



**Final Report: Ceiba Foundation for Tropical
Conservation USFWS Grant**



Agreement number: F18AP00850
Organization: Ceiba Foundation for Tropical Conservation
Project officer: Yasaman Rezai
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A. Executive Summary

The purpose of this project is to create a biological corridor (Jama Conservation Corridor) in coastal Ecuador by helping local landowners conserve and reforest parts of their land while encouraging sustainable livelihoods. The project aims to reconnect the last remnants of semi-deciduous tropical forests in the northernwestern Manabí Province, Ecuador (totaling just 28,000 ha, less than 2% of its original extent) through forest restoration, regeneration of abandoned cattle pastures, and agroforestry, including silvopasture. The goal of this USFWS-funded phase of the project was to restore 200 ha in priority areas to enhance forest connectivity via the methods listed above. We implemented forest restoration on 228 ha (Map A), exceeding the project goal, including the establishment of agroforestry and silvopasture systems with the participation of eight local landowners in five communities (Maps B-F). We created data collection protocols and collected initial baseline data to allow long-term monitoring of ecological and socioeconomic outcomes. Educational workshops, including agroforestry training for landowners, were attended by more than 75 people. One of the greatest unanticipated achievements catalyzed by this project was the establishment of a Conservation and Sustainable Use Zone approved by four municipal governments. These municipal ordinances provide a legal framework for continuation of this forest restoration and sustainable land use program, and have stimulated new collaborations between Ceiba and other local conservation, development, and educational organizations.

B. Location

(Longitude and latitude coordinates of the main location of project work)

The USFWS-funded phase of the Jama Conservation Corridor was implemented between Pedernales (18.0396° N, -71.7415° W) and Jama (-0.2020° S, -80.2635° W) counties, located in Northwestern Manabí province, Ecuador. The project was based out of the Lalo Loor Dry Forest Reserve, owned locally but managed by Ceiba, in Tabuga (Jama County, Manabí Province) (-0.077° S, -80.1528° W).

C. Activities undertaken to achieve each objective of the project proposal

Activities pertaining to each objective are described in the following table:

Objective	Activities
1. Reforest 200 hectares in priority areas of the Jama Conservation Corridor.	Our goal for activity 1.1 was to work with 3-5 landowners to reforest approximately 200 ha of degraded habitat to connect 14,000 ha of forest. In fact, we engaged 8 landowners and reforested 228.05 hectares of land in previously identified priority areas in Jama and Pedernales counties that will increase the connectivity among forest patches totaling nearly 14,000 ha (see Deliverable 1.1, Map A, Photos 1-6 document the process). These landowners were approached specifically since their land represented critical points for biological connectivity between large forest patches in the corridor. Each landowner signed an agreement indicating their commitment to participate and

collaborate with the project. (See Deliverables 1.2: List of landowners, and 1.3: Example Participation Agreement). The breakdown of area under each restoration modality (see Objective 3) was: 208.97 Ha in assisted natural regeneration, 1 Ha in reforestation, 8.08 Ha in agroforestry, 2.5 Ha in silvopasture and 7.5 Ha in riparian restoration.

To achieve activity 1.2, we tailored technical support to landowner needs. Our field personnel met numerous times with each landowner to develop 'farm plans' (Deliverable 1.4: Farm Plans), that included participatory mapping of each farm to assess current land use, designate zones for restoration activities (agroforestry, silvopasture, reforestation or natural regeneration), and recommend sustainable productive activities (e.g., cattle water tanks to get livestock out of streams). The farm plan forms the basis of the activities that the landowner agrees to in their participation agreement. Participatory creation of the farm plan was also part of fulfilling Objective 3 (see below). Landowners who signed participation agreements committed to contributing at least one laborer to work alongside the 15 local people Ceiba hired over the course of the project to learn site selection and preparation, tree planting, seedling marking and maintenance, and fence installation. Ceiba also provided technical support in the form of species recommendations for a native tree nursery in Tabuga to produce the seedlings, and transport of seedlings to planting areas for an acclimation period in-situ prior to planting. We are creating a manual that will be printed and distributed to provide greater longevity to the training, education, and awareness-building activities carried out during the project (see Objective 4).

Activity 1.3 (promoting awareness and participation) was achieved through a public workshop titled "Restoration for the Conservation of Water and Sustainable Production" led by Inty Arcos and Nina Duarte on January 27, 2019 with 10 attendees (Deliverable 1.5: Workshop agenda and attendee registry, Photos 1, 2). Awareness of the project was also generated by numerous field trips to communities and key landowners by our field team, Jeremy Bravo and Marcelo Luque, the field technicians hired to implement the program and charged with speaking to landowners and community leaders directly about the project to garner interest and support. There are too many site visits to list here, however a daily log of the field technicians' activities in Spanish can be provided upon request.

For more information on education, training, and awareness-

	<p>building activities carried out during the project, see Objective 3 below.</p>
<p>Objective 2: Conduct biological surveys to assess the benefits of reforested corridors for wildlife and the environment.</p>	<p>To be able to monitor improvements for wildlife in the reforested areas it is necessary to know what species are using degraded areas. Our intention was to support two graduate students and two undergraduate assistants to carry out wildlife surveys of amphibians and reptiles, birds, and mammals but we were not able to recruit students for biological monitoring despite advertising these opportunities via university contacts in Ecuador and the U.S. Instead, the field team and some Ceiba interns carried out camera trap censuses of mammals in reforested areas and nearby forest reference sites likely to retain the full complement of terrestrial mammal species, including the private reserves Jama Coaque Reserve, Victoria Reserve, and Cerro Seco Reserve. Three farms were selected to test protocols for the initial monitoring of terrestrial mammals. Two cameras were placed in each area of intervention, and two cameras were placed in the nearest adjacent forested area. The climatic conditions, height, and geographical coordinates at each camera were recorded. Cameras were moved every 2 weeks for a period of 3 months, in order to sample a larger and more heterogeneous area so as to maximize the chance of encountering wildlife (Deliverable 2.1: Maps of camera trap placement). We also questioned landowners about observations of wildlife on their property in the year preceding the project. These data will contribute to an initial baseline (still being acquired) for monitoring of wildlife use of reforested areas through time, and the efficacy of corridors at facilitating movement between forest patches. We also collected baseline data on a sample of the planted trees in order to assess future survival and growth rates. In total we marked 452 trees of 12 species (Deliverable 2.2) in 4 plots. Due to time, budget, and personnel constraints we were unable to complete the monitoring of amphibians or birds.</p> <p>Analysis of preliminary camera trap data confirmed a greater abundance and diversity of mammals in forests than in reforested areas (Deliverable 2.3: Results and selected media from camera trap study).</p> <p>We were able to support one graduate student (Lucille Rice) with a small stipend to develop an assessment tool for the socioeconomic impacts of the project on participant livelihoods. The questionnaire and preliminary results from landowner interviews are presented as Deliverable 2.4: Socioeconomic impacts questionnaire.</p> <p>The baseline biological and socioeconomic data collected during</p>

	<p>this project, though not as comprehensive as initially proposed, forms an important initial step important for future monitoring efforts. Additional funding will be needed to more thoroughly evaluate baseline and early outcomes for the purpose of long-term monitoring and adaptive management that integrates socioeconomic benefits with conservation goals.</p>
<p>Objective 3: Build local capacity to sustain reforestation efforts and to improve local livelihoods.</p>	<p>Activities 3.1 and 3.2 were largely achieved together, since agroforestry was often a theme in the educational and outreach activities carried out with both landowners and other community members simultaneously. We created a continuous educational environment throughout the project, involving many stakeholder groups including farmers/landowners, the general public, local schoolchildren and teachers, university members, other local non-profits or community organizations, and representatives of the municipal government. Specific examples are listed below:</p> <p>Early in the project, Ceiba collaborated with the schools in Jama, Don Juan, and Tabuga to provide intensive learning activities about the corridor with participation by kids in some part of the implementation. During the schools' holidays a weekly program was set up together with the local library in Don Juan, which is run by a local foundation "A Mano Manaba". During school periods, 2-weekly sessions were provided in Don Juan, involving 60 children between 6 and 15 years old on general environmental awareness, the importance of water quality (Photos 7, 8), and planting trees in riparian areas to protect water and foster connectivity in a forested corridor. As part of this effort, 60 children planted around 200 trees on January 25, 2019 (Photo 9). A montage of our environmental education work can be viewed here: https://www.youtube.com/watch?v=q4hXVh7e0Z4.</p> <p>Additionally, 4 workshops were held for more than 75 people in the project intervention area on the following topics:</p> <ol style="list-style-type: none"> 1. Restoration and conservation of sustainable use zones (for project participants) – Photos 10, 11 Dates: January 26-17, 2019 Location: Lalo Loor Dry Forest Reserve Number of participants: 12 Given by: Nina Duarte and Inty Arcos 2. Bird tourism ("Aviturismo") and illegal hunting and logging prevention – Photos 12, 13, 14

Dates: May 6-7, 2019

Location: Lalo Loor Dry Forest Reserve

Number of participants: 10

Given by: Marcelo Luque

3. Sustainable farming - visit to model farm – Photos 15, 16

Date: August 23, 2019

Location: Finca La Sarita (growers of To'ak Chocolate)

Number of participants: 15

Given by: Servio Pachard

4. Sustainable agriculture and entrepreneurship

Date: September 13, 2019

Location: Finca La Sarita

Number of participants: 40

Given by: Carolina Toapanta and Servio Pachard

Deliverable 3.1: Registration lists of workshop attendees

Overlapping with Activity 1.2 and 1.3, the 15 workers employed for the project received prior training on forest restoration methods and related sustainable land use systems to be replicated in their families and communities (Deliverable 3.2: List of local workers employed).

We believe our implementation of Activity 3.3 was highly successful in meeting Objective 3 of building local capacity to sustain reforestation efforts and to improve local livelihoods. Our approach was to use local knowledge and practices to implement forest restoration modalities that best fit the landowner's needs. The process of doing this involved field visits and creation of "farm plans" as described above (Objective 1). We tailored our intervention on each property according to four different restoration modalities, designed according to local norms in terms of species utilized and density of planting. The four modalities are as follows:

1) ASSISTED NATURAL REGENERATION

Assisted regeneration harnesses natural ecological processes to restore natural vegetation on the landscape. This modality was

best suited to areas of abandoned or unproductive pasture, degraded shrub land, or secondary growth less than 5 years old with natural vegetation more than 2 meters high. In these areas the intervention included securing the area against cattle (live fences and barbed wire) and, if there were already desirable small native trees, liberating them from competing weeds to facilitate their growth. We also enriched these areas with artificial perches and enrichment planted with desirable tree species at a density not greater than 10 trees/ha to attract birds and other seed dispersers. This modality provided to be the least costly to implement, but relied on the landowner having unproductive areas, or areas he was willing to take out of production.

2) REFORESTATION

Reforestation aims to restore natural forests and their biodiversity by planting native tree species. This modality was applied in degraded pasture or other previously cleared or newly abandoned areas, where the vegetation was less than 2 meters high. This modality was the costliest of all, exceeding initial budget expectations on a per plant basis due to transport and labor, so we prioritized small areas with high ecological importance such as key connections, river margins, or very steep land. Planting density was approximately 900 trees/ha, but varied if existing isolated trees were present.

3) RIPARIAN RESTORATION

This modality of reforestation is applied in 25 meter wide strips on each side along a river where natural vegetation is degraded. The intervention in these areas is the planting of native species suitable to wet sites to restore vegetative cover, create wildlife corridors, and reduce runoff. Installing fencing to keep livestock out is often required. Planting density is between 400-900 trees/ha.

4) AGROFORESTRY and SILVOPASTORAL SYSTEMS

This modality was applied where the owner wanted to maintain an agricultural system with trees. In the case of agroforestry, the main product is vegetative, and in the case of silvopastoral it is animal. Native trees can be combined with fruit trees in these systems. Planting density is around 400 tree/ha in agroforestry, and 100 trees/ha in silvopastoral.

Assisted natural regeneration comprised the majority of our interventions due to the prevalent ecological conditions, such as felled or burned forest in a state of natural recovery. We

	<p>introduced native plants tolerant of harsh conditions to improve the resilience and diversity of the system, and also constructed 5.79 km of fences to keep livestock out. This type of restoration was promoted mainly for landowners who have fallow land because they abandoned pastures or cropland that was no longer productive.</p> <p>Deliverable 1.1 contains maps of each property showing the distribution of the different modalities.</p>
<p>Objective 4: Disseminate results of reforestation effort to local communities and scientific community.</p>	<p>The results of this project have been consistently disseminated throughout the project to the local communities, the general public, and local governments through media, multiple meetings with municipal and community representatives, and during the organized events (workshops, etc.) that were part of this project and the greater Conservation and Sustainable Use Area (ACUS) being adopted regionally due to Ceiba’s efforts. Evidence of broader dissemination on national level is found in this article in Ecuador’s ‘El Comercio’ newspaper:</p> <p>https://www.elcomercio.com/tendencias/turismo-manabi-ayudar-conservar-aprender.html</p> <p>The final outcomes of the project were publicized during a project closure celebration (Photos 17, 18) to recognize participating landowners with a certificate of recognition, and allow them to share their experiences with attendees from the communities, local governments and media in an effort to recruit more participants in future phases of the corridor project. (Deliverable 4.1: List of attendees in final presentation of outcomes; Deliverable 4.2: Example Certificate of Recognition). A video was also created to share the project with the public: https://youtu.be/pclbXym4P-E</p> <p>For activity 4.2, we created a draft manual on Recuperation of Degraded Lands that compiles all the information and lessons learned into a “how to” manual in Spanish that includes descriptions of the four modalities, species recommendations, planting instructions, cost estimates, and an overview of the benefits of land restoration. This document is still being edited and illustrated but will be printed and distributed free sometime in the first half of 2020. We do not yet have enough data from monitoring to publish scientific results of biological outcomes, but this is a future goal (Deliverable 4.3: Draft Manual).</p>

D. Explanation of the problems encountered for any objectives not met

All of the project objectives were met, however we include some comments on challenges encountered during certain activities and lessons learned that will inform future implementation. In the area where the project was executed, some local residents were reluctant to receive training and to conserve forests due to lack of time, economic solvency, and environmental knowledge. However, there were striking differences between people that did want to participate, ranging from very interested to reluctant about their participation. We pared down the initial list of 21 priority participants who had expressed an initial interest, to include the 8 actual participants for this initial phase. This still exceeded our anticipated 3-5 landowners proposed for the project. The lesson learned is that initial interest, particularly when there is a perception that financial support may be offered, does not translate to active participation when implementation takes place. Because of this, we hired 15 local laborers to assist with planting for landowners who were unable to or unwilling to carry out the manual labor. Our general approach going forward is to focus on the “low hanging fruit” or those most enthusiastic and engaged, as this increases the likelihood of success during the initial phase *and* creates local opinion leaders who encourage others in their community to participate in later phases.

Additionally, while we carried out ad-hoc inventories of species and land uses during creation of farm plans, we were not able to collect baseline data on all farms and for all parameters initially proposed due to an underestimation of the time and resources required, and a lack of people to carry out the investigations. We distributed scholarship announcements for two graduate students and undergraduates to design and implement abiotic and biotic monitoring of reforested areas; however we received little interest (Deliverable 4.4). Only one graduate student worked with Ceiba during the project (Lucille Rice, U. Montana), and her interest lay in the socioeconomic impacts. Since socioeconomic indicators also are important for assessing project success, we brought her on board to develop a socioeconomic assessment tool, and she came to Ecuador from Aug-Dec 2019 to carry out the work.

The project coordinators and contracted workers carried out other monitoring activities. However since their focus was getting trees planted and regeneration plots established before the project end date, the time and resources they had available for monitoring was limited. Furthermore, many farms were difficult to access and it took time to get in contact and arrange meetings with landowners in order to set areas for research plots since they were not always present on their farms. Thus we only were able to establish research plots for long-term wildlife monitoring in reforestation and nearby reference forest for three farms. No data was collected on water quality or soils, but we did obtain some preliminary data from camera trap surveys, and with additional funds we plan to continue and expand the vital monitoring aspect of this project. The results of the project have been shared with the population and the participants, but we lack sufficient data for a scientific publication at this time. Instead, we created an instruction manual for reforestation in the region and will distribute it to landowners once final editing is complete. Despite the inability to fully implement all aspects of Objective 2, the intervention areas are all less than one year old and we believe valuable baseline conditions can still be obtained within the next year if additional funds are secured.

The last challenge that forced us to alter our approach was the difficulty in acquiring and planting the number of trees we had initially expected to. We had planned on reforesting all 200 hectares, with 400-900 trees/ha, which would have required a total of 80,000 to 180,000 tree seedlings. However we soon discovered that the capacity to produce this many seedlings did not exist in the region. We worked principally with two nurseries, one in Tabuga, and one near El Carmen, in a wetter region more inland

from the coast. Our partner in Tabuga willingly collected seeds of native species and produced as many seedlings as he could for the project, but being one man with no resources to hire staff or expand his landholdings, he was limited to growing 12,000 trees for us, far short of the number needed. The second nursery had similar capacity limitations, but also had only a few native species in their inventory that would grow in the significantly drier coastal zone. This challenge was overcome by focusing greatly on the restoration modality of assisted regeneration rather than reforestation, which requires far fewer seedlings. Continued implementation of large scale reforestation efforts will require an initial investment in helping communities or local organizations set up native tree nurseries, finding local sources of seed, and training people how to plant and care for nursery-grown seedlings.

E. If the goals and objectives were not met, the reasons why

The overall goals and objectives were met. Our goal was to restore 200 ha (we restored 228 ha) with 3-5 priority landowners (we involved 8), connecting roughly 14,000 hectares of forest. Challenges encountered for specific activities, and how they were overcome is detailed above.

F. Assessment of the project’s impact

<i>Activities</i>	<i>Value</i>	<i>Impact</i>								
Reforestation of degraded areas	Number of hectares of degraded areas	228.05 hectares were recovered to connect 14,000 ha of remaining forest remains in the counties of Jama and Pedernales.								
Selection of participants	Number of participants	In total, there were 8 participating landowners (exceeding our original goal of 3-5), who were selected through a preliminary list as they own areas that were previously identified as high priority due to the ecological importance of their land for forest connectivity. In addition, 170 people participated in various workshops, educational events, and the final presentation; this number includes adults and children.								
Maps of restored areas	Maps	GIS maps were created for each property, showing the number of hectares under each restoration modality, as well as location of rivers, existing infrastructure, and the form of land protection (for example, fences)								
Use of native varieties of the area	Native tree species	<p>A total of 12,000 trees were planted.</p> <p>The following tree species were used for the project (native timber and fruit trees)</p> <table border="1"> <tbody> <tr> <td><i>Annona muricata</i></td> <td>50</td> </tr> <tr> <td><i>Cedrela odorata</i></td> <td>250</td> </tr> <tr> <td><i>Centrolobium ochroxylum</i></td> <td>1500</td> </tr> <tr> <td><i>Cordia alliodora</i></td> <td>1500</td> </tr> </tbody> </table>	<i>Annona muricata</i>	50	<i>Cedrela odorata</i>	250	<i>Centrolobium ochroxylum</i>	1500	<i>Cordia alliodora</i>	1500
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		<i>Citrus sp.</i>	700
		<i>Guazuma ulmifolia</i>	1000
		<i>Inga spectabilis</i>	600
		<i>Leucaena leucocephala</i>	500
		<i>Libidibia glabrata</i>	600
		<i>Lysiloma guachapele</i>	50
		<i>Myroxylon pereirae</i>	50
		<i>Ochroma pyramidale</i>	500
		<i>Prosopis juliflora</i>	600
		<i>Psidium guayaba</i>	50
		<i>Senna spectabilis</i>	500
		<i>Spondias mombin</i>	500
		<i>Swietenia macrophylla</i>	150
		<i>Tabebuia chrysantha</i>	1000
		<i>Tabebuia donnellsmithii</i>	200
		<i>Triplaris cummingiana</i>	600
		<i>Vitex gigantea</i>	500
		<i>Ziziphus thyrsoiflora</i>	600
Creation of local employment	Number of people hired	15 people from within the project region were hired, giving employment that directly benefited the families of hired workers	
Wildlife monitoring	Results of camera trap investigation	We generated a database with the results from camera traps located on the properties of three project participants in Camarones and Rambuche, and forest reserves in order to begin establishing a baseline for animal movement through intervention areas in the corridor.	
Workshops	Number of workshops	<p>A total of 4 trainings were carried out for project participants and other local community members on topics including: Sustainable Agriculture, Entrepreneurship, and Avitourism.</p> <p>Additionally we have provided a total of 5 workshops for local teachers and 18 environmental education activities for children in the communities of Jama, Tabuga, and Don Juan.</p>	

G. Descriptions of any cooperation or collaboration among local organizations

We have worked together with the following local institutions, either based on existing collaboration agreements, or by establishing new collaboration agreements:

- Municipality of Jama: provided support with transportation for students and teachers, provided technical advice and assistance in conducting workshops and trainings of community members as well as the dissemination of the project information
- Municipality of Pedernales: provided technical advice and assistance in conducting workshops and trainings of community members as well as the dissemination of the project information
- Farmer insurance association of Rambuche: collaborated with us to promote working groups in the community of Rambuche, which was one of the locations involved in the project
- Ecuadorian Ministry of Environment: assisted with training on issues of illegal hunting and logging of wild species of flora and fauna and technical advice and assistance, we included this training within the Avitourism workshop
- Universidad Laica Eloy Alfaro de Manabí: university students collaborated in tree planting processes within reforested land
- Universidad Tecnológica de Manabí: teachers and students participated in wildlife monitoring with trap cameras in Bahía de Caraquez and Canoa
- Fundación A Mano Manaba: provided space in the local library of Don Juan for environmental education sessions with the school and community, and supported transport during field visits for environmental education
- Unidad Educativa ‘Manuela Cañizares’ Tabuga: provided space in the school in Tabuga for environmental education sessions with the school children
- Unidad Educativa ‘Bartolomé de las Casas’ Don Juan: provided space in the school in Don Juan for environmental education sessions with the school children
- Unidad Educativa ‘el Milenio’ Jama: provided the space in the school in Jama for environmental education sessions with the school children

H. The cost and purchase date of any equipment purchased

No equipment was purchased for this project, as defined in Section IV of the Award Guidelines (cost >\$5000).