Bull Run Overseas Forest Carbon Project
Climate, Community and Biodiversity 2nd Edition Gold Standard Monitoring Plans

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Facts

Title of the Proposed Project	Bull Run Overseas Forest Carbon Project Phase I
Country	Belize
Nearest City	Mountain Pine Ridge, Cayo District, Belize
Technical Lead	Virginia Polytechnic Institute and State University, Conservation Management Institute (CMI http://www.cmiweb.org/)
Project Proponent	The Aldebaran Company Limited, a company incorporated in Grand Cayman, BWI
Project Manager	Bull Run Overseas
Project Developer	Forest Carbon Offsets LLC (FCO) (http://www.forestcarbonoffsets.net/)
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Carbon Project Quality Standard	Climate, Community, Biodiversity Standard (CCB) 2nd Edition Gold Standard
CCB Project Lifetime	2009 to 2038

Executive Summary

The Bull Run Overseas (BRO) property ("Project") encompasses 4,650 ha of tropical pine forests, grasslands, and mature humid broadleaf forest in the Cayo District of Belize, Central America. The 30-year project plan, from 2009 to 2038, produces climate benefits by avoiding emissions from deforestation. Biodiversity benefits are produced by virtue of habitat protection. Community benefits are produced by providing educational opportunities to the children of BRO staff and providing several types of support to the general community in the area.

Of the total 4,650 ha property, 666.3 ha (the project area) are slated for conversion to agricultural uses in the absence of carbon financing. The baseline scenario for the tropical hardwood component is conversion to coffee.

Climate, Community, and Biodiversity Standard Gold Level is achieved by virtue of the significant biodiversity resources conserved on the property including habitat for 15 IUCN listed species and most notably IUCN-Endangered Baird's tapir (Tapirus bairdii).

Forest Carbon Offsets LLC (FCO) is the Project developer. The Conservation Management Institute (CMI) at Virginia Tech is the Project technical lead. Independent third party validation has been performed by Environmental Services Incorporated . The Project follows the carbon accounting principles of conservatism, accuracy, completeness, transparency, consistency, and relevance. Validation under a carbon accounting standard such as the Verified Carbon Standard is planned. After this further step is successfully achieved, registration of voluntary emission reduction credits will be conducted with Markit Environmental Registry.

CL. Climate Impact Monitoring Plan

The goal of climate impact monitoring for BRO is to insure that estimates of carbon stocks and GHG emissions are accurate and updated and any intentional or natural reversals are detected and documented. The origin of the data will be field observations verified by a 3rd party auditor at least every 5 years. The monitoring times will be during the dry season, typically December through April of each year. Each permanent plot will be remeasured. Summaries will be produced for each verification event. The landowner has responsibility for monitoring and has budgeted personnel and funds for that purpose. The data quality will be assessed at each verification event. The monitoring protocol is available for review and includes a QA/QC component.

The above ground biomass is calculated using allometric equations based on the size of hardwood trees >5cm DBH. Data will be collected in the field using nested fixed area plots using field methods described in the project design document. Each individual tree inventoried is tagged and given a unique ID. Each plot will be revisited. All of the tagged trees will be re-assessed and the DBH and height measured. The resultant data will be used to assess growth rates and above ground carbon stocks. These data will be compared to the estimated values of the carbon stocks. The below ground biomass will be recalculated using accepted regression equations based upon the updated above ground biomass data.

Carbon pools selected are above-ground and below-ground biomass. Other potential pools are minor and would only add to the total climate benefit of the project. All data collected as part of monitoring will be archived electronically and kept at least for two years after the end of the project; 100% of the variables will be monitored if not indicated otherwise in tables below. All measurements must be conducted according to relevant professional standards.

<u>Updating of Strata</u>

The *ex-post* stratification may be updated due to the following reasons:

- Unexpected disturbances occurring during the crediting period (e.g. due to fire, pests or disease outbreaks), affecting differently various parts of an originally homogeneous stratum;
- Unplanned reversals due to illegal forest management activities (cleaning, planting, thinning, harvesting, coppicing, re-planting) implemented in a way that affects the existing stratification.

Established strata may be merged if reason for their establishing said strata have disappeared.

A total of 17 forest inventory fixed plots were allocated and monumented. Plots are randomly allocated using a geographic information systems (GIS) and identified by specific XY coordinates (Table 1).

Table 1: UTM locations of forestry plots used to determine aboveground biomass (coordinates are in NAD27)

Plot ID	Y_PROJ	X_PROJ
BR100	1888578	296402
BR104	1888683	296267
BR105	1883960	303107
BR106	1883080	303723
BR108	1888091	296514
BR109	1883778	303307
BR110	1888526	296074
BR111	1887933	294853
BR112	1888310	296123
BR113	1883780	303438
BR115	1887870	294763
BR116	1887787	294290
BR117	1883953	303374
BR119	1888427	295996
BR121	1884194	302236
BR122	1884233	302767
BR123	1884185	303187
BR125	1884320	302467

Data and Parameters Monitored

Table 2: Area of Stratum

Data / Parameter	A_i
Data unit	Ha
Description	Area of stratum *i*
Source of data to be used	Monitoring of strata and stand boundaries shall be done preferably using a Geographic Information System (GIS), which allows for integrating data from different sources (including GPS coordinates and Remote Sensing data).
Value of data applied for the purpose of calculating expected emission reductions	Data is essential to project success.
Description of measurement methods and procedures to be applied	Strata are presumed ex ante to by constant unless a major external event occurs e.g. hurricane, insect outbreak, etc… If a major external event occurs that would lead to the need for further stratification, then a vegetation map update would be performed using Quickbird or similar imagery (on screen interpretation and delineation) followed by field based confirmation of strata boundaries. Once the

	new strata are confirmed, a new calculation of sample size by strata will be peformed and if necessary additional permanent plots established in the new strata.
QA/QC procedures to be applied	Remote sensing data checked against field data and vice versa. Permanent plots established and audited. Imagery retained and available for audit.
Any comment	It shall be assumed ex-ante that stand boundaries and strata areas shall not change through time

Table 3: Area of Sample Plot

Data / Parameter	*Ap*
Data unit	m^2
Description	Area of sample plot
Source of data to be used	Recording and archiving of size of sample plots
Value of data applied for the purpose of calculating expected emission reductions	Data is essential to project success.
Description of measurement methods and procedures to be applied	Ex-ante the size of plots shall be defined and recorded in the monitoring plan.
QA/QC procedures to be applied	Measurement is periodically checked onsite. Permanent plots available for audit.
Any comment	

Table 4: DBH

Data / Parameter	*DBH*
Data unit	Cm
Description	Diameter at breast height of tree
Source of data to be used	Field measurements in sample plots
Value of data applied for the purpose of calculating expected emission reductions	Data is essential to project success.
Description of measurement methods and procedures to be applied	Typically measured 1.3m above-ground. Measure all trees above 5 cm minimum *DBH* in the sample plots.
QA/QC procedures to be applied	Measurement is periodically checked onsite. Permanent plots available for audit.
Any comment	Procedures for evaluating trees with nontypical bole shapes is described in the methods of the project design document.

Table 5: Years Between Monitoring Time

Data / Parameter	*T*
Data unit	Yr
Description	Number of years between monitoring time *t* and *t1* (*T = t2 – t1*)
Source of data to be used	Calendar.
Value of data applied for the purpose of calculating expected emission reductions	Data is essential to project success.
Description of measurement methods and procedures to be applied	Calendar.
QA/QC procedures to be applied	Monitoring will occur during dry season.
Any comment	Ex-ante the monitoring plan shall detail the planned monitoring intervals through the project life

CM. Community Impact Monitoring Plan

To measure the socio-economic impacts of the with-Project scenario, the monitoring metric will be annual employment of local community personnel in annual work-hours actualized for the Project. Monitoring data will include payroll records, annual audits, and records maintained by the Belize Labor Department.

Additionally data regarding educational benefits for staff children will be recorded annually and made available for audit.

Data collection will occur on an annual basis and will include a desk review of the collected information. An independent third-party audit will occur at least once every five years.

B. Biodiversity Impact Monitoring Plan

The biodiversity objective for the Project is to maintain existing biodiversity and HCVs to the extent possible barring setbacks from natural processes. The following surveys will be conducted no less frequently than every 5 years:

- Large-medium mammals surveyed using remotely-triggered camera trap.
- Anecdotal Observations: Anecdotal observations of other species will be noted.

The initial plan for biodiversity metrics is described Table 6.

Table 6: Objectives of Biodiversity Monitoring

Taxa	**Why**	**Method**	**Analysis**
Medium-Large Mammal Assemblage.	Assessment of ecosystem health, and investigation of "Empty Forest	Sampling array of camera stations (5-10 stations minimum of 50 trap	Diversity indices, species richness, species heterogeneity, species evenness, relative trap

	Syndrome" by human over-hunting pressures.	nights).	success, and population size analysis for individually identifiable species (e.g. jaguar).
Opportunistic observations of avian and mammalian IUCN listed species.	Document presence absence of additional IUCN species of concern.	Time constrained expert searches focused on target species in appropriate habitats during appropriate seasons.	Continued presence/absence documentation of species of global concern.

Medium-Large Mammals for impacts of human hunting pressures

Medium to large sized mammals include all terrestrial herbivores, omnivores and carnivores greater than ~ 1 kg (~2lbs). Until recent advancements in remote triggered cameras, all taxa encompassing surveys were extremely difficult often resulting in a great deal of observer bias (Kelly and Holob 2008). Remote camera trapping allows for the detection and monitoring of elusive wildlife, particularly carnivores, without the need for physical capture and handling (Karanth 1995, Kelly et al 2008). Because it does not involve any direct contact with the individuals, camera-trapping eliminates the negative effects of live-captures and increases the number "captures" that can be made in a given period of time (Kelly 2003). Recent advancements in technology allows for a greater potential to increase the spatial and temporal scales of data collection on these elusive species. Because remote camera trapping "captures" all species triggering the shutter an abundant amount of data is collected on numerous target and non-target species. Researchers can then examine a wide range of questions regarding species distribution, population sizes and movement patterns.

Sampling Array

A grid of monitoring stations, each with a pair of remotely triggered cameras on opposite sides of a trail, pathway, or road are placed throughout the area. Locations are chosen such that a variety of habitat types are sampled and survey area is maximized. A minimum of 5 stations within the grid shall be established. The goal is to leave the camera grid in place long enough to accumulate a total of at least 50 trap nights, which usually results in enough captures and recaptures to allow population detection. The survey duration per grid should not exceed 3 months, as this could violate the assumptions of a closed population. Cameras are placed opportunistically along game trails, roads, creeks, flyways, etc to optimize capture of individuals following the spacing guidelines.

The remote cameras are active 24 hours per day, and are set to take pictures in a rapid succession of three with a date and time stamp. Once in place, the camera stations are checked for data download and battery replacement. The photo data accumulated from the camera stations will be entered into a spreadsheet summarizing all events and recording time of day, date, species, number of photos taken, number of individuals in the photos, camera ID, and station ID for each event. From the photo data, total overall capture rates and capture rates for each species by camera station or other significant variable will be calculated.

Monitoring medium to large mammals using remote camera trapping techniques is cost effective and allows for replication (Waldon, Miller, and Miller 2012). This method of assessing ecosystem health or treatments applied to systems is both a scientifically powerful and defendable means for addressing changes in community composition. The credibility and repeatability of this methodology lends itself to monitoring changes of species diversity for Climate Community Biodiversity Alliance (CCBA) accreditation.

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