

# **Aggregating Forest Carbon to Create a Microfinance Institution in Copa Buena, Costa Rica**

Masters Project of Eliot Logan-Hines  
Yale School of Forestry and Environmental Studies  
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Authors: Eliot Logan-Hines, Danielle Lauber, J'aime Mitchell, Trent Riley

In cooperation with Finca Project and CoopePueblos, R.L

Project Objective:  
to demonstrate that the carbon market is an effective and motivational mechanism to build sustainable livelihoods within a small agricultural community

## **EXECUTIVE SUMMARY**

In the summer of 2009, Finca Project began a feasibility study for the creation of a microfinance institution in Copa Buena, Costa Rica that would use proceeds from the sale of forest carbon credits to fund the institution. Eliot Logan-Hines led the study with three of Finca Project's interns – Danielle Lauber (Clark University), J'aime Mitchell (University of Texas), and Trent Riley (University of San Diego). This report is intended to inform Finca Project's partners and future interns of the steps necessary to create this project.

During the summer of 2010, Eliot Logan-Hines along with Finca Project's Chief Forestry Officer, Javier Fernandez, will be working with Finca Project interns to continue the elaboration of this feasibility study into a working project proposal. By the end of the August 2010, we will produce a PIN (project implementation note) using the World Bank's Carbon Finance template for LULUCF projects.

### Key Findings - Carbon Market Entry Synopsis and Future Plan

- First, Finca Project needs to complete a PIN, project implementation note, as outlined by the World Bank Carbon Finance template.  
<http://wbcarbonfinance.org/Router.cfm?Page=DocLib&CatalogID=7110>
- Estimation of carbon stocks can be made using the World Bank TARAM tool.
- Then Finca Project needs to find a validator that follows VCS and World Bank standards. If permitted, it's obviously most financially viable to have a student or group of students conduct the validation, but if not, the cheapest accredited entity would be the next best option.
- Should the validation process prove fruitful and the project has been deemed satisfactory by VCS standards, the next step will be the verification process. The verifier will ultimately decide whether or not the project will be eligible (and if so, for how many credits) to meet all VCS standards.
- Upon approval, a registry will need to be chosen (or possibly, 2 registries). The Registry Administrator will then issue VCUs. The Finca Project would then have its own account within the registry and other account holders (buyers) will have access to purchase these credits. Once the credits eventually become retired, the entire process will have reached its end.

### Key Findings - Microfinance Institutions Synopsis and Future Plan

- If the sale of carbon credits has provided the necessary profits desired to initiate the MFI, all interested parties will need to convene to discuss the basics of microfinancing and the order of events that should follow.

- After the initial informational meeting, another meeting will be needed to begin the structuring process. The board of directors and employee/s will need to be voted upon. Also, all details concerning the MFI operations will need to be decided upon by vote.
- The next step will involve the training of the employee/s and designing the informational workshops.
- Sometime after these events have transpired, it will then be time to disperse the initial set of loans to the members according to the guidelines set forth by the voting members of the MFI.
- Should the MFI be deemed successful, it may have the opportunity to partner with an established MFI to expand its practices.

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## **CHAPTER 1: BASELINE SCENARIO FOR COPA BUENA**

A baseline scenario is an examination of a potential project site for a specific carbon market activity. It is meant to provide a description of the project site, both of physical characteristics and of land use activity, thereby demonstrating that the area is in danger of suffering further degradation unless some counteraction is taken. (The difference made by this counteraction is referred to as the 'additionality' or additional advantage of the proposed project.) The necessary counteraction then determines the components measured during project implementation. There are two types of activities recognized by the voluntary markets that would benefit Copa Buena, Afforestation, Reforestation, and Revegetation (ARR) and Reductions of Emissions through Deforestation and Degradation (REDD). The baseline methodology for both of these activities is so similar that only one is used in this exercise – though it should be noted that starting carbon stock and further monitoring would differ at project implementation. The most appropriate methodology comes from the approved consolidated Clean Development Model (CDM) methodology AR-ACM0001 version 3: 'Afforestation and Reforestation of Degraded Land (UNFCCC, 2009). It should be noted that the ARR CDM baseline methodology was developed by the compliance market, but provides the foundation of the Voluntary Carbon Standard for alternative markets as well (VCS 2007.1). It is therefore the most universally familiar and can be understood interchangeably with the VCS baseline requirements for the purpose of this project.

This baseline is a combination of remote sensing analysis of historical images, oral ethnography as informal interviews, land use change statistical data modeling, and field observation of existing best practices. The project area is defined through a series of physical boundaries. Within those boundaries, the scenario is mostly concerned with the physical trends of the Copa Buena farms, but will also use unstructured interviews with case study participants to predict activities that would affect carbon stocks should community practices remain undisturbed. Aerial photography and other remote sensed data are compliments of Victor Milla, GIS expert at the Center for Tropical Studies in San Vito. His polygons are derived from data collected by the National Institute of Coffee (ICafe) and independent researchers in the region. Because of excessive cloud cover, this remotely sensed data was regarded as an incomplete source. To supplement the GIS, interviews were conducted with citizens of Copa Buena over a 10-week period. These included questions over land ownership and personal histories that shed light on the history of the town. In addition to over a dozen national documents, raw data collected by two separate graduate studies in the Copa Buena neighborhood was analyzed for this baseline. There is a margin of error present in the survey data because the population sampled was not identical in Babin's study cooperative members were singled out whereas Rickert randomly sampled from the town center, but the general trend may be extrapolated with reasonable accuracy because in both surveys the questions reflected identical information. Where no numerical value is present, or a range of numbers is used for calculation, the authors recommend further empirical data collection before the verification phase of this baseline.

## **I. Project Boundaries**

This case study takes place high in the mountains of southern Costa Rica in a rural pueblo, or small town. It is set within the region of Puntarenas, which runs half the length of the country's Pacific Coast. The easternmost canton of Puntarenas, Coto Brus, contains a southern district made up of two somnolent town centers: Agua Buena and Copa Buena hereafter referred to simply as Copa Buena. This area is made up of 6,118 hectares with a population of just fewer than 7,000 in the last national census (INEC, 2000). Copa Buena lies between 1100-1300 meters altitude, though the surrounding mountain peaks rise above 1800 meters.

For the last 50 years in Copa Buena, people have been refining the practices of the coffee growing industry. Unfortunately, improvements in technology led to a saturation of the coffee market last decade, which caused a price collapse calamitous for a community so dependent on this monoculture. Many in the community turned to cattle ranching, some sold their land to housing developers, and others even abandoned their land after two seasons of crops had reaped all the nutrients from it; all of these land use activities entail cutting vast swathes of forest. It is currently estimated that 94% of land in Copa Buena has been deforested, a huge number that is often overlooked because region-wide the number is only 24% (INEC, 2000). In contrast to the protected majority of the region, by 1994 the natural area around Copa Buena had been reduced to 80% coffee, 15% pasture, and 5% forest.

Today the town of Copa Buena is pocked by the aftermath of the coffee crisis. While some business is finding resurgence in the town, many buildings still stand vacant and dilapidated on Main Street and signs on every surrounding hill advertise farms for sale. Survey results from 2000, 2003, and 2008 reveal that the number of hectares converted from coffee to pasture between 2000 and 2003 was less than 10 but after the coffee crisis (and subsequent closure of the local coffee cooperative in 2003-04) that number rose to over 30 (Babin, 2008 and Rickert, 2005). The view from the highest point overlooking Copa Buena exhibits a topographical quilt with very few scattered patches of coffee trees.

The town is small to begin with, but the restrictions of available field data and proof of landownership limit the project system's boundary even further. Only 51 farms in the area of Copa Buena - all coffee farmers with titles to an amount of land that falls between 0.1 and 10 hectares - are considered eligible for the initial phase of this project. Our goal is to support small-scale landholders by aggregating the smaller individual farms into a larger and more viable pool of carbon sequestration. The land must first divide into the two CDM land use categories named above. Of the surveyed land, the hectares that fall into the ARR category include degraded or marginal land that can be reforested, cattle pasture that can be converted to tree plantation, and shade-grown coffee land. This total measured 316 hectares (Babin, 2008). The REDD category includes only the 33 hectares with natural forest or existing reforestation. There are the simple physical parameters.

However, the complexity of the human environment necessitates a certain degree of normative analysis to assess the predictability of behavioral patterns. A central issue with

all GHG inventories is the definitions of boundaries of which emissions are included in the inventory and assumed as the responsibility of the reporting entity, and which emissions are externalized and not considered in the analysis (Wilson, 2008). It is necessary to set these boundaries based on inputs and outputs of the project system, and determining which elements affect the goal activity. This scope must be determined based on systems of transportation, climate, and energy consumption. Then the researcher must determine take these values for human behaviors and prescribe a plan for GHG reduction. This means that the restricted behaviors must be egalitarian and, to be most effective, acceptable to social norms.

For this system, inputs and outputs for the REDD land are negligible but the ARR land used for agroforestry has agrochemical and animal inputs. This methodology separates emissions reduction activities from carbon sequestration activities. It is therefore not necessary to determine additional greenhouse gas emissions from these chemicals or livestock prior to this project's implementation. However, for economic optimization of this project it is recommended that a secondary emissions capture project be added at a later date. In order to diversify into emissions capture, information would then be needed about the methane emitted from the existing livestock and their particular diet of commercial feed and sugar cane, nitrous oxide emitted from fertilizers and herbicides, etc. At that time, other leakage from the coffee farms could be included as well. To see additional recommended boundaries for tree nutrient cycles, see measuring and monitoring section.

## **II. Climate**

Copa Buena has a seasonal climate marked by a distinct wet and dry season. The dry season lasts from December to April. When the prevailing winds from the southwest collide with the Talamanca Mountains, humidity and temperature can change drastically causing sudden and frequent afternoon showers. These torrents, called *aguaceros*, can last for days on end and annual highway closures. Annual rainfall in Copa Buena varies between 2500 and 3000mm. Temperatures rarely deviate from the 23-32 degree Celsius range during the day, though night temperature can drop as low as 10 Celsius during dry season.

## **III. Natural Disasters and Soils**

In addition to human degradation of the landscape, natural disasters also play a part in the changing face of Coto Brus. Landslides happen annually during the rainy season and from time to time as a result of earthquakes in the region. In addition, the last major wildfire – in 1992 – burned 2,000 ha of forest in the area leaving vast swathes of land exposed to natural erosion. The majority of the soils are highly weathered oxisols with pockets rich volcanic-origin andisols. There is also the presence of large patches of limestone in certain areas near Copa Buena.

## **IV. Hydrology**

A river that flows year round (and is known to flood the roadways during peak precipitation) is the only landform that separates the town centers of Agua Buena and Copa Buena. The only other water features are a pair of waterfalls and a dry river basin about 4 kilometers outside the town center that fill up during the wettest periods of the year.

## **V. Vegetation**

The sun is in the sky from about 5am to 5pm year round, with only about an hour's variation between the winter and summer solstice. At 8 degrees above the equator, Costa Rica has a relatively constant growing season with a sun path almost directly overhead. Therefore the vegetation is lush with over 240 species of ferns, plants, shrubs, and trees in Coto Brus (Polzot, 2004). Farmers in the area have cultivated a select few of these in order to provide important products or nutrients on their land. Staple crops in Copa Buena include corn, beans, tomatoes, sugar cane, legumes, guava, and pineapple that are sold mostly to the lowlands.

The most commonly planted trees in the area for coffee and tree plantations are *Pinus Caribea* (Caribbean pin) , *Eucalyptus spp*, *Erythrina spp* (poro), *Inga spp* (guaba), *Termanalia spp* (amarillion), *Cedralia spp* (cedro), and *Voschysia spp* (mayo). While over 20 useful native species have been identified on the farms in Copa Buena, these are the most profiled by researchers (Babin, 2008). The *Erythrina* and *Inga* are leguminous nitrogen-fixing species that are often planted in agroforestry systems. Pines and eucalypts are the most common tree used in plantations. *Termanalia*, *Cedralia*, and *Voschysia* are the main native hardwoods species used in tree plantations. Average growth rates and predicted maturity size of these ubiquitous species can be helpful in calculating the carbon stock of land where they are used; see the measuring and monitoring section for these.

## **VI. Population**

The establishment of this area was born through a 1951 agreement between the government and the Societa Italiano de Colonizacion Agricola (SICA). SICA would settle them on 10-20 ha parcels within the 10,000ha that had been sold to the organization at the low price of 10colonos/ha (at that time about \$0.55/acre). And, in exchange for an all-weather road built by the Costa Rican government, SICA agreed to organize schools, hospitals, and utilities networks. Also in the early 1970s a group of Mennonites from the USA established small dairy farms in the Tilaran Mountains around Copa Buena. They created local markets for cheese, produce, and wooden furniture.

In 1991 the indigenous people of the region banded together in a proposal to trade foreign debt for forest preservation. This proposal was accepted by the Agenda 21 Earth Summit in Rio de Janeiro, and more land rights were given to the tribes. This is significant because overall percentage of protected land in the Cordillera area, which includes Coto Brus, is higher than any other region in the country. However, none of this protected land currently extends as far south as Copa Buena.

## **VII. Business as Usual**

The project location Copa Buena is categorized as 100% rural, and the residents have little more than landmarks for addresses (Jimenez, 2009). In 2003 this region had the poorest households: 21.5% without basic needs and over 12% in extreme poverty. With the second lowest household income level in the country and little government funding reaching so far

south, the only southern advantage is the beneficial proximity of their less expensive neighbor, Panama, for goods ranging from agricultural chemicals and household goods to designer clothes and imported watches.

In 2003 Copa Buena paid \$53.70 per *fanega* (or \$59.95 per 100lb of coffee), and even though this price was higher than the country average a high poverty level still exists (Rickert, 2005). Two studies estimate between \$1,319 and \$1,433 annual income per hectare used for cattle ranching (Howard/Valerio, 1996 and Kishor/Constantino, 1993). This is comparable to the \$1784 per hectare for coffee growth (Rickert, 2005). However, the average salary for those who find employment in the local service industry is \$6240 so it is apparent that the farmer must own at least 4 hectares of either coffee or pasture to earn as much as the local supermarket cashier (Jimenez, 2009).

The majority of land is foreigners have bought this region over the last decade, and the price of land has climbed 60% during the same time period. Though it was not possible to obtain individual profits from these land sales, it can be assumed by the high rate of emigration that it is a very profitable option - nearly 1 in every 5 family members has migrated to an urban or foreign destination since 2001 (Babi, 2008). The relationship between farmers and their land is a sacred thing for Costa Ricans, but in hard economic times they are forced to sell. Unfortunately, as Darryl Cole relates, this means giving up a long-term livelihood for a short-term solution to a crisis (Cole, 1997).

### **VIII. Laws and Policies**

It is difficult to tell exactly how much deforestation and forest alteration has taken place in Costa Rica because there are so many different classification systems in place, and each has their own definition of a tree and a forest. To this date, the CR government has never implemented a forest inventory system to a) take place at regular intervals nor b) use a standardized methodology. The governmental funding that has reached this part of the country is a long history of subsidies: first it subsidized deforestation; then it subsidized reforestation with nonnative trees; and now its finally getting around to subsidizing native trees (Holl, 2009). There are recent incentives that derive their funding from gas and electricity taxes. This ecosystem service also helps electricity generation as most of Costa Rica's electricity comes from hydroelectric dams, which can frequently be clogged by silt from deforested land runoff.

In addition, this community has agreed to sell their coffee to a market in the United States that demands sustainable growing and harvesting standards. For this, a PhD student has collaborated with the farmers to compose a mandate of standards. Part of this agreement stipulates that 7 species of tree are planted on the farm to conserve biodiversity, so it is in the farmer's best interest to plant trees; the farms earn a higher premium for their coffee with the help of the trees.

There are a couple options existing for Payments for Environmental Service (PES) in Coto

Brus. In the past the PES incentives have been more successful with “wealthier, better educated landowners with larger holdings”. But newer programs, like the Sistemas Agrofrestales (SAF) introduced in 2004, are seeking to improve the stronghold in communities lower on the socioeconomic index, those with community organizations, indigenous organizations, and single female heads of household (Cole, 2007).

There is now another program, which the National University research departments implemented, that pays participants \$1.50 over three years to ensure maintenance. The payments are \$.75 the first year, \$.50 the second, and \$.25 the third. It is possible to write a contract each year with the university for new tree plantings. They have an organization, INISEFOR, do 4 inspections: one at planting, another at 12 months, a third at 24 months, and the final one at 36 months. The size of the tree planted depends on the species, but in general saplings are 6 months old or are 30cm tall. It was determined from these regulations that there is some incentive to reforest abandoned land, though there has been little proven success to date. When INISEFOR was approached about signing contracts with this research project the funding was denied.

There are also a number of laws, ratified and upheld by one of three government agencies that deal with environmental legislation. They can be found with their corresponding ratification date and ministry on the Canadian environmental watch group website: [www.ec.gc.ca](http://www.ec.gc.ca). They demonstrate that since the 1990s Costa Rica has enforced much stricter protection of their land but, as the previous paragraphs have explored, the financial incentives are limited in social scope and success.

#### **The Forestry Act #7575, 16/4/1996**

Establishes the essential state functions to ensure the conservation, protection and proper management of forests, as well as the production, use and industrialization of forest resources based on a vision of sustainable development. MINAE

#### **The Phytosanitary Act #7664, 02/05/1997**

Promotes the integrated management of pests, as well as other sustainable productive practices. It also regulates the use, application and management of chemical and biological substances, their import and registration, as well as control of harmful residues. MAG

#### **The Biodiversity Act # 7788, 30/04/1998**

Ensures the conservation and sustainable use of biodiversity, as well as the equitable distribution of derived benefits and costs. Creates the National Commission for Biodiversity Management and the National System of Conservation Areas. MINAE

#### **The Land Use Management and Conservation Act #7779, 21/05/1998**

Promotes land use planning through land classification. This classification will allow a balance between actual and potential land use. Additionally, it promotes an active community and productive sector participation in decision-making processes on land use and conservation. It also establishes agro-ecology as a means to ensure agricultural

production and land and water resources conservation. MAG and MINAE

**Decree No. 19886: Forestry Act Regulation, 27/08/90**

Establishes the organization and competency of the forestry administration. Creates the Forestry Fund and the National Forestry Council. Sets forth the requirements on forestlands and forest management and regeneration. Creates incentives for the management and regeneration of forests in private lands. MINAE

**Decree No. 28610: Environmental Services Payment, 18/05/2000**

FONAFIFO (National Fund for Forestry Financing) will pay for environmental services rendered by forests and plantations, with funding from public and private institutions. The number of hectares compensated will depend on available funding. It also sets maximum payments for reforestation and protection management plans. MINAE

**Decree No. 29375: Regulation to the Land Use Management and Conservation Act, 21/03/01**

The integrated and sustainable management of land is declared a private or State action of public utility and interest. It regulates the use of best available technology, the application of better land use practices, in order to prevent water and wind soil erosion, and to ensure a sustainable land use. MAG-MINAE

**IX. Approximate Outcome**

According to the current economic, political, and social dynamics of Copa Buena, most likely course of action follows current trends. From personal observation in the community, there are several conflicting political factors at work in the community. First, there are many local outsiders that influence the fate of the cooperative. There is a group of international scientists – associated with a variety of institutions – that occupy the research stations throughout the summertime. Some of which have become heavily involved in reforestation and preservation efforts around Copa Buena. In addition, there are several students interning for CAN who have personal projects that contribute to adaptable sustainability measures in the community. Finally, there are the miscellaneous outsiders, usually made up of 1-2 Peace Corps volunteers and a summering author. Throughout the group there is a concerted effort to better the coffee cooperative, however the direct impacts vary widely. One scientist seemed to think that a third party was necessary for organizing and facilitating money transactions for environmental services, while a Peace Corps volunteer admonished the idea of third parties because it hindered stakeholder empowerment. A separate tension about farming practices formed during field research between the management of the cooperative and a PhD student with CAN. In general, these temporary actors may mean well but they are ill equipped to leave permanent infrastructure in the community. Any project initiated by these actors has the observed effect of ambivalence among community members. Only a project that could install a permanent actor in the community and evoke a sense of ardent trust could boast significant additionality.

2002 saw 1089 farms abandoned and 400 converted to other uses (Valverde, 2003). More migration will continue to drain the population of its rich social resources. Farmers will be faced with the economic decision between maintaining their parents livelihood and salvaging the family savings from the home equity. At the rates experienced between 2001-2008, 2.2 hectares a year will be developed into housing or converted to cattle pasture. This could mean a significant loss of carbon storage every year, in addition to the new sources of emissions such destruction brings. As this study is being performed, Copa Buena is receiving its first improved roadway, finally closing the 1 km gap between the town and the pavement of the Pan-American Highway. History has shown that the paved roads only bring more rapid development.

### **X. Project Potential**

Coffee farmers are used to receiving partial payment for their coffee as they wait for up to a year for the green beans to be sold – so they would be no strangers to the idea that credits need to be realized before payments can be received. Because of this delay, the coffee farmer now bears the most risk of the international market with little direct control over the variables affecting that risk (Pelupussy, 1997). Diversification of livelihood into the carbon market would reduce this risk. It has been calculated that smallholder agroforestry systems in the tropics, potential C sequestration rates range from 1.5 to 3.5 Mg C ha<sup>-1</sup> yr<sup>-1</sup> (Montagnini, 2004). Reforestation and agroforestry efforts are still insufficient methods of carbon recovery; it would take a fast-growing plantation 25 years to recover the carbon emitted during a single clearing of primary growth forest (Montagnini, 2004). Clearly, there is no substitute for the protection of primary growth forests. The best that to do is to use ARR on land that has already been cleared to provide valuable products and food staples for local people, thereby offsetting the need to destroy more primary plots.

## **CHAPTER 2:** **PROPOSED METHODOLOGIES FOR MEASURING AND MONITORING**

Agriculture, Forestry and Other Land Use (AFOLU) projects have great potential to contribute to present and future environmental, social and economic challenges. Tropical forests, in particular store approximately 46% of the global terrestrial carbon pool and about 11% of soil carbon (Rozo, 2005). Carbon projects that promote agroforestry, small-scale plantations, and natural forest regeneration and preservation, have been shown to improve the livelihoods of small-scale farmers, communities, and indigenous peoples (Redondo-Brenes, 2005). To illustrate, within the last decade Costa Rica's Payments for Environmental Services Program (PES) has reforested a total area of 21, 838 hectares (1997-2002) for which the average landowner received US\$540/ha for new plantations, \$210 for a new plantation, forest conservation, or support of agroforestry systems (Redondo-Brenes, 2005).

Therefore, carbon sequestration projects coupled with financial incentives are an effective means of promoting environmental and economical sustainability. The following carbon project proposal considers both agroforestry of coffee and small-scale reforestation to improve the livelihood of farmers, communities and the southern region of Coto Brus. According to the VCS methodology, the agroforestry land use falls under the ARR land activity (VCS 2007.1, 2008). Additionally, Finca Project expects to undertake Reducing Emissions from Deforestation and Degradation (REDD): avoiding unplanned mosaic deforestation and degradation (AUMDD) carbon sequestration with future expansion of carbon sequestration projects.

The intent of the project proponent is to achieve VCS authorized use status for project operation by a set date decided upon by the directors of Finca Project. Although standards for the voluntary carbon market may change in the near future with the expectant COP 15 meeting in December 2009, this document was written with references to current VCS best practices. Undoubtedly, the general principles of ensuring transparency, consistency, comparability, and accuracy will remain.

### **I. Nomenclature**

Key terms have been defined to ensure consistency throughout the document and transparency for all intended parties. The following definitions are adapted from the IPCC GPG for LULUCF protocol (2003) unless otherwise stated and are consistent with VCS guidelines (VCS 2007.1, 2008).

#### **Aboveground Biomass (AGB)**

Is defined as all of the living biomass above the soil, which includes stem, stump, branches, bark, seeds and foliage. For all activities in outlined in this project, AGB will refer to trees greater than 10cm in diameter at breast height, unless otherwise stated. The equations for this estimation include all parts of AGB.

**Accuracy**

Can be considered an increasing state of exact measurement.

**Additionality**

Finca Project is responsible for ensuring that the carbon sequestrations of project activities currently provided by trees are not additional to those that would occur in the absence of a certified project activity.

**Afforestation**

May be considered the anthropogenic modification of previously non-forested land of a minimum of 50 years to forested land.

**Allometric relationship**

Equations that mathematically relate physical characteristics such as tree trunk diameter and tree height to estimate biomass (Redondo, 2005). These equations are considered an indirect measurement of carbon. They are time and cost effective, in addition to being non-destructive. Studies have shown tree biomass-carbon allometric equations to be above 95% accurate (Redondo, 2005).

**Belowground Biomass (BGB)**

May be considered live root material below the soil.

**Biomass**

“Organic material both aboveground and belowground, and both living and dead, e.g., trees, crops, grasses, tree litter, roots etc. Biomass includes the pool definition for above - and below - ground biomass” (IPCC, 2003).

**Conservativeness**

The principle of conservativeness should be followed when completeness or accuracy of quantitative estimates cannot be made - the reduction of emissions should not be overestimated (Grassi, 2008).

**Diameter at Breast Height (DBH)**

Is scientifically accepted to be 1.30 meters above the ground.

**Dead wood**

Consists of non-living biomass “larger than or equal to 10cm in diameter”(IPCC, 2003).

**Deforestation**

Is defined as the measurable and sustained decreased in crown cover below 10- 30%.

**Forest**

Is considered land (minimum of 0.05-1.0 hectare) area with more than 10 - 30% crown

cover and tree height of at least 2-5 meters at maturity.

**Leakage**

Is the accumulation of GHG emissions outside the project boundary, but still within the country boundary. Significant leakage effects must be taken into consideration of project calculations of net emission reductions according to VCS guidelines (2008).

**Litter**

Consists of decomposing non-living biomass.

**Precision**

In terms of understanding inventory is a lessening state of uncertainty.

**Reforestation**

May be considered to be the intended modification of non-forested land to forested. Sequestration is the accumulation of carbon in a pool, excluding the atmosphere.

**II. AFOLU Activities****A. ARR**

The agroforestry system of shade grown coffee currently used by CoopePueblos, R.L. constitutes ARR activities as outlined by VCS. The land use activities include increasing and restoring vegetative cover through human manipulation (VCS 2007.1, 2008).

**B. REDD**

REDD activities will be assessed on properties along side ARR activities. As defined by VCS, the REDD activities are categorized as "Avoiding unplanned mosaic deforestation and degradation (AUMDD) (VCS 2007.1, 2008)." These efforts decrease GHG emissions by stopping deforestation and/or degradation of mature forests of small-scale mosaic formation located within the canton of Coto Brus, Costa Rica. Baseline estimates illustrate that the reforestation and conservation efforts of Finca Project have stopped the planned and potentially unplanned deforestation and/or degradation efforts that would have occurred in the absence of such efforts.

**III. Implementation Complexities**

The structural diversity of shade trees influences the carbon-stock of coffee agro-ecosystems. Farmers may choose to plant a variety of fruit trees for household use, timber trees also for house hold use or to sell within the community, specific species for live fences, and lastly nitrogen fixing trees to enrich the soil (Table 3) (Polzot, 2004). Aside from the ecological benefits of diversifying the shade trees, variety creates vast differences in the carbon storage potential of small-scale coffee producers. Commonly used shade trees for coffee farmers in southern Costa Rica with the greatest carbon storage include Eucalyptus and Poro (Polzot, 2004). Examples of other commonly used trees with lesser potential are Inga species and Musa species. It has also been noted by Polzot (2004), that the carbon stock from the coffee bushes does not vary much; due to similar planting schemes.

### A. Assessment of Geographic Project Boundaries

Project activities will encompass small-scale agroforestry farmers and/or landowners (0.1 ha -10 ha) within the politically recognized canton of Coto Brus in the southern region of Costa Rica. Project implementation is restricted to ARR activities of 51 agroforestry properties located within Copa Buena that are affiliated with the coffee cooperative of CoopePueblos, R.L. Coffea Arabica is the primary crop grown within a diversity of shade tree species. The boundary for the ARR project is the collective agroforestry land area.

The REDD project is the collective land area under reforestation; these properties are currently under survey. Finca Project is responsible for ensuring all geographic coordinates and maps have been established for all land areas (Figure1, Table 1). Finca Project is responsible for ensuring that the small scale aggregation of all project activities are verified within 5 years, prior to the project proposal validation. Both ARR and REDD land areas are discrete, not contiguous areas of land though in some cases they form corridors.

### B. Project Crediting Period

Both ARR and REDD project crediting terms will consist of three 20 year renewable terms contracts with verification occurring every 10 years per term. Start date: when the check is cut; Justification: cost of the forestry engineers, nor the verification and validation processes.

### C. Determination of Carbon Pools

The selection of carbon pools to measure is based on expected rate of carbon flux, magnitude and direction of change, availability and accuracy of methods to quantify change and the cost of measurement. The carbon pools that are anticipated to decrease with project activities should be measured and monitored (Pearson, 2005). A pool can be excluded if it can be reasonably proven that the pool "will not decrease as part of the project activity or increase as part of the baseline" (Pearson, 2005). Ex-ante estimation of net carbon benefits can help to determine whether decreases in carbon pools or increases in GHG emissions are significant and need to be measured and monitored during project activities (Greenhalgh, 2005). According to VCS standards, omission of a pool is permitted if the sum is less than 5% of the total CO<sub>2</sub>-eq benefits generated by the project.

Important carbon pools for the proposed forestry projects are considered to be live AGB, dead biomass, and soil (Greenhalgh, 2005; Brown, 2002). These categories have been further divided and assigned a measurement standing for both ARR and REDD land use activities (Table 2). Plantations/Reforestation has been included in the carbon pool decision matrix to aid future expansion for Finca Project into other land use activities. Pools that are assigned a yes (Y) indicate that a change in this carbon pool is likely to be large and should be measured. A recommended (R) standing indicates that a change in this pool could be significant but the costs to measurement may be high depending on project resources. Carbon pools with a no (N) standing aren't recommended for measurement because the carbon flux is likely to small to none. The herbaceous and litter carbon pools for REDD activities are currently assigned a maybe (M) standing. At the composition of this

proposal it is unclear what the composition and management of these forested areas will be and thus the potential contribution of these pools. It should be noted that due to the tropical climate of the project area there is a high decomposition rate for litter biomass (Polzot, 2004). Soil carbon is difficult to measure, however if resources (time, cost, and expertise) are available it is recommended for both ARR and REDD project types. If in the course of project implementation the soil carbon pool is found to be stable, future measurements need not be taken if land management does not change. Soil carbon is typically found to increase or remain stable over time, depending on land use (Brown, 2002).

#### D. Proposed Field Methodology for General Biomass Measurement

Primary field measurement data is necessary to implement both ARR and REDD carbon projects. Data to establish the measuring and monitoring sampling methodology, as well as improve baseline projections, and guidelines for leakage avoidance includes: tree height, DBH, land cover, land area, soil type, topography, updated information on socio-economic and environmental pressures on the land, and resources, the temperature and rainfall (Brown, 2002). Moreover, such data will be used to determine the appropriate number of sampling plots in which carbon inventory measurements will occur. To initiate a forest carbon inventory, the use of fixed area and permanent nested sampling plots is recommended for the previously stated projects, especially for uneven aged forests (Brown, 2002). Although methods for plot sampling design are well established, Finca Project should maximize precision within resource constraints. Factors that maximize precision are the number, size and distribution of permanent plots (Brown, 2002; Pearson, 2005). The following website may assist field technicians to calculate the most efficient number of plots, with regard to precision <http://www.winrock.org/Ecosystems/tools.asp>. (Pearson, 2005).

Allometric calculations for biomass accuracy are highest with destructive means of felling representative trees to measure the oven-dry-weight; this is considered direct measurement (Brown, 2002; Polzot, 2004). This weight is correlated to the height and DBH of trees to develop regression coefficients and project specific equations (Polzot, 2004). Composing equations for particular projects reduces error, but can be extremely time consuming, costly and is beyond the means of this project proposal. Additionally, studies have shown that in tropical forest zones, the generic regression equations are able to account for 95% of the variation in the tree biomass (Brown, 2002). Therefore, the following methodology was adopted from Polzot (2004). If however a destructive harvest of representative trees is performed at the beginning of ARR and/or REDD projects, these true biomass measurements can be used to verify the generic equations (Brown, 2002). Further details for sampling methodology may be found in the IPCC Good Practice Guidance for LULUCF Chapter 5 (2003).

#### E. ARR Project Field Methodology Specifics

The complexity of measuring carbon sequestration of agroforestry systems is a result of multiple tree species of various ages interspersed with annual or perennial crops (Brown, 2002). The intended carbon sequestration through the proposed ARR project must be

measured and monitored in permanent plots (Brown, 2002).

The following procedure was based upon destructive tree and coffee bush sampling for an ecologically comparable agroforestry system. A possible challenge to be aware of during project implementation may be complications of participation during the acquisition of field data from the expectant large number of landowners involved.

Values for carbon sequestration of the total live trees (foliage, branches, stems) are calculated by converting biomass measurements of diameters at breast height (DBH) (Brown, 2002; Polzot, 2004). The measurements of soil carbon and root biomass are recommended if project resources allow. Root biomass can account for up to 40% of a trees total biomass (Brown, 2002). Nevertheless, quantification is not practical for either carbon pool and at the time of this project proposal there are no standard field methods for measuring soil carbon (Brown, 2002).

During composition of this project proposal there were no plans to harvest wood from reforestation efforts. If such activities eventually take place, then the wood products must be considered a carbon pool. Methodology for evaluating emissions or removals for harvesting wood products can be found in the IPCC Land Use and Forestry Sector guidelines for GHG inventories (IPCC, 2003; Brown, 2002).

The following is a proposed methodology for measurement of aboveground biomass in coffee farms, as adapted from Polzot (2004): Establish a 50m x 50m representative plot and record the GPS coordinates at the four corners and at the center. It is the responsibility of the field technician to measure and record the DBH and height of all the shade trees greater than or equal to 5 cm and the respective species name. Inga tree species heights should be recorded at 0.3m. Average height and DBH of the coffee bushes may be calculated by counting all of the bushes in the plot and recording the height and DBH (at 15cm) of the coffee bushes in every other row. The technician may then create four subplots by walking 10m in each direction (north, east, south, west) to measure the herbaceous vegetation (DBH <5cm), roots and soil (if desired).

#### F. REDD Project Field Methodology Specifics

It is expected that the land areas categorized for REDD activities to be a primarily secondary forest area. As such, one should design a field methodology with a representative 100m x 100m permanent plot to be surveyed within each property. The field technician is responsible for ensuring that GPS coordinates of the four corners and center of the plot, in addition to other field data are recorded. This sample plot may then be subdivided into a random number of equally sized sub-plots (i.e. 10m x 10m) within which the appropriate carbon pools may be measured (Table 2).

A combination of direct field measurements, models and remote sensing of these methods is preferred to improve the accuracy, precision, and verifiability of the proposed projects. Presently, there are no remote sensing technologies that can measure forest carbon stocks directly (Gibbs, 2007). Ground based data is needed to estimate the carbon stock and verify the ground-based calculations.

If project resources permit, confirmation of field data should be performed with remote sensing technologies and aerial photography for both ARR and REDD activities. Confirmation of AGB field data through aerial photography and Light Detection and Ranging (LiDAR) sensing will aid initial quantification of carbon and future monitoring. LiDAR data is considered expensive and needs to be done by an outside party, but the sensing capabilities exceed those of radar and optical sensors for all forest types (Gibbs, 2007). Additionally, even though LiDAR scanning cannot penetrate clouds, the height of vegetation can be assessed through 3-dimensional imaging (Goetz, 2009). The aerial photography is regarded as a good means of validating forest change and is appropriate for the proposed small-scale projects since large areas are not usually monitored (Olander, 2008).

In summary, the magnitude of potential change in a specific carbon pool and availability of project resources are the determining factors for measurement and achieving a specified level of precision.

#### **IV. Data Quantification**

##### **A. ARR**

###### *i. Shade Trees:*

To estimate the biomass (kg), the following regression equation may be used:

$$\text{Log (B)} = -0.9578 + 2.3408 * \text{Log (D)} \text{ (Equation1)}$$

B = biomass per tree (kg), D = DBH (cm), (R<sup>2</sup> = 0.95, P<0.01)  
(Polzot, 2004)

This equation was originally developed using destructive sampling of 35 shade trees from coffee plantations and used in the Polzot (2004) study for agroforestry systems of similar composition to the CoopePueblos, R.L. properties in the Copa Buena region. Since the Musa species have a lower wood density, their biomass (kg) may be estimated with the above equation and multiplying the value by 0.5 (Polzot, 2004).

The total biomass of shade trees in a given farm (t ha<sup>-1</sup>) can be converted to carbon stock (t C ha<sup>-1</sup>) with the following equation:

$$C = B \times fC \text{ (Equation2)}$$

C = carbon stored by trees (tC ha<sup>-1</sup>), B = biomass of trees (t ha<sup>-1</sup>),  
fC = fraction of carbon in biomass (assumed at 0.5)  
(Polzot, 2004)

###### *ii. Coffee Bushes:*

Biomass (kg) may be estimated with the following equation:

$$\text{LN (B)} = -2.39287 + 0.95285 * \text{LN (D)} + 1.2693 * \text{LN (H)} \text{ (Equation3)}$$

B = biomass per plant (kg), D = DBH (cm at 15cm height), H = height (m)  
Equation developed with (R<sup>2</sup>=0.89, p<0.01)  
(Polzot, 2004)

Biomass (t ha<sup>-1</sup>) can be converted to carbon stock (t C ha<sup>-1</sup>) using equation (2).

*iii. Soil:*

The following three variables need to be measured to assess the carbon stock: 1) depth, 2) bulk density, which is calculated from the oven dried weight of soil from a known volume of sampled material and 3) the concentrations of organic carbon within the sample. These guidelines were adapted from Pearson (2005), from which specific instructions on measurements may be found.

*iv. Roots:*

According to the literature, measuring the below ground biomass is extremely time consuming (Pearson, 2005). As such, the following regression model has been adapted:

$$BBD = \exp(-1.0587 + 0.8836 \times \ln ABD) \text{ (Equation 4)}$$

BBD = belowground biomass density, ABD = aboveground biomass density (t/ha)

This value can then be converted into carbon stock using equation (2).

**B. REDD**

*i. Tree biomass:*

May be estimated using the general equation for tropical moist climate zone (1500–4000mm of rainfall/year).

$$\text{Biomass} = \exp(-2.289 + 2.649 \times \ln dbh - 0.021 \times \ln dbh^2) \text{ (Max DBH 148cm) (Equation 5)}$$

Biomass = (kg), DBH = (cm)  
(Pearson, 2005)

The biomass of trees (t ha<sup>-1</sup>) can be converted to carbon-stock (t C ha<sup>-1</sup>) by using equation (2).

*ii. Litter:*

Fresh samples may be collected and weighed during AGB sampling in order to calculate biomass with a dry to fresh weight ratio. A dry weight is established by oven drying the samples. Then, the total fresh weight of each sample is multiplied by the calculated dry to fresh weight ratio, producing an estimation of litter biomass. This figure may be converted to (t ha<sup>-1</sup>) and the application of equation (2) will result in the carbon stock (Polzot, 2004; Pearson, 2005).

*iii. Deadwood:*

a. Standing deadwood:

The DBH, height, and decomposition state should be recorded. Next, volume is calculated using DBH, height and estimate of the top of diameter.

$$\text{Volume (m}^3\text{)} = 1/3 \pi h (r_1^2 + r_2^2 + r_1 \times r_2) \text{ (Equation 6)}$$

h = the height in meters,

r<sub>1</sub> = the radius at the base of the tree,

r<sub>2</sub> = the radius at the top of the tree.

(Pearson, 2005)

Volume is then converted to dry biomass using the appropriate wood density using:

$$\text{Biomass} = \text{Volume} \times \text{Wood density}$$

(from samples, using equation 8) (Equation7)  
(Pearson, 2005)

b. Down deadwood:

According to the literature, the line-intersect method is most efficient (Pearson, 2005). Coarse (>10cm) may be measured using this method; smaller pieces shall be considered litter.

Density is calculated by the following formula:  $\text{Density (g/m}^3\text{)} = \text{mass (g)} / \text{Volume (m}^3\text{)}$   
(Equation8)

mass = the mass of the oven-dried sample,  
volume =  $\pi \times (\text{average diameter}/2)^2 \times \text{average width of the fresh sample}$   
(Pearson, 2005)

Then,  $\text{Volume (m}^3\text{/ha)} = \pi^2 \times [(d_1^2 + d_2^2 + \dots + d_n^2) / (8L)]$  (Equation9)

$d_1, d_2$  etc = diameters of intersecting pieces of dead wood in (cm), L = length of the line in (m).

(Pearson, 2005)

Then, Biomass of lying dead wood (t/ha) = volume x density (Equation10)

(Pearson, 2005)

Biomass values can be converted into carbon stock using equation (2).

The procedure for both soil and root quantification may be found above under the ARR calculations.

## **V. ARR and REDD**

$$\Delta \text{CLU} = \Delta \text{CAB} + \Delta \text{CBB} + \Delta \text{CDW} + \Delta \text{CLI} + \Delta \text{CSO} + \Delta \text{CHWP I} \quad (\text{Equation 11})$$

$\Delta \text{CLU}_i$  = carbon stock changes for a stratum of a land-use category

Subscripts denote the following carbon pools:

AB = above-ground biomass

BB = below-ground biomass

DW = dead wood

LI = litter

SO = soils

HWP = harvested wood products

(IPCC, 2003)

Finca Project is responsible for ensuring that the upper limit of carbon credits is not greater than the project's net carbon stock benefits (I.e. project estimates - baseline estimates) (VCS 2007.1, 2008).

### **A. Accounting for Inefficiencies**

Finca Project must make reasonable efforts to quantify measurement error to instill

confidence in the carbon credits. A discounting or grading system may be used to adjust values, as proposed by Olander (2008). Previously analyzed small-scale carbon projects have used the one-way analysis of variance (ANOVA) to calculate statistical differences in the rates of carbon sequestration and growth amongst species (Redondo, 2005).

### B. Potential Carbon Sequestration Quantities

Carbon sequestration projects, such as this, function under the assumption that properly managed ecosystems may act as sinks for atmospheric CO<sub>2</sub>. The current terrestrial capacity (plant and soil) to store carbon is estimated at  $2000 \pm 500$  Pg (Pg =  $10^{15}$  g or billion tons), which represents 25% of global C stock (Albrecht, 2003). Agricultural land potential to store carbon from the atmosphere is estimated between 42 and 90 Pg over the next 50-100 years (Albrecht, 2003). The carbon storage potential for agroforestry systems in South America is within the range of 39-102 t C ha<sup>-1</sup> (Albrecht, 2003). In terms of global potential for REDD activities, forest systems may be able to store 1-3 Pg C / yr (Albrecht, 2003).

Although one potential methodology to measure carbon has been provided in this document, presently there is a range of methods to measure and monitor forest carbon stock referenced within AFOLU literature.

For example, in 2007 even Costa Rica's national forest biome carbon stock ranged from 471-704 M t C (Gibbs, 2009). Project specific calculations for the proposed ARR or REDD activities have not been assessed within this proposal. However, expected carbon values have been provided from AFOLU project literature. Accordingly, data from Polzot (2004) and other coffee agroforestry system studies present a wide range of carbon tons per hectare sequestered. The potential of such systems ranges from 91.64 tC ha<sup>-1</sup> to 198 tC ha<sup>-1</sup> (Polzot, 2004). The range is a result of differences in species diversity and amount of shade trees. Suarez Pascua (2002) presents a tighter range of 149.9tC ha<sup>-1</sup> - 166.7 tC ha<sup>-1</sup>. These figures can be classified into specific carbon pools as follows: 75 -97% of carbon is stored by the soil; 5.6 - 14% stored by the shade trees; 2.3-3.9% stored by litter; 0.1-1.5% is stored in the coffee bushes (Suarez Pascua, 2002).

As illustrated, the scientific community has recognized the carbon sequestration potential for agroforestry. Therefore, it is expected that an ARR project incorporating the CoopePueblos, R. L. properties can provide additional environmental and economic benefits to the local community and to GHG mitigation efforts globally.

Sequestration values for a REDD project would also dependent on the specific system. Previous studies have found that primary forests (>60-80yrs old) in Costa Rica sequester 110 t C ha<sup>-1</sup> (on average/year) (Redondo-Brenes, 2005). Secondary forests (0-20years old) can accumulate 2-3.5 t C ha<sup>-1</sup> /year. Plantations have been found to maintain 1.4-4.8 t C ha<sup>-1</sup> /year. Polzot (2004) also reports C stock values for secondary forests to be 197.1 tC ha<sup>-1</sup>. Other published reports have found the breakdown of carbon within the secondary and primary forest to be: 60% in aboveground biomass of trees, followed by 18% soil to 30 cm depth, 12% roots and 7% dead wood; the understory and fine litter accounted for 3% of the total (Brown, 2002). Even still in another project, which was composed of 15% pasture

and 85% various stages of secondary forest, the overall weighted mean carbon content of forests was 112 tC ha<sup>-1</sup>, 78% of which is in the live aboveground woody biomass, 13% of which is in roots, 7% of which is in dead wood, and 2% of which is in litter and understory combined (Brown, 2002). All of the above varying carbon sequestration values are due to intrinsic species growth characteristics and management, wood specific gravity, and individual growth conditions, in addition to broader environmental, socio-economic and policy (market and regulatory) influences (Brown, 2002; Redondo-Brenes, 2005). A more specific range for tropical forests is particularly difficult to forecast since 1ha may contain as many as 300 different tree species (Chave, 2005).

### C. Project Monitoring

Project Monitoring refers to the continued measurement of carbon pools and compliance of specified activities within ARR and REDD boundaries. Monitoring schemes should be based on actual measurements, otherwise known as “ex-post,” and incorporate the procedures for data collections and baseline parameters (Greenhalgh, 2005). The established sampling plots should be used for future monitoring because they are considered statically superior, in addition to saving the Finca Project time and money (Brown, 2002). Moreover, not all of the initially sampled pools need to be measured at every interval; frequency and intensity of monitoring is dependent upon by the nature of the project and the developer. Compliance monitoring certifies that the amount of carbon remains constant or has been increasing over time (VCS 2007.1, 2008). Previously mentioned remote-sensing technology can ease the process of monitoring compliance. The small-scale area of the proposed projects is ideal for GIS imagery from which crown diameter and tree height from individual trees can be made (Olander, 2008; Goetz, 2009). Correlations can then be made between these values and previously calculated regressions values (Olander, 2008; Goetz, 2009).

Since the ARR carbon values will be based on the agroforestry efforts of an established coffee cooperative, it may be assumed that land use activities and therefore carbon content will not dramatically change over time.

Speculations as to the fluctuations of carbon in the anticipated REDD project cannot be predicted at the time of this proposal given that the land properties have yet to be determined.

### D. Equations for carbon stock changes in biomass:

There are two general methods used to monitor changes in forest carbon stock. The default methodology is known as the gain-loss method has a built in ecological understanding of how forests grow and the processes that produce carbon losses. In this method, typical tree growth rates are used as the biomass gains and activities such as over-grazing, fire, or logging damage are used as losses. Simply, the measured biomass carbon loss is subtracted from the biomass carbon increment for that year. Above and below ground measurements should be included in both the gain and loss values. Another method is the stock-difference method uses actual measurements from stock of biomass at the beginning and end of the accounting period. It is usually used when large changes of biomass are expected or very

accurate inventory is required. This author recommends that the default method be used. The stock difference method was provided for illustrative purposes.

Gain-Loss Method (default):  $\Delta C = \Delta CG - \Delta CL$  (Equation 12)

$\Delta C$  = annual carbon stock change in the pool, tones C yr-1

$\Delta CG$  = annual gain of carbon, tones C yr-1

$\Delta CL$  = annual loss of carbon, tones C yr-1

(IPCC, 2003)

Stock-Difference Method:  $\Delta C = (Ct2 - Ct1) / (t2 - t1)$  (Equation 13)

$\Delta C$  = annual carbon stock change in the pool, tones C yr-1

$Ct1$  = carbon stock in the pool at time  $t1$ , tones C

$Ct2$  = carbon stock in the pool at time  $t2$ , tones C

(IPCC, 2003)

## **VI. Verification and Validation**

Both project activities, ARR and REDD, are encompassed within the same sectoral scope (scope 14) and therefore may be simultaneously verified by Rainforest Alliance, which is an accredited VCS verifier and validating party and is the preferred party of Finca Project.

As project proponent, Finca Project is aware that the size of the project is validated as if it were ready to be implemented. Finca Project should also be aware that the land area becomes fixed upon commencement of the subsequent process of verification. These stipulations have resulted in current ambitions to expand into REDD activities to be postponed to future phases.

If the project has been implemented, but less than 80% of the proposed land is under control of the project developer prior to validation, then VCS (2007.1, 2008) has outlined four stipulations that should be followed. First, it must be demonstrated that the differing area does not affect the additionality test; second, that the actual area is smaller than intended, otherwise emissions will be considered leakage; third, a monitoring plan must be flexible enough to handle the change in project size; lastly, the total project must be validated within five years (VCS 2007.1, 2008).

It is expected that the verification report will include written assurance by Rainforest Alliance that the GHG emissions reductions from the ARR and future REDD projects are real and the VCS protocol has been followed.

The option of obtaining an independent validation report prior to validation by VCS should be declined by Finca Project to conserve financial resources.

### **A. Non-Permanence Risk Assessment**

According to VCS methodology, the independent validating/verification party to determine the quantity of buffer credits for each project performs non-permanence risk assessment. Buffer credits are a percentage of the project's overall credit pool that is set aside to cover

non-permanence related risks (VCS, 2008). VCS has outlined risk analysis procedures for each AFOLU project with the following three steps:

*1. Implement risk assessment*

- A) Evaluate risks applicable to all AFOLU projects
- B) Evaluate risks specific to project activity; (I.e. ARR and REDD)
- C) Considering the results from (A) and (B), assess overall risk

*2. Based on results from (1) set-aside buffer credits into an account*

*3. Steps (1) and (2) must be repeated each time the project is verified to adjust the percentage of buffer credits.*

It is well known that there are a variety of risks involved with forest carbon sequestration projects. A proposed risk assessment has been performed to assess the proposed project feasibility (Tables 4,5,6).

*i. ARR*

As previously stated, the agroforestry system proposed for the ARR activity in this proposal is associated with an established coffee cooperative. The cooperative has a long-standing business relationship with Santa Cruz Coffee Roasting Co. (Santa Cruz, CA), which holds the farmers to commercial sustainable farming practices. As a result, there are built in economic and ecological incentives to sustain the coffee cooperative and in turn, sustainable agroforestry practices.

Proposed assessment of ARR risks provide a preliminary assessment of the percentage of credits that would need to be set aside as a mandatory buffer (Table 5). The default percentage of buffer credits is as follows: High (40 - 60%), Medium (20-40%), and Low (10-20%), however the verifying party is free to apply the appropriate percentage within each range (VCS, 2008).

*ii. REDD*

Risk Class Avoided Unplanned Mosaic Deforestation & Degradation (AUMDD)  
Again, the composition of the land area for REDD activities has not been defined. Conversely, historical land use trends and familiarity of expectant project area implementation allow for a preliminary risk assessment (Table 6). According to VCS (2008), in the evaluation of REDD project risks ratings, if an individual risk is significant enough it can determine the overall risk standing, regardless of the assessed evaluation. Also, if during the course of assessment there are three or more "high risk" ratings, the project will not be eligible for VCS crediting (VCS, 2008). The default percentage of buffer credits is as follows: High (30-40%), Medium (10-30%), Low (10%). As with the ARR activities, the verifying party is free to use his/her discretion to determine the appropriate percentage.

**B. Determination of "Risk Likelihood X Significance" Approach**

This approach combines the qualitative and quantitative classifications of risk assessment.

This procedure may be followed in circumstances in which the above ratings are not feasible /credible for the specific project. It may be used as an alternative method or supplement to other methods. The following rating incorporates the total risk (from above) including likelihood and significance (VCS, 2008). The quantitative and qualitative risks are calculated based on the prediction of likelihood and significance of an events impact; this is called absolute risk (VCS, 2008). According to VCS, if project expertise and information is available, risk ratings are then weighted on the individual project category sections, from above risk method (VCS, 2008).

General Steps (as adapted from VCS, 2008):

1. Each risk factor for each project category must be assessed and classified as quantitative or qualitative.

2. Determine the absolute risk: the likelihood of that risk occurring and significance of impact without management interference.

2a) Likelihood = inverse of the average number of times the event has occurred over a period equivalent to the life span of the project (historical data is necessary for calculation).

2a1) Likelihood, if no historical data is available, but can be predicted:

Frequency Likelihood

[General rule  $1/(\text{frequency of event})$ ]

Less than once during the life of the project tends to 0.00

Once every 100 years 0.0100

Once every 50 to <100 years (1/75) 0.0133

Once every 20 to <50 years (1/35) 0.0286

Once every 10 to <20 years (1/15) 0.0667

Once every 5 to <10 years (1/7.5) 0.1333

Once every 1 and <5 years (1/3) 0.3333

Once per year 1.0000

(VCS, 2008)

2a2) Likelihood: if frequency cannot be predicted on historical records or probabilities:

Frequency Likelihood

Zero likelihood of occurring or not applicable 0

An event likely to occur less than once during the project 0.05

An event likely to occur once or twice during the project 0.1

An event likely to occur several times during the project 0.25

An event likely to occur at least once a year 1

(VCS, 2008)

3. Significance of quantitative risk is determined by the damage that the project may sustain if the event occurred. It is expressed as a percentage of the total carbon benefits as a result of the project decreasing in carbon storage.

3a) Calculation: tons of carbon lost × likelihood × number of years that loss continues

3b) Calculation for Destructive events where the carbon benefits are destroyed and the project is assumed to be nonviable. Therefore, the number of years that loss continues = remaining life of project: tons of carbon lost × likelihood × life span of the project

4. Significance of qualitative risk is determined by a relative rating of 0-3. Individual risks are related to the whole project and potential damage caused which cannot be expressed as a quantity of lost carbon benefits. Degree of impact score\*

Negligible impact 0

Damaging (a part of) one year's work program 1

Damaging several year's work 2

Damage possibly leading to (almost) complete failure 3

(\*Assessment ratings may be customized.)

5. Identify and record the strategies being employed by the project to mitigate the identified risks and assess the quality of the management system to effectively counter-act them. Assessment ratings may be found below: Rating of Risk Mitigation: Quality of mitigation efforts Score

Failure to recognize potential risks and/or absence of countermeasures 0

Countermeasures developed but not implemented 1

Countermeasures implemented but inadequate for the situation 2

Countermeasures implemented and adequate for the situation 3

Countermeasures using best practices and adapted to the specific risk 4  
(VCS, 2008)

Rating of Risk Mitigation Management System: Guidelines Score

-No evidence of systematic structure in identification of risk or in controlling implementation of countermeasures = 0

- Control activities implemented irregularly but no documentation or corrective actions = 1

- Controls for most countermeasures in place but poorly documented management system and no internal auditing = 2

-System for controlling countermeasures is in place and documented; Internal audits performed but no structures for review and feedback = 3

- Documented management system in place with risks identified, targets for reducing them established, procedures and assigned responsibility, internal auditing, reviews, training = 4

-ISO or EMAS registered management system, (ISO 9000, 14001, EMAS) or equivalent = 4  
(VCS, 2008)

6. Calculate project-specific total quantitative and qualitative risks.

$$R = L \times S \times (1 - (C \times M)/16) \quad (10)$$

R = Total risk,

L = Likelihood of occurrence,

S = Significance of impact,

C = Adequacy of countermeasures to avert or minimize risk,

M = Adequacy of management system.

(VCS, 2008)

7. Convert this figure into a risk class: low, medium, high or unacceptably high (fail). This is based on a combination of quantitative risks (total percentage) and qualitative risks (set of scores).

7a. Quantitative risks are converted into one of the following classes: Risk Score Classification\*

> 6.0 Fail  
4.0 – 6.0 High  
2.0 – 3.9 Medium  
0 – 1.9 Low  
(VCS, 2008)

\*If the quantitative risk percentage exceeds the highest buffer values, then the project is considered “unacceptably high risk” and is no longer eligible for VCS crediting.

7b. Qualitative risks are converted into one of the following classes: Risk Score Classification

2.8 – 3.0 Fail  
2.0 – <2.8 High  
1.0 – <2.0 Medium  
0 – <1.0 Low  
(VCS, 2008)

8. The highest risk from the quantitative and qualitative assessment determines the buffer applied. For example, if a total quantitative risk is high and a total qualitative risk is medium, the project is considered to have an overall high risk. The buffer withholding percentage for the respective category can be found above. It is important to note that since this is a range, the assessor has the freedom to utilize higher or lower values within the range.

## **VII. GHG Leakage**

Leakage assessment boundaries are within the internationally recognized boundaries of Costa Rica (VCS policy does not account for international leakage). Finca Project will make all reasonable efforts to measure leakage for all carbon pools as dictated by VCS standards (VCS 2007.1, 2008). All project activities should be designed and implemented with the intent to minimize, monitor and account for leakage.

### **A. Assessment of potential ARR Leakage Potential**

Leakage for ARR activities that must be examined upon project implementation are shifting of agricultural activities, movement of households or communities, increased use of wooden fence posts, and emissions from transportation and machinery use (VCS 2007.1, 2008). To ensure the highest standards are followed, the IPCC (2003) guidelines should be followed.

### **B. Assessment of potential REDD Leakage Potential leakage**

This assessment is mainly a result of changing socio-economic factors within Copa Buena. Factors that should be examined include, but are not limited to, agricultural intensification practices, ecotourism, sustainable livelihood activities and sustainable production of non-timber forest products (VCS 2007.1, 2008).

It is expected that future leakage prevention will include tree planting. Finca Project is responsible for estimating and subtracting any future GHG emissions from these activities and subtracting them from the project's net reductions (VCS 2007.1, 2008).

REDD market leakage needs to be assessed by two independent parties (VCS 2007.1, 2008). First by a VCS accredited party on behalf of Finca Project to assess completion of VCS project requirements. The VCS secretariat is responsible for assigning a seconding validator or verifier.

### **VIII. Quality Control**

The projects outlined in this proposal will be held to the highest quality control and assurance standards as dictated by VCS and outlined by the IPCC GPG, section 5.5 (2003). An outside party is responsible for coordinating the Quality Assurance and Quality Control plans. This agency is responsible for all QA/QC procedures including, but not limited to reporting, documentation and archiving. These procedures are especially important for LULUCF projects because of their long-term nature and the complexity of data required from variable biological systems.

The purpose of a quality control system is threefold. The first purpose is to provide systematic checks to ensure integrity of data. Secondly, to recognize errors and ensure they are resolved, and lastly, to document and archive all project material (VCS 2007.1, 2008).

A quality assurance review takes place after a quality control inventory has been performed. This review ensures data quality, meaning the "best possible estimates of emissions and sinks given the current state of scientific knowledge and data available (IPCC, 2003)."

#### **A. General Assessment of Total Climate Impact**

Despite the importance of accounting for carbon dioxide (CO<sub>2</sub>) as the focus of this proposal, methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) are also products of adverse climate changing activities which Finca Project must account for prior to project implementation. These gases are produced mainly as the result of anthropogenic activities, such as the use of machinery, fires, the draining of wetland regions and the fertilization of land (Pearson, 2005).

#### **B. General Assessment of Project Impact**

Carbon sequestration projects contribute to global efforts of removing CO<sub>2</sub> from the atmosphere. Collectively, the small landowners described in the proposed ARR project will be able to actively participate in both commodity markets of coffee and carbon.

Costa Rica's coffee production and environmental conservation are important factions of

the country's economy and land usage. While the environmental conservation is vital to the tourism industry, ensuring a high quality of air, water, and soil are just as important to agroforestry throughout the country.

Ecological vitality of environmental media is especially important to the community of Copa Buena. The coffee production is intertwined within the cultural and economic aspects of the community. Although the coffee crisis had negative resonating effects throughout the community, lessons learned have resulted in a greater investment of sustainable agroforestry practices. An agroforestry carbon sequestration project would provide farmers with further incentive of ensuring diversity in shade trees and ecologically sound maintenance for a bountiful coffee harvest and carbon sequestration potential.

### **IX. Conclusions**

A venture such as this will benefit society as a whole, in terms of environmental services, but will also be able to benefit small landowners financially. The ARR project would allow coffee farmers to be less dependent upon coffee prices and have a diversified income. At this time there is limited access to financial services in Copa Buena and throughout Coto Brus. This project would allow landowners to reinvest in their own land and community. The alternative uses of microfinance loans may allow farmers and landowners the freedom to continue their ecological investment and spur other investments of their choosing once access to financial assets is provided.

Although stakeholder involvement is an important aspect of this small-scale project, external forces inherently restrict carbon sequestration. Finca Project must be transparent with all landowners and visa-versa, as land owners and farmers may have their own objectives for agroforestry or reforestation for the land under contract. Adverse activities include: improper soil maintenance therefore causing erosion, economic hardship that may lead to land conversion, or intensive land modification such as initiating a commercial plantation.

## **CHAPTER 3: CARBON MARKET ENTRY**

### **I. Introduction**

The primary reason that the VCS methodology was chosen was for its international recognition as an authority for voluntary carbon offset certification. VCS is recognized by the World Bank as a third party certifier for voluntary emission reduction credits. VCS standards are constantly updated. The VCS association provides the project proponent with a clear 7 step general methodology to achieve VCS eligibility. The rules they provide ensure carbon credits are “credible, robust, permanent and fungible”, not to mention they have been independently reviewed (VCS, 2007.1, 2008). VCS specifications for both ARR and REDD project activities that Finca Project desires to realize were also a factor in choosing VCS. Developing a small-scale carbon project in a developing nation such as Costa Rica, VCS project authorization would provide project activities with international legitimacy. Furthermore, such an affiliation generates the potential to attract private investors for future ambitions Finca Project may develop.

### **II. Market Options**

Currently, there are two options within the carbon markets: compliance and voluntary/pre-compliance. The primary compliance market lies within the European Union in the form of the European Union Emissions Trading Scheme (EU ETS). At the time of this proposals composition, the U. S. House of Representatives has passed the Waxman-Markey Climate Change Bill, within which is a GHG cap and trade system, but is awaiting a successful vote from the Senate.

The primary option, as pertaining to our project, is within the Voluntary Carbon Market. The Voluntary Carbon Market is composed of several standards and registries, each of which contains different methodologies and sectors in which to create carbon offset projects.

Within the EU ETS lies the Clean Development Mechanism (CDM), which is another form of carbon offset. However, at the time of writing, the CDM does not include forestry projects, particularly reforestation, agroforestry, and Reduced Emissions from Deforestation and Degradation in Developing Countries (REDD). Therefore, the CDM cannot be taken into consideration for this project at this time.

#### **A. Voluntary Carbon Markets**

##### **Role of the Voluntary Carbon Market**

The goal for Voluntary Carbon Markets is to provide the opportunity for businesses, brokers, traders, and/or individuals to voluntarily (or with the goal in mind of accomplishing pre-compliance emissions reductions) by offsetting their own emissions via Verified Emissions Reductions (VER) or to trade these VERs in the secondary market.

These VERs can come from either compliance CDM or Joint Implementations (JI) or from within the voluntary markets. In comparison to the CDM/JI market, trading volumes are still relatively small in the voluntary markets, especially after the global financial crisis. However, “a key role of the voluntary market is to shape the rules and procedures for offsets in future compliance markets” (Kollmus, 2009). Voluntary Markets should attempt

to follow and also expand upon the CDM standards. They should desire more stringent regulation than the CDM in an attempt to influence the future CDM and compliance standards. Voluntary Markets currently go a step further than the CDM in that they include sectors previously ignored, such as forestry and hydropower.

*i. Standards:*

Within the Voluntary Markets, several standards exist. The two primary standards currently are the Gold Standard and the Voluntary Carbon Standard (VCS). Project developers also have the opportunity of selling directly to the Chicago Climate Exchange (CCX) within the United States. Several other smaller or less established exchanges exist such as the Regional Greenhouse Gas Initiative (RGGI) in the U.S. and others are being developed such as the Western Climate Initiative (WCI) in the U.S., as well as the Carbon Pollution Reduction Scheme (CPRS) in Australia. However, the Gold Standard only allows Renewable Energy offset projects and the RGGI is a joint effort among several States within the U.S. to trade credits from electric providers.

a. Accounting Standards

Greenhouse Gas Accounting standards have been established within voluntary markets to ensure the legitimacy of carbon measurements. The standards established for this accounting ensures “that offsets are real, additional, and permanent” (Kollmus, 2009). Here, methodologies are established for baselines, additionality, and measurement.

b. Monitoring, Verification, and Certification Standards

Standards boards to ensure accurate carbon measurement so that more accurate credits are created and sold to interested buyers must also establish guidelines. Typically, offset projects must be validated prior to the verification and certification phases. Afterwards, monitoring is conducted to ensure the continued success of the offset.

### **III. Registration and Enforcement Systems**

Many Standards are now implementing programs in which each credit is labeled with its own serial number to ensure that the credits are traded only once. Upon certification and the receipt of credits to the verifiers and project developers, the credits are placed on the registry to be sold and can be tracked by all interested parties.

### **IV. Registries**

Many Standards have begun establishing their own Registries on which credits can be traded. Examples of Standards Boards creating their own Registries are the Gold Standard, Voluntary Offset Standard (VOS), CCX, and Plan Vivo. However, VER+ uses the Blue Registry of TUV SUD and the VCS uses three separate global Registries: APX, TZ1, and Caisse des Dépôts. The role of the Registries is to prevent the double counting of the credits while tracking the sale of credits from account to account and doing so with complete transparency.

#### **A. CDM**

The Clean Development Mechanism (CDM) was designed and implemented through the

Kyoto Protocol to provide another option for Annex 1 countries and companies to offset their carbon emissions. Emission reduction projects are created in developing countries to earn certified emission reductions (CER) that are equivalent to one ton of carbon dioxide. Since it's first sale in 2006, there have been 1,726 registered projects, over 300 million issued CERs, and the UNFCCC expects another 1.6 billion CERs to be registered before the end of 2012. CERs sale for higher than any other type of voluntary market credit (About CDM).

However, the CDM has a large number of critics who believe that the CDM has failed and the idea needs to either be scrapped or radically transformed. The main complaint of the critics is that the CDM allows companies to continue polluting. While the critics agree that these projects are necessary, they feel that they should be additional to companies actually reducing their carbon footprints (Pottinger, 2008).

In addition, forest conservation and REDD projects were emitted from the initial CDM description from the Kyoto Protocol. As deforestation is believed to cause around 20% of carbon emissions worldwide, many feel that they will be included in the new form of the CDM after the COP15 . Therefore, the CDM may still be an option for this project in 2013 depending on what is agreed upon in Copenhagen regarding forestry.

## **V. Standards Board Selection**

Since the Clean Development Mechanism is not currently an option for this project, this project must focus on the voluntary carbon markets. Within the voluntary markets, there is a multitude of options, yet each option is different in many ways. The primarily differences are the used methodologies of measuring and monitoring the carbon sequestration, offset prices, and project types. First, standards that do not include REDD are the Gold Standard, the Voluntary Offset Standard, and VER+. Next, the standards that fetch the lowest prices for their offsets are Plan Vivo and selling directly to the CCX. That leaves the Voluntary Carbon Standard (VCS) and the Climate, Community, and Biodiversity Standards (CCBS), with the VCS fetching slightly higher prices at the high end. The authors have chosen to attempt to use the VCS to enter the voluntary carbon market because of its international recognition as an authority for voluntary carbon offset certification and because they include specifications for ARR and REDD project activities (Kollmus, 2009).

### **A. Description of Chosen Standards**

In 2005, the Climate Group, the International Emissions Trading Association (IETA), and the World Economic Forum created the Voluntary Carbon Standard. The final version of the standard, version 2007.1 was released in November 2007 after 2 years of consultation and discussion. The VCS strives for transparency and credibility in the voluntary carbon market. Their carbon offset is known as a Voluntary Carbon Unit (VCU). "VCS offsets must be real (have happened), additional (beyond business-as-usual activities), measurable, permanent (not temporarily displace emissions), independently verified and unique (not used more than once to offset emissions)" (About the VCS).

### **B. Description of Chosen Registry**

The 3 available registry systems approved by the VCS are the APX, TZ1, and Caisse des Dépôts. Since the APX and TZ1 both have offices located within the United States, and the VCS allows simultaneous use of multiple registries, this project should have no problem using either or both registries.

The APX was founded in 1996 and is now a strong player within energy and environmental markets. They provide professional services such as brokering, analytics, business consulting, and operate electronic exchanges. APX launched their VCS Registry in March 2009 and also have exchanges for the Gold Standard, the Climate Action Reserve, and the North American Renewables Registry. (About Us: APX).

The TZ1 Registry was created in 2007 and was acquired in June 2009 by the New Zealand Exchange. It will now be known as Markit Environmental Registry and will be used for voluntary carbon credits and environmental certificates. Starting in September 2009, the operational headquarters will be in New York City.

### C. Expenses

According to the TZ1 website, the VCS and CCB have the same exact fees. There would be a \$500 joining fee, \$100 account fee, \$0.05/tCO<sub>2</sub>e issuance fee, \$0.03/tCO<sub>2</sub>e transaction fee, \$200 retirement of certificates fee, and \$150 account closing fee for both standards.

### D. Financing Options

The only two options for financing these account fees for registering the project are to use the profits derived from the environmental payment program with UNA or include this amount borrowed from the investors to pay for the validation and verification processes.

## **VI. Validator and Verifier**

### A. Description of Chosen Validator/Verifier (About the VCS)

The authors consulted two separate verifiers in hopes of building a strong relationship that will lead to the selection of one of the two to be the verifier throughout this project. Scientific Certification Systems (SCS) and Rainforest Alliance are both from the U.S. The SCS is an independent, third party verifier of environmental and food quality certification. They verify a wide range of sectors including forestry, green building, food processing, and corporate social responsibility. Unfortunately the responses from these two verifiers proved negative and there is little interest in a project of such small scale.

The Rainforest Alliance is a non-profit organization that focuses on helping people whose way of life depends on the use of their land. They help these individuals to conserve their land and to use it for sustainable business practices. They are recognized by many standards as a third party verifier. (About Us: Rainforest Alliance).

Per the VCS, projects must have separate verifiers and validators. Under the VCS, the verifiers are of most importance as they decide whether or not the project should be registered (the VCS does not do this). Therefore, the authors suggest using a well-known entity such as the SCS or Rainforest Alliance for verification purposes, and preferably a cheaper, though still recognized, forest engineer (or even students if they qualify) to

perform the validation.

### B. Expenses

Currently, SCS has responded with quotes regarding the cost of their services. The SCS charges \$15,000 for verification, regardless of project size. We have only received a project description form to fill out from the Rainforest Alliance and have not yet discovered the fees associated with either APX or TZ1. Nor have we been able to locate any necessary validation costs without actually applying first.

However, for SCS verification, the following break-even analysis has been conducted. Since VCS forest carbon prices range typically from 5-15 Euros (roughly \$7-21), we can attempt to determine the necessary break-even amount of hectares needed at random amounts of credits received per hectare:

$$15,000 = \$7-21 \text{ (forestry credit price)} * X \text{ (amt. credits/ha)} * Y \text{ (total \# ha)}$$

$$\begin{aligned} 15,000 &= 7 * 150 \text{ (credits/ha)} * Y \\ 15,000 &= 1050Y \\ Y &= 14.28 \text{ ha (total, for the project)} \\ 15,000 &= 21 * 150 * Y \\ 15,000 &= 3150Y \\ Y &= 4.76 \text{ ha total} \end{aligned}$$

$$\begin{aligned} 15,000 &= 7 * 50Y \\ 15,000 &= 350Y \\ Y &= 42.85 \text{ ha total} \end{aligned}$$

$$\begin{aligned} 15,000 &= 7 * 25Y \\ 15,000 &= 175Y \\ Y &= 85.71 \\ 85.71/51 \text{ (farms)} &= 1.68 \text{ ha/farm} \end{aligned}$$

Based on this analysis, even at only sequestering 25 t CO<sub>2</sub>/ha, we would have enough hectares to break even just off of the sale of original credits, not to mention the amount of CO<sub>2</sub> that would be sequestered throughout the project's lifetime.

### VII. Potential Returns

OTC market prices as of July 9, 2009 are \$7.00 per Carbon Reduction Ton (CarbonPositive.net, 2009) and if agroforestry systems in South America sequester 39-102 t C ha<sup>-1</sup>, then an approximate return for CoopePueblos, R.L. properties would run anywhere from \$273-714 ha<sup>-1</sup>.

More specifically, if the ARR land area for CoopePueblos, R. L. is estimated at about 317ha, then \$86,541-\$226,338 would be the gross potential return for the agroforestry activities.

### **VIII. Financing Options**

The necessary expenses for this project will be quite substantial once verification, validation, registering, and monitoring are taken into consideration. The only way for this to be an option is to either find a group of interested private investors to fund this step of the project or attempt to register for a specific forestry sector fund.

#### **A. Price Comparison of CDM vs. Voluntary Markets**

Typically, CERs (from CDM) sell between 14-30 Euros apiece. However, many costs are associated with this, therefore, the average wholesale market price is somewhere around 18 Euros per CER.

Typical VCU (from VCS) prices fetch between 5-15 Euros apiece. However, prices vary with project sector (Kollmus, 2009).

### **IX. Roles**

#### **Project Owner**

The project owners will be the owners of each individual *finca* or farm (that are members of the cooperative) that allow us to use their land to develop an emission reduction projects.

#### **Project Developers**

The project developer would be the Finca Project as they are the ones who wish to create the emission reduction project.

#### **Project Funders**

The funding for this project will be used for the costs associated with validation and verification. The projects funders will be are yet to be determined.

#### **Stakeholders**

Those that will be directly or indirectly affected by this project include the owners of the *fincas*, the Finca Project, the project funders, CoopePueblos, R.L., the town of Copa Buena, and possibly the Costa Rican government.

#### **Third Party Auditors, Validators, and Verifiers**

Under VCS protocol, the third party validator cannot also be the third party verifier. The Finca Project will attempt to work with UNA to be its third party validator and will decide among the Rainforest Alliance and the SCS for its third party verifier.

#### **Standards Organization**

Since Costa Rica and the United States are non-Annex 1 countries and this will be registered in the voluntary market, this project will use the VCS as its legislative body.

#### **Brokers and Exchanges**

Buyers and sellers will have access to these carbon credits through exchanges approved by the VCS. The two possible exchanges under consideration are the APX and the TV1.

**Trader**

Those that may be interested in purchasing and selling the carbon credits will include professional traders seeking arbitrage opportunities.

Final Buyers – the final buyers of the created carbon credits will be businesses looking to offset their “carbon footprint” for CSR or pre-compliance reasons (Kollmus, 2009).

**X. Risks****A. Market**

Choosing to enter through the voluntary carbon market (specifically through the VCS), leaves us exposed to market risk. Should voluntary carbon markets become non-desirable after the COP15, the lack of demand for VERs would most likely cause their prices to freefall, thus, endangering the abilities to repay the creditors. The VCS may also lose favor in many buyers’ eyes, which could possibly lead us to the position of not being able to sell the credits. Lastly, forest project credits could saturate the voluntary markets around the time in which we would attempt to sell the credits, thus, driving down the price of forestry related credits.

**B. Financial**

The primary financial risk will be the inability to attract financial lenders, donors, or to find a relevant grant for this project or the inability to agree to reasonable terms with a lender. This project will never make it past the verification stage without proper funding.

**C. Implementation**

There is a possibility that his project never makes it through the validation process, thus, leaving us with possible debt and in scramble mode to try to find another standard, registry, or to alter the project so that it will pass validation, but could also incur more debt. There is also the possibility that the project is cleared to go, but the financial backing is still not there, leading to a stall in implementation. Other possible deterrence to implementation may include weather/natural disaster affecting the validation or verification processes, time overruns by any involved party, or the project not generating the desired amount of credits to be financially feasible.

**D. Legal**

Many possible legal risks are involved including a clear definition as to what the Finca Project’s involvement in this project may be, the risk of fraud or default by a validator/verifier or financial lender, not adhering to all Costa Rican environmental laws, and the possibility that the carbon credit profits not going directly to the project owners may be illegal. Most likely, there will be many more legal risks that are not foreseeable at the present moment.

**E. Community**

The primary community/cooperative risk lies in the possibility that the members do not wish to partake in this particular project.

#### F. Exchange Rate

Since the MFI “carbon fund” is to be operated in Costa Rican *Colones*, the exchange rate can affect the total size of the fund since the VCS operates in US dollars and that is what would be received in terms of profit from the sale of the carbon credits. Should the colon gain on the dollar at the time of the sale of the carbon credits, the initial size of the carbon fund will be decreased. One way to offset this risk would be to buy US dollars forward with *Colones*, but that would involve another loan and may not be financially feasible if the colon does not gain enough against the dollar or if there is no collateral for the loan itself.

## **CHAPTER 4: MICROFINANCE INSTITUTIONS**

### **I. Introduction**

Made famous by Nobel Prize laureate Muhammad Yunus of the Grameen Bank, microfinance has proven to be a popular method of empowering impoverished entrepreneurs to slowly rise out of their destitute futures. It has proven to be a beneficial tool for poverty-stricken people worldwide that do not have access to traditional banking opportunities enjoyed by citizens of developed nations. Without the ability to receive collateral for the loans that they provide, many MFIs use the idea of social capital in the place of traditional collateral, such as property. MFIs are now popping up worldwide and are now providing the world's poor with access to innovative banking opportunities such as loans, savings accounts, insurance, money transfers, and even ATMs in some places.

### **II. Microfinancing Methods**

#### **A. Individual Lending**

Individual lending was the original type of micro lending. It is the most similar form of micro lending to traditional, commercial bank lending. Here, loans can be tailored to meet the needs of the individual lenders. "Customized loans have a price, however. The transaction cost is high, and costs are passed on to the borrowers. Individual loans are effective in supporting small businesses, but not in serving the poorest of the poor" (A Microenterprise Training Guide for Peace Corps Volunteers).

#### **B. Latin American Solidarity Groups**

These groups are composed of 4-7 self-selected members that guarantee each other's loans. Initial loan amounts are quite small and have a quick repayment period. Group members cannot take out more loans until the initial loan has been repaid. "When members repay their loan on time their credit limit for the next loan is increased by about 20 percent" (A Microenterprise Training Guide for Peace Corps Volunteers). Typically, group members must simultaneously open savings accounts that serve as collateral, which cannot be withdrawn until that group member leaves the group. Interest rates are lower in these types of solidarity groups because costs and risks are lower and default rates are quite low.

#### **C. The Grameen Bank Style**

The Grameen Bank format is similar to the Latin American Solidarity Groups in that groups are composed of 5 members and are self-selected. However, this format takes it a step further in that they "are then incorporated into village centers composed of up to eight of these lending groups. These centers are then grouped into regional branch offices" (A Microenterprise Training Guide for Peace Corps Volunteers). This format typically focuses on lending to women and payments are made in weekly increments.

#### **D. Village Banking**

Village Banking (VB) was created by FINCA International and is the most mimicked form of microfinancing throughout the world. Like the Grameen Bank format, VB primarily focuses on women and is comprised of 30-50 members. Management committees are then selected

and this group basically runs the bank itself. The VB is financed initially by outside sources are commercial lending rates and over time, once the VB proves to be self-sustainable, the initial loan is paid off and the bank is funded solely from within. Market interest rates are charged and the loan amounts themselves are typically quite small.

#### E. Credit Unions (CU)

Credit Unions “rely totally on the savings and fees paid by their members to build a loan fund” (A Microenterprise Training Guide for Peace Corps Volunteers). The loan amounts typical correlate to the amount of money each member has saved. CUs can partner with other CUs in the area over time to help create a much larger CU. The drawback of CUs is that many members of the community are discouraged from these types of organizations because they simple do not have the ability to save the necessary amount of money to join the CU.

### **III. Microfinance in Costa Rica**

Costa Rica is composed of 3 national microfinance networks: Red Centroamericana de Microfinanzas (REDCAMIF), Red Costarricense de Organizaciones para la Microempresa (REDCOM), and Red Estrategica para el Desarrollo Integral de la Microempresa (Redesarrollo). Within these three networks, three of the more successful MFIs are as follows:

#### **Asociación Costarricense para Organizaciones de Desarrollo (ACORDE)**

This non-profit MFI, based in San Jose, was founded in 1987 and is not regulated. This group provides micro-loans and voluntary savings accounts.

#### **Asociación ADRI (ADRI)**

This non-profit MFI, based in San Jose, was founded in 1986 and is not regulated. ADRI's products are aimed at microbusinesses in the commercial, services, tourism, and industrial industries. They also provide training and consulting to their clients.

#### **Fundación Integral de Desarrollo Rural del Pacífico Central (FIDERPAC)**

This non-profit MFI, based in San Jose, was founded in 1993 and is not regulated. This group provides micro-loans and voluntary savings accounts.

### **IV. The Purpose of the MFI**

The purpose is to provide financial tools such as credit and savings that were previously unavailable to the members of the carbon cooperative in a safe, transparent manner in hopes of initiating sustainable economic growth in the region and to help create a way in which these members can become financially stable citizens.

### **V. Initial Funding**

The proposed method for funding the MFI will be to use the funds received from the sale of the carbon credits and the profits obtained from the environmental payments for planting new trees from UNA. These funds should be more than enough to start the initial loan process for the members of the cooperative.

## **VI. Business Model**

Originally, there was a desire for the MFI to partner with or to be spearheaded by an already existing MFI that would provide the initial funding and they would manage the loan processes. However, after contact with the San Diego chapter of ACCION, the impression they gave is that they (the organization as a whole) only partner with small, established MFIs. Thence, the following business model has been proposed and upon successful implementation, Finca Project may decide to continue the local MFI management as is or partner with an established MFI.

It would be better to use a group lending model that incorporates individual lending opportunities on a need be basis for the MFI. The MFI would provide credit and savings possibilities for members of the “carbon cooperative”. The MFI would be completely funded by the “carbon fund” created by the sale of the member’s carbon credits on the voluntary market. Paid employees would operate it, but the members of the MFI will make all decisions during monthly group meetings (though Finca Project consultation is allowed). This will be an important factor as the members will need to feel that they have a say in what is done with the funds derived from their carbon credits and so that all group members will be informed as to what is going on within the MFI.

National policies must be strictly adhered to and completely understood before the initial stages of the MFI even begin. The MFI will be transparent in everyway to protect itself from fraud and to allow all members the opportunity to fully understand what is going on within the organization. The members should make the majority of the possible decisions as this is their organization and they should feel a sense of accountability for their decisions since this is their money as well.

Should members of the cooperative receive carbon credits for their sequestered carbon, they shall have the option to submit all of the derived money into the MFI, keep a portion for themselves and submit the rest to the MFI, or keep it all for themselves, if they so desire. However, a key aspect to the plan is for the members to attend micro-finance informational workshops prior to the establishment of the MFI and throughout the borrowing process to encourage reinvestment of carbon market funds (example themes would include “Micro-finance and Wealth Creation”, “The Miracle of Compounding Interest”, “The Importance of Savings”, and “Understanding Loan Contracts”).

### **A. Customers**

The customers that will comprise the initial kick-off to the MFI will be the members of the “carbon cooperative” whose funds received from the sale of their carbon credits helped establish the initial “carbon fund” by which the microloans were derived in Phase I of the proposal. Once Phase II begins, the Finca Project will determine the eligibility of clients based on feasibility and profitability.

### **B. Products or Services**

#### *i. Micro-loans*

Micro-loans lie at the core of all micro-financing institutions. With the interest of all parties involved, the MFI proposes two micro-loan options. 1) Members of the cooperative will have access to traditional individual loans at amounts, interest rates, and loan durations that are dependent upon loan use. Micro-loans will be made available on an individual basis for members of the cooperative and/or members of their immediate families (primarily for side businesses started by member's wives). 2) Members of the cooperative will also have access to group loans. These types of loans are usually composed of groups of 3-10 people (the loans do not have to fund the same project. There can be 10 people within a group funding 10 separate projects) and members may decide if they would like to include individuals from outside of the cooperative to participate in these group loans.

Group loans differentiate from individual loans in that if one group member misses a payment for a given period, the remaining members of the group must pay the non-paying members portion. This can change the dynamic of the group and the treatment of the non-paying member because if the non-paying member continues to miss payments, it will put strain on the other members to the point where they may default on the loan, which would prohibit borrowing opportunities for all members for a given pay period (generally around 1 year's time). Therefore, group loans provide a source of collateral that individual loans do not. "Failing to repay a loan results not in the seizure of physical property by the bank, but rather in the social sanctioning of the defaulter by others in his or her group. In a small village, shunning a friend can have high costs that are both social and economic (not being in a mutually beneficial relationship to help with each other's farms, etc.)" (Goldberg, 2009).

The other advantage group loans have over individual loans is that they drastically reduce transaction costs. Rather than incurring transaction costs for 10 separate loans, the bank would only incur transaction costs for 1 loan consisting of 10 people. This can help reduce interest rates for the borrowers and along with social collateral; group loans are laden with less risk than individual loans. In retrospect, group loans seem to be the obvious choice for any MFI, but customers' needs must be met and at times, individual loans are the most obvious solution for borrowers.

#### a. Eligibility

The sole requirement for borrowers in Phase I is to be a member of the "carbon cooperative and to have sold their carbon credits to help create the "carbon fund". This will help to keep things simple at the onset of this project. Also, it is only fair for those who put off immediate payment to be the only people allowed to borrow the money that came from their property. Preferable, immediate family members of the carbon sellers would also have access to loans and savings, but the members themselves will ultimately decide this.

#### b. Transparency

One of the primary goals of the MFI will be to remain transparent from the very first day and beyond. It is recommended that the members (before it will be put forth for a vote) that the following reports be made public to them by the MFI:

- 1) A monthly report that will be posted in the MFI office that lists the names of all borrowers, the amounts borrowed, the reason for the loan, and any late or non-payments.
- 2) A monthly report containing the repayment rate (which will include the names of all who have defaulted and the amount of periods in which they will not be allowed to borrow – if their appeal for future borrowing privileges is accepted) and the current required interest rate (members will need to understand that this is the current borrowing rate and if they have already taken out a loan, their rates are locked in and will not be affected by this current rate).
- 3) Quarterly simplified financial statements (balance sheet, income statement, and statement of cash flows).
- 4) The auditor's quarterly report stating the accuracy of what he/she discovered through the audit process.

#### c. Auditing

Auditing will be a vital function of the MFI and will help prevent fraud and will help solidify the reputation within the community. The MFI will need to hire a separate (non-affiliated – meaning, someone who does not currently work for the MFI or Finca Project and who is not a borrower) auditor to provide random, unannounced audits of the MFIs financials (preferably once a quarter). The auditor will check all transactions, monthly reports, and quarterly financial statements to ensure that the employees of the MFI are remaining transparent in their roles. The auditor will produce a report stating the accuracy of his/her audit that will also be posted along with the other reports in the MFI office.

#### d. Reasons for the Loans

The members of the cooperative will need to decide whether or not they would like to place restrictions as to what the loans may be used for. Some suggestions may include integrating clean technology into their daily lives or possibly only using the loans for agriculture finance (in which agriculture-related activities are financed from production to market). The cooperative may also choose to allow all types of reasons for financing (including loans for women to start small businesses, basic consumption loans, or encouraging more tree planting). If this is the case, they may choose to set different fixed interest rates for different activities.

Should clean energy investments be chosen as a possibility, the MFI may decide to offer incentives for these types of loans such as reduced interest rates, longer loan terms, and education regarding the clean energy purchase. Purchases could include LED lanterns, bio-digesters, efficient light bulbs, or efficient cooking stoves.

#### e. Crediting Period

The members of the cooperative will decide upon the duration of loan repayment periods. Typically, MFI loan contracts are created for 6 – 24 months. The duration of the loans should be determined by the cause of the loan since borrowers will have no credit at the time of the first loan distribution period.

#### f. Determination of Interest Rates/Credit Worthiness

Interest rates will have to be determined by the members of the cooperative, but will be encouraged to not low-ball the agreed upon rate so as to assure sustainability for the MFI. Interest rates are determined by the following: the cost of funds, operating expenses (personnel costs and administrative costs such as rent, utilities, fixed asset depreciation, etc.), loan losses (default rates), and desired profit to allow for future growth. A good number to start with would be 35%; the current global average rate (Kneiding, 2009). The final fixed rate may be higher or lower than this, but it would be a good idea to start making decisions from this initial rate. Rates may be sustainable at a lower amount if the members do not agree upon savings accounts, as that would chip away at the profit margin initially. However, the final interest rate should be determined after fairly accurate assessments of operating costs have been made. "Operating costs have always been the main driver of MFI's interest rates because microfinance is a labor-intensive business." Also, "operating expenses make up close to 50 % of nominal interest yields in a worldwide comparison" (Kneiding, 2009).

To determine a sustainable interest rate, the following formula can be used:

$$RR = (AE + LL + CF + K - II) / (1 - LL)$$

Where: RR = the required rate

AE = Administrative Expenses such as rent, salaries, utilities, training, benefits, and depreciation (if necessary). This will need to be converted into a percentage that can be found by totaling the operating expenses and subtracting the cost of funds and loan losses (found from the income statement at year's end), then dividing by the year's average outstanding portfolio.

LL = the loan loss rate is the total amount written off due to default. This will also be written in percentage form.

CF = the cost of funds rate. This includes interest paid (for savings accounts), any debt payments (for initial funding, a.k.a. the carbon validation/verification costs), and inflation. The CF rate will be determined by using a weighted average cost of capital (WACC) since the savings accounts and debt payments will have different interest rates.

Therefore, the CF rate = (savings deposits \* interest rate) + (debt payments \* interest rate) + (average equity (avg. equity - fixed assets) \* inflation rate) / average outstanding portfolio.

K = capitalization (desired growth rate of the MFI).

II = investment income. This is the total amount of revenues that have been generated by financial asset other than the loan portfolio (most likely not necessary for us, at least initially). This would also be expressed in percentage form by dividing II by the average outstanding portfolio. (Lesson 2.4: Interest Rate Practices).

#### ii. Savings Accounts:

Savings accounts will also be another option voted on by the members of the cooperative. Savings accounts can be a great tool for MFIs in that they are another way to

receive funding for loans and can provide more profitability in the future by way of increasing the overall fund and loan amount capabilities. However, interest paid on savings accounts can cut into the total amount of funds within the “carbon fund” at the times of closing of the savings accounts. Members of the cooperative will need to be educated on the pros and cons of savings accounts and further financial analysis will need to be conducted (depending on repayment amount, if any, for carbon validation/verification) before a final decision should be made regarding the use of the savings accounts. Savings accounts can be very useful for members of the MFI to provide a safe place to save their extra money or to introduce the concept to them. Savings can be used for things such as weddings, funerals, and educational expenses for children, or as a safety net for families.

Savings accounts may be either forced or voluntary. This option also need to be voted on by the members. The forced savings are typically used as collateral for a loan and cannot be withdrawn until the loan has been completely repaid. Forced savings do not typically pay interest to the borrower, though it can be done. However, forced savings do allow for lower interest rates for the borrower.

Voluntary savings will need to meet all Costa Rican legal requirements. They can be offered in many different ways and draw interest at different time intervals. Restrictions can also be included such as the requirement to not withdraw savings for at least one year’s time.

## **VII. Informational Workshops**

Prior to and during the MFI life cycle, it would be desirable for the MFI to host community informational workshops. These can be conducted by the MFI staff or by an outside agency. Example workshop themes may include:

### **Micro-finance and Wealth Creation**

This workshop would provide a basic overview of how micro-finance works, it’s purpose, and how the members can use micro-finance to obtain profitable business ventures.

### **The Miracle of Compounding Interest (if Savings Accounts are included)**

This workshop will teach members how, in Lehman’s terms, compounding interest can help increase their overall wealth (is this too much?).

### **The Importance of Savings**

This workshop will teach members the different uses of savings and why it is so important for them to take advantage of this opportunity.

### **Understanding Loan Contracts**

This workshop will provide an overview of what to expect when they are signing their loans for the first time and why it is important to understand all details contained within the contract itself.

### **Negotiations and Decision Making**

This workshop will teach cooperative members the value of BATNA (best alternative to a

negotiated agreement), things not to do during a negotiation, and team negotiations to help with the assembly process of the MFI, especially since money will always play a central role.

### **VIII. Community Fund**

Another option to be voted upon by the members of the cooperative will be the possibility of creating a community fund. The basic idea behind this type of fund is that a certain percentage will be kept in a separate “community” account from each loan that will be used to fund community improvement projects. Examples of these types of projects can be a playground, improving roads, a library, or community events.

### **IX. Reserve**

There will be a mandatory reserve for the MFI and the percentage to set aside will be voted upon by the members themselves. Most likely, a reserve between 10-20% would be optimal. The reserves will serve as a safety net should default rates dramatically increase or if a disaster should strike the area. As the MFI grows, the reserve will need to grow as well and there will need to be transparent accounting to show for this increase.

Ideally, the author recommends that the borrowers would also be required to maintain their own reserve (possibly 20-25%) to protect against default. Part of this reserve may also be used as part of the community fund if so desired by the members themselves.

### **X. Start Date**

The MFI itself should begin operation upon the receipt of the initial sale of carbon credits. Also, a treasurer/accountant will have to be hired first and decisions will need to be made by the cooperative regarding the MFI services/products, reporting/auditing, and an establishment of a board of directors (if deemed necessary).

#### **A. Project implementation agreement**

All bylaws for the MFI will have to be agreed upon by the Finca Project and the members of the cooperative. The bylaws will also have to adhere to standards and laws established by the micro-financing community and of the country of Costa Rica. A common, consistent contract format will need to be drawn up and agreed upon and records must be kept for all transactions and made available to any interested parties to adhere to transparency agreements.

#### **B. Confirmation of title to land**

Each member of the cooperative will have to provide proof of land ownership and carbon credits received for said land to determine the proper eligible amount of money to be obtained via loan per member. Copies of land titles and carbon credits sold will be kept on record and made available to interested parties when deemed necessary.

#### **C. Project location**

Members of the cooperative will vote on a location for the MFI to be “located”. The optimal location would be within CoopePueblos, R.L. within the Finca Project office. This depends

on the willingness of CoopePueblos, R.L. to allow us to use that location and the willingness of the Finca Project to rent its office as the location for the MFI office.

#### D. Operations Plan

Phase I of the project will only include members of the current CoopePueblos, R.L. cooperative. Therefore, all members will live within Copa Buena and its surrounding areas. Phase II locations must be agreed upon by members of the cooperative and the Finca Project.

#### E. Facilities, Equipment, and Technology

Once again, the optimal location for the MFI office would be the Finca Project's office. Necessary equipment includes a large safe (preferably bolted into the ground or a wall, if allowed), a computer, and access to a printer. Needed technology consists of Microsoft Excel and/or software such as QuickBooks.

#### F. Labor Force

The cooperative and the Finca Project will decide upon the hiring of a paid accountant/treasurer to oversee the loan process. The two parties may also prefer to use a volunteer Board of Directors to help decide key facets of the MFI and oversee and lead community meetings.

#### G. Budget

The members of the cooperative will need to agree upon a budget for salary expenses, rent, utilities, training for employees, workshop costs, benefits, and office supplies (safe, computer, computer software, printer or printer access, etc.).

### **XI. Financial Risks**

#### A. Credit Risk

Refers to borrowers' late payments or non-payments. This can affect future loan possibilities and can lead to default. Credit risk is one of the reasons why a reserve is required.

#### B. Transaction Risk

Refers to the handling of the loan process by the MFI personnel. Loans must be underwritten correctly and personnel must stay on top of proper loan disbursements, monitoring throughout the loan life cycle, and must ensure proper and efficient collection.

#### C. Portfolio Risk

Refers to the amount of diversification within the loan portfolio. Personnel must ensure those loans are not focused on one particular sector (such as only for the expansion of coffee on farms should the coffee market crash). This can be offset by offering various loan sizes, spreading of loans that fund different types of projects, and continuous monitoring to identify trends (such as late or non-payments for certain sectors of loans).

#### D. Liquidity Risk

Refers to the MFI's inability to maintain an acceptable level of accessible cash on hand in the reserve. Liquidity risk becomes more of a possibility for MFIs that incorporate savings accounts into the product/services portfolio.

#### E. Inflation Risk

Refers to the possibility of a sharp increase in Costa Rica's inflation rate, leading to a demand in loans and higher operating costs. Currently, this type of risk seems minimal, as Costa Rica's inflation rate has decreased in the past few years.

#### F. Foreign Exchange Risk

Refers to a change in exchange rates (specifically between US dollars and Costa Rican *Colones*) that can negatively affect the MFI's ability to repay any sources of funding. If the ability to validate and verify the sequestered carbon is dependent upon private investment that requires financing in US dollars and is to be repaid with profits from the MFI, a strengthening Costa Rican colon against the US dollar could potentially affect the repayment ability.

### **XIII. Operational Risks**

#### A. Human Resources Risk

Refers to the personnel's inability to properly manage and operate the tasks needed for a successful, self-sustainable MFI. Hiring of competent staff is crucial as well as proper training. An inability of the staff to fully grasp all MFI concepts will lead to a rapid downfall of the MFI. Improper data entry is also a risk that falls under this category and all documents and transactions need to be double-checked at the very least.

#### B. Information and Technology Risk

Refers to the possibility of losing all recorded documents due to a computer crash. Therefore, all documents need to be backed up in some way (external hard drive, thumb drives, saved as a Google document, etc.).

#### C. Fraud (Integrity) Risk

Refers to the possibility of fraud on behalf of an employee. Employees will be handling fairly large amounts of cash and therefore, should possess the utmost ethical standards and should be extremely trustworthy. This can be one of the greatest risks for this MFI and proves why MFI transparency and internal auditing is vital. Clients must also be encouraged to speak out against corrupt staff or should they have any reason to feel alarmed. This risk potential shows why the MFI needs its own location and why any operations should not be performed from home. It also proves that staff should be paid considerably well compared to other job opportunities in the area to reduce any fraudulent desires.

#### D. Legal and Compliance Risk

Refers to the MFI's inability to abide by all national laws. Costa Rican banking laws should be taught to staff and posted in the office if possible. Continuous monitoring of new laws or

changes to previous laws is of the utmost importance. Substantial research should be conducted in this area prior to the establishment of the MFI.

#### **XIV. Strategic Risks**

##### **A. Governance Risk**

Refers to corruption within the appointed board of directors. Should a board of directors be desired by the members of the cooperative and the Finca Project, careful selection of community members with extremely high ethical standards to serve on the board is of grave importance for the success of the MFI. The selection process should avoid members with their own agendas and should only include members with strong social ties to the community.

##### **B. Reputation Risk**

Refers to a lack of earnings potential due to a negative opinion of the organization from the community. This can arise from a number of things, such as corruption, poor customer service, poor governance, and even rumors of such things. Once again, this proves why transparency and hiring staff with high ethical standards are so important.

##### **C. External Business Risk**

Refers to the possibility of losing clients due to concerns arising from outside of the organization such as an increase in competition. How would we respond if an established MFI came into the region and started offering the same services as us? The MFI will have to understand the strengths and determine ways to stay competitive, even against those with better track records.

##### **D. Event Risk**

Refers to the risk posed by the possibility of a disaster or uncontrollable event affecting the community. Examples include floods, hurricanes, earthquakes, disease outbreak, agricultural product crashes, and national economic collapses. These events will severely increase the MFI's credit and liquidity risk and could devastate the community to the point that they pack up and leave town. However, in the occurrence of such an event, it would be most desired for the MFI to help the members of the community overcome such a trauma by helping them rebuild their lives.

#### **Topics to be Voted Upon by the Members of the Cooperative**

- 1) Microcredit methods to be used (individual vs. group loans or a combination of the two).
- 2) Customers (who will have access to the credit? Only those who sold the carbon credits?).
  - 3) Amount of members in each group (if group lending is approved).
  - 4) Hiring of employees and auditor (will include salaries).
- 5) Types of loans to be granted and if rates should be different for each type.
- 6) Incentives for clean energy investment (should this be an available option for loans).
- 7) Crediting period (possible 6 – 24 months depending on reasoning).
- 8) Interest rate determination.
- 9) Will savings accounts be included? If so, what is an acceptable rate? Will they be voluntary or forced?

- 10) Do they want informational workshops?
- 11) How do they feel about a community fund?
- 12) What is a desired percentage for the reserve?
  - 13) Project start date.
  - 14) Location of the MFI office.
  - 15) Budget determination.

**Points for Consideration:**

- 1) If we are not allowed to offer savings accounts since we are not a bank, we may be able to offer them to teenagers (children of the MFI's members) who are under the age of 18 since the members have essentially provided their own "share" towards the initial funding of the MFI. An example for this may be the *Empresa de Credito Comunal Nuevos Horizontes* MFI, which was established in 2009 by a Peace Corp volunteer.
- 2) Can we classify the MFI, if need be, as a NGO in order to work with an existing bank to provide group loans to a community organization (the cooperative)?
- 3) Depending on Costa Rica's MFI laws, how will it be classified (NGO, community based organization, cooperative, company, non-profit, etc.)?

## **CONCLUSIONS AND RECOMMENDATIONS**

Finca Project should coalesce coffee cooperatives into a carbon cooperative within the Coto Brus region to ensure that there is a sufficient quantity of measurable carbon for purchase. Finca Project would compose contracts directly with each landowner and redistribute profits accordingly. Stakeholder responsibility thus is instilled through direct transactions.

Finca Project should directly sell carbon offset credits from the website to interested individuals or organizations. If price received per credit is not of the utmost importance, then this will be the easiest and financially feasible option. Most offset websites, such as carbonfund.org, sell their offset credits at or around \$10 apiece. Since Finca Project obviously does not share the same first name recognition status as the carbonfund.org, Finca Project would have to sell credits at a discount, perhaps between \$5-7 per credit. However, it is still important that these credits are legitimate and avoid double counting.

Measurement of above ground carbon pools may be performed by either a) Forestry engineer interns, either from a Costa Rican university or a university in the United States, or b) A hired, part-time forestry engineer. Either party may develop location specific models for biomass assessment, however a "quick and dirty" measurement and quantification analysis may be performed.

Finca Project should only measure aboveground biomass. Field technicians should first determine the minimum diameter of live tree measurements and establish permanent plots for field sampling. In addition, Finca Project should monitor within the permanent plots and measure at set intervals for the length of the project. The number of plots will be primarily based on the variance of species and succession stages of reforestation. Eventually a QA/QC plan should be composed for internal audit purposes to verify the procedures used and data collected. Depending on the terms of the project, the authors also recommend that the socioeconomic and environment impacts of the actual project implemented be assessed.

Biomass measurements are the proxy for analyzing carbon sequestration of any given pool. To determine carbon sequestration, one needs to know how much has been lost or accumulated over time. If Finca Project decides to execute a REDD or ARR project that circumvents international certification, then any biomass equation most suitable to the vegetative landscape and profile may be used. The authors recommend either the equations provided by Polzot (2004), Pearson (2005) for specific species or Chave (2005) provides a general regression model based on destructive sampling as follows:

$$AGB = F \times r \times (\pi D^2/4) \times H$$

Where: AGB is in kg of a tree with D = diameter (cm), r = oven dry wood mass/green volume (g/cm<sup>3</sup>), trunk basal area (BA= $\pi D^2/4$ ), H = total tree height (m). This model assumes tree taper does not change.

F = multiplicative coefficient (taper dependent), if no taper and uniform specific gravity F = 0.1, if uniform taper F = 0.0333, if broad leaf species F = 0.06. This model is to be used for D between 5-156cm and r D<sup>2</sup> H 50–1,000,000.

Finca Project may use the general “rule of thumb” to calculate the carbon stock value, which is to multiply the biomass output value by 0.5. If Finca Project would also like to estimate the below ground carbon pools, which are resource intensive to assess, they may be approximated at 20-30% of the total tree carbon (Chave, 2005). Dead wood may be estimated at 10-20% of AGB (Brown, 2002). Finca Project is aware that carbon pool quantifications should be based on field measurements, especially for the calculation of carbon benefits, for precision purposes and data set integrity. A hired, engineer may perform verification on a yearly basis for a pre-determined period of time. The authors recommend that the gain-loss method be used.

A full-time individual should be hired as a factotum to act as coordinator of website carbon sales, accountant, public relations and assume other responsibilities as necessary. First and foremost, Finca Project will need to drastically improve its current marketing strategy if it hopes to compete with larger offset provider websites in terms of attracting potential clients. Possible ideas include telling the stories of various individuals within the community in which these funds will support, history of the people of the region, the importance of shade grown coffee, the lack of corporate and even national interest in the southern region of Costa Rica, how Finca Project measures the carbon, Finca Project's internship program (if interns conduct the measuring), the MFI proposal, and why direct carbon offset investment should be the client's preferred choice.

Many individuals who chose to offset their own emissions go through websites in which it's hard to know exactly where their money goes. However, the Finca Project carbon offset website will lay all of that information out for them and they will know exactly where their money is going and that it will help support the local MFI to help improve the lives of the citizens of Coto Brus.

The accountant role will be needed to handle all of the transactions and to provide each sale with its own serial number to avoid double counting. If possible, it would be most desirable to set up a mini-registry (similar to that of APX or the Climate Action Reserve) so that purchaser's names will be included in the registry and the remaining amount of credits available will also be included.

This will require someone willing to work in a full-time position and Finca Project will have to pay a full-time salary. However, a portion of the sales from the credits will go towards paying this salary, while the rest will go towards setting up the MFI. It may be advantageous for Finca Project to hire this individual to run the carbon sales website and upon or near completion of all sales (or the initiation of the MFI), this employee would change roles and become the “treasurer” for the MFI.

The world of the carbon markets is certain to change drastically in the coming years. Though this project began as a simple exploration of viability, with stable funding and an expert staff to bring this vision to fruition with scientific integrity, it is possible that Finca Project's MFI model could be duplicated in developing communities worldwide.

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