CO_2OL-USA/FUTURO FORESTAL NATIVE SPECIES REFORESTATION IN PANAMA

for **Land Use, Land-Use Change and Forestry (LULUCF) Projects**

Project name	***CO_2OL-USA and Futuro Forestal S.A. Panama***
Date submitted	July 29, 2006

A. Project description, type, location and schedule

General description	
A.1 Project description and proposed activities	CO_2OL-USA/Futuro Forestal is a private sector initiative to create a mixture of accountable temporary Certified Emission Reductions (tCERs), for both the regulatory and voluntary markets, through sustainable reforestation in the tropics. Sustainability is here defined in its broadest sense covering all its ecological, social and economic aspects. CO_2OL-USA/Futuro Forestal is a product and a component of our corporate reforestation services which we have been offering to our clients since 1995. Our aim is to integrate our carbon mitigation reduction activities into a broader institutional framework and seek enduring mechanisms for marketing tCERs to individual, corporate and institutional clients. CO_2OL-USA/Futuro Forestal climate products consist of three different components: 1. Carbon emission reduction to mitigate climate change through sustainably managed commercial timber plantations. 2. Carbon emission reduction to mitigate climate change through reforestation for protection and extraction purposes in areas which will eventually be passed on to local communities who will be in charge of managing and protecting them to ensure permanency of carbon storage. 3. Carbon emission reduction to mitigate climate change through protection of existing secondary forest areas that are part of the land that Futuro Forestal acquires for the implementation of its reforestation services. These areas of standingsecondary forest are protected due to their ecological value and state of development. CO_2OL-USA is a partner with Futuro Forestal – a reforestation and forest service company based in Panama and currently extending its operations in Nicaragua. CO_2OL-products are offered to Futuro Forestal's international investors as a stand alone concept for carbon sequestration and biodiversity enhancement (CO_2OL-Basic) as well as a component of Futuro Forestal's investment products that focus on the sustainable production of timber from fine, tropical hardwoods (CO_2OL-Invest). The additionality concept of our project is based upon the premise that converting low productivity grasslands into diverse multi-

	species forest plantations for the purposes of ecosystem rehabilitation, habitat protection and timber production directly leads to a net anthropogenic reduction of carbon emissions. This project would not be undertaken without the additional revenue expected from the sale of ecosystem services, specifically carbon credits as tCERs. In addition, there are several barriers preventing such a project from happening in our geographic regions of operations. These are mainly economical, technological and financial in nautre (see Annex 3). We strongly believe that the premise of obtaining additional revenues from the sale of tCERs on the Kyoto market has been a key factor in convincing our sponsors to invest in our reforestation project throughout the years and as such, has directly contributed to overcoming these barriers. Generating revenues for investors through the sale of FSC certified, fine tropical timber and tCERs has always been a fundamental concept of the reforestation approach. The CO_2OL-USA/Futuro Froestal approach is built on creating sustainable and complex plantation ecosystems that contain multiple species, have multiple uses, and that produce a diverse stream of products and benefits. The opportunity to invest in a reforestation project that is guided by a science-based timber management company with the knowledge and experience to effectively grow and commercialize native species plantations and tCERs has been a primary motivating factor convincing our preliminary investors to have confidence in our project. It is also clear that the premise of obtaining additional revenues from the commercialization of tCERs has directly contributed to making our project more economically attractive and environmentally sound to our investors. Though we recognize that the revenues from the sale of carbon credits has thus far only played a minor role in the financial viability of the CO_2OL-USA/Futuro Forestal project in Panama, the promise of obtaining additional returns from the sale of an asset with a promising economic future such as tCERs has been a key element in making our investment concept attractive. Not only did the multi-stream revenue concept stand out as offering multiple environmental and economic benefits, it also directly contributed to making our investment opportunities more diversified and more stable. In other words, the potential offered by the commercialization of tCERs made our investment opportunities safer, which in the end made the entire project a safer and more sustainable venture. For such reasons, we strongly believe that the premise of obtaining additional returns from the commercialization of tCERs has been a key element in attracting clients to invest in our project and as such, in overcoming the barriers we, and others in the region, have faced.
A.2 Technology to be employed	Since its inception in 1995, Futuro Forestal has offered reforestation and management services to its international clients interested in fostering the development of carbon sinks. The international brand "CO_2OL" was established and registered in

	1998 to create a tool to enhance the promotion of climate related environmental services. The Futuro Forestal/CO_2OL-USA project is being implemented on the pacific coast of Panama. The project purchases primarily abandoned grasslands, that were formerly used for extensive cattle ranching, and reforests them with a mix of several native species and teak. By creating these new forest plantation ecosystems on formerly abandoned grasslands, the project helps to improve biodiversity habitat, stabilize and improve soil conditions, reduce erosion, and improve water quality. Our concept of sustainable forestry follows three main objectives: 1. to be economically profitable for our clients (the project sponsors) and for our company. 2. to generate ecological benefits for the project itself and the whole project natural habitat by working towards sustainable resource management, increased biodiversity, ecological corridor creation, habitat regeneration and protection, and the extensive use of ecologically sound technologies and resources. 3. to have positive social impacts upon the employees of the project, the surrounding local communities and on the larger regions surrounding project areas. Some of our activities include: continuous phytosanitary control of existing plantations, in-house production of organic fertilizer, establishment of our own nursery for the production of high quality seedlings from certified seed sources, mosaic spacing of planted species as part of our IPM program, protection and enrichment of secondary vegetation in the project areas, use of buffer and shadow vegetation to enhance biodiversity and control disease and pest risks, meticulous site selection to incorporate low productivity or degraded lands into productive plantations, emphasis on labour-intensive technologies, job creation, the professional and general education of staff (e.g. provision of literacy courses and GPS/GIS training, etc.), allocation of social benefits for employees, etc.
Proponent submitting the project	
A.3 Name	**CO_2OLUSA & Futuro Forestal S.A.**
A.4 Organizational category *(choose one or more)*	a. Government b. Government agency c. Municipality d. **Private company** (Futuro Forestal and CO_2OL-USA) e. Non-Governmental Organization
A.5 Other function(s) of the project developer in the project *(choose one or more)*	a. Sponsor b. Operational Entity under the CDM c. **Intermediary** (Futuro Forestal/CO_2OL-USA have been mandated by its Sponsors (investors) to commercialize all tCERs produce in the project area d. **Technical advisor**
A.6 Summary of relevant experience	CO_2OL-USA has been providing carbon sequestration, carbon credit auditing, accounting, sales and brokerage services to its international clients for over eight years. Nonetheless, carbon sequestration to mitigate climate change has been a component of

	Futuro Forestal products since the inception of the company. Since its inception, Futuro Forestal/CO_2OL-USA have been contracted, for their environmental and investment services, by almost 200 private and corporate investors worldwide. Futuro Forestal currently manages a project area of more than 700 hectares in Panama, including approximately 25% of protected forest areas. In addition, Futuro Forestal has been recently contracted to reforest approximately 10,000 hectares in the north-west region of Nicaragua. To calculate the amount of net carbon emissions mitigated in its plantations, Futuro Forestal/CO_2OL-USA have developed and implemented a comprehensive carbon measurement and monitoring field methodology which has been integrated into the regular plantation monitoring activities. Carbon mitigation projections are developed using the modeling-program CO_2-Fix, which is combined with our GIS-based inventory system on all managed areas. Over the years, Futuro Forestal/CO_2OL-USA have been selling non-certified carbon emission reduction units for its clients as an additional investment benefit. Also, a handful of Futuro Forestal's and CO_2OL-USA's clients have decided to retain their carbon emission reduction units to compensate for their own private emissions. Customers which have purchased emission reduction unit from our Panama project include: Natsource (http://www.natsource.com/), Rheinland Versicherungen (http://www.rheinland-versicherungen.de/), Ideal Works (http://www.idealswork.com/). Last year, companies in the European transport sector such as Lease Plan England also contracted us for our carbon mitigation services as well as numerous small businesses in the USA.
A.7 Address	CO_2OL-USA 415 N. Higgins Ave., Suite #124 Missoula, Montana 59802 USA Futuro Forestal S.A. CO_2OL-Services Department Apdo 9823 David Chiriquí Rep. of Panama
A.8 Contact person	Keegan Eisenstadt - CO_2OL-USA Andreas Eke – Futuro Forestal S.A.
A.9 Telephone / fax	USA +(406) 721-3000 ext.1240 Panama + 011 507 317 1431
A.10 E-mail and web address	keegan@co2ol-usa.com www.co2ol-usa.com ae@futuroforestal.com

	www.futuroforestal.com http://co2ol.com
Sponsor(s) financing the project *(List and provide the following information for each project sponsor)*	
A.11 Name	Hundreds of individual and corporate investors worldwide
A.12 Organizational category *(choose one or more)*	a. Government b. Government agency c. Municipality d. **Private company** e. Non-Governmental Organization f. **Individual investor (s)**
A.13 Address *(include web address)*	CO_2OL-USA 415 N. Higgins Ave., Suite #124 Missoula, Montana 59802 USA Phone: +(406) 721-3000 ext. 1240 Fax: +(406) 721-5912 keegan@co2ol-usa.com www.co2ol-usa.com Futuro Forestal S.A. CO_2OL-Services Department Apdo 9823 David Chiriquí Rep. of Panama T/F (Panama): 00507 317 1431 ae@futuroforestal.com http://www.futuroforestal.com http://co2ol.com
A.14 Main activities	Reforestation with mixed native species plantations. Parts of the company's plantations contain exotic species such as teak. Project sponsors are mainly private individuals and companies with environmental concerns, seeking profitable and sustainable investment opportunities and/or carbon sequestration investment opportunities to mitigate their own CO_2, or other Greenhouse Gas, emissions.
Type of project	
A.16 Greenhouse gases targeted	**CO_2** / CH_4 / N_2O
A.17 Type of activities	Sequestration / Conservation
A.18 Field of activities (*Select code(s) of project category(ies) from the list in Annex 1*)	1a , 4b, 5
Location of the project	
A.19 Country	Panama
A.20 Nearest city	David (Panama)
A.21 Precise location. For multiple sites, include a list in	**Panama**

Annex 6 (*Include latitude and longitude if known*).	1) Las Lajas, Municipio (County) of San Felix, Province of Chiriquí, Panama 81.56° W, 8.12° N 2) El Pito, Municipio (County) of Sona, Province of Veraguas, Panama
Expected schedule	
A.22 Earliest project start date *(Year in which the project will be operational)*	Our project started in 1995. Nonetheless, considering that A/R CDM projects initiated prior to Dec. 31st 1999 are not eligible to apply for CDM certification, only the land areas reforested after this date are included in this project proposal.
A.23 Estimate of time required before becoming operational after approval of the CFD	**Panama** Time required for financial commitments: …0 months Time required for legal matters: …0 months Time required for negotiations: …0 months Time required for establishment: …0 months
A.24 Year of the first expected CER / ERU / lCER / tCER / RMU / VER delivery	The delivery of tCERs has already been accomplished, as well as the brokering/sale of the tCERs for the clients/investors that did not want the tCERs, but wanted the revenue instead. Future delivery of tCERs or sale/brokering services are possible at any time. **2007**
A.25 Project lifetime *(Number of years)*	In the CO_2OL-Invest product model, our plantations in Panama will have a 25 year rotation cycle, that will include fice different harvests activities, 4 thinnings and 1 final harvest.
A.26 Current status or phase of the project	a. Identification and pre-selection phase b. Opportunity study finished c. Pre-feasibility study finished d. Feasibility study finished e. Negotiations phase f. **Contracting phase**
A.27 Current status of the acceptance of the project by the Host Country *(choose one)*	A. Letter of No Objection is available B. Letter of Endorsement is under discussion or available **C. Letter of Approval is available**
A.28 Position of the Host Country on the project *(Are carbon sinks encouraged as CDM/JI activities? Describe the legal relationship between the Project Sponsor and the Owner of the future Emission Reductions? If the Project Sponsor intends to sells the Emission Reductions, is the Sponsor allowed to do so legally? Has the Host Country endorsed the project? If not, when will it do*	The Host Country encourages actively A/R CDM project activities. The Designated National Authorities (DNA) – ANAM – are strongly committed to make Panama a favorable host for the development of A/R CDM projects as can been seen on their website: http://www.anam.gob.pa/cambio%20climatico/CDM%20potential%20in%20panama.htm). Notably, ANAM has recently conducted a study to evaluate the potential of A/R CDM projects in the country and identify prime locations for developing such projects. A complete electronic version of the study can be found at:

so? Is there a risk the Host Country will not endorse the project? Please also refer to Annex 7)	http://www.fao.org/docrep/006/ad441s/ad441s00.htm The first map found on Page 3 of the following section (ftp://ftp.fao.org/docrep/fao/006/AD441S/AD441s07.pdf) indicates that our 2 reforestation sites fall within the region which offers the highest carbon sequestration potential. Upon investing, our project sponsors (our investors) become the legal owners of the land on which reforestation activities take place and therefore, also own the tCERs sequestered in our plantations. There is a contractual agreement between project sponsors and the managing parties (Futuro Forestal /CO_2OL-USA) which grants the right to the managing party to sell tCERs for the sponsors/investors and for their benefit. Such a contractual agreement also stipulates that all management activities during project execution and all future land uses and management activities carried by the managing party have to guarantee permanence of sold tCERs for the duration of the tCERs validity period.
A.29 Position of the Host Country with regard to the Kyoto Protocol *(choose one)*	The Host Country **a. <u>Is a Party to the Kyoto Protocol (i.e. has ratified or otherwise acceded to the Kyoto Protocol)</u>** b. Has signed the Kyoto Protocol and demonstrated a clear interest in becoming a Party in due time c. Has not signed the Kyoto Protocol

B. Expected environmental and social benefits and risks

Environmental benefits and risks	
B.1 Baseline scenario *(Please describe the most likely scenario in the absence of the proposed project and explain why the project leads to more carbon being sequestered than would otherwise occur. What would the future look like without the proposed project? Different scenarios may be envisaged, including the continuation of a current activity ("business-as-usual"), implementation of the proposed project activity and many others. Please also refer to Annex 3 on baseline methodology.)*	The vast majority of the region's primary and secondary forests were cut down between the 1950's and the late 1970's. They were cleared by local slash and burn subsistence farmers. This land use conversion is common practice throughout the region of the project, as well as other regions of rural Panama. Slash-and-burn farmers throughout the project area generally cultivate their land for a few years and then leave it fallow or, more often, sell it to local cattle ranchers. After selling the land to cattle ranchers, the land use is again converted to extensive cattle ranching, as the soil nutrients are not able to support intensive cattle ranching. The subsistence farmers often move on to other areas of the country where the land-use conversion cycle is repeated. The project activity area – which currently includes the Las Lajas and El Pito regions - is no exception to that cycle. Indeed, the lands where our projects sit were traditionally used for subsistence farming followed by extensive cattle ranching activities - the two predominant economic activities of the region. Aerial photographs of all project sites and surrounding regions clearly show that the aforementioned land use conversion cycle has directly contributed to decreasing the forest cover in the project areas. Currently, there are only a few, small, secondary forest fragments and some riparian forests remaining prior to the inception of the project. For the most part, the lands where our project activity is being

	developed have been abandoned or left to fallow for long periods of time by large cattle-ranchers. These large cattle operations required large numbers of hectares to profitably operate extensive grazing operations, they were therefore, accumulating degraded pasture lands and leaving them in a non-productive state for future rotations of cattle. Indeed, while extensive cattle ranching was the dominant economic land use activity in the project area for several decades, new technologies and management techniques have allowed large cattle-ranchers to intensify their grazing activities. This intensification reduces the need for ranchers to own large grazing areas to manage their herd. Therefore, as the need for large grazing areas is diminishing, large cattle ranchers in the project area are able to sell off part of their pasture land holdings without risk to their cattle operations. These are the types of lands that Futuro Forestal/CO_2OL-USA are interested in for reforestation. The negative environmental impacts of extensive cattle ranching are well-known (deforestation, soil compaction, erosion, prevention of natural vegetation re-growth). All together, such impacts are known to directly contribute to decreasing soil productivity and soil regeneration capacity, which limit future land use options. Unless the project area were surrounded by relatively large patches of forests (which can foster natural land regeneration through seed dispersal), it has proven difficult and unlikely that the large patches of degraded pasture land that dominate the project area could be restored through natural seed dispersal. An analysis of aerial photographs shows a low ratio of natural forest/pasture land in the project area, making the natural recruitment of forest tree species into existing pasture land very unlikely. Nevertheless, we recognize the need to monitor the process of natural recruitment of forest species and potential re-establishment processes on baseline lands in our project areas. Considering both the historical and recent economic land use activity, and agricultural development, in the regions where our project activity is developing, it appears unlikely that the lands used for the project activity would have been used for any purpose other than cattle ranching. Land use trends throughout the project regions (as measured from governmental tax and census statistics) lead us to infer that such lands would likely remain abandoned in an unproductive or low-productivity state in the absence of our project. Though the Panamanian countryside contains a handful of agro-industrial enterprises and food-processing industries, both the relative isolation of our project site and its remoteness from important urban centers create important barriers for investors who would be interested in developing such business activities in the project area. Therefore, we believe that without the proposed project activity, the lands where our project is would most likely be used for extensive cattle ranching activities and/or would remain abandoned (permanently) or semi-abandoned as part of a shifting cultivation cycle. Even in the most remote parts of Panama, lands are rarely completely abandoned, but are instead left fallow for undetermined periods of time. In order to maintain a conservative baseline, we assume our baseline to be a fully-green, abandoned pasture land. Although we understand that abandoned pasture lands are submitted to carbon fluctuations during dry and rainy season intervals and during fallow

	intervals, we consider this baseline as the most conservative and appropriate, as it balances carbon sequestration figures of a dry pasture land in the dry season (low biomass) and of green pasture land in the wet season (high biomass). Considering that cattle ranching has been a predominant and long-lasting activity in the project area, we conservatively assume a static baseline, though we believe cattle ranching in some cases contributes to reducing soil carbon content, and in the long run, it is known to catalyze land degradation processes. Monitoring protocols for measuring the carbon content in the baseline land use in the project areas are currently under development. In order to maintain an appropriately conservative estimate for the initial carbon content of our assumed baseline, we have reviewed the appropriate scientific literature and talked with local practicioners. Our estimations were then enriched with the data provided by the IPCC revised guidelines for moist tropical regions. We have set the baseline carbon content of pasture land at 9.0 tC/ha. Carbon stock changes and the increase in GHG resulting from our project activities (organic fertilization and fossil fuel consumption) have not yet been monitored, though it is our intention to do so in the near future. We assume no NO_2 emissions result from our fertilization activities as they are very minor, both in extent and in concentration, owing to the fact that we only apply organic fertilizer on our plantations. Please see Annex 3 for further regarding the methodology used to determine baseline. In short, however, our reforestation project faces several barriers that would have prevented it from being implemented if the project wasn't focussed on the carbon forestry component as well. The project is currently applying to be registered as an A/R CDM activity.
B.2 Estimate of carbon sequestered or conserved *(in metric tonnes of CO_2 equivalent – tCO_2e. Please base estimates on the difference between the proposed project activity and the baseline scenario identified in B.1.)*	Up to the moment: 40,110 tCO_2e Available in 2012: 325,977 tCO_2e Available in 2017: 881,370 tCO_2e
B.3 Existing vegetation and land use	How much land has a tree cover of a. **< 10%:** …X b. 10-30%: … c. > 30%: … The DNAs of Panama have not yet officially adopted their own national definition of forest. Nonetheless, a tentative definition has been established and internally agreed upon by the Forestry department of the National Environmental Authority. The definition goes as follow: *"A forest is a woody vegetative formation of natural or artificial origin that lays on a minimum area of land of 0.5 hectares with tree crown cover of a minimum of 30% of the surface it covers and*

	composed of treeswith the potential to reach a minimum height of 5 meters at maturity in situ" (author's translation). Recent discussions with DNA officials indicate that the following definition of forest will be officially adopted by the DNA in the first quarter of 2007. Using the above definition, and extrapolating from what can be observed in pre-1990 aerial photographs of the project areas, the existing vegetation found in the project area prior to the inception of the project is not a forest.
B.4 Leakage *(Do the activities planned under the project cause leakage, i.e. greenhouse emissions outside the project and baseline boundary? E.g., will agricultural or pastoral activities be displaced from the project sites to other locations? Please also say if the current level of LULUCF activities in the country would be reduced by the project coming on-line due to a process of resource reallocation?)*	Our project will monitor GHG emissions resulting from the project activities that relate to three distinct sources: ▪ GHG emissions caused by vehicle fossil fuel combustion due to activities taking place outside of the project area (transportation of seedlings, laborers, staff and harvest products to and/or from project sites, commuting between project sites, etc.); ▪ Carbon stock decreases caused by displacement of grazing and fuel-wood collection activities to adjacent areas. ▪ Carbon stock decreases caused by the increased use of wood posts for fencing. Though leakage sources from our activities outside the project area have been identified, they have not yet been calculated, but will be in the near future. It will be relatively easy to measure GHG leakage coming from the Futuro Forestal/CO_2OL-USA vehicle fleet, as all fuel consumption quantities are recorded for accounting purposes. It is unlikely that our activities contribute to displacing cattle ranching activities to other locations. Large cattle ranchers' needs for expanding their production surface is constantly diminishing as they modernize their operations and increase productivity through rotational grazing management and through the direct planting of improved forage grasses on their pasture lands. Even though cattle ranching is still the predominant economic activity in the regions of our project operations, its importance as a source of employment is constantly shrinking. While large cattle ranchers are intensifying, and mechanizing, their production and decreasing their pressure on land, an increasing proportion of small land-owners are choosing to sell their land to migrate to urban centers in search of employment. For these reasons, the risk that our reforestation activities contribute to the displacement of cattle ranching to other locations is minimal. Additionally, it is unlikely that our project significantly displaces wood collection activities to adjacent land areas. The project actively designs its policies to minimize this pressure in two ways. First, project employees are allowed to collect dead wood and fallen branches, for household use, from within the project area.

	This means that project workers, and their relatives, do not have to rely on adjacent forested areas for fire wood. Second, though residents from the El Pito area still depend primarily on fire wood for cooking (see table in Annex 5, question1), the relatively small size of the population makes it unlikely that a shift in fire wood collection activities to adjacent areas would have a significant impact of the total carbon stock exchange of the project activity. A much lower percentage of residents of the communities of Las Lajas and San Felix still rely on fire wood for cooking, as most households have switched to natural gas cooking stoves in recent years. Given the reasons above, it is unlikely that our project will provoke a shift in fire wood collection activities from within the project area to outside it. Additionally, the small population that uses fire wood for primary cooking fuel does not traditionally collect from project lands, as they were not significantly forested prior to the project implementaiton. We do recognize, however, that this is a potential source of leakage and intend on following the guidelines of AR-AM0004 to measure and monitor the potential leakage that may result from the displacement of wood collection activities. As for carbon stock decreases caused by the increased use of wood posts for fencing, we do not believe this will be a significant source of leakage, though we intend on following the guidelines set by AR-AM0004 to measure and monitor the potential leakage and adopt a conservative approach to measure our tCER mitigation projections. Likewise, it is our intention to follow the guidelines established by AR-AM0004 to measure leakage caused due to vehicle use for transportation.
B.5 Local environmental benefits and risks *(Please also refer to Annex 4 on environmental benefits and risks.)*	• Our planting model integrates various components that directly contribute to restore habitats and enhance local biodiversity. In addition to planting several endangered native species in the commercial section of the project area (all endangered according to the national association "Amigos de la Tierra" *www.aatafta.org*) we plant over 65 non-commercial native species to enrich reforestation sites and surrounding patches of secondary vegetation. Several of these native species are also considered to be endangered (ex.: *calophyllum longifolium*, *tabebua rosea)*. • By contributing to the re-establishment of several native species in our areas of operation, our integrated planting system helps creating diverse habitats for the local fauna and flora and connects remaining patches of secondary and mangrove forests of the project area. • Our project directly contributes to the re-establishment of a permanent forest cover over the project area's lands. Up to date, Futuro Forestal has reforested more than 400 hectares and contributed to the protection and enrichment of over 200 hectares of secondary forest. • Our two sites are located in mangrove-rich coastal areas with high conservation value. Our reforestation activities directly contribute to regulate regional hydrologic regimes and reduce fluvial erosion, significantly mitigating negative impacts on such sensitive ecosystems.

	• Our project activity directly contributes to regulate the water regimes, reduce fluvial erosion, and protect the watershed ecosystems of the San Félix and Cañazas rivers. • Our project activity helps fostering the creation of diverse ecosystem structures similar to native forests by using a variety of native species in a mosaic, non-regular, planting pattern. • Our project activity contributes to restoring ecosystem habitat functions for several endangered species. Indeed, a handful of species that formally disappeared from the project area are slowing returning to the project area since the inception of our activities. • Functions as biological corridors for animals and plants.
B.6 Consistency between the project and the environmental priorities of the Host Country	A host country letter of support has been signed by the Panamanian Mnistry of the Environemnt, the DNA, which directly supports the Futuro Forestal/CO_2OL-USA project.
Socio-economic benefits and risks	
B.7 How will the project improve the welfare of the community involved in it or surrounding it? What are the direct effects, which can be attributed to the project and which would not have occurred in a comparable situation without that project? *(e.g., employment creation, poverty alleviation, foreign exchange savings).* Indicate the number of communities and the number of people that will benefit from this project. Please also refer to Annex 5 on community benefits and risks.	• The Futuro Forestal/CO_2OL-USA project is currently the largest employer in the two regions where it is currently operating. Our project is located in two separate regions of Panama; the Las Lajas area (Chiriqui Province) and El Pito area (Veraguas Province). • Currently, the project employs 51 people to manage an approximate surface of 640 hectares. During the planting season, 30 to 40 field workers are hired for a period ranging from 3 to 5 months. On a number of employees per hectare of managed surface ratio, this represents approximately 1 employee per 12 hectares, and favorably compares with the employment generated under the predominant land use of cattle ranching. • The jobs provided by the project directly contribute to increasing economic benefits among marginalized segments of Panama's rural population. As an example, 60% of the workers of our Las Lajas operation belong to the Ngobe-Bugle indigenous group, the most impoverished indigenous group in Panama. • All our workers are paid a wage superior to the national minimum wage, which is currently set at $US 1.10/hour. • All our workers are registered with the National social security system, which offers benefits such as: health care coverage for workers and their family, a retirement fund, accident insurance, and pregnancy-leave. We expect that future timber extraction and processing activities will bring additional labor opportunities in our regions of operations. Assuming a conservative 15% yearly increment in our management surface, our Panama operation has the potential to employ approximately 250 workers by the end of the second Kyoto commitment period. • By restoring local ecosystems and creating mixed plantation systems with several vital habitat functions, Futuro Forestal/CO_2OL-USA hopes that its project will generate valuable benefits for surrounding local communities including the creation of new firewood and non-timber product sources for local livelihoods.

	● The complexity of Futuro Forestal/CO_2OL-USA's plantation system and management operations requires that all our workers receive intensive training, which is provided by the company. ● Futuro Forestal/CO_2OL-USA have collaborated extensively with international development agencies such as the GTZ, USAID and the US Peace Corps to train its workers and promote reforestation using native species in its areas of operation.
B.8 Are there other effects? *(e.g., training/education due to the introduction of new technologies and products, replication in the country or the region)*	● Areas managed by the Futuro Forestal/CO_2OL-USA project help to protect small riverbeds and watersheds found in its areas of operation. ● Futuro Forestal/CO_2OL-USA fully support the local NGO OPASI in their work to protect sea turtles.

Annex 1: LULUCF Project Categories

Code	***Afforestation and reforestation***[1]
1	Rehabilitation of degraded lands (e.g. *Imperata* grasslands*)* to
1a	forest
1b	Agroforestry
2	Reforestation of degraded temperate grasslands or arid lands by tree planting
3	Establishing tree/shade crops over existing crops (e.g. coffee)
4	Plantations for wood products
4a	Small scale landholder driven
4b	Commercial scale
5	Landscape rehabilitation through planting corridors etc
6	Fuel wood plantings at a commercial scale
	Forest Management
7	Improved forest management via fertilizer, in-plantings etc
8	Improved fire management
9	Reduced impact logging
10	Alternatives to fuel wood for forest/environmental protection
	Cropland management
11	Reduced till agriculture
12	Other sustainable agriculture
	Grazing land management
13	Revegetation of semi-arid and arid lands with shrubs or grasses
14	Improved livestock management leading to vegetation and soil recovery
15	***Bio-fuels***: Use of biological residue to produce energy
16	***Other***

[1] This is the only class of activities accepted under the CDM for the first commitment period

Annex 2: Financial Documentation Checklist

Please provide for each sponsor and the project company (where applicable):

4. *Experience statement, including all the projects the firm has closed, their current status, and additional details on projects similar to those to be supported by the NCDF.*
   Since its inception in 1994, Futuro Forestal/CO_2OL-USA have been contracted by approximately 200 individual and corporate investors worlwide for its reforestation and carbon emission mitigation services
5. *Any ratings and reports from D&B, S&P, Fitch, OECD (country only).*
   n.a
6. *Public filings, if any.*
   no
7. *Audited financial statements for most recent three years.*
   To be provided with the PDD
8. *Company Bylaws/Articles of Association.*
   To be provided with the PDD
9. *List of Directors and Managers of the Company.*
   Futuro Forestal: Andreas Eke and Iliana Armien

   CO_2OL-USA: Keegan Eisenstadt
10. *Shareholders Agreement.*
    n.a
11. *List of Company Subsidiaries, if not included in financial statements.*
    n.a
12. *List of Company Debts (maturities, interest rates, security) if not included in financial statements.*
    To be provided with the PDD
13. *Paper and electronic copies of company financial projections including assumptions, balance sheet, income statement, cash flow; include proposed projects and other planned investments.*

To be provided with the PDD

Please provide for this project (where applicable):

11. *Financial analysis (please present a spreadsheet using the financial analysis model available at http://carbonfinance.org/router.cfm?Page=submitproj)*
12. *Project Business Plan/Feasibility Study/Market Study.*
    To be provided with the PDD

Please provide as available, but no later than appraisal (where applicable):

13. *Major Project Contracts (e.g. Engineering, Procurement and Construction).*
    n.a
14. *Purchase contracts (e.g. power).*
    n.a
15. *Concession/License and permits.*
    n.a
16. *Financing agreements, letters of intent or similar from banks, equity providers, other carbon finance sources, etc., expected to provide financing.*
    To be provided with the PDD

17. *Technical Assistance Agreements, if applicable.*
We have Memorandums of Understanding with the following institutions:

- **Yale School of Forestry and Environmental Studies**
- **Technical University of Munich - School of Forest Science and Resource Management**
- **Smithsonian Tropical Research Institute – *PRORENA (Native Species Reforestation Project)***
- **National University of Panama**

The basis of our cooperation with these institutions include:
- **Monitoring assistance**
- **Training and technological transfer**
- **Scientific experiments on various topics including regeneration, biodiversity assessment, socio-economic assessment, economic and investment analysis, etc.**

18. *Laws governing project operations (e.g. Build, Operate, Transfer laws, and government decrees).*
To be provided with the PDD

19. *Sources of major procurements.*
To be provided with the PDD

20. *Paper and electronic copies of project financial projections including assumptions, per unit (e.g. $/MWh, $/ton) product costs and prices (tariffs), income statement, and cash flow.*
To be provided in a detailed business plan which will annexed to the PDD

Annex 3: Baseline Methodology

Please use this annex to specify the baseline methodology used in selecting the baseline scenario in B.1 and why it is applicable to the project case. A baseline methodology is a tool to identify the most likely future development out of different possible scenarios in an objective and transparent fashion (e.g. a financial analysis of different investment options). Applying the methodology determines which among these possible scenarios is the baseline scenario. If, through the use of the baseline methodology, a scenario is selected, which leads to less sequestration than the proposed project, the project can be considered additional.
A baseline methodology is an application of an approach listed in paragraph 22 of UNFCCC Decision 19/CP.9 (CoP9 Milan, December 2003) available at http://cdm.unfccc.int/Reference/Documents/dec19_CP9/English/decisions_18_19_CP.9.pdf .
A bottom-up approach has been defined for the development of LULUCF baseline methodologies. Project participants may either use an approved methodology, if applicable, or propose a new methodology established in a transparent and conservative manner. In developing a new baseline methodology, the first step is to identify the most appropriate approach for the project activity and then an applicable methodology. Baseline methodologies approved by the CDM Executive Board are publicly available along with relevant guidance on the UNFCCC CDM website (http://unfccc.int/cdm). Your description in the box must start with a choice of baseline methodology from the options listed in paragraph 22 of the CoP9 text (see link above) and justify it based on the project's circumstances, then describe the baseline scenario arrived at applying this methodology. The box should also argue that the project is additional using the tools proposed by the Executive Board (please refer to http://cdm.unfccc.int/EB/Meetings/016/eb16repan1.pdf).
Please write in the box below and use more space if necessary.

Since the beginnings of its operations, Futuro Forestal/CO_2OL-USA have been following the IPCC guidelines to establish its methodology to determine the quantity of carbon emissions mitigated in its plantations. Since 2003, Futuro Forestal/CO_2OL-USA have been refining their methodology using the IPCC's most recent "Good Practice Guidance for Land Use, Land-Use Change and Forestry" handbook.

Considering that the first AR-CDM methodologies have only been recently approved by the CDM EB, Futuro Forestal/CO_2OL-USA have been comparing their baseline methodology to the four AR methodologies that have been approved thus far, and we concluded that our methodology met most requirements of the newly approved methodology "AR-AM0004". Indeed, as demonstrated in the PIN above, our baseline methodology matches the conditions of applicability of the AR-AM0004 methodology in several aspects. Our project activity consists of:

- Reforestation of degraded land, which is subject to further degradation or remains in a low carbon steady state, through assisted natural regeneration, tree planting, or control of pre-project grazing and fuel-wood collection activities.

- Our proposed project activity can lead to a shift of pre-project activities outside the project boundary, such as displacement of cattle ranching activities and/or, to a lesser extent, fuel-wood collection activities (Although we judge this scenario unlikely).

- The lands where our reforestation activities are taking place are degraded and the lands are still degrading or remain in a low carbon steady state.

- Site preparation does not cause significant longer term net decreases of soil carbon stocks or increases of non-CO_2 emissions from soil. Most soil preparation work is done manually, and only on rare occasions is light machinery used (such as a small weeding tractor).

- Carbon stocks in soil organic carbon, litter and dead wood can be expected to decrease more due to soil erosion and human intervention or increase less in the absence of the project activity, relative to the project scenario.

- Flooding irrigation is not permitted in the project area. In fact, Futuro Forestal/CO_2OL-USA does not carry any irrigation work in its plantations.

- Soil drainage and disturbance are insignificant, so that non CO_2-greenhouse gas emissions from these types of activities can be neglected. Futuro Forestal/CO_2OL-USA does not do any drainage in its plantations and practice minimal tilling.

- The amount of nitrogen-fixing species (NFS) used in the AR CDM project activity is not significant, so that greenhouse gas emissions from denitrification can be neglected in the estimation of actual net greenhouse gas removals by sinks.

- The AR CDM project activity is implemented on land where there are no other on-going or planned AR activities (no afforestation/reforestation in the baseline).

Carbon pools:

Similarly to AR-AM004, our methodology proposes to monitor the two principal carbon pools (above-ground and below-ground). Thus far, Futuro Forestal/CO_2OL-USA have been measuring and monitoring the carbon emissions mitigated it the above-ground biomass generated through its reforestation activities. To this point, Futuro Forestal/CO_2OL-USA have been estimating the below ground carbon pool generated from its reforestation project activities. Current research is underway to determine the allometric expansion and growth of the specific species planted as they are correlated to the sites available in Panama. Additionally, this research will provide significantly more precise projections of carbon sequestration through reforestation with native species and teak. With proper technical and financial support, we believe these minor adjustments can easily be made.

Project boundary:

- All different usage zones as well as all reforestation sites are privately owned by the project sponsors and managed by the implementing body. The project area and the different usage zones have all been mapped using GIS technology.

- Our project activity contains several parcels of land. At this point, not all of these parcels are under the management of the project implanting body. A justification of how and when these parcels will be acquired in the future will be provided in the PDD.

Land eligibility:

- Though one our project prime's objective is to only purchase "CDM-eligible", degraded pasture land, we have thus far only been able to obtain post-Dec. 31 1989 aerial photographies for our project in Las Lajas. In the case we are not able to proof eligibility with post-1990 aerial photographies of all reforestation lands, we propose to review available post-1990 land surveys and carry a participatory rural appraisal, including a set of interviews with local residents to trace back the land-use history of the lands where our project is being developed..

- Only the lands which have been (or will be) reforested after Dec 31st 1999 will be considered in our proposal.

Stratification:

- All usage zones of the project area have been (or will be) delimited using GPS technology.

- Our methodology includes 7 main streams, which correspond to the seven species used for reforesting the parcels of the project area. Species include:

Rosewood	*Dalbergia retusa*
Mahogany	*Swietenia macrophyla*
Spiny Cedar	*Bombacopsis quinatum*
Zapatero	*Hyeronima alchorneoides*
Mountain Almond	*Dipterix panamensis*
Teak	*Tectona grandis*
Amarillo	*Terminalia amazonia*

- Each species holds specific management requirements and thinning and harvesting patterns. A detailed management plan, including land preparation and planting timeline, harvest volumes, fertilization activities, etc. will be including in the PDD. In the meantime, a short description of the species above from our Panama operations can be found in Annex 8.

Baseline scenario and measurements:

We did not yet conduct a detailed historical land-use assessment of our areas of operations though we intend on doing so for the development of the PDD. Nonetheless, available aerial photos and testimonies provided by our workers and local members of Futuro Forestal's managing team make us believe that all existing reforestation sites of the proposed project activity were non-forested prior to Dec 31st 1989 and showed evident signs of degradation. This was recently confirmed by national governmental bodies. As stated in section A28, the National Environmental Authority (ANAM) has recently conducted a country-wide study to identify lands which offer a potential for A/R CDM projects. The study identifies the lands of our reforestation sites as some of the lands offering the best potential to develop A/R CDM project. We believe this is principally attributable to the high deforestation rate which has been observed in the project area over the past 30 years.

For such reasons, we believe that cattle ranching is the most likely alternative to the project's activity, as it holds a significant traditional importance in the areas where our project is being implemented (see also section B1). Assuming that the baseline scenario in the absence of the proposed project activity would be a extensive cattle ranching, it is likely that the carbon emission mitigated in the project area would remain only slightly increase or perhaps even remain constant or diminished, as cattle ranching lead in some cases to soil erosion and soil compaction, two factors which limit soil ability to sequester carbon emissions.

For more details on how we estimate our carbon baseline, please refer to section B1.

Additionality:

In order to determine the additionality aspect of our project activity, Futuro Forestal/CO_2OL-USA has been following the guidelines of the latest version of the CDM Executive Board's "Tool for the demonstration and assessment of additionality in A/R CDM project activities".

The additionality concept of our project lays on the premise that converting low productivity grasslands used for extensive cattle ranching into diverse multi-species forest plantations for protection and timber production purposes directly leads to a net anthropogenic reduction of carbon emissions.

In addition, we believe that our project faces several barriers which could prevent its implementation or replication if it did not receive CDM certification. Such barriers include:

- Traditional barriers: Panama does not have a significant forestry history or economic sector.
- Financial: The initial investment cost to establish such a project is very high and it is unlikely that local agro-pastoralists would be able to obtain the necessary financing to develop a similar type of project.

- Technical: Because Panama does not have a strong forestry sector, there is a significant lack of national expertise and access to forestry technology which impede the development of large-scale, financially viable AR CDM projects.

The regions where the project is currently operating, as with the rest of Panama, do not have a strong forestry tradition. The dominant economic activities include subsistence slash-and-burn agriculture and extensive cattle ranching. Few subsistence farmers integrate agro-forestry or silvi-pastoral practices in their systems. The vast majority of forest plantations found in Panama have been established over the last 20 years. A recent study published by the National Environmental Authority demonstrates that most of these plantations will hardly see a return on their investment, primarily due to poor management. High quality seeds, for appropriate forest species, are difficult to obtain (in our case our seeds are imported from all across Central America or directly from national scientific institutions) and so is technical assistance or capacity. Panama established its first university program in forestry about 5 years ago, and there are very few qualified people in the country who can effectively transfer their newly learned forestry knowledge to local entrepreneurs who would be interested in developing a similar type of project.

In addition, it would be quite difficult for small-scale farmers and even for larger cattle ranchers to obtain the necessary financing to initiate a large scale AR CDM project activity such as the one we are implementing. The financial risks of establishing a project such as ours are high, and only with the proper economic and technical support can a project with such a long lifetime be financially viable. Therefore, we consider our project to be additional to the baseline scenario (abandoned and low-productivity green pasture land).

***Ex ante* actual net GHG removals by sinks:**

As mentioned in previous sections, the increase in GHG due to our project activities (organic fertilization and fossil fuel consumption) have not yet been estimated though it is our intention to do so in the near future. We assume that NO_2 emissions coming from our fertilization activities to be minimal as we use only organic fertilizer on our plantations.

On the other hand, carbon stocks changes have been measured and estimated using the modeling program CO_2-fix. Carbon emission reduction figures can be seen in the carbon calculation sheet provided in the PDD.

Leakage:

As explained in more details in section B4, three sources of leakage are taken into account in our methodology:

- GHGs emissions caused by vehicle fossil fuel combustion due to activities taking place outside of the project area (transportation of seedling, labours, staff and harvest products to and/or from project sites, commuting between project sites);

- Carbon stock decreases caused by displacement of grazing and fuel-wood collection activities to adjacent areas.

- Carbon stock decreases caused by the increased use of wood posts for fencing.

As previously mentioned in section B4, we consider the leakage coming from the displacement of grazing and of fuel-wood collection activities to be minimal. Nonetheless, we intend on following the calculations and guidelines of AR-AM0004 to measure the potential GHG leakages coming from all potential leakage sources mentioned above.,.

Annex 4: Environmental Benefits and Risks

1. *Please identify and briefly describe the physical characteristics and major biological communities of the project area and its surrounds.*

   a. Please provide a map and/or photograph of the project site and project area, including key to landcover classes.

   Aerial photographs of our project area in Las Lajas are provided with the PDD.

   b. Please note if the region, and in particular the project area, is recognized as having important habitat or biodiversity conservation values.

   We are not aware of any scientific studies indicating that our areas of operations have a particular habitat or biodiversity conservation values. Though Panama as a whole is one of Conservation International's biodiversity hotspot, our areas of operation have not received any particular attention from international conservation NGOs, possibly because our two sites in Panama have been severally deforested some 20-30 years ago, leaving them with little conservation value.

   c. Please note whether the region contains any threatened species *(e.g. from* www.redlist.org *or local lists)* and which habitats they are associated with.

   Thought the IUCN' redlist does not contain regional indicators of threaten species for Panama, a list of endangered and critically endangered species in terrestrial habitats (total of 59) for the entire country can be found at the following web link:

   http://www.iucnredlist.org/search/search.php?freetext=&modifier=phrase&criteria=wholedb&taxa_species=1&redlistCategory%5B%5D=CR&redlistCategory%5B%5D=EN&redlistAssessyear%5B%5D=all&country%5B%5D=PA&aquatic%5B%5D=all&regions%5B%5D=all&habitats%5B%5D=1.&habitats%5B%5D=2.&habitats%5B%5D=3.&habitats%5B%5D=4.&habitats%5B%5D=5.&habitats%5B%5D=6.&habitats%5B%5D=7.&habitats%5B%5D=8.&habitats%5B%5D=10.&habitats%5B%5D=11.&habitats%5B%5D=13.&habitats%5B%5D=14.&habitats%5B%5D=15.&threats%5B%5D=all&Submit.x=44&Submit.y=12

   Throughout the years, we have conducted several biodiversity assessment of our plantation areas in collaboration with the National University of Panama. Some of the species identified in our project area of Las Lajas include:

Species	Conservation status according to IUCN Red List
Aguti paca	LR/lc
Alouatta palliata	LC
Anolis (Norops) auratus	Not on Red List
Anolis (Norops) humilis	Not on Red List
Anolis (Norops) limifrons	Not on Red List
Basiliscus basiliscus	Not on Red List
Bufo marinus	LC

Canis latrans	LC
Cebus capucinus	LC
Dasyprocta punctata	LR/lc
Dasypus novemcinctus	LC
Dendrobates auratus	LC
Didelphys marsupialis	LR/lc
Eleutherodactylus fitzingeri	Not on Red List
Gonatodes albogularis	Not on Red List
Herpailurus yaguarondi	LC
Leopardus pardalis	LC
Mabuya unimarginata	Not on Red List
Nasua narica	LR/lc
Physalaemus pustulosus	LC
Procyon lotor	LR/lc
Sciurus granatensis	LR/lc
Sciurus variegatoides	LR/lc
Sylvilagus brasiliensis	Not on Red List
Tamandua mexicana	LC

2. *Please describe in more detail the specific biological communities that will be directly affected by the project.*

   a. Please include the relevant history of the site; for example, time since the last major natural or human induced disturbance; the degree to which it affected the community; significant changes in management regimes etc.

   According to national forest cover data, the areas where our project activity is being developed suffered intense deforestation between 1950 to 1980. Recent studies published by CIFOR link such intense deforestation directly to an increase in the cattle population and to the surface of the country allocated to grazing activities. Chiriqui and Vereguas - the two provinces where our project is being implemented - are proven to be two of the main cattle expansion front of the 1950's and 1960's.

   As explained in more details in section B1 extensive cattle ranching is widely recognized as the driver of several negative environmental changes, including deforestation, soil compaction, soil erosion, and prevention of natural vegetation regeneration. All together, such changes are known to directly contribute to decreasing soil productivity and soil regeneration capacity, breaking down the economic structure of a many rural households living off farm-based activities. Such negative environmental changes have the direct impact of forcing local agro-pastoralists to farm or graze their herd on highly marginalized lands, to shift activity, or to migrate to other areas. The two provinces where we operate have seen their population growth rate decreasing over the years, a situation primarily driven by rural-urban migratory forces. Indeed, it is widely acknowledged that an increasing proportion of the rural Panamanian

population is abandoning the farm to move to nearby cities in search of more "urban" employments.

b. Please also identify any existing threats to the site; for example, changing land use patterns, wildfires, invasive species, overgrazing etc.

The most important threats or risks faced in the project area are occasional fires (during the dry season only) and an invasive grass which is planted by local cattle ranchers to intensify the grazing productivity of their lands. The grass is very aggressive and leaves little room for competition. Our experience shows that it spreads rapidly on abandoned degraded lands and out-compete other pioneer species, slowing down or even preventing natural regeneration from occurring. As can be seen from the following map compiled by the National Environmental Authority, our two regions of operations (San Felix and Sona) were amongst the most deforested areas of Panama in 2000: (http://www.anam.gob.pa/Sif%202002/mapa%20de%20cobertura%20boscosa%202000%20grande.htm)

Yet, as can be seen from the following forest cover map (1992-2000), the regions where we operate are slowly recovering their forest cover, partly because of small human-induced reforestation efforts and partly through slow natural regeneration occuring on lands where large-enough scattered forest patches promulgate natural seed dispersal and allow natural regeneration to occur: http://www.anam.gob.pa/Sif%202002/mapa%20de%20cambios%20de%20la%20cobertura%20boscosa.htm

3. *Please describe the activities to be carried out as part of the project and their areal extent. If the project has several activities (e.g. reforestation, forest protection, reduced tillage) describe areal extent and the biological communities affected by each. Mention any significant interactions between different activities (e.g. "reforestation by selected native species (sp X, Y & Z) will occur in approximately 50 m wide strips around any patches of remnant ABC forest larger than 1 ha; or plantings will be established to minimize runoff onto gardens on steep slopes.")*

A detailed management plan of all reforestation and management activities will be provided with the PDD. In the meantime, please refer to a summary version of our management plan used for our operations in Panama.

4. *Please identify the nature and areal extent of environmental benefits due to each of the project activities. Please make these as explicit as possible. You can cross reference material in other sections and in particular section 3. (For example, "the buffer strips in activity 3c above are expected to greatly reduce the erosion from garden plots and extend their effective life to 6 years so halving the area that needs to be cleared"; or, "the plantings in 3b will include about 5% of species known to be food for threatened species X so extending its foraging range and connecting patches of its prime habitat".)*

Our planting model integrates various elements which contribute to restoring habitats and enhancing local biodiversity. In addition to planting several native

species in the commercial sections of the project area (all endangered according to the national association "Amigos de la Tierra" www.aatafta.org) we plant over 65 non-commercial native species to enrich reforestation sites and surrounding patches of secondary vegetation. Several of these native species area also considered to be endangered (ex.: *calophyllum longifolium*, *tabebua rosea)*. By contributing to the re-establishment of several native species in our areas of operation, our integrated planting system helps creating diverse habitats for the local fauna and flora and connects remaining patches of secondary forests found in the project area.

5. *Please describe the rationale for the use of any species not native to the area. Describe the evidence you have that the introduction of such species will not present a threat (e.g. the species is already long-introduced in similar areas).*

Teak *(tectona grandis)* is the only non-native species planted in the project area. Though the history of teak in Panama is relatively young (approximately 30 years), our experience in plantations shows that it easily adapts to the climatic and physical conditions of the project area. It is used mainly to increase the project sponsors' returns on investment and adds financial stability to the entire project, as teak holds a high value on the international timber market.

6. *Please describe the methods used to create new forests, and any evidence for the success of these methods in the project region.*

A detailed management plan of all reforestation and management activities will be provided with the PDD. In the meantime, please refer to a summary version of our management plan used for our operations in Panama.

7. *Please describe the site preparation methods.*

a. Include the source of any planting stock. If they are native species, describe the geographical source of the seed and steps taken to ensure that their collection did not significantly harm native populations. Will the planting stock have significant genetic variation *(e.g. collected from 50+ parent trees in surrounding forests; or clonal material taken from imported stocks)*?

A detailed management plan of all reforestation and management activities will be provided with the PDD. In the meantime, please refer to a summary version of our management plan used for our operations in Panama.

b. Describe the physical methods used to plant and establish new forests, crops or regeneration in the project area. Include the need for new access roads, herbicides, etc.

A detailed management plan of all reforestation and management activities will be provided with the PDD. In the meantime, please refer to a summary version of our management plan used for our operations in Panama.

8. *Please describe how the effectiveness of steps taken to address identified threats will be monitored. What procedures are in place if the safeguards prove inadequate?*

In addition to providing fire-prevention training to all our field workers, all our plantations are separated by 4 meter-wide fire breaks which are regularly maintained during high-fire risk seasons. Pest and disease controls are carried on a

weekly basis in each of the reforestation parcels. Mechanical and (occasional) chemical weeding is undertaken to control invasive grasses in plantation sites.

9. *Please describe how the environmental benefits from the project will be maintained and sustained after the project is completed. Who will be responsible for this?*

The project activity has an undefined life-time. Indeed though project sponsors are only bound by a 25 to 30 years contract with the managing bodies, they will be asked at year 15 of their contract if they wish to sponsor the project for another 25-30 year cycle. If they decide to do so, the managing bodies will then continue to manage the project area for another 25-30 year cycle. In the contrary, project sponsors – which hold title over the land – will have full ownership and tenure right over the project area and therefore, the future environmental stewardship of the project area will primarily depend on project sponsors inclination.

10. *Please describe how environmental benefits from the project will be monitored and verified and communicated to the wider community.*

Throughout the years, we have established extensive collaboration with several renown scientific institutions (see annex 2, question no.17) which have accompanied us in the monitoring of our plantations and restored forest areas. We are currently redesigning our MOU with PRORENA who will be in charge of establishing and carrying on a new methodology to monitor more effectively the impacts of our reforestation activity on soil regeneration and biodiversity enhancement. In addition, we are currently developing a study to assess how the different species we use contribute to vegetation restoration with the Technical University of Munich.

11. *Please describe the possibility that project activities will be expanded in scale at some future date.*

Our project in Panama is constantly growing (as more and more new sponsors invest in the project).

Annex 5: Community Benefits and Risks

1. Please discuss the project's socioeconomic impacts on individuals, communities, and organizations.

   Several communities directly and indirectly receive social and economic benefits from Futuro Forestal/CO_2OLUSA's activities. They include: (1) the communities of the Greater Las Lajas area, (2) the Greater San Felix, a cluster of small communities located in the nearby indigenous Ngobe reserve), (3) and the community of El Pito. The following table shows population figures for each of the communities benefiting from Futuro Forestal/CO_2OL activities. Since the Ngobe Comarca comprises several small settlements, only the population figure of the town of San Felix – the largest nearby indigenous community – is shown.

Country	*Community*	*Total population*	*Nbr. of households*	*%. of households cooking with firewood*
Panama	**Cabecera de Las Lajas**	**1 191**	**347**	**33%**
Panama	**Greater San Felix**	**2 443**	**564**	**35%**
Panama	**El Pito**	**264**	**71**	**85%**

2. Please indicate if project sites are already being used by local communities for economic or other activities, and how these activities will be affected by the project.

   Futuro Forestal/CO_2OL-USA only purchase degraded, often abandoned pasture land freely sold on the free market by local land owners wishing to sell their properties. Though some of these lands were used for extensive cattle ranching prior to the project activity, it is unlikely that the project activity is displacing cattle ranching to other locations, for reasons explained in section B1.

3. Please describe any socioeconomic development programs or studies you are aware of that have been undertaken in the project area[2], and highlight briefly any experiences/findings relevant to proposed project activities. As applicable, provide references for further information (e.g., citations, contacts).

   At this stage, we are not aware of any socio-economic development program or studies that have been undertaken in our regions of operation. Throughout the years, Futuro Forestal has developed educational and micro-loaning programs for its workers, notably literacy and computing courses. Futuro Forestal is currently coordinating its activities with the USA Peace Corps program in Panama to improve access to potable water in the region of El Pito. In addition, Futuro Forestal is also currently conducting a detailed assessment of its project activity's socio-economic impacts on local livelihoods, partly to answer the recommendations of a team of assessors who recently evaluated our operations based on the CCBA certification criteria.

4. The terms "indigenous peoples," "indigenous ethnic minorities," "tribal groups," and "scheduled tribes" describe social groups with a social and cultural identity distinct from the dominant society that makes them vulnerable to being disadvantaged in the development process. Have socioeconomic survey efforts been undertaken to identify the permanent or intermittent presence of any such groups in the project area? If so, please describe the survey results.

[2] While the project site is the area in which project activities are actually taking place, the "project area" might be thought as the greater area in which project activities will have a direct, foreseeable effect on the land, water, people, resources, etc.

As previously mentioned, our project area of Las Lajas is located nearby the Ngobe-Bugle indigenous reserve and the majority (approximately 60%) of the workers laboring at our Las Lajas project are of Ngobe-Bugle origin. Our two areas of operation in Panama have no recent history of indigenous occupation (permanent or intermittent), nor is there any ancestral claim over the lands where our project is being implemented. Panama has a well defined indigenous reserve system which has established – conjunctly with indigenous leaders - indigenous occupational sites based on ancestral claims.

5. Is the ownership of any of the areas affected by project activities disputed? Will project activities result in any resettlement of people, or, restriction of access to previously used lands? Have studies of land ownership and land use patterns in the project area been undertaken to identify these possibilities? If so, please describe efforts taken.

   No. All land is privately owned and purchased for project sponsors by Futuro Forestal on the free-market from owners who freely wished to sell their land. There has never been any displacement or resettlement of people in the project area throughout the project history.

6. Please describe any anticipated impacts to cultural resources in the project area (e.g., social gathering areas, spiritual sites, burial grounds, etc.). Have survey efforts been undertaken to identify the presence of cultural resources in the project area? If so, describe the survey methods and results.

   Prior to being sold to the project sponsors, the land of the project area was for the most part owned by private individuals and therefore hold little or no public cultural function or significance. At this stage, there has been no study conducted by the implementing bodies on such issues, as we do not see the necessity to do so. As previously mentioned, there is no ancestral claim over the lands where our project is being implemented.

7. Please describe how potential participants in the project are initially identified, and the requirements for participation.

   Project participants are hired by the implementing body to be trained and to work on the project. Futuro Forestal's hiring criteria strongly encourage positive discrimination, which is reflected by the high proportion of women holding management positions in the company and by the large number of indigenous people employed by the company.

8. Please detail the community input process into the formulation of project goals, design, and implementation.

   Project participants (the work force) are encouraged to express their opinions about the project design and orientation. All employees are asked to play a pro-active role in the project's planning and implementation activities.

9. Please discuss the potential negative social impacts community members may incur due to the project, including: legal liability, economic risk, and health and safety. How will these risks be managed and minimized? Describe the content and presentation of consultations that have or will be made to the community to assist them in understanding and evaluating the issues of hosting the project.

   The potential negative socio-economic impacts of the project include the potential dependency that local community may develop towards the employment generated by project. Given that the lands where our project is developing are typically degraded, they do not support a vigorous economy and local people subsist with a diverse array of economic activities. When the project begins, and wages are seen to provide economic benefits that are significantly better than the existing options, several inhabitants of the project area come (or will come) to look for work on the project. By doing so, many of the workers employ will vest more of their economic future on their job provided by the project

and may lose some of the diversity of their previous economic strategy. By reducing the diversity of economic options the project may alter the local economy's resiliency and also creates a certain employment dependency with the local population.

Through the decimation of training programs and courses (literacy and computing courses and teaching forestry techniques) Futuro Forestal aims to actively increase the knowledge base and employability of its workers, both to increase their productivity and provide them with useful skills which they will later be able to use if they wish to pursue higher education or look for a different employment outside of the forestry sector and outside the project.

10. Please discuss what procedures, if any, are in place to determine informed consent.

    n.a

11. Please provide an estimate of the total project budget, and estimate the percentage of the total project budget that will be spent in the project area[3]. Please also provide some indication as to how local investment decisions will be made and by whom, any concerns associated with this process, and how these are being mitigated.

    A detailed project budget will be provided along with the PDD. Though all local investment decisions are made by the implementing bodies and project sponsors, project participants are encouraged to express their opinion at all levels of the decision-making process.

12. Please describe the extent to which the project will generate local employment (e.g., number of people, people/days, etc.), including a discussion of what labor practices will be used. Include a more specific discussion of the employment generated for marginalized groups in the community (e.g., indigenous people, low-income groups, youth, women), and the extent to which local community members will be in management and other upper-level positions. Contrast employment and wages under the project with other typical labor opportunities in the region.

    Currently, Futuro Forestal's workforce in Panama is composed of approximately 50 workers. During planting seasons, an additional 30 to 40 seasonal workers are hired to carry preparation and planting activities.

    As explained in previous sections, Futuro Forestal has a positive discrimination employment policy towards women and indigenous groups. Our management team in Panama is primarily women-led.

13. How will benefits be distributed amongst and within the communities? Do you anticipate any real or perceived inequalities? How will inequalities or related grievances be handled?

    Direct economic benefits will be distributed to project participants under the form of salary in exchange for their labor. We anticipate important indirect economic impacts in our region of operations for non-project participants as many jobs are (and will be) generated, increasing money flow and economic activities in our region of operations.

14. Please describe how the community benefits will be maintained and sustained after the project is completed. Who will be responsible for this? How will it be verified?

    The project activity has an undefined life-time. Indeed though project sponsors are only bound by a 25-30 years contract with the managing bodies, they will be asked at year 15 of their contract if they wish to sponsor the project for another 25-30 year cycle. If they decide to do so, the managing bodies will then continue to manage the project area for another 25-

[3] Local budget expenditures could include, e.g., wages for local personnel, infrastructure, training, supplies, food, equipment, investment in local institutions, etc. The total project budget should include *all* of the costs associated with planning, implementing, managing and monitoring the project.

30 year cycle. In the contrary, project sponsors – which hold title over the land – will have full ownership and tenure right over the project area and therefore, the task of monitoring and sustaining community benefits in the project area will primarily depend on project sponsors.

15. Please describe any plans to periodically measure, verify, and adaptively manage socioeconomic project impacts. Will affected communities be engaged in determining these indicators and in implementing the monitoring and adaptive management plan? If so, describe this involvement.

    Along with PRORENA, we are currently working with our international technical assistance project sponsors to establish a monitoring methodology to measure current and future socio-economic impacts of our activities.

16. Please describe the kind of training of community members undertaken by the project, and how this training relates to the capacity and opportunity of community members to actively design, implement, and monitor specified project activities. Contrast the range of human resources needed for the project with the range of training being offered to community members.

    Along with PRORENA, we are currently developing the guidelines and methods to train project participants in forestry work. Training techniques will include soil preparation, seedling and nursery maintenance, fertilization, phyto-sanitary control, pruning, weeding, fire prevention, thinning and harvesting, GPS marking, land surveying, etc. Our aim is to train project participants with techniques they can replicate later on for their own benefit.

17. Please describe outreach activities, including efforts to advertise and share information about the project with communities beyond the project area. Describe how the project intends to communicate its results with other parties.

    Since the beginnings of our activities, the project has conducted regular meetings with community leaders and project participants to inform residents from the project area about our activities and goals.

18. Please describe scientific experiments being undertaken as part of the project activities, if any. What questions are being addressed? What is the experimental design? Who will benefit from the activity and how will the results be made accessible?

    See information provided in Annex 1, question 17.

Annex 6: Detailed List of Project Sites

Please provide detailed list of sites (where applicable, i.e. for projects with multiple sites)

Currently two project sites (in Panama)with a total of 800 hectares reforested, with the intent to continue reforesting more in the coming years.

***Las Lajas, Chiriqui, Panama**:*
About 10 sites between 15 and 80 ha size within one rural community in the Panamanian province of Chiriquí. Total size is currently about 600 has.

El Pito, Sona, Veraguas, Panama
2 Sites totaling 120 has in the province of Veraguas. Currently 2 other sites are being reforested, of a total surface of 100 hectares. In total, the El Pito site contains approximately 200 hectares of reforested land.

Annex 7: Carbon Ownership

In order to ensure the ownership of carbon sequestered can be identified and effectively assigned to sponsors a number of insecurities must be addressed. In most countries, legislation specifically addressing ownership of sequestered carbon has not been introduced. How do you work within existing legal frameworks and may need to supplement any deficiencies through government and community consultation, land tenure arrangements, legal due diligence and risk mitigation techniques. Please fill out the questions below.

Property Law Issues

Rights and interests in the land where the project is located will have significant impact on the project. In particular, the land on which carbon sinks projects are developed and the degree to which it can be encumbered by property based instruments will impact both the ownership of carbon and risks associated with the permanence of the sequestration.

It is critical to ascertain all relevant interests in the land, both formally registered legal rights, encumbrances and interests, in addition to any customary or traditional uses of the land. In many developing countries where sink projects are being developed, land property systems can be extremely complex or non-existent and often there are no formal recordings of land ownership and no legislative arrangements under which non-land owners use land. Commonly developing country property systems rely heavily on long term leases of land, and therefore it will be imperative to ensure that the lease does not expire within the time frame of the project. As sink projects rely on maintaining the carbon sequestered, it will also be critical that the Seller or project entity has continued access and monitoring rights in relation to the maintenance of any forestry rights.

1. Is the project based on one block of land or several blocks of land?
   Several blocks of land

2. Who has legal title to the land?
   Project sponsors have direct titled ownership to the lands. Every single project sponsors has signed a contractual agreement with the implementing body, granting it managing rights for a period of 25 years and giving it the right to commercialize lumber and tCERs in their name and for their own benefit.

3. What sort of legal title to the land do they have? E.g. absolute ownership, a lease, some other type of right or title?
   Absolute ownership

4. Who has current tenure of the land?
   The implementing body (Futuro Forestal/CO_2OL-USA)

5. Are there any additional rights or interests in the land?
   No

6. Does any third party hold security over the land? (i.e.: a bank or other lender such as a micro-finance facility).
   No

7. If so, is consent of the third party security holder required to carry out sequestration activities?
   n.a

8. Does the security holder have any entitlement (such as "step in" or "resumptions rights") that may interfere with the carbon sequestration activity?

No

9. If interest in the land is contracted by virtue of a leasing arrangement, what are the terms of the lease, in particular when does the lease formally expire and what are the terms of renewal?
   n.a

10. Are there any indigenous claims on the land?
    No

11. Who is currently using the land? (this may be occurring separate from any legal right)
    In the case of the land already purchased, the implementing body is using the land. In the case of future project lands, the land is for the most part owned and/or used by local agro-pastoralists.

12. Is the project land subject to any land-use plans or zone that restrict the capacity of any entity involved in the project in the manner in which it utilizes the land?
    No

13. How is title to land evidenced?
    Registered in the national land registry

14. How is title to land transferred?
    A land purchasing contract must be drafted by a lawyer and signed by both parties (seller and purchaser). The lawyer then takes the contract to the national land registry to register the land title in the name of the project sponsor.

15. Under what circumstances can the Host Country alter, seize or repossess land or land rights?

    There is no known episode of government land seizing throughout the history of Panama. Currently, the government in power is considered to be one of the most transparent and stable Panama has ever had.

Legal Nature of the Carbon

International rules are silent on who has the right to sequestered carbon and currently it is left to the host country to determine who has the rights to carbon in forest sinks. At present, many countries have yet to address the legal status of carbon as a valuable asset and the issue is yet to be conclusively resolved at law.

Carbon stored in forest sinks may be considered a "natural resource" and therefore property of the government. For instance, the New Zealand government has claimed ownership of all carbon stored in existing plantations, and in Zimbabwe a number of planned CDM projects (sugar mills) have been nationalised by the government. In other, jurisdictions, the carbon may be considered a part of the tree and therefore the property of the person who owns or is entitled to harvest and sell the trees. If a government was to nationalize carbon, there may be legal avenues in some jurisdictions to claim compensation on the basis of compulsory acquisition of private property. However, this is something that is required to be assessed on a jurisdictional specific basis, and may vary even according to the state or province.

16. Is there any government policy/legislation on the legal status of carbon as a natural resource?
    No

17. Has a letter of objection or approval been requested or issue by the Host Country'?
    Yes

18. Are there any other instances of natural resources been nationalized?

    Not known. To verify and include in the PDD

Legal title to Carbon

Securing clear title to the sink credit is the critical legal risk.

Some non-Annex I countries have adopted English property law systems and with "profit a prendre" (a legal right to take from the land) which can be applied to deal with carbon sequestered as a separate right from the physical land and forestry asset to which it is attached.

Environmental covenants are another legal instrument under which requirements to maintain carbon can be legally established and secured.

19. Is there any ability to own or register right to the carbon separate to the timber and the land?

    To verify and include in the PDD

20. Has there been any other carbon sink project undertaken in the host country and if so how was the carbon ownership issue addressed?

    None that we are aware of.

Parties to the Contract

We need to ensure that the Seller of sink credits is authorized to do so and has unencumbered title to the credits.

21. Is the Seller the owner of land where the project is located? Or a third party intermediary?

    The sellers of sink credits (the implementing body) is contractually authorized by project sponsors (who are the owners of the credits and of the land) to sell carbon credits in their name and for their benefit.

22. Are there contractual arrangements to ensure that the Seller has unencumbered legal title to the credits with any other party involved in the project?
    Yes. Unless project sponsors have no pending debts towards the implementing body, they hold unencumbered legal title to the credits. In the contrary, the ownership is shared between the project sponsor and the implementing bodies until the project sponsor clears the debt.

23. Who are all the players in the project and all the groups that will be affected by the project? (Note: this could include land owners, foresters, planters, investors, mortgagees, rural communities, indigenous people).

    - **Implementing body (Futuro Forestal/CO_2OL-USA) and their respective employees (foresters, accouters, managers, investment consultant, carbon project and trading experts)**
    - **Project sponsors (hundreds of individual and corporate investors / land owners)**
    - **Several scientific institutions**
    - **Various rural communities and indigenous groups from 2 different countries (workers and residents who will receive indirect economic and/or social benefits from the project)**

24. Is the project managed by a single entity?

    Yes

25. Does that entity have the relevant expertise and local knowledge?

    Yes

Forestry Rights

We must ascertain if any person has a right to harvest trees, and whether the exercise of any such right is dependant upon the permission of the land owner (or relevant security holder). The right to harvest the trees can be express (e.g. through registration on legal title) or implied or established by custom (e.g. through a long pattern of allowing others to harvest trees or crops from the land). Often forestry rights are found in concession agreements issued by governments under which a government may permit a private entity to harvest timber on government land but not to take any other benefits from the land.
In many countries, a forestry right may be held jointly by a community. Depending on the arrangements with the land holder, there may be an ability for the holder of this right to assign it to somebody else.

26. Who has a legal right to harvest the timber? Is it separate from the legal owner of the land?

    Project sponsors (the land owners) have the legal right to harvest (or not to harvest) the timber. Yet, the implementing body offers its harvesting services to the project sponsors, who are free to decide whether the wish to contract the implementing body or another entity to harvest the timber of the project.

27. Can forestry rights be transferred separately to a transfer of land?

    No

28. How does a transfer of harvest or other forestry rights occur?

    n.a.

29. Who owns the timber? Is it separate from the legal owner of the land and /or the person with legal right to harvest timber?

    Unless project sponsors have no pending debts towards the implementing body, they hold full owner over the timber. In the contrary, the ownership is shared between the project sponsor and the implementing body until the project sponsor clears the debt.

    Project sponsors thus have ownership over the land, over the timber, and they hold the legal right to harvest the timber.

30. Is there a customary right to access and utilize the timber?

    No

31. Is this right an individual right or community-based right?

    n.a

32. Under what circumstances can the Host Country alter, seize or repossess harvest or other forest related rights?

    This will be verified and communicated in the PDD.

33. Is the relevant land subject to a concession agreement with the government? If so, are dealings with the carbon sequestration on the land permitted?

    No

34. Can the planting of trees exclude others from using the land?

    Since the lands of the project area are all privately owned, a number of usage limitations have been imposed during the project cycle mainly to ensure that management activities are not disturbed by activities not directly related to the project. The planting of trees does not *per se* exclude others from using the land, but the private nature of the ownership of the project makes it difficult for the implementing body to allow local inhabitants to enter the project area (for example to collect fire wood) during the project management cycle.

Permanence

Under the CDM, the risk of the non-permanence of carbon sequestration, has been addressed by two accounting approaches: tCERs or lCERs. However, both types of credits are subject to verification and certification of the levels of sequestered carbon on a five yearly basis and any decreased in carbon stocks must be accounted for by the replacement with other valid credits. This will ultimately be the responsibility of the buyer, or the Fund in this case.
While the issue of "permanence" is treated very differently in JI projects, JI projects encounter similar risks for the duration of the purchase agreement.

35. What risk management procedures are their in place to prevent:

- fire?

  All reforested parcels are delimited by 4 meter wide fire breaks, which are cleaned on a regular basis. In addition, all our project sponsors hold a fire insurance with the National Agricultural Insurance Institute, valid for the first 5 vulnerable year of the plantation cycle. Moreover, all our field workers receive training in fire prevention, and fire patrols are conducted regularly during the dry season when fire risks are higher.

- pest?

  Our experience shows that only one of the 7 commercial species we plant is subjected to pest attack, namely the *Swietenia macrophyla.* Because it is frequently attacked by the terminal bud eating moth *Hypsipylla grandella*, mahogany has proven to be difficult to grow in monoculture plantations. We have demonstrated in our plantations in Panama that the *Hypsiphyla* moth can be managed more easily in multiple species silviculture systems or in areas of enrichment planting. In our previous, and ongoing, work in Panama as well as other forestry plantation experiences it has also been found that pruning needs to be carried out regularly to control pest attacks until the individual tree reaches a height of approximately 5m. The moth does not seem to cause significant damage to trees >5m tall. Given these sensitivities, Swietenia macrophylla is planted in small groups - and amongst surrounding native forest species, which act as natural breaks – to minimize damages associated with moth attacks. Constant monitoring is carried out to reduce insect attacks, and insecticide is applied (locally) when attacks become difficult to control manually (by pruning infected parts).

- illegal logging?

  Since our inception, we have never been facing any problems with illegal logging in our plantations of Panama.

  To prevent illegal logging, all our reforestation sites are fenced and regularly patrolled by our workers for carrying out daily management activities.

  36. Are there any local insurance products that cover these risks?

  Yes. See fire risk section in question 35 of Annex 7.

  37. Any restriction on land use or other legal claims to the sequestered carbon may impact the ability of the Seller to create emission reductions.

  Not to our knowledge.

Annex 8: Commercial Forest Species

1) Teak

(Scientific name: Tectona grandis, *Familia Verbenaceae)*

Common names: Teak, Teca

Environment and site requirements:

In the wild, Tectona grandis is found in deciduous, mixed tropical Asian forests. In India and Burma, Tectona grandis represents about 50% of the total forest lumber volume. Tectona grandis is a helophytic species that is very aggressive and seldom allows competition from other trees in its early growing stage or understory competition to take hold after establishment. It reaches maximum development in hot tropical climate, where mean annual precipitation varies between 1,200mm-3,800mm annually, though it can grow in areas characterized by lower annual precipitation. Its normal bio-geographic range is between sea-level and 885m of altitude. It grows in a wide variety of soil types, though it typically achieves better results in relatively deep and fertile soils wil a pH of 6.5-8.0 and a relatively high calcium and phosphorous content. Teak does not tolerate waterlogging or infertile lateritic soils.

Species growth form:

Tectona grandis is a large, deciduous tree reaching over 30m in height in favourable conditions. Crown open with many small branches; the bole is often buttressed and may be fluted, up to 15m long below the 1st branches, and up to 1m diameter at breast height (dbh). The bark is brown, distinctly fibrous with shallow, longitudinal fissures. The root system is superficial, often no deeper than 50cm, but roots may extend laterally up to 15m from the stem. The very large, 4-sided leaves are shed for 3-4 months during the later half of the dry season, leaving the branchlets bare. Shiny above, hairy below, vein network clear, about 30 x 20cm but young leaves up to 1m long. Flowers small, about 8mm across, mauve to white and arranged in large, flowering heads, about 45cm long; found on the topmost branches in the unshaded part of the crown. Fruit is a drupe with 4 chambers; round, hard and woody, enclosed in an inflated, bladder-like covering; pale green at first, then brown at maturity. Each fruit may contain 0 to 4 seeds. There are 1,000-3,500 fruits/kg. The generic name comes from ‘tekka’, the Malabar name for T. grandis. The specific name, ‘grandis’, is Latin for ‘large’ or ‘great’.

Lumber characteristics:

Teak lumber has mixed coloratioon, with pale yellow sapwood and darker yellow/light brown heartwood and knots. It is characterized by medium texture, straight grain, a shiny surface, and no particular smell. The density of teak wood is in the medium range for timber with a general density of 0.57g/cm^3 and a heartwood specific density of 0.62g/cm^3. It is highly valued for its quality, durability, and malleability, and is widely used in the making of high quality furniture, floors, decorative structures, boats, and general construction purposes, etc.

Development in Plantations:

Under plantation management, Tectona grandis grows best when separated by a 3x3m distance. Under the best management conditions, as proven by our previous experience in Panama, it can grow between 1.7m to 2.0m/year in height, and gain 2cm/year in diameter.

2) Mahogany

(Scientific name: Swietenia macrophylla, *Family Meliaceae)*

Common names: Caoba, Mahogany, Mara, Aguano, Chacalte, Acaqiu, Caoba de Honduras, caoba de Santo, Caoba del Atlántico, Caoba hondureña, domingo, zopilozontecomacuahuitl.

Environment and site requirements:

Mahogany is a humid tropical forest species, with a bio-geographic range spreading from Brazil to Mexico. It grows at altitudes varying from sea level to 1,000m with annual precipitation ranging between 1,000mm-2,500mm. Optimum growth is achieved in temperatures ranging between 20°C-28°C (max of 35°C). Swietenia macrophylla grows well on deep, well-drained sites with medium to heavy or rich organic soils.

Species growth form:

Swietenia macrophylla is a massive tree, reaching a height of 30-40 m and a girth of 3-4 m; in favourable conditions it can reach 60m high and 9m girth. Trunk straight, cylindrical, with a buttressed base; bark rough, flaking off in small patches. Leaves paripinnate, up to 60cm long; leaflets 6-16, ovate, lanceolate, acuminate, slightly oblique, light green or reddish when young, dark green and shining when mature, up to 20cm long, with 8-12 pale, secondary nerves. Flowers 8mm across, in narrow supra-axillary panicles about 8-13cm long and fragrant; petals greenish-white, oblong, 4mm long, rigidly pointed. Fruit a woody capsule resembling a large inverted club, about 12.5 x 7.5cm, erect. 'Swietenia' commemorates Gerard von Swieten (1700-1772), botanist and physician to Maria Theresa of Austria. The specific name, 'macrophylla', means large leaved and comes from Greek words 'makros' (large) and 'phyllon' (leaf).

Lumber characteristics:

Mahogany is one of the most well known, prized, fine tropical lumber species in the world. Its lumber is used for the production of fine furniture, yacht, decorative structures, among other things.

Development in Plantations:

It is a light demanding species in its early successional stages, and requires protection from competing neighbor trees, whether of the same species or not. Because it is frequently attacked by the terminal bud eating moth *Hypsipylla grandella*, mahogany has proven to be difficult to grow in monoculture plantations. We have demonstrated in our forests in Panama that the Hypsiphyla moth can be managed more easily in multiple species silviculture systems or in areas of enrichment planting. In our previous, and ongoing, work in Panama as well as other forestry plantation experiences it has also been found that pruning needs to be carried out regularly to control pest attacks until the individual tree reaches a height of approximately 5m. The moth does not seem to cause significant damage to trees >5m tall. Also, significant effort is put into ensuring the straight development of the trunk and in minimizing lesions or irregularities that can affect the quality of the lumber. Given these sensitivities, Swietenia macrophylla will be planted in small groups - and amongst surrounding native forest species, which act as natural breaks – to minimize damages associated with moth attacks. Constant monitoring will be carried out to reduce insect attacks, and locally apply insecticide when attacks

become difficult to control manually (by pruning infected parts). This species will be planted in small numbers, but will be financially important.

3) Spiny Cedar

(Scientific name: Bombacopsis quinatum, *Family Bombacaceae)*

Common names: Cedro Espino, Pochote.

Environment and site requirements:

Bombacopsis quinatum is found ranging from Honduras to Venezuela. It grows naturally from sea level to 900m in altitude, and in areas where mean annual precipitation varies from 800mm-3,000mm. Bombacopsis quinatum needs a pronounced dry season of 3 to 5 months. Bombacopsis quinatum is typically grown in areas with lower annual temperatures ranging between 20°C-27°C. In general, it grows better on deep, well drained soils of clear to clay types. Soil pH is typically 6-8. Its growth is inhibited on sites with low fertility or highly compacted soils.

Species growth form:

Bombacopsis quinatum reaches a height of 40m and a trunk diameter of more than 1m in natural stands. Its most distinguishing features are its spiny main stem, fluted base, a rather wide spreading crown of heavy branches and a somewhat irregular bole inclined to be buttressed and completely clothed with heavy prickles towards the base; bark pale greyish-brown, trunk and branches generally covered by hard, stout spines up to 2cm long; degree of spininess is extremely variable, as some trees are completely spineless. Leaves alternate, palmate and composite, with 3-5 oblong or obovate glabrous leaflets. Fruit a woody 5-valved capsule that upon bursting frees soft brown vegetable wool enclosing 30-120 small, brown seeds. Under good conditions, Bombacopsis quinatum grows at a rate of about 1m per year. At three years of age, pruning must be performed to curve its natural growth pattern and obtain a straight trunk.

Lumber characteristics:

The heartwood of Bombacopsis quinatum is a reddish/pinkish color and the sapwood is typically a whiteish cream to light yellow color. It is characterized by a relatively low specific density 0.428g/cm^3, a medium texture, low water content, and a straight grain. The wood is known for its durability and its workability. The lumber can be hard to dry, and its commercial value is high. It is widely used for furniture, doors, windows, ceiling frames, roof construction, interior panelling, particleboard, plywood and veneer.

Development in plantations

Bombacopsis quinatum reaches its best development when grown in soils of low acidity. The use of organic fertilizer, such as bocachi, allows us to control soil pH. Early pruning of Bombacopsis quinatum is not recommended as it can hinder growth, hence, pruning is only carried when it reaches appropriate size. The cutting of offspring for vegetative propagation is done before the plant reaches its sapling stage. When severely damaged in its initial growing stage, by the shoot borer or other insects, our practice is to cut the trunk at the base in order to avoid further damage to the tree. Soon after, new regrowth shoots emerge from the old root system, and the one with the most potential is selected for further management. The sapling with most potential is already well defined once it reaches 40cm in height. In its early development stage, peripheral weeding needs to be carried on a regular

basis to reduce the risks of caterpillar attacks on the plant's basal structure. Under management, its natural enemies include Arsenura armida and Dabrotica spp., which generally attack juvenile trees.

4. Amarillo

(Species: Terminalia amazónia*; Family Combretacea)*

Comon names (in Costa Rica and Panama): Amarillo, Amarillón, Amarillo carabasuelo, Amarillo real, Carboncillo

The Combretacea family is composed of approximately 250 species, some of which produce fine timber. T. Amazonia is the most widespread species in the family, found ranging across the neotropics (from Brazil to Mexico), and is an early successional pioneer species of the humid tropical forest.

Environment and site requirements:

T. Amazonia grows in temperatures varying between 26°C- 35°C. It is found from sea level to 1,200m of altitude. Its development is maximized in acidic to neutral, well-drained soils, ranging from clear to clay like.

Species growth form:

T. Amazonia is a fairly tall tree and can exceed 50m height in Amazonian and Central American forests, and has been observed at up to 70m in the perennifolia forests of Mexico. With a growth rate of about 1.4m/year in height, and 1.2cm/year in diameter it has a relatively rapid growth rate.

Lumber characteristics:

T. Amazonia produces a heavy, durable, hard lumber, which has an average specific density of 0.68g/cm^3. Its hardness makes it resistant to attacks from xylophagous organisms and other insects. When harvested, T. Amazonia lumber dries relatively fast, and the wood has a mixed coloration with grey and pink tints. Its lumber is easily malleable, though its grain is irregular. It is mainly used for furniture, doors, window frames, paper pulp, etc.

Development in plantations

T. Amazonia is not a very demanding species in terms of soil requirements and develops well under many soil conditions. Its main limitation is soil compaction. Its attains rapid development when planted directly in its sapling stage, but it grows more slowly if planted during its seedling stage. We believe this results from it needing to re-establish its root system. Under good conditions, the sapling can establish a strong root system in a period of 3 months. T. Amazonia is planted at a distance of 4x4m from one another, and the first pruning is carried out at about 2.5 years. Peripheral tilling followed by organic fertilizer application needs to be carried out around each individual at least once a year to facilitate thorough root development.

With high quality seeds, of good provenance, the trunk of T. Amazonia adopts a relatively straight form, though it can easily curve if subjected to abundant rainfall. This problem can be easily corrected by pruning the trunk at the curving point, allowing the tree to grow in a straight shape again without creating knots and distortions. Grown in pasture land, T. Amazonia grows more effectively when planted at a 3x5m distance from one another.

5. Numerous native species are being considered for inclusion in the planting scheme. Among the more promising for finanical return are Zapatero (Hyeronima alchorneoides) and Almendro (Dipterix panamensis).