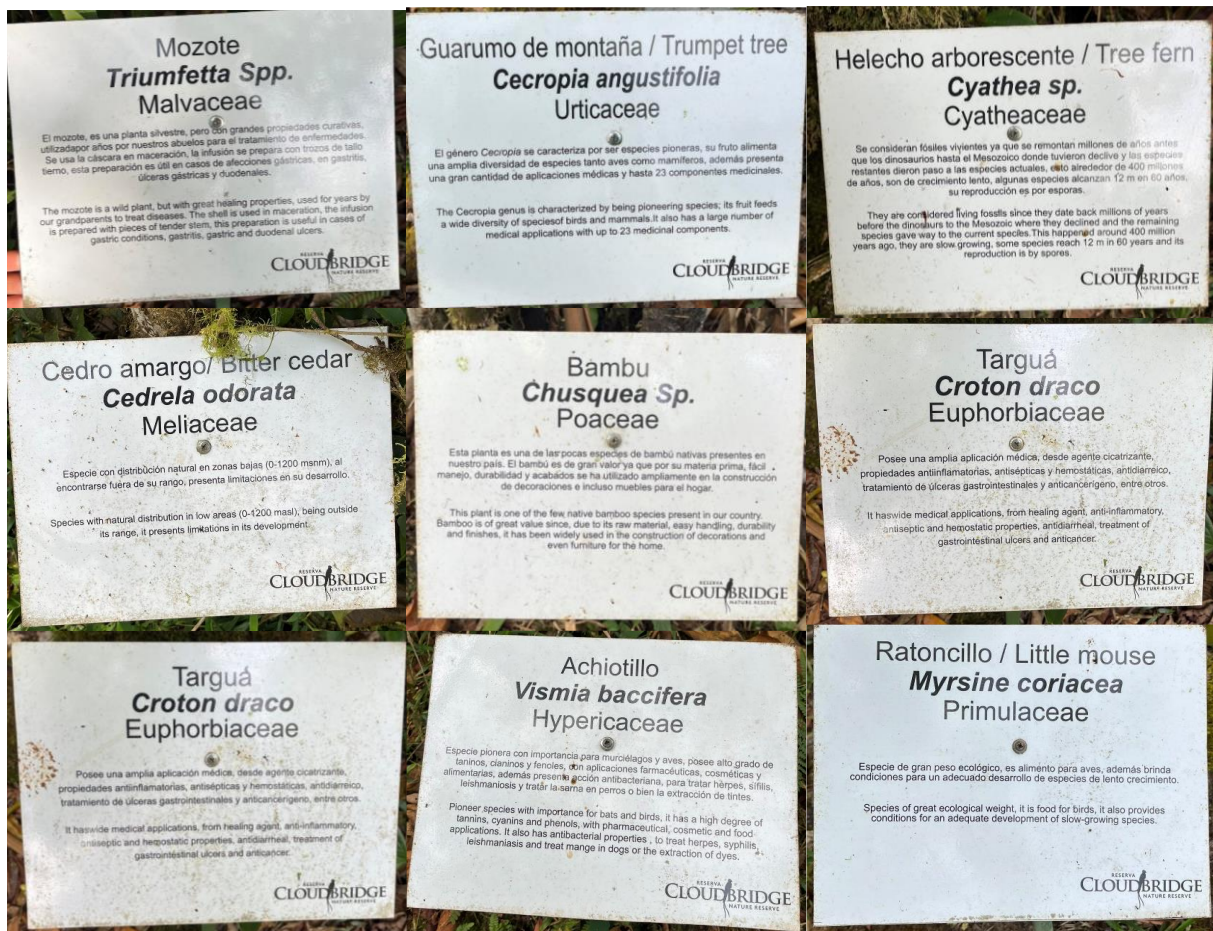


Figure 56- Educational panels with species explanation

14.10.2.4 Species identification



Figure 57 - Educational panels with species identification

14.11 Appendix 16: Limit of verification and questionnaire to visitors

→ In the 166 e-mail retaped (from 15/03/2024 till 10/05/2024), 22 mail have not been able to be sent.

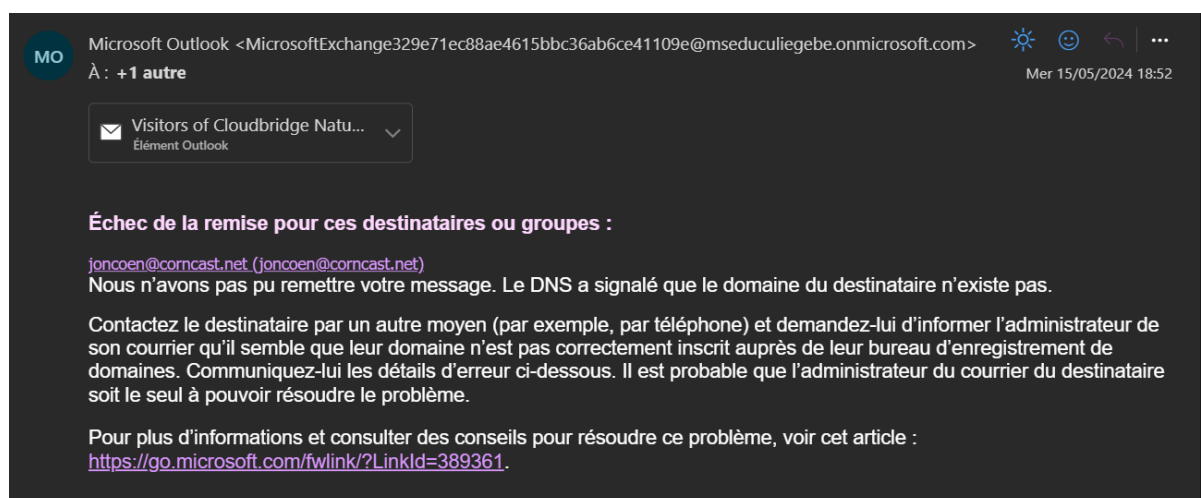


Figure 58 - Failed email delivery to tourists

The reason for the lack of visibility to tap correctly the email address:

Date Fecha	Hour Hora	Pass Country	Nombre/ Name	Conce email	# Recpt	Date Fecha
30/03/24	11:19 a.m	Costa Rica	Jennifer Jigueres	Jen29300@gmail	2	4-5-24
30/03/24	11:00 am	CR	Paul	ianoloppechea@gmail.com	2	4-5-24
30/03/24	12:26	CR	Vera Polukhovskiy	vera@polukhovskiy.com	2	4-5-24
30/03/24	12:30	CR	David Caliano	DavidCaliano@gmail.com	2	4-5-24
30/03/24	12:34	CR	Sicilia Gámez	SiciliaGomez@gmail.com	3	4-5-24
31/03/24	8:15	FRANCE	Hedon DEBIAIS	hedon.debiais@gmail.com	2	6-4-24
31/03/24	10:53	Costa Rica	Ashly B	pamebml@gmail.com	2	7-4-24
31/03/24	10:53	CR	Priscilla H	Conde.cate@gmail.com	2	7-4-24
31/03/24	11:47	CR	Leis Zúñiga	LeisZuniga@gmail.com	2	7-4-24
31-3-24	12:10 pm	CR	Diego Bonilla	dbonilla27@gmail.com	2	7/4/24
1-4-24	4:23	C.R	Angelo Berto	angel314@hotmail.com	2	7/4/24
1-4-24	8:33	Hollanda	Hse Witters	ilse.wit@yahoo.com	2	7/4/24
1-4-24	10:45	CR	Maria José	marijose@gmail.com	8	7/4/24
1-4-24	11:55	UK	Tassilo van Lier	tassilov@gmail.com	1	7/4/24
1-4-24	10:30	CR	Manuel Riquelme	camiere.mc@gmail.com	1	8/4/24
3-4-24	10:05	canada	Mar.C. Camiere	marc.camiere@gmail.com	1	8/4/24
3-4-24	10:30	CR/USA	Angela Sherwin	angela.sherwin@gmail.com	4	8/4/24
3-4-24	8:10	CR/USA	Yamira Kiera	yamirakiera@yahoo.com	3	8/4/24
4/4/24		Costa Rica	Olivia		3	8/4/24
4/4/24	9:00 AM.	COSTA RICA.	Gini Alvarez	GUALAQUIREZ33		8/4/24
4/4/24	9:00 AM.	COSTA RICA.	Federico Nelson	"		8-4-24
4/4/24	1:15 pm	Costa Rica	George Jerzmin	byan21794@gmail.com	2	10-4-24
4/4/24	2 pm	Costa Rica	Katlyn Howard			10-4-24
5/4/24	9:04 AM	CANADA, QC.	MARIE-JOSEE	ARGENTI		10-4-24
11	"	"	MARTIN GARY			

Figure 59 - Page of the notebook with information of day visitor

14.12 Appendix 17: Excel document of the questionnaire's responses

First 23 lines of responses from participants:

N°	Horodateur	Name	People	Gender	Age	Country	Occupation	Hiking trail took				Motivation to go hiking		Highlight of the hike	Animal spotted (bird, mammal, snake...)	Type of animal seen
1	3/20/2024 17:05:03		With a partner	Male	27	France	Employed	Waterfall	Cloudbridge North		River	Tourism		Nature, randonnée en nature, coté difficile du hike, pas mal d'arbre et de végétation, points de vue, reliefs...	Yes	
2	3/27/2024 11:00:57	Micodemus	Alone	Male	68	United States	Retired	Waterfall				Education	Escape	The waterfall	No	
3	3/27/2024 12:01:26	Alondra Jimenez agular	With a partner	Female	24	Costa Rica	Employed	Waterfall				Tourism	Sport	Waterfalls, snake, statue rocks	Yes	Bird
5	3/28/2024 12:54:27	Prescilla	In family	Female	32	Costa Rica	Employed	Cloudbridge North				Tourism		Waterfall	No	
6	4/12/2024 8:26:57	Tom	Alone	Male	24	Netherlands	Enrolled in University	Cloudbridge North				Education		The waterfall and a lizard I saw	Yes	Lizard
7	4/16/2024 12:47:26	Thomas and Gabriel Miller	With a partner	Male	59	Germany	Employed	Waterfall	River			Tourism		Diversity of plants	Yes	Caterpillar, libellule
8	4/16/2024 13:51:01	Leila	A group	Female	21	France	In school	Waterfall	River	Cloudbridge North		Tourism		Singe capucin	Yes	Singe capucin, libellules
9	4/16/2024 13:54:39	Mih	A group	Female	22	France	In school	Waterfall	River	Cloudbridge North		Tourism		Landscape and peace	Yes	Singe capucin, libellule
10	4/16/2024 13:59:45	Amélie	A group	Female	22	France	In school	Waterfall	River	Cloudbridge North		Tourism		River and waterfalls	Yes	Libellule, singe capucin, colibris
11	4/16/2024 15:51:14	Dania	With a partner	Female	42	Cuba	Employed	Waterfall	River	Cloudbridge North		Tourism		Monkeys and birds	Yes	Monkeys, butterflies, birds
12	4/18/2024 10:51:27	Yendry	With a partner	Female	34	Costa Rica	Employed	Waterfall	River	Cloudbridge North		Tourism		Waterfalls	Yes	Black faced solitaire
13	4/18/2024 10:51:40	Miguel Sánchez Sornellán	With a partner	Male	51	Spain	Tourism	Waterfall	River			Tourism		It's natural beauty, river and black faced solitary	No	Birds
14	4/23/2024 12:40:14	Caoimhe O Donnell	Alone	Female	21	Ireland	In school	Waterfall	River	Cloudbridge North	Sendero Montaña Loop	Education		Seeing herps	Yes	Snakes, frogs and lizards
15	4/23/2024 12:50:54	Pau	A group	Male	29	Canada	Employed	Cloudbridge North				Tourism		Waterfalls and big trees	No	Libellules
16	4/23/2024 13:21:36	James	With a partner	Male	31	England	Researcher	Waterfall	River	Cloudbridge North		Tourism		Point of view	Yes	Large species, big green humming bird (few different types, quiet green and blue)
17	4/23/2024 13:27:48	Olivia Evrard	Alone	Female	21	Belgium	Enrolled in University	Waterfall	Sendero Montaña Loop	River	Cloudbridge North	Education		Animals, point of views, waterfalls and biodiversity	Yes	Monkeys, birds, snakes...
18	4/23/2024 15:38:32	Luke Riley	Alone	Male	24	United States	Enrolled in University	River				Education		Resplendent Quetzal	Yes	Birds
19	4/25/2024 13:11:38	Louise Mathieu	In family	Female	8	France	In school	Waterfall	River			Tourism	Escape	See une "cherillie", pique-nique on a table, break next to waterfall	Yes	Bird motmot
20	4/25/2024 13:22:12	India Phillips	Alone	Female	23	England	Not working	River				Sport	Escape	The waterfall	Yes	Bird
21	4/25/2024 15:48:49		In family	Female	47	Costa Rica	Employed	Waterfall	River			Tourism		Agua	No	
22	4/26/2024 17:52:09	Alma	Alone	Female	19	France	Not working	Waterfall	Sendero Montaña Loop	River	Cloudbridge North	Education	Escape	The incredible view!!	Yes	Coati and many different birds
23	5/1/2024 14:32:55	Krysttel	In family	Male	27	Costa Rica	Employed	Waterfall	River			Tourism	Escape	Waterfalls, nature, forest, plants that I have never seen, the change of the weather and the trees where different in some places	Yes	Birds

N°	Do you no the name of the species seen ?	What have you learned from this hike in terms of nature, biodiversity, and environment?	What has the hike brought ?	Would you have liked to see more informative panels along the hiking paths, providing details about the environment?	Suggestions		Did you took the Memorial garden/ Waterfall trail ?
1	No	That there's black milk-snake		Yes	Visite guidée serait intéressant	0	Yes
2	No	Surprise to see a bamboo native from Costa Rica		No	Memorial garden had enough signage but have more signage on the others trail can be good. Sign with the silent tree is quite good explaining the nature and environment. Read some information that Cloudbridge has on their website so it helped a lot for the education. But it's really good to have signage on the trails to know more about the nature and reserve.	0	Yes
3	Yes	Names of species, trees... because of the sign		Yes	No, was amazing	0	Yes
5		Nothing		Yes	Be a great idea to put signs as for the others parc explaining for some species of trees or birds More educational signs, they don't have to be big. Maybe about the importance of some ecosystems etc. Or signs with info about certain species, for example keystone species, or the apex predators that are around here and the importance of them.	0	No
6	Yes	Nothing	The lizard and the waterfall	Yes	More signs make it dangerous because we don't look at the landscape. But that's okay that's what we like	0	No
7	No	Yes, we read a few of the signs on the hike and was really	Normal walk	No	Knowing the distance for the trails and the steep, plus the level of difficulty	0	Yes
8	Yes	There's a ancestral bamboo	Peace, and be more calm, having a great time, reflections, beautiful landscape and memories and health	Yes	Swimming and the level	0	Yes
9	Yes	Finding a plant that looks like banana	Peace and energy, better mental health and thinking	No	Swimming and level of trails	0	Yes
10	Yes	For the bamboo and a flower species	Listening to the nature	No	For the Memorial Garden, it will be nice to have more panels for the species of flowers. If thinking about adding signs it'll be good to do as in Ecuador where they have a garden with medicinal plants with the description of it just in front. That way, it helps people to appreciate, connect and be more appreciative	0	Yes
11	No	Learned about the monkeys when she saw the panels in the WC	Happiness, lot of joy, feeling peaceful	Yes	Handrail, urgent to repair!!	0	Yes
12	Yes	We need to take care of our resources, they mean life!!	Peace	Yes	Improve handrails and some parts of trail a bit slippery	0	Yes
13	No	Stop and breathe	A good shower	No	Maybe more signs for herps	0	Yes
14	Yes	You need to look and listen very carefully to see the nature around you	Happiness seeing how biodiverse cloud bridge is	Yes	Signs about animals and trees, forest formation. On the website, access by car, better explain that it's more of a hassle.	0	No
15	No	There are ferns from prehistory.	Physical efforts, calm, beautiful nature	Yes	It was gonna rain so didn't stop a lot to read anything. But it was good. We liked to have the trails more wild so the memorial garden were a great place to put the panels because it was convenient but maybe keep the wildness on the trails will be better.	0	Yes
16	No	I didn't learn everything	Good challenge, new experience, different environment	No	Adding more panels to explain about the conservation efforts, the biodiversity, the animals we can encounter etc.	0	Yes
17	Yes	Lot of names, how the conservation efforts work here, which type of species can bring something to another	Calm, peace, grateful	Yes	The steep portion of the main trail could use maintenance to reduce the danger of loose rocks and slippery conditions, though this would be a difficult improvement. The Welcome Center could have a wall of photos taken by visitors and interns, similar to the camera trap wall. This might motivate guests to take more photos and feel connected to the reserve.	0	No
18	Yes	I learned that birds are easier to observe in the early morning.	The hike brought fatigue to my quads and birds to my eyes. It was also quite peaceful.	No		0	Yes
19	Yes	There are yellow "paradise flowers". In 10 to 20 years the forest is coming back.	Joy, pleasure, transpiration	No	No	0	Yes
20	No	There are a lot of different species of plants and animals in the cloudforest, but I didn't learn anything specific about them	Joy!	Yes	More signs!	0	Yes
21	No	Es vida	Paz	Yes		0	Yes
22	Yes	I learned how rare and fragile the ecosystem of the Cloudforest is and how important it is to protect it	Sweat but also peace	Yes		0	Yes
23	Yes	Mesmerized knowing that this part of Costa Rica was underwater, the sand is so clear and white as well		Yes	Put something that says distances between trails, because I were exhausted	0	Yes

N°	Did you notice the informative panels along the hiking trail?	How many informative panels did you stop to read?	On a scale of 1 to 5, how informative did you find the content on the panels?	Did the information on the panels enhance your understanding of the reserve and its conservation efforts?	Did the informative panels influence your behavior or actions while hiking?	Did the panels increase your appreciation for the natural environment and biodiversity of the reserve?	Did the informative panels engage your interest and hold your attention?	Do you feel that the content on the panels was presented in a clear and understandable manner?	Did the informative panels contribute to your overall enjoyment of the hiking experience?	Would you recommend adding more informative panels along the hiking trail?	Do you have any suggestions for improving the content or placement of the informative panels?	Do you have any suggestions for improving the content or placement of the informative panels?	Overall, how would you rate the effectiveness of the informative panels in enhancing your hiking experience and promoting awareness of conservation issues?
1													
2													
3													
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9													
10													
11													
12													
13													
14													
15													
16	Yes	All	4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		4
17	Yes	1	4	Yes	No	No	Yes	Yes	Yes	No	Yes	Good to have a good placement, people would like to see distribution map of the species and know what species live in what part of the country. I could have read more panels but I was afraid of the rain	4
18													
19	No	1	4	Yes	Yes	Yes	No	Yes	Yes	No	No		That is good to have informative panels. We had seen other informative panels on other trails before during our trip in costa rica with similar information so we did not read a lot on them.
20	Yes	All	5	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		They are really beneficial and help me learn and appreciate what I am seeing as I hike, and how important this ecosystem is!
21	Yes	All	5	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		Estupendo!
22	Yes	2	4	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Maybe more panel but not too much text and or space and cler as possible to increse the chances that people red it intirely	Always interesting to learn more about the biodiversity and definitely newd more panels!
23	Yes	All	5	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		Pretty effective because it's clear, and go to the point, easy to adjust even if not familiar with some terms

Last 23 lines of responses from participants:

24	5/7/2024 13:37:13	Anna	In family	Female	32	Germany	Employed	Waterfall	River			Tourism		Really liked the mirador, the scenery	Yes	A hummingbird, yellow bird, 1000 feet
25	5/7/2024 16:17:24	Kevin	In family	Male	33	France	Employed	Waterfall	Sendero Montaña Loop	River		Tourism		Atmosphère global avec la forêt, le brouillard, les nuages, il fait bon (même avec la pluie)	Yes	Perroquet
26	5/8/2024 18:08:35	Antony Fuentes	A group	Male	33	Cartago	Employed	Waterfall				Tourism	Escape	Everything was clean and well maintained, also great hosts in the entrance.	Yes	Pavas (Gallinas de monte)
27	5/11/2024 11:49:01	Milo	Alone	Male	20	America	Employed	Sendero Montaña Loop	River	Cloudbridge North		Education	Volunteering	Being able to see the many different species	Yes	Monkey
28	5/12/2024 9:51:47	mahz	With a partner	Male	30	america	Employed	Waterfall	Sendero Montaña Loop	River		Tourism		Mushrooms	No	green parrot
29	5/13/2024 12:26:41	Daniel Laurent	In family	Male	58	Belgium	Employed	Waterfall	River			Tourism		The mirador view	No	Moustique, scarabé, oiseaux, papillons
30	5/13/2024 15:03:57	Tristan SaintPierre	With a partner	Male	28	Canada	Not working	Sendero Montaña Loop				Tourism	Escape	Voir la vue de la vallée, avec les petites vaches	Yes	Oiseaux et vaches
31	5/14/2024 12:42:16	Jake Owen	With a partner	Male	26	United Kingdom	Enrolled in University	Waterfall	Sendero Montaña Loop	River	Cloudbridge North	Tourism	Escape	Seeing an Ornate Hawk-Eagle	Yes	Lots of birds (Ornate Hawk-Eagle and Toucanette are my favourites)
32	5/15/2024 11:03:01	Ashly Betancourt Navarro	With a partner	Female	24	Costa Rica	Employed	Sentinel trail (public)				Sport	Escape	Escuchar los jilgueros	Yes	Aves
33	5/15/2024 11:35:15	Jennifer	Alone	Female	31	Costa Rica	Employed	Waterfall	River	Cloudbridge North		Tourism	Escape, Sport	Mirador de la Catarata	Yes	Aves
34	5/20/2024 9:53:28	Vale	With a partner	Female	31	Switzerland	Not working	River				Tourism	Sport	Catarata Caldera and the birds	Yes	Tucanette, trogons
35	5/20/2024 9:53:34	marc	With a partner	Male	32	Switzerland	Not working	Waterfall	River			Tourism		catarata	Yes	birds
36	5/21/2024 11:06:26	Ashley Rebeca Garcia Rivera	With a partner	Female	18	Costa Rica	Not working	Waterfall				Sport		El jardín celestial	No	Ninguno
37	5/21/2024 11:08:31	Hector Vargas abarca	With a partner	Male	44	Costa Rica	Employed	Waterfall				Tourism		Catarata	No	Ninguno
38	5/22/2024 7:04:02	Christy	With a partner	Female	56	Costa Rica	Retired	Waterfall	Sendero Montaña Loop	River	Cloudbridge North	Tourism		The trails and views	Yes	Quail
39	5/22/2024 13:08:12	Gerardo González	In family	Male	62	Costa Rica	Retired	Waterfall	Sendero Montaña Loop			Tourism		Catarata Pacifica y Memorial Garden	Yes	Pájaros, cien pies
40	5/22/2024 13:15:26	Roxana Cerdas salazar	With a partner	Female	61	Costa Rica	Retired	Waterfall	Sendero Montaña Loop	River		Tourism		Cataratas y caminar al lado del río	Yes	Insectos, pájaros,
41	5/22/2024 13:41:29	Jack Buggle	Alone	Male	24	Ireland	Enrolled in University	Waterfall	River			Education		The herps	Yes	Frogs
42	5/23/2024 5:24:05	Miguel	In family	Male	68	Costa Rica	Retired	Waterfall				Sport		La catarata	Yes	De largo. Vi una especie negra parecido a un gato
43	5/23/2024 13:19:23	Thomas	With a partner	Male	35	Belgium	Employed	Waterfall	Sendero Montaña Loop	River	Cloudbridge North	Tourism		Finishing the tour, many different insect and flowers. A lot of waterfalls and nice environment	Yes	Only insects
44	31/05/2024 12:55	Marion Pellerin	In family	Female	19	Canada, Montreal	In school	Waterfall	River			Tourism		The first waterfall of the Catara trail was spectacular	No	
45	04/06/2024 12:55	Christine NESPOULOUS	With a partner	Female	56	France	Employed	Cloudbridge North				Tourism		Very beautiful View of the Chiripo from the mirador. Path is very nice. Waterfalls and river are Nice	Yes	Bord
46	18/06/2024 02:10		In family	Male	64	BELGIUM	Retired	Cloudbridge North				Tourism		LANDSCAPE, bURDING NATURE	Yes	BIRDS, SUIREL, INSECTS...

24	No	When we say it starts to rain, it starts to rain		Yes	It was nice	0	Yes
25	No	Les espèces de plantes.. mais on n'a pas passé beaucoup de plantes avant. Déforesté il y a 20 ans et à présent on a énormément d'arbres	Pas grand monde et de vrais chemins pas trop aménagés. Le chemin n'est pas rendu rein que pour les touristes comparé aux autres parcs	Yes	Dans le WC c'est pas mal, avoir un équilibre aussi d'avoir des panneaux avec le petit point d'accueil.	0	Yes
26	No	Water is so important.	Peace and refreshment	Yes	Reduce the price for locals. Feels a bit expensive.	0	Yes
27	Yes	The ecosystem up here is constantly going through harsh weather and changes, the competition between the different species is very prominent		Yes	Better signage for the the trails, it's hard to know where and what a turn off for a trail is	0	No
28	No	Diverse mushrooms		Yes	Where to find specific animals	0	Yes
29	No	On a lu les panneaux quand on les voyait		Yes		0	Yes
30	No	Biodorme		Yes	Panneaux sur la flore	0	No
31	Yes	I have learnt a lot of new species of wildlife and about cloudforest climates		Yes	No Suggestions	0	Yes
32	No	Aprendí sobre la paz que brinda el bosque. Aprendí sobre la importancia de cuidar y preservar estos espacios ya que nos brindan muchos beneficios a la sociedad y humanidad en general. La posibilidad de escuchar aves en su habitat natural.		Yes	No	0	Yes
33	No	Debemos preservar mas lugares como estos para mantener el equilibrio del medio ambiente. Me parece excelente que las personas no se puedan bañar en el rio ya que así se evita la contaminación y se ve mas como un lugar para apreciar la naturaleza y no para lucrar de ella y terminar contaminado y destruyendo el habitat		Yes	Rotulación de arboles, y animales que se pueden ver en la zona. Promocionar algun app que nos ayude a identificar el nombre del ave que vemos	0	Yes
34	Yes	How long reforestation takes, the size of some animals that I'd thought would be smaller or bigger		Yes	Some of the steps were very hard to climb/descend for me (I have some knee issues)	0	No
35	No	enjoying quietness		Yes		0	Yes
36	No	Que tenemos que cuidar nuestra naturaleza		Yes	No	0	Yes
37	No	Importancia de la conservación		Yes	Esta muy bien	0	Yes
38	Yes	Codependent environment		No		0	Yes
39	No	La Naturaleza es vida tenemos que luchar junto a ella.		Yes	Indicar distancia del rótulo de guía a la catarata. Por ejemplo la Pacifica casi no pasamos pensando que habia que descender mucho.	0	Yes
40	No	Definitivamente te confirma la riqueza natural y hermosa que nos ofrece este pequeño país, lo importante de su conservación y de todo lo que se pierde cuando por crecer económicamente perdemos la conciencia de lo que realmente es valioso.		Yes	Casi no pasamos a la última catarata, primera entrando, porque temíamos que nos lloviera y decidimos hacerlo, nos sorprendió que fuera un trayecto tan pequeño, y realmente nos habríamos perdido de algo muy hermoso, creo también que los rótulos entre cada información, podría decir la distancia para llegar y así se calcula con más tranquilidad el tiempo de acuerdo a lo que cada persona tenga planeado	0	Yes
41	Yes	The diversity of cloud forests		Yes	More signs highlighting possible species/ reforestation efforts	0	Yes
42	No	Protección de la flora y fauna.		Yes	Todo lo vi muy bien	0	No
43	No	How cloudforest work		Yes	More info about the forrest at the start location	0	Yes
44	No	I would not say I learned things, but I really embraced the beauty of this place.		Yes	We really loved it. I would have liked to have more information about some plant species.	0	Yes
45	No	Nature is so beautiful		Yes	Maybe more information on what animals we could see	0	No
46	No	NOTHING		Yes	IT WILL BE GREAT TO INSTALL INFORMATION PANNELS	0	No

24	Yes		4	4 Yes	No	Yes	Yes	Yes	Yes	Yes	No		3
25	Yes	All		4 Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Comprendre un peu plus pour l'altitude, aux niveau des cascades	2
26	Yes		10	4 Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Make them less wordy and with bigger font size	Great
27													
28	No		1	3 Yes	Yes	Yes	No	Yes	No	Yes	No		2
29	Yes	All		3 Yes	No	Yes	Yes	Yes	Yes	Yes	No		3
30													
31	Yes		2	4 Yes	No	Yes	Yes	Yes	Yes	Yes	No		4
32	Yes		4	4 Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		5
33	Yes		2	4 Yes	No	Yes	No	Yes	No	Yes	No		3
34													
35	Yes	All		4 Yes	No	Yes	Yes	Yes	Yes	Yes	No		5
36	Yes		6	5 Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		5
37	Yes		3	3 Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		5
38	Yes		5	5 Yes	No	Yes	Yes	Yes	Yes	No	No		4
39	Yes		3	4 Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Distancias mas especificas	4
40	Yes		6	4 Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Distancia, tiempo de recorrido, variedad flora	4
41	Yes	All		4 Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	More images possibly, less reliance on sentences	4
42													
43	Yes	All		4 Yes	No	Yes	Yes	Yes	Yes	Yes	No		4
44	Yes		2	5 Yes	No	Yes	Yes	Yes	Yes	Yes	No		5
45													
46													

Table 11 - Excel document of the questionnaire's responses

14.13 Appendix 18: Panels' Placement on the River Trail

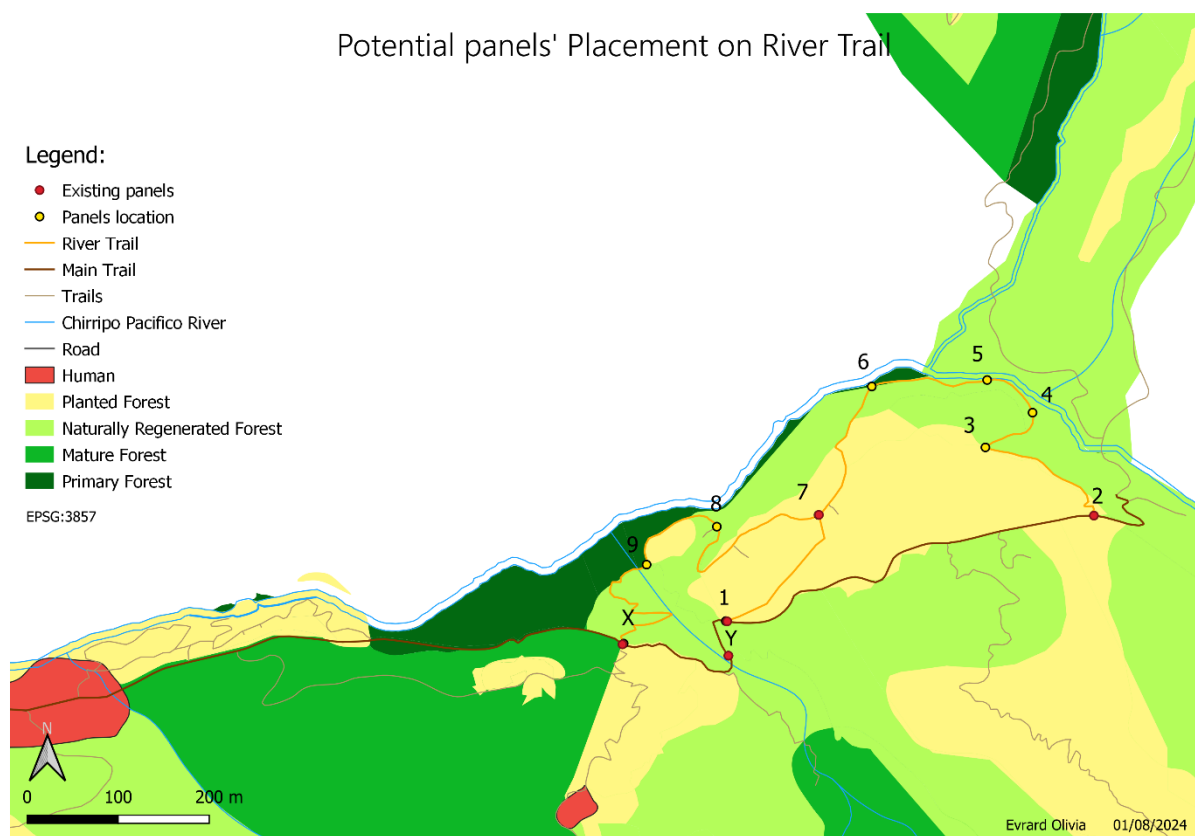


Figure 60 - Panel's potential placement on the River Trail (conceived with QGIS)