PARTICIPATORY ASSESSMENT OF A COMMUNITY'S CLIMATE RESILIENCE AND POTENTIAL FOR THE REDD+ PROGRAM IN THE DOMINICAN REPUBLIC

By

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ABSTRACT

Keywords: agroforestry, climate change adaptation, conservation, corruption, developing country, ecosystem-based management, empowerment, forest, international, public-private partnership.

To adapt to climate change, the Dominican Republic is writing its national strategy for the REDD+ program. An ongoing conservation project managed by the *Fondo Agua Santo Domingo* got fast and cost-effective results compatible with REDD+ activities. The *Ministerio de Medio Ambiente y Recursos Naturales* wants to know how it is managed and what potential it holds for REDD+. Concerns were also expressed as if the *Fondo Agua Santo Domingo* only has donor-based objectives or if it also aims to improve the involved community's resilience. Since this community has the responsibility to maintain an ecosystem service, a climate resilience assessment would empower the participants to build resilience in their community and make external organizations aware of local considerations for sustainable development.

The methodology, inspired from the principles of the Stockholm Resilience Centre and the Community Based Resilience Assessment practical framework, encompasses the most important elements of resilience building through a qualitative and quantitative field assessment done in groups and individual interviews.

The results show that the scale of a reference disturbance like hurricane Noel puts most of a household's capitals at stake. Some pathways locally exist to improve household resilience, but external help is absolutely needed to improve the community-wide absorptive, adaptive and transformative capacities. Interventions should focus on connectivity management and diversity and redundancy maintenance in priority. The community members established that access to health services, resistant houses, access to clean water and resistant streets were their most critical climate resilience needs. Excellent REDD+ potential has been proven by participation in previous projects, communitarian solidarity, trust in the stakeholders, increasing quality of the natural capital, and respected criteria from activities in Peru and Zambia, which states agroforestry is the most optimal for land use. Based on the results, proposed recommendations should improve Santana's resilience, should facilitate REDD+ registration, put perspective on participative conservation design and help to solve systemic corruption. The case for Santana is common across the globe, where the provision of an ecosystem service becomes the responsibility of a vulnerable community. The resilience priorities established should be considered by stakeholders as starting points for community-wide resilience building or for monitoring.

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LIST OF ACRONYMS, SYMBOLS AND INITIALS

AM	Adaptive Management
ASOCAES	*Asocición de Caficultores la Esperanza*
CAASD	*Corporacion de Acueductos Y Alcantarillado de Santo Domingo* (Water Supply Corporation and Aqueduct and Sewer Corporation of Santo Domingo)
CAS	Complex adaptive system
CEDAF	*Centro para el Desarrollo Agropecuario y Forestal* (Centre for the development of agriculture and forestry)
CC	Climate change
CoBRA	Community-Based Resilience Analysis
DFD	Deforestation and forest degradation
DR	Dominican Republic
DOP	Dominican pesos (in 2018, 1 Canadian dollar was worth 38.5 DOP)
ECORED	*Red Nacional de Apoyo Empresarial a la Protección Ambiental* (The National Network of Business Support for Environmental Protection)
FASD	*Fondo Agua Santo Domingo*
FCPF	*Fondo Cooperativo para el Carbono de los Bosques*
FGD	Focus Group Discussion
gha	Global hectare
GHG	Greenhouse gas
ha	Hectare (10,000 m2)
HDI	Human Development Index
KII	Key informant interview
LAC	Latin American and the Caribbean
LAWFP	Latin American Water Funds Partnership
MMARN	*Ministerio de Medio Ambiente y Recursos Naturales* (Ministry of Environment and Natural Resources)

NDS	National Development Strategy
ONE	*Oficina Nacional de Estadísticas* (National Office of Statistics of the Dominican Republic)
$PPP	Purchasing power parity constant of 2011
RA	Resilience Alliance
REDD+	Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries (United Nations Framework Convention on Climate Change [UNFCCC], 2008)
SRC	Stockholm Resilience Centre
SES	Social-ecological system
SLF	Sustainable Livelihoods Framework
TNC	The Nature Conservancy
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

LEXICON

Absorptive capacity	How a community reacts to a direct shock.
Adaptive capacity	"Systems with high adaptive capacity are more able to re-configure without significant changes in crucial functions or declines in ecosystem services. A consequence of a loss of adaptive capacity, is loss of opportunity and constrained options during periods of reorganization and renewal." (Resilience Alliance, n.d.)
Adaptive management	"Adaptive management identifies uncertainties, and then establishes methodologies to test hypotheses concerning those uncertainties. It uses management as a tool not only to change the system, but as a tool to learn about the system." (Resilience Alliance, n.d.)
Bioregion	"Bioregions are relatively large land areas characterized by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems." (Office of Environment & Heritage, 2016)
Complex adaptive systems	"A complex adaptive systems approach means stepping away from reductionist thinking and accepting that within a social-ecological system, several connections are occurring at the same time on different levels. Furthermore, complexity thinking means accepting unpredictability and uncertainty, and acknowledging a multitude of perspectives." (Biggs et al., 2014)
Fiscal policies and incentives	"The ways in which governments use taxes and government revenue to incentivize or penalize certain actions or behaviours." (United Nations Environment Programme, 2017)
Geologic time scale	A time scale relative to Earth's history since its formation.
Mental model	"Cognitive structures upon which reasoning, decision-making and behaviour are based." (Biggs et al., 2014)
Nepotism	The unfair use of power in order to get jobs or other benefits for your family or friends (Collins Dictionary, 2018).
Parnarchy	"All systems […] exist and function at multiple scales of space, time and social organization, and the interactions across scales are fundamentally important in determining the dynamics of the system at any particular focal scale. This interacting set of hierarchically structured scales has been termed a panarchy." (Resilience Alliance, n.d.)
Social-ecological system	"Social-ecological systems are complex, integrated systems in which humans are part of nature." (Resilience Alliance, n.d.)
Transformative capacity	The capacity of a system to change at system scale

Weatherable	That can be degraded by weather.
Life zone	Similar to the concept of biome, an area with similar plant and animal communities, specified by its latitude, altitude and humidity (McColl, 2005).

INTRODUCTION

The increasing concentration of greenhouse gases (GHG) in the atmosphere is capturing more and more solar radiation on the planet, and this increased global energy balance causes climate change. The effects associated to changes in climate patterns may be slow in some locations. They may not be felt, and the need to adapt or to fight these changes may not feel urgent or even be considered. In Dominican Republic (DR), climate change adaptation is implemented in the most important national development strategy. The effects are particularly felt by the damages caused by hurricanes. Hurricanes and tropical storms are natural local phenomenon, but both have increased in wind speed and duration over the last 30 years (Emanuel, 2006). Mitigating the mechanisms responsible for their formation, namely a warm ocean surface temperature and a moist layer in the troposphere (National Oceanic & Atmospheric Administration, 2014), demands a lot of theoretical and practical knowledge, and requires the capacities to act on the global scale and to coordinate with other mitigating actions. Simply put, to reduce the energy absorbed by the atmosphere, the concentration of GHG needs to diminish. The reduction of GHG emissions is widely discussed as a solution to stabilize the concentration, but gases also need to be sequestrated to be able to return to a less disturbed climate state.

Reduction and sequestration prove to be particularly difficult for countries with fewer resources, especially if they are vulnerable to increasingly destructive phenomenon. The geographic position and the socio-economic condition of DR put it in a state of high vulnerability. Every year, hurricanes strike the country and cause infrastructural and human losses, and the scale is unpredictable. Because climate change (CC) can't be reversed in the short term, resisting such events is part of adapting to their acknowledged presence. An enlarged approach to sustainable development based on the management of disruptive events at the scale of a social-ecological system is called resilience. Climate resilience incorporates the capacity to absorb a disturbance linked to CC to the capacity to evolve and transform to be able to cope with or even avoid these disturbances on the long term.

To reduce greenhouse gas emissions, to stock atmospheric carbon, and to empower poorer countries to act, a global solution has been elaborated by the United Nations Framework Convention on Climate Change eleven years ago: a program called Reducing Emissions from Deforestation and forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries, or REDD+. Studies have identified deforestation and forest degradation (DFD) as one of the main sources of GHG emissions. In fact, around 10% of net global GHG emissions have been identified to come from DFD. This takes into account the sequestration of carbon due to forest growth and

recovery. This highlights that restoration acts as a very important sink of atmospheric carbon. (UNEP, 2017) Since the REDD+ program provides the necessary resources to participate in its activities and because of the possibility to make profits in emerging carbon markets, the government of DR has decided to start developing its own national strategy.

Four years ago, the *Ministerio de Medio Ambiente y Recursos Naturales* (MMARN), the Ministry of Environment of DR, started procedures to concretize its participation to REDD+. One key aspect of nationally enabling the program is the establishment of a functional benefit sharing mechanism, from the donors to the implementers, with all the necessary management. This leads to the formulation of three primary objectives for this essay.

I. An ongoing conservation project managed by the *Fondo Agua Santo Domingo* (FASD) has the reputation to have excellent, fast, and cost-effective results. The MMARN is interested to know how a public-private partnership like the FASD is managed to create more efficient national natural resources management solutions. (P. Garcia Brito, pers. comm., May 21, 2018; C. Ortiz Rojas, pers. comm., November 3, 2017)
II. Since the FASD involves agroforestry, an activity compatible with the REDD+ program, the MMARN also wants to know what potential it holds to participate in REDD+. However, since the strategy is in its preparation phase, a methodology to evaluate the potential would need to be developed. (C. Ortiz Rojas, pers. comm., November 3, 2017)
III. Since the community involved in the conservation project, Santana, is very vulnerable to climate change, since the community has the responsibility to maintain the provision of an essential ecosystem service, namely access to water in the national capital, and since the FASD is a prototype that could be replicated, it seemed necessary to assess its climate resilience and inform the stakeholders of the results. A participatory assessment process would seize the opportunity to empower the community with new knowledge and engage discussions on how to develop sustainably.

This participatory assessment is necessary to reach those three objectives, but also serves an important secondary purpose. Concerns are expressed as if the current FASD project only has self-serving, donor-based ecological objectives, or if it also aims to improve Santana's resilience. The essay also tries to answer this question and analyze how exactly the FASD takes part in the resilience of the community. The results should encourage stakeholders to add clear community development or well-being objectives to their activities. A vulnerable community hit by a sufficiently disturbing event can cause the loss of all previously done work (in this case water replenishment and reforestation), and it is in the interest of the durability of

the attainment of the objectives of the donors to build local resilience. Both the primary and secondary objectives should serve to design future projects, to help the orientation of the national REDD+ strategy, to protect the community from unfair treatment, to improve the quality of life of the participants, to develop CC adaptation strategies, and to help the long-term protection of the environment.

The essay is composed of five chapters. The presentation of the context surrounding the assessment serves to understand where the three primary objectives come from, and to answer to the first one. The context allows to understand what the social-ecological situation of the country is, as well as its governmental objectives. Then the mechanism of the FASD is explored in both its history and its implications for the community. The specific context of the community is also presented and serves as a base on which the assessment methodology will source its focus.

The complete mechanism of REDD+ follows and is explored in its international objectives, and strategy development processes. It serves to understand the national goals and challenges, the possible funding opportunities and the possible ways to evaluate the potential of a hypothetical registration. This also helps to reach the second primary objective.

The third chapter is the participatory assessment methodology. It presents the global theoretical framework of resilience, and an inspirational practical framework from the United Nations Development Programme. It is called Community Based Resilience Analysis, and it is specifically designed to empowerment the participants to react to natural disaster threats in a very vulnerable community. Based on the two frameworks and on REDD+ criteria, the resulting participatory resilience assessment's methodology and its five phases are explained, along with how the results will be treated.

The results of the assessment are in two parts given they have to answer to two different objectives. The resilience results explain what the community's own perception is of its composition as a social-ecological system, and what it is vulnerable to. It also led the participants to establish community resilience priorities, which are compared to permanent necessities. The characteristics of the households identified by focus groups as more resilient is then discussed to understand which capital can be attained and which resilience principles are the most needed to build local community resilience. The efficiency of the strategies responsible for those characteristics is then analyzed to confirm what is most needed in the community to build resilience. The last part of these results is a proposition on how each characteristic can be attained and, inversely, what would be the outcomes of each strategy. The resilience pathways are presented in a matrix along with the factors preventing local resilience building. The REDD+ potential results evaluate the interest

of the community for the program and its activities, the capacity of the community to participate in the program, and the current perception of the quality of the natural capital and its usages. The potential is also compared to criteria from other countries to assess the current activities' compatibility to REDD+.

The last chapter is composed of four sets of recommendations coming from the literature, from the assessment's participants, and from contributors to this essay. The first set is about resilience building in the community based on identified vulnerabilities, chosen priorities and found necessities. The second set concerns what is needed for a successful REDD+ registration based on the local potential. Questions about the end of the activities of the FASD are asked to discuss if a possible transition to REDD+ would be possible. The third set concerns general concerns on participative conservation project design, as on how to do fair and efficient decision-making to avoid resource loss and corruption. Since corruption has been mentioned throughout the assessment as one resilience preventing factor, the last set of recommendations proposes solutions on how to fight it in a systemic manner.

1. CONTEXT PRESENTATION

The chosen community for this assessment is called Santana de Benito, or simply Santana, and is situated in the subbasin of the river Mahomita, located in the northeastern part of the Nizao river watershed. Five years ago, The Latin American Water Funds Partnership (LAWFP) started the *Fondo Agua Santo Domingo* (FASD) to protect the bodies of water surrounding the capital, which have been degrading rapidly. Santana got involved with the FASD as a pilot for an upscalable recovery of the water resource, and a process to change the local practices related to agriculture, forest use and water management started.

1.1 Community Characteristics

Santana is part of the municipal district of Los Cacaos, in the province of San Cristóbal. Around 80 households, among which 39 participate in the Mahomita subbasin project, live there, most of them farmers, just south of the *Loma Humeadora* National Park. The community, though isolated and fairly unknown, is in ad equation with its national context and the following section covers how. The scale of the entire Nizao watershed has been chosen to represent its social-ecological characteristics as described below, as well as the pressures that influence it. Different maps of the watershed found in annex 1 are used throughout the following sections to illustrate land usage and cover types.

1.1.1 National Context and Strategies

The sovereign insular state of Dominican Republic (DR) has approximately 10.3 million inhabitants living on a 48,315 km^2 territory, on the eastern side of the island of Hispaniola in the Greater Antilles archipelago of the Caribbean Sea (Oficina Nacional de Estadísticas [ONE], 2018). The only neighbouring country is Haiti, on the western side of the island. Its Human Development Index of 0.722 indicates that the country is in the high human development category, with a context comparable to the ones of El Salvador and Jamaica. In 2015, the life expectancy at birth was 73.7 years, the expected years of schooling were 13.2, and the Gross National Income per capita was 12,756 US$PPP. (United Nations Development Programme [UNDP], 2016)

The country has had one of the fastest economic growth in the Latin America and Caribbean (LAC) region for the last two decades, mainly driven by the construction, manufacturing, tourism, and mining sectors (The World Bank, 2018). As 80.6% of the population lives in cities, secondary and tertiary sectors make up for most of the economic activity. Actually, only 5.5% of the economic activity is related to the agricultural

sector. (Central Intelligence Agency, n.d.) The biocapacity and ecological footprint of the country have been stable since 1998, with a slight deficit of -1.0 gha per person, meaning that the domestic exploitation of resources expanded at the same rate as the population growth (Global Footprint Network, 2018). Even though 79.5% of the forest land cover changed usage since 1990 (UNDP, 2016), the rapid development is due to a dominant value of importations. It has been twice as much as the one of exports for the last eight years. Population growth increased urban sprawl and construction, which means more need for construction materials and land for food production. Even through this growth, 28.9% of the population still lives under the national general poverty line, meaning that inequities between the poorest and the richest citizens are growing as well. (ONE, 2018)

DR has been one of the first countries to finish a National Development Strategy (NDS) that integrates an economic development compatible with CC. In this regard, the government has ambitious visions for its forestry and agriculture sectors. It estimates that the forestry sector could be transformed into a net carbon sink because its current emissions are decreasing. At an estimated average cost of 4 USD/tCO_2eq, sufficient efforts in afforestation, in reforestation, and in slowing down deforestation could lead to create 15,000 new jobs and to capture USD 35 million worth of carbon per year in 2030, mainly through international funds in the REDD+ program and the Clean Development Mechanism. (Consejo Nacional para el Cambio Climático y el Mecanismo de Desarrollo Limpio [CNCCMDL], 2011) The agriculture sector should be developed accordingly, but has not been identified as a priority. It has simply been acknowledged as one of the main sources of greenhouse gases (GHG) emissions and pollution in the country, with a will to act on it. Efforts are more concentrated in stopping agricultural sprawl and displacing small farmers for reforestation than democratizing the transition to sustainable practices. (CNCCMDL, 2011) Therefore, any project with a potential for those programs, like the one in Santana, may be of high interest for the state. The only problem with the national REDD+ strategy is that it may not be operational until 2020 (P. Garcia Brito, pers. comm., May 21, 2018).

1.1.2 Biogeophysical Characteristics of the Nizao and Mahomita Watersheds

The Nizao watershed consists of nine tributary subbasins in the mountainous area of the *Cordillera Central* and covers 1,039.84 km^2. It is distributed over 10 municipalities in the southern part of the centre of the country, in the provinces of La Vega, Peravia, San Cristóbal and San José de Ocoa. It crosses seven life zones and two transition zones. These zones are illustrated in figure A1.1 of annex 1. 42% of the area is covered by super-humid tropical forest and humid subtropical forest, in climates varying between monsoon and oceanic. Precipitations are therefore abundant, ranging from 900 mm to 2000 mm annually, at altitudes

varying from 400 m to 2200 m. In the super-humid forest, the percentage of evapotranspired water is equal to the amount of rain that falls, which results in the channels of the streams carrying water only in the months of maximum precipitation. In the humid forest, potential evapotranspiration is estimated at 20% less than the total annual average precipitation. (Ministerio de Medio Ambiente y Recursos Naturales [MMARN], 2017a)

Agricultural use covers 31.87% of the land. This includes areas with intensively implemented annual crops, intensive crops, and subsistence agriculture, all mainly located in the lower areas. Perennial crops occupy 16.95% of the area, almost entirely composed of coffee, grown mostly in the middle part of the basin, in higher areas. The pasture area represents 15.84%, including intensive and natural pasture. Other coverings in the basin include savannah vegetation, urban areas, dams and lakes. Land cover types can be found in figure A1.2 of annex 1. The northeastern part of the basin is considered to contain a high level of vegetal endemism, and generally a high ecological value. In terms of protected areas which are shown in figure A1.3, 42.22% of the watershed is under the National System of Protected Area as national parks, scientific reserve and ecological corridor. The ministry of environment and natural resources considers that 47.28% of the area is not adequately used regarding productive capacity and actual usage, most of it being overutilized around the Mahomita River. (MMARN, 2017a) These considerations are shown in figure A1.4.

The Mahomita subbasin has an area of 11,460.13 ha. The soils are suitable for forests, distinct by their stoniness, depth, and steep topography. (Segura, 2014; MMARN, 2017a) Still, conditions are perfect to grow coffee, which happens to be a great culture to hold soil. Indeed, coffee is a bush that needs the cover of taller trees which have deep roots. Ideally, coffee requires good drainage, an altitude between 550 m and 1,100 m (the Mahomita subbasin is between 300 m and 1300 m), and a temperature is between 15°C and 24°C (the subbasin has a mean annual one between 21°C and 24°C). (Centro para el Desarrollo Agropecuario y Forestal [CEDAF], 2014b; Diby, L., Kahia, J., Kouamé, C., and Aynekulu, E., 2017; MMARN, 2017a) The abundant rainfall also causes almost continuous flowering in coffee, which results in two harvesting seasons per year. (Coffee Research Institute, 2006)

1.1.3 Specific Social-ecological Context of Santana

For the following section, two maps of the Mahomita subbasin can be found in annex 2. They show the latest data gathered by the MMARN in 2012 regarding rivers, villages, roads and land cover type.

The village of Santana is part of the municipality of Los Cacaos. However, it is at least 25 km further down the meandering road. One needs to continue north of Los Cacaos where the paved road ends, through Calderon and other very small villages, before reaching Santana further in the mountains. It is also located at the very end of the dirt road, just after the village of Arroyo Grande, and both are in the Mahomita subbasin. The geographical conditions are very similar to the ones of the Nizao watershed presented earlier. Evapotranspiration is a bit different, which is about 60% less than the average precipitation, leading to the formation of streams all year long. The soils of this subbasin are mostly sandy loam, a condition that facilitates the erosive processes, with low content in organic matter and nitrogen, and with high content in potassium. (Segura, 2014)

The biggest difference is related to biodiversity, because few forest species constitute the natural arboreal vegetation locally. However, the *Loma Humeadora* National Park just north of Santana, has been declared a key point for the conservation of biodiversity by the Cooperation Fund of Critical Ecosystems, because it houses endemic species under various threat categories on the Red List of Endangered Species of the International Union for Conservation of Nature. In this regard, the potential usage of land for agroforestry is 4,286 ha. As for the rest, 5,148 ha are classified as a protected zone, and 565 ha for forest use. (Segura, 2014) In terms of biological threats, no snake, spider or big mammals threaten agricultural activities. The only two issues mentioned by the locals were the sometimes abundant mosquitoes and two easily identified plants that cause very short skin rashes.

Agriculture is the basis of the economic activities, especially coffee and livestock. The agriculture is not organic, but given the lack of resources and poverty, people have very little access to fertilizers and pesticides. (Segura, 2014; G. Morales, pers. comm., May 11, 2018) The extraction of wood in the area is not very popular, as only 4% of the inhabitants of Santana carried out this activity to expand the agricultural land (CEDAF, 2014a). According to the 2002 census, 49.9% of the homes of the Province of San Cristóbal are considered poor, and, of these, 1,422 are in the municipality of Los Cacaos. The Mahomita Basin has the highest percentage of poverty of the municipality, at 81.8%. (Segura, 2014) During a workshop given by the CEDAF, all attendees mentioned that their favourite activity was agriculture, and that they all loved very much the environment they lived in. All skills related to agriculture are taught by parents to their children through work and rarely come from outside or from specific studies. (R. B. Geronimo, pers. comm., June 26, 2018)

As multiple social studies have been conducted on varying scales in the area, the statistics on Santana are presented in the following table 1.1, sometimes as a part of Los Cacaos and other times joined with Arroyo Grande.

Table 1.1 Statistics on Santana (Retrieved from: CEDAF, 2014a; ONE, 2016)

Living Conditions	
Households made of precarious, mostly organic materials	74%
Households with electricity supply	All those surveyed have electric power from the power line
Households with access to means of transport	59%
Population using wood for cooking	88%
Population receiving drinking water as a service	60% (18% of this water comes from wells or aqueducts, and 57% comes from streams or ponds)
Technology and Communication	
Households with a mobile phone or landline	46.6%
Households with a computer	4.2%
Households with an internet connection	0.9%
Households with radio and/or television	58%
Education	
Population that completed primary education	65%
Illiteracy rate	27.9% "It is rare to encounter people that can read or write" (G. Morales, pers. comm., May 11, 2018)
Economic Activity	
Economically active population	63%, of which 73% is engaged in agricultural work, 12% to trade and 15% to other activities

Economic Activity	
Average Monthly Income	5,000 DOP
Population considered able to work	79.2%
Spending priorities	Food, health and education
Health	
Population reporting a permanent limitation	6%
Population reporting diseases	35%
Political Activity & Gender	
Average population participating to municipal and national elections	75.1%
Women elected officials	42.9%
Community members who think that women have had the same opportunities	86%
Community members who consider women are at a disadvantage	65%
Violence	
Number of reported suicide, traffic accident, drowning or electrocution in 2014	0
Number of reported homicides in 2014	1
Land & Natural Resources	
Population with owned lands or entitlement	50%
Population that manages natural resources on their lands	9%
Population with crops affected by plague	54% (31% use pest control methods)
Population that received agricultural technical assistance	34%
Population that has reforested	56%

In terms of participation to the activities of the FASD, most people in Santana are motivated and are used to visits from stakeholders of the project (G. Morales, pers. comm., May 11, 2018). As an example, 57% of them have participated in the reforestation campaigns from 2013, and 53% of agricultural producers carry out conservation work within their farms. Also, 85% of them understand that the productive capacity of their soils has decreased in recent years and that conservation actions are needed. (CEDAF, 2014a)

The most important local institution is the *Asociación de Caficultores la Esperanza* (ASOCAES). Its creation was triggered by the need to unify in the face of massive culture loss after the passage of hurricane David in 1979. It now regroups more than 600 members across many communities close to Los Cacaos. In Santana, 16 households are members. The coffee is all processed in Los cacaos, from where it is mostly shipped across the region of San Cristobal, but also in Santo Domingo and to a few international buyers. Since coffee production is so important in Santana, the ASOCAES acts as the entry point of external initiatives and key facilitator of development for the community. A few other social groups exist: common monetary savings, the church, and school committees. (R. B. Geronimo, pers. comm., June 26, 2018)

As for future planning, the need to create a local entity responsible for the representation of Santana in Los Cacaos independent from the ASOCAES has been mentioned by many and may happen in the following years. However, the aging population and constant poverty worry the leaders about what the future holds for Santana as many families now try to send their children away from the village in hope of giving them more successful opportunities. (R. B. Geronimo, pers. comm., June 26, 2018)

1.1.4 Pressures

The global and national population growth, expected to peak domestically around 2050, will increase the pressure on forests and agricultural lands with a bigger demand for food, infrastructure, and energy (Department of Economic and Social Affairs of the United Nations [DESA], 2015). Increased productivity on existing cropland will account for some of the supply, but the expansion of agriculture will continue to be a major driver of forest loss. The global demand for wood products, mainly for furniture and construction, is likely to come from tropical developing countries. It is thought that illegal domestic wood trade will increase, unless concerned countries on both sides of the trade improve their law enforcement capacities. (United Nations Environment Programme [UNEP], 2017) Since the energy produced in the country is not available everywhere, is expensive, is only sourced at 13.2% from renewables, and the government identified the energy sector has the most emitting of GHG, the demand for biofuels is likely to increase

(CNCCMDL, 2011; UNDP, 2016). In the Nizao watershed, the main pressures on forest loss are also for wood trade, agricultural expansion, and charcoal production (G. Morales, pers. comm., May 11, 2018).

The geographical localization of Hispaniola puts the DR in a particularly vulnerable situation regarding CC. While Haiti has been among the three most affected countries in the world since 1996, DR is in the eleventh place according to Global Climate Risk Index (Kreft, Eckstein and Melchior, 2017). By 2050, the average annual temperature is expected to increase by 1°C to 2°C, resulting in intensified hydrological cycling. Extreme weather events are also more likely to happen by 30% between May and October. After 2050, the drought season (December to April) may intensify, as the total annual rainfall should decrease by 15%, especially in the provinces of the South and West, where Santana is situated. Moreover, the existence and increase of several vector-borne diseases, such as Zika, chikungunya and dengue, are to be expected due to the change in temperature and precipitation. Therefore, adaptation measures have become a priority for the government since 2011 in their latest NDS. Even if the number of actions is multiplying, concrete results may not be expected soon since the NDS and National Climate Change Adaptation Plan aim to finish the related studies, plans, policies and laws by 2030. (MMARN, 2017c) Since much of the funding to put this in place is international and goes to government-related organizations, the numerous political intentions lack the necessary resources and embodiment means for large-scale implementation.

Concerning the Mahomita subbasin, it presents serious conditions of deterioration. The main factors that cause degradation in this area are the steep slopes, the erosion caused by rain, weatherable rocks highly productive of sands, actions of deforestation, construction of roads without adequate requirements and bad agricultural practices (CEDAF, 2014b). The community is also at risk of natural hazards. Luckily, landslide, volcano eruption and extreme heat are at no to low risk according to the Global Facility for Disaster Reduction and Recovery. River flood, coastal flood, earthquake and water scarcity are at medium risk, which means that any project planning, design, and construction should take into account the risk in the upcoming 10 years. (Global Facility for Disaster Reduction and Recovery [GFDRR], 2017) Regarding access to water, however, there is an inherent water stress all over the country, particularly related to human consumption. In the subbasin it is due to increasingly persistent droughts (rise in temperature), difficult access to a potable supply (lack of infrastructure), loss of water bodies (sedimentation), and unsustainable agricultural practices (sedimentation and pollution). (MMARN, 2017c) Urban flood, cyclone, and wildfire are at high levels, meaning there is a greater than 50% chance of encountering a hazard likely to result in both life and property loss in any given year (GFDRR, 2017).

The last pressure has been recurrently mentioned by FASD stakeholders and by the participants and collaborators of this research. The issue is present everywhere in the country: corruption. According to surveys conducted by Transparency International, Dominican Republic is the second most corrupted country in the LAC region, just after Mexico. Actually, the survey asked if, in the last year, they had to provide a bribe, gift or favour to a school representative, health worker, police officer, court official or government official in order to get a document or to receive basic services, and 46% of the respondents said yes. (Transparency International, 2017) The state of corruption in the country is hard to quantify or even to discuss, as "weak enforcement mechanisms and a lack of political will to prosecute criminals, particularly high-level public officials, are the primary barriers to effective investigations" (International Trade Administration [ITA], 2017). Corruption is also hard to fight as it grows where power and money are. While these may not concern the people of Santana, the stakeholders of the FASD and, with certainty, the results of the assessment in the following chapters, here are some of the negative impacts mentioned throughout the research:

- Slowed political processes;
- Expansion of social divide;
- Inefficient funding allocation;
- Lack of consistency with objectives and decisions, and possibility of evaded obligations through bribes;
- Lack of serious in work and unnecessary efforts spent on appearances;
- Favoritism, missed opportunities and instability of employment;
- Violence, intimidation, fear or obligation to act;
- And fear to denounce.

(K. Rodriguez, pers. comm., May 16, 2018; G. Morales, pers. comm., May 11, 2018; C. Ortiz, pers. comm., May 21, 2018; M. Rodriguez, pers. comm., May 19, 2018; L. Solano, pers. comm., May 11, 2018; L. Rojas, pers. comm., May 27, 2018)

1.2 *Microcuenca Mahomita* Project History

The main problem driving the project in the Mahomita subbasin is the degradation of soils by erosion, which has been made evident by the sedimentation state of the Aguacate reservoir and the output of the Aguacate hydroelectric power plant, and by the decreasing availability of water in all human settlement dependent on the Nizao watershed, including the capital Santo Domingo. It has been decided to implement targeted actions for the restoration of ecosystems, so that erosion levels and the consequent sedimentation of hydraulic infrastructures can be reduced. (CEDAF, 2014b)

1.2.1 Project Initiation

The demand for water has greatly increased in the last 20 years in Santo Domingo, and the city is home to almost the third of the national population. The infrastructures necessary to treat residual waters didn't follow the city's expansion, leading to the contamination of its underground potable water sources. The demand in energy also inevitably increased, but the sedimentation coming from forest loss, soil loss, and from excessive aggregate extraction for construction or granules has been reducing the capacity of reservoirs and clogging the intake grid by up to 40% on four neighbouring hydroelectric dams, therefore decreasing their productivity. Frequent failures to comply with current legislation has also contributed to the elimination of wetlands and some aquatic and terrestrial fauna. The bodies of water around the city present alarming levels of degradation, to the point that they have been classified as priorities for the ordering of natural resources, as they are essential to boost the socio-economic and cultural development of the country. (Díaz González and Florián, 2011; G. Morales, pers. comm., May 11, 2018; Segura, 2014) In view of this complex situation, the international environmental nonprofit The Nature Conservancy (TNC) decided to find a way to implement a sustainable solution. Through the Latin American Water Funds Partnership initiative, the *Fondo Agua Santo Domingo* (FASD) was created to initiate the work, naming the *Centro para el Desarrollo Agropecuario y Forestal* (CEDAF), an important Dominican research institute, the organization responsible for the implementation. (G. Morales, pers. comm., May 11, 2018) The governance of the FASD and the management of its operations will be covered in section 1.3.

As seen in figure 1.1, three rivers provide hydroelectricity and clean water to Santo Domingo: Ozama, Haina, and Nizao. The later one supplies more than 30% of Santo Domingo's water consumption, represents a hydroelectric generation potential of around 200 MW, and a source of more than 50% of the national aggregate production for construction (Díaz González and Florián, 2011). Therefore, since its launch in 2013, the main objective of the partners of the FASD has been:

> "to improve the health of ecosystems and water producers, as well as to reduce the inputs of sediment to the reservoirs to ensure the availability of water in sufficient quantity and quality to users, taking into account the potential impacts climate change, while increasing forest cover by restoring the ecosystems with the consequent benefit to preserve the country's biological diversity."
> (Latin American Water Funds Partnership [LAWFP], 2017a)

The Mahomita subbasin has been prioritized among three sites after two comparative socio-economic and hydrological studies. Its good short term potential for reforestation was reinforced because many local farmers were already engaged in agriculture under forest cover, and because the river is one of the highest and biggest tributaries to the Nizao River. The subbasin would be a pilot, used as a model for areas where the FASD or another initiative could act in the future. (Segura, 2014; D. R. Brito, pers. comm., May 16,

2018; C. Garcia, pers. comm., June 19, 2018) Since the very beginning, the strategy and activities of the project have been planned by the CEDAF and the FASD alone as direct propositions to the community. The community received all offers positively as the project was following local values held by many: give care to nature and fight poverty. (R. B. Geronimo, pers. comm., June 26, 2018)

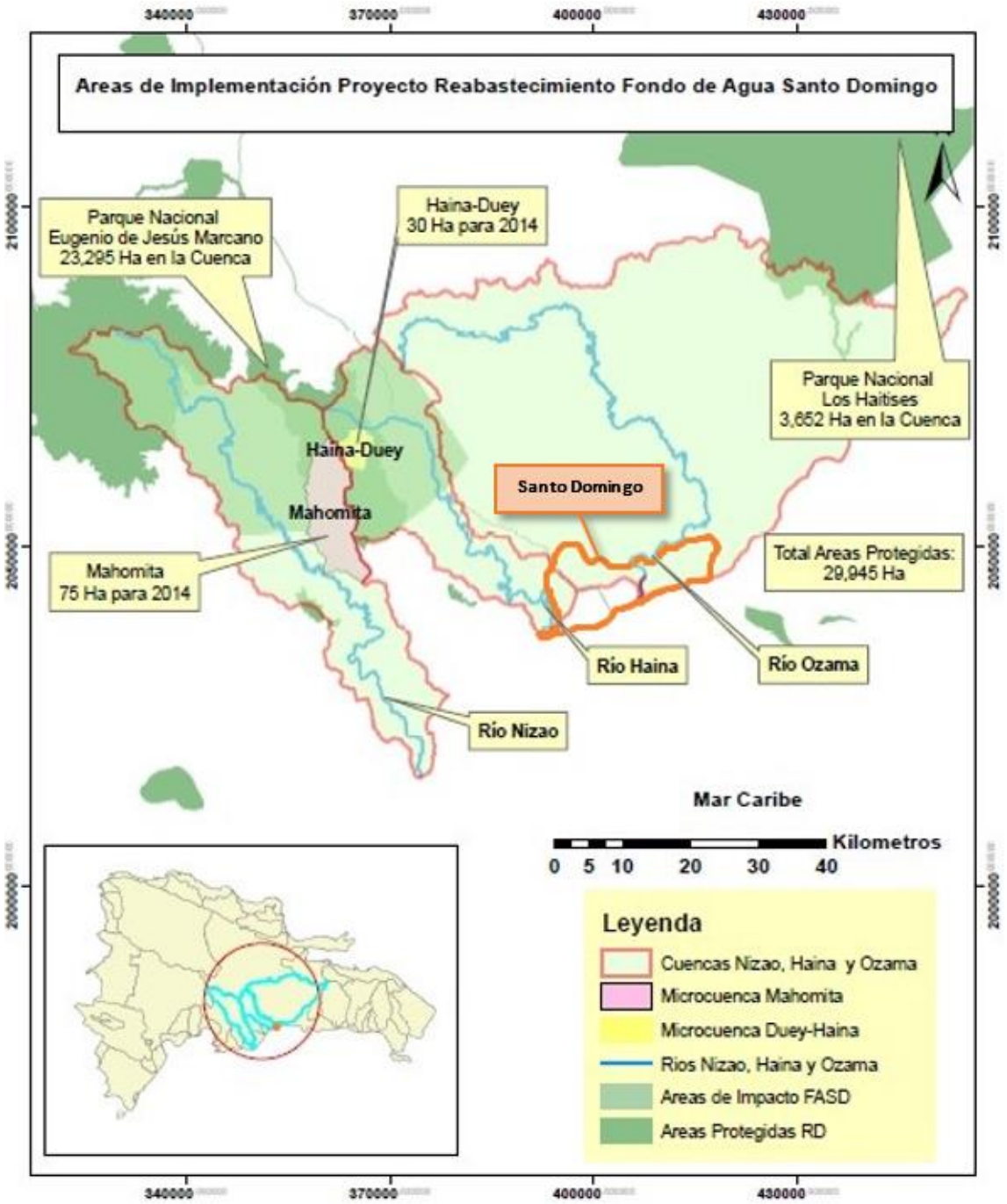

Figure 1.1 First Implementation of FASD in Three Watersheds (Retrieved from: CEDAF, 2014)

1.2.2 Current State

Between 2013 and 2014, the activities of the FASD have been to gather the partners and to determine a site to start a project. This included various social, economic, biological and geophysical studies throughout the whole Nizao watershed, and the creation of various monitoring protocols. Once the Mahomita subbasin was identified as the most pertinent starting point in 2014, other studies were conducted locally, a partnership was established with the ASOCAES, a local association of coffee producers from the Mahomita subbasin, and the participative conservation project started. Two communities were chosen in this subbasin for the implementation: Arroyo Grande, and Santana. (CEDAF, 2018; G. Morales, pers. comm., May 11, 2018; Segura, 2014)

Up until November 2015, conservation actions included reforestation with coffee and native plants systems. Plot owners have also been encouraged to plant banana along with coffee plantations to prevent soil deterioration while coffee is growing. These activities prevented the continuation of the common practice of burning and planting, *Quema*, in higher and more isolated regions. In February 2016, an evaluation concluded that more than half seedlings had died. This triggered TNC, Coca-Cola and Bepensa to make bigger efforts to insure a replenishment of the aquifers in the subbasin, as well as improve the local socio-economic state of the participating communities. This gave birth to the current ongoing project, named Replenishment of water in the Mahomita subbasin, with a new strategy for the maintenance of plots and replacement of seedlings. It should guarantee the permanence of the forest cover and the commitment of the farmers to maintain practices that support productivity, better income and sustainability. Up until now, the project involved 39 community farmer plots throughout the subbasin, provided assistance for the maintenance of their lands and the replacement of the dead seedlings, and helped with soil conservation, reforestation, and riparian ecological restoration. (CEDAF, 2018; G. Morales, pers. comm., May 11, 2018)

The first phase of the project is to carry out the pilot hydrological and forest recovery activities. With the agreement of the FASD, the CEDAF decided on four. The first is the conservation of native forest, which is intended to protect still intact wooded as the local economic stress tends to change the use of land with subsistence cultivation. The second is the assisted reforestation with native and endemic species of coniferous and hardwood in areas suitable. The third activity is the rehabilitation of coffee plantations, as the main activity in the area is growing coffee. It incentivizes the participation of the communities because, in recent years, the plant has been attacked by pests (*Roya* "coffee rust" *Hemileia vastatrix*, and *Broca* "coffee borer beetle" *Hypothenemus hampei*), which have led the owners to replace coffee plantations with crops of short cycles that don't have the same soil stabilization capacities, namely because they don't require

forest cover. Therefore, the CEDAF introduced two varieties of coffee resistant to the mentioned pests and that could grow in high altitude under shade: Costa Rican Catimor and Colombian Lempira. These varieties also yield results from a first harvest only 1.5 years after it has been planted, instead of three years like its predecessor. The last activity is the restoration of riparian corridors. Its purpose is to protect and strengthen the banks of the rivers, with an average strip width of 30 m around the bodies of water. (CEDAF, 2014b; G. Morales, pers. comm., May 11, 2018) To ensure the long-term quality of the results, the CEDAF has also been capacitating the inhabitants of the Mahomita subbasin, which is concretized in continuous accompaniment, and training and workshops related to good practices in soil and water conservation, management of environmental issues related to local economic and conservation activities, the importance of protected areas, CC, ecosystem-based adaptation, good agricultural practices, solid waste management, and the management of pests. (CEDAF, 2018; V. A. Matias, email, May 15, 2018)

This second phase started in 2017 after the pilot was confirmed successful. It is about the maintenance of the plots of the subbasin, and the expansion of the activities. The two phases are more complimentary than subsequent. This one also serves to monitor and adapt in order to conduct relevant activities. The aim for September 2018 is to have involved 769 people directly and indirectly, through conservation actions and workshops, and to have had an impact on 171.47 ha of land. As of now, there is no planned end to the project. In fact, the current commitment of Bepensa and Coca-Cola is to finance the activities until the replenishment of the groundwater will be as big as their yearly use. This commitment is estimated to end in 2020 but may be renewed indefinitely. There is no planned major upscaling or reproducing the project elsewhere. The Mahomita site along with the two others from the FASD will continue to grow slowly in cycles of participant recruitments, land acquisition, technical assistance and replenishment monitoring until Bepensa and Coca-Cola reach their goal and decide to stop the financing. (CEDAF, 2018; G. Morales, pers. comm., May 11, 2018; C. Garcia, pers. comm., June 19, 2018)

1.3 Governance

The Microcuanca Mahomita project has stakeholders on four different scales: international and national for funding; and national, regional, and local for planning, managing and implementing. All partners in the FASD have different roles and consequently need to report their activities to the others. The efforts needed to implement effectively this project are big, and require a close collaboration, from the international organization that monitors CC to the farmer who will be planting new trees.

1.3.1 Responsibilities of Project Initiators and Managers

The LAWFP is managed by TNC, as a means of gathering funds for the specific goal of preserving lands above watersheds through conservation actions in Latin America. The LAWFP creates localized partnerships, like the FASD, to gather local stakeholders from the public, private and NGO sectors, and provide them with technical and financial support to implement conservation projects. The funding of the LAWFP is done by TNC, The Inter-American Development Bank, the Global Environmental Facility, and the Femsa Foundation, which is mainly related to The Coca-Cola Company, fuel distributors and car manufacturers.

The funding of the FASD comes from the private sector: Coca-Cola and its bottling company in Dominican Republic, Bepensa, the vice-president of the partnership. These two partners decided to commit to a financial participation until a specific groundwater replenishment is reached in total for the three sites: 561,555 m^3 of water per year. This volume is equivalent to what Coca-Cola will use in 2020 for its activities in Dominican Republic. Other partners of the assembly include:

- TNC, the representative of the partnership and link with the LAWFP;
- The National Network of Business Support for Environmental Protection (ECORED), president or the assembly;
- The Water Supply Corporation and Aqueduct and Sewer Corporation of Santo Domingo (CAASD), secretary of the assembly and public sector representative;
- The Fundación Universitaria Dominicana Pedro Henríquez Ureña, an academic NGO;
- The PROPAGAS group, a private distributor of hydrocarbons who helps with the financing and the visibility of the partnership;
- The CEDAF;
- The Pro Nature Fund PRONATURA, an NGO responsible for the implementation in the two other sites (Haina and Duey);
- Agroforsa, a sustainable development project implementation private firm;
- The Ministry of Environment and Natural Resources (MMARN);
- And the ASOCAES. (C. Garcia, pers. comm., June 19, 2018; LAWFP, 2017b)

Decisions regarding vision, politics and strategies are taken yearly in assemblies. An external audit is done to certify financial accountability. A yearly report is also discussed. As of now, it is believed that results are better than expected in terms of the replenished volume of water. (C. Garcia, pers. comm., June 19, 2018)

As previously mentioned, the CEDAF is the main responsible for planning and managing the implementation, in close collaboration with the ASOCAES. The CEDAF receives its resources through TNC and reports to them. TNC then reports to the other involved partners of the FASD through the Latin American Water Funds Partnership portal. (J. Segura, email, May 14, 2018) The CEDAF is responsible for land acquisition for conservation, making contracts of 5 years of conservation with farmers agreeing to share a part of their land, provide technical assistance to participating farmers as part of the contract, and coordinate all the field activities. The CEDAF also does the monitoring of the progress for the FASD: the impacted area by type of activity, the participation (directly and indirectly impacted people, number of beneficiaries, and number of workshops provided), and the volume of replenished water (through soil infiltration, forest cover and climate monitoring). (C. Garcia, pers. comm., June 19, 2018)

The MMARN has also been involved in the project as a partner, but has not been assigned a specific role to make the project happen like the others. Since 2000, the national Law 64-00 recognizes environmental services and the need to create mechanisms, norms, methodologies and procedures to manage them. It empowered the MMARN to create mechanisms to finance operations related to the environment, to distribute the benefits, and to sell and charge environmental services to direct beneficiaries or users, therefore facilitating the involvement of the private sector in the management of natural resources. (Díaz González and Florián, 2011; P. Garcia Brito, pers. comm., May 21, 2018) Since some of the stakeholders related to the FASD, namely Coca-Cola, use water as an important resource for their activities, the MMARN influenced their financial participation, and provided technical assistance in the first years. (D. R. Brito, pers. comm., May 16, 2018)

The public sector is not very much involved in the FASD. Currently it is only being represented by the CAASD because the MMARN has stopped its participation two years ago with the change of government. It has been confirmed it is not a choice to avoid inefficient resource allocation because of the well-known problem of corruption, but because the public water management sector in Dominican Republic is very small. Water management is both the responsibility of the private and public sectors, and the FASD is seen has a space to proceed for the harmonization of objectives. (C. Garcia, pers. comm., June 19, 2018)

1.3.2 Responsibilities in the Community

Certain activities are conducted only by the CEDAF, others only by the community, and some others are done together. Land acquisition and native forest conservation are done by the CEDAF alone. However, the human resources needed are hired locally and only one or two technical specialists are sent to overview the

progress. The maintenance and establishment of coffee plantations are done only by the community members. Assisted restoration of forest and riparian corridors is done together, as well as the conduction of workshops. Both are organized with the ASOCAES. (CEDAF, 2018)

To facilitate the autonomous involvement of the community, the CEDAF gives the farmers everything they need to produce coffee: plants, soil, and fertilizers. Since reforestation is done on each participating parcel, the management of a portion of the parcel is given to the CEDAF in exchange for the necessary resources to plant coffee. Since the land belongs to community members, the CEDAF plans the allocation with the beneficiary. Additionally, the new coffee plantations must be planted under shade to guarantee an increase in vegetation cover. (G. Morales, pers. comm., May 11, 2018)

2. THE NATIONAL REDD+ STRATEGY

The MMARN is interested in many aspects of the FASD regarding the upcoming national REDD+ strategy. It first wants to understand its mechanism to establish results—based payments, which is one of the biggest challenges with for REDD+ program. It would also like to determine how to link the REDD+ mechanism to the FASD, as it would facilitate the implementation process, which is another big challenge for the REDD+ program. Since the activities in Santana are related to reforestation and agroforestry production, it is also a potential model that could be reproduced in other communities as a profitable carbon sequestration model for REDD+ solutions around the country. As an entire other analysis of a much bigger scale would be required to come to these conclusions, this essay only partially answers those questions. While the context does respond to how FASD works (it is not result-based), the assessment verifies the potential for the project in Santana to register to the national REDD+ strategy.

The REDD+ program and registration process will therefore be presented from the international to the local scale, along with models from Zambia and Peru before discussing the probable challenges. The REDD+ potential assessment will be presented in chapter 3, the methodology.

2.1 Presentation of the REDD+ Program

The UNFCCC launched a program called Reducing Emissions from Deforestation and forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries (REDD+) with the objective to reduce GHG emissions, to fight CC, and to offer to developing countries the opportunity to review the management of their forest ecosystems. Simply put, REDD+ creates a system to finance initiatives and rewards projects according to their results. These may be related to:

- Reducing emissions from deforestation and forest degradation;
- Sustainable forest management;
- Conservation, sustainable management and enhancement of forest carbon stocks.

Each country participating in the program develops a personalized strategy and creates action plans for priority areas. “The design of support distribution and project implementation are influenced by a country’s forest cover, governance scenario, stakeholder relations, and funding contexts” (Enrici and Hubacek, 2018). Projects are created with local implementers and various assessments are done to calculate potential benefits. The projects put in place also have the side opportunity to register in voluntary carbon markets to increase the benefits of their efforts.

In theory, it may look like a panacea for developing countries. REDD+ is a holistic solution that ensures intertwined sustainable resource management and economic development, which are consistently in conflict across the globalized world. REDD+ is not limited to the ecological aspects of fighting CC, it also addresses the economic and social development of participating countries and communities involved in projects. However, skepticism about REDD+ has developed since the beginning because of the numerous challenges related to the implementation of such a complex and integrated initiative (Enrici and Hubacek, 2018). The REDD+ program is tremendously complex, particularly because it must be integrated in almost all ministries of a country, because the benefit sharing mechanism is complicated to adapt fairly to all projects, and because the number of stakeholders and steps to reach an actual result-based payment are numerous. While these can be determined in the strategy through years of discussions and negotiations, the actual implementation is still to be done and may also present numerous challenges. The commercialization of forest ecosystems through carbon markets actually presents challenges along the whole chain of operations, starting from the pollutants that want to offset their emissions, all the way to the project implementers, passing by international organizations like the World Bank, a national committee and a subregional entity. Therefore REDD+ may not be the best solution to all the problems it is trying to tackle because, even after 11 years of activity, the results are hard to grasp for the participants and the process is still slow. On the CC point of view, the program proves to be relatively efficient, as it has materialized in 29 countries and, to date, has been the largest international conservation effort ever made. (Enrici and Hubacek, 2018; Mwangi, 2015)

At the MMARN, the development of the REDD+ National Strategy is the project with the most employees in the climate change department. As it has been mentioned in chapter 1, there may be a lot of potential benefits to be made with carbon sequestrations through international financing programs and it is why the MMARN is so interested in having its strategy done and active as soon as possible.

The adoption of a national strategy takes place in three phases: preparation (readiness), implementation and actions. The description of these phases can be found in the figure 2.1. The process is adaptively managed in cyclical steps. The first is the identification of drivers of deforestation and forest degradation (DFD). The second is to develop the drafts of the founding documents, namely the national strategy, the national forest monitoring system, the safeguards approach and information reporting systems, and the reference levels of forests and emissions. These documents are sent to the UNFCCC for technical evaluation. Then, the country implements the policies and measures of the national strategy. Summaries of safeguards information are joined to the National Communication, as well as the technical annexes of the updated biennial reports. The

information is finally published on the UNFCCC website, where lessons are learned to restart the cycle of analysis and implementation. The systemic monitoring of the strategy must constantly ensure the assessment of drivers, fiduciary management, analysis of participating institutions, private sector engagement, legal assessment, social and environmental safeguards and benefit sharing.

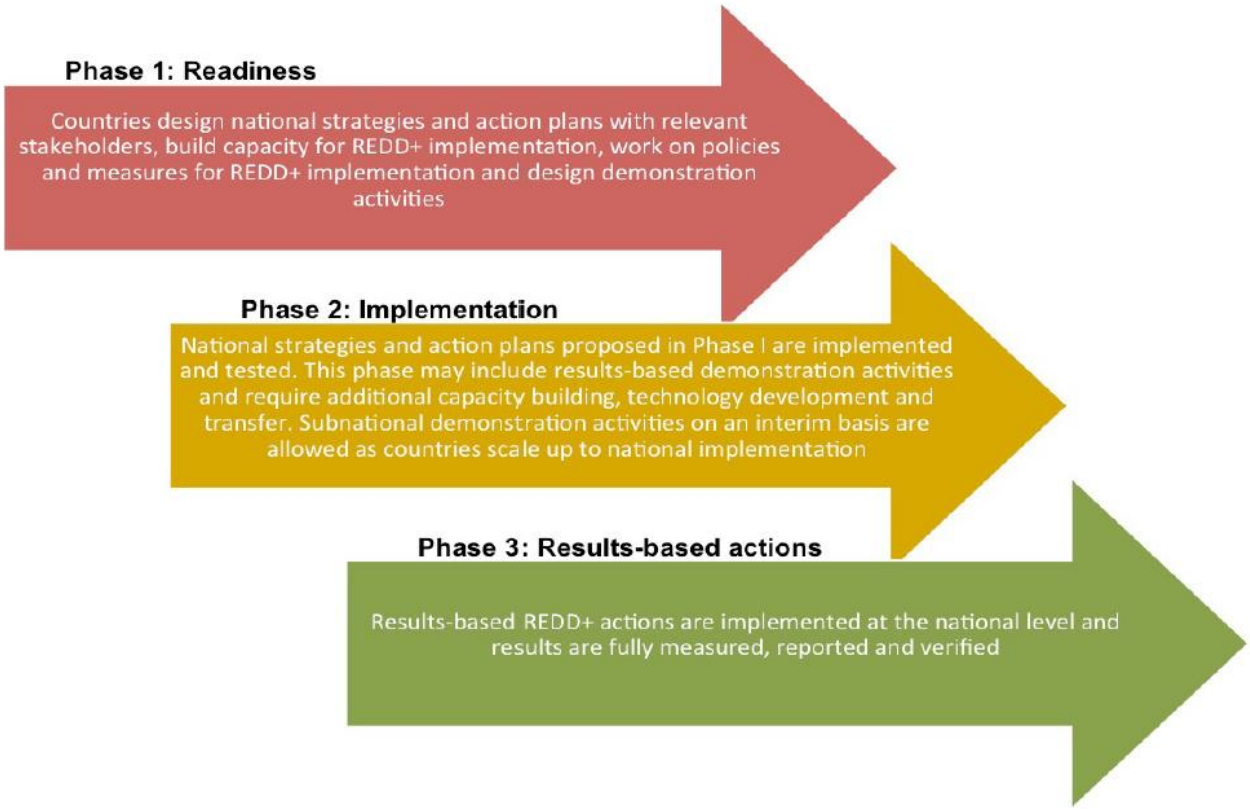

Figure 2.1 Phases of REDD+ National Preparation (Retrieved from UNEP, 2017)

Concretely, the REDD+ program leads countries to carry out actions that are rewarded according to their results. A table summarizing the five types of policies and measures can be found in annex 3. As this is a holistic approach, their implementation cannot be the responsibility of a single national entity like the MMARN. Through policies and committees, the strategy also involves entities related to territorial planning, agriculture, finance, mining, land affairs, indigenous affairs, etc. The scope and scale of REDD+ implementation are based on analytical work, long-term vision, and different political, socio-economic and technical considerations. Thus, by percolation effect, the national strategy goes to the subnational scale, to the priority areas and finally to the local communities in a project, for example, like the participatory conservation in Santana.

The results of the REDD+ program are verified and allow developing countries to receive payments based on their performance. The sources are diverse but come mainly from the Green Climate Fund. Different elements are needed to receive payments: a national strategy, national reference levels, a proven and transparent national monitoring system, and an information system on how REDD+ safeguards are respected throughout the implementation of activities. The submission of results is the responsibility of the participating countries and payments are made only after the results have been verified. (Ministry of the Environment of Brazil, 2016) Otherwise, as the management of REDD+ projects is rigorous, it becomes easy to submit evaluation reports to organizations that allow the generation of carbon credits that can then be sold in markets of voluntary compensation.

2.2 Process for Project Registration

The MMARN and the International Development Association of the World Bank should be done writing the first version of the strategy by 2019, and all agreements should be signed by all parties by 2020, when the activities should start (P. Garcia Brito, pers. comm., May 21, 2018). Verifying the actual potential of an agroforestry project is not possible at this point, because the requirements have yet to be decided, along with the registration process and the whole system of incentives, financing and distribution of benefits. Still, it is possible to understand the direction the strategy is taking, because the UNFCCC has universal requirements for its program, because the Dominican Republic made a draft of what could be the main elements of the strategy concerning the preparation phase objectives, and because the REDD+ strategy development team is using other strategies as models, namely the one from Zambia and Peru.

2.2.1 UNFCCC Requirements

The program has identified the most important drivers of deforestation trends to consider as starting points in creating sustainable solutions: global population, agricultural commodities, wood products, fuelwood and charcoal, and fiscal policies and incentives. In the development of a National Strategy, direct and indirect drivers are to be considered and understood in depth to make sure that actions don't have a positive feedback on current forest loss trends. (UNEP, 2017)

The REDD+ Program in 2015 also established that member countries should abide by seven guarantees called The Cancun Safeguards. These must be promoted and supported throughout the REDD+ process:

I. "That actions complement or are consistent with the objectives of national forest programs and relevant international conventions and agreements;

II. Transparent and effective national forest governance structures, taking into account national legislation and sovereignty;

III. Respect for the knowledge and rights of indigenous peoples and members of local communities, by taking into account relevant international obligations, national circumstances and laws, and noting that the United Nations General Assembly has adopted the United Nations Declaration on the Rights of Indigenous Peoples;

IV. The full and effective participation of relevant stakeholders, in particular indigenous peoples and local communities, in the actions referred to in paragraphs 70 and 72 of this decision;

V. Those actions are consistent with the conservation of natural forests and biological diversity, ensuring that the actions referred to in paragraph 70 of this decision are not used for the conversion of natural forests, but are instead used to incentivize the FCCC/CP/2010/7/Add.1 27 protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits;

VI. Actions to address the risks of reversals;

VII. Actions to reduce displacement of emissions." (UNEP, 2017)

REDD+ readiness must be accompanied by operational policies of the World Bank, as the safeguards policies for REDD+ pilot projects are supported or funded by the World Bank through various funds such as the Forest Carbon Partnership Facility or the BioCarbon Fund. These policies demand social and environmental standards of REDD+ initiatives to ensure efficient implementation and transmission of information. They demand for a regulated quality of forests too, as REDD+ is governed by several forest certification systems such as the Forest Stewardship Council (FSC) which promises sustainable emissions management. (UNEP, 2017)

2.2.2 Key Elements of the Preliminary National REDD+ Strategy

The Dominican Republic has defined its intentions in the preparation phase of the national REDD+ strategy. The World Bank, the MMARN and a few other stakeholders, which are mainly consultants, are working on putting in action this phase. The drivers of DFD have been identified along with prioritized areas, the national reference level should be done by the end of the year, and the drafting of the founding documents is in progress. Many policies are impacted by the future implementation of the program in the country and a lot of energy is deployed to gather stakeholders and discuss the implications of integrating the objectives and the processes of this strategy.

The value of REDD+ has been recognized just by the several important challenges it tackles through its implementation in the country. Mainly, it will have to resolve weaknesses and gaps concerning land tenure and carbon rights, as well as resolve a lack of territorial ordering, the absence of a sectoral forestry law, a centralized administrative state, a lack of scientific basis for monitoring and standardization of practices, and ample difficulties in the management of incentives. During the preparation of the strategy, the REDD+ work teams concentrate their efforts on mapping the actors and their contributions to combat the drivers of DFD. The elaboration of a Social and Environmental Assessment System will enlighten them on individual and collective belonging rights to forest, and will also inform them on the risks faced by the disadvantaged populations in the face of the application of the program. A proposed Work Plan includes consultations and joint studies with stakeholders and forest-dependent communities to deal with the undefined aspects of rights to land, natural resources, carbon and of social protection. (Fondo Cooperativo para el Carbono de los Bosques [FCPF], 2015) While only three will be elected for the final strategy, the table 2.1 presents the five possible strategic orientations being discussed.

Table 2.1 Strategic Options and Related Actions for the National REDD+ Strategy (freely translated from: Alberto Gómez, 2018)

Strategic options and actions
Strengthen the legal and institutional framework for the conservation of the natural heritage and the sustainable use of natural resources
• Promote and encourage development measures (program) that include an economic growth with low emissions and/or resilient to climate change. • Define and implement financial instruments and mechanisms to develop productive activities, conservation and restoration of forest ecosystems. • Promote the enactment and application of the Forestry Law. • Prepare and apply complementary regulations related to forest management (use of fire in agricultural activities, forestry regency, use of biomass for electricity). • Guarantee effective governance structures for the conservation of the natural heritage. • Regularization and legal security of land tenure. • Strengthening of forestry and environmental control programs, including the determination of the legal origin of products (wood) and forest by-products (coal)
Establish, strengthen, harmonize and apply public policies to limit and/or contain the expansion of the agricultural, livestock and infrastructure border in forested areas
• Identify and define areas for forest management, reforestation, watershed protection, biodiversity conservation and for other environmental services derived from forest ecosystems.

- Crop and livestock zoning program.
- Sustainable agricultural production program for small farmers in hillside areas prioritized from the point of view of forest conservation.
- Management and restoration programs in prioritized watersheds.

Promote models of sustainable management of natural resources that contribute to the conservation and sustainable use of forests, and the increase of forest cover in the country

- Strengthening of the *Quisqueya Verde* National Plan.
- Strengthening and expansion of the national agroforestry development programme.
- Promote forest management as an option for the conservation of forests in forest areas under pressure from other land uses.
- Management program for agricultural and livestock farms that incorporate agroforestry systems with high-yield products, especially in buffer zones of protected areas.
- Environmental education and climate change program.
- Strengthening of the protection and surveillance program in protected areas relevant for the conservation of forest resources.
- Strengthen mechanisms for evaluation and monitoring of forest management.
- Strengthening control mechanisms and monitoring the use and commercialization of products. forestry
- Rehabilitate forest ecosystems in relevant fragile zones to facilitate connectivity between forest fragments.
- Promote among owners of private farms and community organizations, the management of natural regeneration of tree species.

Strengthen the management mechanism for the prevention and control of forest fires

- Apply and strengthen the National Fire Management Strategy in the Dominican Republic.
- Program for the restoration of affected ecosystems after fires.

Strengthen and improve management for phytosanitary protection of forest resources

- Strengthening of the phytosanitary protection program in priority forested areas

Three committees coordinate the whole process of the preparation phase. The Committee Director is composed of the MMARN, the Ministry of Agriculture, and the Ministry of Economy, Planning and Development. It supports the two other committees. The technical assessment committee is composed of public institutions, organizations from the civil society, and the private sector. It is in charge of assessing the use of soils and forests, laws and rights, and the safeguards and information sharing. The third committee is the Project Preparation Management Technical Unit, which has an administrative and a technical support

direction, and is in charge of gathering all the information and writing the strategy. (FCPF, 2015; Alberto Gómez, 2018)

To discuss the possibility of an actual REDD+ implementation, there has to be a first contact that makes clear the intentions of the government and that opens a dialogue, and key stakeholders have to be identified, along with their location, interests, alliances and roles (FCPF, 2015). The areas prioritized during the preparation phase are shown in figure 2.2. At the eastern limit of the green area is the municipality of Los Cacaos, where Santana is located. Four criteria are effective to help the prioritization of areas for intervention:

- Following administrative division by Municipalities;
- Areas with evidence of high deforestation, forest degradation and/or soil loss;
- Hydrographic basins of strategic importance in terms of:
    - protected areas/biodiversity;
    - water supply and/or infrastructure such as dams, hydroelectric power stations, aqueducts, irrigation channels;
- Human population benefited by the ecosystem services of the referred basins;
- Areas with high potential for success in REDD+ actions:
    - presence of key institutional actors;
    - places with successful experiences of programs and projects on human/rural development, environment and natural resources. (Freely translated from: MMARN, n.d.)

All the drivers of DFD have been identified and some direct causes are relevant to mention for the evaluation of potential in Santana:

- Expansion of agriculture is responsible for more than 60% of deforestation. Especially livestock production is one of the most important uses in terms of competition and substitution of forests in the country.
- Extraction of forest products such as firewood and charcoal, resin, as well as the free grazing of animals, are used as sources of income for the poorest sectors of the rural population.
- Hurricanes and intense rains cause great damage to vegetation and other associated resources.
- Forest fires occur regularly in pine forest areas due to natural reasons, human carelessness or criminal negligence.
- Infrastructure construction. (FCPF, 2015)

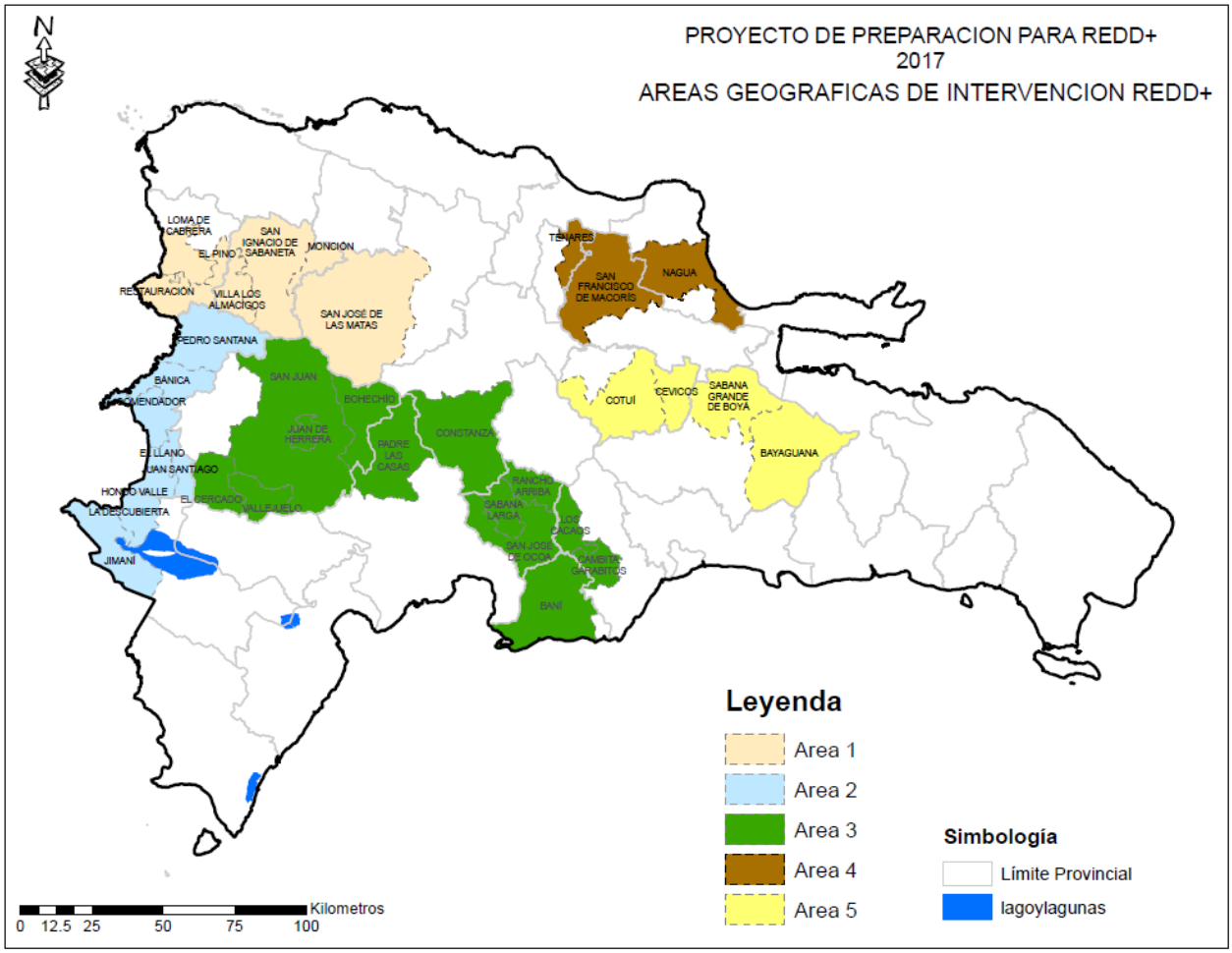

Figure 2.2 REDD+ Areas of Interventions (retrieved from MMARN, 2017b)

Fuelled by demographic growth, poverty and social inequity, according to the *Fondo Cooperativo para el Carbono de los Bosques*, the underlying national causes of DFD are mainly due to four determining factors that influence the behaviour of the actors, of which corruption is interestingly not highlighted:

- Opportunity costs often determine the processes of land use change because it is difficult to develop a sustainable income from the exploitation of forest (for example, the practice of *Quema*).
- Insecurity and uncertainty of land ownership and rights of use slows investment in the management of forests and natural resources.
- Fiscal and development policies with undesirable impacts to the sustainable management of forests, especially perverse subsidies (Subsidized credits for agricultural and livestock expansion; Reduced tax rates for land uses that are in competition with forest use; Duty-free import of equipment for new industries that have a negative impact on forests; Infrastructure and energy development projects that do not take into account the value of lost forest capital; Government-sponsored

colonization programs in which forests were cut down and replaced by marginally productive subsistence agriculture; Subsidies for equipment, infrastructure for water consumption and irrigation, and for the use of agrochemicals).

- The lack of deterrent potential of the regulations due to deficiencies in norms and procedures, and the low capacity of the State to apply the mechanisms of resource administration, surveillance and control. (FCPF, 2015)

The pilot *Yaque del Norte* has been chosen as the first management model for *Pago de Servicio Ambiental*, payment for environmental services, which may be the chosen benefit-sharing mechanism. In summary, depending on the land cover type (forest, agroforestry, etc.) and the surface, a monetary compensation is given by the MMARN to the land owner each year. The pilot is also used to adapt technical and administrative processes for the national strategy and for the design of a monitoring framework. (FCPF, 2015; S. Teresa, pers. comm., July 20, 2018)

2.2.3 Model of National criteria: Peru and Zambia

The strategies of Peru and Zambia propose criteria to evaluate the potential for a future REDD+ project. Peru bases all evaluations on five principles containing more precise criteria, and Zambia first uses a project type to be able to give specific criteria. Only the criteria and principles key to the assessment in Santana are mentioned because evaluating the actual potential held by an existing project is usually a more comprehensive and detailed assessment.

For Peru, the first principle is the effectiveness of emissions reduction. Measuring effectiveness includes external factors such as political viability and the degree of commitment at the national level. But, at project scale, the most important local factor that defines effectiveness is the design of the REDD+ project itself: its solidity, flexibility, additionality, possible leakage, and permanence of reductions for the duration of the project. (Rendón Thompson, Baker, Healey, del Castillo, Jones, and Román Cuesta, 2009)

The second principle is the efficiency, which refers to the achievement of the emission reduction achieved at a minimum cost. Cost-effective actions must seek the balance between effectiveness and precision. Several costs must be considered when designing a REDD+ project, as well as factors that favour their reduction and profitability: start-up costs, implementation costs, and opportunity costs. (Rendón Thompson et al., 2009)

The next principle is equity: the reduction of emissions is achieved in a fair and ethical manner. This refers to participation, the fair distribution of benefits and costs, and to the transparency of the project. Participation means that participants hold the opportunity "to provide and receive informed, timely and meaningful inputs that influence the decisions of projects that generate social and environmental impacts" (Rendón Thompson et al., 2009). The fair distribution seeks a distribution of costs and benefits among all forest users. Transparency is achieved by increasing effective participation, promoting communication and preventing the occurrence of corruption. (Rendón Thompson et al., 2009)

The fourth principle is the generation of co-benefits for stakeholders. These are not mandatory but are considered crucial for the success and permanence of a project. Co-benefits usually include contribution to economic development and poverty reduction and conservation of biodiversity, but can also encompass many social aspects. While at any scale a project is likely to have positive impacts on biodiversity, there needs to be specific conservation objectives that associate, or dissociate depending on the case, a high carbon content with high biodiversity content to ensure the quality of both. (Rendón Thompson et al., 2009)

The last principle is the legality: the rights and legal requirements of the project though the characterization, analysis and application of the legal framework. This refers to respect of forest rights and governance, and the fulfillment of all legal requirements. (Rendón Thompson et al., 2009)

In Zambia, the potential of an agroforestry system project like the one conducted by the CEDAF in Santana can be evaluated based on the following criteria. A preliminary appreciation is also proposed by the strategy to promote this kind of project. Agroforestry is rated as the most optimal land use or management practice (not forest management) among the proposed activities and therefore holds high potential for REDD+. The key filled attributes are presented in figure 2.3. In the figure, SFM stands for Sustainable Forest Management.

- Existing biomass and carbon levels: specific to the project, but systems usually increase tree cover and carbon stocking and sequestration.
- Deforestation degradation threat levels (based on the main drivers in the area): these systems usually reduce agricultural extensification.
- Opportunity costs (cost of forgone benefits): usually provide a wider range of products.
- Clarity of land tenure: specific to the project.
- Governance in terms of the degree of people's participation in management and benefit sharing: these projects are usually run by smallholders or communities, with supporting services from governmental research or NGOs.

- Governance in terms of linkage to a national institution responsible for REDD+: specific to the project.
- Leakage risk (risk to cause direct emissions elsewhere): usually likely to reduce leakage by doing permanent agriculture.
- Replicability: these systems usually hold high replicability and adaptability to various ecological and socio-economic conditions.
- Co-benefits (improve socio-economic welfare, conservation of biodiversity, maintenance or enhancement of soil and hydrological conservation): these systems provide a wide range of products beneficial for food security and income generation, they reduce forest clearing and indirectly enhance biodiversity, they increase soil fertility and water conservation, and they improve nutrient cycling.
- Compatibility with other livelihood activities (enhancement or conflict with other activities): usually these systems enhance the number of livelihoods activities related to a bigger diversity of production. (Kokwe and Mickels-Kokwe, 2012)

SFM Criteria	REDD+ Criteria
Optimization of land resource utilization	Compatibility with other livelihood activities
Forest ecosystem health and vitality	Co-benefits
Maintenance and enhancement of forest resources and contribution to global carbon cycles	Replicability
Maintenance and enhancement of protective FM functions (notably soil and water)	Governance
Maintenance and enhancement of forest resources and their contribution to global carbon cycles	Opportunity costs

Figure 2.3 Key Attributes of Agroforestry Projects for REDD+ (retrieved from: Kokwe and Mickels-Kokwe, 2012)

2.3 Potential Challenges and Solutions

Linking international stakeholders through valuation of carbon, natural ecosystems, policies efficiency and generation of co-benefits is not a simple task. Without a doubt, the process will present challenges, and how they are dealt with may result in either great benefits or great losses for a participating community. In Indonesia for example, the two largest are "insecurity of tenure arrangements at all scales (national, subnational, within site boundaries) and the currently unfavourable economics of REDD+, which favour business-as-usual interests" (Sunderlin, Ekaputri, Sills, Duchelle, Kweka, Diprose, Doggart, Ball, Lima, Enright, Torres, Hartanto and Toniolo, 2014). Major criticism on the REDD+ mechanism is in itself the first

challenge for a proper implementation, as some stakeholders may be tempted to dissociate from the process, limiting the involvement, and the concerns are legitimate (Enrici and Hubacek, 2018). How will REDD+ translate across scales from international vision, national objectives and local realities? Will REDD+ deliver its promised benefits? Why wouldn't it and how to ensure it does fairly? And since projects take a long time to materialize, is the REDD+ mechanism stable? Unfortunately, there is no universal and simple template for how a satisfactory project should be done. (C. Garcia, pers. comm., June 19, 2018; Enrici and Hubacek, 2018)

Funding. Simply put, a project needs a plan for sustained funding, both a present and future accesses to funds. It may seem obvious, but a project should not be initiated if it only holds hope of securing funds from the REDD+ mechanism or from carbon markets. In Indonesia, "the process of obtaining long-term and sufficient funding [is] one of the most frequently mentioned challenges […] because of the stark contrast between some initial perceptions of large funding opportunities among some stakeholders and the absence of funding on the ground" (Enrici and Hubacek, 2018). Ecosystem restoration is a long-term process and the business plan should be clear on how to have enough revenues for operations over the whole life of the project, and even beyond. "Current funding for REDD+ comes overwhelmingly from the public sector through donor country financing to forested countries, and dwarfs the funding available from the voluntary or compliance markets" (Sunderlin et al. 2014). Relying on carbon markets has proven problematic because of the absence of global carbon prices. At the Conference of Parties in 2015, it has been acknowledged that carbon markets are not developed enough, and cannot provide sufficient accessible funding to CC mitigation efforts (Johannsdottir and McInerney, 2016). As a result, projects not funded by agencies or NGOs may find selling carbon credits insufficient. While there has already been substantial funding for REDD+, "many projects are lacking basic funds to support on-the-ground efforts, [especially when] initiated with assumptions that these funds or carbon markets would be easily accessible" (Enrici and Hubacek, 2018). Financial sustainability would therefore need to come through donor organizations willing to offer substantial funding. The different ways this could be facilitated are discussed in section 5.2. (Enrici and Hubacek, 2018)

Community engagement. Having interested and involved participants in a project is crucial for its success. In the case for REDD+, the equitable engagement of a community ensures long-term project effectiveness. It is therefore imperative that stakeholders truly understand and agree with any potential activity. Informing stakeholders early is a common practice for good social acceptability and engagement, but it may also result in fatigue is there if a lack of perceived progress. (Enrici and Hubacek, 2018) The REDD+ mechanism is not tangible enough and humane to be communicated as it is and to be understood properly, especially by

small holders with little education. (C. Garcia, pers. comm., June 19, 2018; R. Díaz de Medina, pers. comm., June 5, 2018) A good solution to avoid this situation is a collaborative management approach, which helps develop a strong working relationship. Regular meetings should be held to give information, to choose the project's activities and directions, and to decide on what to do with funding among suggestions. This will greatly improve community engagement and satisfaction, and also help the equitable distribution of benefits. (Enrici and Hubacek, 2018)

Enforcement of project boundaries and monitoring. Preventing the encroachment of activities and enforcing project boundaries can be difficult and needing to be treated carefully at times and it has always been a concern for conservation projects. However, controlling land use change within the boundaries of a project can prove to be much more challenging because the effort is spent on border encroachment. Support from local authorities for border encroachment can be very helpful so project enforcement can be done within the boundaries. Land tenure rights must be clear to avoid conflictual situations, and it should be possible to get help from official authority in this manner. Unclear situations related to conditional use must be specifically resolved, because result-based funding requires stable and legitimate right holders over the lifetime of the project. Corrupted authorities or influences by business-as-usual interests should be avoided and removed from the project by another, more powerful authority that can't be bought with bribes. Multisectoral subregional committees should be open to review specific cases and empowered to act. Other solutions to corruption are discussed in section 5.4. (Enrici and Hubacek, 2018; Sunderlin et al., 2014)

Effective monitoring, reporting and verification is an important part of REDD+ to overcome all challenges and to show results. Many ways are possible (remote sensing, community-based, independent agency, or combination) and it may be hard to find a balance between accuracy and cost. However, community-based monitoring has proven to be sufficiently accurate and cost-effective while strengthening community engagement. It could be combined with remote sensing as it is the fastest way to measure carbon stock changes. Monitoring should not stop to carbon stock objectives and include sought co-benefits. Monitoring methodologies could be framed on the Community, Climate and Biodiversity standard, which is compatible with the Voluntary Carbon Standard for carbon markets and assesses environmental and economic sustainability. These standards give more credibility to a project and ease credit selling. Decentralized monitoring diversity may be helpful to adapt and improve methodologies, but standardized and verifiable monitoring practices are essential to guarantee the effective routing of funds in this context. (Enrici and Hubacek, 2018)

Carbon sequestration and biodiversity preservation quantification. Given the primary goal of REDD+, forest loss has to be prevented and forest restoration has to occur. While this can happen in monocultures (like palm plantations), biodiversity preservation is also an important component of the program. All types of forests and ecosystems should be considered and integrated in the monitoring, even the less carbon sequestrating ones. Peatlands, for example, can play an important role in carbon sequestration, and landscape diversity may improve overall productivity. Result-based rewards require that monitoring be certain of all quantitative changes regarding carbon and biodiversity. Having an independent agency to do the audit may be preferable to ensure quality. (Enrici and Hubacek, 2018)

3. ASSESSMENT METHODOLOGY

Assessing the resilience of Santana in the context of its participation with the FASD, and at the same time verifying the potential Santana holds for the REDD+ program are the second and third goals of this essay. All done with a short time and limited resources, the current methodology tries to encompass the most important elements of resilience building through a qualitative and quantitative field assessment done in groups and individual interviews. The theoretical framework serves more as an angle of analysis of the results, as "the multidimensional and longer-term nature of resilience makes assessing the impact of any one specific project on resilience outcomes in the short term difficult, if not impossible" (UNDP, 2014a). Currently, there is no consensus in the literature on a general indicator of resilience that could be used to measure absolute and comparable levels of resilience across different contexts. The Community Based Resilience Assessment (CoBRA) framework has been chosen as an inspiration to ease the data collection for its practical and cost-effective qualities. The resulting methodology therefore holds five phases very similar to CoBRA, but to which have been added indicators of REDD+ potential. The specific limits of the assessment are discussed at the end of the chapter. The exact documentation used for the field assessment is presented in annexes 5 and 6.

3.1 Theoretical Framework of Resilience

The resilience of a social-ecological system (SES) is its capacity to resist perturbations and maintain its structure and functions. Its level of resilience depends on how the system can self-organize, learn and adapt. Since human societies are part of the natural world and depend on ecosystem services, resilience links closely the interactions between the social and ecological realms. In a SES with a higher state of resilience, humans have the capacity to anticipate change and influence it. In a lower state, the system is more vulnerable to smaller disturbances. A very vulnerable system could even deteriorate without disturbance, due to gradually changing conditions. While a resilient system can evolve, resilience is all about maintaining the integrity of certain states of variables of the system. A disturbance triggers a certain response in one or more variables, which can bring them over a threshold. Once the variables are over their thresholds, the system enters in a new, more or less desirable state of resilience. Changing state may be easier in one way than it is in the other. Like restoring a degraded ecosystem service to its previous state, the replenishment of the aquifers to increase access to potable water in this instance, may be more difficult, complex, and expensive, than what it required to degrade it. One particularity of the natural world is its irreversibility, due to its complexity and the geologic time scale of its evolution. Sometimes it is actually impossible to restore systems to a previous state. If a system has conditions that make it critically unstable, the transformability

of the system is its capacity to create a completely new system, with new state variables and scales. (Biggs, Schlüter and Schoon, 2014; Resilience Alliance [RA], n.d.)

To analyze SESs, it is important to understand its dynamics. SESs function at multiple scales of time and space that interact. The hierarchy of the structure of these interactions between scales is called panarchy. Understanding the influence of scales allows to predict which variables may change or persist in the event of a disturbance. SESs also go through various stages of adaptation, called the adaptation cycle. This analysis, largely inspired by ecological science, tries to spot where SESs are, as they are alternating between the accumulation and transformation of resources, and the creation of opportunities for innovation. More precisely, SESs have four phases and they are illustrated in figure 3.1. The first (**r**) is its growth or exploitation, and the second is conservation (**K**). Between the first and the second phase, connectedness and stability increase, and resources are accumulated slowly. The capital accumulated gives birth to potential opportunities. As the opportunities are seized, the system goes in the third phase (**Ω**), the collapse or the release. The passage to the fourth stage (**α**), reorganization is quick, and either leads to the renewal of the cycle and an influence on smaller scale cycles. Another aspect to consider regarding the relations between SES components is feedback. Feedback connects components in two directions and reinforces change (positive feedback) or dampen it (negative feedback). They are the response to an interaction or a disturbance. While this seems very theoretical, the understanding of the different scales, interactions, feedback and cycles allows to know the adaptive capacity of the SES. It's the system's ability to "reconfigure without significant changes in crucial functions or declines in ecosystem services" (RA, n.d.). Loss in adaptive capacity means loss of opportunities during periods of reorganization. (Biggs et al., 2014; RA, n.d.)

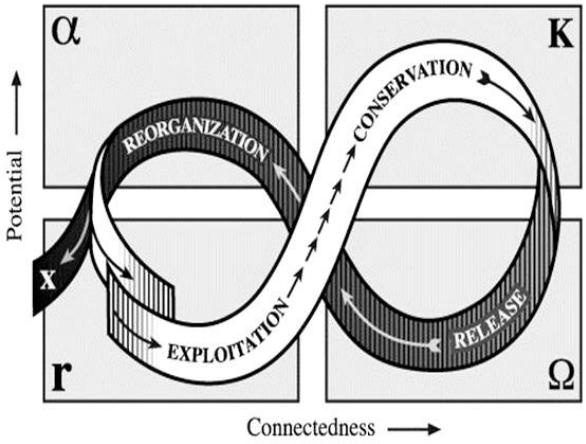

Figure 3.1 Phases of a Social-ecological System (retrieved from RA, n.d.)

An approach called adaptive management (AM) is used to study and build resilience in SESs. It differs from the traditional management cycle when a conscious trial-and-error brings information to adapt and replace previously taken methods. Adaptive management "identifies uncertainties, and then establishes methodologies to test hypotheses concerning those uncertainties. It uses management as a tool not only to change the system, but as a tool to learn about the system" (Resilience Alliance [RA], n.d.). In addition, AM includes past, present and future stakeholders, and most be as much a scientific process as a social one, therefore maintaining political openness. In this matter, AM focuses on "the development of new institutions and institutional strategies just as much as it must focus upon scientific hypotheses and experimental frameworks" (RA, n.d.).

A grand variety of factors influence resilience and is recommended across models. As they were hard to classify and order in importance, the Stockholm Resilience Centre (SRC) of Stockholm University regrouped these factors into seven principles for building resilience that are now widely used throughout the literature. These will serve as a starting point in providing a more generalized analysis of the case of Santana from the empirical data gathered in the field.

Maintain diversity and redundancy. Different components of a SES, like cultural groups, institutions, vegetal species or landscapes, have different functions and capacities. They then deal with disturbances in different manners, and provide to each other different options for responding to change. If a pest hits a monoculture, the whole production may be lost. If there is diversity, certain components of the system may resist and even help other components more vulnerable to the disturbance. Diversity in opinions may also improve problem solving and help the support of other important aspects of resilience like learning and innovation capacities. Redundancy is more of an insurance policy so that if one component fails, then other components with similar function may compensate and continue to provide the function. Response diversity from multiple components with overlapping functions at different scales reduces the risk of having the system fail entirely or even in part. (Biggs et al., 2014)

To properly manage diversity and redundancy, an important attention must be paid to functions or services with low redundancy, especially those controlled by key actors. To enhance diversity, the maintenance of landscapes structures and complexity is important. It can be done with buffer zones around sensitive areas and with corridors. It can also be done through policies that encompass response diversity and that take in account possible conflictual, economic or ecological disturbances. (Biggs et al., 2014)

Manage connectivity. Very much like in landscape ecology theory, connectivity in SES refers to the linkages between biotic, abiotic, and cultural components. Connectivity is qualified by the nature of the interactions between components, which creates the structure of the system. The structure determines the ability to transfer between entities may they be resources, living beings or locations. A high level of connectivity is not always good. It can certainly facilitate a recovery or prevent change, for example with a refuge, but it can also allow disturbances to spread faster throughout the whole system. In this case, limited connectivity may act as a barrier. For social groups, "high levels of connectivity […] can increase information sharing and help build trust and reciprocity. [However, with] homogenization of norms, the explorative ability of social actors drops, [and the network members] may believe they are doing well while they are actually heading towards unsustainable pathways." (Biggs et al., 2014)

Connectivity must therefore be managed with care, it must not be left to itself. One must "identify the relevant parts, their scale, their interactions and strength of connections" (Biggs et al., 2014). Various tools exist to help visualization of the structure and its analysis. Interventions should be guided to optimize the linkages by, first, identifying central, isolated, more vulnerable, and more resilient components. Then, conserve, create, connect, fragment or eliminate components or nodes of linkages. Choosing exactly what to do is highly dependent on the context. (Biggs et al., 2014)

Manage slow variables and feedbacks. The different ways components of a SES connect are infinite, and the specific way they interact through these connections lead to the production of ecosystem services. Many variables influence these connections, the nature of the interactions and the quality of the components. Some act slowly, like CC, and others act faster, like a bicycle tire wears. For feedbacks, dampening ones can help reduce, prevent or eliminate disturbances, like speeding tickets discourage drivers to go faster than a suggested limit, which reduces the risk and gravity of accidents. These can be overwhelmed and lead to the creation of new feedbacks and connections, modifying the provision of ecosystem services. For example, algae absorb nutrients in a lake exposed to fertilizers and keep it clean until the input exceeds their capacity and eutrophication happens. Positive feedback fuel themselves, in a loop of self-reinforcement. Like in Hawaii, where grassy areas more susceptible to fire have been introduced. A fire then leads to more grass, which in turn favours fires. Slow variables and feedbacks are related to resilience because a system shifts are sometimes very difficult to reverse. (Biggs et al., 2014)

The goal of managing slow variables and feedback would be to keep the configuration and functions of the SES so it continues to provide essential ecosystem services. Identifying critical thresholds is the first step. A few guidelines are then recommended by the SRC. The strengthening of feedbacks maintaining desirable

regimes. Avoiding actions that mask or distort dampening feedbacks. The monitoring of important slow variables to detect changes susceptible to cause the system to go over a threshold and reorganize, and the establishment of consequent governance structures. (Biggs et al., 2014)

Foster complex adaptive systems thinking. SESs are open, complex, interacting, and evolving systems, of which the understanding of dynamics and structures are just partial, limited to our learning capacities. The more aware we are aware of this complexity, the more prone we are to act effectively according to our objectives. However, understanding the complexities is not enough to make the system resilient. Our mindset and behaviour need to be adapted to this knowledge. "A complex adaptive systems (CAS) approach means stepping away from reductionist thinking and accepting that within a SES, several connections are occurring at the same time on different levels. Furthermore, complexity thinking means accepting unpredictability and uncertainty, and acknowledging a multitude of perspectives" (Biggs et al., 2014). This can be done by learning about the mental models behind the actions of actors. In other words, actors of a system have to understand how the actors understand the system, and adapt their behaviour to this understanding. (Biggs et al., 2014)

Effective CAS thinking requires a framework to help the understanding of all the relationships. These boundaries allow to integrate clear understanding and limit unnecessary questioning. For example, A influences B, and C exists but is out of the framework. This understanding can then move from a static state to an evolving state. So A influences B, but may influence it in an alternate manner in the presence of D, or in another manner in the presence of E. The creation of scenarios helps to picture these possibilities and be aware of uncertainties. The variety of knowledge here can be highly beneficial to assess the many probable outcomes of different evolving relations. Critical thresholds and non-linear relationships have to be tackled first, as one can have undesired consequences early and the other unexpected consequences. Institutions also have to adapt to this thinking and integrate a social-ecological approach to process management instead of a resource-by-resource approach. Additionally, openness to thinking change has its limits, and these limits must also be recognized as a part of the system. (Biggs et al., 2014)

Encourage learning. As the complexity of a SES is almost impossible to grasp in its entirety. Continuous learning and experimentation are needed to be aware of its state. As resilience is about adapting to change, understanding the state of the system is primary to taking decisions. Managing strategies must account to the constant evolution of the system, incomplete knowledge and its uncertainties. The use of adaptive management is ideal to test different approaches. To enhance information sharing and knowledge, adaptive co-management and adaptive governance allows different stakeholders to share across different scales.

These approach to management also increase cooperation and the development of new social norms, because collaborative learning changes the perspective the stakeholders have of their system. (Biggs et al., 2014) Additionally, according to the theory of the twelve leverage points to intervene in a system by Donella Meadows, sharing knowledge would be the most powerful way the enhance a system's sustainability (Meadows, 1999).

The specific managing techniques needed to encourage learning overlap with some from the other principles: the long-term monitoring of key components, enable engagement and interactions between stakeholders, stay inclusive (diversity), establish a proper context for sharing knowledge, allow resources for learning, facilitate the creation of networks of practices. Deciding on how the learning will take place is essential to avoid obstacles and insure its effectiveness. (Biggs et al., 2014)

Broaden participation. What would be the resilience of a system with connected components that do not collaborate? The whole legitimacy of taken decisions related to resilience enhancement is based on participation. Expanding and deepening knowledge also rests of participation. The active engagement strengthens the bonds of the stakeholders and enhance their trust in each other. Collectively taken risks and actions bring components of a SES closer to each other like diversity, redundancy, and connectivity do. It improves problem solving, support, and response diversity. "Participation can also help strengthen the link between information gathering and decision-making" (Biggs et al., 2014). Participation has to be done carefully to avoid the influence of one stakeholder at the expense of the others, which can cause conflict or competition. A balance between authority and self-determination must be maintained. (Biggs et al., 2014)

Participation is always context specific, and must be adjusted consequently. There must be a proper choice of participants and activities. In order for participation to be effective, sufficient human, time, and financial resources must be considered, as these are the most recurring problems. Good communication, facilitation, capacitation, conflict resolution, and leadership skills are also needed for the successful involvement of all stakeholders, and to establish clear rules of participation, expectations and roles. (Biggs et al., 2014)

Promote polycentric governance systems. The governance of a complex system cannot be done only by one entity. While the principles of democracy may allow the participants of a system to take part in decisions, polycentric governance nests norms and rules across various scales and components. This gives more power to the best-fitted entity to act at the right time on the right scale to address change. Specific knowledge is then more valued, which also increases its chances to be shared and its owners to participate, which in turn increases connectivity and response diversity. (Biggs et al., 2014)

While this may seem like a panacea for the governance of human systems, how to implement properly this theoretical concept is difficult, mainly because assessing how a governance structure impacts the quality of governance is not easily achieved. Still, the SRC identified challenges that should be considered in the implementation. Redundancy has to be balanced properly through effective choice of participants with different interests. Negotiation of compromises have to be done between users of ecosystem services. Conflicts on service use will inevitably arise and have to be managed, or they could lead to favoritism in regard of participants' interests. (Biggs et al., 2014)

3.2 Practical Framework Inspiration: CoBRA

The Community Based Resilience Analysis (CoBRA) is an assessment methodology developed by the United Nations Development Programme (UNDP) to assess the state of disaster resilience and guide the various actions taken to build resilience in the same direction. Given the limitations of the assessment in the context of this essay, this practical framework is ideal to guide the field work and to bridge the gap between theory and practice in an accessible and universal way. While the assessed aspects do not directly refer to the previously mentioned resilience principles but to the characteristics of the Sustainable Livelihoods Framework (SLF) developed by the United Kingdom Department for International Development and TANGO International, they make for a great starting point in reflecting on the more global, theoretical aspects to resilience.

CoBRA seeks specifically to reduce risks and improve human livelihoods in disaster-prone areas, which is exactly what resilience building is about but in a context of great systemwide vulnerability. "Using qualitative, process-oriented tools, CoBRA intends to identify the key building blocks of community resilience and assesses the attribution of various development interventions in attaining these resilience characteristics [in four ways]:

- Identify the priority characteristics of disaster resilience for a target community;
- Assess the community's achievement of these characteristics at the time of the assessment (generally carried out during a 'normal' period) and during the last crisis or disaster;
- Identify the characteristics and strategies of disaster-resilient households; and
- Identify the most highly rated interventions or services in building local disaster resilience." (UNDP, 2014a)

This methodology is based on an extensive literature review, on various consultations, and on numerous test assessments. Its community-based approach comes from its participatory design that includes a practical

package to be applied in various contexts. CoBRA sets reference levels of resilience between households to develop quantitative indicators, and identifies the factors that impact resilience building "through participatory qualitative approaches, namely focus group discussions (FGDs) and key informant interviews (KIIs)" (UNDP, 2014a). The monitoring of these indicators allows to determine if the households are on a resilient or vulnerable pathway. This approach incorporates the multidimensional nature of resilience in only a few indicators for a more practical use. (UNDP, 2014a)

CoBRA measures resilience in two ways. Through universal indicators which indicate if resilience is increasing or decreasing, and through contextually specific indicators which allow to understand how the interventions affect local drivers of resilience. More importance is given to characteristics that contribute to building resilience at community and household levels than quantitative comparison of resilience rates between normal and disturbance periods. These qualitative characteristics feed indicators, inform on the results of interventions, and give context to external policies. The quantitative comparison serves to see how a community adapts and changes under a specific stress: the community bounces back to an improved state, bounces back to the initial state, recovers but worse than before, or collapses. Therefore, this assessment method first identifies the characteristics of resilience at community and household level, defines which households are more or less able to cope with disturbance, identifies the factors affecting the ability to cope, and scores these characteristics in a normal and in a disturbance period. Repeating this process allows to monitor progress and prioritize actions. The challenge is to maximize accuracy and maintain a cost-efficient and user-friendly tool at the same time. (UNDP, 2014a)

Through focus group discussions (FGD) and key informant interviews (KII), the local characteristics of resilience are identified and the state of these characteristics discussed for a normal and disturbance period. This method bases its characteristics of resilience on the SLF, which focuses on five capitals (physical, human, financial, natural, and social). Since resilience is about adaptation, the capacities of the community are added to complete the SLF characteristics. (UNDP, 2014a)

In more details, a CoBRA assessment has three phases, as seen in figure 3.2. During Step 1, current perceptions of resilience and geographic coverage must be considered in selecting a target population. Step 2 is about the preparation of a plan which sets how the assessment will happen from initial training to final reporting, with all roles and responsibilities, as well as resources needs. Step 3, the choice and training of staff, puts an emphasis on experience in local community mobilization and facilitation, with a comprehensive training on resilience theory and continuous support. (UNDP, 2014a)

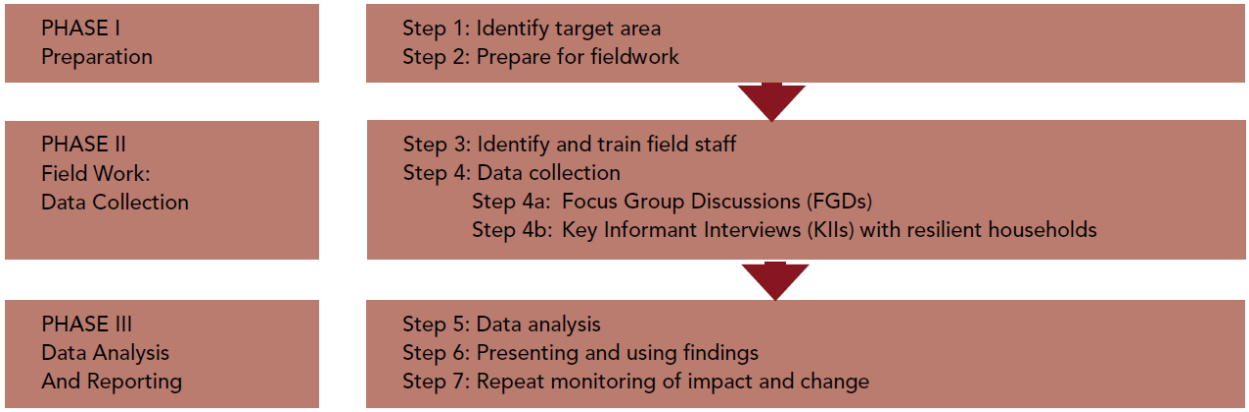

Figure 3.2 Phases and Steps in Undertaking a CoBRA Assessment (retrieved from: UNDP, 2014a)

Step 4a occurs in FGDs. It is the most critical of all steps and is the first of data gathering. It serves to better understand the communities' challenges and goals. During the meetings, the assessment process is thoroughly explained and it is made clear that it is not linked to ongoing or future program, funding or support. The definition of the community (number of inhabitants or households, geographic coverage and livelihoods) is then done through consensus. At this step, participants must understand what resilience is, and define what normal periods are and how they differ from periods of disturbance. This can be done through a list of outcomes if all households were resilient in a period of disturbance, like what characteristics would make the community resilient. Participants are asked to choose which characteristics are the most important without regard to their current state, and to rate how these characteristics have been evolving in the last five years. Another rating is then done to establish the level of achievement from each characteristic for a normal period and for the last significant period of disturbance. Afterwards, participants are asked to identify which households are partially or totally in accord to the prioritized characteristics. The common features of these households and how they got to this point of resilience have to be identified. The number of these more resilient households must also be qualified by the group as increasing, decreasing or staying the same. The last part of this step is the identification of the interventions that have contributed to community resilience. A list of all services and interventions of the last five years can be done, without the intervention of the evaluators. The three most effective interventions are chosen, and a discussion on what interventions should happen in the community occurs. The exercise serves to understand what is helping resilience with evidence rather than showcase projects or organizations. The results should be verified in a second effort to validate the real effectiveness with other stakeholders, as other initiatives may not be visible but still help a lot. (UNDP, 2014a)

Step 4b is done through KIIs, from which the informants were identified in step 4a. These interviews are semi-structured and serve to understand which factors made one group of households more resilient and which others lead others to collapse and fall into more vulnerability. The interviews should also assess the household composition, educational level and livelihood activities of each participant. (UNDP, 2014a)

Data analysis, step 5, starts with the aggregation of statements and their comparison with the SLF categories. Scores have to be normalized, ranked and organized in groups. The use of a radar diagram is recommended to facilitate the comparison between the resulting normal and disturbed states. The features of resilient households have to be clearly listed, as well as ongoing and future prioritized resilience building interventions. Findings from the combination of quantitative aspects from the KIIs and qualitative descriptions gathered in FGD can be used to identify resilience indicators that will be part of the monitoring process. Some indicators are more useful as a static measure of capital, while others are more relevant as dynamic to measure the capacity to change (current state against potential). (UNDP, 2014a)

Step 6 is the presentation of findings and validation with stakeholders and community members. CoBRA recommends multiple meetings and splitting participants in small groups to review the results. Feedback is highly valued and it is to be incorporated to the final CoBRA report. It contains the priority characteristics of resilience, the community's perception on the level of achievement of these characteristics, the features and strategies of the most resilient households, and relative values given to interventions or services related to resilience. With the previously gathered feedback, the recommendations will suggest quantitative indicators to track local resilience. The final report should be distributed for use by all stakeholders to help decision-making. To make it as accessible as possible, CoBRA recommends making a two-page summary, as it also helps to compare with findings of other CoBRA assessments. Since this analysis is particular to the local context, it has to be made clear that it is partial to all aspects of resilience, and that other efforts have to be done, especially to identify the best ways to improve specific characteristics affected by systemic issues. (UNDP, 2014a)

The last step is the integration of the suggested monitored indicators to existing data collection processes and the monitoring of change. A repeated monitoring of the priority characteristics is essential to track progress, rank impacts, and scale up interventions. Of course, even with good interventions, resilience building takes time and concrete results should only be expected on time scales relative to seasons or disturbing events patterns. (UNDP, 2014a)

Overall, this methodology has several benefits. It allows the community to define resilience instead imposing a vision or indicators. This vision is also characterized by real achievements from existing resilient households. It is participatory, which is central to resilience building. It quantifies the impacts of interventions. It is quick and inexpensive (the most expensive pilot of UNDP, in Kenya, cost 16,000 US$ for 6 districts, 42 FGDs and 42 KIIs). It provides a useful contribution for strategic planning, with community views, key issues and effectiveness of interventions. It is easy to conduct everywhere and requires little technical expertise. (UNDP, 2014b)

CoBRA also has its limitations. It doesn't provide a standalone quantitative measure of resilience to compare achievements between different communities. The scores are subjective and subject to change, which makes the expansion of the results to other communities impossible. Otherwise, CoBRA doesn't evaluate individual programs even though organizations would need to know how their programs alone affect resilience as a whole. (UNDP, 2014b)

A last criticism exists regarding the choice of indicators, because CoBRA provides both a universal measure and composite, contextually specific indicators. In pilot assessments, universal measure almost always included a minimum food requirement with a few other basic needs, which has been found to be very comparable to household production and income. Production and income are easier to quantify and compare, and recent data may already exist. The Household Economy Approach precisely quantifies these aspects. Integrated to CoBRA, it would have the potential to provide a better and more comparable tracking of household resilience if it would quantify the "ability of households to access enough income and assets to meet basic needs, in both shock and 'normal' times […] using existing data sets" (UNDP, 2014b).

3.3 Resulting Assessment Methodology

The assessment has two main objectives: discuss the resilience of Santana and evaluate its potential for REDD+. Fortunately, REDD+ integrates characteristics of resilience, namely participation capacities and ecosystem resources, and its potential can then be verified at the same time. The assessment should also empower the participants to build resilience in their community, and make external organizations aware of local considerations for sustainable development. Consequently, the resulting assessment methodology, composed of five phases, will be strongly inspired from CoBRA for its ease of use, adaptability, and empowering results. The present method also integrates aspects of the theoretical framework proposed by the Resilience Alliance and the SRC, but those will be used in the analysis of the results because defining the Santana SES thoroughly and evaluating its past, present and future states concerning all components and

principles is not possible in the context of this essay. The process of the methodology is presented in figure 3.3.

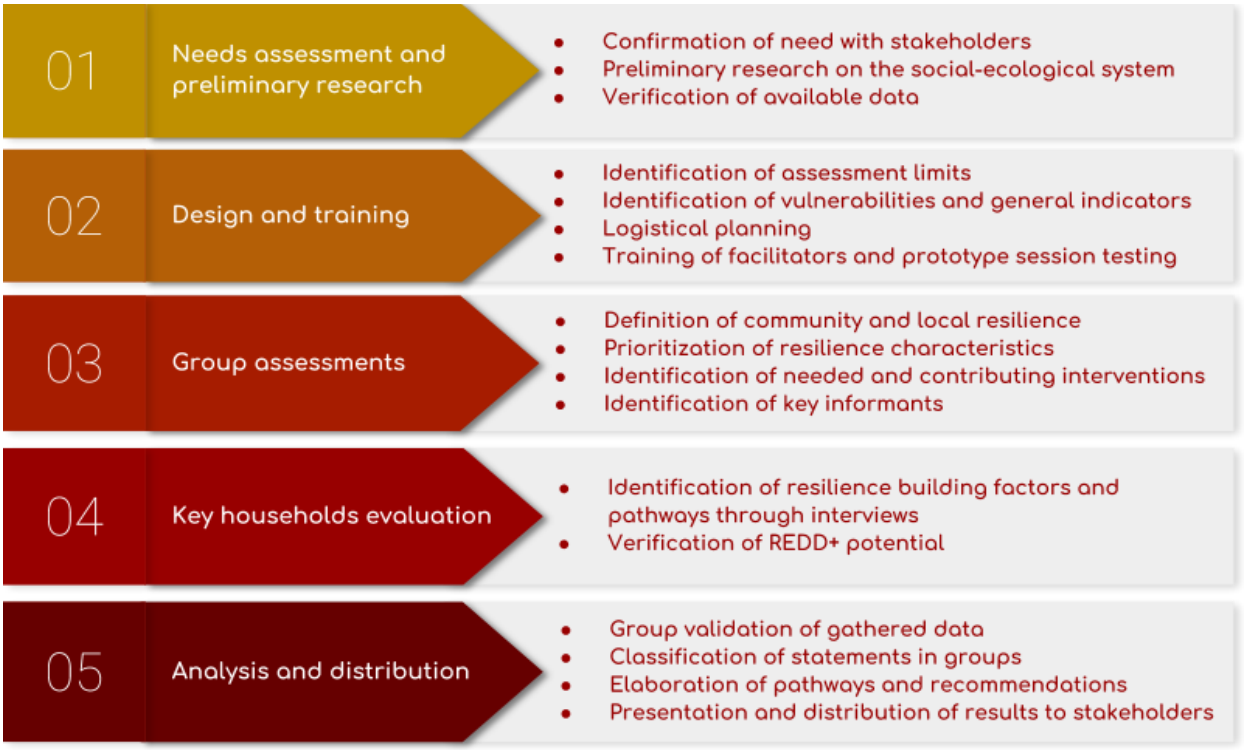

Figure 3.3 Phases of the Resulting Resilience Assessment

3.3.1 Focus of the Assessment

Before applying any of the principles of resilience, it is essential to consider what to build resilience to, and what of. Given the previously mentioned social-ecological characteristics and pressures in chapter 1, the Santana SES is unquestionably vulnerable to certain disturbances. The available data indicates that people are poor, isolated and uneducated, that public services are corrupted, that food production has been weak, that soils are eroding and that access to potable water is very limited. CC is also at the door, with high risks of hurricanes. Since the involvement of the community with the FASD, these conditions have fortunately not been deteriorating, but the farmers have yet to conduct conservation activities on top of the daily life they already had. Even if the FASD monitored data in social, economic, gender, health and ecological realms, the indicators have not been updated since the initial studies conducted in 2014, and were not meant to assess resilience. The only monitored aspects as of today are related to forest cover, the number of people involved, and climate. The resilience approach to sustainability assessment in this community would allow to analyze how to build the capacity to deal with the unexpected, verify if the FASD is on the right path,

and see if other factors should be considered by the community for its development outside of FASD activities. (Biggs et al., 2014) After all, Santana is home to a pilot project. If it is to be upscaled or reproduced elsewhere, considerations for strengthening the communities involved should be taken at the same time as conservation activities. It may also very well influence neighbouring communities and the practices of all stakeholders.

Since the possibilities of carrying a comprehensive resilience assessment are limited in the context of this essay, and because the FASD already monitors water replenishment and participation through aspects relative to conservation activities, the focus of the assessment will be made on CC adaptation, as it is the greatest menace to the integrity of the Santana SES. This encompasses aspects relative to collaboration capacities, access to basic services, food security, economic wealth, and quality of infrastructures. While there is also a need to assess public services' integrity, gender equality, and the strength of social structures, these aspects of resilience will not be directly covered. The specific limits of the assessment are covered in section 3.5.

3.3.2 Phase 1: Needs Assessment and Preliminary Research

The necessity of such an assessment has been confirmed by the community during a climate change adaptation workshop conducted by the CEDAF in May 2018. The idea of conducting a resilience assessment was very well received by the participants. They noted its pertinence because it doesn't come from a governmental institution, because it is organized by an outsider with a neutral view, and because it will help complement ongoing conservation activities with sustainable development and CC adaptation considerations. Preliminary research presented in chapter 1 allowed to understand what the Santana SES is composed of, and what it is vulnerable to. Exactly how CC affects the community of the ground will be defined by FGDs participants during phase 3.

3.3.3 Phase 2: Design and Training

This phase concerns the adaptation of the method to the context of the community. Limitations must be determined to design a feasible assessment in a timely manner. This requires knowledge of available human, financial, infrastructural and temporal resources, as well as the availability of community members.

Based on the data gathered during phase 1, hypothetical vulnerabilities have been identified. These include food production capacity, access to potable water, access to public services, and access to shelter.

Three individuals have been chosen to help in the facilitation of data gathering. The first one, Galin De Los Santos, is native to Santana. Logistical details were planned according to his knowledge of available resources, especially concerning FGDs location and time, transport, communication, housing, and food. He previously helped an ecology student partner to the CEDAF with a research on plants in the whole subbasin. He attended almost all of the CEDAF's workshops since they started and he is therefore already sensitive to many aspects of resilience. The second one, Juan Madera, is a CEDAF employee responsible for technical implementation of the conservation activities. He is usually responsible for the gathering of community members to the workshops. He will therefore help to motivate community members to participate in FGDs. The third one, Cynthia Ortiz Rojas, is an analyst in climate change adaptation at the MMARN and a biology teacher at *Universidad Nacional Pedro Henriquez Ureña*. She has been responsible for helping with the assessment since the beginning and will help in the conduction of FGDs in the first three days to bridge the cultural and language gaps with specific terminology between the facilitators and the participants during the exchanges.

Two visits have been planned. The first visit lasts three days and serves to train Galin, to confirm available resources and to conduct two FGDs. Juan is aware of what resilience is and doesn't live in the community so his help will only be needed to initiate the meetings and motivate participation. The definition of the community is already relatively known from the previously available data, but should also be confirmed during the first visit. It is important that at least the characteristics of resilience are determined during the first visit so households' pathways to resilience can be discussed during the second visit. The second visit will last six days to allow a meaningful amount of KIIs during weekdays, which has been determined to be the best time to make household visits. Other FGDs can also be done during this period if the two first ones were not enough to attain their goals.

The sustainable rural development NGO EduCARE India suggests to have a prototype meeting during the planning phase to test the whole process before the first real FGD. In the event of unawareness of the process from the community, of inexperienced staff or if resources are very scarce and uncertain, it would allow to plan for more effective activities and better contextualized facilitation. It would also allow better meeting designs in case of a polychronic culture, or if not all community members think they should attend public meetings or even speak in public, especially women. The previously gained experience from the CEDAF and the good attendance rates to their workshops allow the current assessment to skip prototyping, dive directly in the first FGD, and adapt as it progresses. However, the first three days will certainly help to design better FGDs and KIIS for the second visit.

3.3.4 Phase 3: Group Assessments

This third phase occurs only in FGDs and decisions are reached through majority votes or consensus. This participatory phase starts by asking the community members to define the community, its content and its limits (number of households, area, available services, livelihoods, institutions). Then a discussion occurs on the definition of resilience. A theoretical explanation of the concepts of CC and resilience are laid down. People discuss what they have witnessed in terms of impacts and vulnerabilities. Among these impacts are expected overly abundant rainfalls, persistent droughts, inundations, higher than usual temperatures, and hurricanes. The group is asked to vote on the most devastating event as it is to this one will we try to build resilience to. To do so, it is easier to ask what the difficulties are during a year affected by an event, and what the differences are between a normal and a disturbed year. The difference between the two states enlighten us on what the vulnerabilities really are, what the community can easily recover from, what causes permanent damage, and what can be done to prevent undesirable changes. The vulnerabilities are then changed into positive statements, for example, by changing "lack of shelter" to "access to a shelter". At this point, it is imperative that the community members understand what resilience is and what it is built from and a reminder can be done before the following step, which is the identification of local resilience characteristics. The group is asked to prioritize the resilience building characteristics. Each participant can choose three by putting beans on drawn symbols representing the characteristics, as seen in figure 3.4. The characteristics of resilience brought during the discussion have to be prioritized from the most to the least important in providing a more resilient state to the community. If it is difficult, outcomes as if all households were resilient in a period of disturbance can be discussed. Three will be elected at the end of all focus groups to assess their pathways in phase 4 and to create indicators, like in CoBRA, without regard to their current state. The achievement of these characteristics over the last five years will be rated through votes as decreased, no change or increased.

All households that achieved or that are recognized with a higher state of resilience, or on their way to be regarding chosen characteristics, have then to be identified for phase 4. The participants simply state who they think should be visited. This opens the possibility to discussing the pathways responsible for these achievements. Eventually, the participants will be asked to tell which services and interventions contribute to resilience building at both household and community scales. After, the group can qualify these interventions and services as good or bad.

This phase should happen in two FGDs during the first three days. The whole process of community definition, resilience theory explanation, characteristics prioritization, achievement determination,

interventions appreciation, and potential informants' identification will be done each time. While results may differ, voting systems are standardized, and statements will be aggregated during the analysis of phase 5.

Figure 3.4 Votes on Local Climate Resilience Building Priorities during the Second FGD

3.3.5 Phase 4: Key Households Evaluation

This phase is very similar to step 4b of CoBRA. The informants were identified during the FGDs of phase 3, and the discussions here may bring other possible informants to the list. These interviews are semi-structured because they have precise questions, but the answers are relatively open. They are also recorded to make sure no details are lost, because the rural Dominican Spanish is known to be spoken rapidly without much accentuation. At the end of a discussion, we should be able to understand which factors made the household more or less resilient.

Before the interview, the local definition of resilience will be explained to the participants, as they were informed that the assessment process would occur but may have not been present in the FGDs. The explanations are interactive to favour the integration of the concepts with local examples and to engage the participants in sharing original ideas. The following questions can be asked in a multitude of manners as the understanding of vocabulary and the length of the questions can get confusing. The objectives and the questions that will be discussed are shown in table 3.1.

Table 3.1 Objectives of the Interviews and Related Questions

Objectives	Questions
Understand what makes a household more resilient	What characteristics have contributed to your household's resilience? What are the qualities of your family?
Understand the pathway to attain characteristics	How would you say your household became resilient? Why did you make those choices?
Understand the reason of the effort	How long has it been resilient? Was it always the case? Was there an event or a reason that triggered the beginning of the process?
Understand if the pathways were efficient, if the characteristics were achieved and if the level of achievement was making the household actually more resilient	Would you say your household coped better with disturbance than the rest of Santana? What would you say the differences are between your family and others after the event?
Understand what they think they would need to build resilience	Without regard to what is already in place, what intervention or service would be the best to build resilience in Santana? What would be ideal? Is there something missing to your household?
Understand what helps them building resilience	Are there current interventions or services that support households in building resilience? What makes the village resilient?
Understand what is preventing resilience	What would you say is preventing resilience building in Santana? Why is the community not resilient?

It is also possible that questions from the FGDs will be asked to the informants if they bring aspects that were not previously considered. These aspects may be integrated in the results of the FGDs.

All the statements from this phase will be quantified to see which pathways are more popular and efficient, and to see if there are general factors that lead to more resilient households. They will be aggregated to make general profile on how to locally become resilient. These pathways can also help to build resilience monitoring indicators at the end.

3.3.6 Phase 5: Analysis and Distribution

The validation step from CoBRA, done on the prioritized resilience characteristics and the quality of contributing interventions in a last FGD after all the KIIs are done, is not mandatory but preferable. It allows to make an ultimate consensus on local resilience building and taking as many opinions as possible into consideration, especially if it doesn't seem like the community agrees. Still, results are not discussed at this point. This step is done to enlighten participants on aspects they may not have considered and to reconfirm their choices.

The second step is the aggregation of statements and classification characteristics in groups. These groups are based on Resilience Alliance definitions, SRC principles and SLF capitals.

At the end of this step, we should have four clear results sections to help understand local resilience building.

1) Definition of the context
    a. What the community is
    b. What the threats are
    c. What the vulnerabilities are
2) Definition of local resilience
    a. Community resilience building priorities
    b. Factors of more resilient households
3) Current state of resilience
    a. Achievements of characteristics
    b. Appreciation of existing service and interventions
4) Actions to build resilience
    a. Possible pathways to achieve characteristics
    b. Recommendations and indicators for resilience building

The resilience building indicators are meant to be integrated to current monitoring activities for all stakeholders to work on common objectives. They should also serve has objectives for resilience building at both household and community levels.

3.4 Indicators of Potential for REDD+

The national REDD+ strategy of Dominican Republic will not be operational until 2020. It is still in its preparation phase, far from potential evaluation and far from benefits distribution mechanisms. It is

therefore very difficult to evaluate the potential, because there are no established criteria or processes yet. However, REDD+ has common guidelines throughout its worldwide application and the national strategy is built on existing methods. It is therefore possible to determine approximately the potential held by a community to participate in the program. The following chosen indicators were proposed by local specialists on REDD+, reforestation, impact assessment and public participation from the MMARN, TNC and the World Bank. These indicators seem pertinent given they are already standardized in other practices by the MMARN, which is the organization mainly responsible for the development of the REDD+ strategy and the registration process. Many aspects can be considered to choose a perfect site and all the current criteria to select an area for reforestation are shown in annex 4 as an example.

Verifying the said potential means to provide a history and context of the community, provide an approximate inventory of the forest and agricultural resources, give an overview of social structures and discuss the interest of the community and its willingness to participate. This assessment facilitates the actual future potential evaluation by explaining the general context in which it would happen. As previously mentioned, implementation is a big challenge for REDD+ projects and the essay is also an attempt to vulgarize the complex concept of the program to the main stakeholders on the ground: in this case, the inhabitants of Santana. Hopefully, if the community shows interest, the results will allow Santana be the first community to participate in REDD+ as a pilot project from which they will benefit.

To approximate the potential, three fundamental aspects were chosen because they are considered worldwide as a basis for all REDD+ projects potentials. Like any activity a community decides to take part in, the factor of interest is the first thing to assess. For this, the community needs to want the benefits of its participation, and should trust the entities responsible for the activity. In this case, REDD+ has many stakeholders and the MMARN is the most active Santana is aware of. The second fundamental aspect to consider is the capacity to participate. People need to be available, to have a structure around which to organize, and to be somewhat used to collaborate. As of now, no implementation organization is responsible for the field coordination, but there can be suggestions among the ones present in or close to Santana. The last fundamental aspect to consider is related to natural capital, because, as REDD+ states, the quality of this capital should be directly rewarded. These three aspects will be assessed during phase 3, 4, and 5. The following indicators presented in table 3.2 illustrate where the data will come from.

Before any question is asked to a group or a household, a neutral definition of REDD+ will be done. When they understand what REDD+ consists of, how it works, what their participation would be and what it could

bring to them, specific questions will be asked after the resilience assessment. The exact definitions and questionnaires are presented in annexes 5 and 6.

Table 3.2 Source of Data for REDD+ Potential Indicators

	Participation	Interest	Natural Capital
Phase 3: Group assessment	Implementation organization		
Phase 4: Key households evaluation	Availability	Trust in stakeholders	
	Social structure capacity	Potential benefits	Ecosystem services diversity and quality
	Current state of collaboration		
Phase 5: Analysis of existing data	Participation in previous programs		
	Similarity of ongoing activities to those accepted by REDD+		

Implementation organization. The participants will be asked if they think they would need an external help for implementation, or if they can organize by themselves. A list of services and interventions that build resilience is made by the participants in the resilience assessment process. The perceived efficiency of the organizations responsible for the services will tell which organization could act as an implementation coordinator. Suggestions may also arise during KIIs.

Availability. Two questions asked to key informants regard their time and resource availability. Again, some questions may arise in terms of what will be the needs of REDD+ activities. The only probable answer would be that they will be similar to the ones conducted with the CEDAF: conservation, development of agroforestry systems and reforestation. Questions may also arise to know if they would get paid to do it. This question as no answer, but they would receive additional benefits along to the ones provided by the improvement of natural ecosystems.

1. Do you think your household has enough time to take part in REDD+ activities?
2. Do you think your household has resources to take part in REDD+ activities? What type?

Social structure capacity. This will be asked after the resilience building interventions and services quality and needs are discussed. It may be necessary to discuss the responsibilities and efficiency of local social groups to clarify what roles social structures play.

1. In terms of how the community is organized and the planning is done, do you think Santana can receive a conservation project such as REDD+?
    a. No, Santana is not able to coordinate its participation to the program by itself or with an external implementation organization.
    b. Yes, but Santana would need to be coordinated by an external implementation organization.
    c. Yes, Santana has a strong enough social structure to implement REDD+ by itself and create a local entity responsible for it.

Current state of collaboration. This may raise questions on their personal capacity and on what would be needed to participate. Again, the only probable answer would be to discuss previous or ongoing community-wide projects. Notes will be taken on specific elements responsible for a better collaboration. Participants will be asked two questions:

1. Do you think people in Santana usually act in solidarity and collaborate with each other when asked by one another?
2. Do you think people in Santana are used to work on community-wide projects?

Trust of stakeholders. While there are multiple instances responsible for REDD+, a list of all current stakeholders of REDD+ with their description and contribution will be there to help answer the questions of participants. They will not all be presented to participants, but the process of implementation and benefit sharing will be explained beforehand. Examples of problems that occurred in other countries will be given to participants to make them aware they should be careful and to help them think about what is at stake in a REDD+ project.

1. Would you trust this program to consider your resilience needs if it was to be implemented here?
2. Given who is responsible for REDD+ today, do you think it is a good idea to start a project here?
3. What would make REDD+ less trustable and what would put you in confidence?

Potential benefits. A list of potential benefits will be presented to the participants. All ideas from the participants are welcome. For now, when the MMARN involves a population in a participatory process, considerations are given to impacts on local culture, architectural landscape, security, property value, basic services (water, energy, sewage systems, health, and education), and number of people involved (MMARN, 2015), so compensations can be given accordingly. REDD+ also has other considerations previously

mentioned in chapter 2, but they have yet to be chosen precisely by the national strategy. Since no guarantee can be given to participants on actual benefits, their opinion will be taken as recommendations to include in the REDD+ strategy or for future local implementers.

1. What kind of benefits would be the more interesting to you?

Ecosystem services diversity and quality. This can be discussed in terms of usage, accessibility, quantity or purity. Examples will be given to participants, but they should come up instinctively with the ones most useful to them.

1. How do you use the forest? And what ecosystem services do you think you benefit from the forest?
2. When thinking about all these services, would you say the quality of the forest has increased, decreased or stayed stable in the last 10 years?

Participation in previous programs. The CEDAF already conducts a participatory conservation program based on some sustainable development considerations. It is believed that the activities wouldn't have to be modified much to fit REDD+ requirements and objectives. The CEDAF gathers information on the number of participants present at each of their workshop and the number of direct household beneficiaries they involve. In this manner, verifying the participation rate to the CEDAF's activities is a good indicator of what would be a potential participation to REDD+.

Similarity of ongoing activities to those accepted by REDD+. Some activities are acceptable for REDD+, and some generate more benefits than others. Based on the two models, from Peru and Zambia, and based on the types of projects that respond to REDD+ activities (as seen in annex 3), ongoing initiatives in Santana will be discussed.

3.5 Limits to the Analysis

Concerning the area of analysis, the assessment will be done on the village of Santana alone, and with inhabitants of this village only. The community will define exactly what is and what is not part of the SES during FGDs. This restriction will allow a more precise understanding of the local situation, what people consider to be part of their own system. While Santana is one of the most isolated of the neighbouring villages, its context is not so different from the other ones so the results may still be pertinent for other villages. Also, even if Arroyo Grande is included in the FASD, Santana is the base of operations.

Indicators of REDD+ potential, land cover type, biomass, carbon sequestration potential, gender issues, and other quantitative indicators requiring specific tools or methodologies will not be assessed and will be thoroughly analyzed for result-based rewarding potential analysis if a REDD+ project comes in Santana. An entire socio-economic study should be done before a project starts there. Some aspects are already monitored by the FASD and MMARN, so they will also not be part of this assessment.

Qualitative data collection faces the possibility of being impacted by selection bias. Theoretical explanations have to be given to participants before they answer and while those are trying to be neutral, the facilitators may influence the answers involuntarily. Some questions need further explanation, especially regarding why participants would or would not trust REDD+ stakeholders, and these explanations may also hold bias. All statements from participants are recorded, all hold the same weight in the analysis and, in the event that the assessor's opinion is too strong, a statement may be eliminated. However, the assessor's opinion during a discussion with the participant is also part of an educational exercise to get more critical responses. Debate brings up questions and helps form opinions too, so statements from the assessor himself may also be considered pertinent for the analysis.

The data collection will also be limited by the short time in the field and by the availability of participants. Only ten days total are planned in the field and Santana is spread in the mountains. Two hours by horse are needed to go from one end to the other, so it is impossible in this context to get the opinion from all households. There are no means of communication, so organizing the FGDs has to be done in person. Some questions from the FGDs will therefore be asked during KIIs if the participants were not present in FGDs. Therefore, the sample will try to represent more than half of the households through both activities with the core components of the assessment: the local characteristics of resilience, and the efficiency of services.

The language barrier will certainly limit the data acquisition and the quality of the statements. It is limiting the capacity to explain, reformulate and understand. While there is a local facilitator for the KIIs, he doesn't speak English. During the KIIs, when participants will present themselves, the assessor will decide if he needs to record the conversation. Otherwise, written documents will be ready and a good theoretical training will have been given to the facilitator. During the FGDs, another facilitator, this time bilingual, will be present to take notes and help reformulation.

Overall the assessment is very limited for what it can analyze for contextual and budgetary reasons. All funding for the assessment comes from the assessor himself, and only some logistical resources have been shared by the stakeholders to help save expenses. Hiring additional staff, having multiple assessment teams,

having more time on the field, having more FGDs and KIIS, or including more aspects to the assessments is therefore impossible. Fortunately, the CoBRA methodology has proven to be very cost-effective to directly get the needed results.

The last limitation concerns the participants and their perception. They may focus on the current season rather than an average for the whole year when thinking about the normal situation. It has implications for seasonally variable characteristics, such as water availability (rainy and dry seasons) (UNDP, 2014b). Some participants may also think they are not resilient because they struggle during an event. They may not see how they differ from others because the disturbance is so big that it feels everyone is in the same bad situation. Therefore, emphasis has to be done on questions related to household qualities and how they coped differently, by asking the question in different ways. A perspective will also be given in this case, because perfect resilience is impossible, systems evolve. To get there, priorities have to be made and some elements or services make bigger differences than others.

4. RESULTS AND DISCUSSION

The assessment led to two sets of results. The first set concerns the current state of resilience of the community, and discusses the pathways based on the current capacities. The second set serves to verify the preliminary potential of the REDD+ program for the community based on its participation, interest, natural capital and compliance to REDD+ criteria.

4.1 Santana's State of Resilience

This part of the assessment was done both in group discussion and in key informant interviews. The community definition, vulnerabilities, priorities, achievements and appreciation of existing services were conducted in FGDs. These FGDs identified key households considered more resilient that should be visited. The following KIIs discussed the resilience characteristics and related strategies. All this allows to understand what the possible pathways to resilience are, and their efficiency based on the number of outcomes and their quality.

4.1.1 Details on the Assessment Process

Two technical details are worth mentioning to better understand the context of the data gathering and the value of the results.

Used definition of resilience

Because it is hard to think of resilience and analyze it holistically for a community or even for a household, questions were separated by components of resilience, either by the five capitals or by SRC principles. The definition given at the beginning of activities included the possible local changes in climate, and was simplified to the capacity of a system to maintain its initial good state during and after a disruptive event, the capacity to revert easily to the initial state, and the capacity to evolve to a better state of resilience after an event even if there was a change of state. If the system changed to a state where it can no longer go back to its initial state, it was not resilient. If it remained unchanged or if it can go back to its initial state easily, it is resilient. The example of the state of a house after a cyclone was easy to understand, but made resilient difficult to differentiate from resistant. Including access to food after a cyclone to a resistant house made clearer the idea that a community cannot be resilient only by having strong houses. Three of the SRC principles were explained to better understand what affects local resilience: the diversity of available services, the connectivity between services and components of the system (compared to ease of access), and the participation of components and service providers (compared to the availability of services made by

service providers and to mutual help between people). People then understood that they needed good access to a variety of services and to participate in the system to be more resilient. The other aspects of the theoretical framework seemed partially integrated in the three explained above, so they were only explained to facilitators and were used during some interviews to analyze specific aspects.

The Sample

Forty-two people took part in the FGDs, from approximately 34 different households. 34 people participated in KIIs, from approximately 25 different households. A total of 69 people participated directly in the assessment, from 52 different households, which represent indirectly 65% of the local population. The participants were aged from 16 to 92 years old, and 48% of them were women. Most of the households had an agricultural livelihood, but others were also included in the sample (police, shop owners, retired, state officers, bankers, barber, students, environmental technicians and tourist guide). More people came from Santana Abajo than Santana Arriba due to accessibility issues, but both were present in each phase of the assessment.

4.1.2 Community Definition

Santana is very isolated, located at the end of the road leaving from the north of Los Cacaos. It is separated in two parts: Santana *Arriba*, the upper Santana, and Santana *Abajo*, lower Santana. It's been stated quickly that Santana Arriba doesn't have access to most of the services present in Santana Abajo. There are no streets, only paths in the mountains. Houses there are far apart, isolated and people use mules as means of transport. Motorcycles and trucks are parked down the mountain, on the street of Santana Abajo.

From October to February is the cold season, and from February to October is the hot season. Rain and hurricane season is from June to November. At the north of Santana are the river Mahoma, the villages of Colorado and Benito, and the *Valle de Dios* (valley of God). At the south and east is the river Mahomita and the village of Arroyo Grande on the other side of the river. At the northwest is the river Nizao. At the west are the rivers Mahoma and Rosalito, and the *Cañada Arroyo* Berida, a small river in a ravine. Without reference to scale, quantity or location, the boundaries and content of Santana are illustrated in figure 4.1. Exact maps of the Mahomita subbasin can be found in annex 2.

Mentioned natural capitals were forests, pastures, protected areas, and agricultural lands for the production of coffee, passion fruit, avocado, lemon, corn, yucca, potatoes, plantains, bananas, beans, pumpkin, trees (nursery), and livestock. Mentioned social capitals were the ASOCAES, two primary schools, one church,

around ten *colmados* (corner stores), a few *bancas* (lottery, phone credit recharge, and money transfers), an association of neighbours and The Society of Parents and Friends of the Basic School of Santana Abajo. The human capital of Santana is composed of 70 to 80 households, of around 7 people each. Young people are reputed to migrate because of the lack of employment, little resources, and the few services and public institutions. In terms of economic capital, agriculture is the most common livelihood. There are also a few tertiary services (teacher, barber, driver of public transport, dressmakers, police, shop owners, landscapist, environmental technician, janitor, tourist guide, bankers, state officers, etc.), and one group of common savings part of the ASOCAES. The physical capital is defined by schools, church, one street in Santana Abajo, wooden and block houses, agricultural areas, a *gallera*, a baseball field, and one aqueduct. In terms of public transport there is a small bus that goes all the way to San Cristobal during the week.

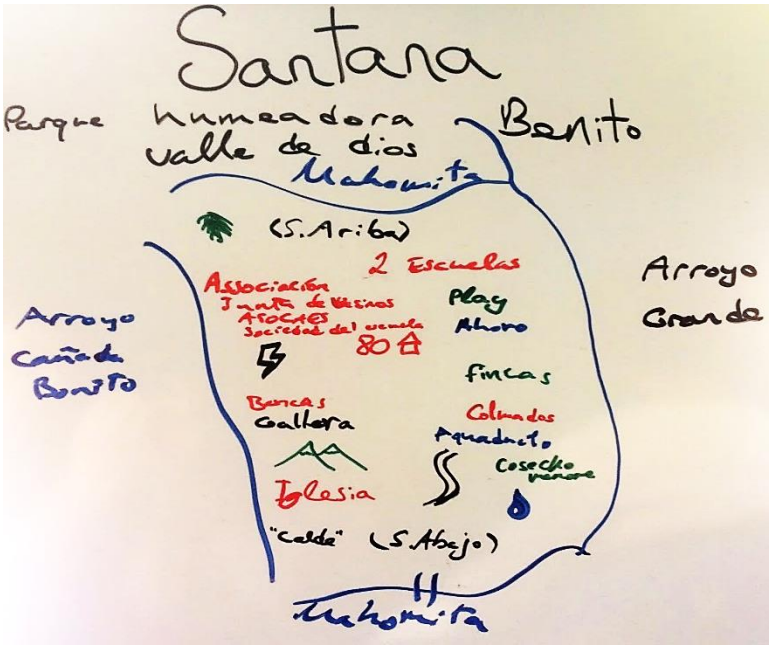

Figure 4.1 Santana's Boundaries and Content as Described during the Second FGD

The mentioned events related to CC were more frequent cyclones and tropical storms, longer droughts, more rain during rainy season, more humidity (to a point it is sometimes impossible to work), and higher temperatures during cold season from August to February. In recent years, these lead to infrastructure loss, impossibility to work, loss of access to food, loss of soil and important flash floods.

4.1.3 Vulnerabilities, Priorities and Achievements

To decide what to be resilient to, the gravity of CC related events was discussed. Were brought up cyclones and tropical storms: David (1979), George (1998), Noel (October and November 2007), Olga (December 2007), Ana (2014), Maria (2017); and a drought of 6 months in 2015. Coffee rust and the coffee borer beetle were also mentioned but their presence in the country is not related to CC (Invasive Species Compendium, 2018; The American Phytopathological Society, 2018). Hurricane Noel was chosen, mainly because of the overflow of rivers and mudflows which caused loss of houses, and loss of agricultural productions.

Once it reached Dominican Republic in October 2007, hurricane Noel was at the beginning of its tropical storm phase, still 3 days away from reaching category 1 off the cost of Bahamas. What was exceptional about Noel was the amount of rainfall. Rain superior to 170% of normal levels in October for the country classified it as one of the most intense historically. The rains lead to inundations that continued for four days after the passage of the storm because of continuous new tropical fronts. The region of San Cristobal, where Santana is located, was especially affected and recorded 337.3 mm of rain. It suffered the most infrastructure loss in the country, both in number of damaged buildings and in monetary value. It also recorded the most casualties in the country. The biggest cumulative losses were for the small-scale farmers, because of the losses from both their production and their infrastructures, which was exactly the case for Santana. (Comisión Económica para América Latina [CEPAL], 2008; Oficina Nacional de Meteorologia, n. d.; Weather Underground, n. d.)

Table 4.1 presents what the focus groups mentioned as the difficulties (includes vulnerabilities and impacts) that followed the passage of Noel. They are categorized by capitals to show which ones are the most vulnerable. Following the principles of the SRC, it seems like what makes Santana vulnerable is a lack of diversity and redundancy because so many essential services are lost, and a lack of connectivity because the locally available resources are not sufficient, and the geographical isolation prevents resources from reaching them. More detailed analysis is explained in sections 4.1.5 and 4.1.6.

As stated by Natalie Topa from the Danish Refugee Council, resilience analysis can be split in three capacities: absorptive capacity (how a community reacts to a direct shock), adaptive capacity (how a community will change to cope better with the disturbance in the future), and transformative capacity (systems level change capacity) (Topa, 2018). What has been mentioned by participants is that they have a very low capacity to absorb a disturbance because almost all infrastructures are lost. Then the capacity to recover is also very low, because there are almost no resources available locally, because emergency

interventions stop at Los Cacaos and don't reach them, and because it takes around six months to recover to a precarious state similar to the one before the event. Since the reference event happened in October and the hurricane season starts in May, seven months later, the community would have had only one month to improve before the high risk of disturbance was back. The capacity to evolve is very limited because no improvements seem to be done by institutions at their location and every year they are as vulnerable to hurricanes as the previous one.

Table 4.1 Vulnerabilities of Capitals after the Passage of Hurricane Noel as Mentioned by Focus Groups Participants

Social	Human	Natural	Financial	Physical
• No access to help • School closed for a long time (used as refuge) • Cessation of communitarian activities	• Untreatable health issues (infections, allergies, injuries) • Dengue propagation • Deaths	• Loss of soil • Water quality loss • Loss of agricultural production • Deforestation	• No money for food • Loss of products to sell • Difficulty to buy and sell products	• Damage to school • Damaged or lost houses • No electricity • No means of communication • No transport • No refuge • No access to locally or externally produced food

Positive Statements and Priorities

Since the groups were big and the number of FGDs was limited, a pause was taken in the middle of the activity to give the facilitators 10 minutes to change all difficulties in positive statements which would become local resilience objectives. For example, a damaged house would be changed to a resistant house, the loss of soil changed for flood-resistant soil, the loss of plantations changed to flood resistant plantations, and so on. With fewer people, more meetings and more time, this exercise would have been interesting to do with the participants to discuss possible pathways and empower them in being able to find solutions critically together.

When asked what interventions or services the participants would want in an ideal future Santana (independent from resilience characteristics), consensus was reached on three priorities: a medical centre, good streets and a community centre that could be used as refuge. While not everyone agreed on a fourth choice, a majority was reached for public transport that could get to the university in San Cristobal.

In table 4.2 are presented the four resilience characteristics prioritized from most to least needed by the participants with the associated level of achievement in the last 5 years. It is to note that what they need

daily is similar and some participants may have seen the assessment as an occasion to discuss less critical needs. For example, the whole village has free access to electricity and they do not use electricity except for a few light bulbs, so this need is filled and they may not find it important to conserve this service for their resilience. However, they all struggle to get to the doctor when they have to, without regards to a disturbing event. Untreatable infections, viruses and injuries were mentioned as problems encountered after the cyclone, but were not brought up as critical like access to water was. On the other hand, everyone agreed they find the street to be in a terrible state and they all use it every day. Access to food, however, which seems more critical from a survival point of view, was far behind in the votes. Therefore, further analysis and additional consulting should be done to confirm these should be the actual priorities to build local resilience and not only what people require on a daily or occasional basis.

Table 4.2 Prioritized Resilience Characteristics and Level of Achievement in the Last 5 Years

Resilience characteristic		Achievement in the last 5 years	
1	Access to health services	Equal	The quality of the service got better, but the access is the same (a 45-minute ride on a precarious dirt road).
2	Resistant houses	Worse	The grand majority of houses are fragile and will be completely lost if a similar disturbance was to strike.
3	Access to clean water	Better	Slightly better with the aqueduct in lower Santana and with the interventions of the CEDAF.
4	Resistant streets	Worse	The state has been getting worse and it is more and more difficult to get from Los Cacaos to Santana.

All proposed resilience characteristics were important and prioritizing was a difficult exercise for many participants. They know what they need better than outsiders to cope with disturbances. If these priorities don't specifically improve climate resilience per se, they can certainly improve the general resilience of the community. Resistant houses and access to clean water make sense in terms of capital vulnerabilities, and resistant streets also do in a perspective of connectivity and access to resources from outside the village, so these choices certainly remain valuable.

4.1.4 Appreciation of Existing Services and Interventions

The quality of some services was discussed during the FGDs regarding their impact on local climate resilience. Ideal complementary interventions and services were also discussed in the context of the REDD+ potential assessment and are presented in section 4.2.2.

The majority of participants said the CEDAF has a good impact, mainly because of the more resistant agrosystems, the increased productivity of coffee, water quality improvement, soil conservation and an increase in forest cover. However, some participants mentioned that the CEDAF's activities mostly concerned coffee growers and that the impacts of their activities do not do community-wide resilience building. Through agroforestry and reforestation, the CEDAF does a great compromise between development and conservation. It keeps a part of the village active through nonrestrictive job offers (reforestation brigades) and an increase in production of the most popular livelihood in the village, which at the same time reduces soil and water loss. It even has a good carbon sequestration potential, which may prove useful in a potential registration to a compensation program. It is true the activities only develop the community economically through the participants and don't result in direct investment in community-wide critical needs. The CEDAF maintains the jobs of the coffee producers that were about to lose their livelihood (coffee rust and coffee borer beetle), so it keeps them to a stable state of resilience instead of a degrading one like before. They also provide monthly workshops on various topics related to resilience (climate change, conservation, sustainable agricultural practices, etc.), which may help increase the adaptive capacities. Moreover, the new agroforestry designs have the reputation of resisting disturbances better, so it is safe to say their resilience has increased. However, only the next hurricane will be able to prove it, and hopefully the plantations will have strong enough roots by then to hold the soil together and not to wash away in a mudslide. Still, the FASD also has two recognized qualities that insure more stable and quality help to the community:

- Its activities are implemented by professionals who are aware of the local issues and the overall objectives of the project, and they know how to manage the solutions;
- The FASD doesn't only involve government-based decisions, a process which, so far, seems to have avoided corruption.

In the neighbouring region of Ocoa, a program led by the MMARN, to similarly counter sedimentation, expropriates small farmers and enforces reforestation while actions to counter excessive excavation for

construction material and fraudulent construction permits remain unnoticed. (M. Rodriguez, pers. comm., May 19, 2018)

The ASOCAES is considered to provide partial resilience to the community. The majority agrees that it provides great services to its members, especially a good and stable income. However, it doesn't provide community-wide services, and membership is not available to everyone. Local resilience is achieved through both individual household improvements and community-wide shared assets and services. One household mentioned it was evidently more resilient since the foundation of the association in 1979 and is now able to help other community members when they are in need (R. B. Geronimo, pers. comm., July 7, 2018). If some components of the system are more resilient, they can assist more vulnerable components, or at least they may require fewer resources when recovering from a disturbance, so the overall community resilience is certainly slightly increased by the ASOCAES.

Other service providers have been mentioned as good throughout the assessment, but only by a few participants: the Ministry of Education, the MMARN (mainly for soil conservation), Elesur (electricity), and this assessment (for taking the time to listen to the needs of the people on the ground, and trying to connect the stakeholders with them).

Claro and Altice (for telecommunication service), and the municipality of Los Cacaos (for roads and water) are considered bad service providers that are not helping local resilience.

4.1.5 Characteristics and Strategies of the more Resilient Households

The households considered the most resilient by the community were visited during the assessment to understand exactly what characteristics brought them to a higher state of resilience, and what strategies allowed them to obtain these characteristics. Based on what outcome they lead to, an efficiency rating has been given to each of them. While these characteristics and strategies make households more resilient, it is important to note that none of the consulted households mentioned being able to cope better with a disturbance like hurricane Noel than any other household. Out of the 17 elected by the community on an approximate total of 80 in the village, only 6 said they had coped slightly better than the rest of the village but were still living almost the same difficulties. Therefore, if some characteristics or strategies are qualified as more or less effective, all households remain very vulnerable and the efficiency of these characteristics and strategies are only relative to local absorptive, adaptive and transformative capacities, not to a general state of climate resilience.

Annex 7 presents the characteristics of the most resilient households, their relative efficiency and the impacts on resilience. The calculation of efficiency is done by the addition of the number of capitals it improves, and by the number of SRC principles concerned. Table 4.3 gives an example of the calculation done for a good house. An additional point was given if the characteristic was common to at least three of the six households that consider themselves more resilient, and in the figure this point is represented by the heart. The star means the characteristic is an outcome of least six different strategies (the characteristic obtained by the fewest strategies was three, and the most was eight), which eases its attainability.

Table 4.3 Example of Calculation of Characteristic Efficiency for Good House

Factors	Points
Physical capital: Infrastructure quality	1
Financial capital: Assets diversity	1
Human capital: Health	1
SRC principle: Manage slow variables and feedbacks	1
Adopted by the most resilient households: 3/6	1
	Total: 5

Because those characteristics come from the households considered by the community as the most resilient and were mentioned by them as improving their resilience, none were given a low efficiency. Also, all of them provide at least three different capitals and are relevant to at least one SRC principle.

The characteristics with the highest efficiency both improve some similar capitals and principles but differently. The most notable difference is that the first one is strongly related to the principle of connectivity and the second to diversity, which were previously identified as the principles lacking the most in the community and provoking the most vulnerabilities. In this case, the mentioned social network extends outside of Santana, which gives an indirect access to capitals not available locally. In fact, all the characteristics related to connectivity improvement all scored 8 points or above. The characteristics related to diversity don't get similar scores it is joined by the SRC principle to the concept of redundancy, which may prove to be the source of local vulnerability. Coffee production is a redundant service and it is good for its own resilience, but participants didn't mention it provided more than financial capitals, which proves

to be useful but not sufficient to provide community-wide climate resilience. In this sense, agricultural diversity seems to provide other types of capitals and a maybe less abundant but more stable income. It is also related to more knowledge capital and complex adaptive systems thinking, which were only found in characteristics scoring 7 points or above.

Annex 8 presents the relative efficiency of the different strategies used by the households considered more resilient to attain resilience characteristics. The points were given according to the number of characteristics a strategy leads to. An additional point per characteristic used by three or more of the households that consider themselves more resilient. Another point was given if the strategy was used by three or more of these same households. The heart represents this last given point. Table 4.4 gives an example of how points were calculated.

Table 4.4 Example of Efficiency Calculation for the Resilience Strategy of Secondary Studies

Factor	Self-considered resilient households concerned	Points
Characteristic: Good access to communication and to outside of Santana	1	1
Characteristic: Access to refuge	1	1
Characteristic: Agricultural production different from coffee	3	2
Number of households using the strategy: 8	3	1
		Total: 5

In this case, low efficiency strategies are not considered bad, because they lead to at least one resilience characteristic. If a household wants to be more resilient and only has access to these strategies, or if the household wants to question its own resilience building strategies, it would know that the low efficiency ones lead to more resilience but would need to be complemented.

The most popular strategies unfortunately all scored 6 points or fewer, except for Participation in community development and values of cooperation. This shows that most households in Santana don't know how to build climate resilience. A lack of knowledge on how to prepare for disturbances and how to cope with them is evident which supports the statements of some participants regarding the poor absorptive, adaptive and transformative capacities of the community. In fact, even though they prove to be more efficient and to be

the favourite of the most resilient households, most longer-term strategies are less popular than the ones with shorter-term outcomes.

In this case again, the two most efficient strategies are highly related to the principle of connectivity. The third one is related to fostering complex adaptive systems thinking and to the management of slow variables. All these principles take time to build and for the case of Santana there is annually very little time to adapt and transform, and with the locally available capitals, it is hard for the inhabitants to have a long-term vision.

4.1.6 Resilience Pathways

The previously mentioned lack of capitals has been identified by participants as the main reason preventing Santana to be resilient. Tables 4.5 presents the reasons stated by participants to explain the inability to build local resilience, and the associated underlying SRC principle.

Table 4.5 Mentioned Resilience Preventing Factors and Underlying Resilience Principles

Resilience preventing factor (from most to least mentioned)	Underlying SRC principle
People don't have enough money or resources	• Manage connectivity • Maintain diversity and redundancy • Foster complex adaptive systems thinking
Low human capital (old population, low employability, lack of knowledge or studies, bad health)	• Manage connectivity • Maintain diversity and redundancy • Encourage Learning
No employment	• Manage connectivity • Maintain diversity and redundancy • Encourage Learning • Foster complex adaptive systems thinking
Isolation	• Manage connectivity
No transport or too expensive ones	• Manage connectivity
Houses are bad	• Encourage Learning • Foster complex adaptive systems thinking • Manage slow variables and feedbacks
Lack of diversity of livelihood activities	• Maintain diversity and redundancy

Resilience preventing factor (from most to least mentioned)	Underlying SRC principle
Government is corrupted, promises of interventions only serve to get elected, and the state doesn't genuinely care	• Promote polycentric governance systems • Broaden participation
Events are intense and in succession, so it takes a lot of time to recover from them and it is not possible to progress	• Foster complex adaptive systems thinking • Manage slow variables and feedbacks

The first three ones were stated by almost all participants. This again supports that the biggest issue in Santana is its lack of connectivity and its lack of diversity and redundancy. Complex adaptive systems thinking can only be achieved through education and it is a human capital lacking in the community. This situation creates a positive feedback, because young or more educated people don't find work opportunities in the village and tend to migrate. For the ones who stay, annex 9 presents a matrix to understand the current pathways to resilience: which strategies lead to a characteristic, and which characteristics can be attained by a strategy. It is intended to help household decision-making if they are looking for a specific outcome and want to know how to get to it, or if they want to adopt or question a strategy to get as many characteristics as possible. Beside its flexibility, the strength of this tool is its origin from experience: at least one household mentioned achieving better resilience through each pathway. However, there is no guarantee on the results because many factors can influence these pathways. It is possible that a strategy will not lead to the desired outcome, or that a characteristic can be achieved with a strategy that doesn't suggest a pathway.

A successful combination of pathways has been mentioned with more certainty by some of the most resilient households. Participation in communitarian activities, secondary studies, and long-term thinking should allow to get a better social network, more diverse work, solider infrastructures and more autonomy. Some participants also mentioned that having the possibility to migrate to a more resilient area during a disturbance facilitated their progressive reintegration because they could secure some capitals during the event itself. Having a house not too close to the river also proved to be less risky because heavy rainfall almost inevitably results in river flooding.

The most efficient resilience pathways are all related to improved connectivity and access to a wider diversity of services. This proves one last time, along with the fostering of complex adaptive systems thinking, that Santana lacks the principles of connectivity management and diversity and redundancy maintenance the most. The fact that these last two principles are so strongly and repeatedly related means they should be the point of departure for resilience building in Santana. It may also means that they could

be used in priority to create a more general and comparative resilience scale in future assessments of similar cases.

4.1.7 Overall Resilience

When considering its capacities and its vulnerabilities, Santana is not currently a resilient community. Some pathways exist to improve household resilience, but external help is absolutely needed to improve the community-wide absorptive, adaptive and transformative capacities. The FASD and the MMARN are both slowly helping, but the most needed interventions should be related to the principles of connectivity management and diversity and redundancy maintenance in priority. Otherwise, the community members established that access to health services, resistant houses, access to clean water and resistant streets were their most critical needs to be able to cope with an event as disruptive as hurricane Noel.

4.2 REDD+ Potential

The data of the REDD+ potential assessment was gathered during the KIIs. The respondents were therefore households considered more resilient by the rest of the community. Since the national REDD+ strategy doesn't have a potential evaluation process yet, the assessment was based on nine criteria linked to participation capacities, interest in the program, the local natural capital and the similarity of local activities to REDD+ projects elsewhere in the world.

4.2.1 Participation

In terms of social structure capacity and implementation organization, 91% of respondents think Santana can receive a REDD+ initiative, but they would need to be coordinated by an external organization instead of creating one locally and only having REDD+ committee representatives help them. The reasons supporting this are that there is no central governance body in Santana to gather everyone, and that people feel they don't have sufficient knowledge to implement properly a proposed project and to organize the community around it (W. De La Cruz, pers comm., July 5, 2018; J. Batista Cabrera, pers. comm., July 6, 2018). It has been proposed by a few people to start small, to get help from the ASOCAES, and to slowly give Santana some autonomy (R. B. Geronimo, pers. comm., July 7, 2018). Given the quality and appreciation of their interventions, the CEDAF could be a good choice of implementing organization.

In terms of availability, 97% of respondents think they have enough time to participate in a REDD+ project if its activities are similar to the ones conducted by the CEDAF. However, 79% say they do not have any resource to help with the development of a REDD+ project. Two households mentioned owning tools and two others mentioned owning land that could be made available. This is probably due to the previously stated lack of employment, and to a desire to improve local living conditions either through financial capital or through community-wide investments leading to a diversification of available services. The vulnerable state of Santana fuels a desire to become more resilient and REDD+ is seen as a vector of improvement.

For the current state of collaboration in the community, 56% of the respondents think that people act in solidarity and collaborate, and 59% think they can work in community-wide projects. This is supported by the fact that there is not a lot of work, and because people already take part in activities from the CEDAF, from the church and from reforestation brigades of the MMARN. However, 32% think it depends on the incentives, and so compensation would be needed from the start. A few people also mentioned that there has never been a community-wide initiative and so Santana is not entirely used to work together. Two leaders have been identified as able to facilitate the process of rallying the community: Milagros Soto Martinez (Santana Arriba) and Galin De Los Santos (Santana Abajo). The latter was the local facilitator of this assessment.

As for Santana's participation in previous programs, none were qualified as communitarian aside from the FASD. The CEDAF gathers participation data at each workshop and keeps track of directly and indirectly impacted beneficiaries. From Santana and Arroyo grade, around 125 different people participated to at least one workshop, 20 participated in reforestation brigades and 150 are direct beneficiaries producing coffee. The two villages have fairly the same population size. So, on close to 1000 people, a direct involvement of more than 10% seems good, because the activities were only offered to identified coffee producers, and indirect beneficiaries are estimated to 730 people. (CEDAF, 2018) This means that a REDD+ project could very well involve more people if its scope was wider, and that the gains could spread easily and lead to even more involvement.

4.2.2 Interest

The interest for the REDD+ program and the trust in the current stakeholders of the national strategy were surprisingly high given that some participating institutions don't have a good reputation in the region. In fact, 94% of the respondents said they would trust the program to consider their resilience needs. The remaining 6% think that if there has not been any program or initiative interested in helping them so far,

there will not be in the future (W. De La Cruz, pers. comm., July 5, 2018). This assumes that both the national and international culture and view of what holds value would stay the same. 79% of the respondents said they would want Santana to be involved with the current stakeholders, even if some projects in other countries didn't prove to help their host community, mainly because they think that without projects from outside the community will never develop. While 29% of the respondents said they would trust without doubt any initiative offering to do a project locally, some opinions were shared as to what would be important to maintain this trust:

- 53% need the project to show concrete interest and work for what the community needs without exploitation, with a guarantee to help and develop the community;
- 34% need the project to integrate the whole community (Santana Arriba and Abajo), which needs to clearly understand and accept and to be equally offered work;
- 29% need the implementation organization to be present locally or to have someone from the community represent the community in front of the other stakeholders;
- 29% need the project to give what was promised, and guarantee being able to manage the project from star to end.

Some potential benefits were mentioned as what would be acceptable in exchange for a local REDD+ project, and they do not differ so much from the resilience needs:

- Good streets and pathways (67%)
- Medical centre and access to health services (41%)
- Services and good treatment that help the whole community, namely the possibility for everyone to work (41%)
- Money (35%)
- *Pago de servicio ambiental*, payment for environmental service (a monetary compensation mechanism for the maintenance of environmental services present in other regions of the country as a pilot initiative to encourage conservation) (S. Teresa, pers. comm., July 20, 2018) (29 %)
- Public transport that goes all the way to the university in San Cristobal (26%)
- Weather-resistant houses (23%)
- Better access to food (18%)
- Better access to potable water (18%)

4.2.3 Natural Capital

The verification of the specific natural capital potential cannot be obtained through qualitative statements from interviews. However, the different forest usages made by the inhabitants of Santana were listed, as well as their appreciation of the quality of the forest in the last five years. The most popular usages were:

- Local food production for humans (71%)
- *Leña*, firewood (62%)
- Local construction wood (50%)
- Agriculture to sell (41%)
- Protection/conservation/reforestation/care (41%)

65% think the quality of the forest has been increasing in the last five years. They agree more care has been given to it, that the knowledge about its usefulness has increased, and that successful reforestation and protection activities have been ongoing for a few years with the help of the CEDAF and the MMARN. On the other hand, 30% think the state of the forest has been degrading. Some think the forest is not being used properly by everyone, because of extending agricultural land and because of overusing the ecosystem services to a point of impossible recovery. It was also mentioned that cyclones are responsible for a faster degradation than the forest is capable to recover from, and that the locally available resources are not sufficient to help the recovery.

The main drivers of DFD identified in the preparation phase of the national strategy are well aligned with the drivers of DFD in Santana, namely the extraction of forest products like firewood, food for animals, and materials for construction. However, the most damageable driver, agricultural extensification, has not been identified as a big driver in Santana, which means that by the time the strategy will be ready for implementation, the quality of the forest may have increased based on the local perception. The presence of the MMARN and the CEDAF in the region surely helps to maintain and improve that quality through land use change prevention and sustainable management practices.

4.2.4 Similarity of Ongoing Activities to those Accepted by REDD+

In terms of the respect of the principles from Peru, the effectiveness of emissions reduction seems to be possible. The project from the FASD will have maturity and the experience that will allow it to be solid and flexible. This previous experience will also allow efficiency of the reduction of emissions (in this case sequestration) at a minimum cost. The third principle, equity, may also be respected given the solidarity and the desire of equity mentioned during the KIIs. The generation of co-benefits is undeniable in this case,

because of the increased productivity of coffee, the creation of jobs, and the replenishment of underground water. In fact, the only principle that is not verifiable is the last one: the legality. This will depend on the strategy and the country's ability to overcome the difficulties related to land ownership and law enforcement.

In Zambia, agroforestry is rated as the most optimal land use or management practice, and holds high potential for REDD+. This type of system increases tree cover and carbon stocking, decreases agricultural extensification, reduces leakages by doing permaculture, is highly replicable and adaptable, provides a wider range of products beneficial for food security and income generation, enhances biodiversity, increases soil fertility and water conservation, and improves nutrient cycling.

4.2.5 Overall REDD+ Potential

Given a good potential participation proven by previous projects and general communitarian solidarity, given the high interest to take part in new projects and the trust in the stakeholders, given the current usages of forest ecosystems that seem responsible and the perception of increasing quality, and given the current presence of mature activities in an area where drivers of DFD are diminished, where the principles from Peru are almost all respected, and where the specific type of project, agroforestry, is rated by Zambia as the most optimal for land use and holding high potential for REDD+, Santana is considered to have an ideal potential to start a REDD+ initiative with the help of an external implementation organization.

5. RECOMMANDATIONS

Based the results, four sets of recommendations are proposed. The first concerns Santana's resilience, its vulnerabilities, its attitude towards interventions, and the upcoming end of the FASD in 2020. The second discusses how to facilitate the registration and the success of a future REDD+ project by addressing the main difficulties of the program and the opportunity of transition with the FASD. The third puts in perspective how to design participative conservation by giving more value to environmental responsibility and by exploring the strengths and weaknesses of private and public initiatives. The last set is about corruption, its effects and solutions coming from contributors to this essay.

5.1 For Santana's Resilience

Connectivity management and diversity and redundancy maintenance were identified has the two resilience principles lacking the most in Santana. Overcoming the vulnerabilities starts by addressing those principles, as well as creating a local governance institution to enhance focus and coherence. The attitude towards interventions should also include a better understanding of underlying objectives and a fair discussion on benefits compensation.

5.1.1 Overcoming Vulnerability

As it seems that most households don't have efficient strategies to build climate resilience, it is a critical priority to enhance the local knowledge on the issue. Further support should be given regarding this issue, as how to empower Santana's inhabitants. This could first address the lack of connectivity which leads directly to the lack of diversity.

Households should have the priority to connect to within and outside the community, and enhance their social network to improve their knowledge and the diversity of services they have access to. Functional roads will help with geographical isolation, and phones and internet communications should be considered to improve the absorptive capacity and early response to natural disasters.

To improve diversity and redundancy, a livelihood portfolio dissimilar to farming, such as seasonal tourism-related activities rather than alternative agricultural production, will provide greater response diversity and reduce the pressure on the parts of the system producing a particular service. The focus should not be made on the maximum efficiency of a single service, but on the constant ability to provide a diversity of services with less efficiency. (Biggs et al., 2014)

Households should also prepare for disturbing events before they hear about them, because they are recurring and increasing in both intensity and quantity. For that, the lack of locally centralized governance should be addressed. A local organization representing Santana at the municipality of Los Cacaos should exist and this instance should also promote the needs of the inhabitants to any external entity interested in local intervention. It should coordinate the development of the community, strengthen its bonds and insure a common focus for better resilience building.

5.1.2 Attitude Towards External Interventions

As stated by a participant: "outsiders are only interested in the environment, not in the community's development" (F. Gomez Cabalo, pers. comm. July 5, 2018). The local natural capital has a high value and if it wasn't perceived previously, it is now. Projects coming from outside may be seen as an opportunity of work and development, but the underlying objectives of these projects should be clearly understood by the community and fair conditions should be discussed before any participation, because these projects may not take local resilience needs into consideration. A participant who decided to stay anonymous mentioned having bitter feelings regarding past and ongoing projects: "we waste our lives working for the objectives of outsiders without developing our own community." In fact, having a community that protects and betters a capital is an amazing advantage as long as it doesn't alter the capital. In this manner a project could plan to keep a community from developing to insure a minimal impact on the capital, all in exchange for a small compensation that would feel necessary to local stakeholders because of their state of vulnerability (Miller, 2012). In the end, this choice serves to minimize the project's expenses and doesn't allow the community to improve its resilience. Another recommendation regards this issue in section 5.3.

5.1.3 The End of the FASD

The FASD should prepare a strategy with its funders for a transition. If the FASD stops its activities after attaining the replenishment objective because it is out of funds, Santana would need to continue by itself. However, there is no monitoring of autonomy regarding the local management capacities to maintain the replenishment. Agricultural practices have changed, and sustainability knowledge has improved, but the community's resilience is still very weak. Another tropical storm could wipe the village with all the efforts that have been done, and the opportunity cost of doing conservation again may be questioned by the community if it needs fast results and resources for recovery. The FASD should make sure that the efforts are secured and that the community will be more resilient at the end of the project. It should question what

will happen at project closure, what it wants to transition to, and how it will make the results last. Will Santana be autonomous? Will the FASD continue? Will it transition to REDD+?

5.2 For a Successful Registration to REDD+

Some solutions to the main challenges of REDD+ initiatives have been mentioned in section 2.3. Further recommendations are presented here regarding the specific context of Santana and the available options in DR. A suggestion follows on how to link the activities of the FASD to REDD+ in 2020.

5.2.1 Overcoming the Main Difficulties

For financial sustainability, revenue could come through donor organizations willing to offer substantial funding based on environmental service use compensation. A good example of functional financing, though it is limited to a specific attainable objective instead of a long-term financing, could be similar to what Bepensa and Coca-Cola do in the FASD. An environmental service user already pays for the extraction of a resource, but it should also pay for its replenishment, which represents more accurately its value. Services and resources should not be considered of single-use, but imperatively renewable to ensure a continuous use and quality. Increasing the value of resources may be risky but seems necessary to change the mentality behind current resource extraction practices and environmental service valuation. A more generalized and long-term financing options for the whole REDD+ program in DR is the growth of regional compliance markets, like the carbon markets in Quebec and California. However, these markets have proven to be less efficient, more complex to manage, and providing fewer co-benefits than national carbon taxes. (Parry, Veung and Heine, 2014; Working group on carbon pricing mechanisms, 2016)

As previously mentioned in section 2.3, community engagement can be effectively improved through monitoring activities. Linking community monitoring to national measurement proved to be reliable, effective, economic, and even lead to more equitability. It specifically enhances ownership and motivation, and may densify carbon stock assessments. (Centro de Investigaciones en Geografía Ambiental, Universidad Nacional Autonoma de México [CIGA-UNAM], 2012) It may also:

- “Strengthen their position to gain rights to forests from which they were historically excluded;
- Feel recognized for their knowledge of forests [and] feel empowered to participate in REDD+ actions on more equal terms;
- Be more motivated to contribute to forest protection as they have enhanced trust in the credibility of data and REDD+ actions;

- Derive enhanced benefits from REDD+ either through compensation for the costs of monitoring or through better opportunities for development of benefit-sharing mechanisms;
- Strengthen their position to obtain or maintain access to culturally and economically important forest areas." (Danielsen, Adrian, Brofeldt, van Noordwijk, Poulsen, Rahayu, ...Burgess, 2013)

Community monitoring is especially recommended for assessing carbon stock changes. Degradation is often caused by inconsistent community uses of forest, and forest care is often the result of an improved, more aligned community management, and this improvement may be facilitated by a monitoring responsibility. (CIGA-UNAM, 2012)

For the enforcement of project boundaries many solutions are proposed by Sunderline et al. depending on what the specific difficulties are, and could be incorporated in the national strategy:

- "Direct linkage of forest tenure reform with targeted environmental outcomes as has been attempted in Brazil through the *Terra Legal* program and accompanying Rural Environmental Registry;
- Integration of national forest land-use planning among all ministries and sectors and alignment with REDD+ goals as has been attempted in Indonesia through their One Map policy;
- Incorporation of participatory tenure mapping into national tenure institutions and processes;
- Resolution of contestation between statutory and customary claims on forest lands;
- Promote sustainable agriculture supply chains that align with REDD+;
- Improve governance and reduce corruption and cronyism in forest and land-use decision-making;
- Enforce laws against illegal logging and other illicit activities that lead to forest land conversion." (Sunderlin et al. 2014)

As for benefit distribution, the International Institute for Environment and Development proposes ten aspects to consider to design schemes that are equitable and benefit the poor.

1) "Communities should be consulted on whether they prefer to have benefits transferred to the entire community or directly to households.
2) Consider economic feasibility, local institutional capacity and governance structures before deciding whether to transfer benefits to communities as a whole or directly to households.
3) [Avoid disparity and consider] proportionality, equality and need.
4) In such unequal societies equitable benefit distribution could be achieved by systematically favouring the poor, such as landless and small landholders.
5) Projects should be designed to use the primary asset of the poor – their labour.
6) Whether to transfer cash or in-kind benefits should be based on a careful assessment of community preferences and the logistical and social consequences of each payment type.

7) An analysis of the availability and access to local markets should decide whether to provide cash or in-kind payments.
8) Consider whether the type of payment will have a negative impact on the local economy.
9) Where cash payments are made, some measures need to be taken to overcome inflationary pressures.
10) Project design needs to be flexible and include the periodic assessment by participants of their payment preferences." (Mohammed, 2012)

5.2.2 Transitioning with the FASD

The ideal situation would be a private funding that compensates for the regeneration of used resources or, at least, for more than what it uses. It should reward directly the participants and invest in community-wide resilience. In this case, the deal on how to attain the replenishment objective is already done between the stakeholders of the FASD. As it may finish in 2020, a transition or addition to REDD+ could be perfect, because the project does reforestation and agroforestry, which holds a high potential. It would leave REDD+ the task to adapt those activities with the program's objectives, to give resources to help strengthen the initiative, and to additionally reward participants with community-wide resilience building investments based on results. Since the CEDAF is also participating in the national REDD+ strategy development, and since it is aware of the context and is trusted in Santana, it may very well be the best choice of implementation organization.

However, neither the community nor the CEDAF should settle for small, uncertain or unsustainably proven payments or rewards. The REDD+ committees should provoke sufficient investments in the program so activities get the proper resources. The CEDAF is currently overloaded with work, and activities in Santana could happen more often. The community is not the limiting factor, people have time and are ready to work. The community shouldn't settle for small or uncertain rewards either, even if they are interesting given their vulnerable state. The current pays for MMARN activities are quoted as insufficient to make a living by most participants and ridiculous by others. They still accept it because they have no other income opportunity, but it shouldn't be seen by managers as a way to fix low salaries. Decent rewards and resources will allow longer-term results, because they will generate resilience as a co-benefit.

5.3 For Participative Conservation in General

Two recommendations relate to the general approach on how to design participative conservation projects. The first one discusses the importance given to the community with the environmental responsibility, and the other offers a perspective on the advantages and inconveniences of public and private initiatives.

5.3.1 Supporting Sustainable Environmental Responsibility

Integrating resilience improvement to environmental responsibility is unavoidable. If a community is in charge of maintaining or producing a service used by more than only themselves, insuring the community's resilience is imperative for sustainable results. The community needs sufficient resources to conduct the related activities, but it also needs to be able to continue to exist as long as it has the environmental responsibility.

A part of the resilience of a third of the national population depends on a few small communities who insure the continuous replenishment of the water they use every day. These communities should be rewarded sustainably and all stakeholders should ensure their resilience for the long term good of all. If it were not for their work, the state of accessibility to the water would continue to deteriorate. If Santana is in a precarious situation today either it is because the state is not aware of its importance or because it has other priorities that compete with access to water.

5.3.2 Between Private and Public Management and Funding

A private initiative like FASD has specific interests and objectives which in this case are very ecological (water replenishment through increase in forest cover). The participation of people in Santana is a means to attaining that objective. The project does not aim at the well-being of local inhabitants as its primary target, it aims to make a compromise between land use and conservation. While practices may increase and secure production, the rewards are limited to the participants. However, such a project has the advantage of bypassing corrupted public instances, and of getting efficient results fast. In terms of investment in the community, it is very similar to what REDD+ invests to develop new projects or to help existing ones. All that is missing to be comparable would be rewards based on results that could profit the whole community.

A public process has the advantage of thinking of the greater good of everyone and aiming for a holistic well-being. It doesn't require specific results to compensate for activities, so investments that do not bring money back to the investors or that do not attain specific objectives are not a problem. The main issue is

that it is a very slow and heavy process with risks of corruption, and therefore with resource loss, which may later cripple the potential community-wide rewards.

Further analysis is needed to understand which process is more efficient to build community resilience, but given the quality and efficiency of the activities of the CEDAF to get conservation results that involve some resilience building, this kind of private compensation initiative seems ideal. A partnership that requires the state data gathering and legal responsibilities that don't involve money management or project implementation, and that gives it an overview of the situation and a seat to the decision table, seems to give good results. The strength of the FASD is its multi-stakeholder partnership, where a diversity of public (state and academia) and private (corporate and NGO) actors take harmonized decisions and fix objectives together.

5.4 For Corruption

Throughout this essay, the subject of corruption constantly came back, and everyone agreed that it is a huge resilience issue in the country. Cultural acceptability may be the source of this generalized issue. A single small action may prove inoffensive but has two less perceived indirect impacts.

The first one is sustaining the idea that it is isolated, small and inoffensive. A resilient society fosters complex adaptive systems thinking, which means the components of the system are aware they are part of one and no actions are isolated or don't have consequences on others. Cumulated, all such actions may prove to have a bigger and longer-term impact. This is also what the resilience principle regarding the management of slow variables and feedbacks tries to avoid: the accumulation of small disturbances that slowly bring the system over the threshold in another state where getting rid of the problem may be harder to do than what it would have required to prevent it.

The second indirect impact of minimizing the importance of small corruption actions makes it acceptable, and promotes a culture of not caring for the greater good. The limit between what is considered an unimportant action and a terrible one is hard to draw, and is relative to the experience of each person committing it. The more it is acceptable to do those actions, the more people are getting used to it, and the more a very harmful action will feel harmless. Dominicans have the reputation to "have a high tolerance for nepotism, often regarding it as a justified and expected activity of those with power and influence. [Corruption is recognized] as the most problematic factor for doing business in the Dominican Republic" (ITA, 2017).

The outcomes are always inequitable and it thins out public trust. Throughout the discussions, five solutions were proposed by the contributors of this essay.

1. Make it unacceptable. When someone is about to commit an act, or if you know someone who commits these acts, question the actions and discuss the two consequences mentioned above. Having an open discussion about it will make it less acceptable, and a social conscience and solidarity may emerge. Committing those actions will be less comfortable if someone feels judged and if social bonds are at risk.
2. Teach children about it. The environmental movement is mainly supported by the younger, more sensitized generations. This should also be true for corruption, which should not be taught as acceptable to children or to adults. John Elkington, one of the pioneers of the sustainable development movement, argues that "paradigms don't shift in 5 years, or 10, or 15, or 20. They take like 60 to 80 years. These are multi-generational processes of changes. You need the previous generation, infected by the paradigm, to die, and then the people they taught, to die or retire, before the new order really comes through." (Elkington, 2018).
3. Report corruption as much as possible. Even if they may not feel trustable, structures exist to fight corruption effectively. Among NGOs: the Foundation for Institutionalization and Justice (FINJUS), the Citizen Participation (*Participación Ciudadana*), and the Dominican Alliance Against Corruption (ADOCCO). Among governmental agencies: *Procuraduría Especializada contra la Corrupción Administrativa* (PEPCA) and *Linea 311*.
4. Avoid shady governmental or intermediate processes, and favour partnerships with transparent reporting platform.
5. Commit to solving the issue and discuss and share the solutions.

CONCLUSION

Simultaneously building climate resilience, reducing GHG emissions and reversing climate change is probably the biggest challenge humanity has ever faced. The impacts and the associated solutions to climate change have only just begun to surface, and the scale of what the future holds for us is very uncertain. As the Dominican Republic is in one of the most precarious position in the face of this issue, the urgent necessity to adapt is forcing multilateral paradigm changes. The global questioning on how to sustainably develop is what makes living this page of history very exciting, but at the same time very frightening.

The case for Santana is similar to many other locations across the globe, where the provision of a necessary natural ecosystem service has become the responsibility of an isolated vulnerable community. As the initial incentive for the development of REDD+ in DR may have been monetary, but the opportunity to harmonize and bring new considerations to the management of many aspects of the Dominican society beyond natural resources, like poverty, justice, transparency, scientific knowledge, land use or food production, gave the writing of the national strategy a priority among other climate-related governmental initiatives. Still, doubt resides as if this solution will be truly beneficial to the participating communities, and if this model of funding and management will be optimal to get fast and long-lasting results given the local challenges associated with sustainable funding, land tenure rights and a centralized state affected by systemic corruption.

The FASD is a very promising model involving various private and public stakeholders active in different sectors and at different scales. This partnership allowed an effective management where the decisions were given to the partners acting on the pertinent action scales and where responsibilities were shared to the right experts. The transparent reporting and regular consulting of other partners allowed thoroughly thought decision-making, quick reaction to issues, and fast delivering of results. The governmental plans of improving the efficiency of agricultural production, of reducing its expansion, of reducing sedimentation through reforestation, and of increasing the carbon stock were all met. The participating community also gained a few resilience characteristics, namely through a more stable source of income and a better access to water. The only problem of this privately funded partnership is the lack of community-wide resilience building investment and in the uncertainty of its continuity once the donor's ecologically restricted goal of water replenishment volume will be reached in 2020.

REDD+ might hold the answer to the continuation of conservation activities in Santana. This solution may be able to add the previously missing community-wide resilience building rewards. The current activities

are perfectly compatible with the program based on criteria from Peru and Zambia. The inhabitants are also inclined to welcome an implementation organization, given their willingness and availability to work. They hold a favourable prejudice towards current REDD+ stakeholders and will gladly negotiate if REDD+ is able to demonstrate concrete interest in the community, and guarantee, with proof, fair working conditions and community development before the project starts. The quality of the natural capital is locally perceived as increasing because of the conservation activities that have been going on for the last four years, because no one practices *quema* or exploits the forest for other means than local necessities, and because many inhabitants are involved in conservation activities. This is particularly significant for any potential conservation activity: the local culture nurtures the integrity of natural ecosystems as its source of well-being and essential services.

For any conservation activity to hold on its results, the community in charge of the environment will need to be resilient. Santana is not considered resilient as all types of capitals are at risk, especially physical capital. Santana's absorptive, adaptive and transformative capacities are also very limited. During an event like hurricane Noel, most houses, agricultural productions and roads were destroyed. This isolated the village from access to food, refuge, health services and potable water. It took around six months to recover from the event, to a state as precarious as the one before the hurricane, and this can happen every year. Since then, the only significant improvements were brought through the interventions of the FASD, with consolidation of river banks, increase in forest cover, soil and water conservation, agricultural diversification, improved coffee productivity, and environmental management education. However, these gains are restricted mainly to the direct participants.

The participative assessment methodology inspired by the Stockholm Resilience Centre's theoretical principles and by the United Nations Development Programme's Community Based Resilience Analysis practical framework proved to deliver significant results in a very effective manner. A good preparatory research of the context in phase 1 eased the elaboration of the questions and the discussions during phase 3, the focus group discussions, and phase 4, the key informants' interviews. These two phases only took nine days of field work to three facilitators and reached 69 participants representing 65% of the village's households. A thorough understanding of resilience theory and of REDD+ were absolutely necessary to entertain the activities because of the lack of knowledge of the participants concerning both of these concepts. The help of a local facilitator was mandatory for local vocabulary understanding, for guidance in the village, and, above all, to inform, invite and put in confidence the participants. The only difficulty occurred during phase 5, analysis, because the CoBRA methodology doesn't suggest clearly how to process the gathered data. The aggregation of qualitative results was challenging, because discriminating between

characteristics, strategies, capitals, pathways and capacities got confusing. Making those results quantitative, linking them to theory for discussion, and still be able to recommend practical solutions also proved to be a significant challenge. This is mainly due to the huge gap between the theory and practice of resilience, which in this case had to be bridged twice, and to the holistic considerations in system components, geographical and time scales, quality of interactions, and relative efficiency and feasibility of solutions. For a future resilience assessment inspired by the same theoretical and practical frameworks, more consideration should be given to how the primary data will be processed, and what potential solutions are available for recommendations prior to data gathering with participants.

Nevertheless, the results are significant and lead to useful conclusions. The participants had a good understanding of what their system was composed of and what they were vulnerable to the most. The four resilience priorities established (access to health, resistant houses, access to clean water, and resistant streets) are consequent choices that should be considered by external stakeholders as starting points in community-wide resilience building activities or to local resilience monitoring. The assessment proved the improvement of connectivity and the development of a wider diversity of services are needed the most. Only 6 of the 17 households considered by the community as more resilient actually considered themselves more resilient. In fact, these six said they could barely cope with disturbances like hurricane Noel better than other households. All the identified resilience characteristics, strategies, and pathways are therefore effective to improve resilience, but only slightly. Other interventions are absolutely necessary to increase household and community resilience.

The most efficient resilience characteristics all point to a higher state of connectivity, and an increased access to a diversity of services. This is locally attained with a good social network and good relationships, and with a diversification of livelihood from agriculture. The most popular strategies didn't prove to be the most efficient, which reveals a significant lack of climate resilience knowledge. While resilience was easily understood as the capacity to survive by participants, climate change and its effects had to be explained in more details and was harder to grasp. Basing all questions of phase 4 on the event chosen in phase 3 as the one to adapt to, hurricane Noel, helped a lot to put the answers in perspective. The most efficient strategies (participation in community and values of cooperation, and maintained access to agricultural production) are again highly related to the principles of connectivity management and diversity and redundancy maintenance, which were identified as the ones lacking the most in the community. The participants think that Santana is not resilient because it lacks financial capital (monetary resource and employment opportunities) and human capital (old population, lack of knowledge or studies, and bad health), and because it is geographically isolated, which is consistent with the findings of the analysis. The pathways responsible

for an increased resilience all pointed to an improvement in those capitals that came from more connectivity and diversity. A combination of participation in communitarian activities, secondary studies, and long-term thinking have been identified has generally the most successful pathway to resilience.

A household should have the general priority to connect more within and outside of Santana to improve its knowledge and to increase the diversity of services it has access to. It should also try to prepare for hurricanes before is it aware of an imminent strike. The scale of the disturbance is so big that most of a household's capital is at stake. A local governance organization would help a lot to connect and coordinate the local needs with all interventions coming from outside for a proper adaptation to climate change. Currently, what will happen with the FASD in 2020 still has no answer, and a strategy should be planned for a smooth transition to either autonomy or to another intervention.

A successful REDD+ registration would require solid propositions on sustainable funding, on community engagement through monitoring, on project boundaries enforcement, and on fair benefit sharing. Santana's inhabitants require to be thoroughly consulted, to be treated with dignity and to be assured that an investment in community-wide resilience is done. A transition or a combination with the ongoing activities would be highly beneficial, and doing it sooner than later will give the managers and the community the proper resources from the start and more capacity to adapt to changes.

As for the systemic issue of corruption, the cultural acceptability makes it hardly treatable in the short term. Constant but careful efforts have to be done in discussing its unacceptability, in teaching children about it, in reporting cases as much as possible, and in avoiding any process susceptible to provoke it. Since corruption has been mentioned as negatively affecting everyone by almost all contributors of this essay, the democratization of efforts could bring results more rapidly than other paradigm changes. People are already convinced, all that is missing is general involvement and commitment to change.

Building resilience starts by addressing an issue at a time. Being resilient is an ideal towards which to tend, it is not exactly attainable. Perfect resilience would mean immortality. Right now, humanity faces a challenge to which it has to adapt holistically, and no solution can offer complete resilience. While there is no panacea for solving climate change, some solutions are better than others and rely on resilience principles. Contexts vary so much from one location to another that adapting a solution to each location while following general principles seems to be the only possible path. The meaning of these principles for each system has to be determined individually, and the system needs to be empowered by its objectives to

allow long-lasting results. What the assessment shows is that whatever the initiative and the location, it is important to stay connected and to cooperate.

> "The world can neither afford to wait nor is it waiting for an enforceable global agreement to address the threat of climate change. Rather, a polycentric system is emerging. Advances in climate policy among subnational and national institutions – and the 'messy' connections between them – provide fertile ground for considering effective approaches to climate governance that go beyond a top-down global process." (Sunderlin et al. 2014).

REDD+ has the advantage of connecting people and adapting solutions to locality. It may not be efficient at all it tries to do, especially given the size of the challenge, but at least it pushes forward into changing the minds of the people involved. And that, involving a lot of people all around the world, is what we need.

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ANNEX 1: LAND USAGE AND COVER TYPES IN THE NIZAO WATERSHED

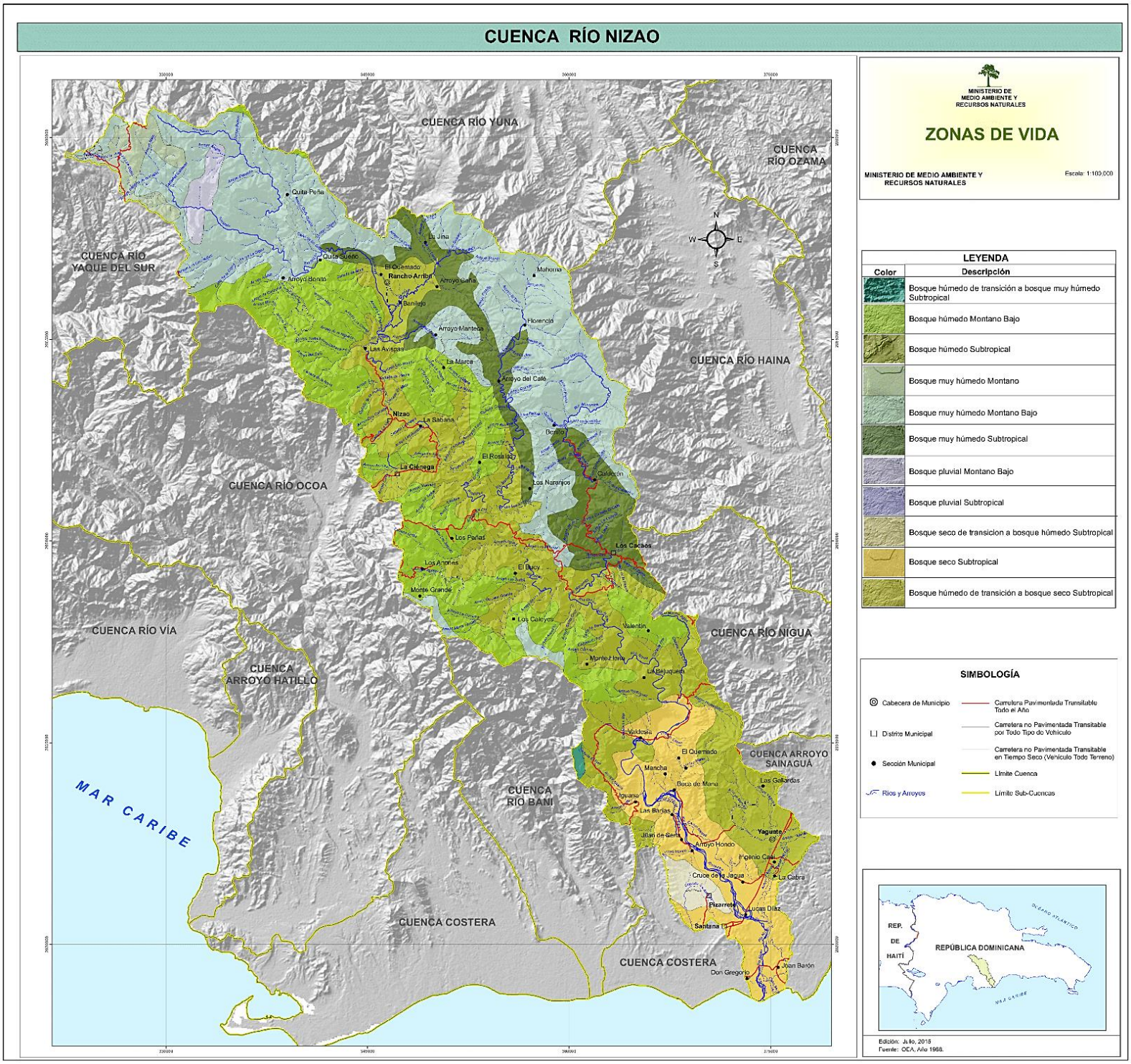


Figure A1.1: Life Zones in the Watershed (Retrieved from: MMARN, 2012)

Figure A1.2: Land Cover Types in the Watershed (Retrieved from: MMARN, 2012)

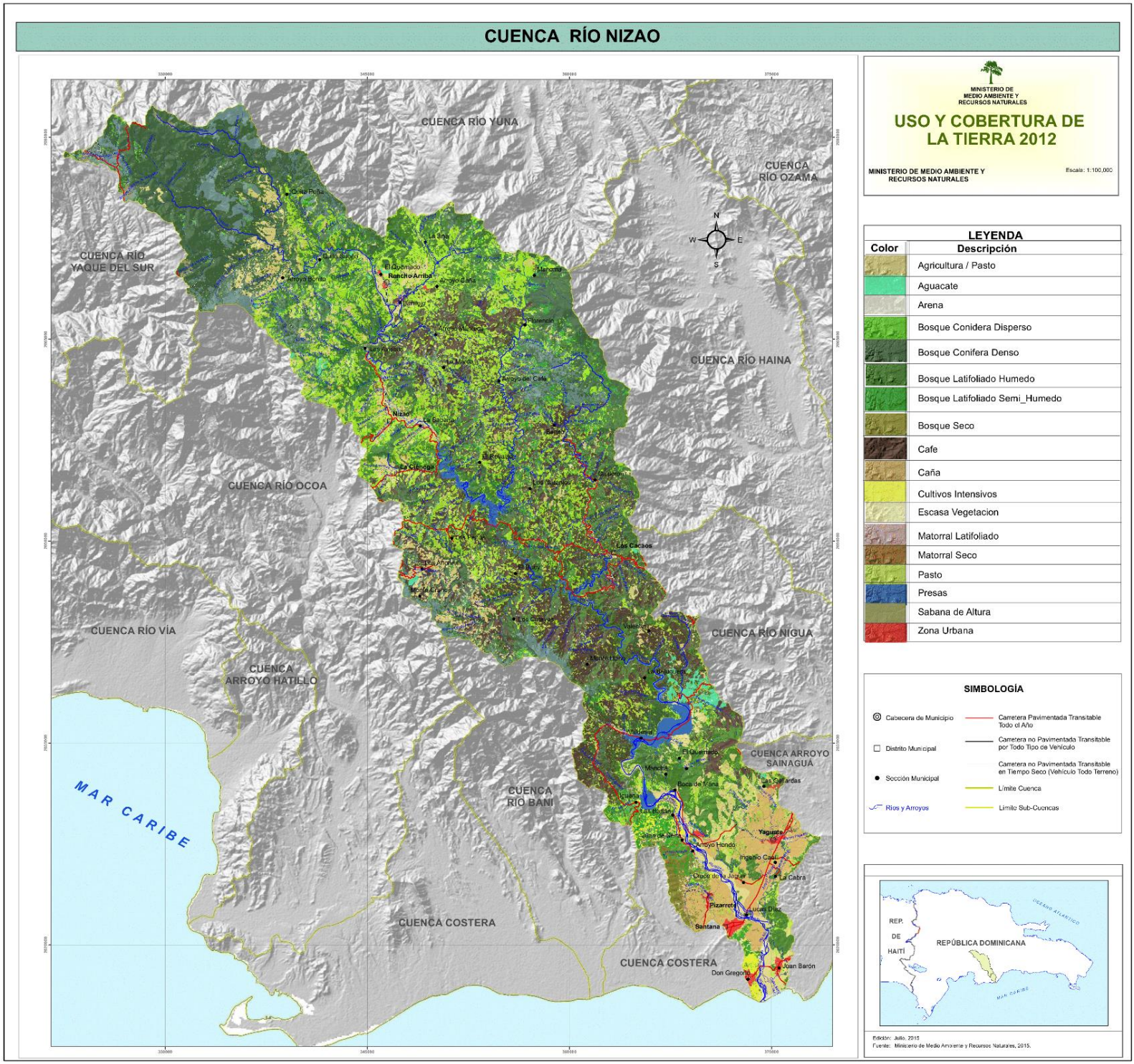
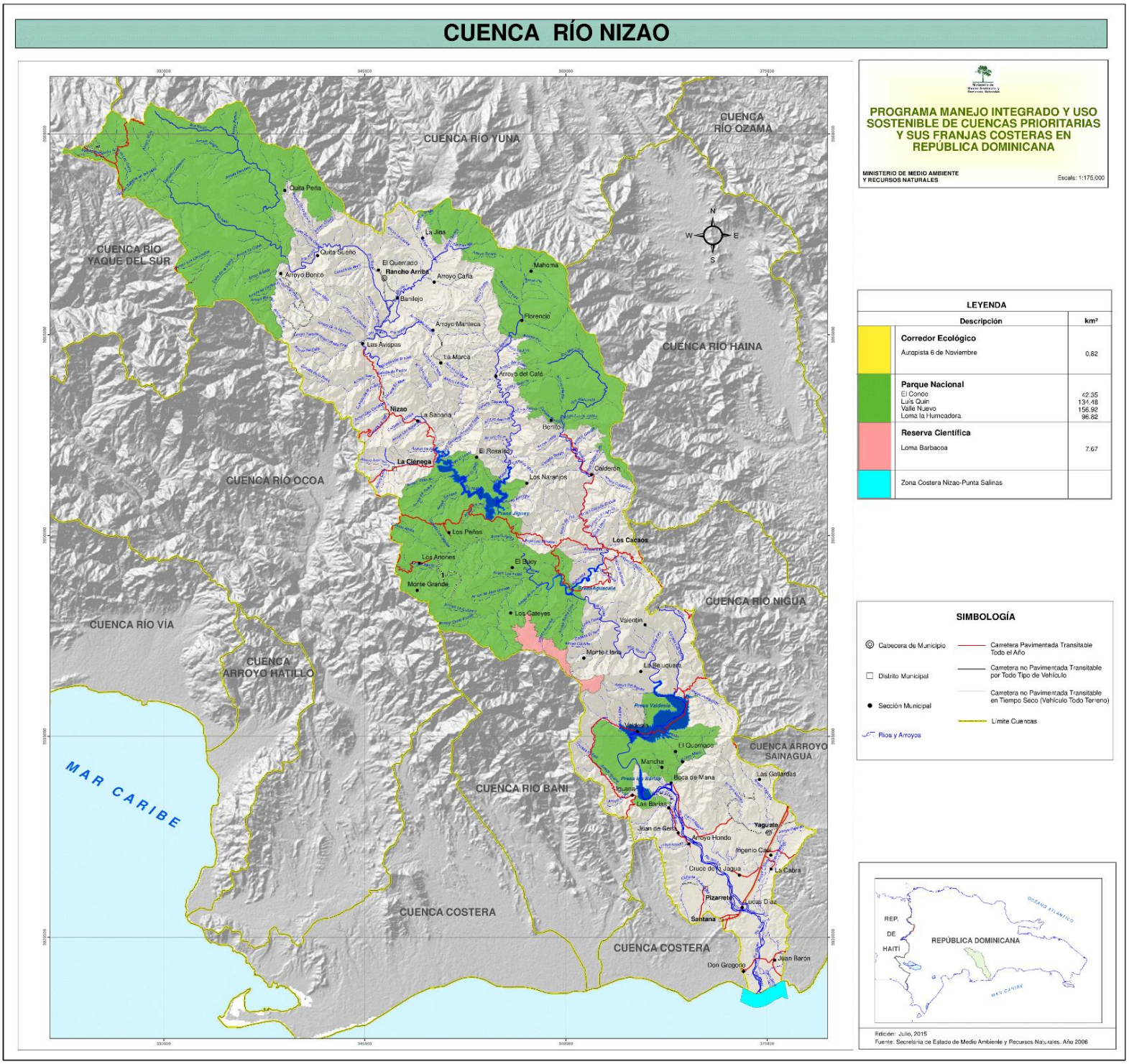


Figure A1.3: Protected Areas in the Watershed (Retrieved from: MMARN, 2012)



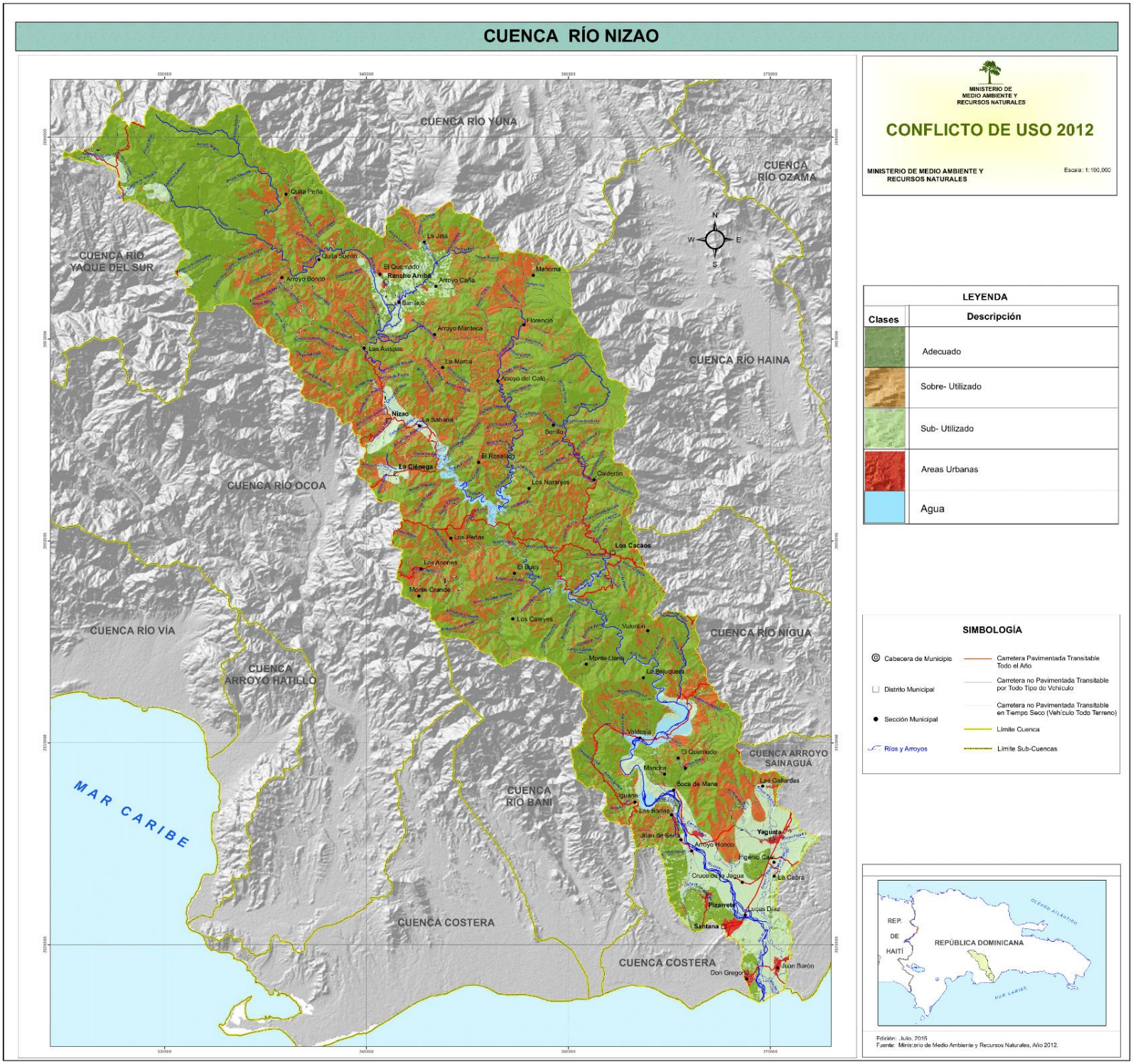


Figure A1.4: Usage Conflict of the Soil in the Watershed (Retrieved from: MMARN, 2012)

ANNEX 2: MAPS OF THE MAHOMITA SUBBASIN (RETRIEVED FROM MORN, 2018)

Figure A2.1 Location of the Mahomita Subbasin in the Country, with Relative Position to San Cristobal and Santo Domingo (retrieved from MMARN, 2018)

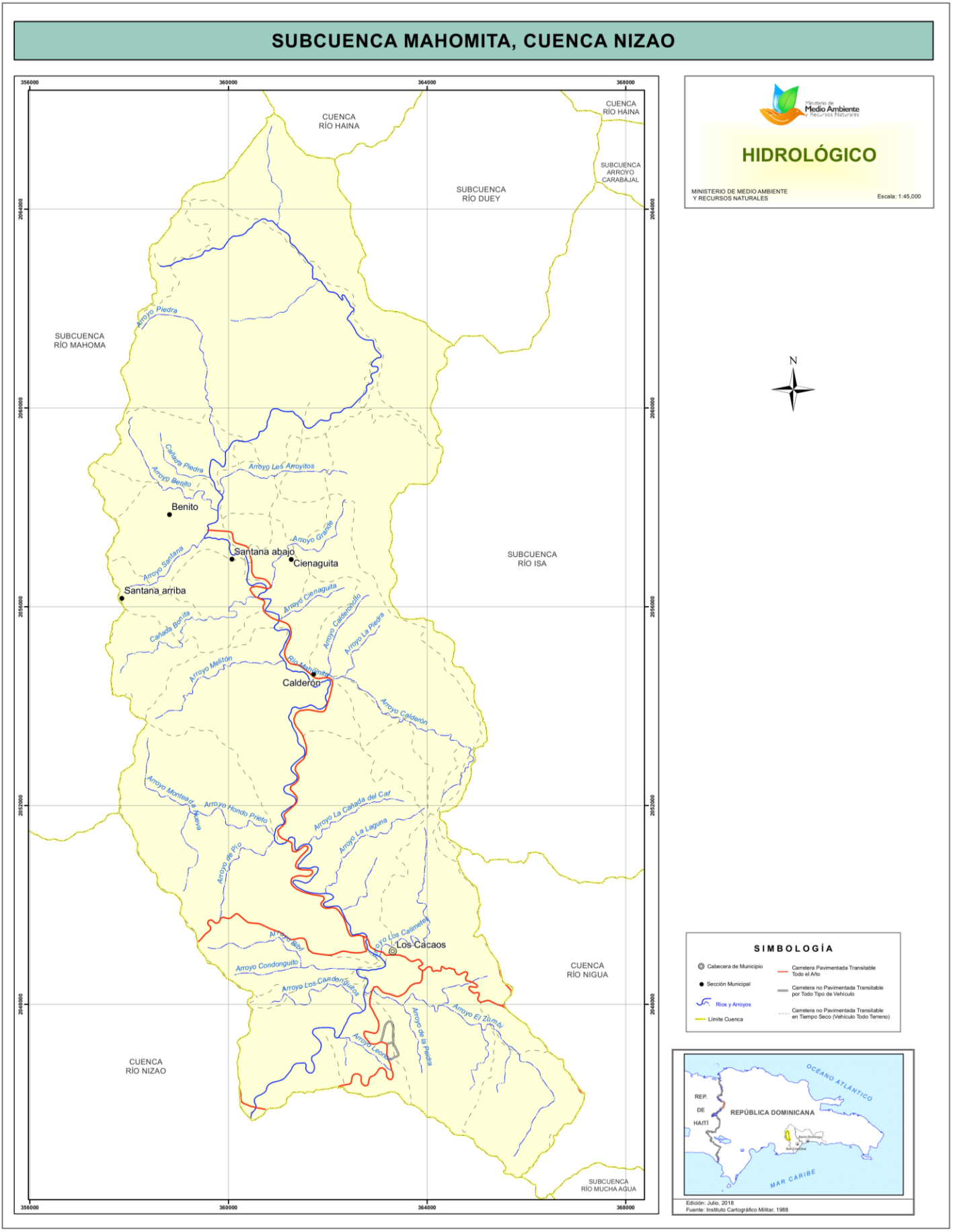


Figure A2.2 Hydrology, Villages and Roads in the Mahomita Subbasin (Retrieved from MMARN, 2018)

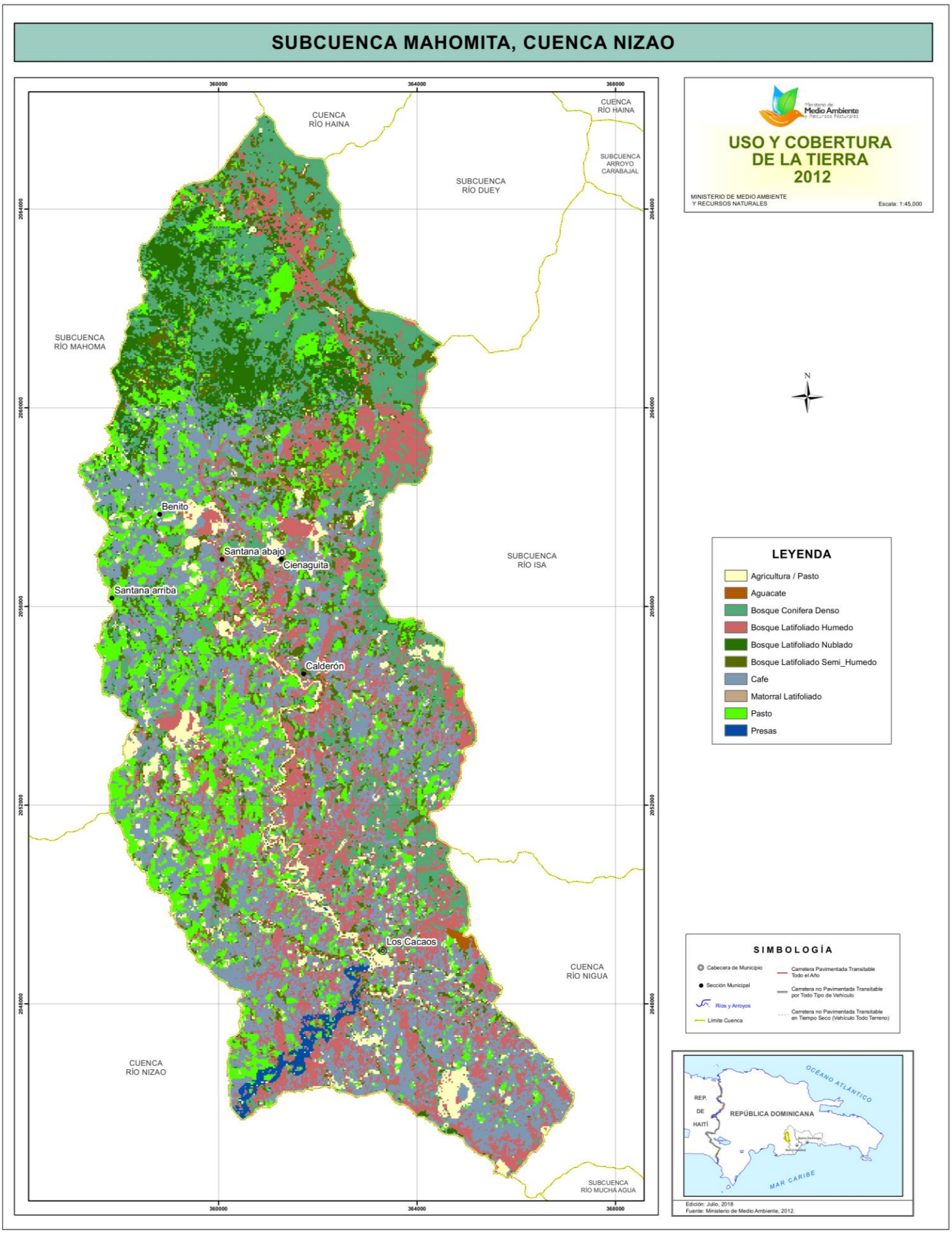


Figure A2.3 Land Cover Types in the Mahomita Subbasin (Retrieved from MMARN, 2018)

ANNEX 3: REDD+ POLICIES AND MEASURES (RETRIEVED FROM UNEP, 2017)

	REDD+ Activities				
	Reducing emissions from **deforestation**	Reducing emissions from **degradation**	**Conservation** of forest (carbon stocks)	**Sustainable Management** of forest (carbon stocks)	**Enhancement** of forest carbon stocks
Agricultural intensification (when tied to land use planning, as well as conditional incentives and/or enforcement)	✔✔	✔✔	✔		✔
Removal of subsidies for activities leading to deforestation and forest degradation, and/or land clearance taxation (fiscal framework)	✔✔	✔✔	✔		
Sustainable biomass energy programmes	✔	✔✔	✔	✔	✔
Strengthening of protected area networks and improved management (including community-based management)	✔	✔	✔✔	✔	
Support for **community forestry**	✔	✔	✔	✔✔	✔
Strengthening of **forest law enforcement** combined with improved monitoring and traceability	✔✔	✔✔	✔	✔	✔
Afforestation/reforestation on degraded land (including agroforestry)				✔	✔✔
Payments for environmental services and/or other types of incentive schemes	✔	✔	✔	✔	✔
Improving **tenure security**, including of indigenous peoples' lands, and women's and men's land use and access rights	✔	✔	✔	✔	✔✔
Support for **forest certification** and/or **reduced impact logging**		✔✔		✔✔	
Implementation of forest-friendly national or subnational **land use planning**, including infrastructure development (e.g. roads)	✔✔	✔	✔✔	✔	✔
Support for **microcredit** programmes to improve off-farm and/or sustainable business development and employment	✔✔	✔✔	✔		✔
Funding of **fire prevention** programmes	✔	✔✔	✔		✔✔

ANNEX 4: NATIONAL CRITERIA FOR SELECTING AN AREA TO BE REFORESTED

(RETRIEVED FROM MARN, 2013)

Criterios Sociales	Valoración	Puntuación
Presencia de familias que puedan beneficiarse de la reforestación/bosques	20	
Pocas oportunidades de empleo-ingresos	15	
Coordinación con autoridades (Ayuntamientos, Juntas de Distritos, otros)	10	
Coordinación con organizaciones comunitarias y productores	5	
Asegurar la equidad de género	5	
Factibilidad de uso del bosque	5	
Subtotal	**60**	
Criterios Estratégicos		
Áreas que al ser intervenidas, generen beneficios a la mayoría.	6	
Colindancia de terrenos	6	
Recuperación/restablecimiento/mantenimiento de funciones ecosistémicas claves (dentro y fuera de áreas protegidas):	6	
• Regulación del ciclo del agua (ej. Protección de acuíferos, nacimiento de ríos, tomas de acueductos)	2	
• Retención del suelo (control erosión)	2	
• Protección biodiversidad – recuperación áreas para biodiversidad (especies en peligro)	1	
• Fijación de carbono y producción O2.	1	
Grado de Amenaza del bosque (impactos antrópicos incrementando: presión cambio uso suelo, dentro y fuera de áreas protegidas)	5	
Mitigación de desastres naturales:	**4**	
• Deslizamientos	2	
• Inundaciones	2	
Protección de infraestructuras:	**4**	
• Acueductos	2	
• Presas	1	
• Riego	1	
Potencial de recuperación del bosque original (dentro y fuera de áreas protegidas)	3	
Zonas de amortiguamiento de áreas protegidas	3	
Zonas deforestadas próximas a áreas protegidas	2	
Potencial demostrativo	1	
Subtotal	**40**	
TOTAL GENERAL	100	

Freely translated

Social
Presence of families that can benefit from reforestation/forests
Few employment-income opportunities
Coordination with authorities (City Councils, District Boards, others)
Coordination with community organizations and producers
Ensure gender equality
Feasibility of forest use
Strategic
Areas that, when intervened, generate benefits for the majority
Adjacent land
Recovery/restoration/maintenance of key ecosystem functions (inside and outside protected areas): • Regulation of the water cycle (e.g. Protection of aquifers, birth of rivers, aqueduct intakes) • Soil retention (erosion control) • Protection of biodiversity—recovery of areas for biodiversity (endangered species) • Carbon fixation and O2 production. • Degree of Forest Threat (increasing anthropogenic impacts: pressure change, land use, inside and outside protected areas)
Mitigation of natural disasters: • Landslides • Floods
Infrastructure protection: • Aqueducts • Dams • Irrigation
Recovery potential of the original forest (inside and outside protected areas)
Buffer zones of protected areas
Deforested areas next to protected areas
Demonstrated potential

ANNEX 5: FOCUS GROUP DISCUSSION FORM

NCRA
Nizao Community Resilience Assessment

Check-in

- Buenos dias
- Nombres
- Ocupaciones
- Interés de estar presente hoy (escribirlos)

Contenido

El objetivo de hoy es establecer qué influye en la resiliencia del pueblo y cómo se volverá a devenir más resiliente.

- Definiremos los límites de la comunidad
- Explicaré qué es la resiliencia y cómo la evaluaremos
- Determinaremos los criterios de evaluación
- Identificaremos servicios e intervenciones que mejoren la resiliencia
- Finalmente, identificaremos qué casas en la comunidad son las más resilientes

Definición de la comunidad

¿Cuántas casas? ¿Saben aproximadamente cuántas personas hay total en la comunidad o por casa?

¿Dónde están los límites? ¿Dónde comienza y termina la comunidad? ¿Hay un mapa?

Cuestionario para los grupos de la primera visita

NCRA
Nizao Community Resilience Assessment

¿Qué instituciones están presentes?ejemplo: tiendas, servicios públicos, empresas

¿Cuáles son los medios de vida aquí? ¿Cómo logran las personas mantener sus estilos de vida?

Definición de resiliencia

Ahora hablaremos de resiliencia. ¿Quién estuvo presente en el taller sobre cambio climático? Simplemente, es que la actividad humana en el planeta ha tenido un impacto significativo en los ecosistemas en los últimos sesenta años. Esto significa que los patrones climáticos que utilizamos cambian lentamente y estos cambios continuarán. Entonces debemos acostumbrarnos. Todos los fenómenos relacionados con el clima serán más intensos. Esto se puede manifestar por una mayor precipitación, vientos más fuertes o temperaturas más altas. ¿Podrían describirme eventos relacionados con estos cambios?
(inundaciones, huracanes, sequías)

Adaptarse a estos cambios es parte de la resiliencia. De hecho, la resiliencia es la capacidad de mantener su estado a través de eventos disruptivos.

Tomar el ejemplo de una familia con un hogar frágil. Después de un huracán, la casa está muy dañada y debe repararse antes de que la agricultura pueda continuar. En este caso, esta familia no es resiliente. Debe tomarle mucho tiempo y esfuerzo para restaurar su condición al estado inicial. En comparación, una familia con un hogar resistente no se verá afectada. Por lo tanto, es más resiliente porque su condición no habrá cambiado. También es muy similar a la salud, ya que podemos resistir un virus si nuestro cuerpo está sano. Somos menos vulnerables.

Pero resistir un choque se puede hacer de muchas maneras. Porque básicamente, lo que nos hace sobrevivir se ve afectado por los servicios que provienen de nuestros esfuerzos, como la agricultura, los ecosistemas naturales, como el agua potable y de los servicios producidos por otros humanos, como cuidado de la salud. Mi casa puede ser sólida, pero no seré resiliente si no puedo comer. La resiliencia es un poco como nuestra capacidad para sobrevivir en un sistema.

Muchas cosas afectan la resiliencia:

- La diversidad de servicios. ¿Tengo acceso a comida, a una escuela, a un hospital, y tengo suficiente dinero para reparar mi casa si hay daños?
- La conectividad ¿Estoy cerca o lejos de los recursos?
- La participación. ¿Estoy solo para organizar mi casa? ¿Debo depender de alguien más? ¿Mi comunidad me ayuda o me apoya?

Para mí, la resiliencia es la riqueza de una comunidad. Ayuda a mantener el estilo de vida tal como es si hay cambios abruptos. Mucha gente piensa que la riqueza económica está relacionada con nuestra capacidad a reaccionar en caso de un problema, para recibir servicios o recursos. Pero si hay un inundacion, ¿será sus primera reacción gastar dinero o asegurarse de que todos estén a salvo?

Esta teoría se aplica tanto a los ecosistemas naturales, a la agricultura y a las comunidades humanas. El propósito de la evaluación es, por lo tanto, verificar cuáles son las vulnerabilidades y las estrategias de desarrollo de resiliencia para Santana. La capacidad de recuperación de una comunidad garantiza su buena salud a largo plazo. Todos los elementos son importantes a considerar: los aspectos sociales, económicos, naturales, humanos y infraestructura. Por el momento, el proyecto con el CEDAF es un modelo que podría ser replicado en otras partes del país para restaurar el agua potable. Por lo tanto, es importante incorporar consideraciones de desarrollo sostenible, a largo plazo, en estos proyectos. Como la resiliencia afecta a todos los aspectos de una comunidad, necesitamos saber a qué nos adaptamos y cómo ser resilientes.

Me gustaría agregar que la resiliencia de Santana es particularmente importante. Porque el agua del río Mahomita va a Santo Domingo y es en parte gracias a ustedes si casi 30% de la población del país tiene acceso a agua de calidad.

Preguntas?

Características locales de la resiliencia

Entonces, vamos a buscar lo que hace que esta comunidad sea resiliente, porque las amenazas y los recursos son diferentes en todos los lugares.

¿Cuál es el peor evento que le ocurrió a la comunidad en relación con el cambio climático?
¿Cuándo fue? (eligir)

Tomemos este evento como un evento de referencia. Si es lo peor, para eso debemos adaptarnos primero.
En términos de resiliencia, ¿cuáles son las diferencias entre un año normal, digamos este año, y el año donde ocurrió el último evento perturbador? Nombrenme todas las diferencias.

Ok, ahora tendremos que agrupar todo eso. Tratemos de hacer las características que representan la resiliencia. Por ejemplo, mi familia sería más resiliente si tuviera un campo que pudiera resistir las inundaciones. Ella podría continuar produciendo alimentos y la cosecha no se perdería. Es como decir, qué características tendrían todos los hogares si fueran resilientes en un período de perturbación?

Perfecto. Ahora vamos a votar. Elegiremos las características más importantes. Todos tienen tres votos. Pueden venir y soltar sus propias habichuelas en los tres que consideres más importantes. Recuerden que debe considerarse que este evento afecta a toda la comunidad, en aspectos económicos, institucionales, naturales, infraestructurales, humanos y sociales.

Perfecto. Con estas opciones, podemos discutir si Santana ha logrado estas características. Durante los últimos 5 años, ¿podrían decir que Santana ha progresado, retrocedido o se mantuvo igual para cada característica? Puedes poner sus tres habichuelas sobre las hojas.
↗ ↘ =

Casas resilientes

Excelente. Ahora, del número total de hogares en Santana, ¿cuánto dicen que han llegado a un estado de resiliencia o están en camino de ser? Podemos enumerar todas las casas.

En general, ¿dirían que la cantidad de hogares que son resilientes o están en proceso de serlo, son más o menos o iguales en los últimos cinco años? + - = ?
Podemos hacer una mano alzada si no hay consenso.

Servicios e intervenciones

La última parte de esta actividad se refiere a intervenciones y servicios en Santana.

Sin considerar los servicios e intervenciones existentes, qué servicios e intervenciones podrían contribuir mejor a la construcción de resiliencia a escala tanto doméstica como comunitaria? ¿Qué servicios o intervenciones serían ideales? Por ejemplo, una producción local y autónoma de alimentos. O el acceso al agua potable en cada casa.

Perfecto. Ahora, ¿pueden nombrarme todos los servicios e intervenciones que están presentes en Santana y que contribuyen a la construcción de su resiliencia? Los escribiremos en hojas.

¿Hay intervenciones o servicios que afectan negativamente la resiliencia? Por ejemplo, un corte de árboles o quema de un bosque que evitaría aprovechar sus servicios a largo plazo.

Nuevamente con sus tres habichuelas, los invito a elegir las tres intervenciones o servicios más efectivos para desarrollar resiliencia.

ANNEX 6: KEY INFORMANT INTERVIEW FORM

Questionario individual

Contenido

- Presentación del proyecto
- Presentación de objetivos
- Definición de resiliencia
- Preguntas sobre la resiliencia
- Definición de REDD
- Preguntas sobre REDD

Check-in

Presentación

- Yo y el proyecto

Objetivos

- Comprenda cómo este hogar es más resiliente
- Comprenda cómo sucedió y por qué su hogar es diferente
- Obtenga sus opiniónes sobre REDD

Definición de resiliencia

Ahora hablaremos de resiliencia. ¿Quién estuvo presente en el taller sobre cambio climático? Simplemente, es que la actividad humana en el planeta ha tenido un impacto significativo en los ecosistemas en los últimos sesenta años. Esto significa que los patrones climáticos que utilizamos cambian lentamente y estos cambios continuarán. Entonces debemos acostumbrarnos. Todos los fenómenos relacionados con el clima serán más intensos. Esto se puede manifestar por una mayor precipitación, vientos más fuertes o temperaturas más altas. ¿Podrían describirme eventos relacionados con estos cambios?
(inundaciones, huracanes, sequías)

Adaptarse a estos cambios es parte de la resiliencia. De hecho, la resiliencia es la capacidad de mantener su estado a través de eventos disruptivos.

Cuestionario para las familias durante la segunda visita

NCRA
Nizao Community Resilience Assessment

Tomar el ejemplo de una familia con un hogar frágil. Después de un huracán, la casa está muy dañada y debe repararse antes de que la agricultura pueda continuar. En este caso, esta familia no es resiliente. Debe tomarle mucho tiempo y esfuerzo para restaurar su condición al estado inicial. En comparación, una familia con un hogar resistente no se verá afectada. Por lo tanto, es más resiliente porque su condición no habrá cambiado. También es muy similar a la salud, ya que podemos resistir un virus si nuestro cuerpo está sano. Somos menos vulnerables.

Pero resistir un choque se puede hacer de muchas maneras. Porque básicamente, lo que nos hace sobrevivir se ve afectado por los servicios que provienen de nuestros esfuerzos, como la agricultura, los ecosistemas naturales, como el agua potable y de los servicios producidos por otros humanos, como cuidado de la salud. Mi casa puede ser sólida, pero no seré resiliente si no puedo comer. La resiliencia es un poco como nuestra capacidad para sobrevivir en un sistema.

Muchas cosas afectan la resiliencia:

- La diversidad de servicios. ¿Tengo acceso a comida, a una escuela, a un hospital, y tengo suficiente dinero para reparar mi casa si hay daños?
- La conectividad ¿Estoy cerca o lejos de los recursos?
- La participación. ¿Estoy solo para organizar mi casa? ¿Debo depender de alguien más? ¿Mi comunidad me ayuda o me apoya?

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considerar: los aspectos sociales, económicos, naturales, humanos y infraestructura. Por el momento, el proyecto con el CEDAF es un modelo que podría ser replicado en otras partes del país para restaurar el agua potable. Por lo tanto, es importante incorporar consideraciones de desarrollo sostenible, a largo plazo, en estos proyectos. Como la resiliencia afecta a todos los aspectos de una comunidad, necesitamos saber a qué nos adaptamos y cómo ser resilientes.

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Preguntas sobre la resiliencia

Chosen characteristics for an event like el huracan Noel

- Casas resistentes (1)
- Acceso a salud (2)
- Acceso al agua limpia (3)
- Carreteras resistentes (4)

Además de las características prioritarias de la resiliencia, ¿qué características han contribuido a la resiliencia de sus hogar?

In addition to the prioritized characteristics of resilience, what characteristics have contributed to your household's resilience?

¿Cómo diría que su hogar se volvió resiliente?

How would you say your household became resilient?

¿Cuánto tiempo ha sido resiliente? ¿Siempre fue el caso?

How long has it been resilient? Was it always the case?

¿Diría usted que su hogar hizo frente mejor a la perturbación que el resto de Santana?

Would you say your household coped better with disturbance than the rest of the Santana?

Sin tener en cuenta lo que existe, ¿qué intervención o servicio sería el mejor para construir resiliencia en Santana?

Without regard to what is already in place, what intervention or service would be the best to build resilience in Santana?

¿Hay intervenciones o servicios actuales que apoyen bien a otros hogares de la comunidad en la creación de resiliencia?

Are there current interventions or services that support well other households of the community in building resilience?

¿Qué dirías que está impidiendo la construcción de resiliencia en el hogar? ¿Y a nivel comunitario?

What would you say is preventing resilience building at household level? And at community level?

Definition of REDD

El programa REDD es una iniciativa internacional de las Naciones Unidas. Su objetivo es reducir la deforestación y fomentar la conservación de los bosques. El programa ofrece a los países más ricos y las empresas contaminantes la oportunidad de proteger el medio ambiente invirtiendo en iniciativas de desarrollo sostenible relacionadas con los bosques. El programa también apunta a estandarizar los métodos de manejo forestal.

Le programme REDD est une initiative internationale de l'organisation des nations unies. Il vise à réduire la déforestation et à encourager la conservation. Le programme propose aux pays riches et aux entreprises polluantes de protéger l'environnement en investissant dans des initiatives de développement durable liées aux forêts. The program also aims to standardize forest management methods.

El programa ofrece recursos técnicos y monetarios para desarrollar nuevos proyectos o para ayudar a proyectos existentes. Después, los proyectos son recompensados según sus resultados. Las recompensas son variadas, pero se pueden realizar en forma de pago o inversión en el desarrollo sostenible de las comunidades participantes. Puede ser el desarrollo cultural, la protección del paisaje, la seguridad, el aumento del valor de la tierra o un mejor acceso a los servicios (agua, electricidad, alcantarillado, salud, educación).

Le programme offre des ressources techniques et monétaires pour développer des nouveaux projets ou pour aider les projets existants. Les projets sont ensuite récompensés selon leurs résultats. Les récompenses sont variés, mais elles peuvent se concrétiser sous forme de paiement ou d'investissement dans le développement durable des communautés participantes. Ça peut être le développement culturel, la protection du paysage, la sécurité, l'augmentation des valeurs foncières et un meilleur accès aux services (eau, électricité, égouts, santé, éducation).

Actualmente, varias organizaciones están trabajando para que este programa sea activo en la República Dominicana. Entre otras cosas, hay Ministerio de Medio Ambiente, Ministerio de Agricultura, MEPyD (Ministerio de Economia, Planificacion y Desarrollo) y el CEDAF. También hay otras organizaciones públicas y privadas, nacionales e internacionales como el Banco Mundial.

Présentement, plusieurs organisations travaille pour que ce programme soit actif en république dominicaine. Entre autre, il y a le MMARN et le CEDAF qui sont actifs ici. Il y a aussi plusieurs autres organisations publiques et privées, nationales et internationales.

Preguntas sobre REDD

Disponibilidad.

Las actividades deben ser similares a las realizadas con CEDAF.

1) ¿Cree que su hogar tiene suficiente tiempo o recursos para participar en las actividades de REDD?
    a) No tenemos tiempo ni recursos para otras actividades.
    b) Tenemos tiempo, pero no recursos.
    c) No tenemos tiempo, pero podemos compartir nuestros recursos.
    d) Tenemos tiempo y recursos para compartir.
2) ¿A qué hora crees que tendrías por semana para participar en las actividades de REDD? Una mañana, una tarde o una tarde (alrededor de 4 horas)? ¿Un día? ¿Más?

Capacidad de estructura social.

1) En términos de cómo se organiza la comunidad y cómo se planifica, ¿cree que Santana puede recibir un proyecto de conservación como REDD?
    a) No, Santana no puede coordinar su participación en el programa por sí mismo o con una organización de implementación externa
    b) Sí, pero Santana necesitaría ser coordinado por una organización de implementación externa
    c) Sí, Santana tiene una estructura social lo suficientemente fuerte como para implementar REDD por sí misma y crear una entidad local responsable de ella

Estado actual de colaboración.

¿Crees que las personas en Santana podrán colaborar para hacer efectiva la participación en REDD?

a) No, Santana no se usa para colaborar en proyectos comunitarios.
b) No, la gente en Santana generalmente no está interesada en colaborar entre ellos.
c) Sí, las personas en Santana suelen actuar en solidaridad y colaboran entre sí cuando se lo piden los unos a los otros.
d) Sí, las personas en Santana están acostumbradas a trabajar en proyectos comunitarios.

Confianza en las partes interesadas.

1) ¿Confiarías en este programa para considerar tus necesidades de resiliencia si fuera implementado aquí? Si No Porque Cual aspecto

2) Dado los que son responsables de REDD hoy, ¿cree que es una buena idea comenzar un proyecto aquí? Si No Porque

3) ¿Qué haría a REDD menos confiable y qué le daría confianza? + / -

Beneficios potenciales.

Por ahora, cuando el MMA involucra a una población en un proceso participativo, se tienen en cuenta los impactos en la cultura local, el paisaje arquitectónico, la seguridad, el valor de la propiedad, los servicios básicos (agua, energía, alcantarillado, salud y educación), la igualdad de género y el número de personas involucradas.

1) ¿Qué tipo de beneficios sería más interesante para ti? Puedes priorizar los 3 más importante?

Diversidad y calidad de los servicios ecosistémicos.

1) ¿Qué servicios ecosistémicos crees que te benefician del bosque?
2) Para cada uno de estos servicios, ¿qué puede decir de la calidad en los últimos cinco años? + / - / =
    a) La calidad es mejor
    b) La calidad es estable
    c) La calidad es peor

ANNEX 7: CURRENT RESILIENCE CHARACTERISTICS EFFICIENCY

Current Resilience Characteristics Efficiency

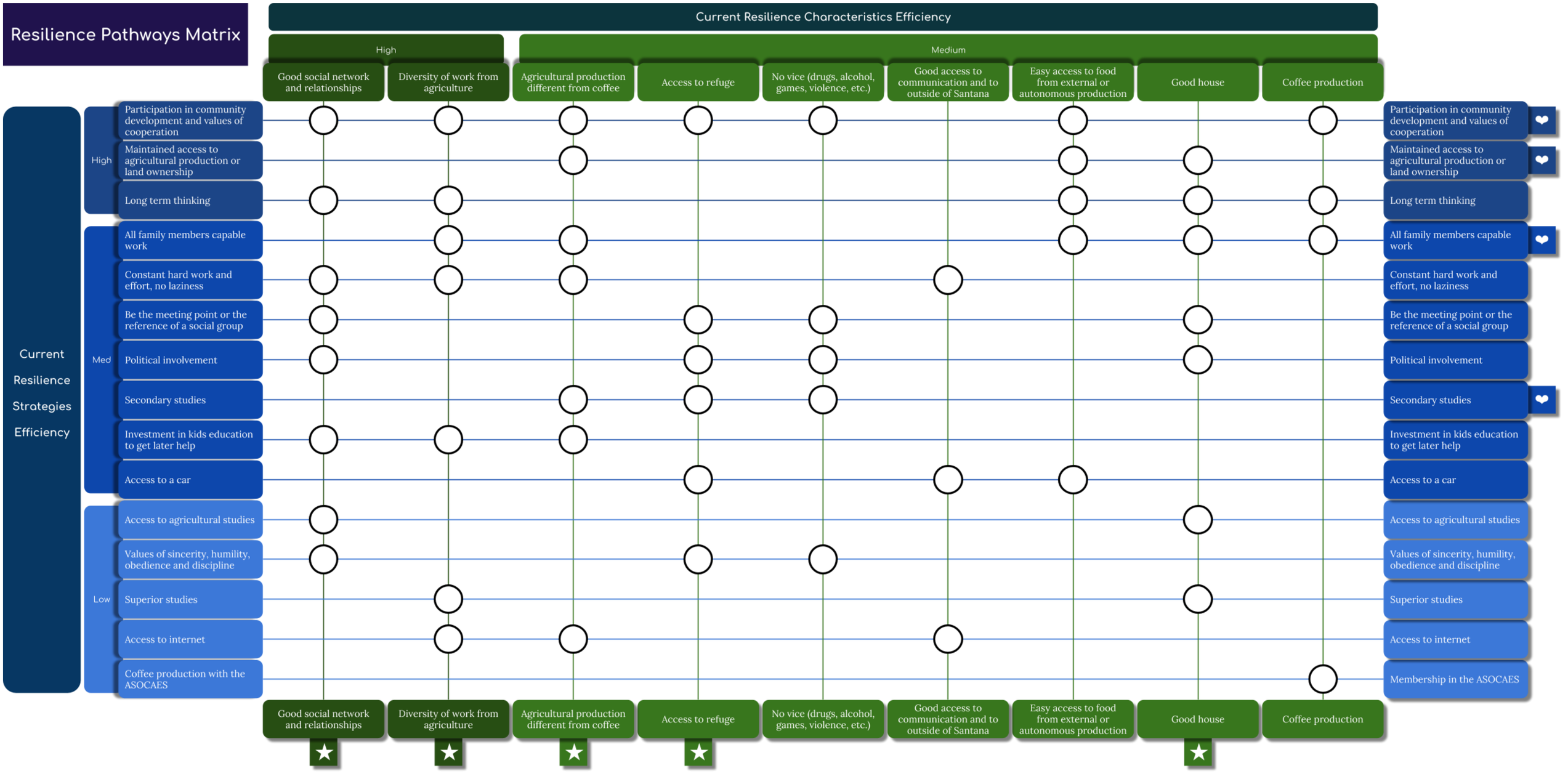
	Points	Characteristic	Impacts	Easiest to attain	Prefered by the most resilient
High	15	Good social network and relationships	Because humans are the main responsible for service provision, an improved social capital greatly enhances connectivity, which gives access to other capitals, may they be human, natural, financial or physical.	★	
	10	Diversity of work from agriculture	A greater diversity of services improves the capacity to respond to disturbances and to secure some capitals while others may be lost. Shared diverse knowledge also betters variables management and fosters complex adaptive thinking.	★	
Med	8	Agricultural production different from coffee	Agricultural diversity will specifically secure financial, natural and physical capitals if some crops are lost but others saved.	★	❤
	8	Access to refuge	This physical capital can protect humans and household or community assets. A public refuge used as a community centre will also increase connectivity and facilitate participation, which in turn may increase all types of capitals.	★	
	8	No vice (drugs, alcohol, games, violence, etc.)	Healthy habits improve human capital directly and will help protect financial capital, but may even enhance social capital through trust and participation.		
	8	Good access to communication and to outside of Santana	Connectivity in this case improves information sharing, learning and access to capital diversity. This in turn may facilitate complex adaptive thinking and polycentric governance though coordination with external instances.		
	7	Easy access to food from external or autonomous production	Eased access to food will insure good human health, and will therefore help maintain service production at household or even community scales as a direct response to disturbances.		❤
	5	Good house	Good physical infrastructure will improve slow variables management, and will protect assets and residents from weather or other security issues. A good house may also be used as a shared refuge by other community members.	★	❤
	5	Coffee production	As coffee production is the most redundantly produced commodity, its exchange is accentuated and thus will enhance financial capital input (income quantity, common assets). The ASOCAES also facilitates communitarian participation.		

ANNEX 8: CURRENT RESILIENCE STRATEGIES EFFICIENCY

Current Resilience Strategies Efficiency

	Points	Strategy	Impact	Prefered by the most resilient
High	10	Participation in community development and values of cooperation	This nurturing of social capital will greatly increase the connectivity, diversity and accessibility to resilience characteristics. It will also foster complexe adapting thinking.	❤
	7	Maintained access to agricultural production or land ownership	Chosen by many of the most resilient households, it secures both a constant access to food and an income from production.	❤
	7	Long term thinking	Directly related to the management of slow variables and feedback and the fostering of complex adaptive thinking, it allows prepare, adapt and evolve.	
Med	6	All family members capable work	Putting all the available human capital to use leads to a more diversified and increased financial capital.	❤
	5	Constant hard work and effort, no laziness	This popular strategy seeks to constantly better the household's or community's state of resilience and has proven to lead to a diversity of excellent resilience characteristics.	
	5	Be the meeting point or the reference of a social group	Similar to involvement in the community, though not available for every household. It creates a common priority where to concentrate and organize the services responsible for resilience.	
	5	Political involvement	Increases the social network to political institutions, which are responsible for some services helping the attainment of characteristics, and ease the access to external resources.	
	4	Secondary studies	Increased critical thinking and general knowledge improve adaptability through variables management, which has proven to lead to easily attained and good resilient characteristics.	❤
	4	Investment in kids education to get later help	May lead to work diversification and increase in human and financial capitals. However, the children may also migrate out of Santana.	
	4	Access to a car	A car may be easier to drive through a very damaged road than a motorcycle and allow for the transportation of more people and resources. It also allows to migrate to more resilient areas.	
Low	3	Access to agricultural studies	May improve agricultural productivity and social, human and financial capitals.	
	3	Values of sincerity, humility, obedience and discipline	Nurturing these values will increase the quality of interpersonal relationships, which may ease the access to some resilience characteristics.	
	2	Superior studies	The efficiency is surprising given an increased adaptability related to possibly more critical thinking and financial income, but limited local work opportunities may lead to migration.	
	2	Access to internet	Increases access to knowledge which may be useful to better responsive, adaptive and elolutive capacities if locally available resources allow it.	
	1	Membership in the ASOCAES	This strategy can bring more than income from coffee, but no other specific outcome or resilience characteristic as proven recurrent.	

ANNEX 9: CURRENT RESILIENCE PATHWAYS MATRIX



ANNEX 10: ENGLISH EXECUTIVE SUMMARY

PARTICIPATORY ASSESSMENT OF A COMMUNITY'S CLIMATE RESILIENCE AND POTENTIAL FOR THE REDD+ PROGRAM IN THE DOMINICAN REPUBLIC

EXECUTIVE SUMMARY

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MAÎTRISE EN ENVIRONNEMENT
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INTRODUCTION

In Dominican Republic (DR), climate change (CC) adaptation is implemented in the most important national development strategy, because tropical cyclones have increased in wind speed and duration over the last 30 years (Emanuel, 2006). The reduction of greenhouse gases (GHG) emissions is widely discussed as a solution to stabilize the change, but these gases also need to be sequestrated to return to a less disturbed climate state. An enlarged approach to sustainable management of disruptive events is called resilience. Climate resilience incorporates the capacity to absorb a disturbance to the capacity to avoid these disturbances. To fight CC, to adapt to it and to empower poorer countries to act, the REDD+ program has been elaborated eleven years ago by the United Nations Framework Convention on Climate Change (UNFCCC). Since the program provides the necessary resources to participate and the possibility to make profits in carbon markets, the government of DR decided to start developing its own national strategy. This leads to the formulation of three primary objectives for this assessment.

I. An ongoing conservation project managed by the *Fondo Agua Santo Domingo* (FASD) got fast and cost-effective results. The *Ministerio de Medio Ambiente y Recursos Naturales* (MMARN) wants to know how it is managed.
II. The MMARN also wants to know what potential this project holds for REDD+.
III. Since the community involved, Santana, has the responsibility to maintain an ecosystem service, a climate resilience assessment will inform the stakeholders of its state.

Concerns are expressed as if the FASD only has donor-based objectives or if it also aims to improve Santana's resilience. The essay therefore analyzes how the FASD helps the community. The results should encourage stakeholders to add clear community development or well-being objectives to their activities.

This executive summary is composed of five chapters. The context allows to understand what the local social-ecological situation is, as well as the governmental objectives. Then the FASD is explored in both its history and its implications for the community. The mechanism of REDD+ is explored to understand the national challenges and the possible ways to evaluate the potential of a hypothetical registration. Based on theoretical principles, a practical framework, and on REDD+ criteria, the resulting assessment methodology is explained. The results discuss the community's own perception of its resilience, and the different pathways possible. The REDD+ potential results discuss the compatibility of the current activities, the interest of the community, its capacity to participate, and its perception of the quality of the natural capital. The last chapter proposes four sets of recommendations, about resilience building in the community, the

needs for a successful REDD+ registration, concerns on participative conservation project design, and solutions to fight corruption it in a systemic manner.

1. CONTEXT PRESENTATION

The chosen community for this assessment is called Santana and is situated in the subbasin of the river Mahomita in the northeastern part of the Nizao river watershed. Five years ago, The Latin American Water Funds Partnership (LAWFP) started the FASD to protect the bodies of water surrounding the capital. Santana got involved and a process to change agriculture and forest use started.

1.1 Community Characteristics

Santana is part of the municipal district of Los Cacaos, in the province of San Cristóbal. Among 80 households, 39 participate in the Mahomita subbasin project. This isolated community is in ad equation with its national context. Maps in annexes 1 and 2 help understand land usage and cover types in the region.

1.1.1 National Context and Strategies

DR has approximately 10.3 million inhabitants living on the eastern side of the island of Hispaniola in the Caribbean Sea (Oficina Nacional de Estadísticas [ONE], 2018). The only neighbouring country is Haiti. DR's Human Development Index of 0.722 indicates the country is in the high human development category. (United Nations Development Programme [UNDP], 2016) The country had one of the fastest economic growth in the Latin America and Caribbean (LAC) for the last two decades, driven by the construction, manufacturing, tourism, and mining sectors (The World Bank, 2018). Even through this growth, 28.9% of the population still lives under the general national poverty line, meaning that inequities are growing as well (ONE, 2018). As 80.6% of the population lives in cities, secondary and tertiary sectors make up for most of the economic activity. Only 5.5% of the economic activity is related to the agricultural sector. (Central Intelligence Agency, n.d.)

DR has been one of the first countries with a National Development Strategy (NDS) that integrates an economic development compatible with CC. It estimates that the forestry sector could be transformed into a net carbon sink because its current emissions are decreasing. Sufficient efforts could lead to create 15,000 new jobs and capture USD 35 million worth of carbon per year in 2030, mainly through mechanisms like

REDD+ and the Clean Development Mechanism. (Consejo Nacional para el Cambio Climático y el Mecanismo de Desarrollo Limpio [CNCCMDL], 2011) Agriculture has been acknowledged as one of the main sources of greenhouse gases (GHG) emissions and pollution in the country. Efforts are concentrated in stopping its sprawl and displacing small farmers for reforestation. (CNCCMDL, 2011) Therefore, any project with potential for those programs, like the one in Santana, may be of high interest for the state.

1.1.2 Specific Social-ecological Context of Santana

The Mahomita subbasin has an area of 11,460.13 ha. The soils are suitable for forests, distinct by their stoniness, depth, and steep topography. (Segura, 2014; MMARN, 2017a) Conditions are perfect to grow coffee because it requires good drainage, an altitude between 550 m and 1,100 m (Santana is between 300 m and 1300 m), and a temperature is between 15ºC and 24ºC (Santana has a mean annual one between 21ºC and 24ºC). (Centro para el Desarrollo Agropecuario y Forestal [CEDAF], 2014b; Diby, L., Kahia, J., Kouamé, C., and Aynekulu, E., 2017; MMARN, 2017a) The abundant rainfall causes almost continuous flowering in coffee, which results in two harvesting seasons per year. (Coffee Research Institute, 2006) The potential usage of land for agroforestry is 4,286 ha. 5,148 ha are classified as a protected zone, and 565 ha for forest use. (Segura, 2014) Agriculture is the basis of the economic activities, especially coffee. (Segura, 2014; G. Morales, pers. comm., May 11, 2018)

The village of Santana is part of the municipality of Los Cacaos, but 25 km further down a meandering dirt road. The Mahomita Basin has the highest percentage of poverty of the municipality, at 81.8%. (Segura, 2014) All agriculture knowledge is passed down from parents to children through work and rarely comes from outside or from studies. (R. B. Geronimo, pers. comm., June 26, 2018) Social statistics on Santana are presented in the following table 1.1.

Table 1.1 Statistics on Santana (Retrieved from: CEDAF, 2014a; ONE, 2016)

Living Conditions	
Households made of precarious, mostly organic materials	74%
Households with access to means of transport	59%
Population using wood for cooking	88%
Population receiving drinking water as a service	60% (18% of this water comes from wells or aqueducts, and 57% comes from streams or ponds)

Technology and Communication	
Households with a mobile phone or landline	46.6%
Households with an internet connection	0.9%
Households with radio and/or television	58%
Education	
Population that completed primary education	65%
Illiteracy rate	27.9% "It is rare to encounter people that can read or write" (G. Morales, pers. comm., May 11, 2018)
Economic Activity	
Economically active population	63%, of which 73% is engaged in agricultural work, 12% to trade and 15% to other activities
Average Monthly Income	5,000 DOP
Population considered able to work	79.2%
Spending priorities	Food, health and education
Health	
Population reporting a permanent difficulty or limitation	6%
Population reporting diseases	35%
Land & Natural Resources	
Population with owned lands or entitlement	50%
Population with crops affected by plague	54% (31% use pest control methods)
Population that received agricultural technical assistance	34%
Population that has reforested	56%

In terms of participation to the activities of the FASD, 57% of inhabitants took part in the reforestation campaigns of 2013, and 53% of agricultural producers carry out conservation within their farms. 85% understand the productive capacity of soils has decreased and conservation is needed. (CEDAF, 2014a) The most important local institution is the *Asociación de Caficultores la Esperanza* (ASOCAES). In Santana, 16 households are members. The ASOCAES acts as the entry point of external initiatives and key facilitator of development for the community. (R. B. Geronimo, pers. comm., June 26, 2018)

1.1.3 Pressures

The global and national population growth increases the pressure on forests and agricultural lands with a bigger demand for food, infrastructure, and energy (Department of Economic and Social Affairs of the United Nations [DESA], 2015). Increased productivity on existing cropland will account for some of the supply, but expansion of agriculture will continue to be a major driver of deforestation and forest degradation (DFD) (United Nations Environment Programme [UNEP], 2017). In Santana, the main pressures are wood trade, agricultural expansion, and charcoal production (G. Morales, pers. comm., May 11, 2018).

The geographical localization of Hispaniola puts the DR in a particularly vulnerable situation regarding CC. By 2050, the average annual temperature is expected to increase by 1ºC to 2ºC, resulting in intensified hydrological cycling. Extreme weather events are more likely to happen by 30% between May and October. After 2050, the drought season (December to April) may intensify and the total annual rainfall should decrease by 15%. Moreover, the increase of several vector-borne diseases is to be expected due to the change in temperature and precipitation. Adaptation measures have become a priority for the government since 2011. Even if actions are multiplying, concrete results may not be expected soon since the NDS and National Climate Change Adaptation Plan aim to finish the related studies, plans, policies and laws by 2030. (MMARN, 2017c) For Santana, river flood, earthquake and water scarcity are now at medium risk, which means project planning, design, and construction should consider the risk in the upcoming 10 years. (Global Facility for Disaster Reduction and Recovery [GFDRR], 2017) Regarding access to water, there is an inherent water stress all over the country, particularly related to human consumption. Urban flood, cyclones, and wildfire are at high levels, meaning there is a greater than 50% chance of encountering a hazard likely to result in both life and property loss in any given year (GFDRR, 2017).

The last pressure has been recurrently mentioned by collaborators of this assessment: corruption. According to surveys, DR is the second most corrupted country in the LAC region, just after Mexico (Transparency International, 2017). Some negative impacts mentioned were: slowed political processes; expansion of social divide; inefficient funding allocation; lack of consistency with objectives and decisions, and possibility of evaded obligations through bribes; lack of serious in work and unnecessary efforts spent on appearances; favoritism, missed opportunities and instability of employment; violence, intimidation, fear or obligation to act; fear to denounce. (K. Rodriguez, pers. comm., May 16, 2018; G. Morales, pers. comm., May 11, 2018; C. Ortiz, pers. comm., May 21, 2018; M. Rodriguez, pers. comm., May 19, 2018; L. Solano, pers. comm., May 11, 2018; L. Rojas, pers. comm., May 27, 2018)

1.2 *Microcuenca Mahomita* Project History

The main problem driving the project in the Mahomita subbasin is the degradation of soils by erosion, which has been made evident by the sedimentation state of the Aguacate reservoir and the output of the Aguacate hydroelectric power plant, and by the decreasing availability of water in all human settlement dependent on the Nizao watershed, including the capital Santo Domingo. Through the LAWFP initiative, the FASD was created to initiate a solution, naming the *Centro para el Desarrollo Agropecuario y Forestal* (CEDAF) the organization responsible for the implementation. (G. Morales, pers. comm., May 11, 2018) Three rivers provide hydroelectricity and clean water to Santo Domingo: Ozama, Haina, and Nizao. The later one supplies more than 30% of Santo Domingo's water consumption, represents a hydroelectric generation potential of around 200 MW, and a source of more than 50% of the national aggregate production for construction (Díaz González and Florián, 2011).

Until November 2015, conservation actions included reforestation with coffee and native plants systems. Plot owners have been encouraged to plant banana with coffee to prevent soil deterioration while coffee is growing. It should guarantee the permanence of the forest cover and the commitment to maintain practices that support productivity, better income and sustainability. The project now involves 39 community farmer plots throughout the subbasin and helped with soil conservation, reforestation, and riparian ecological restoration. (CEDAF, 2018; G. Morales, pers. comm., May 11, 2018) The CEDAF has also been capacitating the inhabitants with continuous accompaniment, training and workshops. (CEDAF, 2018; V. A. Matias, email, May 15, 2018) There is no planned end or major upscaling. The commitment of Bepensa and Coca-Cola is to finance the activities until the replenishment of the groundwater is as big as their yearly use. (CEDAF, 2018; G. Morales, pers. comm., May 11, 2018; C. Garcia, pers. comm., June 19, 2018)

1.3 Governance

The LAWFP is managed by The Nature Conservancy (TNC), as a means of gathering funds for the specific goal of preserving lands above watersheds. It created the FASD to gather local stakeholders from the public, private and NGO sectors, and provide them with technical and financial assistance. The initial funding is done by TNC, The Inter-American Development Bank, the Global Environmental Facility, and the Femsa Foundation. The following funding of the FASD comes from Coca-Cola and Bepensa, its bottling company in DR. Decisions regarding vision, politics and strategies are taken yearly in assemblies. An external audit is done to certify financial accountability. (C. Garcia, pers. comm., June 19, 2018) The CEDAF receives its resources through TNC and reports to them. TNC then reports to the other partners through the LAWFP portal. (J. Segura, email, May 14, 2018) Land acquisition and forest conservation are done by the CEDAF.

The human resources needed are hired locally. The maintenance and establishment of coffee plantations are done by the community members. Since reforestation is done on each participating parcel, the management of a portion of the parcel is given to the CEDAF in exchange for the necessary resources to plant coffee (G. Morales, pers. comm., May 11, 2018).

2. THE NATIONAL REDD+ STRATEGY

Since the activities in Santana are related to reforestation and agroforestry, they could be reproduced in other communities as a profitable carbon sequestration model for REDD+. The program and its registration process will therefore be presented, along with models from Zambia and Peru before discussing the probable challenges.

2.1 Presentation of the REDD+ Program

The UNFCCC launched REDD+ with the objective to reduce GHG emissions, to fight CC, and to offer to developing countries the opportunity to review the management of their forest ecosystems. It is a holistic solution that ensures intertwined sustainable resource management and economic development, which are consistently in conflict across the globalized world. Simply put, REDD+ finances initiatives and rewards projects according to their results. Each participating country develops a personalized strategy and creates action plans for priority areas. Projects are created with local implementers and various assessments are done to calculate potential benefits. Different elements are needed to receive payments: a national strategy, a national reference levels, a proven and transparent national monitoring system, and an information system on how safeguards are respected throughout the implementation. The submission of results is the responsibility of the participating countries and payments are made only after the results are verified. (Ministry of the Environment of Brazil, 2016) Since REDD+ is rigorous, it becomes easy to submit reports to organizations that generate carbon credits that can then be sold in voluntary carbon markets. The REDD+ program is tremendously complex, particularly because it must be integrated in almost all ministries of a country, because the benefit sharing mechanism is complicated to adapt fairly to all projects, and because the number of stakeholders and steps to reach an actual result-based payment are numerous. After 11 years, the results are still hard to grasp for some participants and the process is still slow. On the CC point of view, has materialized in 29 countries and, to date, has been the largest international conservation effort ever made. (Enrici and Hubacek, 2018; Mwangi, 2015)

2.2 Process for Project Registration

DR should be done writing the first version of the strategy by 2019, and all agreements should be signed by all parties by 2020 (P. Garcia Brito, pers. comm., May 21, 2018). The value of REDD+ has been recognized just by the several important challenges it tackles through its implementation in the country. Mainly, it will have to resolve weaknesses and gaps concerning land tenure and carbon rights, as well as resolve a lack of territorial ordering, the absence of a sectoral forestry law, a centralized administrative state, a lack of scientific basis for monitoring and standardization of practices, and ample difficulties in the management of incentives. (Fondo Cooperativo para el Carbono de los Bosques [FCPF], 2015)

Fuelled by demographic growth, poverty and social inequity, the underlying national causes of DFD are mainly due to four determining factors that influence the behaviour of the actors:

- Opportunity costs often determine the processes of land use change because it is difficult to develop a sustainable income from the exploitation of forest.
- Insecurity and uncertainty of land ownership and rights of use slows investment in the management of forests and natural resources.
- Fiscal and development policies with undesirable impacts to the sustainable management of forests, especially perverse subsidies.
- The lack of deterrent potential of the regulations due to deficiencies in norms and procedures, and the low capacity of the State to apply the mechanisms of resource administration, surveillance and control. (FCPF, 2015)

The pilot *Yaque del Norte* has been chosen as the first management model for *Pago de Servicio Ambiental*, payment for environmental services, which may be the chosen benefit-sharing mechanism. The pilot is also used to adapt technical and administrative processes for the national strategy and for the design of a monitoring framework. (FCPF, 2015; S. Teresa, pers. comm., July 20, 2018)

2.3 Model of National criteria: Peru and Zambia

Verifying the potential of an agroforestry project is not possible because the requirements have yet to be decided. Still, the strategy development team is using other strategies as models, namely the ones from Zambia and Peru. For Peru, the first principle is the effectiveness of emissions reduction. Measuring effectiveness includes external factors such as political viability and the degree of commitment at the national level. The second principle is the efficiency, which refers to the achievement of the emission

reduction achieved at a minimum cost. The next principle is equity: the reduction of emissions is achieved in a fair and ethical manner. This refers to participation, the fair distribution of benefits and costs, and to the transparency of the project. The fourth principle is the generation of co-benefits for stakeholders. These are not mandatory but are considered crucial for the success and permanence of a project. The last principle is the legality: the rights and legal requirements of the project though the characterization, analysis and application of the legal framework. (Rendón Thompson et al., 2009) In Zambia, the potential of an agroforestry system can be evaluated based on a preliminary appreciation. Agroforestry is rated as the most optimal land use or management practice and holds high potential for REDD+. The key filled attributes are presented in figure 2.1. In the figure, SFM stands for Sustainable Forest Management.

SFM Criteria	REDD+ Criteria
Optimization of land resource utilization	Compatibility with other livelihood activities
Forest ecosystem health and vitality	Co-benefits
Maintenance and enhancement of forest resources and contribution to global carbon cycles	Replicability
Maintenance and enhancement of protective FM functions (notably soil and water)	Governance
Maintenance and enhancement of forest resources and their contribution to global carbon cycles	Opportunity costs

Figure 2.1 Key Attributes of Agroforestry Projects for REDD+ (retrieved from: Kokwe and Mickels-Kokwe, 2012)

2.4 Potential Challenges and Solutions

Major criticism on the REDD+ mechanism is the first challenge for a proper implementation, as some stakeholders may be tempted to dissociate from the process, limiting the involvement, and the concerns are legitimate. How will REDD+ translate across scales from international vision, national objectives and local realities? Will REDD+ deliver its promised benefits? Why wouldn't it and how to ensure it does fairly? And since projects take a long time to materialize, is the REDD+ mechanism stable? (C. Garcia, pers. comm., June 19, 2018; Enrici and Hubacek, 2018)

Funding. In Indonesia, "the process of obtaining long-term and sufficient funding [is] one of the most frequently mentioned challenges […] because of the stark contrast between some initial perceptions of large funding opportunities among some stakeholders and the absence of funding on the ground" (Enrici and Hubacek, 2018). Ecosystem restoration is a long-term process and the business plan should be clear on how to have enough revenues for operations over the whole life of the project, and even beyond. At the

Conference of Parties in 2015, it has been acknowledged that carbon markets are not developed enough and cannot provide sufficient accessible funding to CC mitigation efforts (Johannsdottir and McInerney, 2016). Financial sustainability would therefore need to come through donor organizations willing to offer substantial funding. (Enrici and Hubacek, 2018)

Community engagement. The equitable engagement of a community ensures long-term project effectiveness. Informing stakeholders early is a common practice for good social acceptability and engagement, but it may also result in fatigue if there is a lack of perceived progress. (Enrici and Hubacek, 2018) The REDD+ mechanism is not tangible enough and humane to be communicated as it is and to be understood properly, especially by small holders with little education. (C. Garcia, pers. comm., June 19, 2018; R. Díaz de Medina, pers. comm., June 5, 2018) A good solution to avoid this situation is a collaborative management approach, which helps develop a strong working relationship. This will greatly improve community engagement and satisfaction, and help the equitable distribution of benefits. (Enrici and Hubacek, 2018)

Enforcement of project boundaries and monitoring. Support from local authorities for border encroachment can be very helpful so project enforcement can be done within the boundaries. Unclear or conditional use must be specifically resolved, because result-based funding requires stable and legitimate right holders over the lifetime of the project. Corrupted authorities or influences by business-as-usual interests should be avoided and removed from the project by another, more powerful authority that can't be bought with bribes. Multisectoral subregional committees should be empowered to act and open to review specific cases. (Enrici and Hubacek, 2018; Sunderlin et al., 2014) Community-based monitoring has proven to be sufficiently accurate and cost-effective while strengthening community engagement. It could be combined with remote sensing as it is the fastest way to measure carbon stock changes. Monitoring methodologies could be framed on the Community, Climate and Biodiversity standard, which assesses environmental and economic sustainability, and is compatible with the Voluntary Carbon Standard for carbon markets. Standardized and verifiable monitoring practices are essential to guarantee the effective routing of funds in this context. (Enrici and Hubacek, 2018)

Carbon sequestration and biodiversity preservation quantification. All types of forests and ecosystems should be integrated in the monitoring, even the less carbon sequestrating ones. Peatlands, for example, can play an important role in carbon sequestration, and landscape diversity may improve overall productivity. Having an independent agency to do the audit may be preferable to ensure quality and certainty. (Enrici and Hubacek, 2018)

3. ASSESSMENT METHODOLOGY

The current methodology tries to encompass the most important elements of resilience building through a qualitative and quantitative field assessment done in groups and individual interviews. The theoretical framework serves as an angle of analysis of the results. The Community Based Resilience Assessment (CoBRA) framework has been chosen as an inspiration for its practical and cost-effective qualities. The methodology therefore holds phases to which have been added indicators of REDD+ potential.

3.1 Theoretical Framework of Resilience

The resilience of a social-ecological system (SES) is its capacity to resist perturbations and maintain its structure and functions. Since human societies are part of the natural world and depend on ecosystem services, resilience links closely the interactions between the social and ecological realms. The level of resilience depends on how the system can self-organize, learn and adapt. A disturbance triggers a certain response in one or more variables, which can bring them over a threshold, and changing state may be easier in one direction than it is in the other. (Biggs, Schlüter and Schoon, 2014; Resilience Alliance [RA], n.d.) A grand variety of factors influence resilience, so the Stockholm Resilience Centre (SRC) regrouped them into seven principles that are now widely used throughout the literature.

Maintain diversity and redundancy. Components of a SES have different functions and capacities. They deal with disturbances in different manners and provide to each other different options for responding to change. Redundancy is more of an insurance policy so that if one component fails, others with similar function may compensate and continue to provide the function. Response diversity from components with overlapping functions at different scales reduces the risk of failure. (Biggs et al., 2014)

Manage connectivity. The structure determines the ability to transfer, may it be a resource, living beings or changing locations. A high level of connectivity can facilitate a recovery or prevent change, but it can also allow disturbances to spread faster. Limited connectivity may act as a barrier. (Biggs et al., 2014)

Manage slow variables and feedbacks. Many variables influence the connections, the nature of the interactions and the quality of the components. For feedbacks, dampening ones can help reduce, prevent or eliminate disturbances. These can be overwhelmed and lead to the creation of new feedbacks and connections, modifying the provision of ecosystem services. Positive feedback fuel themselves, in a loop of self-reinforcement. (Biggs et al., 2014)

Foster complex adaptive systems thinking. SESs are open, complex, interacting, and evolving systems, of which the understanding of dynamics and structures are just partial. The more aware we are aware of this complexity, the more prone we are to act effectively according to our objectives. (Biggs et al., 2014)

Encourage learning. Understanding the state of the system is primary to taking decisions. To enhance information sharing and knowledge, adaptive co-management and adaptive governance allows different stakeholders to share across different scales. These approaches increase cooperation and the development of new social norms, because collaborative learning changes the perspective the stakeholders have of their system. (Biggs et al., 2014) According to the theory of the leverage points to intervene in a system, sharing knowledge would be the most powerful way the enhance a system's sustainability (Meadows, 1999).

Broaden participation. The active engagement strengthens the bonds of the stakeholders and enhance their trust in each other. Collectively taken actions bring components closer to each other improvs problem solving, support, and response diversity. (Biggs et al., 2014)

Promote polycentric governance systems. Polycentric governance nests norms and rules across various scales and components. This gives more power to the best-fitted entity to act at the right time on the right scale to address change. Specific knowledge is more valued, which also increases its chances to be shared and its owners to participate, which in turn increases connectivity and response diversity. (Biggs et al., 2014)

3.2 Practical Framework Inspiration: CoBRA

The Community Based Resilience Analysis (CoBRA) is an assessment methodology developed by the United Nations Development Programme (UNDP) to assess the state of disaster resilience and guide the various actions taken to build resilience in the same direction in four ways:

- "Identify the priority characteristics of disaster resilience for a target community;
- Assess the community's achievement of these characteristics at the time of the assessment (generally carried out during a 'normal' period) and during the last crisis or disaster;
- Identify the characteristics and strategies of disaster-resilient households; and
- Identify the most highly rated interventions or services in building local disaster resilience." (UNDP, 2014a)

CoBRA sets reference levels of resilience between households to develop quantitative indicators, and identifies the factors that impact resilience building "through participatory qualitative approaches, namely

focus group discussions (FGDs) and key informant interviews (KIIs)" (UNDP, 2014a). The monitoring of these indicators allows to determine if the households are on a resilient or vulnerable pathway. (UNDP, 2014a) It allows the community to define resilience instead imposing a vision, which is central to resilience building. This vision is also characterized by real achievements from existing resilient households, which provides a useful contribution for strategic planning, with community views, key issues and effectiveness of interventions. It is easy to conduct everywhere and requires little technical expertise. (UNDP, 2014b) CoBRA also has its limitations. It doesn't provide a standalone quantitative measure of resilience to compare achievements between different communities. And it doesn't evaluate individual programs even though organizations would need to know how their programs affect resilience. (UNDP, 2014b)

3.3 Resulting Assessment Methodology

The assessment has two main objectives: discuss the resilience of Santana and evaluate its potential for REDD+. The assessment should also empower the participants to build resilience in their community and make external organizations aware of local considerations for sustainable development. The process of the assessment is presented in figure 3.1.

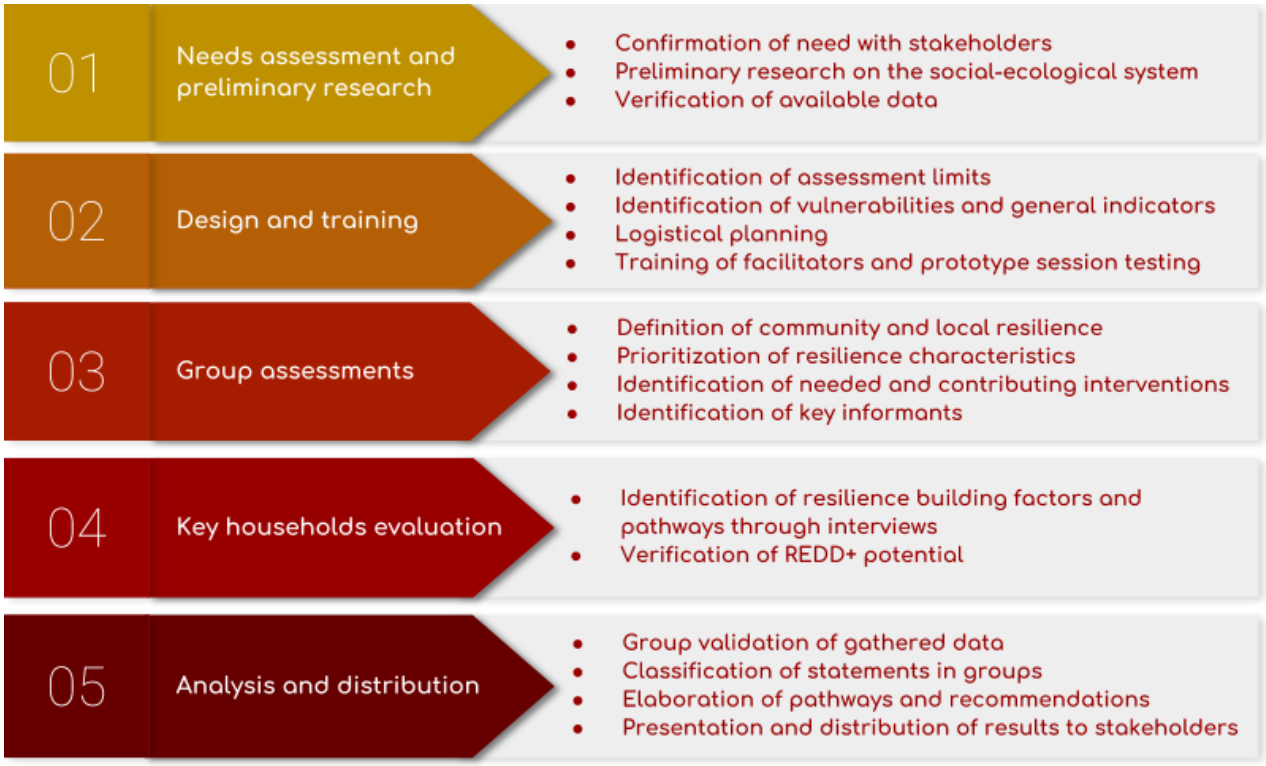

Figure 3.1 Phases of the Resulting Resilience Assessment

The necessity has been confirmed by the community during a CC adaptation workshop conducted by the CEDAF in May 2018. They noted its pertinence because it doesn't come from a governmental institution, because it is organized by an outsider with a neutral view, and because it complements ongoing conservation activities with sustainable development and CC adaptation considerations.

The second phase concerns the adaptation of the method to the context of the community. Limitations must be determined to design a feasible assessment in a timely manner. This requires knowledge of available human, financial, infrastructural and temporal resources, as well as the availability of community members. Based on the data gathered during phase 1, hypothetical vulnerabilities have been identified.

The third phase occurs only in FGDs and decisions are reached through majority votes or consensus. This participatory phase starts by asking the community members to define the community, its content and its limits. Then a discussion occurs on the definition of resilience. The group is asked to vote on the most devastating event as it is to this one will we try to build resilience to. The mentioned difficulties occurring during the event are then changed into positive statements, for example, by changing "lack of shelter" to "access to a shelter". The group is asked to prioritize these new resilience building characteristics. The achievement of these characteristics over the last five years will be rated through votes. After, the participants will be asked to tell which services and interventions contribute to resilience. Finally, all households being recognized with a higher state of resilience must be identified for phase 4.

During phase 4, the interviews are semi-structured, with precise questions and open answers. At the end of a discussion, we should be able to understand which factors made the household more and less resilient.

At the end of phase 5, we should have four clear results sections to help understand local resilience building. The resilience indicators should be integrated to current monitoring activities for stakeholders to work on common objectives at both household and community levels.

1) Context: what the community is, what the threats are, and what the vulnerabilities are.
2) Definition of local resilience: resilience building priorities and factors of more resilient households.
3) State of resilience: achievements of characteristics and appreciation of existing service and interventions.
4) Actions to build resilience: possible pathways to achieve characteristics and recommendations and indicators for resilience building.

3.4 Indicators of Potential for REDD+

Like any activity a community decides to take part in, the factor of interest is the first thing to assess. For this, the community needs to want the benefits of its participation and should trust the entities responsible for the activity. The second fundamental aspect to consider is the capacity to participate. People need to be available, to have a structure around which to organize, and to be somewhat used to collaborate. The last aspect to consider is the quality natural capital, because it will be directly rewarded. Table 3.2 illustrates where the data will come from. The exact definitions and questionnaires are presented in annexes 5 and 6.

Table 3.1 Source of Data for REDD+ Potential Indicators

	Participation	Interest	Natural Capital
Phase 3: Group assessment	Implementation organization		
Phase 4: Key households evaluation	Availability	Trust in stakeholders	
	Social structure capacity	Potential benefits	Ecosystem services diversity and quality
	Current state of collaboration		
Phase 5: Analysis of existing data	Participation in previous programs		
	Similarity of ongoing activities to those accepted by REDD+		

4. RESULTS AND DISCUSSION

The assessment led to two sets of results. The first set concerns the current state of resilience of the community, and discusses the pathways based on the current capacities. The second set serves to verify the preliminary potential of the REDD+ program for the community based on its participation, interest, natural capital and compliance to REDD+ criteria.

4.1 Santana's State of Resilience

When considering its capacities and its vulnerabilities, Santana is not currently a resilient community. Some pathways exist to improve household resilience, but external help is absolutely needed to improve the

community-wide absorptive, adaptive and transformative capacities. The FASD and the MMARN are both slowly helping, but the most needed interventions should be related to the principles of connectivity management and diversity and redundancy maintenance in priority. Otherwise, the community members established that access to health services, resistant houses, access to clean water and resistant streets were their most critical needs to be able to cope with an event as disruptive as hurricane Noel.

4.1.1 Community Definition

Santana is separated in two parts: Santana *Arriba*, the upper Santana, and Santana *Abajo*, lower Santana. Santana Arriba doesn't have access to most of the services present in Santana Abajo. From October to February is the cold season, and from February to October is the hot season. Rain and hurricane season is from June to November. Mentioned natural capitals were forests, pastures, protected areas, and agricultural lands for the production of coffee, passion fruit, avocado, lemon, corn, yucca, potatoes, plantains, bananas, beans, pumpkin, trees (nursery), and livestock. Mentioned social capitals were the ASOCAES, two primary schools, one church, around ten *colmados*, a few *bancas*, an association of neighbours and The Society of Parents and Friends of the Basic School of Santana Abajo. The human capital of Santana is composed of 70 to 80 households, of around seven people each. Young people are reputed to migrate because of the lack of employment, little resources, and the few services and public institutions. In terms of economic capital, agriculture is the most common livelihood. There are also a few tertiary services, and one group of common savings part of the ASOCAES. The physical capital is defined by schools, church, one street in Santana Abajo, wooden and block houses, agricultural areas, a *gallera*, a baseball field, and one aqueduct. In terms of public transport there is a small bus that goes all the way to San Cristobal during the week.

4.1.2 Vulnerabilities, Priorities and Achievements

Hurricane Noel was chosen, mainly because of the overflow of rivers and mudflows which caused loss of houses, and loss of agricultural productions. Table 4.1 presents the difficulties that followed its passage. It seems like what makes Santana vulnerable is a lack of diversity and redundancy, because so many essential services are lost, and a lack of connectivity because the locally available resources are not sufficient, and the geographical isolation prevents resources from reaching them.

Table 4.1 Vulnerabilities of Capitals after the Passage of Hurricane Noel

Social	Human	Natural	Financial	Physical
• No access to help • School closed for a long time (used as refuge) • Cessation of communitarian activities	• Untreatable health issues (infections, allergies, injuries) • Dengue propagation • Deaths	• Loss of soil • Water quality loss • Loss of agricultural production • Deforestation	• No money for food • Loss of products to sell • Difficulty to buy and sell products	• Damage to school • Damaged or lost houses • No electricity • No means of communication • No transport • No refuge • No access to locally or externally produced food

Participants mentioned have a very low capacity to absorb a disturbance because almost all infrastructures were lost. The capacity to recover is also low, because there are almost no resources available locally, because emergency interventions don't reach them, and because it took around six months to recover to a state similar to the one before the event. Since the event happened in October and the hurricane season starts in May, seven months later, the community would have had only one month to improve before the high risk of disturbance was back. The capacity to evolve is very limited because no improvements seem to be done by local institutions at their location and every year they are as vulnerable as they were previously.

In table 4.2 are presented the four resilience characteristics prioritized from most to least needed by the participants. Further analysis should be done to confirm these should be the actual priorities to build local resilience and not only what people require daily. Some participants may have seen the assessment as an occasion to discuss less critical needs. For example, untreatable infections, viruses and injuries were mentioned as problems encountered after the cyclone, but were not brought up as critical like access to water was. Access to food too, which seems critical from a survival point of view, was far behind in the votes. Still, resistant houses and access to clean water make sense in terms of capital vulnerabilities, and resistant streets also do in terms of connectivity to access resources from outside the village.

Table 4.2 Prioritized Resilience Characteristics and Level of Achievement in the Last 5 Years

Resilience characteristic		Achievement in the last 5 years	
1	**Access to health services**	Equal	The quality of the service got better, but the access is the same (a 45-minute ride on a precarious dirt road).
2	**Resistant houses**	Worse	The grand majority of houses are fragile and will be completely lost if a similar disturbance was to strike.
3	**Access to clean water**	Better	Slightly better with the aqueduct in lower Santana and with the interventions of the CEDAF.
4	**Resistant streets**	Worse	The state has been getting worse and it is more and more difficult to get from Los Cacaos to Santana.

4.1.3 Appreciation of Existing Services and Interventions

Most participants said the CEDAF has a good impact because of the more resistant agrosystems, the increased productivity of coffee, water quality improvement, soil conservation and the increase in forest cover. However, some participants mentioned that the CEDAF's activities concern coffee growers and their activities didn't impact community-wide resilience. Through agroforestry and reforestation, the CEDAF does a compromise between development and conservation. It keeps a part of the village active through nonrestrictive job offers (reforestation brigades) and an increase in production of the most popular livelihood in the village, which at the same time reduces soil and water loss. It even has a good carbon sequestration potential, which may prove useful for a compensation program. The activities develop the community economically through the participants and don't result in direct investment in community-wide critical needs. However, the CEDAF maintains the jobs of the coffee producers that were about to lose their livelihood to pests. It keeps them to a stable state of resilience instead of a degrading one. It also provides monthly workshops on topics related to resilience, which may increase the adaptive capacities. Moreover, agroforestry designs resist disturbances better, so it is safe to say their resilience has increased.

The ASOCAES is considered to provide partial resilience to the community. The majority agrees that it provides great services to its members, especially a good and stable income. However, it doesn't provide community-wide services, and membership is not available to all. One household mentioned it was evidently more resilient since the foundation of the association in 1979 and is now able to help other community members when they are in need (R. B. Geronimo, pers. comm., July 7, 2018). Resilience is achieved through both individual household and community-wide improvements. If some households are more resilient, they can assist more vulnerable ones, or at least they may require fewer resources when recovering from a disturbance, so the overall community resilience is certainly increased by the ASOCAES.

Other service providers have been mentioned as good throughout the assessment, but only by a few participants: the Ministry of Education, the MMARN (mainly for soil conservation), Elesur (electricity), and this assessment (for taking the time to listen to participants and trying to connect the stakeholders with them). Claro and Altice (for telecommunication service), and the municipality of Los Cacaos (for roads and water) are considered bad service providers that are not helping local resilience.

4.1.4 Characteristics and Strategies of the more Resilient Households

While these characteristics and strategies make households more resilient, none of the consulted households mentioned being able to cope better with a disturbance like hurricane Noel than any other. Out of the 17 elected by the community on an approximate total of 80 in the village, only 6 said they had coped slightly better than the rest but were still living the same difficulties. Therefore, the efficiency of these characteristics and strategies are only relative to local absorptive, adaptive and transformative capacities, not to a general state of climate resilience. Annex 7 presents the characteristics of the most resilient households, their relative efficiency and the impacts on resilience. Annex 8 presents the relative efficiency of the different strategies used by the households considered more resilient to attain resilience characteristics.

The characteristics with the highest efficiency are related to the principles of connectivity and diversity, which were previously identified as the principles lacking the most in the community. In this case, the mentioned social network extends outside of Santana, which gives access to capitals not available locally. In fact, all the characteristics related to connectivity improvement all scored 8 points or above. The characteristics related to diversity don't get similar scores because the SRC principle also includes redundancy. Coffee production is a redundant service and it is good for its own resilience, but participants didn't mention it provided more than financial capitals, which is not sufficient to provide community-wide resilience. In this sense, agricultural diversity seems to provide other types of capitals and a maybe less abundant but more stable income. It is also related to more knowledge capital and complex adaptive systems thinking, which were only found in characteristics scoring 7 points or above.

The most popular strategies unfortunately all scored 6 points or fewer, except for Participation in community development and values of cooperation. This shows that most households in Santana don't know how to build climate resilience and supports the statements of some participants regarding the poor absorptive, adaptive and transformative capacities of the community. In fact, most longer-term strategies are less popular than the ones with shorter-term outcomes even though they prove to be more efficient and to be the favourite of the most resilient households. In this case again, the two most efficient strategies are related to

the principle of connectivity. The third one is related to fostering complex adaptive systems thinking and to the management of slow variables. All these principles take time to build and for the case of Santana there is annually very little time to adapt and transform, and with the locally available capitals, it is hard for the inhabitants to have a long-term vision.

4.1.5 Resilience Pathways

Tables 4.3 presents the reasons stated by participants to explain the inability to build local resilience, and the associated underlying SRC principle. The first three ones were stated by almost all participants. This again supports that the biggest issue in Santana is its lack of connectivity and its lack of diversity and redundancy. Complex adaptive systems thinking can only be achieved through education and it is a human capital lacking in the community. This situation creates a positive feedback, because young or more educated people don't find work opportunities in the village and tend to migrate. For the ones who stay, annex 9 presents a matrix to understand the current pathways to resilience: which strategies lead to a characteristic, and which characteristics can be attained by a strategy. At least one household mentioned achieving better resilience through each pathway. However, there is no guarantee on the results because many factors can influence these pathways. It is possible that a strategy will not lead to the desired outcome, or that a characteristic can be achieved with a strategy that doesn't suggest a pathway.

Table 4.3 Mentioned Resilience Preventing Factors and Underlying Resilience Principles

Resilience preventing factor (from most to least mentioned)	Underlying SRC principle
People don't have enough money or resources	• Manage connectivity • Maintain diversity and redundancy • Foster complex adaptive systems thinking
Low human capital (old population, low employability, lack of knowledge or studies, bad health)	• Manage connectivity • Maintain diversity and redundancy • Encourage Learning
No employment	• Manage connectivity • Maintain diversity and redundancy • Encourage Learning • Foster complex adaptive systems thinking
Isolation	• Manage connectivity
No transport or too expensive ones	• Manage connectivity
Houses are bad	• Encourage Learning

Resilience preventing factor (from most to least mentioned)	Underlying SRC principle
	• Foster complex adaptive systems thinking • Manage slow variables and feedbacks
Lack of diversity of livelihood activities	• Maintain diversity and redundancy
Government is corrupted, promises of interventions only serve to get elected, and the state doesn't genuinely care	• Promote polycentric governance systems • Broaden participation
Events are intense and in succession, so it takes a lot of time to recover from them and it is not possible to progress	• Foster complex adaptive systems thinking • Manage slow variables and feedbacks

A successful combination of pathways has been mentioned with more certainty by some of the most resilient households. Participation in communitarian activities, secondary studies, and long-term thinking should allow to get a better social network, more diverse work, solider infrastructures and more autonomy. Some participants also mentioned the possibility to migrate to a more resilient area during a disturbance facilitated their progressive reintegration because they could secure some capitals. Having a house not too close to the river also proved to be less risky because heavy rainfall inevitably results in river flooding. The most efficient resilience pathways are all related to improved connectivity and access to a wider diversity of services. The fact that these last two principles are so strongly and repeatedly related proves one last time they should be the point of departure for resilience building in Santana.

4.2 REDD+ Potential

Given a good potential participation proven by previous projects and general communitarian solidarity, given the high interest to take part in new projects and the trust in the stakeholders, given the current usages of forest ecosystems that seem responsible and the perception of increasing quality, and given the current presence of mature activities in an area where drivers of DFD are diminished, where the principles from Peru are almost all respected, and where the specific type of project, agroforestry, is rated by Zambia as the most optimal for land use, Santana is considered to have an ideal potential to start a REDD+ initiative with the help of an external implementation organization.

4.2.1 Participation

In terms of social structure capacity, 91% think Santana can receive a REDD+ initiative, but they would need to be coordinated by an external organization instead of creating one locally and only having REDD+

committee representatives help them. There is no central governance body in Santana to gather everyone, and people feel they don't have sufficient knowledge to implement a proposed project and to organize the community around it (W. De La Cruz, pers comm., July 5, 2018; J. Batista Cabrera, pers. comm., July 6, 2018). It has been proposed to get help from the ASOCAES, and to slowly give Santana autonomy (R. B. Geronimo, pers. comm., July 7, 2018). Given the quality of their interventions, the CEDAF could be a good choice of implementing organization. In terms of availability, 97% think they have enough time to participate if the activities are similar to the ones conducted by the CEDAF. However, 79% say they do not have any resource to help with the development. This is due to the previously stated lack of employment, and to a desire to improve local living conditions. For the current state of collaboration in the community, 56% think that people act in solidarity and collaborate, and 59% think they can work in community-wide projects. This is supported by the fact that there is not a lot of work, and because people already take part in activities from the CEDAF, from the church and from reforestation brigades of the MMARN. As for Santana's participation in previous programs, the CEDAF keeps track of directly and indirectly impacted beneficiaries. On close to 1000 people, a direct involvement of more than 10% seems good, because the activities were only offered to identified coffee producers, and indirect beneficiaries are estimated to 730 people. (CEDAF, 2018) This means that a REDD+ project could very well involve more people if its scope was wider, and that the gains could spread easily and lead to even more involvement.

4.2.2 Interest

The interest for the REDD+ program and the trust in the current stakeholders of the national strategy were surprisingly high given that some participating institutions don't have a good reputation in the region. 94% of the respondents said they would trust the program to consider their resilience needs. 79% said they would want Santana to be involved, even if some projects in other countries didn't prove to help their host community, mainly because they think that, without projects from outside, the community will never develop. Some opinions were shared as to what would be important to maintain this trust:

- 53% need the project to show concrete interest and work for what the community needs without exploitation, with a guarantee to help and develop the community;
- 34% need the project to integrate the whole community (Santana Arriba and Abajo), which needs to clearly understand and accept and to be equally offered work;
- 29% need the implementation organization to be present locally or to have someone from the community represent the community in front of the other stakeholders;
- 29% need the project to give what was promised, and guarantees to be able to manage the project from star to end.

Some potential benefits were mentioned as what would be acceptable in exchange for a local REDD+ project, and they do not differ so much from what the resilience needs:

- Good streets and pathways (67%)
- Medical centre and access to health services (41%)
- Services and good treatment that help the whole community, namely the possibility for everyone to work (41%)
- Money (35%)
- *Pago de servicio ambiental*, payment for environmental service (a monetary compensation mechanism for the maintenance of environmental services present in other regions of the country as a pilot initiative to encourage conservation) (S. Teresa, pers. comm., July 20, 2018) (29 %)
- Public transport that goes all the way to the university in San Cristobal (26%)

4.2.3 Natural Capital

The most popular usages were: local food production for humans (71%); *leña*, firewood (62%); local construction wood (50%); agriculture to sell (41%); protection/conservation/reforestation/care (41%). As for the quality of the forest, 65% think it has been increasing in the last five years. They agree more care has been given to it, knowledge about its usefulness has increased, and successful reforestation and protection activities have been ongoing for a few years with the help of the CEDAF and the MMARN. Still, some think the forest is not being used properly by everyone, because of extending agricultural land and because of overusing the ecosystem services to a point of impossible recovery. It was also mentioned that cyclones are responsible for a faster degradation than the forest can recover from, and that the locally available resources are not sufficient to help the recovery. The main drivers of DFD identified in the preparation phase of the national strategy are well aligned with the drivers of DFD in Santana, namely the extraction of forest products like firewood, food for animals, and materials for construction. However, the most damageable, agricultural extensification, has not been identified as significant in Santana. The MMARN and the CEDAF help locally to prevent land use change and sustainable practices.

4.2.4 Similarity of Ongoing Activities to those Accepted by REDD+

In terms of the respect of the principles from Peru, the maturity of the FASD will allow it to be a solid and flexible base to build with. It will allow efficiency of the reduction of emissions (in this case sequestration) at a minimum cost. Equity is also being respected given the solidarity and the desire of equity mentioned as a condition of trust. The generation of co-benefits is undeniable in this case, with the increased productivity

of coffee, the creation of jobs, and the replenishment of underground water. In fact, the only principle that is not verifiable is the legality. This will depend on the country's ability to overcome the difficulties related to land ownership and law enforcement. In Zambia, agroforestry is rated as the most optimal land use practice. This type of system increases tree cover and carbon stocking, decreases agricultural extensification, reduces leakages by doing permaculture, is highly replicable and adaptable, provides a wider range of products beneficial for food security and income generation, enhances biodiversity, increases soil fertility and water conservation, and improves nutrient cycling.

5. RECOMMANDATIONS

Based on the results, four sets of recommendations are proposed. The first concerns Santana's resilience. The second discusses how to facilitate REDD+ registration and ensure its success The third puts in perspective how to design participative conservation. The last set is about corruption.

5.1 For Santana's Resilience

As it seems that most households don't have efficient strategies to build climate resilience, it is a critical priority to enhance the local knowledge on the issue. Households should have the priority to connect to within and outside the community, and enhance their social network to improve their knowledge and the diversity of services they have access to. Functional roads will help with geographical isolation, and phones and internet communications should be considered to improve the absorptive capacity and early response to natural disasters. To improve diversity and redundancy, a livelihood portfolio dissimilar to farming, such as seasonal tourism-related activities rather than alternative agricultural production, will provide greater response diversity and reduce the pressure on some parts of the system. The focus should not be made on the maximum efficiency of a single service, but on the constant ability to provide a diversity of services with less efficiency. (Biggs et al., 2014) A local organization representing Santana at the municipality of Los Cacaos should exist it should promote the needs of the inhabitants to any external entity interested in local intervention. It should coordinate the community, strengthen its bonds and insure a common focus.

Projects coming from outside may be seen as an opportunity of work and development, but the underlying objectives should be clearly understood, and fair conditions should be discussed before any participation, because these projects may not have local resilience needs into consideration. In fact, having a community that protects a capital is an amazing advantage if it doesn't alter it. In this manner, a community could be

kept from developing to minimize its impact, in exchange for a small compensation that feels necessary because of its state of vulnerability (Miller, 2012).

The FASD should prepare a strategy with its funders for a transition. There is no monitoring of autonomy regarding the local management capacities to maintain the water replenishment. Agricultural practices have changed, and sustainability knowledge has improved, but the community's resilience is still very weak. Another tropical storm could wipe the village with all the efforts that have been made, and the opportunity cost of doing conservation again may be questioned by the community if it needs resources for recovery. The FASD should make sure that the community is more resilient at the end of the project. It should question what will happen at project closure, what it wants to transition to, and how it will make the results last.

5.2 For a Successful Registration to REDD+

Further recommendations for the main challenges of REDD+ are presented here regarding the specific context of Santana and the transition from the FASD to REDD+ in 2020.

5.2.1 Overcoming the Main Difficulties

An environmental service user already pays for the extraction of a resource, but it should also pay for its replenishment, which represents more accurately a value that ensures a continuous use and quality. Increasing the value of resources may be risky but seems necessary to change the mentality behind current resource extraction practices and environmental service valuation. A longer term financing option for the REDD+ program in DR is the growth of regional compliance markets. However, these markets have proven to be less efficient and providing fewer co-benefits than national carbon taxes. (Parry, Veung and Heine, 2014; Working group on carbon pricing mechanisms, 2016)

Linking community monitoring to national measurement proves to be reliable, effective, economic, and even lead to more equitability. It specifically enhances ownership and motivation, and may densify carbon stock assessments. Community monitoring is especially recommended for assessing carbon stock changes. Degradation is often caused by inconsistent community uses of forest, and forest care is often the result of an improved, more aligned community management, which may be facilitated by a monitoring responsibility. (Centro de Investigaciones en Geografía Ambiental, Universidad Nacional Autonoma de México [CIGA-UNAM], 2012)

As for benefit distribution, the International Institute for Environment and Development proposes ten aspects to consider to design schemes that are equitable and benefit the poor.

11) "Communities should be consulted on whether they prefer to have benefits transferred to the entire community or directly to households.
12) Consider economic feasibility, local institutional capacity and governance structures before deciding whether to transfer benefits to communities as a whole or directly to households.
13) [Avoid disparity and consider] proportionality, equality and need.
14) In such unequal societies equitable benefit distribution could be achieved by systematically favouring the poor, such as landless and small landholders.
15) Projects should be designed to use the primary asset of the poor – their labour.
16) Whether to transfer cash or in-kind benefits should be based on a careful assessment of community preferences and the logistical and social consequences of each payment type.
17) An analysis of the availability and access to local markets should decide whether to provide cash or in-kind payments.
18) Consider whether the type of payment will have a negative impact on the local economy.
19) Where cash payments are made, some measures need to be taken to overcome inflationary pressures.
20) Project design needs to be flexible and include the periodic assessment by participants of their payment preferences." (Mohammed, 2012)

5.2.2 Transitioning with the FASD

As the FASD may finish in 2020, a transition or addition to REDD+ could be perfect, because the project holds a high potential. It would leave REDD+ the task to adapt those activities with the program's objectives, to give resources to help strengthen the initiative, and to additionally reward participants with community-wide resilience building investments based on results. Since the CEDAF is participating in the development of the national REDD+ strategy, and since it is aware of the context and is trusted in Santana, it may be the best choice of implementation organization. However, neither the community nor the CEDAF should settle for small, uncertain or unsustainably proven payments or rewards. The current pays for MMARN activities in Santana are quoted as insufficient to make a living by most participants. They still accept it because they have no other income opportunity, but it shouldn't be seen by managers as a way to fix low salaries. Decent rewards and resources will allow longer-term results and will generate resilience as a co-benefit.

5.3 Supporting Sustainable Environmental Responsibility

Integrating resilience improvement to environmental responsibility is unavoidable. If a community is in charge of maintaining or producing a service used by more than themselves, insuring the community's resilience is imperative for sustainable results. The community doesn't only need resources to conduct conservation activities, it needs to be able to thrive.

5.4 For Corruption

Cultural acceptability may be the source of this generalized issue. A single small action may prove inoffensive but has two less perceived indirect impacts. A resilient society fosters complex adaptive systems thinking, the components are part of the system and all actions have consequences on other components. Cumulated, all such actions have a bigger, longer-term impact. The resilience principle on the management of slow variables and feedbacks tries to avoid the accumulation of small disturbances that slowly bring the system in a state where getting rid of the problem is harder than what is required to prevent it. Minimizing the importance of small corruption actions promotes a culture of not caring for the greater good. Acceptability will lead to habit, and a harmful action will feel harmless. Dominicans have the reputation to "have a high tolerance for nepotism, often regarding it as a justified and expected activity of those with power and influence" (ITA, 2017). Throughout the discussions, five solutions were proposed by the contributors of this essay.

1. Make it unacceptable. When someone wants to or does commit such an act, question the actions and discuss the consequences mentioned above. It will make it less acceptable, and a social conscience may emerge. Corruption will be less comfortable if social bonds are at stake.
2. Teach children about it. The environmental movement is mainly supported by the younger, more sensitized generations. This should be true for corruption, which should not be taught as acceptable to children or adults. "Paradigms don't shift in 5 years, or 10, or 15, or 20. They are multi-generational processes. You need the previous generation, infected by the paradigm, to die, and then the people they taught, to die or retire, before the new order really comes through." (Elkington, 2018)
3. Report as much as possible. Structures exist to fight corruption effectively. Among NGOs: the Foundation for Institutionalization and Justice (FINJUS), the Citizen Participation (*Participación Ciudadana*), and the Dominican Alliance Against Corruption (ADOCCO). Among governmental agencies: *Procuraduría Especializada contra la Corrupción Administrativa* (PEPCA) and *Linea 311*.
4. Avoid shady or unclear processes and favour partnerships with transparent reporting platforms.
5. Commit to solving the issue and discuss and share the solutions.

CONCLUSION

The impacts and solutions to climate change have only just begun to surface. The Dominican Republic is in a precarious position and the necessity to adapt is forcing multilateral paradigm changes. REDD+ is the opportunity to bring new considerations to the management the Dominican society beyond natural resources, like justice, transparency and food production. Still, doubt resides as if the participating communities will benefit from this solution, and if the program will get long-lasting results given the challenges associated with sustainable funding, land tenure rights and a centralized state affected by systemic corruption.

The FASD is a very promising model involving private and public stakeholders from different sectors and scales. This partnership effectively managed decision-making, sharing responsibilities between pertinent action scales and expertise. Transparent reporting and regular consulting of partners allowed thoroughly thought reactions, and fast delivery of results. The objectives to improve agricultural production, to reduce its expansion, to reduce sedimentation, and to increase carbon stock were all met. The participating community gained resilience through a more stable income, more resistant plantations and an improved access to water. The only problems are the lack of community-wide resilience building investment and the uncertainty of the continuity once the donor's goal of water replenishment is reached in 2020.

REDD+ might hold the answer to the continuation and add the missing community-wide rewards. Current activities are compatible with the program. The inhabitants welcome an implementation organization, and are available to work. They hold a favourable prejudice and will gladly negotiate if REDD+ can demonstrate interest in the community and guarantee fair conditions and community development before the project starts. The natural capital is perceived as increasing because of conservation activities and the democratization of good practices. The local culture nurtures the integrity of natural ecosystems as a source of well-being and essential services.

For conservation activities to hold on results, the community in charge needs to be resilient. Santana is not. All types of capitals are at risk. Santana's absorptive, adaptive and transformative capacities are very limited. During an event like hurricane Noel, the village lost access to food, refuge, health services and potable water. It took six months to recover to a state as precarious as the one before the hurricane, and this can happen any year. The only significant improvements were brought by the FASD with consolidation of river banks, increase in forest cover, soil and water conservation, improved coffee productivity, and environmental management education.

The assessment inspired by the Stockholm Resilience Centre's theoretical principles and by the Community Based Resilience Analysis practical framework effectively delivered significant results. The four resilience priorities established (access to health, resistant houses, access to clean water, and resistant streets) should be considered by stakeholders as starting points in community-wide resilience or for monitoring. Improvement of connectivity and diversification of services are needed the most. Only 6 of the 80 households considered themselves only slightly more resilient than others. All identified resilience characteristics, strategies and pathways are therefore relative to the context and interventions are necessary to increase household and community resilience.

The most efficient characteristics point to higher connectivity and increased diversity of services. This is locally attained with a good social network and good relationships, and with a diversification of livelihood from agriculture. The most popular strategies reveal a significant lack of climate resilience knowledge. The most efficient strategies are also related to connectivity management and diversity and redundancy maintenance, which were identified as the principles lacking the most in the community. Participants think Santana is not resilient because it lacks financial and human capital, and because of isolation, which is consistent with the findings of the assessment. The pathways responsible for resilience pointed to an improvement in those capitals that came from more connectivity and diversity. A combination of participation in communitarian activities, secondary studies, and long-term thinking has been identified has the most successful pathway. A household should also try to prepare for hurricanes an imminent strike. The scale of disturbance puts most of a household's capitals at stake. A local governance organization would help to coordinate local needs with interventions for proper adaptation.

A successful REDD+ registration requires solid propositions on sustainable funding, on community engagement through monitoring, on project boundaries enforcement, and on fair benefit sharing. Santana's inhabitants require to be thoroughly consulted, to be treated with dignity and to be assured that an investment in community-wide resilience is done. A strategy for 2020 should be planned for a smooth transition from the FASD to either autonomy or another intervention like REDD+.

For corruption, cultural acceptability makes it hardly treatable in the short term. Discussing its unacceptability, teaching children about it, reporting cases, and avoiding shady processes must be done with consistency. Since it has been mentioned by most contributors to this assessment, the democratization of efforts could bring results faster than expected. Only general commitment to change is missing.

While there is no panacea for solving climate change, relying on resilience principles seems like a

sustainable solution. The meaning of these principles must be determined locally to allow empowerment and long-lasting results. The assessment shows it is imperative to stay connected and to cooperate and REDD+ has the advantage of connecting people and adapting solutions to the locality. It may not be efficient at all it tries to do, especially given the size of the challenge, but at least it pushes forward into changing the minds of the people involved. And that, involving a lot of people all around the world, is what we need

ANNEX 11: FRENCH EXECUTIVE SUMMARY

ÉVALUATION PARTICIPATIVE DE LA RÉSILIENCE CLIMATIQUE ET DU POTENTIEL D'UNE COMMUNAUTÉ POUR LE PROGRAMME REDD+ EN RÉPUBLIQUE DOMINICAINE

RÉSUMÉ FRANÇAIS

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Mots-clés : agroforesterie, adaptation, changement climatique, conservation, corruption, pays en développement, autonomisation, forêt, international, partenariat public-privé.

Pour s'adapter au changement climatique, la République dominicaine élabore sa stratégie nationale pour le programme REDD+. Un projet de conservation en cours, géré par le *Fondo Agua Santo Domingo* (FASD), a obtenu des résultats rapides, rentables compatibles avec les activités de REDD+. The *Ministerio de Medio Ambiente y Recursos Naturales* (MMARN) veut savoir comment ce dernier est géré et quel potentiel il a pour REDD+. Des préoccupations ont également été exprimées à savoir si le FASD ne visait que des objectifs fondés sur ceux de ses donateurs ou s'il visait également à améliorer la résilience de la communauté concernée, Santana. Étant donné que cette communauté a la responsabilité de maintenir un service écosystémique, une évaluation de sa résilience climatique permettrait aux participants de renforcer la résilience de leur communauté et de sensibiliser les organisations externes aux considérations locales de développement durable. La méthodologie, inspirée des principes du *Stockholm Resilience Centre* et du cadre pratique du *Community Based Resilience Assessment*, englobe les éléments les plus importants du renforcement de la résilience au moyen d'une évaluation de terrain qualitative et quantitative effectuée en groupes et en entretiens individuels.

Les résultats montrent que l'ampleur d'une perturbation de référence telle que l'ouragan Noel met en jeu la plupart des capitaux d'un ménage. Certaines voies existent localement pour améliorer la résilience des ménages, mais une aide extérieure est absolument nécessaire pour améliorer les capacités d'absorption, d'adaptation et de transformation à l'échelle de la communauté. Les interventions devraient être axées en priorité sur la gestion de la connectivité et le maintien de la diversité et de la redondance. Les membres de la communauté ont établi que l'accès aux services de santé, des maisons résistantes, l'accès à l'eau potable et des rues résistantes étaient leurs besoins les plus critiques en matière de résilience climatique. Un excellent potentiel pour REDD+ a été prouvé par la participation à des projets antérieurs, la solidarité communautaire, la confiance dans les parties prenantes, la qualité accrue du capital naturel et les critères respectés des activités au Pérou et en Zambie, selon lesquelles l'agroforesterie est la plus optimale pour l'utilisation des terres. Les recommandations proposées devraient améliorer la résilience de Santana, faciliter l'inscription à REDD+, mettre en perspective la conception de la conservation participative et aider à résoudre la corruption systémique. Le cas de Santana est commun à travers le monde, où fournir un service écosystémique devient la responsabilité d'une communauté vulnérable. Les priorités en matière de résilience établies devraient être considérées par les parties prenantes comme des points de départ pour le renforcement de la résilience à l'échelle de la communauté ou pour le suivi d'activités futures.

TABLE DES MATIÈRES

LISTE DES FIGURES ET DES TABLEAUX

LISTE DES ACRONYMES, DES SYMBOLES ET DES SIGLES

$PPP	Constante de parité de pouvoir d'achat de 2011
ALC	Amérique latine et caraïbe
ASOCAES	*Asoción de Caficultores la Esperanza*
CAASD	*Corporacion de Acueductos Y Alcantarillado de Santo Domingo* (Corporation d'aqueduc et d'égout de Santo Domingo)
CC	Changement climatique
CCNUCC	Convention-cadre des Nations Unies sur les changements climatiques
CEDAF	*Centro para el Desarrollo Agropecuario y Forestal* (Centre de développement agricole et forestier)
CoBRA	*Community-Based Resilience Analysis*
DDF	Déforestation et dégradation des forêts
DDG	Discussion de groupe
DOP	Pesos Dominicain (en juillet 2018, 1 dollar canadien valait 38,5 DOP)
ECORED	*Red Nacional de Apoyo Empresarial a la Proteccion Ambiental* (Réseau national de soutien aux entreprises pour la protection de l'environnement)
EIC	Entretien avec informateur clé
FASD	*Fondo Agua Santo Domingo*
FCPF	*Fondo Cooperativo para el Carbono de los Bosques*
GES	Gaz à effet de serre
gha	Hectare global
ha	Hectare (10 000 m^2)
IDH	Indice de développement humain
LAWFP	*Latin American Water Funds Partnership*
MMARN	*Ministerio de Medio Ambiente y Recursos Naturales* (ministère de l'Environnement et des Ressources naturelles)
ONE	*Oficina Nacional de Estadísticas* (Office national des statistiques)

RA	*Resilience Alliance*
REDD+	Réduction des émissions liées à la déforestation et à la dégradation des forêts et rôle de la conservation, de la gestion durable des forêts et du renforcement des stocks de carbone forestier dans les pays en développement
RD	République dominicaine
SND	Stratégie nationale de développement
SRC	*Stockholm Resilience Centre*
SSE	Système socioécologique
TNC	*The Nature Conservancy*

LEXIQUE

Capacité d'absorption	La capacité d'une communauté à réagir à un choc direct.
Capacité d'adaptation	« Les systèmes à forte capacité d'adaptation sont plus à même de se reconfigurer sans modifier de manière significative les fonctions cruciales ou les services écosystémiques. La perte de capacité d'adaptation a pour conséquence la perte d'opportunités et des options limitées pendant les périodes de réorganisation et de renouvellement. » (Tradution libre de Resilience Alliance, n.d.)
Systèmes adaptatifs complexes	« Une approche complexe des systèmes adaptatifs signifie s'éloigner de la pensée réductionniste et accepter que, dans un système socioécologique, plusieurs connexions se produisent simultanément à différents niveaux. En outre, la réflexion sur la complexité implique l'acceptation de l'imprévisibilité et de l'incertitude et la reconnaissance d'une multitude de points de vue. » (Tradution libre de Biggs et al., 2014)
Système socioécologique	« Les systèmes socioécologiques sont des systèmes complexes et intégrés dans lesquels les humains font partie de la nature. » (Tradution libre de Resilience Alliance, n.d.)
Capacité de transformation	La capacité d'un système à changer à l'échelle du système.

INTRODUCTION

En République dominicaine (RD), l'adaptation aux changements climatiques (CC) est mise en œuvre dans la stratégie de développement national la plus importante, parce que la vitesse des vents et la durée des cyclones tropicaux ont augmenté au cours des 30 dernières années (Emanuel, 2006). La réduction des émissions de gaz à effet de serre (GES) est largement discutée en tant que solution pour stabiliser le changement, mais ces gaz doivent également être séquestrés pour revenir à un état climatique moins perturbé. Une approche élargie de la gestion durable des événements perturbateurs s'appelle la résilience. La résilience climatique intègre la capacité à absorber une perturbation de la capacité à éviter ces perturbations. Pour lutter contre le changement climatique, s'y adapter et permettre aux pays les plus pauvres d'agir, le programme REDD+ a été élaboré il y a onze ans par la Convention-cadre des Nations Unies sur les changements climatiques (CCNUCC). Étant donné que le programme fournit les ressources nécessaires pour participer et la possibilité de réaliser des bénéfices sur les marchés du carbone, le gouvernement de la RD a décidé de commencer à élaborer sa propre stratégie nationale. Cela conduit à la formulation de trois objectifs principaux pour cette évaluation.

I. Un projet de conservation en, géré par le *Fondo Agua Santo Domingo* (FASD), a obtenu des résultats rapides et rentables. Le *Ministerio de Medio Ambiente y Recursos Naturales* (MMARN) veut savoir comment il est géré.
II. Le MMARN souhaite également connaitre le potentiel de ce projet pour REDD+.
III. Comme la communauté concernée, Santana, a la responsabilité de maintenir un service écosystémique, une évaluation de sa résilience climatique informera les parties prenantes de son état.

Des préoccupations sont exprimées comme si le FASD n'avait que des objectifs basés sur les donateurs ou s'il visait également à améliorer la résilience de Santana. L'essai analyse donc comment le FASD aide la communauté. Les résultats devraient encourager les parties prenantes à ajouter des objectifs clairs de développement communautaire ou de bien-être à leurs activités.

Ce résumé est composé de cinq chapitres. Le contexte permet de comprendre la situation socioécologique locale ainsi que les objectifs gouvernementaux. Ensuite, le FASD est exploré à la fois dans son histoire et dans ses implications pour la communauté. Le mécanisme de REDD+ est exploré pour comprendre les défis nationaux et les moyens possibles d'évaluer le potentiel d'un enregistrement hypothétique. Sur la base de principes théoriques, d'un cadre pratique et de critères REDD +, la méthodologie d'évaluation qui en résulte est expliquée. Les résultats analysent la perception de la communauté de sa résilience et les différentes voies

possibles pour l'atteindre. Les résultats du potentiel pour REDD+ analysent la compatibilité des activités actuelles, l'intérêt de la communauté, sa capacité à participer et sa perception de la qualité du capital naturel. Le dernier chapitre propose quatre séries de recommandations sur le renforcement de la résilience dans la communauté, les besoins pour un enregistrement REDD+ réussi, les préoccupations concernant la conception de projets de conservation participative et les solutions pour lutter contre la corruption de manière systémique.

1. MISE EN CONTEXTE

La communauté choisie pour cette évaluation s'appelle Santana et se situe dans le sous-bassin de la rivière Mahomita, dans la partie nord-est du bassin versant de la rivière Nizao. Il y a cinq ans, le *Latin American Water Funds Partnership* (LAWFP) a lancé le FASD pour protéger les étendues d'eau entourant la capitale. Santana s'est impliquée et un processus pour changer l'agriculture et l'utilisation des forêts a commencé.

1.1 Caractéristiques de la communauté

Santana fait partie de la municipalité de Los Cacaos, dans la province de San Cristóbal. Parmi les 80 ménages, 39 participent au projet *Microcuenca Mahomita* du FASD. Cette communauté, bien qu'isolée, est en phase avec son contexte national. Les cartes des annexes 1 et 2 aident à comprendre l'utilisation des terres dans la région.

1.1.1 Contexte du pays et stratégies nationales

La RD compte environ 10,3 millions d'habitants vivant à l'est de l'île d'Hispaniola, dans la mer des Caraïbes (Oficina Nacional de Estadísticas [ONE], 2018). Le seul pays voisin est Haïti. L'indice de développement humain de 0,722 de la RD indique que le pays est dans la catégorie de développement humain élevé. (United Nations Development Programme [UNDP], 2016) Le pays a connu l'une des plus fortes croissances économiques de l'Amérique latine et des Caraïbes (ALC) au cours des deux dernières décennies, principalement menée par les secteurs de la construction, de l'industrie manufacturière, du tourisme et de l'industrie minière (The World Bank, 2018). Malgré cette croissance, 28,9 % de la population vit encore sous le seuil national de pauvreté, ce qui signifie que les inégalités augmentent également (ONE, 2018). Comme 80,6 % de la population vit dans les villes, les secteurs secondaire et tertiaire constituent l'essentiel de l'activité économique. Seulement 5,5 % de l'activité économique est liée au secteur agricole. (Central Intelligence Agency, n.d.)

La RD a été l'un des premiers pays à avoir une stratégie de développement national (SDN) intégrant un développement économique compatible avec les CC. Le secteur forestier pourrait être transformé en puits de carbone net parce que ses émissions actuelles diminuent. Des efforts suffisants pourraient mener à la création de 15 000 nouveaux emplois et à l'acquisition de 35 millions USD de carbone par an en 2030, principalement par le biais de mécanismes tels que REDD+ et le mécanisme de développement propre. (Consejo Nacional para el Cambio Climático y el Mecanismo de Desarrollo Limpio [CNCCMDL], 2011) L'agriculture a été reconnue comme l'une des principales sources d'émissions de gaz à effet de serre (GES) et de pollution dans le pays. Les efforts se concentrent sur l'arrêt de son expansion et le déplacement de petits agriculteurs pour le reboisement. (CNCCMDL, 2011) Par conséquent, tout projet présentant un potentiel pour ces programmes, comme celui de Santana, peut présenter un grand intérêt pour l'État.

1.1.2 Contexte socioécologique spécifique de Santana

Le sous-bassin Mahomita a une superficie de 11 460,13 ha. Les sols conviennent aux forêts, distincts par leur robustesse, leur profondeur et leur topographie abrupte. (Segura, 2014; MMARN, 2017a) Les conditions sont idéales pour faire pousser le café, car il nécessite un bon drainage, entre 550 m et 1 100 m d'altitude (Santana se situe entre 300 m et 1 300 m) et une température comprise entre 15 ^{o}C et 24 ^{o}C (Santana moyenne annuelle entre 21 ^{o}C et 24 ^{o}C). (Centro para el Desarrollo Agropecuario y Forestal [CEDAF], 2014b; Diby, L., Kahia, J., Kouamé, C., et Aynekulu, E., 2017; MMARN, 2017a) Les pluies abondantes provoquent une floraison presque continue du café, qui se traduit par deux saisons de récolte par an. (Coffee Research Institute, 2006) L'utilisation potentielle des terres pour l'agroforesterie est de 4 286 ha. 5 148 ha sont classés en zone protégée et 565 ha en usage forestier. (Segura, 2014) L'agriculture est à la base des activités économiques de la région, en particulier le café. (Segura, 2014; G. Morales, conversation, 11 mai 2018)

Le village de Santana fait partie de la municipalité de Los Cacaos, mais 25 km plus loin sur le chemin de terre sinueux. Le bassin de Mahomita a le plus haut pourcentage de pauvreté de la municipalité, à 81,8 %. (Segura, 2014) Les connaissances agricoles y sont transmises des parents aux enfants par le travail et viennent rarement de l'extérieur ou d'études. (R. B. Geronimo, conv., 26 juin 2018) Quelques statistiques sociales d'intérêt sur Santana sont présentées dans le tableau 1.1.

Tableau 1.1 Statistiques sur Santana (Tiré de : CEDAF, 2014a; ONE, 2016)

Conditions de vie	
Ménages de matériaux précaires, principalement organiques	74 %
Ménages ayant accès à des moyens de transport	59 %
Population utilisant du bois pour cuisiner	88 %
Population recevant de l'eau potable en tant que service	60 % (18 % de cette eau provient de puits ou d'aqueducs et 57 % provient de cours d'eau ou d'étangs)
Technologie et communication	
Ménages avec un téléphone portable ou une ligne fixe	46,6 %
Ménages avec une connexion internet	0,9 %
Ménages avec radio et/ou télévision	58 %
Éducation	
Population ayant terminé ses études primaires	65 %
Taux d'analphabétisme	27,9 % « Il est rare de rencontrer des personnes capables de lire ou d'écrire. » (G. Morales, conv., 11 mai 2018)
Activité économique	
Population économiquement active	63 %, dont 73 % travaillent dans l'agriculture, 12 % dans le commerce et 15 % dans d'autres activités
Revenu mensuel moyen	5 000 DOP
Population considérée capable de travailler	79,2 %
Priorités de dépenses	Alimentation, santé et éducation
Santé	
Population déclarant une difficulté ou une limitation permanente	6 %
Population déclarant des maladies	35 %
Terre et ressources naturelles	
Population possédant des terres ou des droits à la terre	50 %
Population avec des cultures affectées par une peste	54 % (31 % utilise des méthodes de lutte)
Population ayant reçu une assistance technique agricole	34 %
Population ayant reboisé	56 %

En termes de participation aux activités de le FASD, 57 % des habitants ont participé aux campagnes de reboisement de 2013 et 53 % des producteurs agricoles réalisent des activités de conservation dans leurs exploitations. 85 % comprennent que la capacité de production du sol a diminué et que la conservation est nécessaire. (CEDAF, 2014a) L'institution locale la plus importante est l'*Asociación de Caficultores la Esperanza* (ASOCAES). À Santana, 16 ménages sont membres. L'ASOCAES agit comme point d'entrée des initiatives externes et comme facilitateur clé du développement pour la communauté. (R. B. Geronimo, conv., 26 juin 2018)

1.1.3 Pressions

La croissance de la population mondiale et nationale augmente la pression sur les forêts et les terres agricoles, avec une demande accrue en nourriture, en infrastructures et en énergie (Department of Economic and Social Affairs of the United Nations [DESA], 2015). L'augmentation de la productivité des terres cultivées existantes représentera une partie de l'offre, mais l'expansion de l'agriculture continuera d'être un facteur majeur de déforestation et de dégradation des forêts (DDF). (United Nations Environment Programme [UNEP], 2017). À Santana, les principales pressions sont le commerce du bois, l'expansion de l'agriculture et la production de charbon de bois (G. Morales, conv., 11 mai 2018).

La localisation géographique d'Hispaniola place la RD dans une situation particulièrement vulnérable vis-à-vis les CC. D'ici 2050, la température annuelle moyenne devrait augmenter de 1 à 2 °C, entraînant une intensification du cycle hydrologique. Les événements météorologiques extrêmes seront plus susceptibles de se produire de 30 % entre mai et octobre. Après 2050, la saison sèche (de décembre à avril) pourrait s'intensifier et les précipitations annuelles totales devraient diminuer de 15 %. De plus, on peut s'attendre à une augmentation de plusieurs maladies à transmission vectorielle en fonction de l'évolution de la température et des précipitations. Les mesures d'adaptation sont devenues une priorité pour le gouvernement depuis 2011. Même si les actions se multiplient, des résultats concrets ne seront peut-être pas attendus bientôt, puisque la SDN et le Plan national d'adaptation aux changements climatiques visent à terminer les études, plans, politiques et lois associées d'ici 2030. (MMARN, 2017c) Déjà aujourd'hui pour Santana, les inondations, les tremblements de terre et la pénurie d'eau sont à risque moyen, ce qui signifie que la planification, la conception et la construction du projet devraient prendre en compte le risque dans les 10 prochaines années. (Global Facility for Disaster Reduction and Recovery [GFDRR], 2017) En ce qui concerne l'accès à l'eau, il existe un stress inhérent dans tout le pays, notamment lié à la consommation humaine. Les inondations urbaines, les cyclones et les incendies de forêt sont à des niveaux élevés, ce qui

signifie qu'il y a plus de 50 % de chances de rencontrer un danger susceptible d'entraîner à la fois des pertes de vie et des pertes de biens au cours d'une année donnée. (GFDRR, 2017)

La dernière pression a été régulièrement évoquée par les collaborateurs de cette évaluation : la corruption. Selon des enquêtes, la RD est le deuxième pays le plus corrompu de la région ALC, juste après le Mexique (Transparency International, 2017). Les impacts négatifs mentionnés sont les suivants : ralentissement des processus politiques; expansion du clivage social; allocation de financement inefficace manque de cohérence entre les objectifs et les décisions, et possibilité de se soustraire à des obligations grâce à des pots-de-vin; manque de sérieux dans le travail et efforts inutiles consacrés aux apparences; favoritisme, opportunités manquées et instabilité de l'emploi; violence, intimidation, peur ou obligation d'agir; peur de dénoncer. (K. Rodriguez, conv., 16 mai 2018; G. Morales, conv., 11 mai 2018; C. Ortiz, conv., 21 mai 2018; M. Rodriguez, conv., 19 mai 2018; L. Solano, conv., 11 mai 2018; L. Rojas, conv., 27 mai 2018)

1.2 Historique du projet *Microcuenca Mahomita*

La problématique principale derrière le projet dans le sous-bassin Mahomita est la dégradation des sols due à l'érosion. Elle a été mise en évidence par l'état de sédimentation du réservoir Aguacate et par la production amoindrie de la centrale hydroélectrique Aguacate et la diminution de la disponibilité de l'eau dans tous les établissements humains tributaires du bassin versant de Nizao, y compris la capitale Santo Domingo. Dans le cadre de l'initiative LAWFP, le FASD a été créé pour trouver une solution et a nommé le *Centro para el Desarrollo Agropecuario y Forestal* (CEDAF) l'organisme responsable de l'implémentation. (G. Morales, conv., 11 mai 2018) Trois rivières fournissent de l'hydroélectricité et de l'eau propre à Santo Domingo : Ozama, Haina et Nizao. La dernière fournit plus de 30 % de la consommation d'eau de Santo Domingo, représente un potentiel de production hydroélectrique d'environ 200 MW et une source de plus de 50 % de la production nationale d'agrégats pour la construction (Díaz González et Florián, 2011).

Jusqu'en novembre 2015, les actions de conservation comprenaient le reboisement avec des systèmes de café et de plantes indigènes. Les propriétaires de parcelles ont été encouragés à planter de la banane avec lu café pour empêcher la détérioration du sol pendant la croissance de plus grands arbres. Cette approche devrait garantir la permanence du couvert forestier et le maintien des pratiques qui favorisent la productivité et durabilité des cultures et ainsi de meilleurs revenus. Le projet implique maintenant 39 parcelles dans tout le sous-bassin et a aidé à la conservation des sols, au reboisement et à la restauration écologique riveraine. (CEDAF, 2018; G. Morales, conv., 11 mai 2018) Le CEDAF a également aidé les participants avec un accompagnement continu, de la formation et des ateliers. (CEDAF, 2018; V. A. Matias, courriel, 15 mai

2018) Il n'y a pas de reproduction ou de fin planifiée au projet. L'engagement de Bepensa et de Coca-Cola est de financer les activités jusqu'à ce que le renouvellement des eaux souterraines soit aussi important que leur utilisation annuelle. (CEDAF, 2018; G. Morales, conv., 11 mai 2018; C. Garcia, conv., 19 juin 2018)

1.3 Gouvernance

Le LAWFP est géré par The Nature Conservancy (TNC), en tant que moyen de collecter des fonds dans le but spécifique de préserver les terres des bassins versants. Il a créé le FASD pour rassembler les acteurs locaux des secteurs public, privé et des ONG et leur fournir une assistance technique et financière. Le financement initial est effectué par TNC, l'*Inter-American Development Bank*, le *Global Environmental Facility* et la Fondation Femsa. Le financement d'opération provient de Coca-Cola et de Bepensa, son entreprise d'embouteillage en RD. Les décisions concernant la vision, la politique et les stratégies sont prises chaque année en assemblées. Un audit externe est effectué pour certifier la responsabilité financière. (C. Garcia, conv., 19 juin 2018) Le CEDAF reçoit ses ressources par le biais de TNC et leur rend compte. TNC fait ensuite rapport aux autres partenaires via le portail du LAWFP. (J. Segura, courriel, 14 mai 2018) L'acquisition de terres et la conservation des forêts sont effectuées par le CEDAF. Les ressources humaines nécessaires sont embauchées localement. L'entretien et l'établissement des plantations de café sont assurés par les membres de la communauté. Le reboisement étant effectué sur chaque parcelle participante, la gestion d'une part déterminée est confiée au CEDAF en échange des ressources nécessaires à la plantation de café. (G. Morales, conv., 11 mai 2018).

2. LA STRATÉGIE NATIONALE REDD+

Les activités de conservation à Santana étant liées au reboisement et à l'agroforesterie, elles pourraient être reproduites dans d'autres communautés en tant que modèle de séquestration du carbone rentable pour REDD+. Le programme et son processus d'inscription seront donc présentés, ainsi que des modèles de Zambie et du Pérou avant de discuter des défis à envisager.

2.1 Présentation du programme REDD+

La CCNUCC a lancé REDD+ dans le but de réduire les émissions de GES, de lutter contre les CC et d'offrir aux pays en développement la possibilité de remettre en question la gestion de leurs écosystèmes forestiers. C'est une solution holistique qui assure une gestion durable des ressources et un développement économique, qui sont constamment en conflit dans le monde globalisé. En termes simples, REDD+ finance

des initiatives et récompense des projets en fonction de leurs résultats. Chaque pays participant développe une stratégie personnalisée et crée des plans d'action pour les domaines prioritaires. Des projets sont créés avec des exécutants locaux et diverses évaluations sont effectuées pour calculer les avantages potentiels. Différents éléments sont nécessaires pour recevoir des paiements : une stratégie nationale, des niveaux de référence nationaux, un système de suivi national éprouvé et transparent et un système d'information sur la manière dont les garanties sont respectées tout au long de la mise en œuvre. La soumission des résultats est de la responsabilité des pays participants et les paiements ne sont effectués qu'après vérification. (Ministry of the Environment of Brazil, 2016) Étant donné que REDD+ est un programme rigoureux, il devient facile de soumettre des rapports aux organisations qui génèrent des crédits carbone qui peuvent ensuite être vendus sur des marchés de compensation volontaire. Le programme REDD+ est extrêmement complexe, en particulier parce qu'il doit être intégré dans presque tous les ministères d'un pays, parce que le mécanisme de partage des avantages est compliqué à adapter de manière équitable à tous les projets et que le nombre de parties prenantes et parce que les étapes nécessaires pour parvenir à un paiement basé sur les résultats sont nombreuses. Après 11 ans, les résultats sont encore difficiles à cerner pour certains participants et le processus est encore lent. Du point de vue des CC, REDD+ s'est concrétisé dans 29 pays et, à ce jour, il s'agit du plus grand effort de conservation international jamais réalisé. (Enrici et Hubacek, 2018; Mwangi, 2015)

2.2 Processus d'enregistrement d'un projet

La RD devrait avoir terminé la rédaction de la première version de la stratégie d'ici 2019 et tous les accords devraient être signés par toutes les parties d'ici 2020 (P. Garcia Brito, conv., 21 mai 2018). La valeur de REDD+ a été reconnue par les nombreux défis importants auxquels elle est confrontée lors de sa mise en œuvre. Principalement, le pays devra résoudre les faiblesses et les lacunes concernant le régime foncier et les droits du carbone, ainsi que le manque d'ordre territorial, l'absence de loi forestière sectorielle, un État administratif centralisé, un manque de base scientifique pour le suivi et la normalisation des pratiques et de grandes difficultés dans la gestion des incitations. (Fondo Cooperativo para el Carbono de los Bosques [FCPF], 2015)

Alimentées par la croissance démographique, la pauvreté et les inégalités sociales, les causes nationales sous-jacentes à la DDF sont principalement dues à quatre facteurs qui influencent le comportement des acteurs :

- Les coûts d'opportunité déterminent souvent les processus de changement d'utilisation des terres, car il est difficile de générer des revenus durables grâce à l'exploitation des forêts;

- L'insécurité et l'incertitude liées à la propriété foncière et aux droits d'utilisation ralentissent les investissements dans la gestion des forêts et des ressources naturelles;
- Les politiques fiscales et de développement ayant des effets indésirables sur la gestion durable des forêts, en particulier les subventions perverses;
- L'absence de potentiel dissuasif de la réglementation en raison de lacunes dans les normes et procédures et la faible capacité de l'État à appliquer les mécanismes d'administration, de surveillance et de contrôle des ressources. (FCPF, 2015).

Le pilote *Yaque del Norte* a été choisi comme premier modèle de gestion pour tester le mécanisme de partage des bénéfices *Pago de Servicio Ambiental*, soit le paiement pour services environnementaux. Le projet pilote est également utilisé pour adapter les processus techniques et administratifs à la stratégie nationale et pour concevoir un cadre de suivi. (FCPF, 2015; S. Teresa, conv., 20 juillet 2018)

2.3 Modèle de critères nationaux : Zambie et Pérou

La vérification du potentiel d'un projet d'agroforesterie n'est pas possible, car les exigences doivent encore être définies. Néanmoins, l'équipe de développement de la stratégie REDD+ utilise d'autres stratégies comme modèles, à savoir celles de la Zambie et du Pérou. Pour le Pérou, le premier principe est l'efficacité de la réduction des émissions. La mesure de l'efficacité comprend des facteurs externes tels que la viabilité politique et le degré d'engagement au niveau national. Le deuxième principe est l'efficacité, qui réfère à la réduction des émissions réalisée à un coût minimum. Le principe suivant est l'équité : la réduction des émissions est réalisée de manière équitable et éthique. Cela concerne la participation, la répartition équitable des avantages et des coûts et la transparence du projet. Le quatrième principe est la génération de cobénéfices pour les parties prenantes. Ceux-ci ne sont pas obligatoires, mais sont considérés comme cruciaux pour le succès et la pérennité d'un projet. Le dernier principe est la légalité : les droits et les exigences juridiques du projet à travers la caractérisation, l'analyse et l'application du cadre juridique. (Rendón Thompson et al., 2009) En Zambie, le potentiel d'un système agroforestier peut être évalué par une appréciation préliminaire. L'agroforesterie est considérée comme la pratique optimale en matière d'utilisation des terres ou de sa gestion et présente un potentiel élevé pour REDD+. Les attributs clés sont présentés à la figure 2.1. Dans la figure, SFM signifie *Sustainable Forest Management*.

SFM Criteria	REDD+ Criteria
Optimization of land resource utilization	Compatibility with other livelihood activities
Forest ecosystem health and vitality	Co-benefits
Maintenance and enhancement of forest resources and contribution to global carbon cycles	Replicability
Maintenance and enhancement of protective FM functions (notably soil and water)	Governance
Maintenance and enhancement of forest resources and their contribution to global carbon cycles	Opportunity costs

Figure 2.1 Principaux attributs des projets d'agroforesterie pour REDD+ (tiré de : Kokwe et Mickels-Kokwe, 2012)

2.4 Défis potentiels et solutions

Les critiques majeures sur le mécanisme REDD+ constituent le premier défi pour une mise en œuvre, car certaines parties prenantes peuvent être tentées de se dissocier du processus, limitant la participation. Les préoccupations sont légitimes. Comment la stratégie REDD+ adaptera-t-elle la vision internationale, les objectifs nationaux et les réalités locales? REDD+ offrira-t-il les avantages promis? Pourquoi ne le ferait-il pas et comment s'assurer qu'il le fasse de manière équitable? Et comme les projets mettent beaucoup de temps à se concrétiser, le mécanisme REDD+ est-il stable? (C. Garcia, conv., 19 juin 2018; Enrici et Hubacek, 2018)

Financement. En Indonésie, « le processus d'obtention d'un financement suffisant et à long terme est l'un des défis les plus fréquemment mentionnés [...] en raison du contraste frappant entre certaines perceptions initiales de grandes opportunités de financement parmi certaines parties prenantes et l'absence de financement réelle » (traduction libre de Enrici et Hubacek, 2018). La restauration d'écosystème est un processus à long terme et le plan d'affaires doit indiquer clairement comment générer des revenus suffisants pour les opérations pendant toute la durée du projet et même au-delà. Lors de la Conférence des Parties en 2015, il a été reconnu que les marchés du carbone ne sont pas suffisamment développés et ne peuvent pas fournir un financement accessible suffisant aux efforts d'atténuation des CC. (Johannsdottir et McInerney, 2016). La viabilité financière devrait donc passer par des organisations de donateurs disposées à offrir un financement substantiel. (Enrici et Hubacek, 2018)

Engagement communautaire. L'engagement équitable d'une communauté garantit l'efficacité à long terme du projet. Informer rapidement les parties prenantes est une pratique courante pour une bonne acceptabilité et un engagement social, mais cela peut également entraîner de la fatigue en cas de manque de

progrès perçu. (Enrici et Hubacek, 2018) Le mécanisme REDD+ n'est pas suffisamment tangible et humain pour être communiqué tel quel et pour être bien compris, notamment par des petits exploitants peu éduqués. (C. Garcia, conv., 19 juin 2018; R. Díaz de Medina, conv., 5 juin 2018) Une bonne solution pour éviter cette situation est une approche de gestion collaborative qui aide à développer une relation de travail solide. Cela améliorera grandement l'engagement et la satisfaction de la communauté et contribuera à une répartition équitable des avantages. (Enrici et Hubacek, 2018)

Application des limites et du suivi des projets. Le soutien des autorités locales pour l'empiètement des frontières peut être très utile. Une utilisation peu claire ou conditionnelle doit être spécifiquement résolue, car le financement axé sur les résultats exige des détenteurs de droits stables et légitimes pendant toute la durée du projet. Les autorités corrompues ou les influences exercées par des intérêts commerciaux maintenant le statu quo doivent être évitées et retirées du projet par une autre autorité plus puissante qui ne peut être achetée avec des pots-de-vin. Les comités sous-régionaux multisectoriels devraient être habilités à agir et ouverts à examiner des cas spécifiques. (Enrici et Hubacek, 2018; Sunderlin et al., 2014) Le suivi fait par la communauté s'est avéré suffisamment précis et rentable tout en renforçant l'engagement. Il pourrait être combiné avec la télédétection, car c'est le moyen le plus rapide de mesurer les variations des stocks de carbone. Les méthodologies de suivi pourraient être inspirées du *Community, Climate and Biodiversity Standard*, qui évalue la durabilité environnementale et économique et qui est compatible avec le *Voluntary Carbon Standard* pour les marchés du carbone. Des pratiques de suivi normalisées et vérifiables sont essentielles pour garantir l'acheminement efficace des fonds dans ce contexte. (Enrici et Hubacek, 2018)

Quantification de la séquestration du carbone et de la préservation de la biodiversité. Tous les types de forêts et d'écosystèmes doivent être intégrés dans le suivi, même les moins séquestrant. Les tourbières, par exemple, peuvent jouer un rôle important dans la séquestration du carbone et la diversité des paysages peut améliorer la productivité globale. Avoir une agence indépendante pour effectuer l'audit peut être préférable pour assurer la qualité et la certitude. (Enrici et Hubacek, 2018)

3. MÉTHODOLOGIE D'ÉVALUATION

La méthodologie ci-présente cherche à englober les éléments les plus importants du renforcement de la résilience à travers une évaluation de terrain qualitative et quantitative réalisée en groupes et en entretiens individuels. Le cadre théorique sert d'angle d'analyse des résultats. Le *Community Based Resilience*

Assessment (CoBRA) a été choisi comme source d'inspiration pour ses qualités pratiques et sa rentabilité. La méthodologie comporte donc des phases auxquelles ont été ajoutés des indicateurs du potentiel REDD+.

3.1 Cadre théorique de la résilience

La résilience d'un système socioécologique (SSE) est sa capacité à résister aux perturbations et à maintenir sa structure et ses fonctions. Puisque les sociétés humaines font partie du monde naturel et dépendent des services écosystémiques, la résilience lie étroitement les interactions entre les domaines social et écologique. Le niveau de résilience dépend de la manière dont le système peut s'auto-organiser, apprendre et s'adapter. Une perturbation déclenche une certaine réponse dans une ou plusieurs composantes, ce qui peut les amener à dépasser un seuil, et le changement d'état peut être plus facile dans un sens que dans l'autre. (Biggs, Schlüter et Schoon, 2014; Resilience Alliance [RA], n.d.) Une grande variété de facteurs influence la résilience et le Stockholm Resilience Center (SRC) les a regroupés en sept principes qui sont maintenant largement utilisés dans la littérature.

Maintenir la diversité et la redondance. Les composantes d'un SSE ont des fonctions et des capacités différentes. Elles traitent les perturbations de différentes manières et s'offrent mutuellement différentes options pour répondre au changement. La redondance est plutôt une police d'assurance, de sorte que si une composante cesse son activité, d'autres avec une fonction similaire peuvent compenser et continuer à fournir la fonction. La diversité des réponses des composantes avec des fonctions qui se chevauchent à différentes échelles réduit le risque d'effondrement du système. (Biggs et al., 2014)

Gérer la connectivité. La structure détermine la capacité de transfert, que ce soit une ressource, des êtres vivants ou des lieux. Un haut niveau de connectivité peut faciliter une reprise ou empêcher un changement, mais il peut également permettre une propagation plus rapide des perturbations. Une connectivité limitée peut donc constituer un obstacle. (Biggs et al., 2014)

Gérer les variables lentes et les rétroactions. De nombreuses variables influencent les connexions, la nature des interactions et la qualité des composantes. Pour les rétroactions, en amortir certaines peut aider à réduire, prévenir ou éliminer les perturbations. Celles-ci peuvent être cependant conduire à la création de nouveaux retours et connexions, modifiant la distribution de services écosystémiques. La rétroaction positive se nourrit elle-même, dans une boucle d'autorenforcement. (Biggs et al., 2014)

Favoriser la réflexion sur les systèmes adaptatifs complexes. Les SSE sont des systèmes ouverts, complexes, interactifs et évolutifs, dont la compréhension de la dynamique et des structures n'est que partielle. Plus nous sommes conscients de cette complexité, plus nous sommes enclins à agir efficacement en fonction de nos objectifs. (Biggs et al., 2014)

Encourager l'apprentissage. Comprendre l'état du système est essentiel pour prendre des décisions. Pour améliorer le partage d'informations et les connaissances, la cogestion adaptative et la gouvernance adaptative permettent aux différentes parties prenantes de partager leurs connaissances à différentes échelles. Ces approches renforcent la coopération et le développement de nouvelles normes sociales, car l'apprentissage collaboratif change la perspective des parties prenantes sur leur système. (Biggs et al., 2014) Selon la théorie des points de levier pour intervenir dans un système, le partage des connaissances serait le moyen le plus efficace d'améliorer la durabilité d'un système (Meadows, 1999).

Élargir la participation. L'engagement actif renforce les liens des parties prenantes et renforce leur confiance mutuelle. Les actions prises collectivement rapprochent les composantes les unes des autres en améliorant la résolution des problèmes, le support et la diversité des réponses. (Biggs et al., 2014)

Promouvoir des systèmes de gouvernance polycentriques. La gouvernance polycentrique intègre les normes et les règles à différentes échelles et composantes. Cela donne plus de puissance à l'entité la mieux adaptée pour agir au bon moment et à la bonne échelle pour faire face aux changements. Les connaissances spécifiques sont plus valorisées, ce qui augmente également leurs chances d'être partagées et ses propriétaires de participer, ce qui augmente la connectivité et la diversité de réponse. (Biggs et al., 2014)

3.2 Inspiration de cadre pratique : CoBRA

Le *Community Based Resilience Analysis* (CoBRA) est une méthodologie d'évaluation mise au point par le Programme des Nations Unies pour le développement afin d'évaluer l'état de la résilience aux catastrophes et d'orienter dans la même direction les différentes mesures prises pour renforcer la résilience de quatre manières :

- Identifier les caractéristiques prioritaires de la résilience aux catastrophes pour une communauté;
- Évaluer l'atteinte de ces caractéristiques par la communauté au moment de l'évaluation (généralement effectuée pendant une période « normale ») et pendant la dernière crise ou catastrophe;
- Identifier les caractéristiques et les stratégies des ménages résilients aux catastrophes;

- Identifier les interventions ou services les mieux notés dans la construction de la résilience aux catastrophes locales. » (Traduction libre de UNDP, 2014a).

CoBRA établit des niveaux de résilience de référence entre les ménages pour développer des indicateurs quantitatifs et identifie les facteurs qui ont un impact sur le renforcement de la résilience « grâce à des approches qualitatives participatives, à savoir des discussions de groupe (DDG) et des entretiens avec des informateurs clés (EIC) » (traduction libre de UNDP, 2014a). Le suivi de ces indicateurs permet de déterminer si les ménages sont sur une voie résiliente ou vulnérable. (UNDP, 2014a) Cela permet à la communauté de définir la résilience au lieu de se faire imposer une vision, ce qui est essentiel au renforcement de la résilience. Cette vision se caractérise également par les réalisations réelles des ménages résilients existants. Cela apporte une contribution utile à la planification stratégique avec les points de vue des communautés, les problèmes clés et l'efficacité des interventions. De plus, CoBRA est facile à réaliser partout et nécessite peu d'expertise technique. (UNDP, 2014b) CoBRA a également ses limites. Il ne fournit pas de mesure quantitative autonome de la résilience pour comparer les réalisations entre différentes communautés. Et il n'évalue pas les programmes individuels même si les organisations devraient savoir comment leurs programmes affectent la résilience. (UNDP, 2014b)

3.3 Méthode d'évaluation résultante

L'évaluation a deux objectifs principaux : analyser la résilience de Santana et évaluer son potentiel pour REDD+. L'évaluation devrait également permettre aux participants de renforcer la résilience de leur communauté et de sensibiliser les organisations externes aux considérations locales en matière de développement durable.

La nécessité a été confirmée par la communauté lors d'un atelier d'adaptation aux CC mené par le CEDAF en mai 2018. Ils ont remarqué sa pertinence, puisqu'elle ne provient pas d'une institution gouvernementale, car elle est organisée par un étranger à la vision neutre et parce qu'elle complète les activités de conservation en cours avec des considérations liées au développement durable et à l'adaptation aux CC.

La deuxième phase concerne l'adaptation de la méthode au contexte de la communauté. Les limites doivent être déterminées pour concevoir une évaluation réalisable en temps opportun. Cela nécessite la connaissance des ressources humaines, financières, infrastructurelles et temporelles disponibles, ainsi que la disponibilité des membres de la communauté. En fonction des données recueillies lors de la phase de recherche initiale, des vulnérabilités hypothétiques ont été identifiées.

La troisième phase ne se produit qu'en DDG et les décisions sont prises à majorité ou par consensus. Cette phase participative commence par demander aux membres de définir leur communauté, son contenu et ses limites. Ensuite, une discussion a lieu sur la définition de la résilience. Le groupe est invité à voter sur l'événement le plus dévastateur et c'est à celui-ci que nous essaierons de renforcer la résilience. Les difficultés mentionnées lors de l'événement sont ensuite transformées en déclarations positives, par exemple en changeant le « manque de refuge » en « accès à un refuge ». Le groupe est invité à hiérarchiser ces nouvelles caractéristiques de renforcement de la résilience. La réalisation de ces caractéristiques au cours des cinq dernières années sera décidée par le biais de votes. Après, les participants seront invités à dire quels services et interventions contribuent à la résilience. Enfin, tous les ménages ayant un niveau de résilience plus élevé doivent être identifiés pour la phase 4.

Au cours de la phase 4, les entretiens sont semi-structurés, avec des questions précises et des réponses ouvertes. À la fin d'une discussion, nous devrions être en mesure de comprendre quels facteurs ont rendu le ménage plus ou moins résilient.

À la fin de la phase 5, nous devrions avoir quatre sections de résultats claires pour aider à comprendre le renforcement de la résilience locale. Les indicateurs doivent être intégrés aux activités de suivi actuelles pour que les parties prenantes travaillent sur des objectifs communs au niveau des ménages et de la communauté.

1) Contexte : la communauté, les menaces et les vulnérabilités.
2) Définition de la résilience locale : priorités de renforcement et facteurs de résilience des ménages.
3) État de résilience : atteinte des caractéristiques et appréciation des services et interventions existants.
4) Actions pour renforcer la résilience : voies possibles pour obtenir des caractéristiques et recommandations et indicateurs pour renforcer la résilience.

3.4 Indicateurs de potentiel pour REDD+

Comme toute activité à laquelle une communauté décide de participer, le facteur d'intérêt est la première chose à évaluer. Pour cela, la communauté a besoin de connaitre les avantages de sa participation et devrait faire confiance aux entités responsables de l'activité. Le deuxième aspect fondamental à considérer est la capacité de participer. Les gens doivent être disponibles, avoir une structure autour de laquelle s'organiser et être quelque peu habitués à collaborer. Le dernier aspect à considérer est la qualité du capital naturel, car

il sera directement récompensé. Les définitions exactes et les questionnaires sont présentés dans les annexes 5 et 6.

4. RÉSULTATS ET ANALYSE

L'évaluation a conduit à deux séries de résultats. La première concerne l'état actuel de la résilience de la communauté et analyse des voies à suivre en fonction des capacités actuelles. La seconde série sert à vérifier le potentiel préliminaire pour le programme REDD+ en fonction de la participation, de l'intérêt, du capital naturel et de la conformité aux critères REDD+.

4.1 État de résilience de Santana

En considérant ses capacités et ses vulnérabilités, Santana n'est actuellement pas une communauté résiliente. Certaines voies existent pour améliorer la résilience des ménages, mais une aide extérieure est absolument nécessaire pour améliorer les capacités d'absorption, d'adaptation et de transformation à l'échelle de la communauté. Le FASD et le MMARN aident tous deux lentement, mais les interventions les plus nécessaires doivent être liées en priorité aux principes de la gestion de la connectivité et du maintien de la diversité et de la redondance. Autrement, les membres de la communauté ont établi que l'accès aux services de santé, des maisons résistantes, l'accès à l'eau potable et des rues résistantes étaient leurs besoins les plus critiques pour être en mesure de faire face à un événement aussi perturbateur que l'ouragan Noel.

4.1.1 Définition de la communauté

Santana est séparée en deux parties : Santana *Arriba*, Santana supérieur, et Santana *Abajo*, Santana inférieur. Santana Arriba n'a pas accès à la plupart des services présents à Santana Abajo. D'octobre à février, c'est la saison froide et de février à octobre, c'est la saison chaude. La saison des pluies et des ouragans s'étend de juin à novembre. Les capitaux naturels mentionnés sont les forêts, les pâturages, les zones protégées et les terres agricoles destinées à la production de café, fruits de la passion, avocat, citron, maïs, manioc, pomme de terre, banane, haricot, citrouille, arbres et bétail. Les capitaux sociaux mentionnés sont l'ASOCAES, deux écoles primaires, une église, une dizaine de *colmados*, quelques *bancas*, une association de voisins et la Société des parents et amis de l'école élémentaire de Santana Abajo. Le capital humain est composé de 70 à 80 ménages d'environ sept personnes chacun. Les jeunes sont réputés émigrer en raison du manque d'emplois, des ressources limitées et du peu de services et d'institutions publics. En termes de capital économique, l'agriculture est le moyen de subsistance le plus courant. Il existe également quelques

services tertiaires et un groupe d'épargne commune à l'ASOCAES. Le capital physique est défini par les écoles, l'église, la rue de Santana Abajo, des maisons en bois et en blocs, des zones agricoles, une *gallera*, un terrain de baseball et un aqueduc. En ce qui concerne les transports en commun, il y a un petit bus qui va jusqu'à San Cristobal pendant la semaine.

4.1.2 Vulnérabilités, priorités et réalisations

L'ouragan Noel a été choisi principalement en raison du débordement des rivières et des coulées de boue qui ont entraîné la perte de maisons et la perte de productions agricoles. Il semble que ce qui rend Santana vulnérable soit le manque de diversité et de redondance, car de nombreux services essentiels sont perdus, et un manque de connectivité, car les ressources disponibles localement ne sont pas suffisantes et l'isolement géographique empêche les ressources de les atteindre.

Les participants ont mentionné une très faible capacité à absorber une perturbation, car presque toutes les infrastructures ont été perdues. La capacité de récupération est également faible, car il n'y a presque pas de ressources disponibles localement, car les interventions d'urgence ne les atteignent pas, et parce qu'il a fallu environ six mois pour retrouver un état similaire à celui d'avant l'événement. Comme l'événement a eu lieu en octobre et que la saison des ouragans débute en mai, sept mois plus tard, la communauté n'aurait eu qu'un mois pour s'améliorer avant que le risque élevé de perturbation ne soit de retour. La capacité d'évolution est très limitée, car aucune amélioration ne semble être réalisée par les institutions locales sur leur site et chaque année elles sont aussi vulnérables qu'auparavant.

Le tableau 4.2 présente les quatre caractéristiques de résilience classées par ordre de priorité, du plus nécessaire au moins nécessaire pour les participants. Une analyse plus approfondie devrait être effectuée pour confirmer que ces priorités constituent les véritables priorités pour renforcer la résilience locale et pas seulement ce dont les gens ont besoin quotidiennement. Certains participants ont peut-être vu l'évaluation comme une occasion de discuter de besoins moins critiques. Par exemple, les infections, les virus et les blessures ont été cités comme des problèmes rencontrés après le cyclone, mais ils n'ont pas été jugés aussi critiques que l'accès à l'eau. L'accès à la nourriture, qui semble critique du point de vue de la survie, était très loin dans les votes. Néanmoins, les maisons résistantes et l'accès à l'eau potable sont pertinents compte tenu de la vulnérabilité des capitaux, et les rues résistantes ont également un impact sur la connectivité pour accéder aux ressources extérieures au village.

Tableau 4.1 Caractéristiques prioritaires de la résilience et niveau d'atteinte au cours des cinq dernières années

Caractéristique de résilience		Atteinte au cours des 5 dernières années	
1	**Accès aux services de santé**	Égale	La qualité du service s'est améliorée, mais l'accès est le même (trajet de 45 minutes sur un chemin de terre précaire).
2	**Maisons résistantes**	Pire	La grande majorité des maisons sont fragiles et seront complètement perdues si une perturbation similaire venait à frapper.
3	**Accès à l'eau potable**	Meilleure	Un peu mieux avec l'aqueduc de Santana inférieur et avec les interventions du CEDAF.
4	**Rues résistantes**	Pire	L'état s'aggrave et il est de plus en plus difficile de se rendre de Los Cacaos à Santana.

4.1.3 Appréciation des services et interventions existants

La plupart des participants ont déclaré que le CEDAF avait un bon impact en raison de la plus grande résistance des agrosystèmes, de la productivité accrue du café, de l'amélioration de la qualité de l'eau, de la conservation des sols et de la couverture forestière. Cependant, certains participants ont mentionné que les activités du CEDAF concernent uniquement les caféiculteurs et que leurs activités n'ont pas eu d'impact sur la résilience à l'échelle de la communauté. À travers l'agroforesterie et le reboisement, le CEDAF fait un compromis entre développement et conservation. Il maintient une partie du village active grâce à des offres d'emploi non restrictives (brigades de reboisement) et à une augmentation de la production du moyen de subsistance le plus populaire dans le village, ce qui réduit en même temps les pertes de sol et d'eau. Il a même un bon potentiel de séquestration du carbone, ce qui peut s'avérer utile pour un programme de compensation. Les activités développent la communauté sur le plan économique grâce aux participants et n'aboutissent pas à un investissement direct dans les besoins critiques de la communauté. Cependant, le CEDAF maintient les emplois des producteurs de café sur le point de perdre leurs moyens de subsistance. Cela les maintient dans un état de résilience stable plutôt que dégradant. Il propose également des ateliers mensuels sur des sujets liés à la résilience et susceptibles d'accroître les capacités d'adaptation. De plus, les modèles d'agroforesterie résistent mieux aux perturbations. On peut donc dire que leur résilience a augmenté.

L'ASOCAES est considéré comme fournissant une résilience partielle à la communauté. La majorité est d'accord pour dire qu'elle fournit d'excellents services à ses membres, en particulier un revenu stable et de qualité. Toutefois, il ne fournit pas de services à l'échelle de la communauté et l'adhésion n'est pas accessible à tous. Un ménage a mentionné qu'il était manifestement plus résilient depuis la fondation de

l'association en 1979 et qu'il est maintenant capable d'aider d'autres membres de la communauté quand ils en ont besoin. (R. B. Geronimo, conv., 7 juillet 2018). La résilience est obtenue grâce à des améliorations individuelles au niveau des ménages et de la communauté. Si certains ménages sont plus résilients, ils peuvent aider les plus vulnérables, ou du moins ils ont besoin de moins de ressources pour se remettre d'une perturbation, de sorte que la résilience communautaire globale est certainement accrue par l'ASOCAES.

D'autres prestataires de services ont été mentionnés comme bons pendant l'évaluation, mais seulement par quelques participants : le ministère de l'éducation, le MMARN (principalement pour la conservation des sols), Elesur (électricité) et cette évaluation (pour prendre le temps d'écouter les participants) et essayer de connecter les parties prenantes avec eux. Claro et Altice (pour le service de télécommunication) et la municipalité de Los Cacaos (pour les routes et l'eau) sont considérés comme de mauvais prestataires de services qui ne contribuent pas à la résilience locale.

4.1.4 Caractéristiques et stratégies des ménages les plus résilients

Bien que ces caractéristiques et stratégies rendent les ménages plus résilients, aucun des ménages consultés n'a mentionné être capable de mieux faire face à une perturbation telle que l'ouragan Noel qu'un autre. Sur les 17 choisis par la communauté sur un total approximatif de 80 dans le village, seulement 6 ont déclaré avoir fait un peu mieux que les autres, mais vivaient sensiblement les mêmes difficultés. Par conséquent, l'efficacité de ces caractéristiques et stratégies ne concerne que les capacités d'absorption, d'adaptation et de transformation locales, et non pas un état général de résilience climatique. L'annexe 7 présente les caractéristiques des ménages les plus résilients, leur efficacité relative et les impacts sur la résilience. L'annexe 8 présente l'efficacité relative des différentes stratégies utilisées par les ménages considérés comme plus résilients pour atteindre les caractéristiques de résilience.

Les caractéristiques les plus efficaces sont liées aux principes de connectivité et de diversité, qui étaient auparavant identifiés comme les principes les moins présents dans la communauté. Dans ce cas, le réseau social mentionné s'étend en dehors de Santana, ce qui donne accès à des capitaux non disponibles localement. En fait, toutes les caractéristiques liées à l'amélioration de la connectivité ont toutes obtenu 8 points ou plus. Les caractéristiques liées à la diversité n'obtiennent pas les mêmes scores, car le principe du SRC inclut également la redondance. La production de café est un service redondant, ce qui est bon pour sa propre résilience, mais les participants n'ont pas mentionné qu'il fournissait plus que des capitaux financiers, ce qui ne suffit pas à assurer une résilience à l'échelle de la communauté. En ce sens, la diversité agricole semble fournir d'autres types de capitaux et un revenu peut-être moins abondant, mais plus stable.

Elle est également liée à davantage de capital de connaissances et à une réflexion complexe sur les systèmes adaptatifs, qui ne se retrouvent que dans les caractéristiques ayant obtenu 7 points ou plus.

Malheureusement, les stratégies les plus populaires ont toutes obtenu 6 points ou moins, sauf pour la participation au développement communautaire et les valeurs de coopération. Cela montre que la plupart des ménages à Santana ne savent pas comment construire une résilience climatique et soutient les déclarations de certains participants concernant les faibles capacités d'absorption, d'adaptation et de transformation de la communauté. En fait, la plupart des stratégies à plus long terme sont moins populaires que celles qui ont des résultats à court terme, même si elles s'avèrent plus efficaces et sont les favorites des ménages les plus résilients. Dans ce cas encore, les deux stratégies les plus efficaces sont liées au principe de connectivité. La troisième est liée à l'encouragement de la pensée en systèmes adaptatifs complexes et à la gestion des variables lentes. Tous ces principes prennent du temps à se construire et, dans le cas de Santana, il y a chaque année très peu de temps pour s'adapter et transformer. Avec les capitaux disponibles localement, il est aussi difficile pour les habitants d'avoir une vision à long terme.

4.1.5 Voies vers résilience

Le tableau 4.3 présente les raisons invoquées par les participants pour expliquer l'incapacité de renforcer la résilience locale et les principes du SRC associés. Les trois premiers ont été déclarés par presque tous les participants. Cela confirme encore une fois que le plus gros problème de Santana est son manque de connectivité et son manque de diversité et de redondance. La pensée des systèmes adaptatifs complexe ne peut être atteinte que par le biais de l'éducation et c'est un capital humain qui fait défaut dans la communauté. Cette situation crée une boucle de rétroaction positive, car les jeunes ou les personnes plus instruites ne trouvent pas de possibilités d'emploi dans le village et ont tendance à migrer. Pour ceux qui restent, l'annexe 9 présente une matrice pour comprendre les voies actuelles de la résilience : quelles stratégies conduisent à une caractéristique et quelles caractéristiques peuvent être atteintes par une stratégie. Au moins un ménage a mentionné avoir atteint une meilleure résilience par chaque voie. Cependant, les résultats ne sont pas garantis, car de nombreux facteurs peuvent influencer ces voies. Il est possible qu'une stratégie n'aboutisse pas au résultat souhaité ou qu'une caractéristique puisse être atteinte avec une stratégie qui ne suggère pas une voie.

Tableau 4.3 Facteurs de prévention de la résilience mentionnés et principes sous-jacents

Facteur de prévention de la résilience (du plus au moins mentionné)	Principes du SRC sous-jacents
Les gens n'ont pas assez d'argent ou de ressources	• Gérer la connectivité • Maintenir la diversité et la redondance • Favoriser la réflexion sur les systèmes adaptatifs complexes
Faible capital humain (population âgée, faible aptitude à l'emploi, manque de connaissances ou d'études, mauvaise santé)	• Gérer la connectivité • Maintenir la diversité et la redondance • Encourager l'apprentissage
Pas d'emploi	• Gérer la connectivité • Maintenir la diversité et la redondance • Encourager l'apprentissage • Favoriser la réflexion sur les systèmes adaptatifs complexes
Isolation	• Gérer la connectivité
Pas de transport ou trop cher	• Gérer la connectivité
Les maisons sont mauvaises	• Encourager l'apprentissage • Favoriser la réflexion sur les systèmes adaptatifs complexes • Gérer les variables lentes et les rétroactions
Manque de diversité des activités de subsistance	• Maintenir la diversité et la redondance
Le gouvernement est corrompu, les promesses d'interventions ne servent qu'à être élu, et l'État ne se soucie pas vraiment de Santana	• Promouvoir des systèmes de gouvernance polycentriques • Élargir la participation
Les événements sont intenses et successifs, il faut donc beaucoup de temps pour s'en remettre et il est impossible de progresser	• Favoriser la réflexion sur les systèmes adaptatifs complexes • Gérer les variables lentes et les rétroactions

Une combinaison réussie de voies a été mentionnée avec plus de certitude par certains des ménages les plus résilients. La participation à des activités communautaires, des études secondaires et une réflexion à long terme devraient permettre d'améliorer le réseau social, de diversifier le travail, de renforcer les infrastructures et d'accroître l'autonomie. Certains participants ont également mentionné que la possibilité de migrer vers une zone plus résiliente pendant une perturbation facilitait leur réintégration progressive, car ils pouvaient sécuriser certains capitaux. Avoir une maison pas trop près de la rivière s'est également avérée moins risqué, car les fortes précipitations entraînent inévitablement des inondations. Les voies de résilience les plus efficaces sont toutes liées à l'amélioration de la connectivité et à l'accès à une plus grande diversité de services. Le fait que ces deux derniers principes soient reliés étroitement et à maintes reprises prouve une dernière fois qu'ils devraient être le point de départ d'un renforcement de la résilience à Santana.

4.2 Potentiel pour REDD+

Compte tenu d'une bonne participation potentielle prouvée par des projets antérieurs et la solidarité communautaire générale, étant donné le grand intérêt de participer à de nouveaux projets et la confiance envers les parties prenantes, compte tenu des usages actuels des écosystèmes forestiers qui semblent responsables et la perception d'une qualité croissante, et compte tenu de la présence actuelle d'activités matures dans une région où les facteurs de DDF sont amoindris, où les principes du Pérou sont presque tous respectés et où le type de projet spécifique, l'agroforesterie, est classé par la Zambie comme étant le plus optimal pour l'utilisation des terres, Santana est considéré comme ayant le potentiel idéal pour lancer une initiative REDD+ avec l'aide d'une organisation de mise en œuvre externe.

4.2.1 Participation

En termes de capacité de structure sociale, 91 % pensent que Santana peut recevoir une initiative REDD+, mais qu'elle devrait être coordonnée par une organisation externe au lieu d'en créer une localement et que seuls les représentants des comités REDD+ les aident. Il n'y a pas d'organe de gouvernance central à Santana pour rassembler tout le monde et les gens ont le sentiment de ne pas avoir suffisamment de connaissances pour mettre en œuvre un projet proposé. (W. De La Cruz, conv., 5 juillet 2018; J. Batista Cabrera, conv., 6 juillet 2018). Il a été proposé d'obtenir de l'aide de l'ASOCAES et de donner lentement son autonomie à Santana. (R. B. Geronimo, conv., 7 juillet 2018). Compte tenu de la qualité de ses interventions, le CEDAF pourrait constituer un bon choix d'organisme se mise en œuvre. En termes de disponibilité, 97 % des habitants pensent avoir suffisamment de temps pour participer si les activités sont similaires à celles menées par le CEDAF. Cependant, 79 % déclarent ne pas avoir de ressources pour aider au développement. Cela est dû au manque d'emploi mentionné plus tôt et à la volonté d'améliorer les conditions de vie locales. Pour l'état actuel de la collaboration au sein de la communauté, 56 % pensent que les gens agissent de manière solidaire et collaborent et 59 % pensent qu'ils peuvent travailler ensemble dans des projets communautaires. Ceci est soutenu par le fait qu'il n'y a pas beaucoup de travail et parce que les gens participent déjà aux activités du CEDAF, de l'église et des brigades de reboisement du MMARN. Quant à la participation de Santana à des programmes précédents, le CEDAF suit les bénéficiaires directement et indirectement touchés. Sur près de 1000 personnes, une implication directe de plus de 10 % semble prometteuse, car les activités ne sont proposées qu'aux producteurs de café identifiés et les bénéficiaires indirects sont estimés à 730 personnes. (CEDAF, 2018) Cela signifie qu'un projet REDD+ pourrait très bien impliquer davantage de personnes si son champ d'application était plus large et les gains pourraient se propager facilement et entraîner une implication encore plus grande.

4.2.2 Intérêt

L'intérêt pour le programme REDD+ et la confiance dans les acteurs actuels de la stratégie nationale ont été étonnamment élevés étant donné que certaines institutions participantes n'ont pas une bonne réputation dans la région. 94 % des répondants ont déclaré qu'ils feraient confiance au programme pour prendre en compte leurs besoins de résilience. 79 % ont déclaré qu'ils souhaiteraient que Santana soit impliqué, même si certains projets dans d'autres pays n'avaient pas aidé leur communauté d'accueil, principalement parce qu'ils pensent que sans projets extérieurs la communauté ne se développera jamais. Certains avis ont été partagés sur ce qui serait important pour maintenir cette confiance :

- 53 % ont besoin que le projet démontre un intérêt concret, qu'il travaille à l'atteinte des objectifs sans exploitation et qu'il garantisse de l'aide au développement de la communauté;
- 34 % ont besoin que le projet intègre l'ensemble de la communauté (Santana Arriba et Abajo), qu'il soit clairement compris et accepté et qu'il offre le travail également;
- 29 % ont besoin que l'organisation de mise en œuvre soit présente localement ou que quelqu'un de la communauté représente la communauté devant les autres parties prenantes;
- 29 % ont besoin que le projet donne ce qui a été promis et qu'il garantisse pouvoir être géré du début à la fin.

Certains avantages potentiels ont été mentionnés comme ce qui serait acceptable en échange d'un projet REDD+ local et ceux-ci ne diffèrent pas beaucoup des besoins de résilience :

- De bonnes rues et de bons sentiers (67 %);
- Un centre médical et un accès aux services de santé (41 %);
- Des services et un bon traitement qui aident toute la communauté, incluant la possibilité pour tout le monde de travailler (41 %);
- De l'argent (35 %);
- *Pago de servicio ambiental*, soit des paiements pour services environnementaux (mécanisme de compensation monétaire pour le maintien des services environnementaux présents dans d'autres régions du pays en tant qu'initiative pilote pour encourager la conservation) (S. Teresa, conv., 20 juillet 2018) (29 %);
- Des transports en commun qui vont jusqu'à l'université de San Cristobal (26 %).

4.2.3 Capital naturel

Les usages les plus populaires étaient : la production alimentaire locale pour les humains (71 %); *leña*, le bois pour cuisiner (62 %); bois de construction local (50 %); agriculture à vendre (41 %); protection/conservation/reboisement/soins (41 %). En ce qui concerne la qualité de la forêt, 65 % pensent qu'elle a augmenté au cours des cinq dernières années. Ils conviennent que plus d'attention lui a été accordée, la connaissance de son utilité a augmenté et des activités de reboisement et de protection réussies sont en cours depuis quelques années avec l'aide du CEDAF et du MMARN. Pourtant, certains pensent que la forêt n'est pas utilisée correctement par tous, en raison de l'extension des terres agricoles et de la surexploitation des services écosystémiques à un point de rétablissement impossible. Il a également été mentionné que les cyclones sont responsables d'une dégradation plus rapide que celle à laquelle la forêt se remet et que les ressources disponibles localement ne sont pas suffisantes pour aider à la récupération. Les principaux moteurs de DDF identifiés lors de la phase de préparation de la stratégie nationale sont bien alignés sur les moteurs du DDF à Santana, à savoir l'extraction de produits forestiers tels que le bois pour cuisiner, les aliments pour animaux et les matériaux de construction. Cependant, l'extensification agricole n'a pas été identifiée comme significative à Santana. Le MMARN et le CEDAF aident localement à prévenir les changements d'utilisation des terres et à adopter des pratiques durables.

4.2.4 Similarités des activités en cours par rapport à celles acceptées par REDD+

En ce qui concerne le respect des principes du Pérou, la maturité du FASD lui permettra d'être une base solide et flexible. Cela permettra une réduction efficace des émissions (dans ce cas, la séquestration) à un coût minimum. L'équité est également respectée étant donné la solidarité et le désir d'équité mentionnés comme condition de confiance. La génération de co-bénéfices est indéniable dans ce cas, avec l'augmentation de la productivité du café, la création d'emplois et le réapprovisionnement des eaux souterraines. En fait, le seul principe non vérifiable est la légalité. Cela dépendra de la capacité du pays à surmonter les difficultés liées à la propriété foncière et à l'application des lois. En Zambie, l'agroforesterie est considérée comme la pratique d'utilisation des sols la plus optimale. Ce type de système augmente le couvert forestier et le stockage du carbone, réduit l'extensification agricole, réduit les fuites en faisant de la permaculture, est hautement reproductible et adaptable, fournit une gamme plus large de produits bénéfiques pour la sécurité alimentaire et la génération de revenus, améliore la biodiversité et améliore le cycle des nutriments.

5. RECOMMANDATIONS

En fonction des résultats, quatre séries de recommandations sont proposées. La première concerne la résilience de Santana. La seconde discute de la manière de faciliter l'enregistrement à REDD+ et assurer son succès. La troisième met en perspective la conception de la conservation participative. La dernière série aborde la corruption systémique.

5.1 Pour la résilience de Santana

Comme il semble que la plupart des ménages n'ont pas de stratégies efficaces pour renforcer la résilience climatique, il est essentiel d'améliorer les connaissances locales sur la question. Les ménages devraient avoir la priorité de se connecter à l'intérieur et à l'extérieur de la communauté et améliorer leur réseau social pour améliorer leurs connaissances et la diversité des services auxquels ils ont accès. Des routes fonctionnelles diminueraient l'isolement géographique. Des téléphones et l'accès à internet devraient être considérés pour améliorer la capacité d'absorption et la réponse rapide aux catastrophes naturelles. Pour améliorer la diversité et la redondance, un portefeuille de moyens de subsistance différent de l'agriculture, comme les activités touristiques saisonnières plutôt que la production agricole alternative, offrira une plus grande diversité de réponses et réduira la pression sur certaines parties du système. L'accent ne devrait pas être mis sur l'efficacité maximale d'un service unique, mais sur la capacité constante à fournir une diversité de services avec une efficacité moindre. (Biggs et al., 2014) Une organisation locale représentant Santana à la municipalité de Los Cacaos devrait exister pour promouvoir les besoins des habitants auprès de toute entité externe intéressée par une intervention locale. Elle devrait coordonner la communauté, renforcer ses liens et assurer un objectif commun.

Les projets provenant de l'extérieur peuvent être considérés comme une opportunité de travail et de développement, mais les objectifs sous-jacents doivent être clairement compris et des conditions équitables doivent être discutées avant toute participation, car ces projets peuvent ne pas considérer les besoins de résilience locale. En fait, avoir une communauté qui protège un capital est un avantage extraordinaire si elle ne l'altère pas. De cette manière, une communauté pourrait être empêchée de se développer pour minimiser son impact, en échange d'une petite compensation qui semble nécessaire en raison de son état de vulnérabilité. (Miller, 2012)

Le FASD devrait élaborer une stratégie avec ses bailleurs de fonds pour une transition. Il n'y a pas de suivi de l'autonomie en ce qui concerne les capacités de gestion locales pour maintenir le réapprovisionnement en eau. Les pratiques agricoles ont changé et les connaissances sur la durabilité se sont améliorées, mais la

résilience de la communauté est encore très faible. Une autre tempête tropicale pourrait lessiver le village avec tous les efforts déployés. Le coût d'opportunité de la conservation pourrait alors être remis en question par la communauté si elle a rapidement besoin de ressources pour son rétablissement. Le FASD doit s'assurer que la communauté soit plus résiliente à la fin du projet. Il devrait s'interroger sur ce qui se passera à la clôture du projet, sur la manière dont il souhaite effectuer la transition et comment cela fera durer les résultats.

5.2 Pour une inscription réussie à REDD+

D'autres recommandations concernant les principaux défis de REDD+ sont présentées ici selon le contexte spécifique de Santana et la transition du FASD à REDD+ en 2020.

5.2.1 Surmonter les difficultés principales

Un utilisateur de service environnemental paie déjà pour l'extraction d'une ressource, mais il devrait également payer pour son réapprovisionnement. Cela représente plus précisément une valeur qui garantit un usage et une qualité continus. Augmenter la valeur des ressources peut être risqué, mais semble nécessaire pour changer la mentalité derrière les pratiques actuelles d'extraction des ressources et de marchandisation des services environnementaux. Une option de financement à plus long terme pour le programme REDD+ en RD est la croissance de marchés régionaux de conformité. Cependant, ces marchés se sont révélés moins efficaces et moins avantageux que les taxes nationales sur le carbone. (Parry, Veung et Heine, 2014; Working group on carbon pricing mechanisms, 2016)

Lier un suivi assuré par la communauté à la mesure nationale s'avère fiable, efficace, économique et même plus équitable. Cela renforce spécifiquement la propriété et la motivation et peut densifier les évaluations des stocks de carbone. Cette approche est particulièrement recommandée pour évaluer les variations des stocks de carbone. La dégradation est souvent causée par des utilisations incohérentes des forêts et les soins résultent souvent d'une gestion communautaire améliorée et mieux alignée qui peut être facilitée par une responsabilité de suivi. (Centro de Investigaciones en Geografía Ambiental, Universidad Nacional Autonoma de México [CIGA-UNAM], 2012)

En ce qui concerne la distribution des avantages, l'*International Institute for Environment and Development* propose dix aspects à prendre en compte pour concevoir des projets équitables et bénéfiques aux pauvres.

1) « Les communautés doivent être consultées pour savoir si elles préfèrent transférer des avantages à l'ensemble de la communauté ou directement aux ménages.
2) Considérer la faisabilité économique, la capacité institutionnelle locale et les structures de gouvernance avant de décider de transférer ou non les bénéfices aux communautés dans leur ensemble ou directement aux ménages.
3) [Évitez les disparités et considérez] la proportionnalité, l'égalité et le besoin.
4) Dans des sociétés aussi inégales, une distribution équitable des avantages pourrait être obtenue en privilégiant systématiquement les pauvres, tels que les paysans sans terre et les petits propriétaires terriens.
5) Les projets doivent être conçus pour utiliser le principal atout des pauvres, soit leur travail.
6) Le transfert d'avantages en espèces ou en biens et services devrait se fonder sur une évaluation minutieuse des préférences de la communauté et des conséquences logistiques et sociales de chaque type de paiement.
7) Une analyse de la disponibilité et d'accès aux marchés locaux devrait décider s'il faut fournir des paiements en espèces ou en biens et services.
8) Déterminer si le type de paiement aura un impact négatif sur l'économie locale.
9) Lorsque des paiements en espèces sont effectués, certaines mesures doivent être prises pour surmonter les pressions inflationnistes.
10) La conception du projet doit être flexible et inclure l'évaluation périodique par les participants de leurs préférences de paiement. » (Traduction libre de Mohammed, 2012)

5.2.2 Transition avec le FASD

Comme le FASD pourrait se terminer en 2020, une transition ou un ajout à REDD+ pourrait être idéal, car le projet a un potentiel élevé. Il incomberait à REDD+ d'adapter ces activités aux objectifs du programme, de donner des ressources pour renforcer l'initiative et de récompenser les participants avec des investissements de renforcement de la résilience à l'échelle de la communauté basés sur les résultats possiblement rétroactifs. Étant donné que le CEDAF participe à l'élaboration de la stratégie nationale REDD+, qu'il est conscient du contexte et que Santana lui fait confiance, il serait le meilleur choix d'organisation de mise en œuvre. Cependant, ni la communauté ni le CEDAF ne devraient accepter des paiements ou des récompenses peu importants, incertains ou éprouvés. Le paiement actuel des activités du MMARN à Santana est indiqué comme étant insuffisant pour gagner sa vie par la plupart des participants.

Ils l'acceptent toujours parce qu'ils n'ont pas d'autres possibilités de revenus, mais cela ne devrait pas être perçu par les gestionnaires comme un moyen de fixer des salaires bas. Des récompenses et des ressources décentes permettront d'obtenir des résultats à plus long terme et généreront une résilience comme cobénéfice.

5.3 Soutenir la responsabilité environnementale durable

L'intégration de l'amélioration de la résilience à la responsabilité environnementale est inévitable. Si une communauté est chargée de maintenir ou de produire un service utilisé par plus de gens qu'eux-mêmes, assurer la résilience de la communauté est impératif pour obtenir des résultats durables. La communauté n'a pas seulement besoin de ressources pour mener des activités de conservation, elle doit aussi pouvoir prospérer.

5.4 Pour la corruption

L'acceptabilité culturelle peut être à l'origine de ce problème généralisé. Une seule petite action peut s'avérer inoffensive, mais a deux impacts indirects moins perçus. Une société résiliente favorise la réflexion sur les systèmes adaptatifs complexes, les composantes font partie d'un système et toute action a des répercussions sur les autres composantes. Cumulées, toutes ces actions ont un impact plus important et à plus long terme. Le principe de résilience sur la gestion des variables lentes et des rétroactions essaie d'éviter l'accumulation de petites perturbations qui amènent lentement le système dans un état où il est plus difficile de se débarrasser du problème que de l'empêcher. Minimiser l'importance des petites actions de corruption favorise une culture de non-prise en charge du bien commun. L'acceptabilité mènera à l'habitude et une action néfaste paraitra dorénavant inoffensive. Les Dominicains ont la réputation d'avoir « une grande tolérance au népotisme, le considérant souvent comme une activité justifiée et attendue de ceux qui ont du pouvoir et de l'influence. » (Traduction libre de International Trade Administration, 2017). Au cours des discussions, cinq solutions ont été proposées par les contributeurs à cette évaluation.

1. Rendre inacceptable. Quand quelqu'un veut ou commet un tel acte, interrogez les actions et discutez des conséquences mentionnées ci-dessus. Cela le rendra moins acceptable et une conscience sociale peut émerger. La corruption sera moins confortable si les liens sociaux sont en jeu.
2. Enseigner la problématique aux enfants. Le mouvement environnemental est principalement soutenu par les générations les plus jeunes et les plus sensibilisées. Cela devrait être également vrai pour la corruption, qui ne devrait pas être enseignée comme acceptable aux enfants ou aux adultes. « Les paradigmes ne changent pas en 5 ans, ni en 10, 15 ou 20 ans. Ce sont des processus multigénérationnels.

Il faut que la génération précédente, infectée par le paradigme, meure, puis que les personnes à qui elle a enseigné meurent ou prennent leur retraite, avant que le nouvel ordre ne soit vraiment concrétisé. » (Traduction libre de Elkington, 2018)

3. Signaler autant que possible. Des structures existent pour lutter efficacement contre la corruption. Parmi les ONG : la *Foundation for Institutionalization and Justice* (FINJUS), la *Participación Ciudadana*, et l'Alliance dominicaine contre la corruption (ADOCCO). Parmi les agences gouvernementales : *Procuraduría Especializada contra la Corrupción Administrativa* (PEPCA) et *Linea 311*.
4. Éviter les processus douteux ou imprécis et favoriser les partenariats avec des plateformes de rapport transparentes.
5. S'engager à résoudre le problème et partager les solutions.

CONCLUSION

Les impacts et les solutions aux changements climatiques commencent tout juste à faire surface. La République dominicaine est dans une situation précaire et la nécessité de s'adapter impose des changements de paradigme multilatéraux. REDD+ est l'occasion d'apporter de nouvelles considérations à la gestion de la société dominicaine au-delà des ressources naturelles, comme la justice, la transparence et la production alimentaire. Cependant, il reste à savoir si les communautés participantes bénéficieront de cette solution et si le programme obtiendra des résultats durables compte tenu des défis liés au financement, aux droits fonciers et à un État centralisé affecté par la corruption systémique.

Le FASD est un modèle très prometteur impliquant des acteurs privés et publics de différents secteurs et échelles. Ce partenariat a permis de gérer efficacement la prise de décision, en partageant les responsabilités entre les échelles d'action et les compétences pertinentes. Une reddition de compte transparente et une consultation régulière des partenaires ont permis des réflexions approfondies et une livraison rapide des résultats. Les objectifs d'amélioration de la production agricole, de réduction de son expansion, de réduction de la sédimentation et d'augmentation des stocks de carbone ont tous été atteints. La communauté participante a gagné en résilience grâce à un revenu plus stable, à des plantations plus résistantes et à un meilleur accès à l'eau. Les seuls problèmes sont l'absence d'investissement dans la résilience à l'échelle de la communauté et l'incertitude de la continuité une fois que l'objectif de réapprovisionnement en eau du donateur aura été atteint en 2020.

REDD+ pourrait être la réponse de la suite et ajouter les récompenses communautaires manquantes. Les activités en cours sont compatibles avec le programme. Les habitants accueillent une organisation de mise en œuvre et sont disponibles pour travailler. Ils ont un préjugé favorable et négocieront avec plaisir si REDD+ peut manifester de l'intérêt pour la communauté et garantir des conditions équitables et un développement communautaire avant le démarrage du projet. Le capital naturel est perçu comme croissant en raison des activités de conservation et de la démocratisation des bonnes pratiques. La culture locale valorise l'intégrité des écosystèmes naturels en tant que source de bien-être et de services essentiels.

Pour que les activités de conservation maintiennent leurs résultats, la communauté responsable doit être résiliente. Santana ne l'est pas. Tous les types de capitaux sont en danger. Les capacités d'absorption, d'adaptation et de transformation de Santana sont très limitées. Lors d'un événement comme l'ouragan Noel, le village a perdu l'accès à la nourriture, au refuge, aux services de santé et à l'eau potable. Il a fallu six mois pour retrouver un état aussi précaire que celui d'avant l'ouragan et cela peut arriver chaque année. Les seules améliorations significatives ont été apportées par le FASD avec la consolidation des berges, l'augmentation de la couverture forestière, la conservation des sols et de l'eau, l'amélioration de la productivité du café et l'éducation à la gestion de l'environnement.

L'évaluation inspirée par les principes théoriques du *Stockholm Resilience Centre* et par le cadre pratique du *Community Based Resilience Analysis* ont efficacement livré des résultats significatifs. Les quatre priorités en matière de résilience établies (accès à la santé, maisons résistantes, accès à l'eau potable et rues résistantes) doivent être considérées par les parties prenantes comme des points de départ pour la résilience à l'échelle de la communauté ou pour le suivi. L'amélioration de la connectivité et la diversification des services sont nécessaires. Seuls 6 des 80 ménages se considèrent comme légèrement plus résilients que les autres. Toutes les caractéristiques, stratégies et voies de résilience identifiées sont donc relatives au contexte et des interventions sont nécessaires pour accroître la résilience des ménages et de la communauté.

Les caractéristiques les plus efficaces indiquent une connectivité accrue et une plus grande diversité de services. Ceci est atteint localement avec un bon réseau social et de bonnes relations et avec une diversification des moyens de subsistance. Les stratégies les plus populaires révèlent un manque important de connaissances sur la résilience climatique. Les stratégies les plus efficaces sont également liées à la gestion de la connectivité et à la maintenance de la diversité et de la redondance, qui ont été identifiées comme les principes qui manquent le plus dans la communauté. Les participants pensent que Santana n'est pas résiliente, car elle manque de capital financier et humain et à cause de l'isolement, ce qui est cohérent avec les conclusions de l'évaluation. Les voies responsables de la résilience ont mis en évidence une

augmentation des capitaux issus de la connectivité et de la diversité. Une combinaison de participation à des activités communautaires, d'études secondaires et de réflexion à long terme a été identifiée comme la voie la plus efficace. Les ménages devraient également essayer de se préparer à l'arrivée imminente d'ouragans, car l'échelle des perturbations met en jeu la plupart des capitaux d'un ménage. Une organisation de gouvernance locale aiderait à coordonner les besoins locaux avec des interventions pour une adaptation adéquate.

Une inscription réussie à la REDD+ nécessite des propositions solides sur le financement durable, l'engagement des communautés à travers le suivi, l'application des limites des projets et le partage équitable des avantages. Les habitants de Santana ont besoin d'être consultés en profondeur, d'être traités avec dignité et d'être assurés qu'un investissement dans la résilience communautaire sera réalisé. Une stratégie pour 2020 devrait être planifiée pour une transition sans heurts du FASD vers l'autonomie ou vers une autre intervention comme REDD+.

En ce qui concerne la corruption, l'acceptabilité culturelle la rend difficilement traitable à court terme. Discuter de son caractère inacceptable, en informer les enfants, signaler les cas et éviter les processus douteux doit être fait avec cohérence. Puis la plupart des contributeurs à cette évaluation l'ont mentionné, la démocratisation des efforts pourrait amener des résultats plus rapidement que prévu. Seul l'engagement général à changer est manquant.

Bien qu'il n'y ait pas de panacée pour résoudre les problèmes des changements climatiques, se fier aux principes de résilience semble être une solution durable. La signification de ces principes doit être déterminée localement pour permettre l'autonomisation et des résultats durables. L'évaluation montre qu'il est impératif de rester connecté et de coopérer. REDD+ a l'avantage de connecter les gens et d'adapter les solutions à leur localité. REDD+ n'est peut-être pas efficace pour résoudre toutes les problématiques abordées, surtout compte tenu de l'ampleur du défi, mais au moins il fait évoluer l'esprit des nombreuses personnes impliquées. Et c'est ce dont nous avons besoin, impliquer beaucoup de gens à travers le monde.