ASSESSMENT SUMMARIES AND MANAGEMENT PLANS FOR THE PROPOSED ADUM SMALLHOLDER NEW OIL PALM DEVELOPMENT PROJECT, MPOHOR DISTRICT, WESTERN REGION, GHANA.

The land for the proposed Adum Smallholder oil palm project

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1 Overview and background

1.1 Description of location

This report was commissioned by Benso Oil Palm Plantation (BOPP), owned by Wilmar International for a proposed new planting smallholder oil palm project on a 1,477 ha communal farmland located in Trebuom in the Mpohor District of the Western Region of Ghana. The proposed land is owned by the Trebuom community and will not be acquired by BOPP under the project. BOPP will only support the community in developing their own smallholder oil palm plantation with the understanding that the Fresh Fruit Bunches (FFBs) will be sold to BOPP. The Adum Smallholder Oil Palm Project (ASOPP) which will be implemented in full compliant with the requirements of the Roundtable on Sustainable Palm Oil (RSPO) is located on a relatively flat land in an agriculture landscape in the Mpohor District of the Western Region of Ghana.

1.2 Topography, landform and drainage

The Mpohor District is generally low-lying, with most parts below 150 meters above sea level, and average height of 70 meters above sea level. Similarly, from analysis of global-level satellite data (digital elevation models), the proposed project land generally consists of low-lying plains, with slopes mostly below 25^{o}. Field observations however, recorded a few occurrences of significant steep outcrops within the assessment area. The wider landscape is generally undulating with a few areas up to, and above 25^{o} scattered on the western and south-eastern sides of the assessment area. The proposed project land is drained by the River Butre to the east and the River Buri to the west, both almost overlapping with the respective boundaries. These rivers and their tributaries are the main waterbodies within the assessment area. The River Ayiem which appears to be a tributary of Buri is also close to the boundary on the southwest but lies outside of the assessment area.

1.3 Description of the proposed project land

The 1,477.96-ha assessment area lies between latitudes 5° 3’ 32” and 5° 0’ 21” North and longitudes 1° 57’ 17” and 1° 54’ 51” West and in the Mpohor District of the Western Region of Ghana. It lies about 2 kilometres south of the BOPP nucleus plantation. This is a community-owned land which the local population intend to use for smallholder oil palm project with technical and financial support from BOPP and a financial institution respectively. BOPP will not acquire the land but will provide technical and financial support to the farmers with the understanding that farmers will sell their FFB to BOPP. The land will remain under the original ownership of the respective stool. The community members would then decide on who would partake in the project and how the plots of land would be allocated to individual members of the community. The land use in the area, at the time of this assessment was mainly farming with the proposed land dominated by farmlands with extensive fallow land interspersed with rubber and cocoa farms and few pockets of farm houses. The communities have other farmlands outside of the project area for food crop farming, and that the project would not lead to extreme scarcity for food crop farming in the area. Besides, other cash crops such as cocoa and rubber already planted on the land will not replace with oil palm and therefore the proposed area may consist of mix of crops and not 100% oil palm.

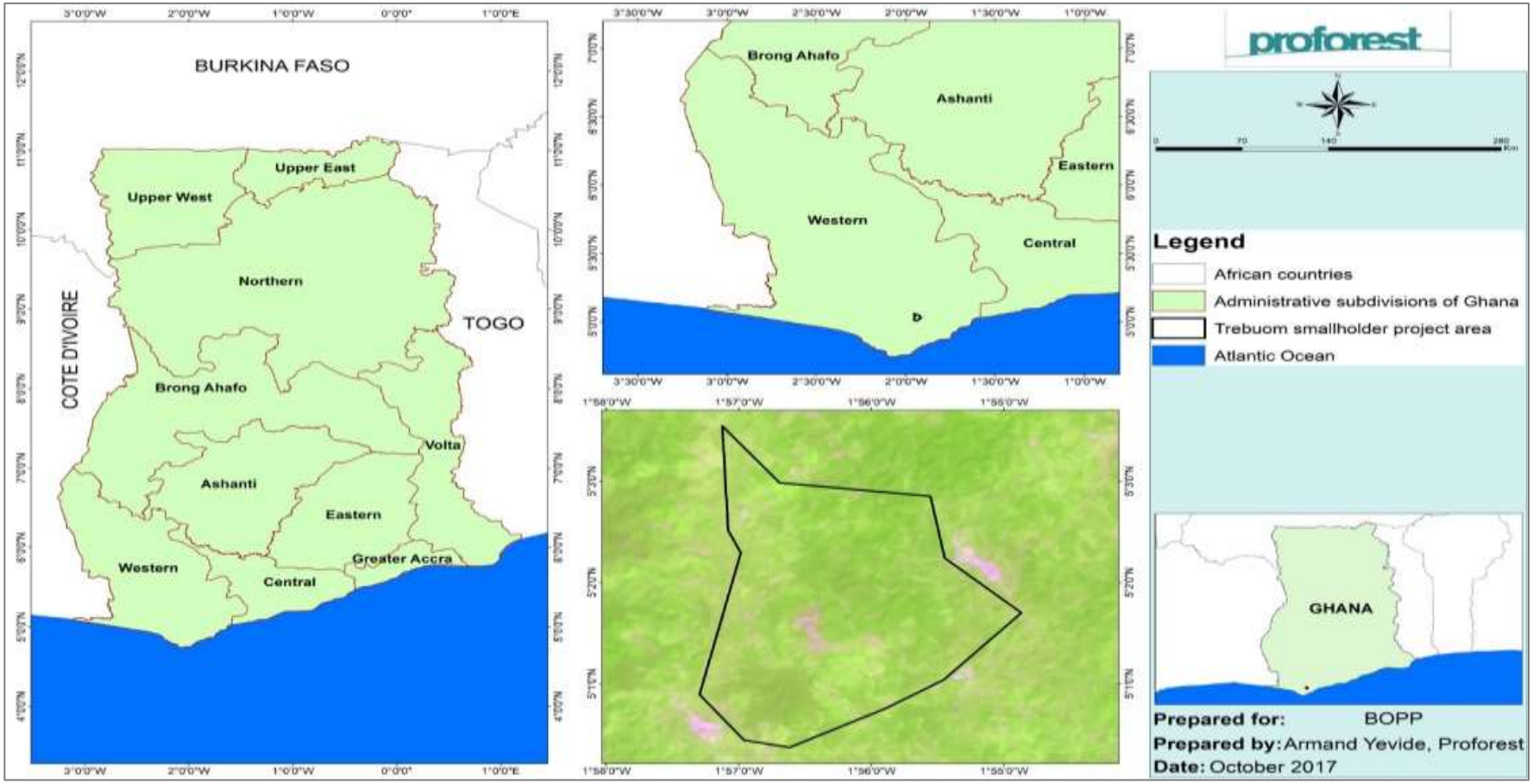


Figure 1: Location of the proposed ASOPP project land in the Western Region of Ghana

Figure 2: The location of the assessment area, BOPP's main plantation and forest reserves in the landscape

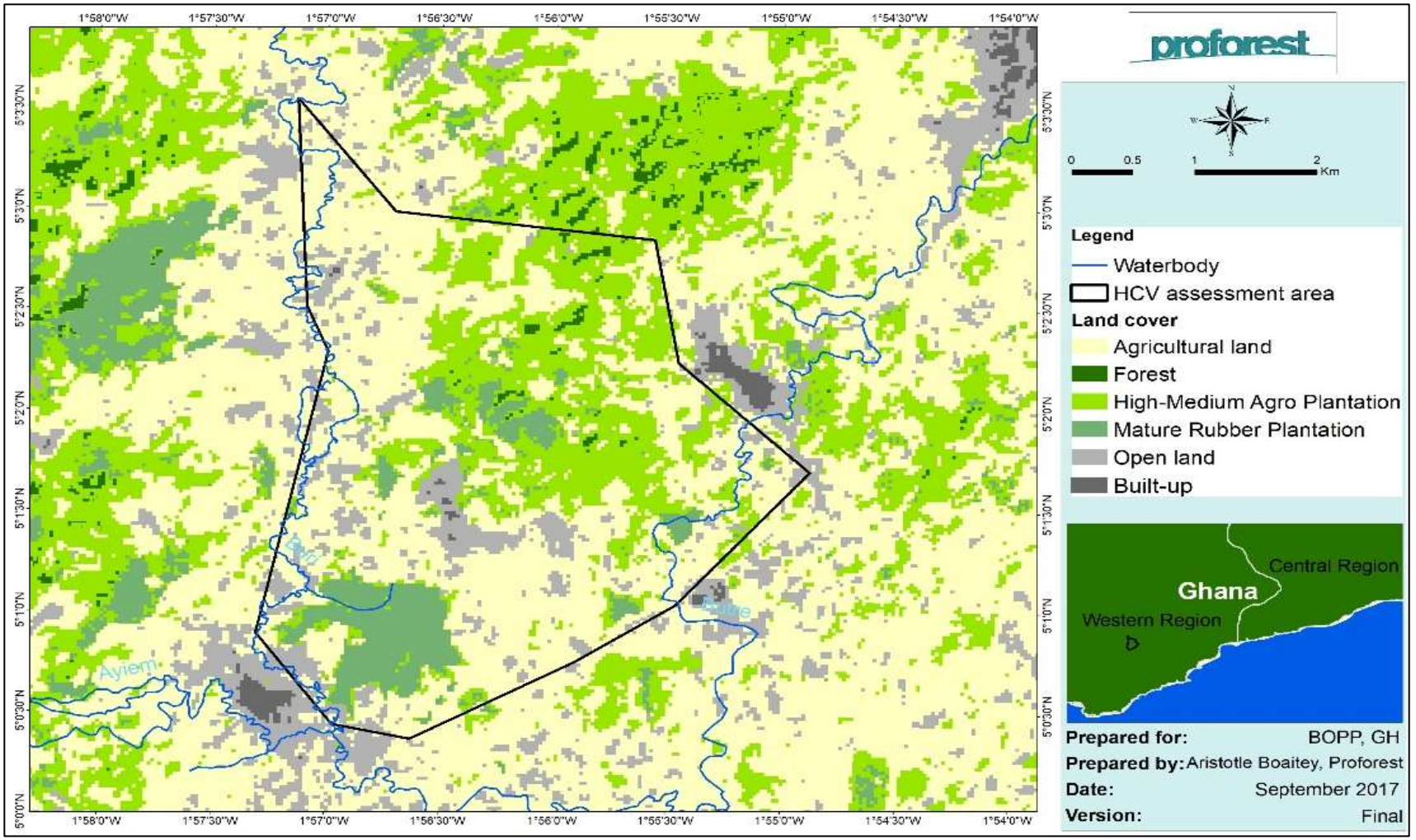


Figure 3: Land cover in the assessment landscape (classified 30m resolution LandSat image, 31 December 2016)

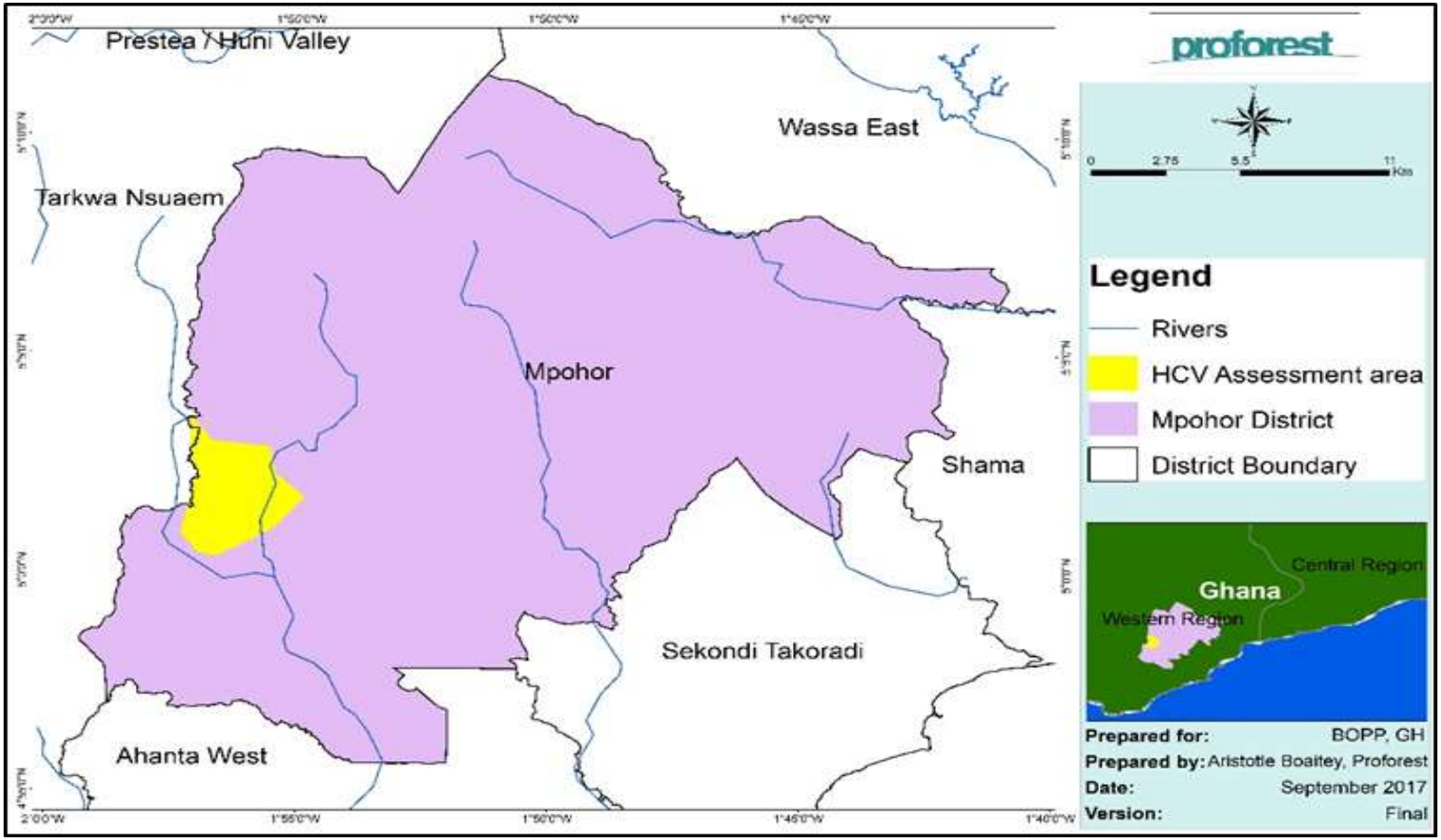


Figure 4 Map showing the location of the assessment area in Mpohor District

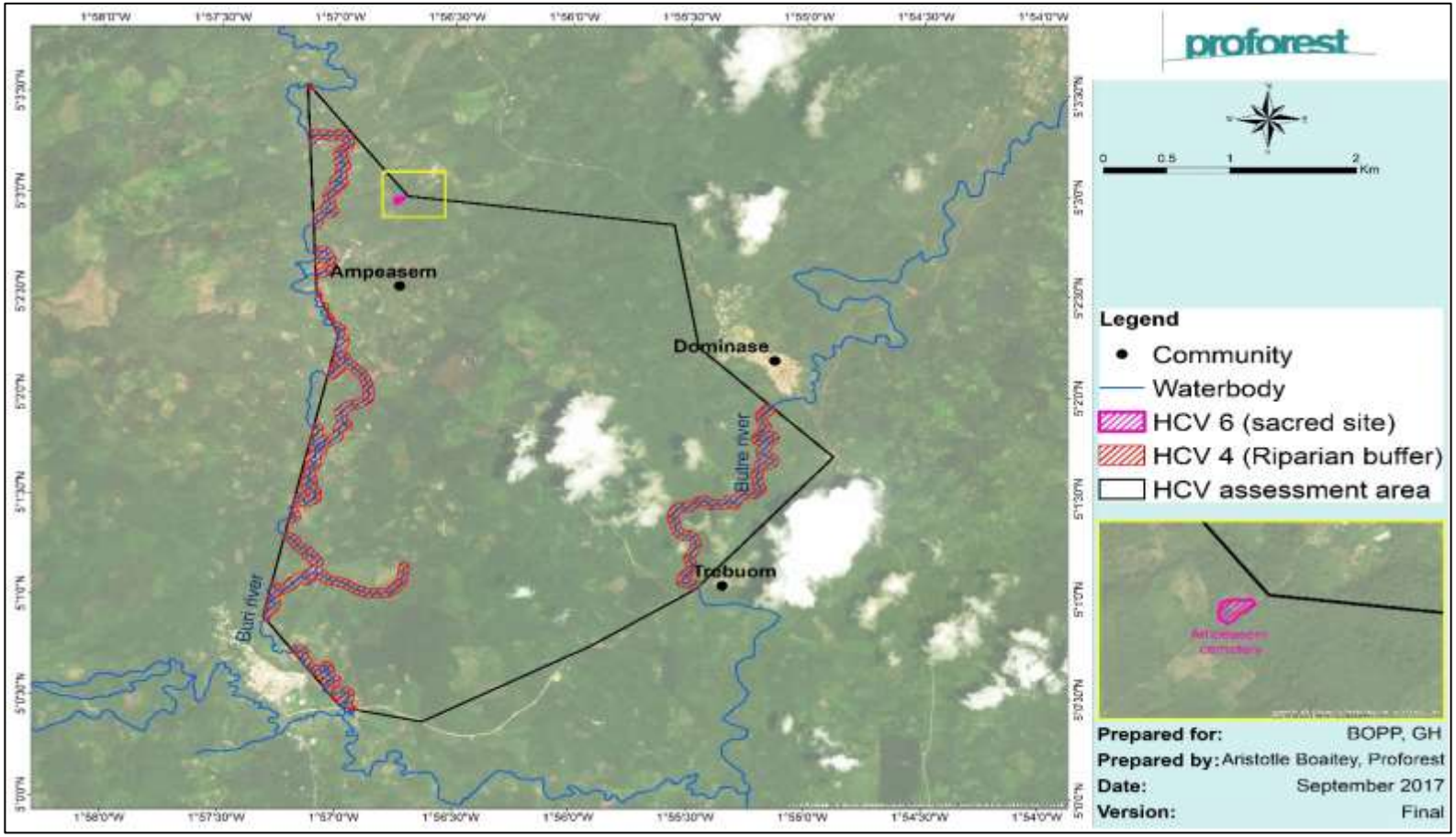


Figure 5: Map showing all identified HCVs and management area

The total area of the project land and summary of the proposed areas to be developed and HCV management areas:
Total concession area: 1,477.96 ha

HCV and their management areas: 89.81 ha

Total area to be developed: 1,388.15 ha

Table 1 Proposed planting schedule

Phase	Year	Hectare
1	2019	500
2	2020	500
3	2021	388.15
Total		1,388.15

2. Assessment process and methods

2.1 HCV assessment process and methods

Assessment overview and references

HCVs refer to biological, ecological, social or cultural values considered outstandingly significant or critically important at the national, regional or global level and which require special measures for their maintenance and/or enhancement. The HCV concept aims to identify whether these values are present and to develop appropriate management and monitoring strategies to maintain and/or enhance the values. The assessment of the six categories of HCVs was conducted using the Ghana HCV Toolkit produced by WWF in 2006. The identification of the different categories of HCVs is therefore consistent with the requirements of this Toolkit. However, since this Toolkit was prepared about ten years ago, other current best practice guidance on HCV identification, management and monitoring were also used where necessary and have been referenced. The following guidance documents were therefore used to support the HCV identification, management and monitoring recommendation:

1. HCVRN, 2014. HCV Assessment Manual
2. Brown, E., N. Dudley, A. Lindhe, D.R. Muhtaman, C. Stewart, and T. Synnott (eds.), 2013. Common Guidance for the identification of High Conservation Values. HCV Resource Network.
3. Brown, E. and M.J.M. Senior, 2014. Common Guidance for the Management and Monitoring of HCVs. HCV Resource Network
4. WWF-GFTN, 2006. An interpretation of the HCVF toolkit for use in Ghana. WWF-WARPO

Date of assessment

Proforest was contracted on 30th June 2017 to conduct the High Conservation Value (HCV) assessment. An earlier scoping study was conducted by Proforest in March 2017. Field assessment

including biological surveys and stakeholder consultations commenced in July and were completed in December 2017. The High Conservation Value Resource Network Quality Panel review was completed in February 2018.

Assessors and their credentials

The HCV assessment team consisted of 8 specialists with diverse academic and professional background and vast experiences appropriate to the specific tasks. The team consisted of professionals from various fields including forestry, sociology, wildlife, and GIS mapping. The specialist members of the team and their roles in the assessment is presented in Table below.

Table 2. The HCV assessment team

Name	ALS License	Institution	Role	Expertise
Abraham Baffoe	ALS15006AB (Fully licensed)	Proforest	Lead assessor	Forest Ecology, and social expert
Dr. Emmanuel Danquah	N/A	[1]FRNR, KNUST	Wildlife expert	Ornithologist and mammal expert
Seth Kankam Nuamah	N/A	Independent consultant	Botanical expert	Botany and ecology expert
John Amonoo	N/A	Proforest	Team member	Social expert, stakeholder engagement
Aristotle Boaitey	N/A	Proforest	Team member	Social expert, GIS, Forestry
Dr. Armand Yevide	N/A	Proforest	GIS expert	GIS/Mapping/ Hydrology
Dr Michael Abedi-Lartey	N/A	Proforest	Fauna survey team member	Nature conservation and wildlife management
Delali Kpetsigo	N/A	Independent Consultant	Social team lead	Sociologist/Population expert

The HCV assessment methods used

The methods for the HCV assessment included collection of both primary data through field assessments and engagement with stakeholders and a secondary data from literature reviews. To inform the field data collection methods, the secondary data was collected mainly during the pre-assessment and scoping stages of the assessment and prior to the main field assessment.

Scoping

A scoping study, commissioned by BOPP, was conducted by Proforest in March 2017 to identify the key environmental and social issues in relation to three proposed sites for a proposed smallholder project scheme, including the area under this assessment. The other two parcels of land may be considered later for another smallholder oil palm development and are thus not included in the scope of this full HCV assessment. The main activities prior to the scoping studies were review of documents to enhance Proforest's understanding of the area. Several meetings were also held during the scoping including meeting with BOPP management, the chief and elders Trebuom, Dominase and

[1] Faculty of Renewable Natural Resources, Kwame Nkrumah University of Science and Technology

Ampeasem. The team also met with the chief and elders of Adum Banso. In addition to this, the team had communal meetings with all the three communities (Trebuom, Dominase and Ampeasem). The team also carried out rapid assessment of the land cover, physical features, distribution of settlements and land use activities within the proposed land. The site visit involved a drive through the site and trekking through randomly selected spots to examine features of interest. The scoping study enabled Proforest to acquire preliminary understanding of the socio-economic and cultural dynamics of the three main catchment communities, as well as conservation issues, potential HCVs in the area and the adjoining landscape to inform the identification of relevant expertise requirements, choice of methodology and process steps used for this HCV assessment.

Table 3 HCV Assessment timelines

Date	Activity
March 2017	Scoping
July 2017	Desk-based review
10th – 16th July 2017	Field data collection • Stakeholder Consultation • Participatory mapping • Flora survey • Fauna survey
End of August 2017	Data analysis and mapping
End of September 2017	Drafting of report
October to mid-December	Further consultation with stakeholders
December 2017	Finalization and submission of report to HCV RN for Quality Panel review

Secondary data collection

A desk review of relevant documents and reports was carried out to identify key landscape concerns related to the proposed land area under this assessment. Literature reviewed included previous HCV assessment report for BOPP operations, surveys and studies that had been conducted within the assessment area and adjoining landscape, BOPP management documentation, maps, and satellite imageries. The desk review was conducted to get a better understanding of the land cover classes and effort requirement for field surveys. The review was also aimed at identifying the potential conservation values present in the area.

Stakeholder consultation

In order to elicit inputs from the wider stakeholder groups, the team organised consultative meetings with public sector institutions including the regional District Assembly (a local government authority), COLANDEF, Conservation Foundation and Forest Watch-Ghana. All three communities (Trebuom, Dominase and Ampeasem) were consulted throughout the assessment process to help in the identification and mapping of HCVs.

Assessment of socio-cultural values

Review of literature

Assessment of socio-cultural values formed part of the Social Impact Assessment (SIA) which was also conducted concurrently by Proforest. Before field assessment, the team reviewed reports of previous

socio-cultural studies, surveys and assessments conducted in the assessment area. This gave the team a fair idea of the communities likely to be impacted by the proposed oil palm development, the social, economic and cultural dynamics of the communities living within and around the assessment area, as well as the potential socio-cultural values that. Literature reviewed included among others, the 2017 draft District Development plan, the 2000 and 2010 Population and Housing Census reports of the area.

Community consultations and participatory mapping

Consultative meetings were held with the 3 main communities in and around the assessment area. Each of the 3 communities consulted held either land-owing or use rights. Representation in such meetings included chiefs and elders, various community groups (e.g. women and youth) and the general community members. The objective of these meetings was to find out if there were any resources in the proposed area that the communities depend on for their livelihood and/or subsistence, and whether there are any sites of cultural significance. This was also to give the local population the opportunity to express their and concerns they may have about the proposed oil palm development. Due to varying dependence and utilization of resources by different groups and women and men, focal group discussions were held with different groups of people including the youth, women groups, men, palm wine tappers and hunters. Efforts were made to encourage and capture views of men, women and children during the consultations. Women were particularly encouraged to share their views and concerns, as this may not always be the norm in the local cultural setting.

Participatory mapping was an important part of the community consultations. At each of the community meetings, the social team lead for this assessment presented a simplified map of the assessment area to the communities to indicate approximate locations of socio-cultural and traditional values as well as any other use areas. In addition to the community consultations which was conducted concurrently with the social impact assessment carried out by Proforest, the assessment team also consulted other stakeholder groups including the district assembly and an NGO operating in the area such as COLANDEF.

Assessment of fauna and flora/biological survey

Fauna survey

Distribution of transects

A 500-meter grid was overlaid on the landcover map (unsupervised classification) of the assessment area using GIS application. Based on this, starting points of 18 North-oriented transects were systematically selected, taking into account distribution of various land cover and habitat types. The midpoint of each of these 1 km transects was identified based on the transect distribution for the flora survey. In total, 18 km of transects were walked in the assessment area.

Data collection

Fieldwork for the fauna survey was conducted on 10th to 14th July 2017, almost at the end of the early rainy season. Information on mammals, birds, herpetofauna and amphibians were systematically obtained by direct observation and record of signs (vocalizations, droppings and footprints) along transects. Additional information was obtained by interviewing local people, particularly hunters. Pictures in field guides (Stuart and Stuart, 2006) and (Happold and Happold, 1990) were shown to the local people to help in the identification of the mammals. This also gave the opportunity for others to corroborate or challenge the authenticity of information given. All captured and identified specimens were released as soon as possible at the point of captures.

Data Analysis

Conservation status: The conservation status of the fauna in the area of influence was assessed using the global (International Union for the Conservation of Nature (IUCN) and the CITES and the national (Ghana Wildlife Laws) criteria.
The IUCN criteria: The International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species (2017) provides taxonomic, conservation status and distribution information on taxa that have been evaluated using the IUCN Red List Categories and Criteria. The main purpose of the IUCN Red List is to catalogue and highlight those taxa that are facing a higher risk of global extinction (i.e. those listed as Critically Endangered, Endangered and Vulnerable). The IUCN Red List also includes information on taxa that are categorized as Extinct or Extinct in the Wild; and taxa that cannot be evaluated because of insufficient information (Data Deficient).
CITES: The Convention on International Trade in Endangered Species of Wild Fauna and Flora is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The species covered by CITES are listed in three Appendices, according to the degree of protection they need. Appendix I includes species **threatened** with extinction. Trade in specimens of these species is permitted only in exceptional circumstances. Appendix II includes species **not necessarily threatened** with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival. Appendix III is a list of species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation.
National criteria: Ghana's wildlife laws (Ghana Wildlife Conservation Regulations, 1995) also categorize animal species into three main schedules based on the level of protection required for the particular species.

Flora surveys
Data collection
The start points of transect lines for the flora survey were systematically selected such that the distribution of various land cover and habitat types was reasonably represented. A 500-meter grid was overlaid on a landcover map (unsupervised classification) of the assessment area.
One-hectare rectangular sample plots were then established from the starting points. In all, 18 sample plots were laid in the assessment areas, covering a total of 18 hectares which constitutes a little over 1% of the entire assessment area. Within each sample plot, 20m X 20m quadrats were laid (i.e. 25 quadrats per sample plot). The assessment team walked along the transect lines and identified and recorded all trees with dbh of 10cm and above within each quadrat. The variables recorded were species name, dbh (measured with diameter tape) and height (measured with clinometer or ocular estimated). Other characteristics of the trees were recorded. These include as whether they are forked, fluted, multi-stem, coppice, etc. Tree conditions of conservation interest were also recorded; spotters looked out for and recorded fruiting trees, seed trees, hollow trees, etc. To obtain an idea of regeneration, seedlings, saplings and other plants with dbh below 10cm were also identified and separately recorded. This was done for one quadrat per transect. Additionally, descriptive information about the area (such as farm, fallow land, regenerating area, etc.) was also noted.
Determination of the conservation status of species:
The conservation status of the individual species was determined at two (2) levels: the Global conservation importance based on The IUCN Redlist of Threatened Species and the Star-rated conservation importance based on the rarity of individual species in Ghana and internationally, with subsidiary consideration of the ecology and taxonomy of the species (Hawthorne and Abu-Juam, 1995).

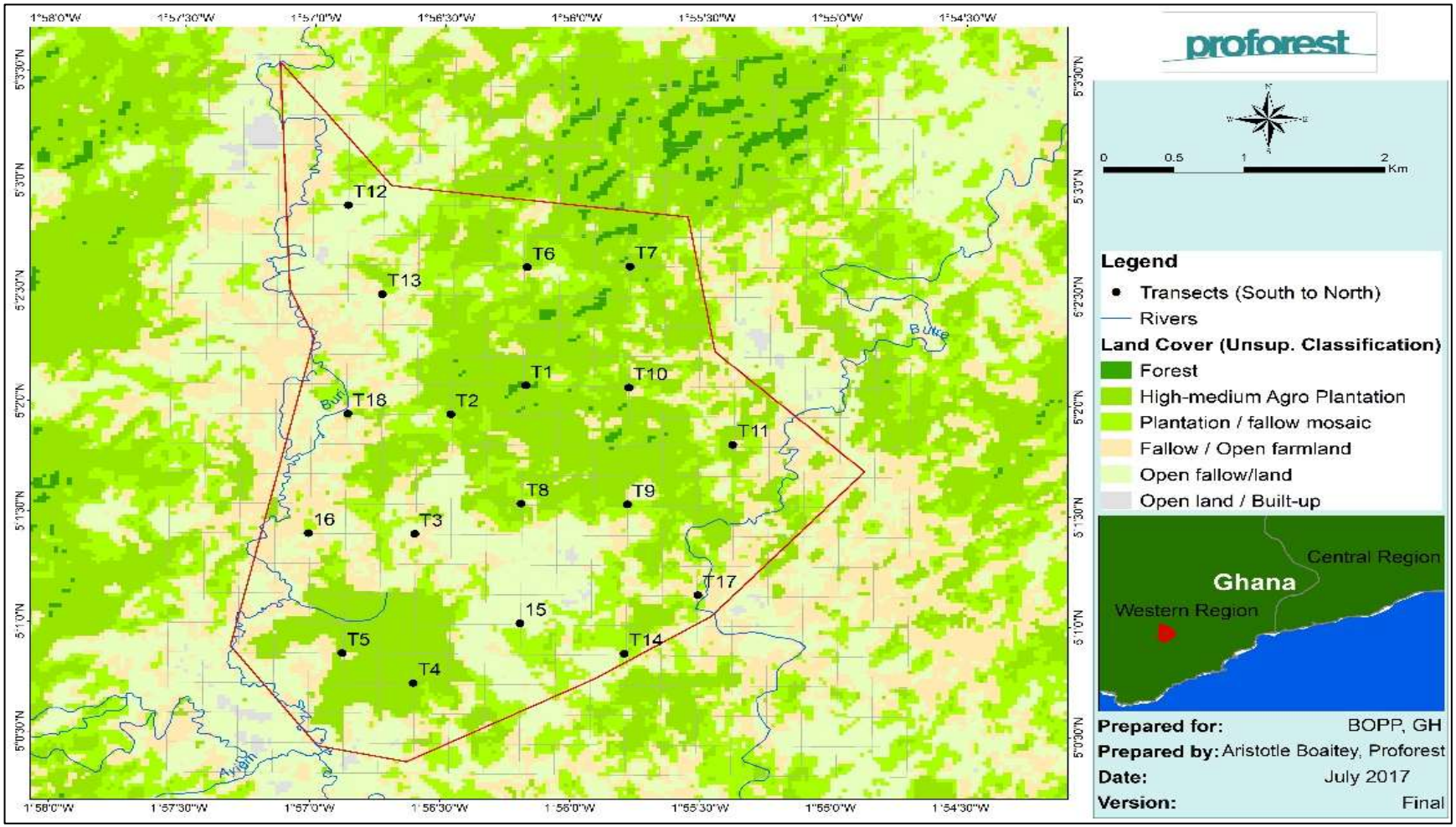


Figure 6 Distribution of flora survey transects in the assessment area

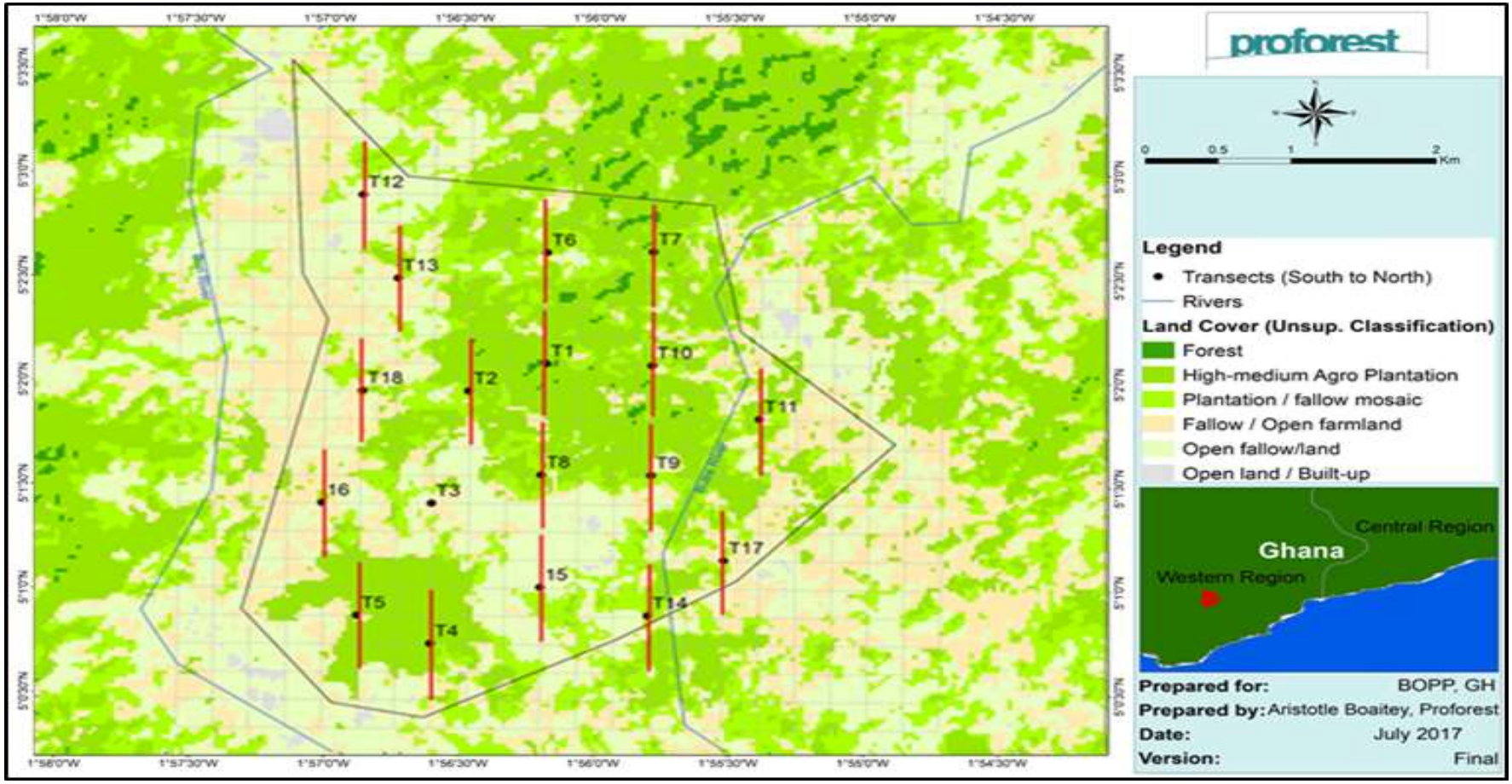


Figure 7: Distribution of fauna survey transects in assessment area

- **Social and cultural surveys to assess HCV 5 and 6**: Consultative meetings were held with all the 3 communities who generally use the land for socio-economic activities. Each of the 3 communities consulted held either land-owing or use rights of the proposed project land. Representation in such meetings included chiefs and elders, various community groups (e.g. women and youth) and the general community members. The objective of these meetings was to find out if there were any resources in the proposed area that the communities depend on for their livelihood and/or subsistence, and whether there are any sites of cultural significance. This was also to give the local population the opportunity to express their and concerns they may have about the proposed oil palm development. Due to varying dependence and utilization of resources by different groups and women and men, focal group discussions were held with different groups of people including the youth, women groups, men, palm wine tappers and hunters. Efforts were made to encourage and capture views of men, women and children during the consultations. Women were particularly encouraged to share their views and concerns, as this may not always be the norm in the local cultural setting. Participatory mapping was an important part of the community consultations. At each of the community meetings, the social team lead for this assessment presented a simplified map of the assessment area to the communities to indicate approximate locations of socio-cultural and traditional values as well as any other use areas. In addition to the community consultations which was conducted concurrently with the social impact assessment carried out by Proforest, the assessment team also consulted other stakeholder groups including the district assembly and COLANDEF which is an NGOs operating in the area.

Figure 8: Final communities' consultation meeting at Mpohor District Assembly Hall

Figure 9: Community consultation meeting at Dominase

Dates Environmental and social impact assessment (ESIA) were conducted

The Environmental and Social Impact Assessment (ESIA) for the proposed Adum Smallholder project was conducted jointly by Proforest and Maiden Environmental Services (MES). The field work of the EIA commenced in early December 2017 and was completed in January 2018 with the final report submitted on 20th September 2018. The field work of the SIA started in early June and was completed in late June 2017 with submission of final report in December 2017.

Table 4: ESIA Assessors and FPIC experts and their credentials

Name of Consultant	Organisation	Qualification	Role played
John Kwesi Gyakye Amonoo	Proforest	MSc. Agroforestry	SIA team lead
Abraham Baffoe	Proforest	MSc. Forestry and Environmental Policy	FPIC team lead
Aristotle Boaitey	Proforest	MSc Geoinformation Science and earth observation	SIA team member
Delali Kpetsigo	Independent Consultant	MSc. Social Sciences	Household survey team lead
Lebene Ledi	MES	MSc Environmental Management	Quality Assurance, consultations, review of draft report
Edward Dwomoh Appiah	MES	BSC Land Economy, P.G Certificate in Public-Private	Project management, baseline studies, social impact assessments, stakeholder

		Partnerships Development	identification and analysis, project document review
James Adu	MES	Geologist, Environmental Engineer	Consultations, baseline studies, air quality, analysis, water quality assessment, project document review, preparation of data analysis tools, report preparation
Nii Ayitiah Adu- Aryee	MES	BSc Environmental Science	Research, Air quality, water quality, biological/agricultural resource assessments, baseline data analysis, report drafting

ESIA methods

Secondary data

Data and information gathering from literature entailed the following:

a. Background information on the oil palm industry in Ghana from various literature including the Ghana Oil Palm Master Plan
b. The relevant institutional, legal and regulatory framework was obtained from publications by the regulatory agencies and ministries;
c. Population data from Ghana 2010 Population and Housing Report
d. District Planning Information and data from the Mpohor District Assembly Planning Office; and
e. Meteorological data and information from Ghana Meteorological Agency

Period of Field Data Gatherings

Preliminary field study started in July 2017 after completing the scoping study. The social impact assessment which included engagement with the local population to collect socio-economic data was completed in November 2017 whiles the EIA data collection including the field data gathering of environmental parameters such as water quality, air quality, noise level, air temperature, vegetation type, and plant form/species was completed in January 2018.

2.3 Soil suitability assessment

Dates soil suitability assessments were conducted

The soil suitability assessment was conducted in July 2018 by a team of experts from the Council for Scientific and Industrial Research using the free survey system.

Soil suitability assessment experts and their credentials

The soil suitability assessment was conducted by a team of experts from the Council for Scientific and Industrial Research. The Table below provides details of the assessment team.

Table 5: Soil suitability assessment experts and their credentials

Name	Qualification	Role in the assessment
F. M. Tetteh	PhD. Soil Science / Research Scientist	Soil Fertility Assessment
Kwabena Abrefa Nketia	PhD Student, Physical Geography / Research Scientist	Land Evaluation, Digital Soil Mapping
Johnny Kofi Awoonor	MPhil Soil Health and Environmental Resources Management / Senior Technologist	Soil Sampling, Land Evaluation
Eric Asamoah	MPhil Soil Health and Environmental Resources Management / Principal Technical Officer	Soil Sampling, Land Evaluation, Digital Soil Mapping
Alexander Owusu Ansah	MPhil Soil Health and Environmental Resources Management / Technical Officer	Soil Sampling, Land Evaluation, Digital Soil Mapping
Anim Boafo	MPhil Soil Health and Environmental Resources Management / Senior Technical Officer	Soil sampling, Soil Classification, Land Evaluation
Sampson Owusu	Diploma in Soil Science / Technical Officer	Soil sampling, Soil Classification, Land Evaluation
Akwasi Appiah	BSc. Soil Science / Senior Technical Officer	Soil sampling, Soil Classification, Land Evaluation
Adams Sadick	MSc. Geoinformatics and Earth Observation / Research Scientist	Soil Analytical Services
Prince Charles Asante	MPhil Soil Health and Environmental Resources Management / Principal Technical Officer	Soil Analytical Services

Soil suitability assessment methods

The methods employed includes soil identification and sampling, laboratory analysis and soil suitability evaluation. To identify the various categories of soil and for sampling purposes, soil identification exercise was carried out along pre- delineated catenas (topo-sequence). At each observation site, chisel holes and auger borings to a depth of 80 – 100 cm were dug at regular intervals along the predetermined traverses (i.e. cut lines). Soils of the holes/borings were examined to identify their variability and their morphological properties recorded. Also, GPS locations were recorded. Areas where soil was moist, an auger was used and where gravelly, chisel holes were adopted. Sub-samples from the first level (0 – 20cm) were placed into a plastic bucket, mixed thoroughly and about 500 grams placed into a sampling bag. Collected soil samples were air-dried, ground and sieved through 2 mm mesh size in the laboratory. The parameters determined were: gravel content, particle size analysis (texture), pH, organic carbon, total nitrogen, available phosphorus, exchangeable bases, exchangeable acidity, effective cation exchange capacity, and base saturation. Soil parameters described included soil depth, soil texture (by hand feel), soil structure, soil consistency, presence and percentage of coarse fragments (gravels, stones and boulders), root distribution, krotovinas, coatings, boundary, biotic activity, soil colour and mottles and position along the landscape (FAO, 2006). Soil suitability evaluation was conducted as per FAO (1976) framework. Soil suitability class specifications were developed ranging from S1 to N2 (where S1 represents highly suitable; S2, moderately suitable; S3, marginally suitable; N1, marginally not suitable and N2, being permanently not suitable).

2.4 High Carbon Stock assessment

Dates High Carbon Stock assessment was conducted

The Carbon Stock assessment was conducted on July-September 2018.

High Carbon Stock assessment experts and their credentials

The Carbon Stock assessment was led by Dr Sedami Igor Armand Yevide and he was assisted by Aristotle Boaitey, Abraham Baffoe, Seth Kankam Nuamah and Jonathan Daboh.

- **Dr. Sedami Igor Armand Yevide**: Armand holds a PhD in Natural Resources Management and spent about 2 years as post doctor at the Institute of Remote Sensing and Digital Earth (RADI) working for the United Nations Environment Programme-International Ecosystem Management Partnership (UNEP-IEMP) under the Chinese Academy of Science's International Young Scientist Programme. He has many scientific publications on the ecology, dynamic, productivity and tree growth modelling of natural and man-made forests, ethnobotany, biodiversity and ecosystem monitoring network with a special focus on Africa.
- **Abraham Baffoe:** Abraham has more than 18 years' experience working on natural resource management, specialising in sustainable forest management, certification and forest policy. His experience involves managing community forestry projects, developing and implementing forest certification programmes and providing support to sustainability standard setting and policy implementation.
- **Aristotle Boaitey**: Aristotle has a background in sustainability processes for natural resources management. He holds a BSc in Forest Resources Technology from the Kwame Nkrumah University of Science and Technology in Ghana, as well as an MSc in Geo-Information Science and Earth Observation for Natural Resources Management from the University of Twente in the Netherlands. His MSc research focused on using a GIS-based approach for the assessment of ecological quality in cocoa landscapes.
- **Seth Kankam Nuamah**: Seth has strong background in forest tree identification, forest management and ecosystem assessment, natural resources management, Geospatial analysis, biodiversity conservation and forest biomass and soil carbon estimation. He has good knowledge in Agriculture and forest data management and analysis, Climate change adaptation and mitigation. He has worked with Lead scientist in International and national NGOs such as Solidaridad West Africa, SNV, IITA, and Biodiversity International, to gain adequate knowledge in Climate-Smart Agriculture, Forest and soil carbon stock estimation, as well as implementation of tree agroforestry in cocoa landscapes. Seth has good understanding of land use and land use dynamics in oil palm and cocoa landscapes, good communication skills and good knowledge in GPS, GIS and statistical analytical software
- **Jonathan Daboh**: Jonathan is botanist with several years of experience in tree identification and enumeration in general.

High Carbon stock assessment methods

Secondary data: A desk review of documents including paper and cadastral maps provided by BOPP was carried out prior to the field assessment. BOPP provided map of the proposed land. In planning for the assessment, a combination of satellite images of the wider landscape was used. This included publicly available Google Earth imagery which were used in the initial planning for the assessment. Satellite imageries were thereafter used to aid the assessment of the study area and to have a sense of the coarse land cover classes in the area. This was crucial to inform the distribution of the flora survey transects and sampling plots. There are no peat areas in the project area.

Primary data: Prior to carrying out the botanical survey and carbon stock estimation, the team conducted ground-truthing which was aimed at verifying the accuracy of the land cover classification conducted using the satellite images. An approximately 1% sampling rate was used to determine the sample size for the estimation of the total carbon stock for the proposed concession. 18 sampling plots were laid across the project area. These plots were distributed along 9 transect lines oriented North South and, which were at least, 500 m from each other. Each plot was a rectangle of 1 ha (length 500 m and width 20 m) which was subdivided into 25 quadrats of 20x20 m (400 m2) each. At the starting points of each plots, a bearing was taken with a compass when surveying the quadrats to keeping the North direction fixed and effectively walk along the transect line. Data collected from the plots included the name of the species, diameter at breast height, and observation on the individual tree (whether it was diseased, fruiting, etc). Only live trees and lianas with trunk diameter at breast height (dbh) ≥10 cm was measured in the 25 quadrats of each plot, using a diameter tape. For each plot, one quadrat was randomly selected for assessment of regeneration (tree species having less than 10 cm dbh but greater than 5 cm). In addition to the dbh measurements, the height of each individual tree was estimated visually. Each quadrat within the plot was assigned to a one of the vegetation types obtained after the land use and land cover classification. The data was further processed to estimate the carbon stock for land cover class of the proposed development area.

2.5 Land Use Change assessment

Dates land Use Change assessment was conducted

The Land Use Change assessment was conducted internally in year 2015 by Wilmar's internal GIS team, while an updated land use change analysis for year 2018 was conducted by Proforest and results described in their HCS assessment report dated 18 September 2018.

Land Use Change analyst credentials

The Land Use Change (LUC) analysis for year 2015 was carried out by Rusli Awaludin, Senior GIS Officer at Wilmar International Plantations, while the LUC analysis for year 2018 was conducted by Dr. Sedami Igor Armand Yevide of Proforest.

Land Use Change assessment methods

Remote sensing application provides appropriate tool for Land Use/Cover Change Analysis. And Satellite imagery is one of the tools in remote sensing that can be used in this analysis. Land Use/Cover Change Analysis was conducted at the proposed Adum Smallholder project site for the period November 2005 to May 2014.

Image acquisition

Images for this LUCA were acquired in August, 2016. The project area is generally covered by clouds and to overcome this challenge, many satellite imageries were used. The images were taken from the United States Geological Survey (USGS) official website (https://earthexplorer.usgs.gov/) and Google Earth.

ERDAS ERMapper and ARC GIS were used in the image processing and vector editing. Satellite imagery used in the analysis has been pre-process (radiometric and geometric correction) by USGS. First process for Raw Satellite imagery data is Layer stacking/band Marge. In this process, single band image was merged into one multi-band image.

Composite imagery with proper band combination was produced by using multi-band image. Composite band Shortwave Infrared 1 (SWIR 1), Near Infrared (NIR) and Red (R) were used for LandSat

7 and LandSat 8 satellite imagery. While, Combination band Near Infrared (NIR), Red (R) and Green (G) were used For ASTER. This composite is used because it allows clear identification of various types of vegetation, provides a clear land/ water interface and penetrate thin cloud or haze. Variation in moisture contents are evident with this set of bands. And to obtain better image visualization, the next process that should be done is Image Enhancement and image Pan Sharpening. Image Enhancement is done manually using ER Mapper to improve spectral quality on all imagery used. Moreover, to increase spatial resolution LandSat 7 and LandSat 8 Imagery from 30 m to 15 m, Image Pan Sharpening proses with the Smoothing Filter based Intensity Modulation (SFIM) method was performed using ER Mapper Software.

Image classification

Visual Classification method was used to analyze Land Use/Cover for 3 time period; After Nov 2005, After Jan 2010 and After May 2014. In carrying out this, the area was classified into 5 classes and this include: Oil Palm, Rubber, Shrub, Grass Land and Cleared Land. Local Knowledge is important information for conducting Visual Classification and google earth was used to obtain the information. Land Use/Cover Change Analysis is done by overlaying 3 land use / cover from each period.

Table 6: Description of the land use or land cover categories used for the classification

Land use/land cove classes	Description
Oil palm	Area characterized with mosaic of oil palm farms/plantations
Rubber	Land characterized with agricultural commodity plantations predominantly rubber
Shrub	Land characterized with short natural woody vegetation cropland and shrubland. This vegetation is degraded and has a very low tree density.
Grassland	This includes areas predominantly covered with grass
Clearland	This includes completely cleared and barren lands with exposed soil, sand or rocks.

2.6 Greenhouse Gas analysis

Dates Greenhouse Gas analysis was conducted

The field work for the Greenhouse Gas assessment was conducted in June 2017 with analysis and reporting completed on 18th June 2018.

Greenhouse Gas analyst credentials

The Greenhouse Gas analysis was carried out by Dr Sedami Armand Yevide, see above for Dr Sedami's credentials.

Greenhouse Gas analysis methods

The current Greenhouse Gas emission estimation was done in accordance with the RSPO recommendation for New Planting Procedures. Prior to this GHG emission estimation, Carbon Stock and HCV assessments were conducted for the project area. The CS assessment allowed the land use and land cover classification of the project areas' landscape and the estimation of their carbon

sequestration potential as well as recommendations for sustainable production. Through the HCV assessment, social and environmental HCVs and their management areas were identified and recommended to be set aside. The outputs of these two assessments were used to generate and analyse various scenarios and recommend those that ensure negative carbon dioxide emission that are environmentally and economically efficient. The estimation of the GHG emissions were done using the New Development GHG Calculator provided by RSPO and downloaded from the link below: http://www.rspo.org/certification/ghg-assessment-procedure. Parameters of fertilizer were per BOPP SH 2017 data while parameters of diesel & petrol usage were per BOPP Nucleus 2017 data. BOPP POM 2017 data were used as parameters of POME for the Trebuom project.

3 Summary of findings

3.1 ESIA summary findings

The findings from the social impact assessment suggest that the proposed smallholder oil palm development has the potential to provide significant positive impacts on the three beneficiary communities and people in the project catchment area. This, notwithstanding, the operations may also have some potential negative impacts or pose some challenges to the local communities if adequate measures are not taken to ameliorate or eliminate the potential negative impacts. This include impacts on food security and sufficiency, potential exposure to health and safety risks and pollution. To mitigate the negative impacts while enhancing the positive ones, recommendations have been provided by this assessment that BOPP should adopt and implement to ensure that the project's potential to contribute to the socio-economic development and wellbeing of the communities in the catchment area is delivered. Additionally, the company is encouraged to proactively and continuously engage with the relevant stakeholders to ensure any issue that may arise is addressed effectively and timely.

The findings of the EIA identified potential impact areas to include ecological impact, impact on soil, impact on water resources and water quality, impact on air quality, noise and impact on health and safety. Other impact areas include potential increase in demand on public utilities and land litigation. Recommendations have therefore been provided for BOPP to adopt and implement to ensure these potential negative impacts are avoided or mitigated. There appears to be no legal, administrative, natural and socio-economic limitations to prevent the proposed Adum smallholder oil palm plantation development project from going ahead since the project is an initiative of the landowning communities. The project shall be implemented in accordance with the proposed environmental management plan (EMP). With implementation of the mitigation measures defined in the EIA, all the likely adverse environmental impacts associated with the project will be prevented, eliminated, or minimized to an environmentally acceptable level. It is therefore recommended that BOPP goes ahead to support the people of the three beneficiary communities to implement the proposed smallholder oil palm plantation development project by fulfilling obligations as outlined in the respective impact assessment reports.

Potential positive impacts

The following are some of the potential positive socio-economic benefits of the proposed Adum Smallholder oil palm development project.

a. **Employment creation and income generation:** The project will improve income generation as well as increased job opportunities. The household survey indicated that agriculture is the

major occupation of the communities. In addition, because most farmers are already into oil palm production with some cocoa farmers intending to move from cocoa production to oil palm production, the context is set for a high level of participation in the proposed smallholder project. This will also increase the trend whereby oil palm production is one of the highest sources of household income. It must be noted that a significant increase in household income has other positive concomitances including improved livelihood and an increase in general well-being.

b. **Communities' development:** The proposed smallholder project could lead to an increase in support to community development in the three communities. Road construction to access the new planting sites could open up the communities to further commercial activities.
c. **Health care:** The clinic at BOPP is already accessible by the people of the local communities for their health needs. It is envisaged that this will continue, and access may be enhanced with more and more local farmers involved in the smallholder project with BOPP.
d. **Training and capacity-building for employees and smallholders**: It is generally believed that large-scale oil plantation companies have higher productivity than smallholder farmers. MoFA (2012) reported that large oil palm estates achieve productivity levels of between 10 – 15 tons/ha whiles the smallholder and out-grower farmers operating under the same natural conditions produce between 7 – 10 tons/ha with private small-scale farms producing about 3 tons/ha. The difference in productivity has been attributed to large companies' use of high yielding planting materials, better management and agronomic practices.
e. **Improved productivity and economic value of the land**: Low productivity of smallholder farmers have been a major driver of deforestation as farmers aim at expanding their farms into new frontiers rather than improving productivity as a means achieving their production target. Oil palm productivity depends on several factors. Significant among them in addition to agronomic practices is the type and source of seeds or seedlings used. It has been established that a major contributory factor to the low productivity of oil palm plantations in West Africa particularly by smallholder farmers is the use of low-yielding Dura type. For this project, BOPP intends to provide not only training and extension services but also support smallholder farmers with high yielding oil palm seedlings which will contribute to improving the productivity of the land compared with the current farming practices. This will enhance the income levels of smallholder farmers due to the higher productivity. The overall benefit is that increased productivity of oil palm farmers enhances the crop's contribution to the local economy.
f. **Contribution to district and national revenue:** BOPP makes statutory payments such as property rates to the district assembly and through subcontracting some of their project activities to contractors. Secondly, the company has made registration with the District Assembly a pre-condition for its sub-contractors which ensures the sub-contractors make statutory payments to the Assembly, thus contributing to the Assembly's revenue generation. BOPP's payment of Business Operation Permit fees is also a major source of income for the district assembly. Additionally, revenue from personal income tax of the company's employees (PAYE tax) and other statutory payments (such as corporate taxes) are also a significant source of income to the government. Social security contributions of company employees are also invested by the Social Security and National Insurance Trust (SSNIT) to provide capital for some developmental projects at the national level. BOPP's renewal of its environmental permit issued by the EPA upon expiration also contributes to national revenue.

Potential negative impacts

The potential negative impacts envisaged by community stakeholders include:

a. **Impact on food security and sufficiency**: Low productivity of smallholder farmers have been a major driver of deforestation as farmers aim at expanding their farms into new frontiers rather than improving productivity as a means achieving their production target. Oil palm productivity depends on several factors. Significant among them in addition to agronomic practices is the type and source of seeds or seedlings used. It has been established that a major contributory factor to the low productivity of oil palm plantations in West Africa particularly by smallholder farmers is the use of low-yielding Dura type. For this project, BOPP intends to provide not only training and extension services but also support smallholder farmers with high yielding oil palm seedlings which will contribute to improving the productivity of the land compared with the current farming practices. This will enhance the income levels of smallholder farmers due to the higher productivity. The overall benefit is that increased productivity of smallholder farmers enhances oil palm's contributions to the local economy.
b. **Pollution**: Land clearing and plantation management (including fertilizer and pesticide application), if not properly carried out, could potentially cause sedimentation, eutrophication and chemical pollution of streams and rivers that run through the intended planting areas. These could reduce the fish stock in the waterbodies and potentially pose health risks to local people who depend on these watercourses for water for domestic use and for fish protein. The lateritic roads and movement of company vehicles result in the throw-up of dust in the communities and within the company's estate. This could, over a prolonged period, pose a potential health hazard to residents. Vehicular emissions could also constitute an air pollutant, as do the exhaust emission of CO, CO2, SO2, NO, NO2, HC and particulate matter from diesel engines.
c. **Exposure to health and safety risks:** It is expected that BOPP's operations will pose potential health and safety risks both to its workers and surrounding communities. The risks to workers include injuries from operations such as chemical application and weeding, operation of machinery, etc. in situations where those applying chemicals fail to wear the appropriate Personal Protective Equipment. This could pose health hazards to them. Potential safety risks to communities include injuries or casualties resulting from accidents involving BOPP vehicles and an increase in the incidence of snakebites since snakes will be attracted to the rodents that feed on the palm nut fruits.
d. **Gender, reproductive health and harassments:** Experience shows that females are more vulnerable to workplace harassment (including sexual harassment and discrimination. There is therefore the potential of female employees suffering sexual harassment if adequate mechanisms are not put in place to protect them. BOPP's operational activities could also have adverse impacts on the reproductive health of female workers, particularly the handling of agrochemicals by pregnant and lactating women. Linked to this is the potential of breastfeeding mothers being unable to attend to their infants if the working hours are not made favorable and this could have adverse impacts both on the mothers and their infants.

Table 7: Issues raised by stakeholders and assessors' comments

Date of consultations	Stakeholder	Key Issues / concerns raised	Response / comments
9th March 2017	**Trebuom community**	Trebuom community has decided to set up a committee to represent them on matters relating to the proposed project.	No response required. The assessment team thanked the stakeholder for their views.
		They also raised concerns that "We have been waiting for the start of the project for far too long. When will the project officially start?"	The assessment team responded that the project could commence only after the necessary assessment and requirements have been met and that is likely to be in 2018.
12 July 2017		Some families have land in the proposed project area whiles others' lands are outside. They enquired what should be done to ensure the project does not benefit only those families with land in the project area.	The assessment team responded that the community would have to deliberate and agree on a system of plot allocation that they consider fair and workable for the community members and in consultation with the management of BOPP.
		Although BOPP has not acquired the land but will support the local farmers to establish oil palm farms, will BOPP compensate those farmers with crops already on the land?	BOPP responded that rubber and cocoa would not be converted unless owners voluntarily requested to switch from those crops to oil palm. Food crop farmers would also be given time to harvest before land preparation commences.
12 December 2017	**Trebuom**	Since it is very clear that everybody wants the project to proceed, why didn't BOPP just go ahead and commence the project rather than spending time for all these assessments and consultations?	The consultations are to ensure that everyone associated directly and indirectly with the project has fully understood all issues involved and agrees that the project should proceed.
12 July 2017 Dec 2017	**Mpohor District Assembly** Mr Enoch Koranteng, Dist. Agric Director and Mrs Aisha Mahama, Dist. Planning Officer	The district officials expressed optimism and are hopeful that the proposed project will provide job opportunities for the local population. However, several concerns were raised, and this relates to clearing of NTFP sites, soil degradation and fair allocation of project land.	The assessment team is engaging with all neighbouring local communities to identify HCVs including HCV 5 (local people livelihoods) of which NTFPs are a part. As part of the HCV assessment, all areas prone to erosion such as fragile soils and hilly areas will be identified as HCV 4 and will be set-aside. The communities have agreed to set up project committees who will work with the community leaders to ensure equitable and fair allocation of plots/oil palm farms.
13 & 14 July 2017	**Dominase community**	They asked whether the boundary of the proposed land will change or stay the same and will not be extended to other farm areas. The reaming land must be left for enough land for the community for food crop farming.	The assessment team indicated that land-related issues must be resolved among affected parties. They were also asked to explain whether they have any concerns with the current area proposed for the project, but the response was negative.
12 Dec 2017	**Dominase**	They requested that BOPP change the name of the project from Trebuom to	The team indicated that the request will be passed on to BOPP for the company to consider. All the communities agreed during

		Trebuom-Dominase Smallholder Project	the final consultation that the project should be called “Adum Smallholder Project”
		The community has identified a committee to represent them in all matters related to the proposed project	No response required. The assessment team thanked the stakeholder for their views.
		There are no known issues of litigation or disputes on the land.	No response required. The assessment team thanked the stakeholder for their views.
13 July 2017	**Ampeasem or Agrave community**	The people of Ampeasem recognises that the project could bring several positive benefits and are therefore positive of the project but wanted clarification on how the project will affect farm houses and smaller villages on the proposed project land and whether cash crop farms such as cocoa and rubber will be converted. The also wanted to know how the land will be divided for interested farmers and whether BOPP will accept to use part of their land for the oil palm project?	The team informed them that the project will not displace any village or town given that the communities remain as owners and holders of the land since it has not been acquired by BOPP. The response was that BOPP will not convert rubber and cocoa to oil palm but the decision to convert or not is for the individual farm owners to make. Owners of those farms may voluntarily request for conversion to oil palm. Food crop farmers would also be given time to harvest before land preparation. The allocation of plots to individuals of the community will agreed upon by the community and elders and that BOPP will not make that decision for the communities.
		The community indicated that they have a burial site which should be protected.	The assessment team requested to be escorted to the site for verification and mapping which was done.
12 December 2017	**Ampeasem**	Why should a 100m buffer be maintained around the proposed project area when communities want to use the land for oil palm farm	The buffer zone is demarcated so as to ensure that space is maintained for future community expansion.
		Why is this final consultation necessary when you can immediately determine from the results of the assessments whether the project can proceed or not?	The consultations are necessary to clarify the issues and to ensure that all stakeholders are aware of, and clearly understand the issues as pertains to the requirements of the RSPO.
		What will happen to existing oil palm and cocoa farms on the land?	Old oil palm farms will be felled and replanted with high yielding tenera, and the owners will also be compensated. The compensation is to be a source of income for owners while the new oil palm farm matures. Old cocoa and rubber farms will not be affected unless expressly requested for by their owners, in this case such farmers will be compensated
17 July 2017	**COLANDEF (NGO)**	COLANDEF indicated that the proposed project presents a good opportunity to enhance coordination between the communities, especially Trebuom and Dominase.	No response required. The assessment team thanked the stakeholder for their views.
		They also highlighted the need to analyse existing land rights system in the area, and the link with paramountcy, since the well-	No response required. The assessment team thanked the stakeholder for their views.

		established Wassa Fiase Traditional council would be very interested in the progress of such a project in their area.	
30 July 2017	**Conservation Foundation (NGO)**	Although potential positive benefits were acknowledged, they caution that BOPP must prioritise the welfare of smallholders and the community, instead of only focusing on yield They emphasized training of farmers to manage riparian buffers (especially along River Butre which is polluted by mining activities) and other HCVs. CF indicated interest in supporting the management of HCVs	No response required. The assessment team thanked the stakeholder for their views.
30 July 2017	**Forest Watch Ghana (NGO)**	FWG advised the project to be aware of key issues in the area such as illegal mining and replacement of food crop farms with cash crops. They also emphasized the importance of communities' consent through a robust FPIC process. FWG also recommended that labour should be sought locally to ensure maximum benefit to communities and the need for the project to comply with APOI requirements.	No response required. The assessment team thanked the stakeholder for their views.

List of legal documents, regulatory permits, national legislation and property deeds related to the areas assessed

List of legal documents

- National Population and Housing Census report (2010)
- Mpohor District Profile report (Draft 2017)
- Labour Act, Act 651 (2003)
- Labour Regulations, LI 1833 (2007)
- Workmen's Compensation Law, PNDCL 187 (1987)
- Fair wages and Salaries Commission Act, Act 737 (2007)
- Environmental Protection Act, 490 of 1994
- Environmental Assessment Regulation (LI 1652)
- Land Title Registration Law, PNDCL 152, 1986
- Proposed smallholder project lands Act, Act 124 (1962)
- Administration of Lands Act, Act 123 (1962)
- National Land Policy – June 1999
- Water Use Regulations, LI 1692 (2001)
- National Water Policy, June 2007
- National Irrigation Policy, Strategies, and Regulatory Measures – May 2006
- Buffer zone policy (2011)
- Public Holidays Act, Act 601 (2001)
- National Pensions Act, Act 766 (2008)
- Social Security Law, PNDCL 247 (1991)

3.2 HCV assessment summary findings

National/regional context

Forests in Ghana form part of the Upper Guinean High Forest (UGHF) biome which stretches from southern Guinea through eastern Sierra Leone, Liberia, Cote d'Ivoire, Ghana and western Togo. This represents the upper half of the Guinean High Forest Hotspot, which is separated from the Lower Guinean Forest ecosystem (from western Nigeria to South-Western Cameroon) by the Dahomey Gap (a mixture of savannah and dry forests in Togo and Benin). Together, the UGHF ecosystems constitute the Guinean High Forest Hotspot which is home to some 9,000 vascular plant species (20% of which are endemic), over 785 bird species (of which 78 are known to be endemic) and some 320-mammal species (more than 60 of them endemic, including 18 primates). The Guinean High Forests are ranked as the highest priority for primate conservation with more than 30 distinct species. The forests of south-western Ghana and south-eastern Cote d'Ivoire are among the most important centres for primate diversity and endemism, but also with the highest threat. The region is also important for bird diversity and endemism and has six Endemic Bird Areas (EBAs), as defined by Birdlife International (2017). Despite these, the Guinean High Forests have been reduced from an estimated 1,265,000 km² to 141,000 km², representing an estimated 85% loss during the last century.

Scope

The scope of this HCV assessment is to conduct HCV assessment in the 1,477-ha land proposed for smallholder oil palm development. The purpose of the assessment which was carried out within the context of the RSPO certification requirements, is to undertake a comprehensive and participatory assessment of HCVs, with a view to identifying any area(s) required to maintain or enhance one or more of the six categories of HCVs and to identify local people's or individuals land that should be excluded from the plantation development.

Demographic and socio-economic context

Based on the 2010 Ghana Population and Housing Census, the population of the Mpohor District was projected to be 49,372 persons in 2017. It is expected to increase to 50,370 in 2018, and 53,484 by the end of the District Planning period which is 2021.

Livelihood and income:

Farming is the main economic activity in the district, with an estimated 63.9% of the households directly in agriculture. Other identifiable livelihood activities in the district include trading, hairdressing, dressmaking, carpentry, block-making, auto-electricians. According to the 2010 population and housing census, 75% of the population in the productive age bracket (15 – 65 years) were economically active, with majority of this number (96.7%) being economically engaged. The economically inactive people accounted for 24.3% of the population in the district and this comprised pensioners, aged, disabled and children under the age of 15 years. There were more females than males in the economically inactive proportion of the population. Small-scale mining activities are also rampant in the district creating employment for several people and reducing the economic hardships of the people in the district. On the other hand, the increasing number of small-scale mining activities popularly galamsey in the district is gradually degrading the forest and polluting water bodies through their activities which pose threats on the environment.

Education:

The total educational facilities in the Mpohor District as at 2018 are 128 which comprise of 49 Pre-schools, 49 Primary schools, 29 Junior High Schools (JHS) and 1 Senior High School (SHS). The district is divided into five circuits. The five circuits are Mpohor, Manso A, Manso B, Dominase/Ayiem and Adum Banso circuits. In fact, education infrastructure in the three beneficiary communities is quite weak. Although all the three beneficiary communities have primary schools, only Ampeasem and Adum Dominase have Junior High Schools and only Adum Dominase has a Senior High School. The primary and Junior High Schools are within an average of 15 minutes of walking from homes. The people of Trebuom and Ampeasem indicated that their children must walk for more than an hour to access the Senior High School located at Adum Dominase. They also indicated that the standard of education at the basic schools in their communities was low, prompting them to send their wards to schools in areas outside of their communities at a very high cost**.**

Religion:

With regards to pluralism nature of religion in Ghana, the Mpohor District is of no exception. The District, just like Ghana is a secular society where each one is free to practice any religion of his or her choice provided it does not infringe on the laws of the state. According to the 2010 Population and Housing Census 82.0% of the total population of the District are Christians, 12.7% are without any form of religion, 3.9% belong to the Islamic religion, traditionalist form 0.8% and those belonging to other religions not specified are 0.6%. These statistics reflect the religion of the three beneficiary communities.

Health:

There are Thirteen (13) health facilities in full operation in the district. However, two of them one each at K9 and Botodwina are uncompleted. Unfortunately, none of the three beneficiary communities have healthcare facility. Also, it can be concluded that majority of the facilities are government owned except BOPP clinic which is operated privately. BOPP's health care facility is already accessible by the people from the local communities for their health needs. It is envisaged that this will continue, and access may be enhanced with more and more local farmers involved in the smallholder project with BOPP.

Cultural implications:

The three beneficiary communities Trebuom, Dominase and Ampeasem have similar culture in the way of greetings, marriage, tradition and other norms and values. Predominant language in all the three communities is Akan whiles Christianity is the dominant religion in all three communities.

Land ownership and use rights

The proposed project land is part of a traditional or customary landuse area and falls within a landscape which is outside protected areas and has undergone cycles of intensive agriculture production for several years. It is a communal land that is administered by the chief of Trebuom with use right held by inhabitants of the three communities. A land cover classification of a 30-meter resolution Landsat 8 image acquired in 31 December 2016, showed that forest remnants (tree patches) represent only 0.6% (9.26 hectares) of the assessment area. Agricultural land, rubber and other agro-plantations account for more than 88% of the proposed project land area. There are patches of rubber, cocoa and scattered oil palm farms within the land, mostly individually owned or appearing to be from the abandoned farms under the erstwhile Presidential Special Initiative (PSI) on oil palm development. Within the land are also some food crop farms (mostly cassava, plantain, maize) and patches of fallow land. The farms were found to be mostly managed by farmers under traditional sharecropping arrangements or by encroachment without formal recognition by the

traditional authorities. Part of Ampeasem, a settler community was found to be located within the assessment area on the north-western side. Engagements with the elders of Ampeasem indicated that they held a valid 50-year lease commencing 1985 covering about 220 acres of the land. This was confirmed by the chief of Trebuom who the stool land owner and whose predecessor is granted the 50-year lease to the people of Ampeasem. The people of Ampeasem intimated during the consultations that they would like to benefit from the smallholder project and therefore would like the land they have acquired to be included in the project. BOPP does not intend to acquire the land for the proposed out-grower project. However, the land for the project, which is largely communal land would be allocated to individual farmers for oil palm development. Interested farmers who own lands would be allowed use part of their land for the project whiles those who do not own land but are interested in the project could benefit from allocations of plots from the communal land.

Protected areas

According to Ghana's Ministry of Environment and Science (2002), sixteen percent (16%) of Ghana's land surface area had been set aside to conserve representative samples of her natural ecosystems in the form of forest reserves, national parks, and other wildlife reserves, including various traditional forms of conservation. In Ghana, land including forest lands are generally communally-owned and communities until forest reservation starting from the late 1920s had the right to use their land for whatever purpose they deem fit including conversion to agriculture. Realising the wanton destruction of forestlands, the Government of Ghana enacted the Forest Act of 1927 (CAP157) for which Section 21 vested in the Head of State the power to use Executive Instruments to designate forestlands as forest reserves based on the advice of the then Forestry Department (now Forestry Commission) who may have to identify forestlands that are of public interest and should be protected from destruction. Forest reservation in Ghana therefore started in 1927 and by the 1970s the government had reserved about 216 forest lands covering a total land area of 1.64 million ha within the high forest zone of Ghana. In addition to this is about 126,000 ha of wildlife reserves for permanent protection under the management of Wildlife Division of the Forestry Commission. Most of the remaining forests in Ghana are located within the forest and wildlife reserve network which is estimated to constitute about 20% of the original extent of forest cover in Ghana (Hawthorne and Abu-Juam, 1999).

Land cover

The land is in the moist evergreen vegetation zone of Ghana (Hall and Swaine, 1981). Major landuse include food crop farm, rubber plantation, oil palm and cocoa plantations and fallow lands. The table below provides details of the dominant land cover types in the proposed project area, showing that Agricultural land for food crops accounts for 52.7% followed by Agricultural commodities plantations 35.8% such as rubber, oil palm and cocoa.

Table 8: Size of land use types of proposed Adum Smallholder project land

Land use classes	Total area covered (ha)	Proportion (%)
Agricultural land	779.0	52.74
Forest	9.4	0.63
High-Medium Agro Plantation	380.4	25.76
Mature Rubber Plantation	148.4	10.05
Open land and Settlements	159.8	10.82
Total	**1477.0**	**100.00**

NB: The land cover classification was based on a 30 metres resolution satellite image acquired from the EarthExplorer webpage of the United States Geological Survey (USGS) (http://earthexplorer.usgs.gov/) for the year 2016 (Scene Identifier: LC81940562016366LGN00 acquired on the 31st December 2016).

Water bodies

The main water body in the proposed land and in the landscape are the Buri and Butre Rivers which form the western and eastern boundaries of the proposed land respectively.

HCVs identified and justification

Table 9: Summary of HCV assessment findings

HCV	Definition	Present	Potentially present	Absent
1	Concentrations of biological diversity including endemic species, and rare, threatened or endangered (RTE) species that are significant at global, regional or national levels			
2	Intact forest landscape and large landscape-level ecosystems and ecosystem mosaics that are significant at global, regional and national levels, and landscape functions such as connectivity			
3	Rare, threatened, or endangered ecosystems, habitats or refugia			
4	Basic ecosystem services in critical situations including protection of water catchments and control of erosion of vulnerable soils and slopes			
5	Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous peoples…			
6	Sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance, and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or indigenous peoples			

HCV 1: Species diversity

Interpretation

HCV	Key question	Finding
HCV 1 - Species diversity.	Concentrations of biological diversity including endemic species, and rare, threatened or endangered (RTE) species that are significant at global, regional or national levels	**ABSENT**

Identification and justification

The proposed land for the smallholder oil palm project is neither contained within nor share boundaries with any protected area. It also doesn't contain or share boundaries with forest areas that that contain outstanding concentration of rare, threatened or endangered species. No endemic species or CITES listed species was sighted during the assessment. Of the 69-forest dependent and forest-edged species in Ghana which are listed on the IUCN Redlist, only one forest edged species, *Tockus fasciatus* was sighted in the assessment area. The presence of the *Tockus fasciatus* may be

explained by the fact that the species is omnivorous and eats fruit and insects and generally attracted to oil palm, in this case the BOPP oil palm plantation next to the assessment area. The species is also known to occur in large numbers in the BOPP plantations. The results of the assessment indicate that the assessment area does not contain and is not contained in HCV 1.1 (*protected areas)* or HCV 1.2 (*forest areas containing outstanding concentrations of threatened or endangered species*). Also, no globally and nationally threatened species of flora or fauna were encountered in the assessment area as indicated above. **It is therefore concluded that HCV 1 is absent in the assessment area.**

HCV 2: HCV 2: Globally, regionally or nationally significant Intact Forest Landscapes (IFL) and large landscape level forest, landscape level ecosystem and ecosystem mosaics.

Interpretation

HCV	Key question	Finding
2	Does the concession contain or form part of a regionally or nationally significant Intact Forest Landscapes and large landscape forest or ecosystem, or does it serve as a linkage joining two such forests or ecosystems?	**ABSENT**

Identification and justification

The Ghana National HCV Toolkit concluded that no HCV 2 areas are present in Ghana. The reasons given are that:

- Forest reserves in Ghana have had a long history of management and intervention. Many of the reserves are also extensively degraded.
- Most Forest Reserves in Ghana are smaller than 50,000 ha.
- Most reserves cannot be considered as uniform blocks of intact forest, due to fragmentation within reserves. On a landscape level, this pattern is matched by fragmentation *between* reserves, most of which are separated by intensively managed agricultural land and cocoa plantations, a situation which is consistent with what prevails at SRFR.

According to the Ghana HCV Toolkit, "*Greenpeace, together with the Rainforest Action Network and World Resources Institute have created a global database of Intact Forest Landscapes (IFL) from analysis of satellite imagery. They define an IFL as an area of at least 50,000 ha of forest that is un-fragmented by roads or other forms of man-made disturbance. This global database of IFL does not identify any areas of forest in Ghana as meeting the criteria*". Forest reserves in Ghana are the main areas with good forest cover and although there are some forest reserves in the wider landscape, a significant number of Ghana's forest reserves are degraded and do not meet the requirements as described in HCV 2. **It is therefore concluded that HCV 2 is absent from the assessment area.**

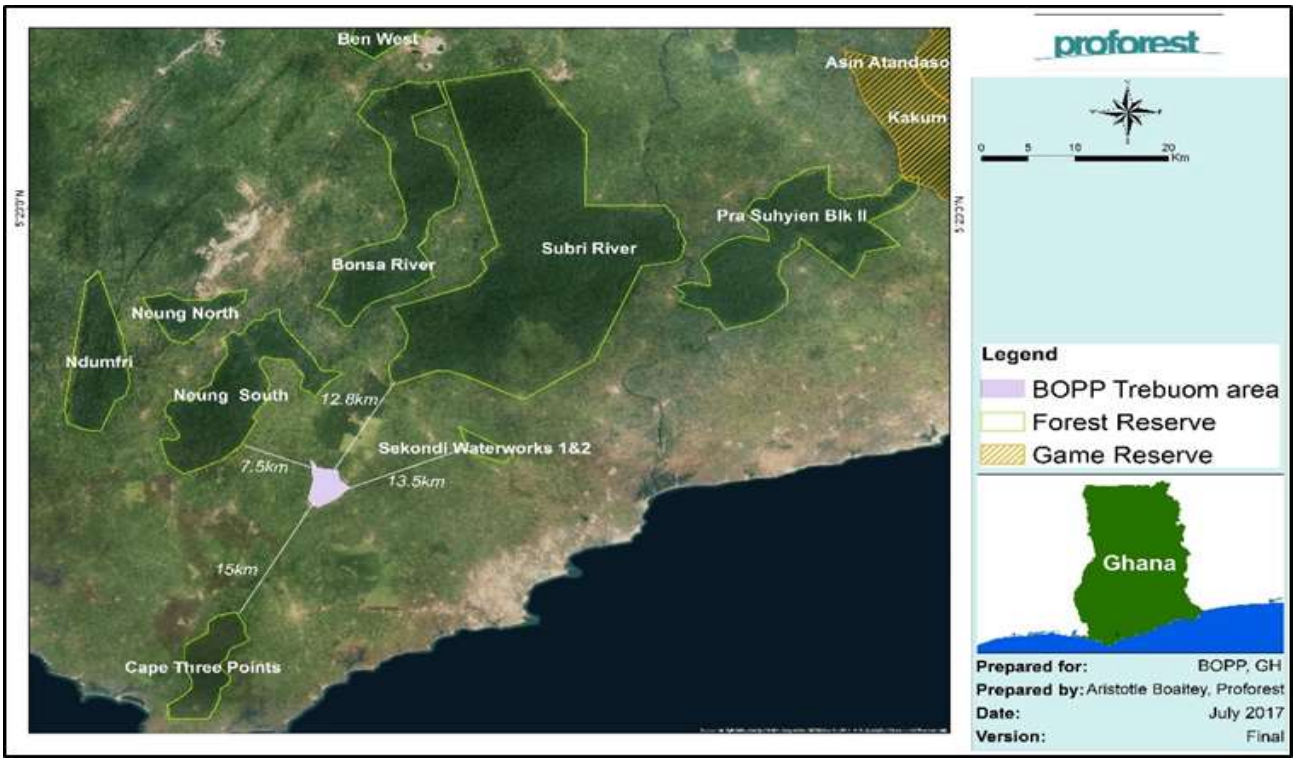


Figure 10: Map showing the proposed land and forest reserves in the landscape

HCV 3: Areas that are in or contain rare, threatened and endangered ecosystems

Interpretation

HCV		Finding
3	Rare, threatened, or endangered (RTE) ecosystems, habitats or refugia.	ABSENT

Identification and justification

Naturally rare forests and habitats: Forest types in Ghana considered as naturally rare by the Ghana HCV Toolkit are Wet Evergreen, Southern Marginal, Mangroves, while upland marshes and wetlands, savannah gallery forest and lowland swamps and coastal savannah are classified as naturally rare habitats. These are considered HCV 3. Although the assessment area falls within the Wet Evergreen forest type, the proposed land and its immediate environs are farmlands and have been used for food crops cultivation that there are only tiny patches of forests with none of them up to 1 ha which is the threshold definition of forests under the Ghana REDD+ programme. Therefore, there is no area within the proposed land that meet the definition of forest.

Forest and habitats dramatically reduced in extent of quality: According to the Ghana Toolkit this category of HCV 3 includes the southern marginal, mangroves, and dry and moist semi-deciduous forest types. The assessment area neither contains, nor is contained within any of these forest and habitat types and does not even adjoin any of the habitat types described above.

Habitats so threatened by existing and planned activities that should be considered threatened/endangered: This includes dry and moist semi-deciduous forest types as well as savannah gallery forest, upland marshes and upland wetlands. None of the above habitat types is found within or adjoining the assessment area.
Conclusion: Based on the above justification**, it is concluded that HCV 3 is absent in the assessment area**.

HCV 4: Areas that provide basic services in critical situations

Interpretation

HCV	Key question	Finding
	Ecosystem services. Basic ecosystem services in critical situations, including protection of water catchments and control of erosion of vulnerable soils and slopes.	**PRESENT**

Identification and justification

The Ghana HCV Toolkit identifies 4 categories of HCV 4. These are:
HCV 4.1: Forest areas critical to water catchment: Indicators for the presence of HCV 4.1 are:

- Communities adjacent to forest reserves that do not have access to boreholes for drinking water and depend exclusively on the river in the catchment area
- Communities that are adjacent to forest reserves and that are in low lying areas known to be susceptible to flooding
- Communities adjacent to forest reserves that are dependent on river fish as a major source of protein.

The Trebuom, Dominase and Ampeasem communities had access to boreholes as sources of drinking water but they also depend on the Butre and Buri rivers as sources of water for domestic uses. **The team therefore concluded that the riparian vegetation along the two main water bodies, the Butre and Buri rivers in the assessment area constitute HCV 4.1**
HCV 4.2: Forest critical to erosion control
The Ghana HCV Toolkit considers as HCV 4.2 catchment forest areas that prevent landslides (e.g. Afram, Atewa, Owabi, Sekondi and Bia Headwaters forests) or shelterbelt forests. It was also concluded by the assessment team that vegetation of slopes greater than 9^0 would provide erosion control, especially considering the high rainfall pattern in the area. In line with best practice, on slopes ranging from 9^0 to 25^0, soil conservation measures should be implemented, such as terracing, cover, cropping and platforms. Areas of slope greater than 25° should however, be avoided because they have a high potential for erosion. Such terrains with slope greater than 25^0 are considered HCV 4. However, from the analysis of available global scale digital elevation models (DEM), the assessment team found no slopes greater than 25^0 in the assessment area **and that the conclusion is that HCV 4.2 is absent.**

HCV 4.3: Forest areas providing barriers to destructive fires: The Ghana HCV Toolkit may consider a forest as HCV 4.2 if there is:

- Evidence of a fire risk from the activities of man, and
- The likelihood that they will act as natural barriers to fire spreading into the reserve towards an existing protected area, or another area designated as HCV.

Additionally, areas that have been subjected to increasing levels of human-induced fires in recent years as well as forests that may prevent the spread of fire into protected areas could also constitute HCV 4.3. Due to the high rainfall regime in the area, coupled with the fact that the area is dominated by rubber and cocoa farms which typically do not use fire for maintenance, the risk of fire is low. Also, field observations and satellite image analysis found no significant forest patches in the assessment area that could be considered as natural barriers to fire.

HCV 4.4: Forest that play critical role in local climate regulation

Ghana's HCV Toolkit classifies forests that play a critical role in local climatic conditions such as reduction of fire risks or preventing exposure to dry winds that would compromise productive agriculture. These include designated shelterbelt forest reserves, and forest areas in the transition zone between the high forest zone and the dry savannah, that provide protection against the North-East trade winds and/or 'Harmattan' dry winds. The assessment area does not lie within either of the described forest categories, does not fall within the transition zone and does not contain or contained within any significant forest cover. **HCV 4.4 is thus concluded to be absent**.

Conclusion: Vegetation along the two main waterbodies, the Buri and Butre rivers and their tributaries provide ecosystem services including the protection of water catchment and the maintenance of water quality. **It is thus concluded that HCV 4 is present in the assessment area. Based on the Ghana Buffer Zone Policy and the width of the two rivers, a recommended buffer of 40 m on either side of the two rivers have been designated as HCV 4 management areas. The total area of this HCV 4 which is mapped is 89.56 ha.**

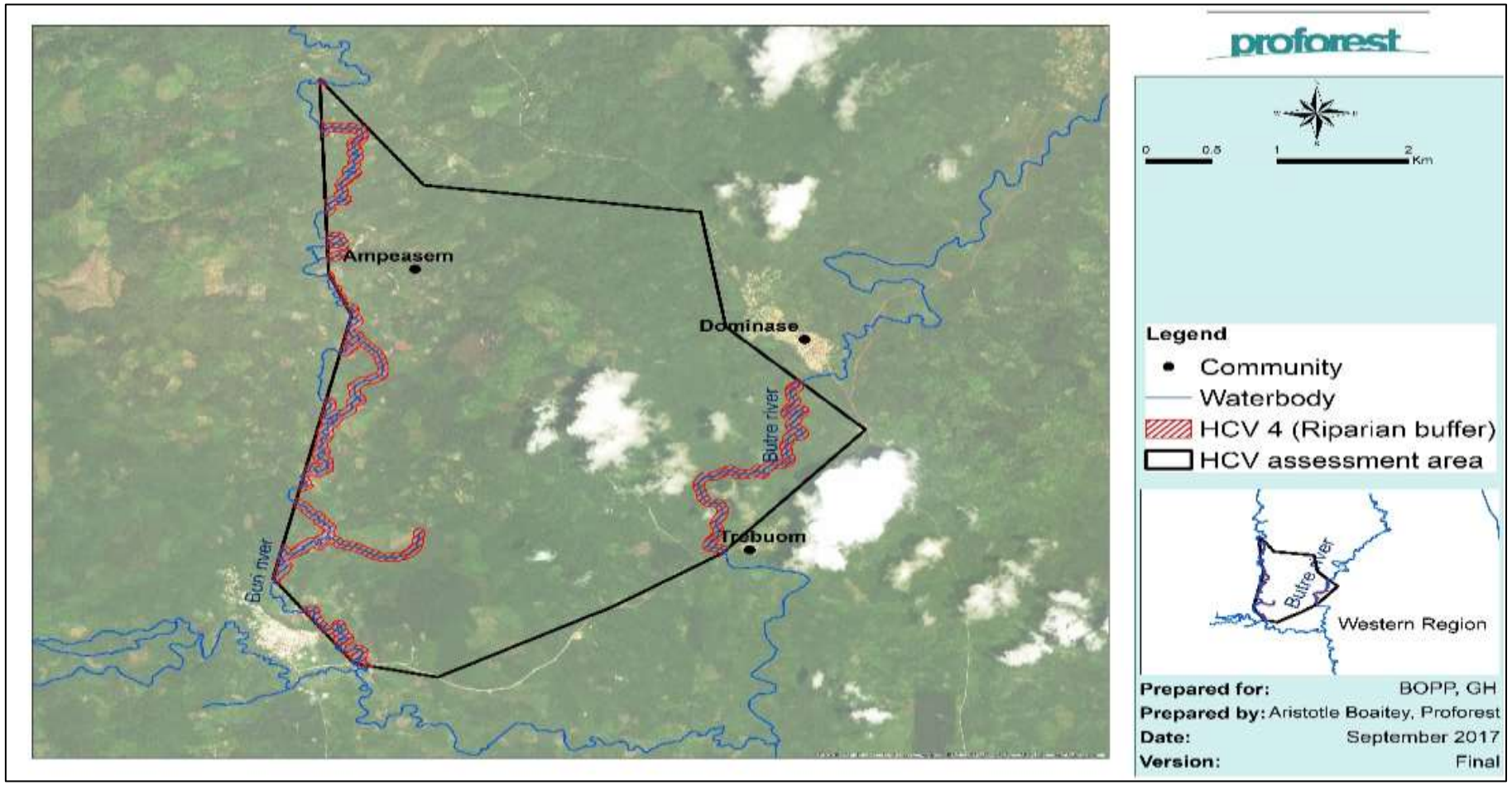


Figure 11: Map showing HCV 4 areas (riparian vegetation) in the assessment area

HCV 5: Areas fundamental to meeting basic needs of communities

Interpretation

HCV		Finding
5	Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous peoples (for example for livelihoods, health, nutrition, water), identified through engagement with these communities or indigenous peoples.	ABSENT

Identification and justification

The Ghana HCV Toolkit identifies the presence of any of the following to constitute HCV 5: Food (e.g. bushmeat), NTFPs harvesting, medicinal and building materials.

Food (e.g. bushmeat): From the consultations, the community members of Trebuom, Dominase and Ampeasem (also called Agrave) all indicated that food from their farms in the assessment area is a source of nutrition. However, they indicated that they have large tract of farmlands to the **right and south of the Butre River and to the north of the assessment area** that they will continue to cultivate food crops. For bushmeat, people from all three communities indicated that the proposed area is not a source of bushmeat and there are no animals of their choice there since the area is heavily farmed. They also indicated, due to farming activities in the area, bushmeat is not limited to any specific area but are scarce and in fact, diffused in the wider landscape.

NTFP harvesting: The local people also indicated that although individuals may chance upon and collect some NTFPs within the assessment area, such collection was not actively conducted for purposes of providing a source of income or livelihood to the individual or household. They also reiterated that NTFPs are not common in the assessment area and that the only NTFP one may be lucky to find is either snail or mushroom, but these are not localised.

Medicinal materials: All three communities consulted indicated that they do not depend on the medicinal resources in the assessment area for healthcare, but rather depend on hospitals, clinics and health posts in the area for the healthcare.

Building materials (e.g. roof thatches, wood etc.): The local communities mainly use concrete and mud blocks as building materials. They also use timber from nearby wood markets for parts of their constructions, such as roofing. They therefore indicated that they did not depend on the area for building materials since the area does not even contain trees.

Other basic household needs: The local community indicated that although they collected resources including fuelwood and pestle for domestic use, such resources are not common and are also diffused in the wider landscape and not limited to specific locations in the landscape. They rather hunt for them and therefore could not specify where these can be found.

Conclusion: Based on the outcome of the field assessment and the stakeholder consultations, the assessment team concluded that **HCV 5 is absent in the assessment area**.

HCV 6: Areas critical to local communities' traditional cultural identity

Interpretation

HCV		Finding
6	Sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance, and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or indigenous peoples, identified through engagement with these local communities or indigenous peoples.	PRESENT

Identification and justification

Traditional burial grounds for chiefs located in forest areas: All three communities consulted indicated that there were no designated burial grounds for chiefs within the assessment area. Trebuom and Dominase communities had their community burial grounds outside of the assessment area. However, Ampeasem have their community burial grounds within the proposed area at the north-west. This area was verified and mapped by the assessment team as directed by the community's delegated representatives. **It was thus concluded that HCV 6 is present in the assessment area**. The total area the community indicated as required for the burial site is 0.25 ha (Figure 12). This has been set-aside already by the communities and it's bounded to the north and northwest by rubber plantation, south-east by the road to Ampeasem. There is therefore no scope for the cemetery to expand beyond the 0.25 ha. Besides, the elders of Trebuom are in discussions with the people of Ampeasem, a migrant community to use the common cemetery with the people of Trebuom for future burial of the dead which means the people of Ampeasem may in the future stop using the cemetery.

Ritual grounds for traditional religious worship of shrines and fetish gods: All the communities consulted indicated that there were no ritual grounds or designated sites for traditional religious worship, shrines or fetish gods within the assessment area.

No-go areas of forest, possibly overseen by a traditional/religious leader: From the community consultations, it was found that none of the communities had designated no-go areas within the assessment area.

Forest animals hunted for festival occasions; forest provides only habitat for cultural totems; significance for stool or skin identity: The assessment area, as earlier described is highly converted for agriculture. Additionally, the communities engaged did not indicate any forests within the area where animals are hunted for festivals, or areas providing habitats for totems or significant stool or skin identity

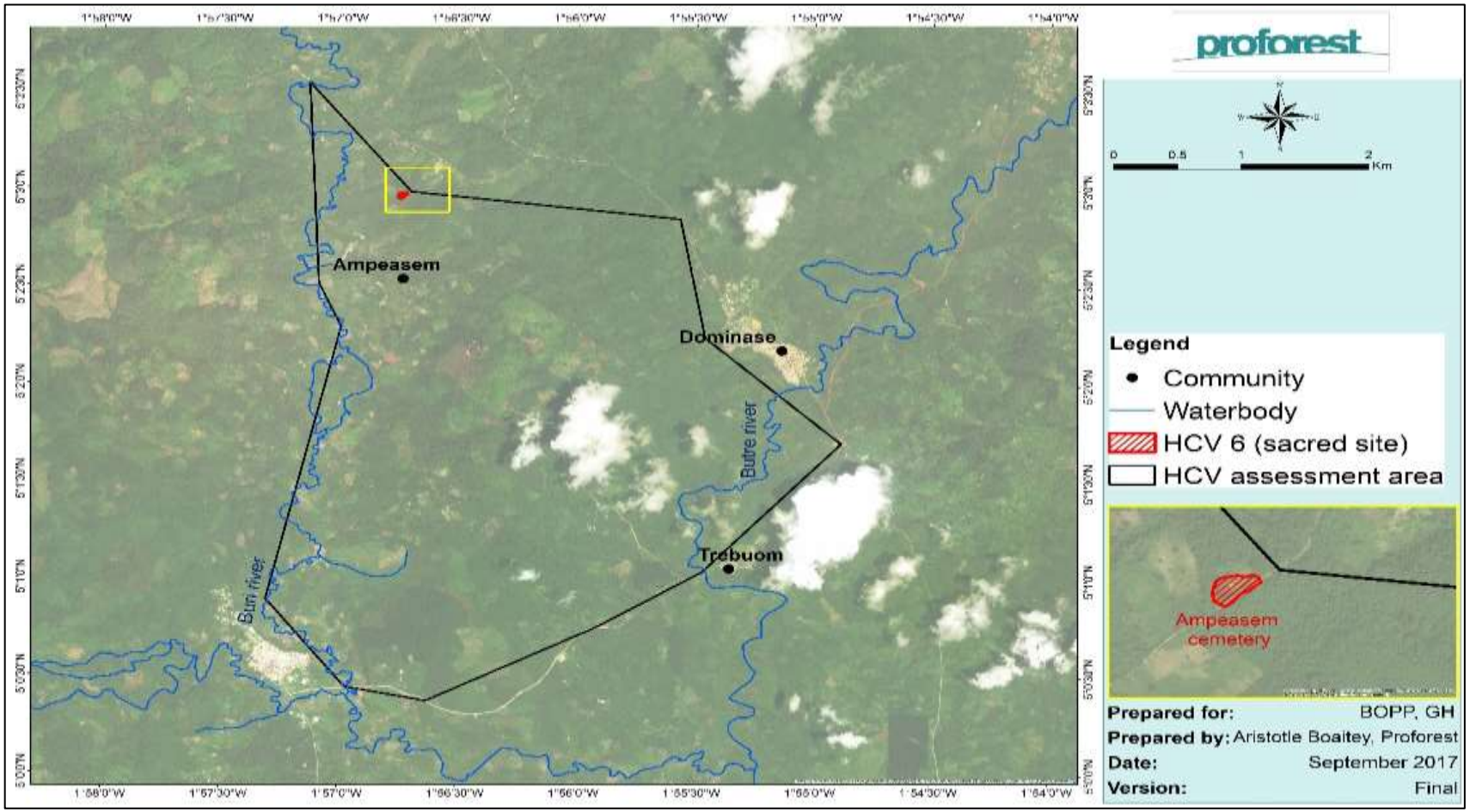


Figure 12: Map showing HCV 6 areas (burial site) in the assessment area

Stakeholder consultations

As part of the impact assessment process, key stakeholders were identified and consulted. These included the three beneficiary communities with some ownership or use rights over the proposed land, officials of the Mpohor District Assembly and COLANDEF (an NGO operating in the area with a focus on land rights, policy and gender). Other national NGOs including Forest Watch and Conservation Foundation were also consulted. Although all the identified stakeholders were consulted during the assessment, a final round of consultation meeting was held on 12th December 2017 at the District Assembly Hall where all the communities and stakeholders were invited and were presented with assessment findings and recommendations and their views on the HCV management and monitoring recommendations were elicited. Table 7 below provides details of stakeholders consulted, consultation dates, issues raised and assessors' response

Table 10: Outcome of stakeholder consultations

Date of consultations	Stakeholder	Key Issues / concerns raised	Response / comments
9th March 2017	**Trebuom community**	Trebuom community has decided to set up a committee to represent them on matters relating to the proposed project.	No response required. The assessment team thanked the stakeholder for their views.
12 July 2017		They also raised concerns that "We have waited for the start of the project for far too long. When will the project start?"	The assessment team responded that the project could commence only after the necessary assessment and requirements have been met and that is likely to be in 2018.
		Some families have land in the proposed project area whiles others' lands are outside. They enquired what should be done to ensure the project does not benefit only those families with land in the project area.	The assessment team responded that the community would have to deliberate and agree on a system of plot allocation that they consider fair and workable for the community members and in consultation with the management of BOPP.
		Although BOPP has not acquired the land but will support the local farmers to establish oil palm farms, will BOPP compensate those farmers with crops already on the land?	BOPP responded that rubber and cocoa would not be converted unless owners voluntarily requested to switch from those crops to oil palm. Food crop farmers would also be given time to harvest before land preparation commences.
12 December 2017	**Trebuom**	Since everybody wants the project to proceed, why didn't BOPP just go ahead and start the project instead of doing all these assessments and consultations?	The consultations are to ensure that everyone associated directly and indirectly with the project has fully understood all issues involved and agrees that the project should proceed.
12 July 2017 December 2017	**Mpohor District Assembly** Mr Enoch Koranteng (Dist. Agric Director,	The district officials expressed optimism and are hopeful that the proposed project will provide job opportunities for the local population. However, a few concerns were raised during the initial consultations:	The assessment team is engaging with all neighbouring local communities to identify HCVs including HCV 5 (local people livelihoods) of which NTFPs are a part. In collaboration with the local people, all NTFPs areas will be identified and set-aside from all plantation development activities including land clearing. However, no NTFP areas were found in the

	Mrs Aisha Mahama (Dist. Planning Officer	Major concerns are clearing of NTFP areas which may be a source of livelihood for the local population. Soil degradation and erosional problems from land clearing for oil palm development Concern about how the project land will be allocated to ensure fairness and equity	assessment area and this was explained during the final consultation which District Agric Director and the Planning Officer attended & agreed to the finding. As part of the HCV assessment, all areas prone to erosion such as fragile soils and hilly areas will be identified as HCV 4 and will be set-aside. The communities have agreed to set up project committees who will work with the community leaders to ensure equitable and fair allocation of plots.
13 & 14 July 2017	**Dominase community**	They wanted to know if boundaries of the proposed land will change or not and will not be extended to other farm areas. The remaining land must be left for food crop farming.	The assessment team indicated that land-related issues must be resolved among affected parties. They were also asked to explain whether they have any concerns with the current area proposed for the project but the response was negative.
12 December 2017	**Dominase**	They requested that BOPP change the name of the project from Trebuom to Trebuom-Dominase Smallholder Project	The assessment team indicated that the request will be passed on to BOPP for the company to consider. The communities agreed during the final consultation that the project should be called "Adum Smallholder Project"
		The community has identified a committee to represent them in all matters related to the proposed project	No response required. The assessment team thanked the stakeholder for their views.
		There are no known issues of litigation or disputes on the proposed land.	No response required. The assessment team thanked the stakeholder for their views.
13 July 2017	**Ampeasem/Agrave community**	The people recognise that the project could bring many positive benefits and are therefore positive of the project but wanted clarification on the following: How will the project affect farm houses and villages on the project land? Will BOPP convert cash crop farms such as cocoa and rubber? How will the land be divided for interested farmers? Will BOPP accept to use part of the land previously acquired by settlers of Ampeasem for the oil palm project?	The team informed them that the project will not displace any village or town given that the communities remain as owners and holders of the land since it has not been acquired by BOPP. The response was that BOPP will not convert rubber and cocoa to oil palm but the decision to convert or not is for the individual farm owners to make. Owners of those farms may voluntarily request for conversion to oil palm. Food crop farmers would also be given time to harvest before land preparation. The allocation of plots to individuals of the community will agreed upon by the community and elders and that BOPP will not make that decision for the communities.
		The community indicated that they had a burial site which should be protected due to its cultural significance to them.	The assessment team requested to be escorted to the site for verification and mapping which was done.
12 December 2017	**Ampeasem**	Why should a 100m buffer be maintained around the proposed project area when communities want to use the land for oil palm.	The buffer zone is demarcated so as to ensure that space is maintained for future community expansion.

		Why is this final consultation necessary when BOPP can use the assessments results to make decisions on project's viability	The consultations are necessary to clarify the issues and also to ensure that all stakeholders are aware of, and clearly understand the issues as pertains to the requirements of the RSPO.
		What will happen to existing oil palm and cocoa farms on the land?	Old oil palm farms will be felled and replanted with high yielding tenera, and the owners will also be compensated. The compensation is to be a source of income for owners while the new oil palm farm matures. Old cocoa and rubber farms will not be affected unless expressly requested for by their owners. In the event old cocoa and rubber farms are cleared, their owners will also be compensated
17 July 2017	**COLANDEF (NGO)**	COLANDEF indicated that the proposed project presents a good opportunity to enhance coordination between the participating communities.	No response required. The assessment team thanked the stakeholder for their views.
		They also highlighted the need to analyse existing land rights system in the area, and the link with paramountcy, since the well-established Wassa Fiase Traditional council would be very interested in the progress of such a project in their area.	No response required. The assessment team thanked the stakeholder for their views.
30 July 2017	**Conservation Foundation (NGO)**	CF indicated that the project has potential positive impacts such as increased productivity for the smallholders and better livelihoods for the communities. They caution that BOPP must prioritise the welfare of smallholders and the community, instead of only focusing on yield. They also emphasized the need for BOPP to train farmers to manage riparian buffers (especially along River Butre which is polluted by mining activities) and other HCVs. CF indicated their readiness to help maintain and enhance the identified HCVs	No response required. The assessment team thanked the stakeholder for their views.
30 July 2017	**Forest Watch Ghana (NGO)**	FWG emphasized the need for the project to be aware of replacement of food crops land with cash crop such as rubber. They also wanted communities to give their consent through a robust and effective FPIC process. They indicated that suitable alternative land parcels must be	No response required. The assessment team thanked the stakeholder for their views.

	identified for displaced food crops farms in the proposed land to ensure food security. FWG also recommends that labour should be sought locally to ensure maximum economic benefit to communities and that development of the project should adhere to APOI principles.	

3.3 Soil and topography

Areas with marginal and fragile soils

The finding of the soil study was that texture of the composite soil samples were sand, loamy sand, sandy loam, loam, Sandy Clay Loam and clay loam. These are considered as light to medium textured soils. The medium textured soils such as loam, sandy clay loam and clay loam have the most plant available water, even though they hold less total water in a foot of soil than clay. These soils have about 50% of the soil water present available for root uptake. The light textured soils (Sand and loamy sand) hold much less water and therefore lose water rapidly which affects plant growth. Water conservation practices such as mulching, cover cropping should be adhered to. Considering the above requirements, the climatic conditions of the plantation area are suitable for oil palm growth. The soils are good with depth > 1.0m and the subsoils are mainly sandy clay loams. The soils are well drained in the uplands and poorly drained in the lowlands. The poorly drained soils in the lowlands /valley bottoms are currently commonly used for oil palm production. They are normally drained during the initial establishment of the crop. There were no marginal or fragile soils identified within the proposed land for the smallholder oil palm development.

Identification of all areas of excessive gradients (>25^{o})

There are generally no known areas of excessive gradients with slopes greater than 25^{o} on the proposed land earmarked for the smallholder oil palm project.

3.4 Summary of Carbon Stock assessment and Greenhouse Gas emission

The proposed project land will be used oil palm plantation development but will also retain patches of cash crops such cocoa and rubber that already on the land. No new mill will be established, as it is expected that the FFB produced from the operation will be transferred to the existing BOPP processing facility at which is located less than 10 km north of the proposed land.
The most likely emission sources from this project would be the following:

- Emissions from landuse change
- Emissions associated with fertiliser use
- Emissions associated with FFB transport
- Emissions associated with fossil fuel and electricity
- Emissions from Palm Oil Mill Effluent

Land cover classification

A Landsat 8 satellite imagery was downloaded from the EarthExplorer webpage (http://earthexplorer.usgs.gov/) of the United States Geological Survey (USGS) that provides free access to several remote sensing products of various dates. The acquisition date of the downloaded

satellite image (Scene Identifier: LC81940562016366LGN00) was the 31st December 2016. The land use or land cover classification was carried out in two phases. The first which was an unsupervised classification was performed in ERDAS and the output was reclassified into six main vegetation types. The second phase was a supervised classification performed in ArcGIS version 10.3 which uses an object-based image classification method. During the flora survey, ground truthing data were collected and used as training sample through the maximum likelihood algorithm to classify the vegetation of the Trebuom smallholder project area for December 2016 into five classes. Eventually, a visual screening of the classification results was conducted to reduce mis-classifications and improve classification accuracy. The outcome of the assessment shows a highly-degraded land cover. The table 10 presents the area covers by each type of land use. It reveals and confirms that, the dominant land use form in the landscape of the project area is indeed Agricultural land (52.7%) followed by Agricultural commodities plantations (35.8%) such as rubber, oil palm and cocoa.

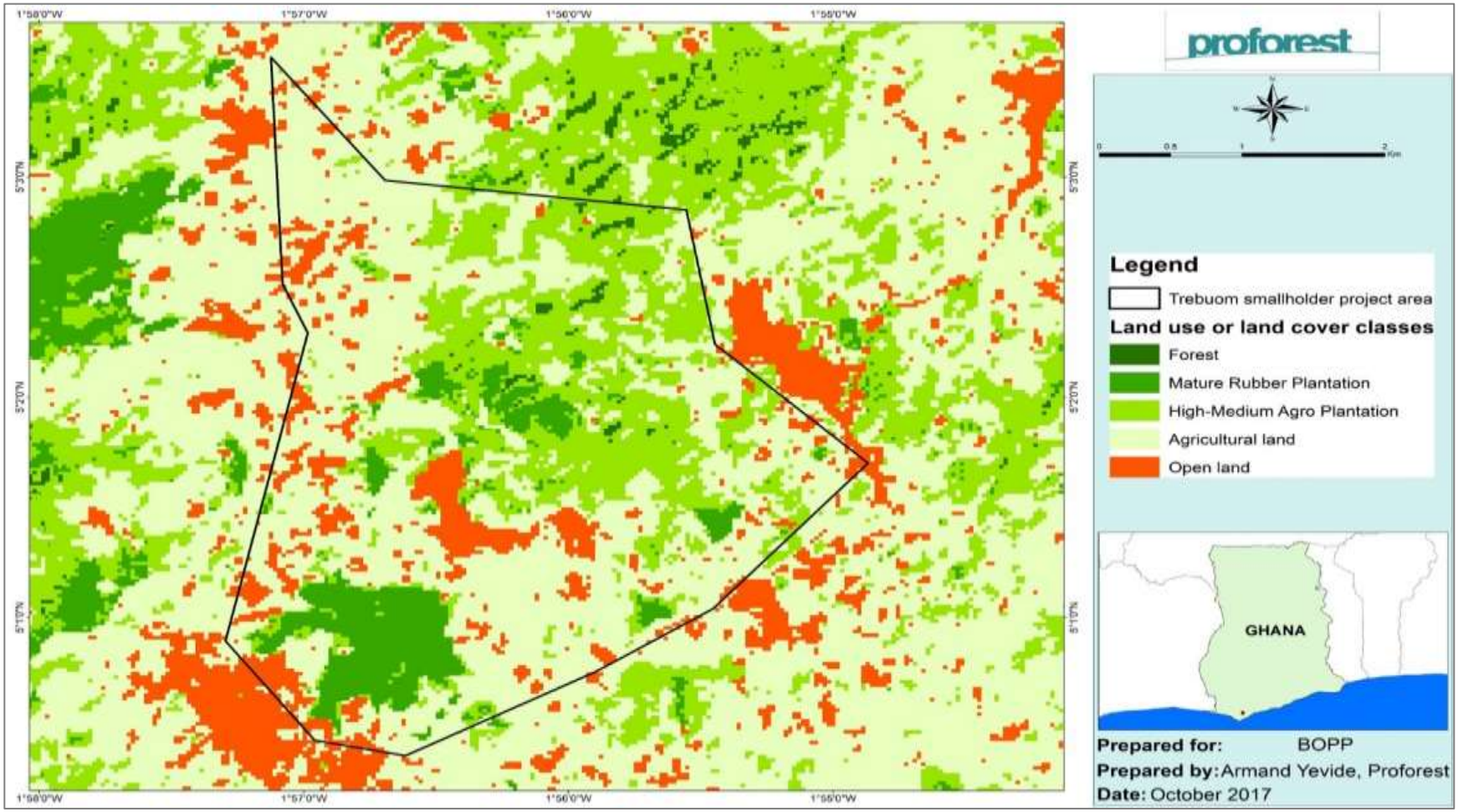


Figure 13: Land cover classification output for the land for the proposed smallholder oil palm plantation**NB: The land cover classification was based on a 30 metres resolution satellite image acquired from the EarthExplorer webpage of the United States Geological Survey (USGS) (http://earthexplorer.usgs.gov/) for the year 2016 (Scene Identifier: LC81940562016366LGN00 acquired on the 31st December 2016)**

Map and description of areas with significant carbon stocks including areas of peat soils

There are no peat soils in the project area.

The figure 14 below shows the distribution of carbon stock across in the landscape of the project. The estimated carbon stock varies from 2.34 tC/ha for Open Land to 27.70 tC/ha for the mature rubber plantation. The estimated carbon stock for the sampled plots was 234.91 tC with an average of 13.05 tC/ha. Extrapolated for the entire land gives a total carbon stock of 19,274.85 tC (Table 11) below.

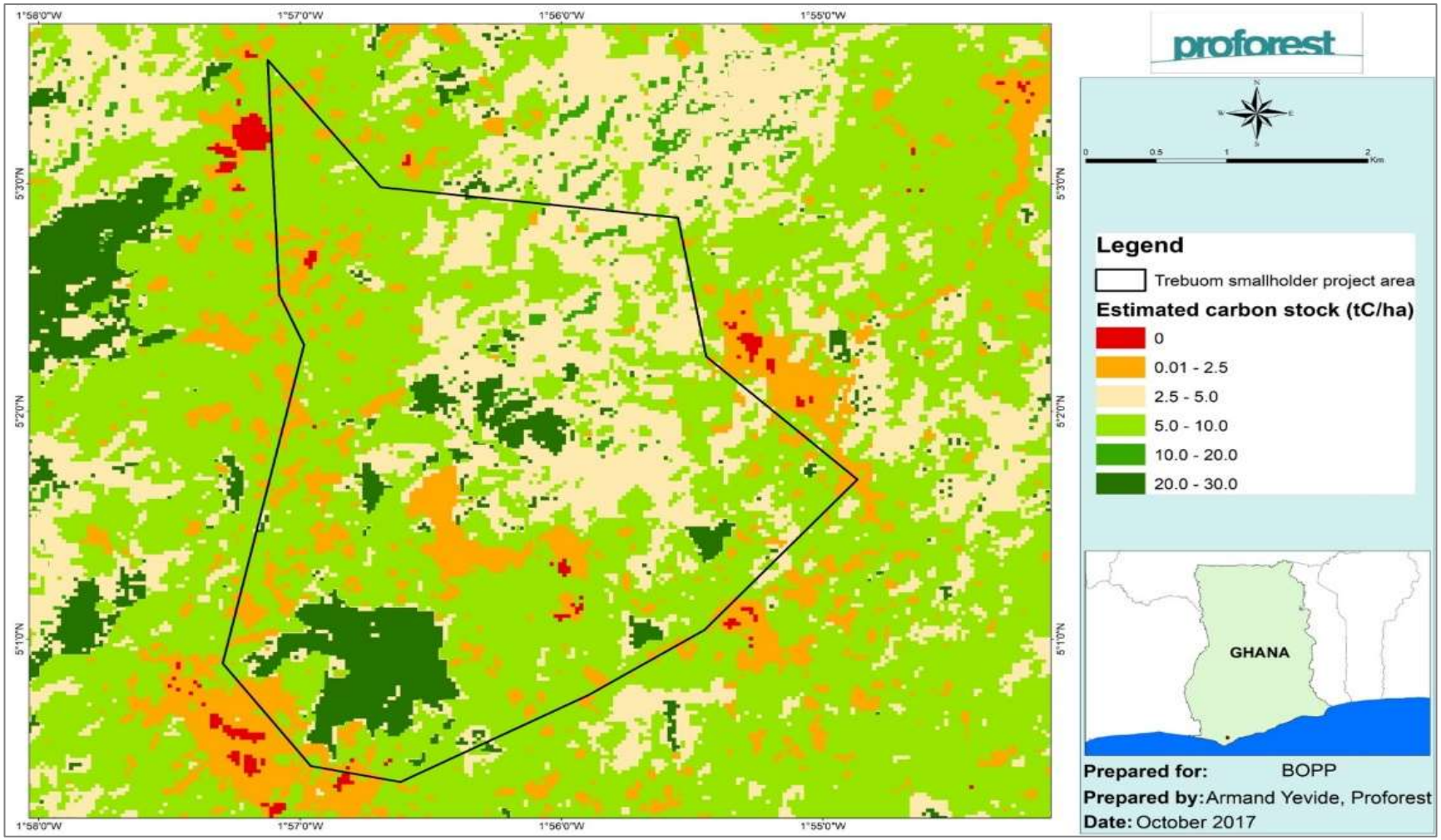


Figure 14: Distribution of carbon stock estimated for BOPP's Trebuom smallholder project area.

Table 11: Size of different land cover types at proposed land for smallholder oil palm development

Land use classes	Total area covered (ha)	Proportion (%)
Agricultural land	779.0	52.74
Forest	9.4	0.63
High-Medium Agro Plantation	380.4	25.76
Mature Rubber Plantation	148.4	10.05
Open land and Settlements	159.8	10.82
Total	**1477.0**	**100.00**

Table 12: Total carbon stock estimated in the different vegetation types in the concession

	Sampled area			Total concession	
Vegetation types	Sampled area (ha)	Total carbon (tC)	Carbon (tC/ha)	Total area (ha)	Total carbon (tC)
Agricultural land	5.76	37.30	6.48	779.0	5047.92
Forest	1.32	20.56	15.58	9.4	146.45
High-Medium Agro Plantation	4.92	23.02	4.68	380.4	1780.27
Mature Rubber Plantation	5.52	152.91	27.70	148.4	4110.68
Open land and Settlements	0.48	1.12	2.34	159.8	373.93
Total	**18.00**	**234.91**	**13.05***	**1477.0**	**19274.85**

* This value is equal to the total carbon obtained for the sampled area (234.91 tC) divided by the total sampled area (18.00 ha).

Emission estimations (Scenario analysis)

Five scenarios were run using the New Development GHG Calculator provided by RSPO. The Table below and Figure below present the results of the analysis.

Table 13: Characteristics of the scenarios used for the GHG emission estimation.

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Concession lease	1477	1477	1477	1477	1477
Set aside area for Carbon credit (HCV + buffers)	0.00	148.40	157.80	936.80	247.61
Land cleared for other use (5.5%)	77.00	69.26	68.77	28.16	64.09
Possible planting area	1400.00	1259.34	1250.43	512.04	1165.30
Percentage of possible planting area (%)	94.79	85.26	84.66	34.67	78.90

Agricultural land	738.39	738.39	738.39	0.00	653.26
Forest	8.91	8.91	0.00	0.00	0.00
High-Medium Agro Plantation	360.57	360.57	360.57	360.57	380.4
Mature Rubber Plantation	140.66	0.00	0.00	0.00	0.00
Open land and Settlements	151.47	151.47	151.47	151.47	159.8
Field emissions & sinks	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e
Crop sequestration	-12,173.19	-10,950.10	-10,872.63	-4,452.24	-10,132.43
Projected fertiliser emission	1,264.22	1,137.19	1,129.15	462.38	1,052.28
Projected field fuel	97.95	88.11	87.48	35.82	81.53
Conservation credit by each scenario	0	-357.64	-380.30	-2,257.69	-596.74
Mill emissions & credit	t CO2e	t CO2e	t CO2e	t CO2e	t CO2e
POME emission	4,116.36	3,702.77	3,676.57	1,505.52	3,426.27
Mill fuel	40.62	36.54	36.28	14.86	33.81
Electricity utilisation	108.69	108.69	108.69	108.69	108.69
Electricity credit	0	0	0	0	0
Biomass utilisation (EFB, if any)	-2,882.70	-2,2882.80	-2,882.70	-2,882.70	-2,882.70

NB: Except the 'Percentage of possible planting area' which is in % the other numbers are in hectare (ha).

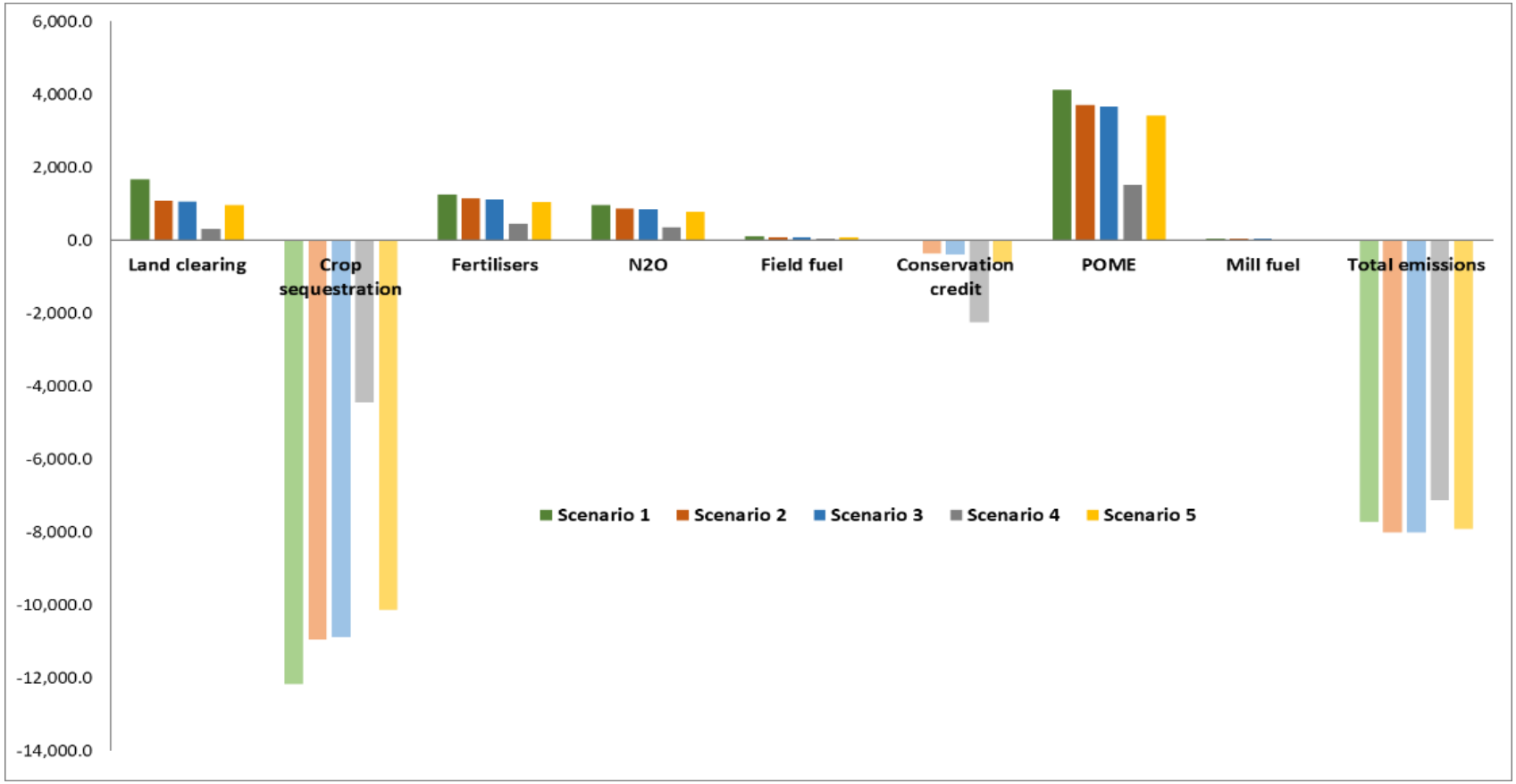


Figure 15 Expected emissions from proposed development

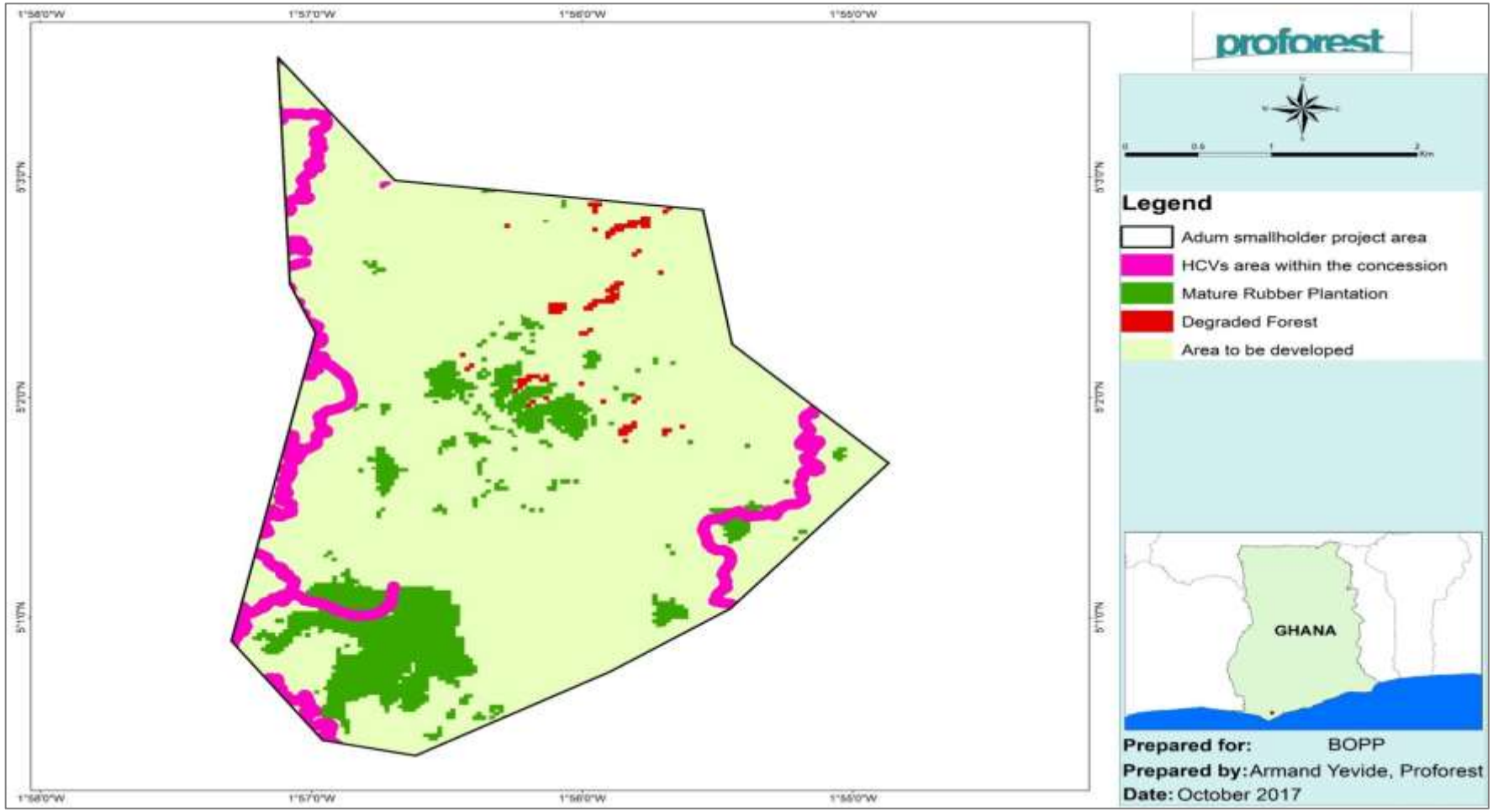


Figure 16 Distribution of development and set aside areas in the recommended scenario 5

3.5 Land Use Change Scenario analysis

Results and discussions

As recommended by RSPO, for all the five scenarios, 5.5% of the project area was set aside for infrastructures such as roads. Crop Sequestration is per 'Average Growth' as indicated for smallholder. The first scenario, which could be considered as the default scenario is based on the assumption that there is full development of the project area which means that the entire project area is converted into oil palm with no set aside area for conservation purposes. The second scenario is based on the recommendation not to clear the mature rubber plantations that exist in the project area as it will contribute to generate carbon credit for the project implementation as part of the set aside area. The third and fourth scenarios increased the set aside area by including the degraded small patches of forest within the project area (scenario 3) and the agricultural land (scenario 4). The fifth scenario is based on the recommendation to set aside the mature rubber plantation, the degraded forest, and the identified HCVs.

The scenario 1 which is the default scenario has the highest absolute value of crop sequestration (12,173 tCO2e) with also the highest total emission (-6,788 tCO2e). There is no carbon credit with the scenario 1 as no area was set aside for conservation purposes. Though the scenario 4 has the highest conservation credit (2,258 tCO2e), it has the lowest crop sequestration value at 4,452 tCO2e. Scenario 2 has the lowest net emission at 7716 tCO2e, but that would mean land use change on forest area. Scenarios 3 and 5 are very similar with almost the same net emission (7184 & 7140 tCO2e respectively). The scenario 3 which is based on the recommendation of carbon stock and HCV assessments has a net sequestration of 7,184 tCO2e, represents the scenario that has the most efficient use of land with balance between carbon stock and commercial return. We therefore recommend this scenario 5 for the project implementation. Because the landscape of the proposed concession is dominated by agricultural land, the sequestration potential of the vegetation within the project area is very low. It appears that, oil palm development will contribute to sequester more carbon than the current vegetation would do if it was left as it is. Kongsager *et al*. (2013) have conducted a study on the carbon sequestration potential of tree crop plantations including oil palm plantations in Ghana. They have noticed that, there is a considerable carbon sequestration potential in plantations if the plantations are established on land with modest carbon content such as degraded forest or agricultural land, and not on land with old-growth forest. Their study has revealed that oil palm plantations sequester about 45 tC/ha which is more than 5 times the average carbon sequestration potential of the dominant vegetation of the BOPP's Trebuom project area.

Protecting natural carbon sinks like forests (natural or planted) and oceans or creating new sinks through silviculture or green agriculture contribute to sequestrating part of GHG and mitigating their impact on global warming (Tian et al., 2016; Tiemeyer et al., 2016). In addition, using new technologies and renewable energies, making older equipment more energy efficient, or changing management practices are known to contribute to GHG mitigation (den Elzen et al., 2013; Esen and Yuksel, 2013). Therefore, the mitigation plan team has identified key strategies to enhance GHG sequestration and reduce their emission.

Carbon Stock and HCV

Figures 17 and 18 below are HCV and Carbon Stocks maps of the land for the proposed smallholder oil palm development.

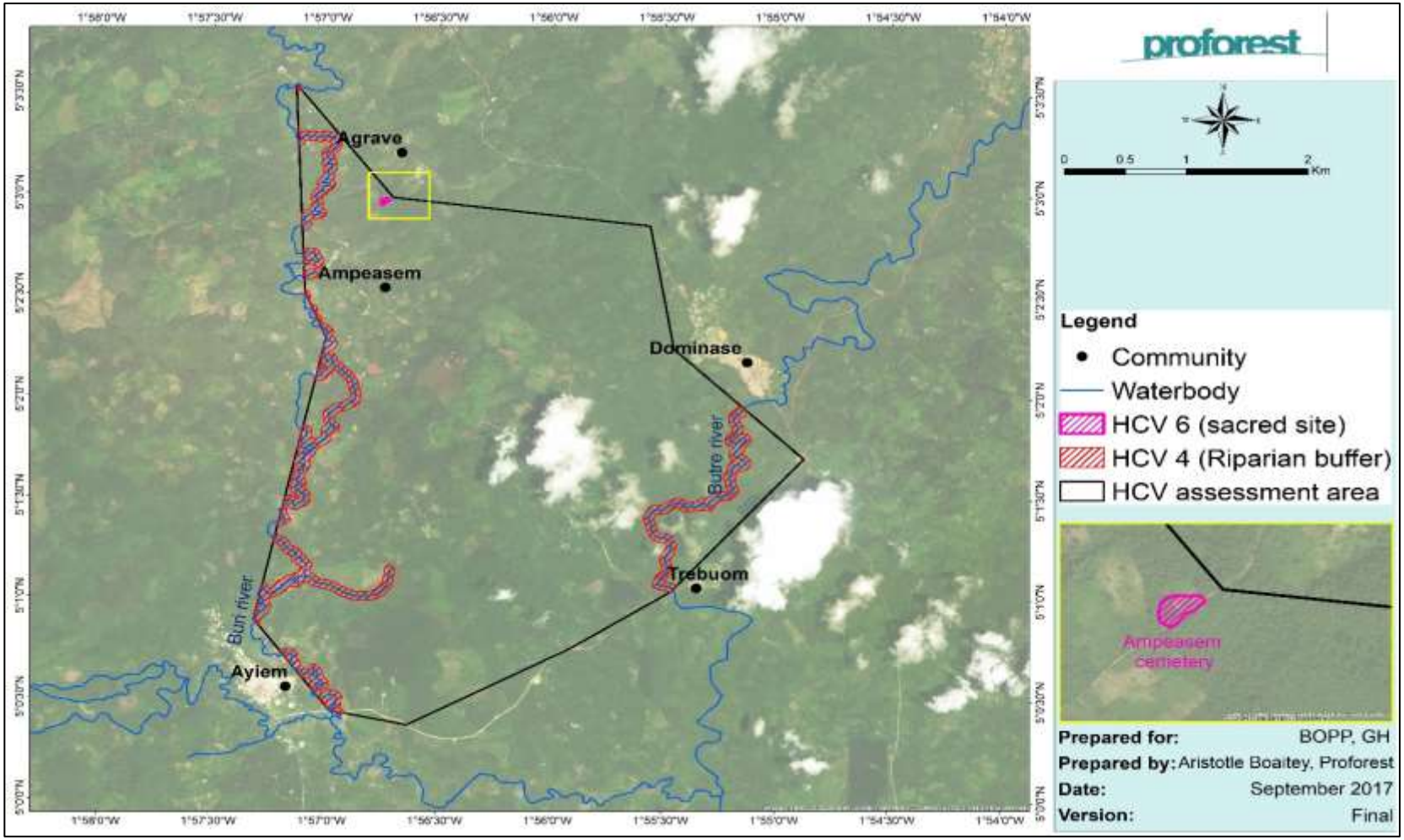


Figure 17: HCVs and their management areas of the land for the proposed smallholder oil pal development

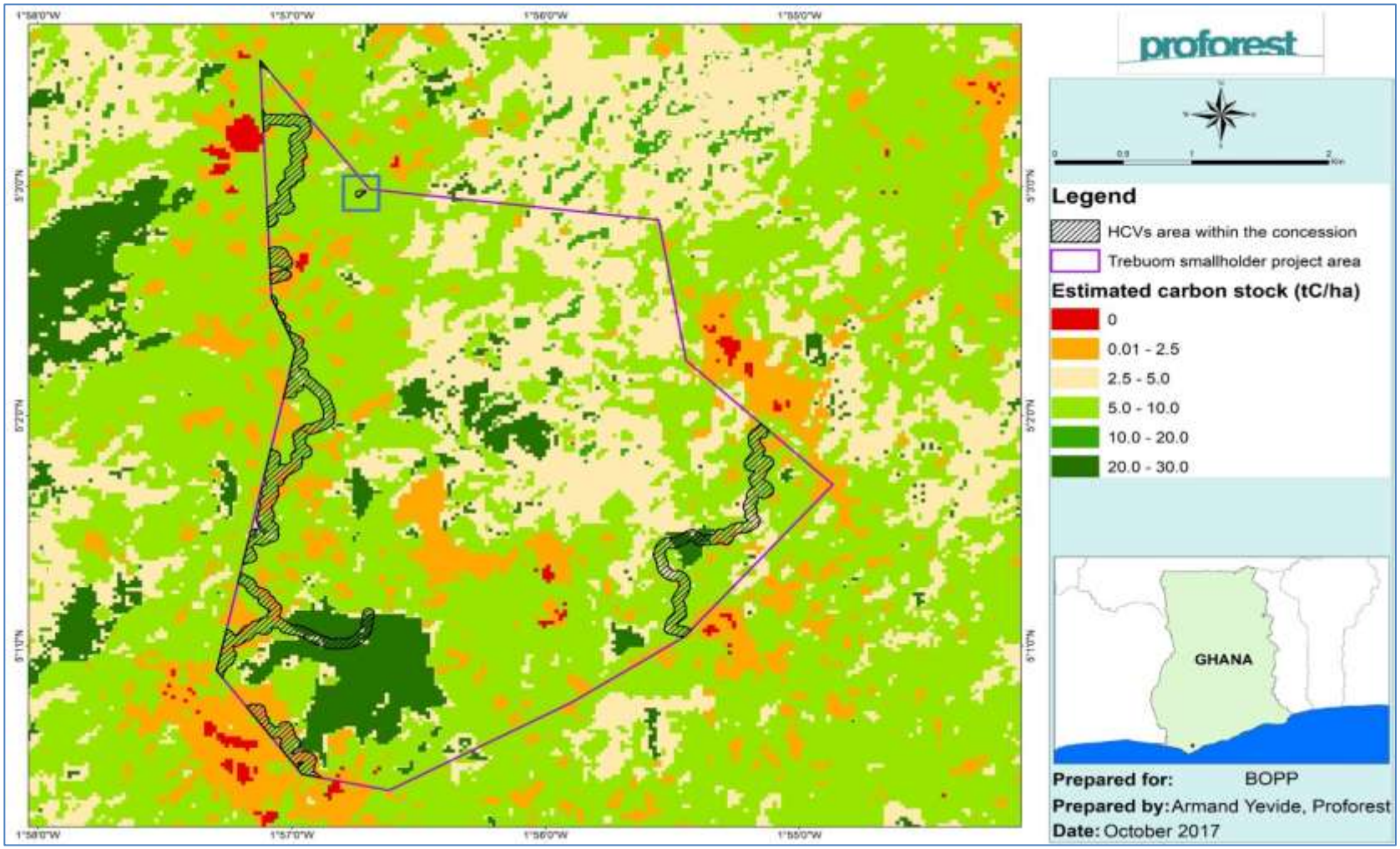


Figure 18: HCVs and their management areas overlaid with the estimated carbon stock in the concession

3.6 LUC analysis

The LUC analysis was carried out in line with the RSPO requirements and to complement the HCV assessment. The analysis included a systematic land use change analysis utilizing satellite imagery. The analysis was conducted in year 2015 by Rusli Awaludin with an updated LUC analysis conducted in year 2018 by Dr. Sedami Igor Armand Yevide of Proforest. The study consisted of a systematic land use change analysis using satellite imagery that shows the land use of the proposed area for the period 2005-2018. The analysis conducted by Senior GIS Officer of Wilmar International Plantations and the updated analysis by Proforest confirms Proforest's findings that the proposed development is dominated by agricultural land, rubber and oil palm farms and fallow land.

Image classification

The land cover classification was carried out with ERMapper and ArcGIS were used in the image processing and vector editing. Satellite imagery used in the analysis has been pre-process (radiometric and geometric correction) by USGS. First process for Raw Satellite imagery data is Layer stacking/band Marge. In this process, single band image was merged into one multi-band image. Composite imagery with proper band combination was produced by using multi-band image. Composite band Shortwave Infrared 1 (SWIR 1), Near Infrared (NIR) and Red (R) were used for LandSat 7 and LandSat 8 satellite imagery. While, Combination band Near Infrared (NIR), Red (R) and Green (G) were used for ASTER. This composite is used because it allows clear identification of various types of vegetation, provides a clear land/ water interface and penetrate thin cloud or haze. Variation in moisture contents are evident with this set of bands. And to obtain better image visualization, the next process that should be done is Image Enhancement and image Pan Sharpening. Image Enhancement is done manually using ER Mapper to improve spectral quality on all imagery used. Moreover, to increase spatial resolution LandSat 7 and LandSat 8 Imagery from 30 m to 15 m, Image Pan Sharpening proses with the Smoothing Filter based Intensity Modulation (SFIM) method was performed using ER Mapper Software. **Results of the LUCA are shown in Figure 19**. This also shows the tabular forms of the various land use categories.

Table 14: Description of the land use or land cover categories used for the classification

Land use classes	Description
Shrub	Low-density forest. This includes old fallow that could be qualified as young regenerating forests.
Mature Rubber Plantation	Area covered by mature plantation of rubber tree (*Hevea brasiliensis*).
Oil Palm	Area covered by the agricultural commodities plantations oil palm
Agricultural land	Area covered by annual crops
Open Land	Area cleared or having a minor vegetation cover or roads. This includes settlements or built up areas

Results of LUCA

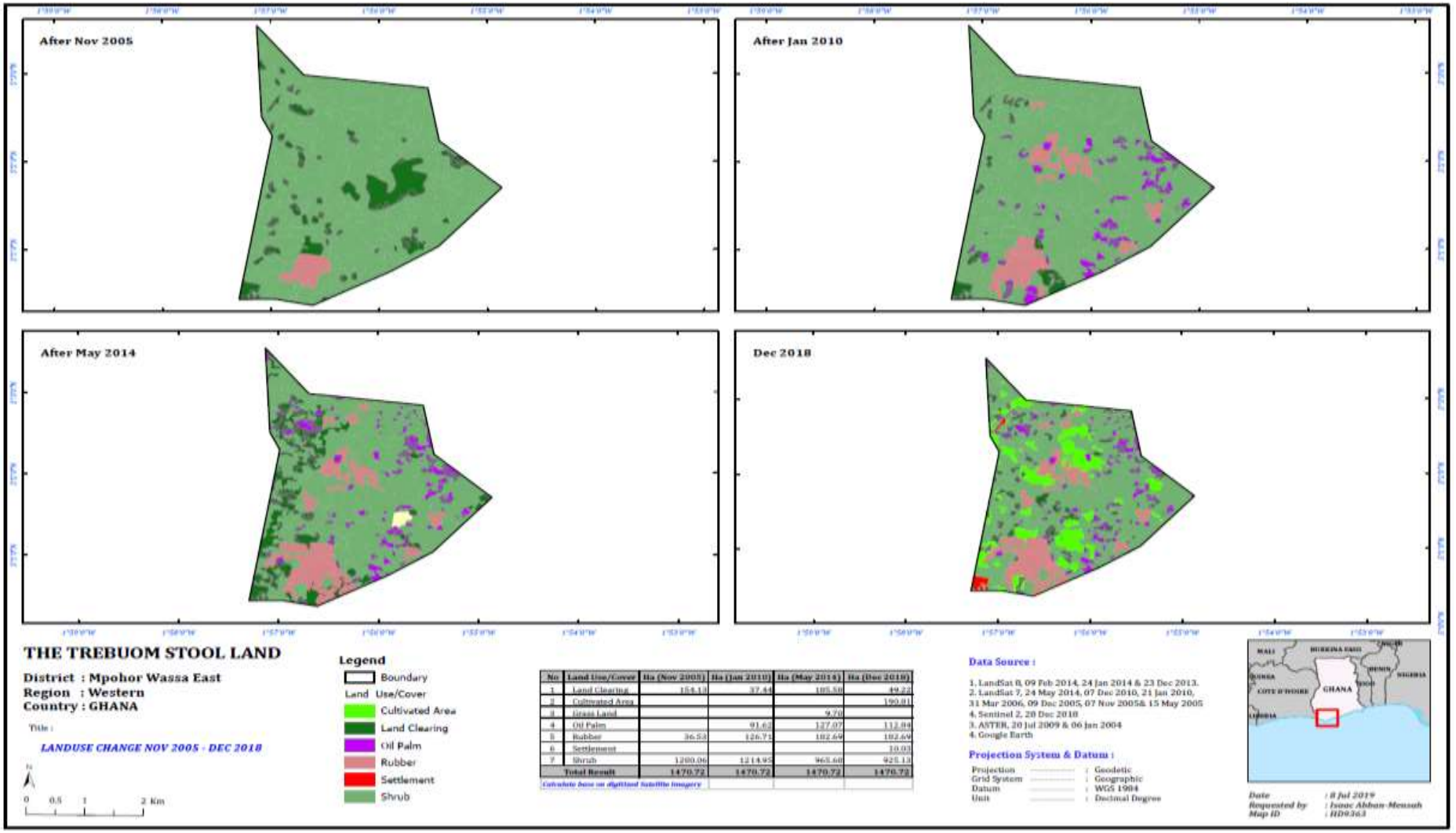
The results of the Land Use Change Analysis, confirm that the project location is located in an area that is predominantly under agricultural land use. As at 2005, the vegetation was dominated by bush fallows/ shrubs (1,280 ha) with some rubber plantations (36.53 ha) and cleared lands. The bulk of these cleared lands seem to have gone into establishing new rubber and oil palm plantations between 2005 and 2010. It is clear that most of these small plantations are controlled by smallholder farmers in non-commercial clearings. Whilst the existing areas under rubber plantations seem to have increased between 2005 and 2014, there has been no extension of the rubber plantations after 2014. The increasing rubber and oil palm areas have come predominantly from the existing cleared lands whilst as well as conversion of shrubs and bush fallows between 2005 and 2018.

It is apparent that there are no forests or high vegetation in the area. Farmers continue to return cultivated areas to fallows and convert fallows to new farms and plantations. With the increasing populations in the area, it is very unlikely that the existing fallows/shrubs would be allowed to fully regenerate into tropical high forests. The cycle of shifting cultivation and returning fallows to agriculture is likely going to continue in the area, without the project intervention.

The oil palm plantation development in the area would thus present a more economic outlook to the communities in the area whilst also setting aside areas of conservation importance aside perpetually for protection.

Table 15: LUC analysis between 2005 and 2010

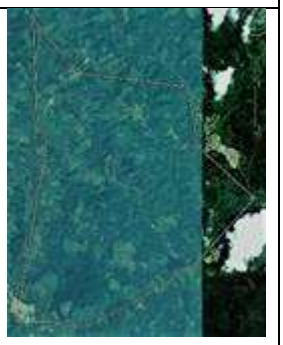
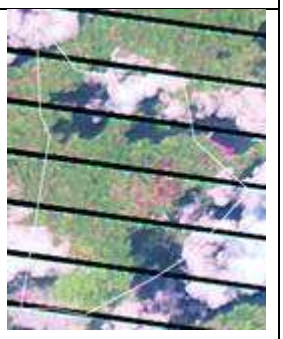
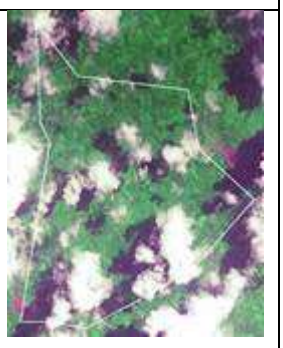
No.	Land use	Ha (Nov 2005)	Ha (Jan, 2010	Ha (May 2014)	Ha (Dec 2018)
1	Land Clearing	154.13	37.44	185.58	49.22
2	Cultivated Area			9.70	190.81
3	Oil Palm		91.62	127.07	112.84
4	Rubber	36.53	126.71	182.69	182.69
5	Settlement				10.03
6	Shrub	1280.06	1214.95	965.68	925.13
	Total	**1470.72**	**1470.72**	**1470.72**	**1470.72**

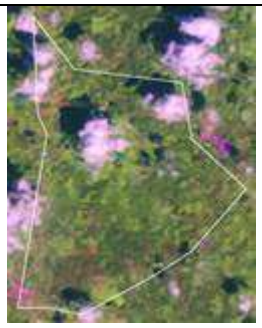
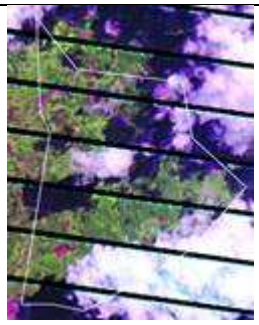
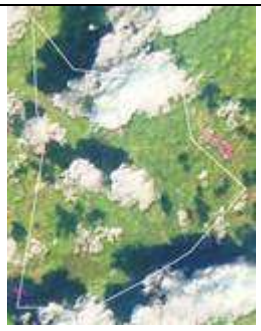


No	Land Use/Cover	Ha (Nov 2005)	Ha (Jan 2010)	Ha (May 2014)	Ha (Dec 2018)
1	Land Clearing	154.13	37.44	185.58	49.22
2	Cultivated Area				190.81
3	Grass Land			9.70	
4	Oil Palm		91.62	127.07	112.84
5	Rubber	36.53	126.71	182.69	182.69
6	Settlement				10.03
7	Shrub	1280.06	1214.95	965.68	925.13
	Total Result	1470.72	1470.72	1470.72	1470.72
	Calculate base on digitized Satellite Imagery				

Figure 19 : LUCA map showing tree cover loss/gain

Table 16: Satellite imagery used in LUCA

Description	Image	Description	Image
Google Earth Acquisition date 08 Dec 2013 Composition Natural color		Google Earth Acquisition date 02 Jan 2015 Composition Natural color	
ASTER VNIR (2004) *AST_L1T_00302062004104016_20150503041047_89028_V* Spatial Resolution 15 m Acquisition date 06 Feb 2004 Composition NIR-R-G		LandSat 7 ETM+ (2005) *LE71940572005135EDC00* Spatial Resolution 15 m Acquisition date 15 May 2005 Composition SWIR 1-NIR-R	
LandSat 7 ETM+ (2005) *LE71940572005311EDC00* Spatial Resolution 15 m Acquisition date 07 Nov 2005 Composition SWIR 1-NIR-R		LandSat 7 ETM+ (2005) *LE71940572005343EDC00* Spatial Resolution 15 m Acquisition date 09 Dec 2005 Composition SWIR 1-NIR-R	
LandSat 7 ETM+ (2006) *LE71940572006090ASN00* Spatial Resolution 15 m Acquisition date 31 Mar 2006 Composition SWIR 1-NIR-R		ASTER VNIR (2009) *AST_L1T_00307202009104553_20150529002945_15372_V* Spatial Resolution 15 m Acquisition date 20 Jul 2009 Composition NIR-R-G	

LandSat 7 ETM+ (2010) *LE71940572010021ASN00* Spatial Resolution 15 m Acquisition date 21 Jan 2010 Composition SWIR 1-NIR-R		LandSat 7 ETM+ (2010) *LE71940572010341ASN00* Spatial Resolution 15 m Acquisition date 07 Dec 2010 Composition SWIR 1-NIR-R	
LandSat 8 OLI (2013) *LC81940572013357LGN00* Spatial Resolution 15 m Acquisition date 23 Dec 2013 Composition SWIR 1-NIR-R		LandSat 7 ETM+ (2014) *LE71940572014144ASN00* Spatial Resolution 15 m Acquisition date 24 May 2014 Composition SWIR 1-NIR-R	
LandSat 8 OLI (2014) *LC81940572014024LGN00* Spatial Resolution 15 m Acquisition date 24 Jan 2014 Composition SWIR 1-NIR-R		LandSat 8 OLI (2014) *LC81940572014040LGN00* Spatial Resolution 15 m Acquisition date 09 Feb 2014 Composition SWIR 1-NIR-R	
Sentinel 2A (2018) *L1C_T30NXL_A018366_20181228T103650* Spatial Resolution 10 m Acquisition date 28 Dec 2018 Composition SWIR 1-NIR-R			

3.7 FPIC process

The smallholder oil palm development was an initiative of the local communities. However, to ensure the communities who have traditional and use rights to the land give their consent prior to the development of the proposed oil palm plantations, BOPP in collaboration with Proforest initiated an FPIC process which also included a full day FPIC training for the three beneficiary communities in August 2018. This was to the local people's full understanding of the FPIC requirements and to secure

consent of all farmers and communities who have traditional and use rights over the land. Key outcome of this process was the consent given by the communities and with the understanding that:

- All fallow areas and all areas of the land currently being used for food crop farming will be used for the smallholder oil palm project
- Farmers with cash crops such as oil palm will be compensated based on Ghana Government's compensation rates and their farms replanted for them with high yielding tenera
- All farmers with cocoa and rubber farms will have the option maintaining their farms or at their individual requests, their cash crops will be replaced with oil palm but will also receive compensations.

4 Summary of management plans

The sections below provide summaries of the management plans which should be implemented and monitored to ensure all potential social and environmental negative impacts associated with the project are addressed.

4.1 Team responsible for developing management plans

The Environment and Sustainability Unit of BOPP has the overall responsibility to implement the mitigation and management recommendations summarized in this report.

Table 17: Internal responsibility for management plans

Position	Responsibility
Africa Sustainability Controller	Ensure annual monitoring is conducted and reports are reviewed and compliant to the management plans within this report.
General Manager	Ensure all resources as necessary are provided for effective implementation of the management recommendations.
Estate Manager	Ensure all management recommendations as communicated by Sustainability Manager and this report are implemented.
Estate Manager/Health, Safety and Environment Manager	Facilitate compliance to management recommendation through provision of training and technical support. Monitor and report implementation of management recommendations through regular inspections.

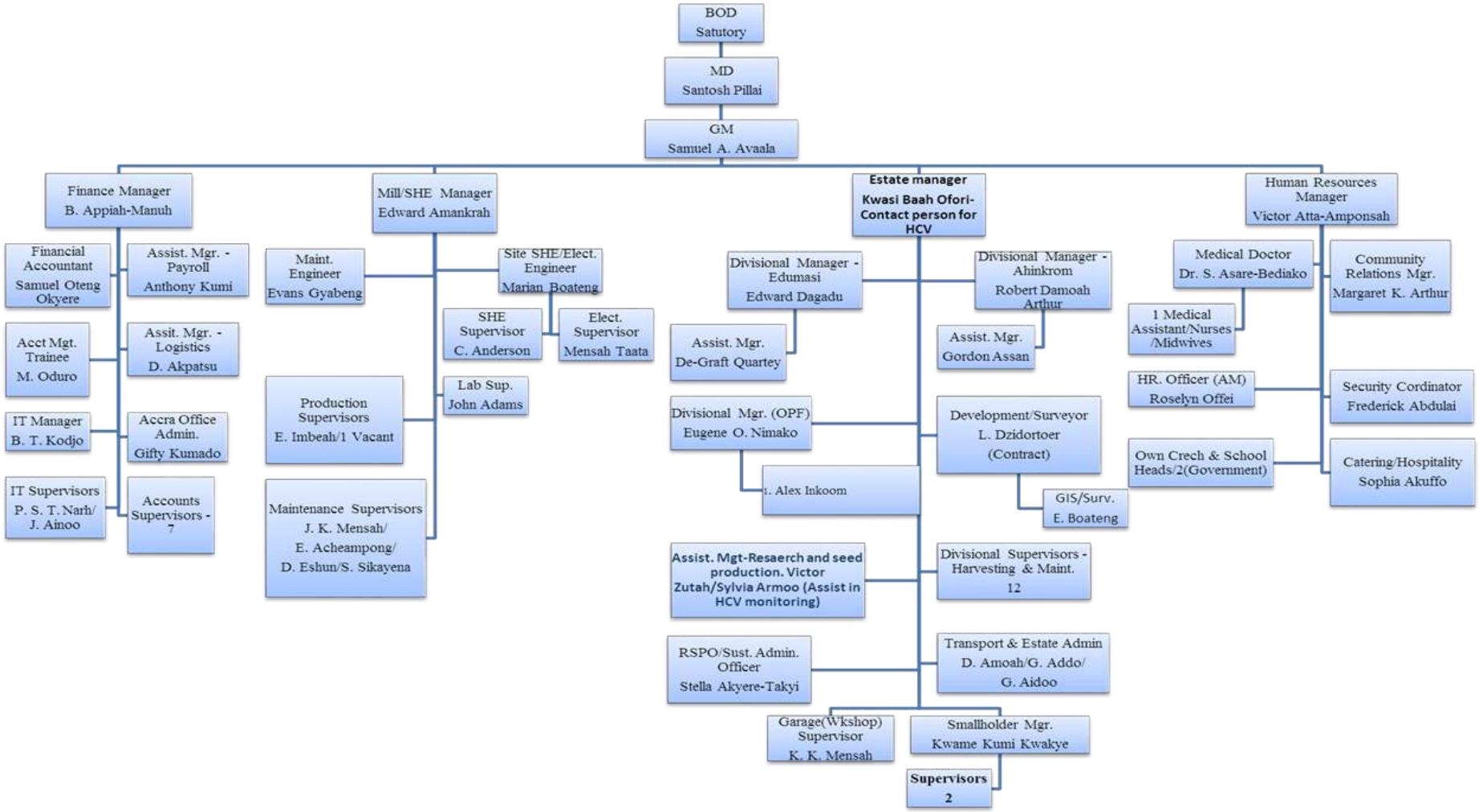


Figure 20 Organisational chart for BOPP .

4.2 Elements to be included in the management plans

HCV management plan

The recommendations for maintaining and enhancing the HCVs identified in the proposed land are based on the importance of the values present and the threats they face. Table 18 below summarises the management and monitoring recommendations as per the HCV report. These recommendations must be adopted and included in the HCV management plan.

Table 18: HCVs and their management and monitoring recommendations

HCV	Brief description of value present	Main threats	Management recommendation	Monitoring recommendation
4	Basic ecosystem services and hydrological functions to maintain water quality and quantity for community uses: Rivers Buri and Butre, other streams and their tributaries, as well as the riparian vegetation along these watercourses Vegetation on steep slopes	**Current threats:** **Farming:** The assessment area is highly an agricultural land, including intensively managed cash crops and food crops with most farms closed to water bodies and within the recommended buffer. **Illegal gold mining activities:** Although illegal gold mining is prevalent in the wider district, there were no signs of mining within the assessment area. However, illegal mining outside the area and close to any water body could cause pollution of the water body as this is very common in the region. **Potential threats** **Pollution** of water bodies from agrochemicals from plantation operations. **Conversion** of riparian forest for food crop farming especially when introduction of the project limits available land for food crop production. **Conversion of** riparian forests and threats to water bodies from, road, and bridge construction during plantation land development and maintenance. **Threats of erosion** if vegetation on slopes of more than 9°are converted/bulldozed without	• Ensure sufficient alternative land to the left of Trebuom community (south of Butre River) and all other areas the communities have set-aside for farming of food crops are available and not used for oil palm • Develop and implement SOPs for land preparation and chemical use. • Conduct training awareness and sensitization on HCVs and their management for workers, smallholders and local communities and aim to seek collaboration with local communities to protect riparian buffers. • Ensure agrochemicals are applied by trained workers. • Riparian areas should be avoided during road construction. If necessary that roads go through riparian areas across a bridge/culvert, the construction should be properly planned and executed to ensure least possible damage to the vegetation. Vegetation on slopes should be	• Establish network of independent water monitoring stations along the two main rivers in the assessment area. • Perform quarterly tests to monitor quality performed on water samples taken from points where the watercourses enter and exit the assessment (plantation) area as required by the EPA. Implement remedial measures if significant differences are found between the results of the two sets of samples Conduct regular monitoring of riparian buffer zones • Conduct periodic review of implementation of SOPs. • Conduct annual monitoring of agrochemical applicators understanding of

		any appropriate measures during land preparation. **Destruction** of minor and seasonal streams in the proposed project area during land preparation	maintained. On moderate slopes between 9^0 and 25^0, soil conservation techniques such as terracing, platforms and cover cropping must be employed. • Steep slopes greater than 25^0 should be avoided during land preparation and road construction. • Engage and collaborate with other farmers and occupants in the area to ensure maintenance and/or enhancement of riparian vegetation and vegetation on slopes greater than 9^0. • Collaborate with the District Assembly to provide education, sensitisation and awareness on impacts of illegal mining	and adherence to training measures. • Monitor smallholders' workers' and communities' understanding of HCVs and their management. • Bi-annual monitoring of set-aside zone shows at least no decrease in canopy cover. • Ongoing monitoring of hilly and areas with high slopes. • Conduct regular monitoring of collaborative approach with farmers and local communities on management of HCV areas. • Annual monitoring of the effectiveness of the collaborative approach to education and awareness raising on dangers illegal mining pose to water bodies and the environment.
6	Sites of cultural/traditional importance to the local people: burial site for the Ampeasem community	**Current threat** **Rubber expansion:** It was observed during field assessment that the area adjacent to the Ampeasem cemetery is cultivated with young rubber. The expansion of these rubber establishments could encroach on the land allocated for the cemetery. **Potential threat** **Restrictions** on community's access to their burial site. **Road construction/expansion:** The cemetery is also adjacent to	• Ensure that the Ampeasem community's access to their burial site is neither hindered nor impeded by the operations of the oil palm development. • Develop and sensitize smallholders and workers on SOPs for land preparation and management of oil palm to avoid damage to burial site. • Ensure land preparation team has adequate training and sufficient	• Develop a collaborative monitoring system for the HCV 6 site, with annual feedback and review with stakeholders. • Conduct annual monitoring of collaborative activities with the Ampeasem community and managers of adjacent rubber establishments.

	the main road leading to the community. During road maintenance or expansion, the land allocated for the cemetery could be affected. **Land preparation:** If the boundaries of the cemetery are not properly delineated and physically indicated, land preparation for the oil palm project could convert part of the land allocated for the cemetery.	understanding on the application of the SOPs • Collaborate with community members as well as managers of rubber establishments around the burial site to effectively manage the site.	• Monitoring of land preparation team's understanding of the application of the SOP. • Develop a simple HCV 6 monitoring system and ensure annual internal reporting against the monitoring system. • Conduct annual monitoring of the HCV 6 management area following the above monitoring system to be developed. Implement appropriate remedial actions as soon as any intrusion is detected

Environmental and Social Impact assessment management plans

The monitoring and management actions laid out in the table above are aimed at mitigating negative environmental and socio-economic impacts relating to HCVs whiles enhancing the positive ones. The implementation of these actions has received the commitment and support of the management of BOPP. The main actions for reducing negative environmental and social impacts whiles enhancing the positive ones have therefore been detailed below as critical management measures for consideration and implementation by the management of BOPP.

Management of potential environmental impact:

Table 19 below provides a summary of the potential environmental impacts and their proposed mitigation measures.

Table 19: Environmental Management Plan for the Proposed Smallholder project

Environmental Aspects	Type of Impact	Mitigation measures	Residual Impact
Land and soil degradation	Land preparation on a sloping land may result in higher erosion potential. Because of soil erosion, soil particles will be transported by run-off water and sediments will be fed into river system. Increased	Planting of cover crops (prureira and/or mucuna). Terracing where necessary to reduce/check erosion	High

	sediment load will induce migration of aquatic fauna. Degradation of sensitive habitats will result in loss of biodiversity and displacement of indigenous species.		
Water and air pollution from road construction	Dust and particles from road construction and sediments into water bodies	Grading and creating paths for vehicles to the site	Low
Air quality	Dust and gaseous emissions from land preparation leading to high suspended particulates in the atmosphere.	BOPP shall ensure: • Low-emission/high efficiency engines shall be used • Transportation of workers and materials shall be properly coordinated to optimize vehicle use and resultant emissions • Avoid burning on site (i.e. zero burning)	Low
Water Quality and Hydrology	Increased receiving water body turbidity from runoff from the plantation.	BOPP shall ensure the following: • Enforce and monitor adequate riparian buffer zone management that promotes retention of vegetation cover and prohibits use of chemicals close to rivers • Stack waste materials properly to reduce turbidity effect on surface runoffs; • Adequate contingency measures should be put in place to contain accidental spills, ensure spill containment equipment are available	Low
Solid Waste	• Solid waste constituting aesthetic nuisance • Sewage nuisance	BOPP shall ensure that wastes are contained and removed regularly by her own waste management plan already in place.	Low
Health, Safety and security	Health hazards Assaults and theft	• Organize safety training programmes • Minimize dust pollution through enforcement of speed limits, surface improvement (e.g. gravelling) and surface treatment (e.g. watering) • Proper disposal and storage of solid waste. For example, chemical containers must be stored carefully and not reused or disposed of at the dumpsites.	Low

		• Provide workers with appropriate protective gears • Development of security personnel and training on key security issues	

Management of potential socio-economic impact:

The management recommendations for addressing potential negative social impacts are further summarised in the Table 20 below.

Table 20: Potential Socio-economic Impact and Mitigation and Management Measures

Potential Impact	Mitigation Measure(s)
Livelihood and food security	Develop and implement sustainable alternative and additional livelihood program in the communities
	Provision of farm inputs (on credit basis or as part of social responsibility engagement) that allows local farmers to cultivate their existing plots more intensively to increase yield
	BOPP to engage with other actors to provide training and agricultural extension services to local food crop farmers to assist them better manage their existing farmland for greater productivity
	Support the District Assembly to facilitate land acquisition for food crop farming
	BOPP to consider supporting farmers' award scheme as motivation
Access to NTFPs	BOPP should continue to allow regulated access to community members to fetch firewood and other NTFP's from their proposed smallholder project land as currently arranged
Employment opportunities	Implementation of skills development programmes to ensure support for local population to obtain employment opportunities.
Gender, reproductive health and harassment	BOPP should mainstream gender into the project BOPP should have a gender/harassment policy with focus on sexual harassment
Land conflict	Collaborate with traditional authorities and the local population to ensure all interested persons benefit from the project

Carbon and Greenhouse Gas Management plans

The following management recommendations are made for effective management of carbon and greenhouse gas based on the carbon emission sources identified in the GHG Calculator.

HCV management and set-aside areas

The scenario 5 which was based on the Carbon Stock and HCV assessments recommendation has led to set aside 247.61 ha that represents 16.8% of the project area. In addition to this, riparian buffer vegetation would be marked out in the field prior to land preparations. Recommended set-aside areas for buffering of rivers and streams are outlined below.

Table 21: Recommended buffer for all rivers and streams in and around the project land

Water body category	Width (m)	Recommended buffer zone on each side (m)
Perennial streams	< 5	10
Major perennial rivers	[5 - 20]	50
Big rivers	> 20	100

Managing emission from land clearing

Land clearing and land preparation are known to contribute to GHG emission especially when biomass is burnt or when there are done solely mechanically. Therefore, biomass burning practices during land clearing and land preparation process should be avoided and these two operations should combine mechanic and manual methods to minimise greenhouse gas emission.

Managing emissions from fertilizer application

Emission from fertilisers is a major source of GHG on the plantation. To reduce these emissions, the operation will optimise the use of fertiliser in the plantations. All forms of fertiliser use shall be justified following periodic soil and tissue sampling and shall be applied by trained staff with supervision from management. Fertiliser would only be applied to address identified deficiencies from tissue sampling reports. The company will also strive to use organic matter from its operations to complement soil nutrition and physical properties. Typically, the operation will ensure that EFB is returned to the field, palm fronds are stacked. The company would also make optimal use of nitrogen fixing cover crops in its operations to help minimise the amount of organic Nitrogen that would be required for optimum yield.

Emissions from FFB Transport

To minimise emissions from FFB transport, the operation would ensure the use of trucks that are very fuel efficient and large enough to minimise the number of trips. Additional measures to be implemented would include regular and scheduled maintenance of vehicles to maintain their fuel efficiency whilst sourcing only highly quality fuel that is guaranteed to give optimal performance of vehicles. Appropriate measures will be taken to ensure road planning, design and construction are carried out in a way that minimise the travel distance between the harvesting sites and the processing mill. It is recommended that the company develops an implemented road maintenance programme that keeps the roads in good condition all year around. This would also be essential in reducing the amount of fuel used in FFB transport.

5. References

5.1. List of references used in the assessment

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6 Internal responsibility

6.1: Formal signing off by assessors and Company (BOPP)

The following assessors formally accept our interpretation of their findings and management recommendation as summarised in this report:

Name of lead assessor	Name of lead assessor	Signature
Environmental impact assessment	Miss Lebene Ledi	
Social impact assessment	Mr. Abraham Baffoe	
High Conservation assessment	Mr. Abraham Baffoe	
Carbon Stock assessment	Rusli Awaludin Dr Armand Sedami Yevide	 
Land Use Change assessment	Dr Armand Sedami Yevide	
Green House Gas assessment	Dr Armand Sedami Yevide	

6.2: Statement of acceptance of responsibility for assessment and formal signing off of management plans

This document is the public summary of the integrated ESIA, HCV and HCS management for the proposed Adum Smallholder new oil palm development which has been approved by the management of BOPP. All management, mitigation and monitoring recommendations would be implemented.

Mr Samuel Avaala: General Manager

Signature: 

Mr Isaac Abban-Mensah: Sustainability Controller

Signature: 

Mr. Kwasi Baah Ofori, Estate Manager/Health & Safety Manager

Signature: 

6.3 Organisational information and contact persons

For RSPO matters:

Mr Isaac Abban-Mensah: Sustainability Controller, Wilmar Africa
Email: isaac.mensah@ng.wilmar-intl.com

6.4 Personnel involved in planning and implementation

1. Mr Samuel Avaala
2. Mr Isaac Abban-Mensah
3. Mr Kwasi Baah Ofori