Food and Agriculture Organization of the United Nations

Conservation Alliance

Monitoring Measures of Impacts

EDITED BY

Yaw Osei-Owusu (PhD), Vincent Awotwe-Pratt & Abigail Frimpong

NOVEMBER 2016

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FAO/GEF TRANS-FRONTIER CONSERVATION PROJECT

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EXECUTIVE SUMMARY

The goal of the FAO/GEF Transfrontier Conservation Area (TFCA) project is to improve the ecological health of the project landscape, including the elephant corridor and the wellbeing of the communities within the area. This document includes a Monitoring Protocol and Manual to serve as a guide for training fringing community members and local forestry staff to monitor the impacts of the project being implemented in both Ghana and Cote d'Ivoire.

The Monitoring Protocol is described in terms of the type of audience, data collection methods, analysis and presentation of data, the type of personnel and the plan for the various activities of the project. It further details out the methods for gathering data on the key outcomes of the project. The final part of the Protocol provides information on analysis of data collected, its management and communication of the results.

On the other hand, the Monitoring Manual, provides guidance on the use of methods that have been suggested in the protocol. It also entails detailed steps on implementing the monitoring system for the project including the description of methods, approaches, and the expected outputs. The methods have been categorized into three sub headings; Biophysical, Governance, and Socio-economics to reflect the different thematic areas of the project.

This document (which includes a protocol and manual) was developed based on the outcome of on-going project initiatives within the landscape. The manual, Measures of Success by Richard Margoluis and Nick Salafsky (1998) provided useful guidance in the choice of protocols. Additionally, the choice of the various models for data collection was carefully done to reflect national and international monitoring and evaluation frameworks.

Specifically, the data that would be collected will contribute to reporting on the State of Biodiversity within participating countries as required by the Convention of Biological Diversity. The data could also provide useful information for the Biodiversity Clearing House Mechanism[1] and other national and international databases including the Global Forest Resources Assessment[2] and the Global Biodiversity Information Facility.

The use of participatory monitoring mechanisms will ensure commitment by governments and all participating institutions including local communities and will offer a feedback loop for assessing the performance of the project. This is an indispensable attribute of outcome monitoring because progress cannot be assessed without some knowledge of what partners are doing. Participatory approaches for generating information may include a mix of approaches including surveys, individual interviews, stakeholder meetings, field observations, steering committee meetings and focus group discussions. A team of experts with considerable experience in data collection will conduct the field monitoring of the project.

1 Ghana Clearing House Mechanism (http://gh.chm-cbd.net/implementation/national-biodiversity-committee)

2 Ghana National Respondent (Mr. Kofi Affum Baffoe, RMSC of FC, Ministry of Lands and Natural Resources)

ACKNOWLEDGEMENT

Monitoring Biodiversity has traditionally been part of protected area management activities for local forestry staff in Ghana and Cote d'Ivoire. This document (protocol & manual) is a product of many years of forest management activities and survey experience from partners and stakeholders within the TFCA. It has gone through a number of reviews over the years with inputs from technical people and field staff who have considerable experience working within the landscape. Also, the analysis, discussions and existing information from partners have really shaped the direction of the document and provided it with the needed relevance it deserves.

We are grateful for the financial support from the Food and Agricultural Organization (FAO), especially the West Africa Sub Regional Office for their guidance and inputs. We are indebted to partners, who have contributed their time, information and other resources to ensure that this document meets the requirements for monitoring biodiversity within the TFCA.

ACRONYMS / ABBREVIATIONS

ALOS	Advanced Land Observation Satellite
ARocha	A Rocha Ghana
ASTER	Advanced Space-borne Thermal Emission and Reflection Radiometer
CA	Conservation Alliance
CHM	Clearing House Mechanism
CREMA	Community Resource Management Area
DBH	Diameter at Breast Height
DEMs	Digital Elevation Models
DPN	La Direction de la Protection de la Nature
FAO	Food and Agriculture Organization
FORIG	Forest Research Institute of Ghana
FSD	Forest Services Divisions
GBIF	Global Biodiversity Information Facility
GDEM	Generalized Digital Environmental Model Data Base
GEF	Global Environment Facility
GFC	Forestry Commission of Ghana
GIF	Ghana Institute of Foresters
GIS	Global Information System
GPS	Global Positioning System
GTZ/GIZ	German Technical Cooperation Agency
IBA	Important Bird Areas
IITA	International Institute of Tropical Agriculture
IPM	Integrated Pest Management
ISODATA	Iterative Self-Organizing Data Analysis
ITTO	Tropical Timber Organization
IUCN	International Union for Conservation of Nature and Natural Resources
MIKE	Monitoring the Illegal Killing of Elephants
MIST	Management Information System
MME	Management, Monitoring and Evaluation
MODIS	Moderate-Resolution Imaging Spectro-radiometer
NDVI	Normalized Difference Vegetation Index.
NTFPs	Non-Timber Forest Products
OIPR	L'Office Ivoirien des Pares et Réserves
PA	Protected Area
PALSAR	Pulsating Radio Star
PCR	Principal Component Analysis
PROFOR	Program of Forest
RMSC	Resource Management Support Center
SLM	Sustainable Land Management
SODEFOR	La Société de Développement des Forêts

SOP	Standard Operating Procedures
TFCA	Trans-frontier Conservation Area
TSPs	Temporary Sample Plots
UN-REDD	United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation
VGI	Volunteered Geographic Information

1.0 Introduction

1.1 Purpose of the Monitoring Document

Monitoring activities provide government and partners' opportunity for experiential learning, improving service delivery, planning and allocating resources and demonstrating results as part of accountability to key stakeholders. The purpose of this document is therefore, to provide a first step in the mechanism for measuring impacts and enhance protocols for tracking key milestones. It will also provide useful guidance in the monitoring and evaluation of on-going project activities to ensure consistency with the management plan.

1.2 Structure of the Document

This document is divided into three main sections; Sections A, B and C. Section A is the General Introduction, Section B the Monitoring Protocol (Principle) and Section C is the Monitoring Manual (Implementation guide).

SECTION A: General Introduction

This section gives users a succinct background information on the project including its general context, landscape and its objectives. It describes the implementation structure of the project including its key activities and concludes with a conceptual model on local site condition of the project. This information provides a common understanding of the project for users of this document.

SECTION B: Monitoring Protocol

This section describes the requirements of a monitoring protocol in terms of the type of audience, data collection methods, analysis and presentation of data, the type of personnel and the plan for the various activities of the project.

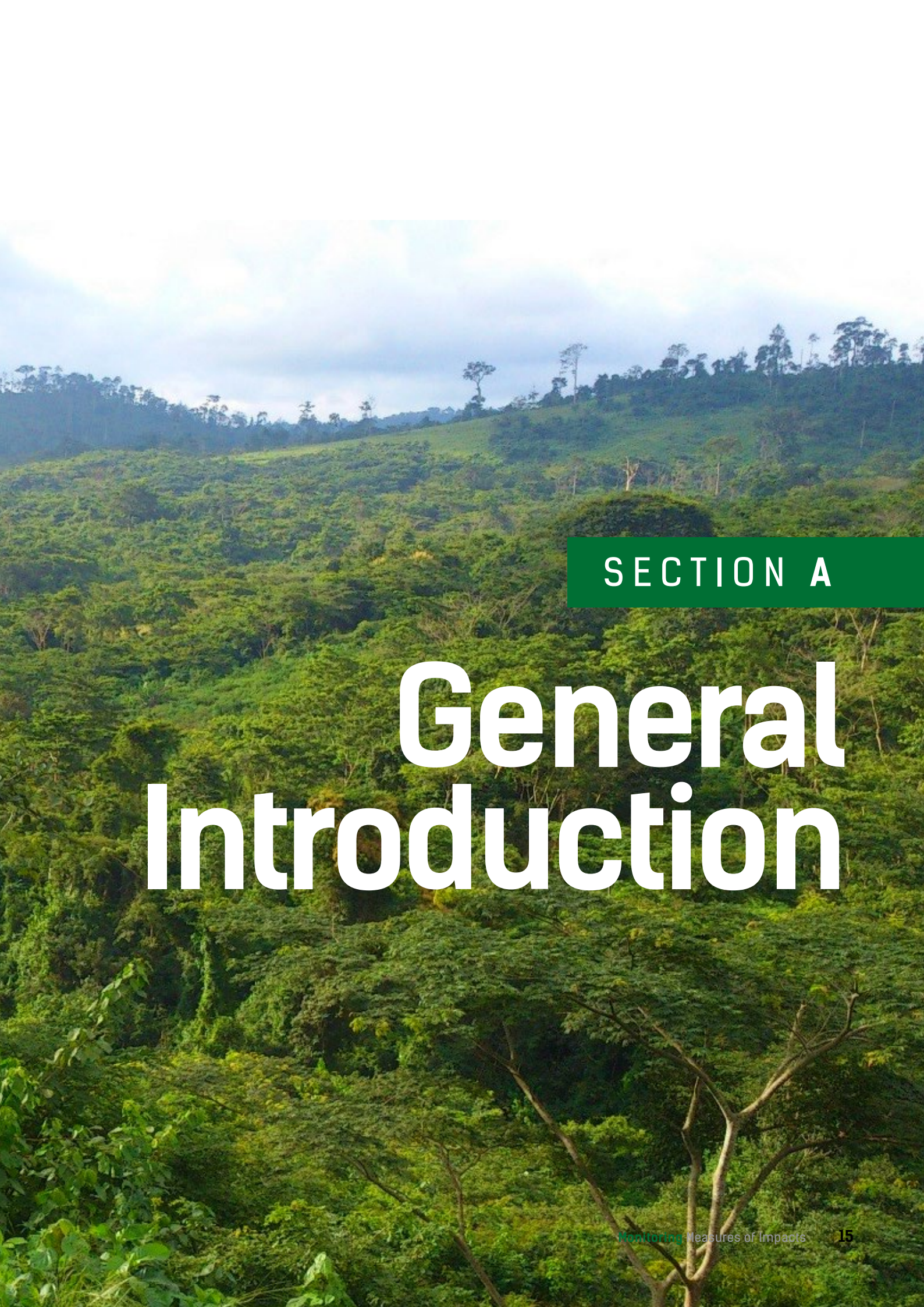
It further details out the methods for gathering data on the key outcomes of the project. The final part provides information on analysis of data collected, its management and communication of the results.

SECTION C: Monitoring Manual

The manual is also structured to provide guidance on the use of methods that have been suggested in the protocol. It also entails detailed steps on implementing the monitoring system for the project including the description of methods, approaches, and the expected outputs. The methods have been categorized into three sub headings; Biophysical, Governance, and Socio-economics to reflect the different thematic areas of the project.

1.3 Use of this Document

This document should be used by persons authorized by the project to collect data on the progress being made. It will be most useful to members of the field team who are responsible for tracking all activities being implemented and the impacts of the project. Additionally, it can be adapted to monitor other projects of similar nature.



SECTION A

General Introduction

2.0

Project Background

2.1 General Context

The tropical forests of West Africa harbor more than half of all mammalian species in Africa, yet only 15 percent of the area's original forest cover remains (Larsen 2008). The "Guinean Forests of West Africa", including the forest zone in Ghana and neighboring Côte d'Ivoire, are considered one of the world's 34 "Biodiversity Hotspots" – the Earth's highest priority areas for biodiversity conservation due to rich concentrations of globally significant species coinciding with very high threats to their survival. It is estimated to have originally covered as much as 420,000 km2. Most of the forest in this region has been lost over the past 50 years. The remaining Guinea forests are restricted to a number of isolated patches that contain exceptionally diverse ecological communities, distinctive flora and fauna, and a mosaic of forest types that provide refuge to numerous endemic species (Spinage 2012). Ghana and Côte d'Ivoire together house a significant portion of the biodiversity of the Guinean Forests (Figure 1). Most of this diversity has been lost largely to anthropogenic factors in recent times.

	Ghana	Cote d'Ivoire
Total Land Area (ha)	22,754,000	32,246,300
Total Forest Area (ha)	5,517,000	10,405,000
Annual Change in Forest cover (ha)	115,400 (2%)	15,400 (0.1%)
Total Forest Loss (ha) (Since 1990)	1,931,000 (25.9%)	183,000 (1.8%)
Total Faunal Species	1,172	1,208
Total Floral Species	3,725*	4,700**

*1.2% Endemic; 4.6% Protected under IUCN Categories I-V

**3.6% Endemic; 6.3% Protected under IUCN Categories I-V

Source: Forest Information and Data* http://rainforests.mongabay.com/deforestation/archive/Ghana.htm Wed. 20 Feb 2016.

FIGURE 1: **Summary Biodiversity Statistics of Ghana and Cote d'Ivoire**

In Côte d'Ivoire, agriculture, uncontrolled fires, and logging for tropical woods - once Côte d'Ivoire's largest export by value - are the primary causes of forest loss. Since independence in 1960, Côte d'Ivoire's forested area has fallen from around 16 million hectares to about 10 million hectares today. In Ghana, the primary rainforest has been reduced by 90 percent, with deforestation progressing at a rate of about 3 percent - or 65,000 hectares per year. Since many of the endemic faunal species of this Hotspot, including several species of primates and antelopes, are dependent on rainforest, their habitat and prospects for survival decrease rapidly with the decline in forest cover.

BOX 1: What is a driver and how does it affect biodiversity?

Biodiversity change is caused by a range of drivers. A driver is any natural or human-induced factor that directly or indirectly causes a change in an ecosystem.

A direct driver unequivocally influences ecosystem processes. An indirect driver operates more diffusely, by altering one or more direct drivers.

Important direct drivers affecting biodiversity are habitat change, climate change, invasive species, overexploitation, agriculture and pollution; while indirect drivers include poverty, high demand for wood-energy, etc.

Conversion of forest for agriculture, and especially for cocoa farms, is one dominant factor among several, contributing to both the historical and on-going deforestation in Ghana. The cocoa tree introduced in Ghana over 100 years ago, was initially cultivated in the southeast of the country and progressively expanded into the central regions and then, further southwest. The same process took place, with a delay of one to two decades, in Côte d'Ivoire but at a faster rate justifying Côte d'Ivoire's stand as the largest cocoa producer in the world. Cocoa production is now a major economic activity and land is used across the six West African countries that make up this hotspot, from southern Guinea to Ghana, and also in the forest zones of Togo, Nigeria and Cameroon. Unless joint efforts are made to reduce the rate of degradation within this hotspot, the region risks losing significant levels of its biological resources within the next decades.

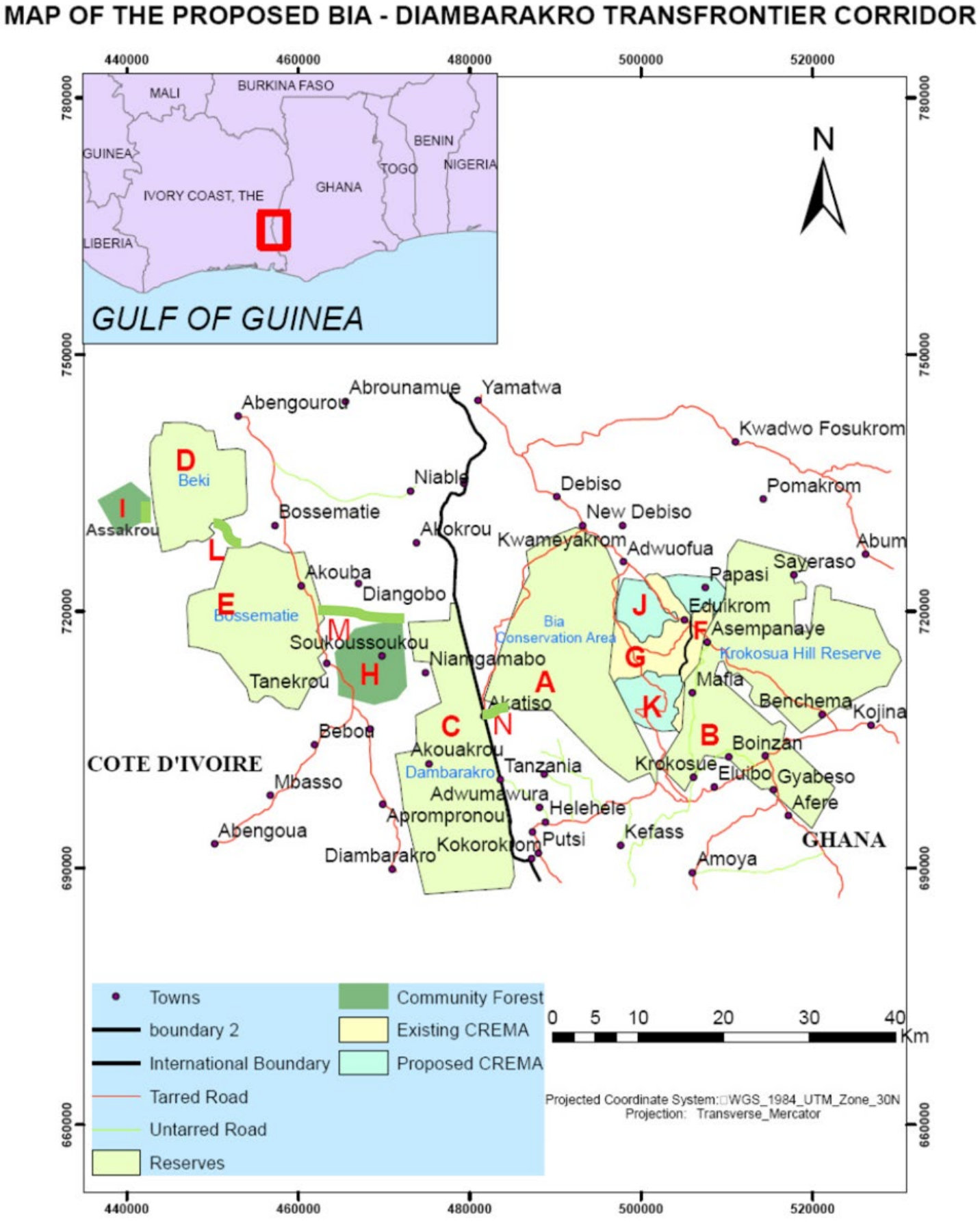


FIGURE 2 **The Bia–Diambarakro Trans-Frontier Conservation Area**

2.2 Project Landscape

The Bia-Diambarakro Trans-Frontier Conservation Area (TFCA) falls within the Upper Guinean Forests bordered by the Bia National Park in Ghana and the Diambarakro forest in Côte d'Ivoire (Figure 2). This is one of the region's priority areas for biodiversity conservation due to its rich concentrations of globally significant species with high threats to their survival (Figure 2). The landscape comprises several fragments of forests of various degrees of ecological importance.

These areas currently contain some of the highest concentrations of endemic but threatened plant and animal species of the Hotspot and they have been identified as one of the priority conservation landscapes in that ecosystem. They also contain significant populations of key species of global importance including seven globally threatened species of large mammals. The various forest blocks in the area have different protection statuses depending on the management objectives that have been defined for the protected area.

These protected areas have facilitated species interaction by connecting various critical habitats in the landscape and provided ecosystem services and goods that support cocoa production.

Article 31 of the revised Treaty of the Economic Community of West African States requests member states to harmonize and co-ordinate their policies and programs in the field of natural resource management.

This is to emphasize the transboundary nature of natural resources and their importance to the social and economic wellbeing of the citizens (especially the poor and vulnerable) of the two countries and the need for the countries to jointly manage these resources. The governments, key stakeholders and conservation partners have therefore identified the area as a feasible corridor for movement of populations and genetic resources. Population within the landscape is similar for both Ghana and Côte d'Ivoire. Approximately 300,000 people live within the landscape with over 50% below 30 years of age. The majority of the youth are males representing more than 50% of the total youth population in the landscape. Initial information collected suggests that agriculture, particularly cocoa production, is the main economic activity in the area, with more than 70% of the population engaged in it. The presence of isolated patches of forests within the areas, largely accounts for the increasing in-migration and the resultant degradation of the classified forests.

The increasing threats, particularly from humans, to the rich biological resources within the landscape motivated the design of this initiative. Whereas the communities recognize that their activities of exploring these resources may have an impact on biodiversity, these communities can contribute to biodiversity conservation. The project was therefore designed to ensure that all partners (working in concert with fringe communities) use their strengths, knowledge, and experience to advance the conservation of species, biological communities and ecological systems within the landscape.

2.3 Project Objective

The project's conservation objective is to establish a viable and sustainable trans-frontier conservation area that links forest reserves and protected areas in and around Bia and Diambarakro. In terms of development, it aims at enhancing the sustainable livelihoods of local communities in and around the area through sound agricultural and conservation practices. The project also aims to facilitate the development and implementation of a bilateral cooperative framework for management of the Bia-Diambarakro Trans-Frontier Conservation Area in addition to developing, testing and promoting best practices in cocoa agroforestry for the rehabilitation of degraded forest landscapes that will also provide connectivity between the fragmented forest blocks and enhance ecosystem services.

Finally, the project presents an opportunity for local communities to be encouraged to set aside forest mosaics as community forests to support sustainable harvesting of non-wood forest products, following the Community Resources Management Area (CREMA) concept under the Collaborative Resource Management Policy (Forestry Commission 2004) used in Ghana.

These objectives are consistent with the conservation and development agenda of the participating countries. Ghana and Côte d'Ivoire signed and ratified the Convention on Biological Diversity during the Earth summit. Article 6 of the Convention urges countries to develop national strategies for the conservation and sustainable use of their biological diversity. In fulfilment of this provision in the Convention, both countries have put in place a number of relevant policies and legislations governing management, development and conservation of natural resources.

Additionally, the ratification of International conventions and agreements form an important backdrop to the issues surrounding biodiversity and they are a significant pressure driving the development of a strong case for biodiversity conservation.

BOX 2: National Project Stakeholders

National stakeholders include national government agencies with responsibilities for natural resource management and the environment, national NGOs, private foundations and private-sector organizations.

These include: the Forestry Commission of Ghana (FC); the FC Wildlife and Forest Services Divisions; A Rocha Ghana; La Société de Développement des Forêts (SODEFOR); L'Office Ivoirien des Parcs et Réserves (OIPR); La Direction de la Protection de la Nature (DPN) of Côte d'Ivoire; and the relevant Ministries and research institutions in both countries.

They will benefit from the project both in terms of achievement of their mandates and objectives as well as benefitting directly from activities (such as capacity-building) as part of their participation in the project.

2.4 Project Implementation Structure

The project was designed to achieve a defined set of outputs and outcomes within a three-year period of implementation.

The main components of the project are:

1 Improved capacity for biodiversity conservation
2 Ecosystem restoration and protection
3 Strengthened conservation in the production landscape
4 Project management and monitoring

The successful implementation of the project is expected to yield the following three broad outcomes:

1 Stakeholders have the capacity, information and organization for improved biodiversity conservation in the TFCA.
2 Ecological processes and ecosystem services enhanced through ecosystem restoration.
3 Conservation and incomes in the surrounding production landscape improved.

These specific outcomes will be measured using the following indicators:

1 Population levels of forest elephants and other focal species.
2 Number of communities participating in ecosystem restoration activities.
3 Technical capacity of GFC, SODEFOR and local community members in biodiversity monitoring, assessment and protected area management.
4 Agreement of and adherence to rules and regulations supporting biodiversity conservation and sustainable forest management (e.g. tree registration, hunting and encroachment).
5 Total area of forest restored and/or managed more effectively to provide connectivity.
6 Cocoa farm productivity and area following best practices.

Based on these objectives and expected outcomes, activities were planned under four components and a number of sub-components as follows:

1 **Improved capacity for biodiversity conservation**
- Protected area management, monitoring and evaluation (MME)
- Development of a management plan for the area

2 **Ecosystem restoration and protection**
- Strengthening the protection of forest and tree resources outside government forest reserves
- Strengthening community management of forest and wildlife resources
- Ecosystem restoration

3 **Strengthened conservation in the production landscape**
- Assessment and reduction of human-wildlife conflict
- Cocoa agroforestry and improved SLM practices

4 **Project management and monitoring**
- Project planning and coordination
- Partner and stakeholder meetings and negotiations

These components are to be implemented in Ghana and Côte d'Ivoire concurrently. At the end of the project implementation phase, the corridor linking Ghana and Côte d'Ivoire should be ecologically secured to facilitate the free movement of elephants and other focal species. Again, the activities of communities should contribute to improving the integrity of the corridor in order to reduce any potential conflicts between humans and wildlife.

2.5 Conceptual Model based on local site conditions

The development of the conceptual model is to help establish a framework to identify and inventory critical paths, important or dominating factors or elements, significant resources or changes, and indicators and report on them in a consistent framework. The identified components and their cause-and-effect relationships may be used to forecast and evaluate the effects of interventions on the integrity, stress, risks, and other changes within the landscape.

The simple model (Figure 3) is an illustration of the identified problem and the proposed project measures to address the poor health of the corridor. This model could be modified if needed, to take on board additional inputs and emerging issues from partners and community members.

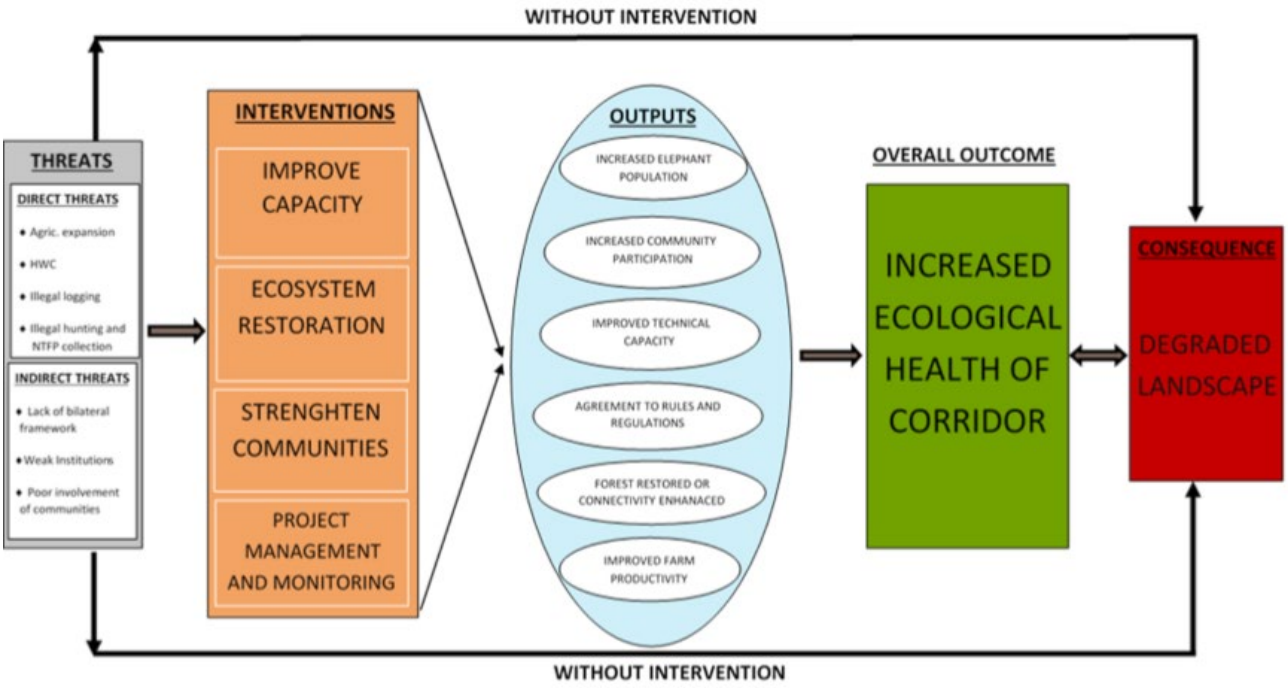


FIGURE 3 **Diagrammatic Representation of Project**

The continued degradation of the elephant corridor and the broad landscape have been attributable to both direct and indirect threats. These threats were identified through a comprehensive stakeholder engagement and assessments by key experts in the area.
These threats include:

1. Agricultural expansion
2. Perverse incentives to remove tree cover
3. Hunting pressure
4. Human-wildlife conflict
5. Weak capacity of local institutions to address the aforementioned issues.

The project has designed a set of activities to mitigate these threats in order to improve the ecological health of the corridor and enhance the delivery of ecological services within the broader landscape. These activities include improving the capacity of biodiversity conservation, the restoration of ecosystems, strengthening conservation activities within the landscape and monitoring of project impacts.

The efficient delivery of these activities, is expected to yield corresponding outcome of increased protection for the elephant population within the corridor, improved technical capacity of agencies and communities in biodiversity management and increased number of communities involved in ecosystem restoration activities. Additionally, the project team is working to improve cocoa farm productivity and ensure adherence to regulations governing biodiversity use within the landscape.

2.6 Assessment of Local Site Conditions

The total land area of the landscape is approximately 176,002 ha comprising 1 National Park (Bia National Park) and 1 forest reserve (Krokosue Hills Forest Reserve) in Ghana, and 3 classified forests (Diambarakro, Beki, and Bosse Matie) in Côte d'Ivoire, plus a number of adjoining forest blocks with variation in tree cover. These large forest blocks cover about 149,982 ha (85% of the area). In addition, other forest fragments and community forests/Resource Areas may amount to a further 19,031 ha (10% of the area). The total area of strictly protected areas (1 PA) amounts to about 35,562 ha.

The landscape contains significant populations of both faunal and floral species, amongst a huge number of expanding human settlements. The local communities are considered the most important actors in forest management and they have been recognized by the Protected Areas Management Strategy that is implemented by the Ghana Forestry Commission in recent times. By this recognition, they collaborate with local forestry staff in managing their natural resources and on the other hand, they facilitate or contribute to the degradation of the landscape. Meanwhile the forest landscape serves as a major source of livelihood for the large majority of the community members.

The economy of these rural communities is predominantly agriculture-based, including forestry, like most rural areas in both countries. Overall, 79% of the population are engaged in various farming activities particularly crop production. Cash crops such as cocoa, citrus, oil palm and food crops like plantain, cocoyam, cassava, maize and vegetables are the main agricultural produce in these communities. Due to its high agricultural potential and rich biodiversity, the landscape has recorded high population growth through migration and immigration. Thus, the TFCA project is a direct response to the threats posed by humans and their activities to the landscape.


CAS DE BEBOU
Presentation faite par les agents des deux Administrations
Analyse commune
Solutions d'attenuation envisageables

SECTION B

Monitoring Protocol

3.0
Development of Monitoring Protocol

The development of the monitoring protocol requires that the type of audience, methods for data collection, analysis and presentation, the type of personnel involved and the plan for the various activities are well defined. For this case, a protocol is needed to guide stakeholders, partners and the general public as they gather information for decision making in the future.

3.1 Types of Audience, Information Needs, and Strategies for Information Gathering

The first step is to determine who will be using the information that will be collected and what it is that they would like to know. One may have collected the best information in the world, but if no one cares about it or it is in the form that people cannot or will not use, then all the hard work would have been wasted. The trans-boundary project like all others has multiple audiences- internal and external audiences. The internal audience include the project team, local community members and collaborating institutions. The potential external audience include donors, public policy makers and other government agencies, other members of the conservation and development community, and the broader public. The audiences and their information needs are spelt out in Table 1. For instance, issues of interest to the project team are indicated by black markings across the issue column.

TABLE 1 Audiences and Information Needs

Audience/ Issues	A bilateral framework on forest and wildlife conservation.	Incentives to increase tree cover.	Enhanced capacity of government institutions	Improved farming practices	Land tenure	Increased desire for change in communities
Internal Audience						
Project Team						
Communities						
Forestry Commission						
IITA						
ARocha Ghana						
GIF						
FORIG						
SODEFOR						
DEPN						
OIPR						
CSRS						
External Audience						
GEF						
FAO						
Governments Agencies						

These project audiences will be interested in the extent to which the main threats to biodiversity conservation and sustainable land and forest management in the area have been jointly addressed and sustained. The project proponents consider the poor ecological health of the Bia-Diambarakro to be largely due to these factors:

- → Lack of a bilateral framework on forest and wildlife conservation.
- → Perverse incentives to remove tree cover.
- → Weak capacity of government institutions to promote community-based approaches to sustainable land management.

- Current farming practices
- Land tenure
- Other factors include the resistance to change in communities, poor coordination between agencies and the lack of technical capacity for managing the landscape.

Other emerging issues like cross border conflict resulting from natural resource management/ governance among neighboring communities that are not being addressed by the project because of their low priority may be considered during the monitoring exercise.

4.0 Methods for Data Collection

The project proposes a cocktail of methods and approaches for generating relevant information that will determine the status of the performance of the project. These methods follow standard measures for data collection and have been structured to generate specific data that will help in determining the extent to which the project outcomes have been achieved. For each outcome, a number of approaches are recommended and stipulated in the Monitoring Manual (Section C).

4.1 Biophysical Methods

4.1.1 Population levels of forest elephants and other focal species.

Loxodonta Africana Cyclotis (African Forest Elephant) and other keystones species like the Pan troglodytes (chimpanzee) (IUCN Redlist 2016) and Agelastes meleagrides (Breasted Guinea fowl) (Birdlife International 2016) still occur in isolated populations within the forest fragments in the project landscape but unfortunately, their numbers are rapidly declining. The major threats to the continued survival of these species are habitat loss through forest degradation and fragmentation, as well as illegal killing or capture—usually as a result of conflicts with humans.

Effective monitoring programs, which involve systematic collection of data on the distribution, size and trend of selected focal species[3] populations, as well as threats such as illegal killing, are needed to provide a rational basis for the management of their populations. The population figures will be compared with the baseline to assess the variance and determine effectiveness of project implementation.

Proposed Methods

To perform a total population study of species within the landscape will require a considerable investment in personnel, equipment and time, which is beyond the scope of this project. Also, the requirements of the project do not include an absolute estimate of the population density from a total count (census). To satisfy the requirements of the project, statistically firm estimators of species population densities are used (see Monitoring Manual, Actual Field Estimation). The use of population estimators will form the basis for estimating densities of both fauna and flora within the landscape. These estimators were selected based on their applicability in the project area and their continued use by national agencies, research institutions, and universities.

3 Species whose ''requirements for persistence define the attributes that must be present if [the landscape] is to meet the needs of the remaining biota''; species are identified on the basis of threatening processes. (Source Lambeck 1997; Lindenmayer 2002)

Collection of data for relative estimates of population densities could be direct or indirect or with the use of the Management Information System (MIST) software for monitoring elephant populations. Direct methods include spot counts, searches (opportunistic and systematic) and trapping (live and kill). Indirect methods include estimations using activities of the species. For example, the use of presence of footprints, fecal matter, evidence of browsing on leaves, etc. Indirect methods are more practical for species that are nocturnal, secretive, or hard-to-find.

Direct methods are particularly applied for large or easily seen organisms such as birds, large grassland mammals, whales and showy, active insects such as butterflies. While it may be possible to count organisms from a suitable vantage point or while moving along a transect, the count can only be converted to a density estimate if the area scanned can be estimated. The MIST software is a unified database management system designed as a full suite of tools and services for conservation, protected area and park management needs (see Monitoring Manual, Actual Field Estimation).

Where density estimates cannot be computed, the use of presence/absence information will be used. An important source of presence/absence information will be from oral communications with local people. The relative abundance of species will then be estimated based on this information.

Outputs

- Status of Biodiversity: Up-to-date information of the population size, trend and distribution as well as of the threats to Loxodonta Africana cyclotis within the Bia-Diambarakro established.

- Also, the status of other focal and IUCN Redlist species including the Pan troglodytes (chimpanzee) and Agelastes meleagrides (Breasted guinea fowl) updated and shared with national and international biodiversity platforms including the Global Biodiversity Information Facility (GBIF), Birdlife International's Important Bird Areas (IBA) Database , and with the Ghana Biodiversity Clearing House Mechanism (CHM).

- A consolidated framework for the visualization and presentation of biodiversity information for policy decisions and local land use planning.

4.1.2 **Plant Surveys**

Interest in surveys for monitoring plant abundance is increasing, due in part to the need to quantify the rate of loss of biodiversity within the landscape and the closer linkages between the health, nutrition, and economic wellbeing of fringe communities. Floral surveys will be conducted at the landscape and plot level. Remote sensing and GIS techniques will be employed to monitor habitat condition at the landscape. At the plot level, Temporary Sample Plots (TSPs) approaches (McCullough, Alonso, Naskrecki, Wright & Osei-Owusu 2007) will be designed based on initial GIS

4 The Global Biodiversity Information Facility (GBIF) is an international open data infrastructure, funded by governments. www.gbif.org

5 The function of the BirdLife Important Bird and Biodiversity Area (IBA) Programme is to identify, protect and manage a network of sites that are significant for the long-term viability of naturally occurring bird populations, across the geographical range of those bird species for which a site-based approach is appropriate. http://www.birdlife.org/datazone/site

work to determine the various classes of vegetation cover present in the landscape (See Monitoring Manual, Actual Field Estimation) .

Proposed Methods

Landscape level:

Temporary Sample Plots (TSP) of 50 m x 50 m and regeneration subplots of 10 m x 10 m will be established at each site and vegetation occurring within each plot will be identified. Flora of less than 5 cm diameter at breast height (DBH) at a height of 1.3 m will also be identified inside the sub-plot. A number of TSPs will be set up at a defined survey site using the four cardinal geographic coordinates. A Garmin GPS 76 will be used to record georeferenced positions and altitudes of sample plots.

Additionally, transect walks of at least 6 km will be traversed. Existing timber hauling roads, footpaths and lines cut through forests will serve as useful transects. Trees within 20 m on either side of each transect will be identified. Leaf samples of plant species not identified in the field will be collected and pressed for proper identification at a reputable herbarium.

Output

The plant surveys will provide information on the abundance of different plant species as well as on forest health and the degree of forest degradation. It is expected that there will be improvements over the baseline in plant species numbers and diversity within the project landscape.

4.2 Suggested Socio-economic Approaches

4.2.1 Cocoa farm productivity and area following best practices.

The objective of this subcomponent is to train farmers in better management practices to help them increase yields and incomes and improve biodiversity on their farms.

A number of activities are being implemented under the project Component 3 aimed at training farmers (through farmer field schools and training-of-trainers) in integrated pest management (IPM), soil and water conservation (sustainable land management or SLM) and best-practices in cocoa cultivation. Farmers are also being encouraged to increase tree cover on their farms to improve the long-term sustainability of cocoa production. The project also assisted with strengthening the organization and skills of local farmers' groups to enable them to produce certified commodities.

Proposed Method

The methods of production change over time and it is important to be able to capture the effects of such changes on output. Capturing such effects can ideally be done within the production function[6] framework.

6 A production function relates physical output of a production process to physical inputs or factors of production.

Productivity will be determined at the farm level and extrapolated to the landscape level using the partial factor productivity. By this, total cocoa beans at the farm gate for individual farms that is documented at the society level by Purchasing Clerks will be accessed and used together with other farm level information collected to develop a farm budget for sampled farms. Other information available at the landscape level will be collected to conduct a principal component analysis (PCR) and subsequently determine any trends and correlation at the landscape level. A number of assumptions will be made and this will guide the use of the information that is generated from this analysis.

Outputs

- Productivity of cocoa in Ghana is expected to be 525kg/ha against the baseline of 474kg/ha
- For Côte d'Ivoire, productivity of cocoa is expected to be 300kg/ha against the baseline of 250kg/ha.
- Area of certified cocoa production is expected to be 50ha in total for both countries combined. Baseline is 0 ha.
- Tree cover in off-reserve areas increased by 150ha (Ghana) and 50 ha (Côte d'Ivoire). Baseline is 0ha.
- At least five-hundred local farmers trained in IPM, SLM and best-practices in cocoa cultivation in Ghana and Côte d'Ivoire.
- One hundred farmers increase tree shade on their farms to 30 percent (roughly 200 hectares in total, so final tree cover of approx. 60 ha).

4.2.2 Number of communities participating in ecosystem restoration activities.

The Bia-Diambarakro TFCA has seen a number of modifications from its original state. This modification is primarily a result of human interventions within the landscape. Whilst some areas have remnants of the original state, portions of the ecosystem have undergone significant degradation with negative impacts on biological diversity and peoples' livelihoods.

There is now a growing realization among stakeholders, particularly, community members that, they will not be able to conserve the landscape's biological diversity through the protection of critical areas alone. In this way, ecological restoration becomes a fundamental element of ecosystem management, although until recently, its potential has not always been fully recognized. What makes ecological restoration uniquely valuable is its inherent capacity to provide people with the opportunity not only to repair ecological damage, but also to improve the human wellbeing (Gann & Lamb, 2006).

Given that many people now depend on what have become degraded ecosystems to sustain their livelihoods, ecological restoration needs to address five elements (Gann & Lamb, 2006). These elements are critical to successful ecosystem management. Ecological restoration should therefore:

- Improve biodiversity conservation
- Improve human livelihoods
- Empower local people's capacity for good management of natural resources
- Improve ecosystem productivity
- Reduce threats to natural resources

Reducing the impacts of human activities on biodiversity will lead to significant improvement in the status of the ecosystem and the services it provides.

Proposed Methods

Proposed methods for monitoring ecosystem restoration activities will identify and establish the total

area that has been improved because of ecosystem restoration activities. Also, the number of communities and individuals that participated in the ecosystem restoration activities will be documented. The suggested methods are:

- There are no direct methods for measuring improved biodiversity conservation. However, improved biodiversity conservation is an output at the landscape level as a result of a number of management activities that are implemented at the ecosystem level. These activities are meant to improve habitat conditions (both off-reserve and on-reserve areas), effective management area for species, sustainable resource use from the landscape, and fair and equitable benefit sharing. By use of ecological modelling techniques, spatial maps could be produced and integrated into an ecological model to define how changes in an ecosystem's structure and function are likely to affect the flows and values of ecosystem services across the landscape.

- One of the benefits of ecological restoration is its positive effect on the livelihoods of people living close to the resource. Livelihood can be analyzed at household level or communal level and extrapolated to reflect landscape conditions. For the purposes of this project, a number of participatory methods including community meetings, focal group discussions, key informant interviews, amongst others will be used. These approaches will be aided by tools including questionnaires, profiling and mapping (See Monitoring Manual; Appendices). The use of a mix of these approaches allows the vulnerability, livelihood strategies, processes and outcomes of communities to be incorporated into an analytical framework allowing for linkages between micro and macro levels.

- Local community members play a pivotal role in ecological restoration efforts if they are well involved and up to date with natural resource governance issues in their community. To assess this, the number of committees, groups and individuals involved in local natural resource governance activities will be documented and analyzed. Also, the number and extent of community participation in local forestry programs will be assessed.

Output

- Improved forest condition and cover of Bia National Park and Krokosue Forest Reserve in Ghana, and Bekki, Bosse Mati and Diambarakro Community forests in Côte d'Ivoire.
- Improved access and sustainable harvest of Non-Timber Forest Products (NTFPs) by fringe communities within the Bia-Diambarakro TFCA.
- Improved micro-climate to support agriculture (especially cocoa production) within the landscape.
- Hectares and numbers of off-reserve areas (including CREMAs, private plantations, farms, fallows, etc.) managed under sustainable restoration practices increased.

4.3 Suggested Governance Methods

The quality of governance often determines whether forest resources are used efficiently, sustainably and equitably, and whether countries achieve forest-related development goals. Poor forest governance has ripple effects and often reflects overall weakness in governance within a country. These governance methods have been adopted to be used to detect weaknesses of forest governance systems in the landscape and monitor results.

4.3.1 Policy, Legal and Institutional Arrangements.

The existing policy, legal and institutional arrangements, influence the conduct of institutions and individuals within the TFCA. These arrangements determine the power and authority, organization and structure of the various actors within the landscape and ultimately impact the biological status of the corridor. Weak law enforcement for instance, could motivate individuals or groups to undertake illegal activities within the corridor and thus compromise its health.

4.3.2 Technical capacity of GFC, SODEFOR and local community members in biodiversity monitoring, assessment and protected area management.

Capacity building seeks to improve the performance of work units, departments and the whole organization. Organizational capacity building is a system-wide planned effort to increase organizational performance through purposeful reflection, planning and action. Even though there are some human resources to implement management recommendations for the project landscape, most of the agencies responsible for conservation in these countries and the communities suffer from a lack of adequate technical capacity, resources and information necessary to provide effective support for biodiversity conservation and sustainable forest and land management.

Each country has identified some of their most serious deficiencies that should be addressed by the project through technical assistance and other investments. The project envisages that forestry agencies and institutions will need to strengthen the capacities of local people to care for their own local environment so that, limited government resources can be directed to where they are most needed. A technical capacity development program is at various stages of implementation in Ghana and Cote d'Ivoire to improve the knowledge and skills of park managers in landscape management.

BOX 3: Technical Capacity

Specific ability of an entity (person or organization) or resource, measured in quantity and level of quality, over an extended period. For the TFCA project, technical capacity development is about helping people build expertise and access the resources they need to own and deliver conservation.

Proposed Methods for governance assessment

A broad range of qualitative and quantitative approaches based on the Framework for Assessing and Monitoring Forest Governance[7] by the Program of Forest (PROFOR) of the FAO will be adopted for assessing the legal and policy settings and the technical capacity of GFC, SODEFOR and beneficiary communities in project management. This will include aspects of accountability, effectiveness, efficiency, fairness/equity, participation and transparency within the forestry sector in both countries (See Monitoring Manual, Actual Field Estimation)

Output

- Forest related policies and laws translated and implemented at the local level
- Legal framework to support and protect tree tenure, use and ownership implemented at the local level
- Financial incentives, economic instruments and benefit sharing mechanisms implemented at the local level
- Adequate stakeholder participation in forestry activities
- Stakeholder capacity improved

It is expected that there will be at least 25% (50% is the target) improvement over baseline and should find expression in improved management of the protected area.

7 The Framework facilitates description, diagnosis, monitoring, assessment and reporting on the state of governance in a country's forest sector. It features a globally relevant and comprehensive list of the major elements that describe forest governance. http://www.fao.org/docrep/014/i2227e/i2227e00.pdf

5.0 Project Monitoring Plan

5.1 Elements of the Project Monitoring Plan

A detailed program of work that sets out what monitoring activities will take place, when and by whom, and how that information will be fed-back into the project implementation plan will be developed. The plan will include an estimate of resources needed for the implementation of the plan and identification of training and capacity building needs for local staff and institutions responsible for monitoring identified indicators and implementing the M&E plan. Resource allocation will take into consideration the cost of equipment (including maintenance) and for training in their use.

The plan will also describe mechanisms for feeding results back into the management process and indicate how the proposed activities will contribute to the establishment of a long-term monitoring and evaluation capability in the landscape. The elements of a good M&E plan would be translated into a template (Table 2).

TABLE 2 **Sample Monitoring Plan for Project Activities**

Project Activity	Outcome	Start Date	Completed Date	Person Responsible/ Institutions
Ghana				
Tree registration	300 farmers registered	July 2015	July 2016	FORIG
Farmer training on SLM	250 farmers trained	March 2016	December 2016	IITA
Cote d'Ivoire				
Forest assessment	Assessment conducted	July 2015	Sept 2015	SODEFOR
Community empowerment	15 communities	August 2016	September 2016	SOS Forets

5.2 Monitoring Plan Implementation

The implementation of the monitoring plan is key to the success of the project. Monitoring enables an impact assessment of the project's interventions to be determined i.e. whether you have achieved your goals and objectives and what you need to do to improve the project. The core of an impact assessment lies in developing a monitoring strategy for each information need. In order to measure the impact of each of the project interventions, the results of the project interventions need to be compared to some benchmark. It is also critical to determine the extent to which the assumptions have been ascertained. This comparison involves groups of individual and monitoring units that are drawn from a defined population.

5.3 Assembling Necessary Resources and Materials

Before monitoring, it is essential to assemble necessary resources and materials. These will relate to:

- Monitoring costs - may include budget for staff salaries, field expenses, transportation, training, equipment and materials.
- Monitoring material and equipment – The team may need notebooks, pens, pencils and papers, small backpacks, rain gears, water bottles, sleeping bags and flash lights.
- Permissions required before start of fieldwork - clearance or authorizations that are required to work in the project area.

6.0

Data Analysis, Management and Communication of Results

Data is useful if it can be transformed from data (raw material) to information (cleaned and analyzed) and eventually to knowledge (related back to a challenge or situation). This can be a gradual process since data needs to be collected over a timeframe. Data, once collected, can move from the field enumerators, various partners and stakeholders to be centrally available for reporting and decision-making. It is therefore important that data should not only be collected but a plan developed for the transformation of the data to knowledge. Furthermore, the efficiency rule in data collection and transformation should be observed; that is, data should be collected and transformed into knowledge up to the point where the marginal value of the data collected and transformed is equal to the marginal cost of collecting and processing them. In other words, if the marginal value of a data (collected and transformed) is less than the marginal cost of collecting and transforming this data, then such an information should not be sought.

Handling and Storing Data

Coding Data: this involves defining how you want to represent and record them.

Reviewing Coding Data: this involves checking for obvious recording errors and gaps.

Transcribing Data: this involves recording your data in a systematic format.

Entering and Organizing Data: this involves setting up a database

Backing up Data: this involves making duplicate copies for storage

Cleaning and Preparing Data for Analysis: This involves going over data to catch any errors introduced during any of the previous steps.

6.1 Collation of Information

This involves the scaling up of information from smaller units of analysis to a larger form. By this, information is standardized and can be applied at the higher level of scope and compared spatio-temporarily. Collation of information requires an appropriate format which has been elaborated and described in the Standard Operating Procedure (SOP) (See Appendices). It elaborates on the choice of data collection instruments (forms and questionnaires- paper-based and electronic), statistical programs, GIS and Remote sensing tools and data formats and labels for variables.

6.2 Communicate results to your internal and external audience

The next step in the monitoring process is to develop and give presentations of the results from the analysis to internal and external audiences including project partners, other stakeholders in and around the project site and outside audiences. The medium of communicating the results should be appropriate and understood by the category of stakeholders in view.

6.3 Selecting a Presentation Format for your Audience

Specific types of communication tools that are recommended include:

- Oral presentations
- Discussion sessions
- Informal contacts
- Reports
- Press and media releases
- Brochures and pamphlets
- Formal (academic) papers and books
- Visual presentations (posters, slide shows, films)
- Internet and world wide web

The type of format to be used depends on the type of audience, information needs and circumstances. With the exception of beneficiary communities, all project partners will require project reports particularly in the area of interests.

BOX 4: **Reports**

What are they? Written documents that focus on one or more topics. These documents can arrange from handwritten paper outlining analysis findings to a glossy printed annual report.

Who will they reach? Reports obviously reach audiences who can read. Reports will be used by researchers and by other people who use written documents. They also have the potential to be stored in libraries and other collections and are thus accessible to any person interested in the topic. Unfortunately, they also have a tendency to sit on people's shelves gathering dust and never being read.

When are they useful? When you have large amounts of information that you need to share with many people. Reports are useful for getting your findings out into the public domain.

When are they not useful? When you are working with illiterate people. Reports also do not work very well with busy people who have no time to read detailed documents.

What do they cost? Moderately to very expensive, depending on the size and quality of the final product.

What other resources re required? Reports require significant investment of time and skill to write and produce. In particular, attention should be focused on ensuring that the report is well structured, written and formatted so that is both attractive and easy to use.

6.4 Use of Results to Adapt and Learn

Monitoring data is of little value unless the knowledge acquired is used to systematically test the assumptions to see which interventions worked and which did not and why. The entire process of monitoring provides a framework for testing the assumptions. This information could then be used to adopt and improve the project. The next stage will be to document what has been learned and share the information with other people in a broader conservation and development community.

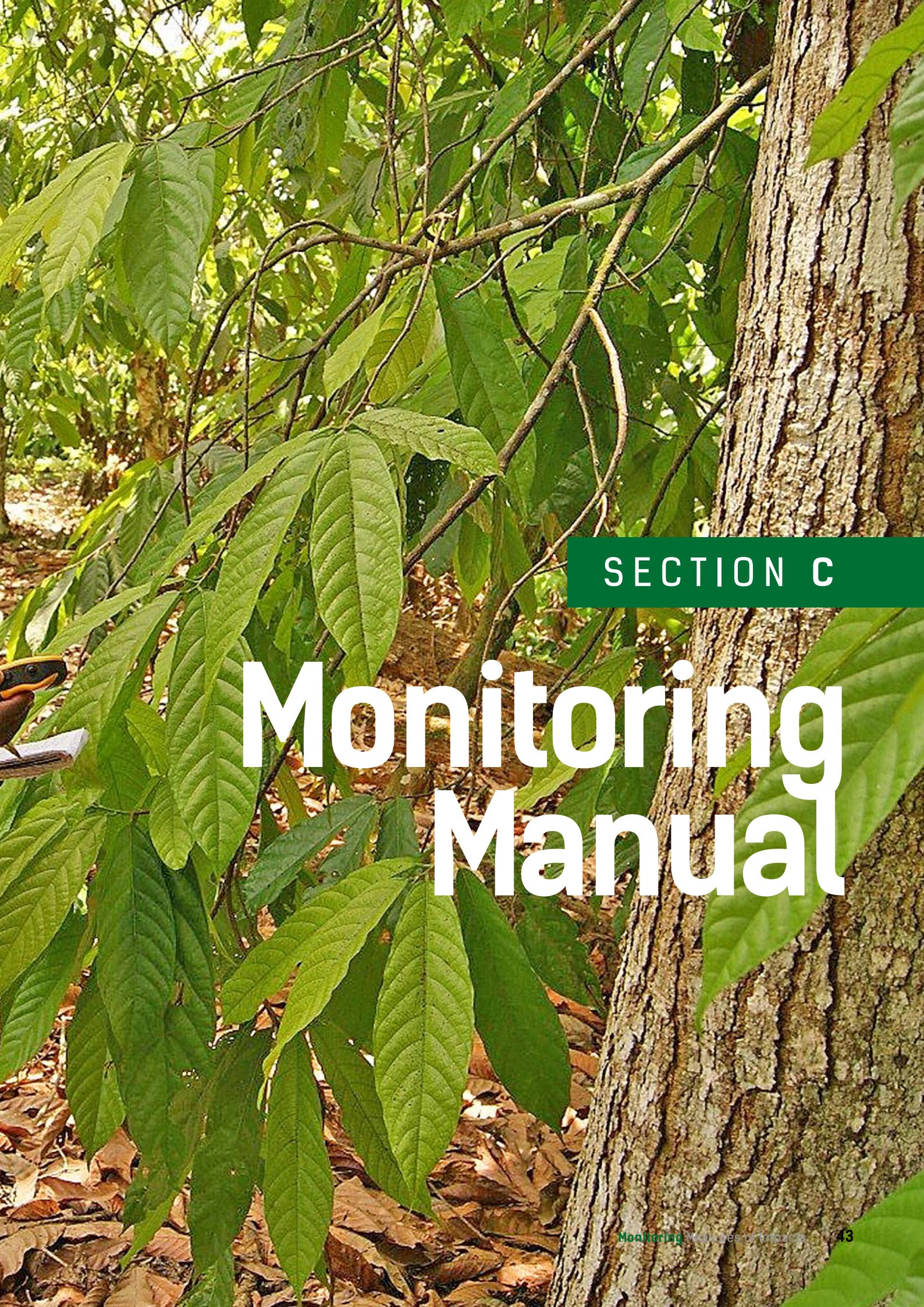
7.0

Conclusions

Monitoring and evaluation (M&E) framework is an essential element in designing and implementing projects. M&E should be part of the project right from its inception and used throughout the implementation phase of the project to measure: the extent to which planned project activities are being implemented; the process followed to achieve the expected outcomes; the progress made in achieving the desired outcomes and the impact of the project on its beneficiaries. This protocol is developed to function as a guiding tool that will significantly help the management process of the GEF/FAO funded transboundary project between Ghana and Cote d'Ivoire.

This monitoring protocol is expected to generate a great amount of vital information, which will help ascertain the major problems, constraints and successes encountered during project implementation. It will also enable project implementers to adjust project activities, plans and budgets according to data generated through the use of tools and methodologies and to provide information for accountability and advocacy to the project donors and beneficiaries and all other stakeholders involved.

The monitoring protocol is tailored to identify and monitor critical indicators of project progress and constraints through the use of tried and tested measuring tools including the MIST monitoring method, catch per effort and population of species (plants and animals). These methods are expected to generate information on elephant and keystone species populations, vegetation cover, communities' level of involvement in biodiversity conservation efforts and the enhanced capacities of monitoring agencies. The protocol will therefore play a crucial role in enhancing the success of this multi-stakeholder project.



SECTION C

Monitoring Manual

8.0

Introduction

This manual provides the practical techniques, methods and standards for data collection, analysis and management, serving as the implementation mechanism for the Transboundary Project's Monitoring Protocol. This manual will help to monitor the project's progress within the TFCA, by collecting data on key indicators and processes to improve tracking of success or otherwise of project deliverables.

The manual will assist field data collectors on the choice of methods in collecting data. The data collected will be analyzed and information generated will be presented in the form of reports, briefs and presentations for stakeholders and funders. The information generated will form a key part of the information which evaluators will use in assessing the overall performance of the 3-year project. The key project outcomes and outputs stated in the monitoring protocol will be measured using the tools this manual provides for each deliverable. Users of the monitoring protocol are therefore directed to refer to these tools. It must be emphasized that there are existing monitoring systems at the PA, regional and national levels in both countries. As such, this document will compliment and improve the monitoring system that is in place at each level and enhance the feedback of information for daily management of the TFCA. Also, the indicators, methods, and analytical frameworks presented here will help Ghana and Cote d'Ivoire (in their conservation efforts?).

8.1 Steps in Implementing the Monitoring System

STEP 1 Compile Basic Information about the TFCA

This is done to establish a baseline of the TFCA and provide basis for comparison in the future. By collecting this information, managers will be aware of major threats to biodiversity and community livelihoods in the landscape and possible areas to intervene. Also, managers will be able to tell the extent to which project outcomes have been achieved.

STEP 2 Identify Priorities for monitoring

In this instance, priority for monitoring will be outcomes/outputs set by the TFCA Project document, various drivers and threats to biodiversity and community livelihoods that were identified during the baseline information collection. Spotlights include vulnerable ecosystems/habitats and flash points communities where drivers of biodiversity loss and threats exists. These priority areas could also be defined within the management plan.

STEP 3 Training

It is expected that the team that will be involved in collecting monitoring data will be personnel or community members already involved in collecting monitoring data. Where necessary, their capacities will be enhanced to bring them up to speed on modern tools and approaches that they may not be used to.

STEP 4 Establishing the Monitoring System

In order to achieve the objectives of the project and the monitoring objectives set by each country for the landscape, four methods are recommended here and detailed in the ensuing chapters. These are:

1 Estimation of wildlife population
2 Land Use/Cover Characterization and mapping
3 Forest Governance Assessment
4 Determination of social dynamics and changes

In addition to these methods, it is recommended that a field diary be kept to give a chronological order of field events. Also, a photo documentary will give a visual appreciation and evidence of events.

STEP 5 Analyse Data and establish trends

It is important to do a quick analysis of information collected to establish trends that may need further investigation and also identify inconsistencies in data collected. This should be done at regular intervals (daily, weekly, bi-weekly, monthly) depending on the kind of information collected. Information should reflect ground conditions taking into consideration changes in climatic conditions, equipment or personnel collecting the information. Where there seem to be real changes, it will be important to identify the reasons for the change, the importance of the change and then assess whether any management intervention is appropriate.

STEP 6 Validate, Present Results and make decisions based on results of monitoring

It will be important to validate monitoring information that have been analysed with communities before presenting them and making decisions to strengthen governance and management of the landscape. After validation with communities and other relevant stakeholders, results will be put in the form of graphs, maps, etc., and presented to decision-makers.

9.0

Actual Field Estimation

Despite the proliferation of technology-based monitoring methods for biodiversity monitoring, most of the data required for addressing general biodiversity management and livelihoods issues are obtained using simple methods to estimate the impacts on biophysical, socio-economic, and governance parameters.

9.1 Biophysical

9.1.1 Estimation of Wildlife Population

Four general approaches to estimate population sizes of wildlife: total counts, incomplete counts, indirect counts methods and the use of the MIST software will be used. In practice, population estimates are done once a year, at best, because of manpower and funding shortages but for species that are used for bushmeat, such inventories should be taken three times a year.

Approach

Total Counts or Complete Counts: In order to obtain the absolute population of a species within an area, two measures are necessary. These are: the total number of organisms in the unit of the habitat sampled and the second, the total number of these units in the whole habitat of the population in the landscape.
A complete count or total count, counts every member of a population. This could be achieved with opportunistic walks that are done in where populations are suspected to be: a sizeable group of people counting all species that pass in each direction. The errors in using these methods to estimate population is normally below the true value because the efficiency of sighting or chancing on the organisms is less than 100%.

If it proves possible to count all of the individuals, n, within a known area, a, then this is termed a census and the estimated density, P, is simply:

$$P=n/a$$

In a case where a strip transect[8] , an observer moves along a strip of length, L, and width, 2w. This is usually done on foot or with a vehicle. Thus, P becomes:

$$P=n/2wL$$

Incomplete Counts: An incomplete count involves counting part of a population and then extrapolating to the entire population. Quadrants may be established in a sample area and an attempt made to count all the individuals in each quadrant. An opportunistic walk census using large sized quadrants or transects, can be an effective way to estimate animal populations in

8 Strip Transects are long, narrow plots or quadrats and are typically used in conjunction with finite population sampling theory

forests. As with complete counts, distances between observers and between members of the drive crew are critical for success.

The line transect which is a generalization of the strip transect would be a more convenient approach since there is no assumption that all animals are detected. A straight line transect is traversed by an observer and perpendicular distances are measured from the line to each detected object. If a proportion, G, of a population is detected then the equation becomes:

$$P=n/2wLG$$

The sighting distance and angle are measured and used to estimate G.

Indirect Counts: As it is often impossible to obtain accurate visual or auditory counts of the animals in a population, wildlife managers use indirect signs of the animals present as indices of relative abundance. An index of population indicates relative size of a population and shows population trends (up, down, stable) but does not provide an actual estimate of the number of animals. Examples of indirect counts include counting numbers of muskrat houses, counting scats (fecal pellets) of deer and rabbits, and counting numbers of nests or den sites in a given area. Sometimes counting the number of birds heard singing is considered an incomplete count and sometimes it is considered an indirect count.

One can count fecal pellets of deer or rabbits along transects or in delineated study plots. In either case, the first thing to do after establishing the transects or plots is to remove all old pellets. Then, at a predetermined interval, count all new piles of fecal pellets. This is an index of the number of deer or rabbits in the area: the more animals, the more pellets produced.

In those areas where muskrats build houses of vegetation in marshes, the number of active, maintained houses in a marsh year to year, is an index of the number of muskrats: more muskrats make more houses. If, for a given area, one knows the average number of muskrats living in each house, then, the number of houses can be used to estimate the population size. It should be remembered, however, that indirect counts are only indices of population sizes unless other information is known such as, the average number of muskrats living in each house.

Management Information System (MIST) Software: MIST is a unified database management system designed as a full suite of tools and services for conservation, protected area and park management needs. MIST is the most complete, comprehensive, yet easiest to use and learn system in its class of applications for PA Management. MIST is able to store and analyze data that rangers collect while patrolling and then can produce maps of locations of these sightings and trends in their detection rate corrected for patrol effort. This correction is very important and is what makes MIST so much more useful than other ranger-based data collection tools that have been developed.

The Convention on International Trade in Endangered Species (CITES) has adopted MIST for use in Monitoring the Illegal Killing of Elephants (MIKE) program. The efficient use of the MIST requires the Team leader of the rangers to develop the following to be used by the rangers in MIST data collection:

- **A** Flow diagrams for all aspects of illegal activities to be recorded by ranger patrols,
- **B** A data sheet designed based on the species lists and flow diagrams,
- **C** Instructions for filling in the data sheet (based on country specific procedures),

- **D** Clear instructions for the set-up of the specific GPS model(s) used,
- **E** A sub-division of the protected area in strata (management sectors).
- **F** A set of standard monthly report, chart, map outputs to be produced by MIST on a single button click, and
- **G** A MIST computer and database with protected area specific look-up tables and shape files.

Outputs

The information generated will be reported on in the quarterly reports of the project to inform partners, stakeholders and funders of progress being made.

9.1.2 Land Use/Cover Classification

This is an iterative process to determine drivers of forest/ tree cover losses within the TFCA in both countries even though land use within PAs is defined, the reverse is the case in off-reserve areas where land ownership is complex and not regulated.

Approach

A revised version of the classification scheme developed by Hawthorne and Abu-Juam (1995) will be used even though existing schemes being used by the national forestry agencies in Ghana and Cote d'Ivoire will be evaluated and considered in the process. A single score is applied to each sample plot (TSPs), to summarize its general condition as indicated in Table 1. The condition score runs from 1 to 6, with condition 1 forest reserves showing minimal signs of disturbance and condition 5 forests being seriously degraded, with few upper canopy trees. Condition 6 reserves have no significant forest at all.

Scores 1-3 are low-to-moderate and ecologically tolerable, with healthy vital parts of the mosaic in the ascendance and regeneration of timber trees and other forest plants usually abundant. Well-managed selective logging should generate condition 2-3 forest by the end of a felling cycle. Scores 4-6 are applied to forests that have suffered slight degradation over more than half the reserve or heavy degradation over more than one-quarter of it. Very often, significant parts of the mosaic have poor regeneration of timber trees and other forest plants, partly because of lack of 'good' parts of mosaic nearby. Badly managed logging typically produces condition 4-5 forest.

TABLE 3 **Scale used by Hawthorne and Abu-Juam (1995) to Condition scores used to summarize the condition of forest reserves**

Condition Score	Description
1	**EXCELLENT** with few signs (<2%) of human disturbance (logging/farms) or fire damage, with a good canopy and virgin or late secondary forest throughout
2	**GOOD** with <10% heavily disturbed, Logging damage restricted or light and well- dispersed, Fire damage none or peripheral.
3	**SLIGHTLY DEGRADED:** Obviously disturbed or degraded and usually patchy, but with good forest predominant, max 25% with serious scars and poor regeneration; max, 50% slightly disturbed, with broken upper canopy.
4	**MOSTLY DEGRADED:** Obviously disturbed and patchy, but with bad forest predominant; 25-50% serious scars but max 75% heavily disrupted canopy, or forest lightly burnt throughout.
5	**VERY POOR:** Forest with coherent canopy <25% (more than three-quarter disturbed), or more than half the forest with conspicuous Eupatorium and other pioneers throughout, Not, however, qualifying as condition 6.
6	**NO SIGNIFICANT FOREST LEFT:** Almost all deforested with savanna, plantation or farm etc.; <2% good forest; or 2-5% v, disturbed forest left; or 5-10% left in extremely poor condition e.g. as scattered trees or riverine fragments, remnants with little chance of surviving 10 years.

A team of experts will be required to apply this technique to obtain information on the current state of the protected forest resources within the TFCA.

To compliment this landscape approach towards determining the extent of forest cover, a land use assessment datasheet (See Appendix 1) will be used to develop a profile of sample plots, their condition, features of interest, extent of canopy cover, understorey species composition and characteristics and, a species list amongst others.

Outputs

The information generated through the use of this tool will inform the governments of the two countries on the state of the protected areas within their respective jurisdiction. This information will be used to support ongoing efforts including the development of the TFCA management plan to garner the commitment of the two countries in the sustainable management of their shared resources.

9.2 Forest Governance

This framework provides a means to view and analyze the institutions and interactions within and outside the forest sector that together create the conditions and possibilities for the governance of a country's forests and forest resources. The framework uses the term "institutions" to refer to customs, behavioral patterns and rules that define:

- who has access to forests and forest resources and shares in their benefit flows;
- what can be withdrawn from, modified or put into forests;
- who has what rights and duties related to forests and forest resources; and
- who participates in key decisions about these issues and about transferring rights and duties to others.

These institutions result from, and are played out through the decisions and actions of diverse actors, stakeholders, organizations and agencies including government forest agencies.

Approach

The basic elements of the framework are its pillars, components and subcomponents. There are 3 pillars and 13 basic components. This manual will cover issues under all the 3 pillars as listed below:

PILLAR 1 Policy, Legal, Institutional and regulatory frameworks

Legal framework to support and protect land tenure, ownership and use rights

A Extent to which the legal framework recognizes customary and traditional rights of indigenous people, local communities and traditional forest users

B Consistency between formal and informal rights to forest resources

Financial incentives, economic instruments

A Equity in the distribution of access to forest resources, rights and rents

B Existence of economic incentives and policies to promote increased value-addition and sustainable utilization of timber and non-timber forest products

C Mechanisms for the internalization of social and environmental externalities from forest resource use including payments for forest-derived environmental services

PILLAR 2 Planning and Decision-making process

Stakeholder Participation

A Existence and effectiveness of processes that ensure participation by key stakeholders including sanctions for failure to facilitate stakeholder participation

B Extent to which government engages with, creates space for and supports the participation of civil society, indigenous peoples and forest dependent communities in forest-related processes and decision-making

C Existence and effectiveness of conflict resolution and grievance mechanisms

PILLAR 3 Implementation, Enforcement and Compliance

Administration of Forest Resources

A Adequacy of staff capacity and effectiveness of agencies tasked with forest administration

B Quality and effectiveness of information and data management systems

C Extent to which on-the-ground management of forests follows adopted policies, laws and plans

Forest Law Enforcement

A Effectiveness of measures and tools to prevent forest crimes

B Effectiveness of incentives for officers and agencies to enforce forest laws including investigation and prosecution investigation and prosecution

C Capacity of law enforcement agencies to suppress, detect and prevent forest-related crimes and illegal activities

Cooperation and Coordination

A Effectiveness and implementation of forest-relevant international commitments

B Effectiveness of cross-border cooperation in the management of common forest resources and in other forest-related international activities

C Effectiveness of cross-border cooperation in law enforcement to combat illegal trade in forest products.

Outputs

Based on these Pillars, and their respective components, a scoresheet is to be developed for assessing the indicators that are generated from these components. The scoresheet will serve as a guide in collecting and analyzing information. It is expected that stakeholders will review and modify the form to serve current needs.

9.3 Socio-economics

Monitoring in this regards is expected to determine people's perception on biodiversity. It is also intended to determine/confirm people's perceptions on management effectiveness and how it relates to their livelihoods. Since the TFCA includes a number of forest blocks that are under permanent protection, it will be good to know how access to forest and forest resources has changed over the years from the traditional way of resource control to the new and modern way of resource management.

Approach

Both quantitative and qualitative approaches will be adopted for data collection. Quantitative methods emphasize objective measurements and the statistical, mathematical or numerical analysis of data collected through polls, questionnaires and surveys, or by manipulating pre-existing statistical data using computational techniques. The three most common qualitative methods are participant observation, in-depth interviews and focus groups. Each method is particularly suited for obtaining a specific type of data.

To be able to answer the questions asked here, a focus group approach which is a form of qualitative research approach will be employed. Specialized groups within the landscape will be organized in meetings to know their perceptions, opinions, beliefs and attitudes towards biodiversity in the area. Groups engaged will be those that were identified during the baseline data collection. Focus groups are usually small groups of six to ten individuals led through an open discussion by a skilled moderator. For the discussion to be rich, the group needs to be large enough to generate the kind of interest that is desired. These discussions are usually up to an hour long and should not last beyond the perceived attention span of the participants. Questions to be asked should not go beyond 10 but a number of sub-questions could be generated from the major questions that have been planned.

Additionally, a quantitative (survey) research strategy will be used to ascertain the perception of a cross-section of the population regarding the status of the corridor. The essence of survey method can be explained as "questioning individuals on a topic or topics and then describing their responses".

Outputs

Information generated through focus group discussions and interviews serve as confirmation of information generated through biophysical methods. It also complements other data sources thereby providing a good basis for decision making.

10.0

Conclusion

These methods for estimating the impacts of the project on the biophysical forest governance and the socio-economic characteristics of the landscape have proven effective for generating relevant data for decision making. Notwithstanding, existing reliable methods could also be employed to validate field results.s.

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GLOSSARY OF TERMS

Trans-frontier Conservation Area is defined as a component of a large ecological region that straddles the boundaries of two or more countries encompassing one or more protected areas as well as multiple resource use areas (Cumming, 2011).

Monitoring is the systematic process of collecting, analyzing and using information to track a program's progress toward reaching its objectives and to guide management decisions. Monitoring usually focuses on processes, such as when and where activities occur, who delivers them and how many people or entities they reach (Davenport, 2013).

Sampling is the process of selecting units from a population of interest so that by studying the sample we may fairly generalize our results back to the population from which they were chosen (Seawright, J., & Gerring, J. 2008).

Data is information that has been translated into a form that is more convenient to move or process (Polkinghorne, 2005).

Information knowledge that you get about someone or something; facts or details about a subject (Cross, R., & Sproull, L. 2004).

APPENDICES

APPENDIX 1. Standards for Data Collection, management and reporting

Collection and Management of Geo-Information

Geo information collection and storage

For want of simplicity and universality, the GIS database for the Bia-Diambarakro TFCA will be created in ArcGIS (file geodatabase). Feature data sets will be created for the protected areas, towns fringing the FR, roads, trails, physical features, demographics, forest condition, etc.

The database will have the following projection/ transformation:

Projected Coordinate System: WGS_1984_UTM_Zone_30N
Projection: Transverse Mercator
False Easting: 500000.00000000
False Northing: 0.00000000
Central Meridian: -3.00000000
Scale Factor: 0.99960000
Latitude of Origin: 0.00000000
Linear Unit: Meter
Geographic Coordinate System: GCS_WGS_1984
Datum: D_WGS_1984
Prime Meridian: Greenwich
Angular Unit: Degree

Metadata will also be kept for each data feature collected. Specifically, all features will be described in terms of:

Data Type:
Shapefile:
Geometry Type: Polygon
Coordinates have Z values: No
Coordinates have measures: No
Name of Data Collector:

Imagery selection

Image acquisition

Landsat data from 1999 to present will be acquired and examined to judge any missing scenes or data gap including cloud cover. Scenes selected for the mapping will have at most 20% cloud to almost cloud free. The vegetation bands (Bands 3 and 4 of Landsat) will be further examined and used for the classification after the necessary geometric and radiometric corrections have been made. Additional imagery (high resolution) may be acquired to aid in the classification and identification of ground features. Quickbird or IKONOS imagery will be purchased for 2014 or earlier.

Image pre-processing

Storage format/ Image Registration: Imagery will be registered in ArcView and stored in the geo TIFF for easy conversion to other formats when being used in other softwares. The images will then be geo-referenced in ArcView (due to its flexibility). The TFCA and its immediate environs of about 10km buffer will be cut-off from the larger data acquired and stored in the geodatabase created.

Image Enhancement: Both radiometric and geometric techniques will be used to enhance the images that have been acquired.

Classification: A hybrid approach that combines the advantages of the automated and manual methods to produce a better forest condition map. This approach involves the use of ISODATA (Iterative Self-Organizing Data Analysis) algorithm to do an initial classification and then use the On-Screen Digitizing method to refine the classification and correct obvious errors.

In this case, the manual methods will be used to effectively edit the map output from the automated classification based on the experience of the team working on TFCA in the past. With this approach a reasonably good classification could be developed with the automated approach and then manual methods to refine the classes that did not get labelled correctly.

The homogeneous clusters corresponding to specific forest cover types will be assigned appropriate cover classes based on reference data from colour composite images, high resolution images, and training data when collected later in the field.

Ancillary Data

Ancillary data from ASTER (GDEM), MODIS (vegetation indices) and PALSAR from ALOS will be used to increase the accuracy of the classification process. Some possible ancillary data types are digital elevation models (DEMs) and their derived data sets (slope and aspect), climate data such as precipitation and temperature, and vector overlays such as roads, rivers, and human population density. Also, DEM and its derivatives (Slope and Aspect), NDVI values, VGI, etc. will be processed from the ancillary data obtained.

Incorporating ancillary data into the classification process can be tedious and sometimes practically impossible. In this case where ancillary data is incomplete, it will be stored in the database but not used for the classification process. An important application of ancillary data is to use such data to develop a grid system and stratify the landscape into regions based on one or more environmental variables.

Habitat Assessment

A brief training should be given to park and classified forest staff by the leader of the assessment team on the ethics of collecting this data. It is important the Ghana and Cote d'Ivoire share data collected by their respective teams to avoid duplicating of efforts especially with data collected from their shared borders.

APPENDIX 2 Land Use Assessment Datasheet

Plot ID	
Compartment #	
Time of Day	

Date	
GPS Point of Plot	Latitude
	Longitude

Estimated Age of Plot:	
Signs of Past Use	☐ Logging (legal) ☐ Logging (illegal) ☐ Farming ☐ Harvesting of NTFPS ☐ Others 1. 2. 3.
Features of Interest	1. 2. 3. 4. 5. 6.
Presence of Species of Conservation Concern (Should be indicated in species list)	☐ YES ☐ NO
Vegetation type:	☐ Logging (illegal) ☐ Farming ☐ Harvesting of NTFPS ☐ Others

Forest Condition Score	☐ 1 Excellent ☐ 2 Good ☐ 3 Slightly Degraded ☐ 4 Mostly degraded ☐ 5 Very Poor ☐ 6 No Forest
Tree canopy	☐ Closed (> 30%) ☐ Opened (< 30%) % Cover _____ Canopy Height_____ metres

Number of trees felt	Natural	
	Humans	
Trees present	<10cm DBH	
	>10cm DBH	

5m X 5m PLOT

Dominance (%)		Degradation Score		Soil Colour (Use Colour Chart)	
Cover (%)				DBH (# of plants with DBH 1cm -9cm)	
Soil Texture	☐ Fine ☐ Intermediate ☐ Coarse			Signs of Dead Saplings	☐ YES ☐ NO

#	Species Name	Family Name	Number of Individuals	Conservation Status

APPENDIX 3 Stakeholder Analysis and Engagement Guide

Strategy	Methodology	Questions to Ask to Engender Group Discussions and Mapping
1. Identification of Stakeholders in the Management of the FRs and Off reserve areas. **Identifiable Groups:** i. Fringe Community Groups: • Traditional Authorities, • Women's Groups, • Youth Groups • Others. ii. Public Institutions: • MMDAs Key Personnel; • Forestry Commission • Others.	**Carry out Participatory Stakeholder Analysis** › Combine Focus Group Discussion with Participatory Mapping/ Visualization e.g. Chapati or Matrix › Focus: Stakeholders' ✔ Interests in the Offset Project, ✔ Level of Importance, ✔ Power and ✔ Influence and ✔ Potential Roles and Involvement in the project).	1 Who are the key Stakeholders i.e. groups of persons, institutions or individuals with interest or stake in the Bia-Diambarakro TFCA concern to be addressed? 2 Which institution(s) in the community, traditional area (s) and district (s) exercise (s) control and management over the TFCA? 3 Who are the "voiceless" for whom special efforts may have to be made? 4 Who are the representatives of those likely to be affected? 5 What have been the responsibilities of the Stakeholders of the TFCA (Fringe Community Leadership and Public Institutions)? 6 Who can make what is intended more effective through their participation or less effective by their nonparticipation or outright opposition? 7 Who can contribute financial and technical resources to TFCA? 8 Whose behavior has to change for the TFCA project to be successful? 9 What resources might the stakeholders of the TFCA be able and willing to mobilize in support of the Offset? 10 What landscape stakeholders' interests may conflict with the TFCA Project? 11. Which of the TFCA Stakeholders wields greater Power and has higher status with respect to Offset? (political, social, and economic)

		12 Which of the TFCA Stakeholders has control of strategic resources? 13 Which of the TFCA Stakeholders has Informal influence (for example personal connections)? 14 Power relations with other stakeholders. 15 Which groups of persons, institutions or individuals are likely to work against the TFCA project and why?
	Plan stakeholder involvement according to: › Interests, importance, and influence of each stakeholder group › Particular efforts needed to involve important stakeholders who lack influence › Appropriate forms of participation throughout the project cycle. › Create a database on all Stakeholders › Location Address, › Postal Address › Phone Number › Etc.	**Other Questions** 16 How does a collector of NTFPs secure right of access into the TFCA? What are the processes involved in this? 17 When and how are NTFPs collectors controlled in their access to the TFCA, if any? 18 How do Non-Timber Forest Products (NTFPs) collectors add value and market forest and wildlife resources collected from the TFCA? (a) Indicate the marketing chain. 19 Which of the NTFPs are processed locally and what can be done to improve the situation? 20 Who are involved in the planning process for the collection of the NTFPs? 21 What are their roles and responsibilities? 22 How effective and efficient have they been? 23 What have been the issues considered? 24 What alternative livelihoods will be considered appropriate and embarked upon to improve on the living conditions of the inhabitants to reduce over-dependence and exploitation of TFCA?

		25 As the communities are required to be involved in the effective biodiversity conservation activities, what roles can they appropriately play in this direction? 26 What factors are mostly to adversely affect the existence and sustainability of TFCA? 27 How have you been dealing with the situation with regards to preventing and mitigating the negative activities that have the potential to degrade the TFCA 28 Traditionally, how do you conserve plants/trees and animals of social, economic and cultural importance to your well-being and that of the community? Cite specific examples. 29 What problems have been encountered in the planning and implementation processes?

Conservation Alliance International (CAI) is a registered regional environmental organizaton with a vision to conserve biodiversity at the local, national and global levels. Our mission is to work with strategic partners to empower communities to lead in agricultural development, biodiversity conservation and create opportunities for economic growth and improved human wellbeing. Our multidisciplinary orientation provides a strong platform for discussing rural policy issues and increasing awareness of why investment in natural resources management and rural development is critical to reducing poverty and improving food security.

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