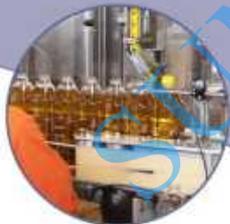


Carbon Stock Assessment and GHG Emission Report for Presco's Sakponba Concession in Edo State in Nigeria

08 February 2017



About Proforest

Proforest is an independent organisation working with natural resource management and specialising in practical approaches to sustainability. Our expertise covers all aspects of the natural resources sector, from sustainable forestry and agricultural commodities production to responsible sourcing, supply chain management and investment.

Proforest works to transform commodity supply chains and sectors through developing **awareness** about sustainability, helping to generate **commitment** to better practice, supporting **implementation** of these commitments in practice and working with the wider community to increase the positive **impact**.

Proforest Ghana leads on delivery of Proforest activities in West and Central Africa including direct support to companies implementing responsible production, sourcing and investment for agricultural and forest commodities together with long-term programmes to support capacity building and multi-stakeholder initiatives in the region. Proforest also has offices in Brazil, Malaysia and the UK.

Our team comprises specialists in forest management, agricultural commodities such as palm oil, conservation and sustainability initiatives and certification. We have extensive experience in Africa and internationally and can work in English, French and Portuguese.

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Proforest Ghana is a company registered in Ghana as Proforest Limited (Company Number CS115042012).

Executive Summary

About 1% sampling rate was used to assess aboveground and belowground carbon stock in the Presco's Sakponba proposed concessions of 14,436 ha located in Edo State in Nigeria. One hundred sixteen plots of 1 ha each, subdivided into 25 square quadrats of 0.04 ha, were used. The diameter and height (estimated) of all the living trees with diameter at breast height (dbh) of 10 cm and above were recorded. The vegetation type of each quadrat was recorded and the collected field data were processed with Microsoft Excel, QGIS and ArcGIS. Riparian forest, low to medium density forest, grassland, farmland, plantations, and water bodies were the six main vegetation types that characterize the landscape of the proposed concession. Tree density varies from 0.6 tree/ha for grassland to 50.1 trees/ha for low to medium density forest. The estimated total carbon stock was: 0.03 tC/ha, 1.20 tC/ha, 3.61 tC/ha, and 4.67 tC/ha for grassland, farmland, low to medium density forest, and plantations respectively. For the entire proposed concession, the total carbon stock obtained was 19,208.06 tC (1.32 tC/ha). No significant carbon sink was identified. On the basis of the results obtained from the assessments (HCV and CS) as well as the scenario analysis, recommendations were made to ensure that, the establishment of oil palm in the proposed concession is environmentally friendly.

SUMMARY

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1 Introduction: About Presco

Presco Plc is one of the subsidiaries of SIAT Group, a Belgian agro-industrial company specialized in industrial as well as smallholder plantations of tree crops, mainly oil palm and rubber, and allied processing industries such as palm oil mills, palm oil refining / fractionation, soap making and crumb rubber factories. The company was incorporated as a limited liability company in Nigeria on September 24, 1991, and with its head office at Obaretin Estate in the Edo State of Nigeria. Presco was listed on the Nigeria stock exchange in 2002 following a successful Initial Public Offering.

It operates oil palm estates at Obaretin (total concession area of 6,462 ha) and Ologbo (total concession area of 12,560 ha of which 8,429 ha is planted) in Edo State; with Cowan (2,822 ha) in Delta State, Nigeria. The Cowan and Obaretin Estates were existing plantations established by the State government that the company inherited while the Ologbo plantation was established by Presco in a former forest reserve land. In 2015, Presco Plc produced 176,477 tons of fresh fruit bunches, 39,328 tons of crude palm and 29,159 tons of refined oil. As of April 2016, employee strength stood at 4,027 persons, comprising 428 and 3,599 permanent and contract staff respectively.

As part of its commitment to responsible production and meeting the requirements of the RSPO New Plantings Procedure, Presco has engaged Proforest to conduct an HCV and carbon stock assessment for its Sakponba proposed concession in Edo State, which covers an area of 14,436 ha (Figure 1).

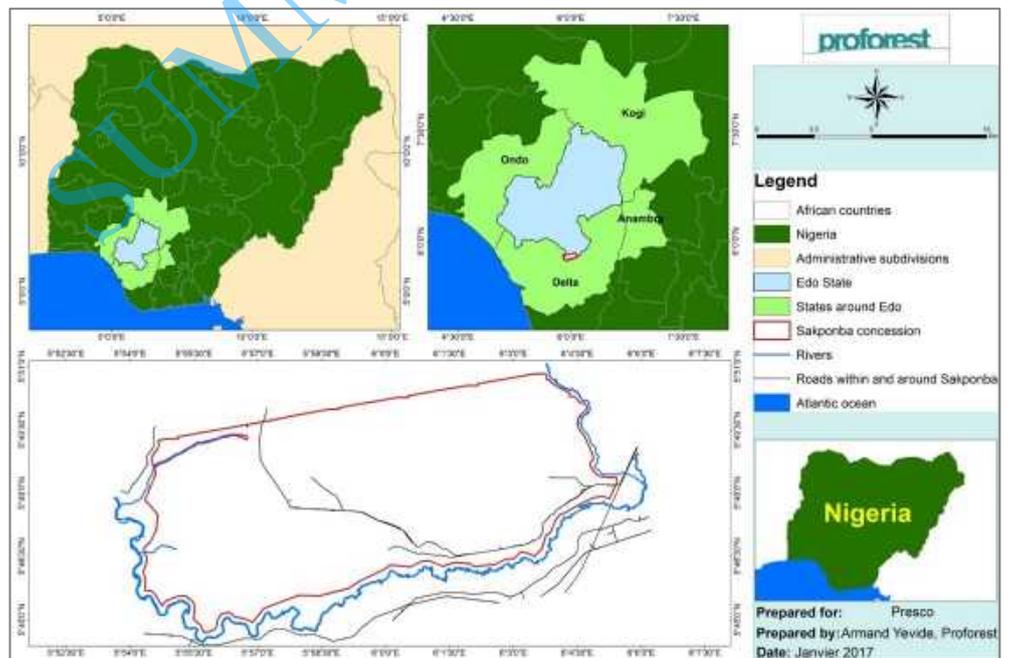


Figure 1: Location of Presco's Sakponba concession.

2 Assessment process and methods

In order to optimise the use of human and financial resources, the carbon stock assessment of the Presco's Sakponba concession was carried out at the same time with the HCV assessment. The process was led by an HCV Resource Network Licensed Assessor working with other discipline experts including GIS, Botanist, Ecologist and other support staff.

2.1 Assessors and their credentials

In conducting this carbon stock assessment for Presco's Sakponba concession in Edo State, Proforest has drawn on its internal capacity from the regional office in Accra, Ghana and local consultants in Nigeria. The team involved in the assessment are therefore highly competent in the field of natural resources management, botany, forest survey and data processing.

Table 1: List of the assessors and their qualification.

Name	Organisation/company	Role in the assessment
Abraham Baffoe	Proforest	Assessment oversight and Ecology/landuse planning
Michael Abedi-Lartey	Proforest	Assessment Coordination
Armand Yevide	Proforest	Flora survey coordination plus GIS and mapping
Aristotle Boaitey	Proforest	GIS and community consultation
Akomaye Ashikem	Cross River State Forestry Commission	Botanists/Flora survey
Joseph Ugbe	Cross River State Forestry Commission	Botanists/Flora survey
Adesoji A. Adeyemi	Federal University of Technology	Botanists/Flora survey

The team members had collective expertise in Botany, Agriculture, Forestry, Environmental Science. Together, they possess several years of experience working on plant identification, tree measurement techniques, forest survey, carbon stock assessment, vegetation dynamic study, big data treatment and processing, ArcGIS and remote sensing. Below are brief summaries of the team members' experience:

Abraham Baffoe, Assessment oversight

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. As the

Forest Programme Leader at the WWF West Africa Forest Office, he coordinated several forestry projects and provided technical support to the Forest Law Enforcement, Governance and Trade (FLEGT)/Voluntary Partnership Agreement (VPA) process. He has also provided training and technical support to companies on forest certification for the Global Forest and Trade Network.

Abraham has led several HCV and baseline assessments for forestry, rubber, coffee and palm oil operations. These include new plantation developments in several countries in Africa including Cameroon, Cote d'Ivoire, Ethiopia, Gabon, Ghana, Liberia, Nigeria, Tanzania and Zambia. Abraham is an RSPO approved team leader for HVC assessment.

Michael Abedi-Lartey, Assessment coordination

Michael is based in our Africa Regional Office where he co-leads on our Africa legality and responsible commodity supply chains programme, as well as in HCV/HCS assessment. His broad interests cover environmental systems analysis and management, protected areas management, remote sensing/GIS, project planning/implementation, law enforcement, team-building, community participation, land use planning, and institutional capacity-building. He also has a keen interest in species (primates and bats) and habitat conservation, with a long-term focus on landscape restoration.

Michael specializes in conservation and natural resources management, with over 21 years of extensive experience in several countries in West Africa, including Ghana, Cote d'Ivoire, Liberia Togo and Burkina Faso. After obtaining a BSc in Natural Resources Management (KNUST, Ghana) in 1994, he held various technical and senior management positions over the next 12 years with the Ghana Wildlife Department (Forestry Commission), including running a zoo, national park, the national bio-monitoring unit, and monitoring and evaluation.

Michael joined the Liberia Country Office of Fauna & Flora International in 2006 as Chief Technical Advisor in the country's post-conflict Protected Areas management and in HCV and Environmental and Social Impact Assessment for oil palm development.

Since 2012, he has been a PhD candidate at the Max Planck Institute for Ornithology and University of Konstanz (Germany), researching on the role of fruit bats in forest regeneration in Afro-tropical landscapes. He also has an MSc in Geo-Information Science and Earth Observation (Twente, The Netherlands).

Armand YEVIDE, Flora survey coordination plus GIS and mapping

Armand's background is in agronomy, natural resources management especially ecology, forestry and agroforestry, in species distribution modelling under climate change scenarios, in long-term ecosystem monitoring, and in social network analysis. He has worked as consultant for the "Institut National de la Statistique et de l'Analyse Economique (INSAE)" on the dynamic of cash crop chains (Cashew, Sugar cane, Pineapple and Tabaco) in Benin. Additionally, he has more than 5 years of experience teaching undergraduate students in many private and public universities in Benin.

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 a number of scientific publication 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. Armand is fluent in French and English, and has basic communication skill in Chinese. He is currently a Project Manager in the Proforest Africa regional office and has been involved in several audits against various standards including RSPO, FSC and OECD.

Aristotle Boaitey, GIS and community consultation

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.

He has four years' experience providing structured training and technical support to forest-based industries and stakeholders on trade regulations and sustainable management. He has developed procedures and policies for wood processing companies in Ghana, leading to successful FSC Controlled Wood and Chain of Custody certification. He speaks English, French and Akan.

Akomaye Ashikem, Botanist/Floral survey team leader

Ashikem has several years of experience working with the Cross-River State Forestry Commission (CRSFC) as Forest Officer responsible for forest inventories. He has more than 10 years of experience in biodiversity assessment especially in monitoring economically valued tree species in the forests of Cross River State. He has participated in several HCV assessments undertaken by Proforest in Nigeria including in Edo and Cross River States. He has also participated in two HCV trainings conducted by Proforest.

Joseph Ugbe, Floral survey team member

Joseph has several years of experience working with the Cross-River State Forestry Commission (CRSFC). He has more than 10 years of experience working as the research expert in both wildlife and plants with special focus on aquatic species. Joseph has participated in several HCV assessments undertaken by Proforest in Nigeria including in Edo and Cross River States. He has also participated in two HCV trainings conducted by Proforest. He currently holds a position of *Higher Forest Superintendent* at the Cross-River State Forestry Commission.

Adesoji Akinwumi Adeyemi, Floral survey team member

Adeyemi is a *Senior Lecturer* in the Department of Forestry and Wildlife Technology of the Federal University of Technology in Nigeria. He has extensive experience in Forest Inventory and Biometrics with competences in Forest Mensuration and Measurement, Botanical Survey and Species Identification, Forest Ecology, Biodiversity Assessment and Monitoring, Fauna Survey, Wildlife

Population Analysis, Conservation, Forest Management, Remote Sensing/GIS, and a PhD in Forest Resources Management.

2.2 Methodology and procedure used

2.2.1 Desk-based literature review

A desk review of documents including paper and cadastral maps provided by Presco was carried out prior to the field assessment. The objective of the desk review was to identify the key landscape level concerns that are relevant for the assessment area and to also have a better understanding of the geo-physical characteristics of the landscape.

2.2.2 Planimetrics and land cover classification

Presco provided maps of its Sakponba concession in Edo State. 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 determine the land cover classes in the area. The figure 2 below presents the key outputs of the land cover classification. The satellite imageries were studied closely in order for the team to get a clearer picture of the nature of the vegetation cover, and to help inform sampling design.

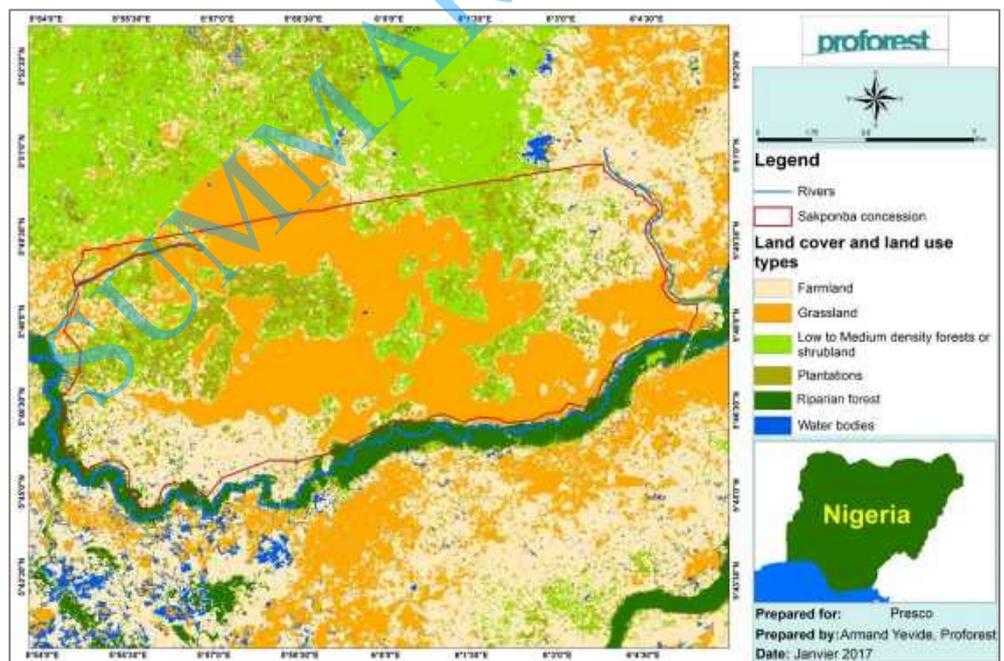


Figure 2: Land cover classification output for Presco's Sakponba concession.

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: LC81890562016027LGN00 acquired on the 27th January 2016).

2.2.3 Sampling and experimental design

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



Photo 1: Assessor taking the South bearing of the transect at its starting point.

cover classification within the concession area. An approximately 1% sampling rate was used to determine the sample size for the estimation of the total carbon stock for the proposed concession. 116 sampling plots were laid across the proposed concession. These plots were distributed along 39 transect lines oriented North South and, which were at least, a distance of 500 m from each other (Figure 3). 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. In some few cases, the total size of the plot was less than 1 ha because they were closer to the concession boundaries. At the starting points of each plots, a bearing was taken with a compass when surveying the quadrats to keeping the South 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 were measured, using a diameter tape. 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 number of quadrats in each vegetation type was used to estimate its area within the entire proposed concession.

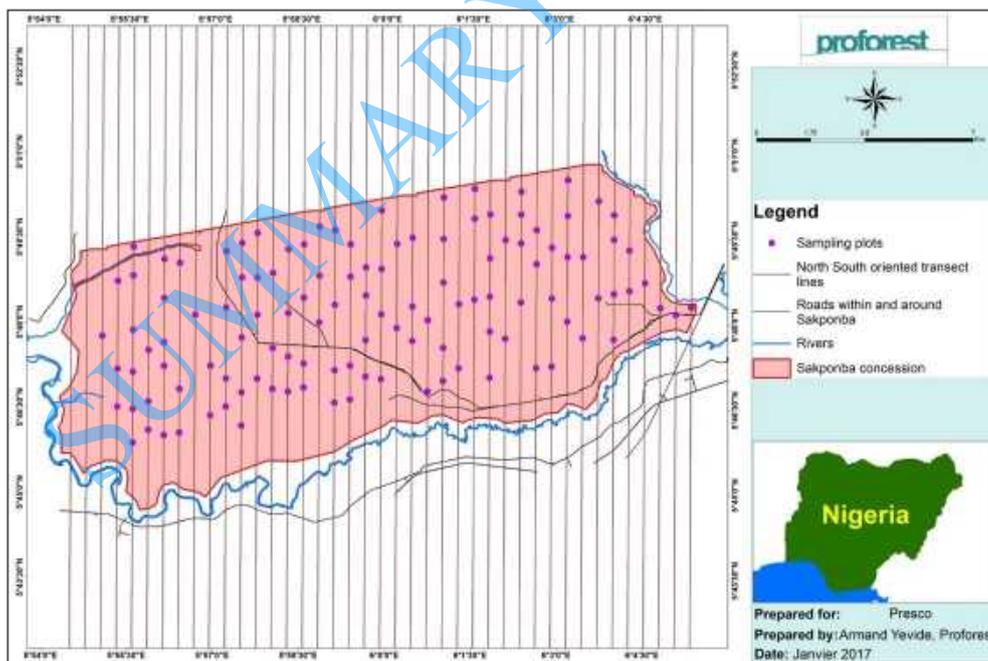


Figure 3: Distribution of sampling plots along transect lines across the proposed concession.

2.2.4 Data analysis

Above ground biomass was estimated using the latest improved allometric model of Chave *et al.* (2014) which uses tree height, stem diameter and wood density as covariates. To deduce carbon content from the biomass, we used the assumption that carbon concentration is about half (47.5%) of the biomass (Whittaker & Likens, 1973; Brown, 1997; Losi *et al.*, 2003; Nasi *et al.*, 2009). The biomass was estimated for each individual tree (including all stems for multi-stemmed trees) using the equation below:



Photo 2: Assessors measuring and recording the diameter at breast height of trees.

$$AGB = 0.0673 \times (\rho D^2 H)^{0.976}$$

Where **AGB** is aboveground dry biomass (in kg); ρ is wood density (in g/cm³) **D** is diameter at breast height (in cm) and **H** is the height (in m).

The underground or belowground biomass (BGB) was deduced using the assumption that, for each individual tree, the belowground biomass represents 20.5% of the aboveground biomass (Mokany *et al.*, 2006). Therefore, the total biomass was equal to 1.205 * AGB.

Wood density was compiled from the Global Wood Density Database (Chave *et al.*, 2009; Zanne *et al.*, 2009), and from the African Wood Density Database (Carsan *et al.*, 2012). Of the 77 species recorded in the inventory of the proposed concession, wood density was available for 47 species (61.0%). For the remaining species not reported in these databases, we used the mean wood density of the matching genus (21 species) or matching family (9 species).

A 30 m resolution satellite imagery retrieved from the USGS's EarthExplorer webpage (<http://earthexplorer.usgs.gov/>) was used to stratify the landscape of the proposed concession. The retrieved satellite image (Scene Identifier: LC81890562016027LGN00) was acquired on the 27th January 2016. Once retrieved from the EarthExplorer, the raw satellite image was pre-processed and classified into 6 classes (riparian forest, low to medium density forest, grassland, farmland, plantations, and water bodies) using the maximum likelihood algorithm.

Microsoft Excel, QGIS version 2.14.3 and ArcGIS version 10.2 were the three main programmes used to process the data collected.



Photo 3: Assessors working along a transect line.

2.3 Team responsible for the mitigation plan

For sustainability and in order to assure that plantation development does not adversely affect the structure and functioning of the landscape containing the proposed concession, Presco has constituted a team to draw a mitigation plan and assure its implementation on the ground (Table 2). Below is the list of the members of the team and their position in the company.

Table 2: List of the team responsible for the mitigation plan.

Name	Office location	Position
Florent Robert	Edo State, Nigeria	Group Sustainability Manager
Paul Hameed	Edo State, Nigeria	Sociologist
Benedicta Okholo	Edo State, Nigeria	HSE

3 Carbon stock assessment and summary

3.1 Description of the assessment area

Lying between the latitudes 4° and 14°N, and the longitudes 2° and 15°E, Nigeria is a federal republic in West Africa, bordering Benin in the West, Chad and Cameroon in the East, and Niger in the North. Its coast in the south lies on the



Photo 4: Photo showing the extent of the grassland within the proposed concession.



Photo 5: Photo showing a riparian vegetation along a stream within the proposed concession.



Photo 6: Photo showing a Farmland (cassava farm) at the edge of a Low to Medium density forest or Shrubland in the proposed concession.

Gulf of Guinea in the Atlantic Ocean. It comprises 36 states with a total area of 923,768 km², making it the world's 32nd-largest country.

Due to its location in the Tropics, Nigeria is affected by four climate types (warm desert climate, warm semi-arid climate, tropical savanna climate and Monsoon climate) according to Köppen climate classification system. These four climate types are more humid when moving towards the coast leading to a forest to open woodland biome predominating in the south of the country. The major and minor vegetation types are savanna and desert respectively.

The proposed concession is located in Edo State which is an inland state in Southern part of the country. Its capital is Benin City and it is bounded in the North and East by Kogi State, in the South by Delta State and in the West by Ondo State. It shares about 7.9 km of its boundary with Anambra State in the East. The concession landscape is highly modified habitat consisting of extensive grassland. The rest of the area is characterized by farmlands, oil palm plantations and bush fallows, with very limited patches of low to medium density forests and riparian forests. Based on the assessment data collected, the landscape of the proposed concession was classified into six land use classes: riparian forest, low to medium density forests or shrubland, plantations, farmland, grassland and water bodies.

The table below presents the area covers by each type of land cover. It reveals that, the dominant land covers of the proposed concession are indeed the grassland (44.72%) followed by the farmland (25.96%). The least represented land use covers are riparian forest (0.66%) and water bodies (0.55%).

Table 3: Size of land use types of Sakponba proposed concession.

Land use classes	Total area covered (ha)	Proportion (%)
Farmland	3747.9	25.96
Grassland	6456.0	44.72
Low to Medium Density Forests or shrubland	2097.5	14.53
Plantations	1960.7	13.58
Riparian forest	95.0	0.66
Water bodies	79.0	0.55
Total	14,436	100.00

NB: The figures in the table come from the land cover classification of the satellite imagery retrieved from the EarthExplorer webpage of the United States Geological Survey (USGS).

3.2 Results of the carbon stock assessment

3.2.1 Biodiversity and vegetation cover dominant species

A total of 1,800 living trees belonging to 77 species, 67 genera and 30 families were recorded within the surveyed plots across the proposed concession area. The most abundant species were *Albizia zygia* (322 individuals), *Havea brasiliensis* (300 individuals), *Albizia lebbbeck* (199 individuals) and *Margaritaria discoiidea*

(143 individuals). Consequently, Albizia and Fabaceae were the most dominant genus and family respectively.

3.2.2 Total carbon stock distribution across the proposed concession

The figure 4 below shows the distribution of carbon stock across the Presco's Sakponba proposed concession. The estimated carbon stock varies from 0.03 tC/ha for the grassland to 4.6 tC/ha for plantations which are *Havea brasiliensis* dominated. The estimated carbon stock for the sampled plots was 153.91 tC and averaged 1.32 tC/ha. Extrapolated to the entire size of the proposed concession, the total carbon stock was 19,208.06 tC (Table 4).

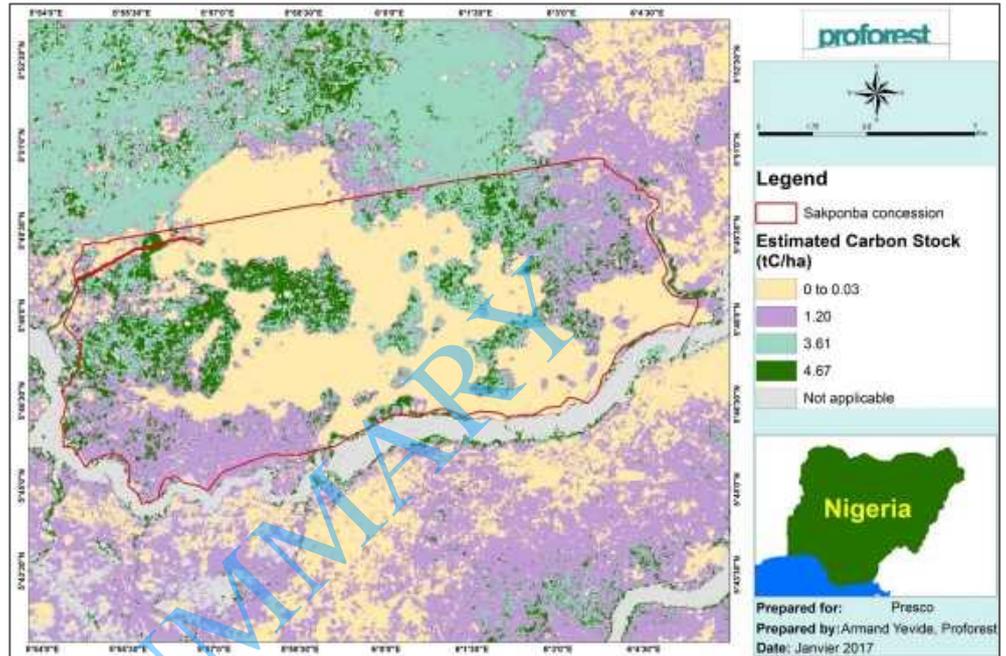


Figure 4: Distribution of carbon stock estimated for Sakponba proposed concession.

Table 4: Total carbon stock estimated in the different vegetation types of Presco's Sakponba proposed concession.

Vegetation types	Sampled area				Total concession	
	Sampled area (ha)	Proportion	Total carbon (tC)	Carbon (tC/ha)	Total area (ha)	Total carbon (tC)
Farmland	13.04	0.11	15.63	1.20	1587.96	1903.36
Grassland	67.68	0.58	1.78	0.03	8372.88	220.21
Low to medium density forest	28.68	0.25	103.59	3.61	3609	13035.44
Plantation	7.04	0.06	32.91	4.67	866.16	4049.05
Total	116.44	1.00	153.91	1.32*	14436	19208.06

* this value is equal to the total carbon obtained for the sampled area (153.91 tC) divided by the total sampled area (116.44 ha).

The estimated carbon stock for the different vegetation types has revealed that Presco's Sakponba proposed concession has no significant carbon sink to be set aside.

3.2.3 Description of the vegetation types across Sakponba concession

During the assessment, trees having more than one stem were encountered. There represents 22.4% of the total number of trees. For those multiple-stemmed trees, the number of stems per tree varies from 2 to 12 regardless of the vegetation types. However, the proportion of multiple-stemmed trees is greater than 21.0% for the four vegetation types. Tree density was the highest in the low and medium density forest and the smallest in the grassland. The average diameter varies from 16.25 ± 5.72 cm for the grassland in the plots where trees were encountered to 22.67 ± 13.07 cm for the plantations. The basal area, that expresses forest productivity, was less than $1.0 \text{ m}^2/\text{ha}$. Trees height stretches from 3 to 55 m irrespective of the type of forest (Table 5 and 6).

Table 5: Number of individual trees recorded and tree density in the identified vegetation types.

	Farmland	Grassland	LMDF	Plantations
Area (ha)	13.04	67.68	28.68	7.04
Single stem	127	28	1124	117
Multiple stem	34	11	314	45
Number of stems	2 to 5 and 7	2 to 6	2 to 7 and 12	2 to 5 and 8
Total number of trees	161	39	1438	162
Density (trees/ha)	12.3	0.6	50.1	23.0

*LMDF = Low to medium density forest

Table 6: Dendrometric characteristics of trees in the different vegetation types.

		Farmland	Grassland	LMDF*	Plantation
Diameter (cm)	Min	10	10	10	10
	Max	82	44	92	91
	Average	20.75	16.25	19.35	22.67
	Standard deviation	10.42	5.72	8.97	13.07
Height (m)	Min	4	4	3	3
	Max	21	10	55	28
	Average	5.78	4.65	5.76	7.26
	Standard deviation	1.98	0.93	2.09	4.42
Basal area (m^2/ha)	Average	0.36	0.23	0.45	0.64
	Standard deviation	0.41	0.19	0.48	0.92

*LMDF = Low to medium density forest

The figure 5 below shows the distribution of the number of trees as function of the diameter classes for each vegetation type. It reveals that most the trees have a diameter at breast height less than 50 cm. regardless of the vegetation type, more than 90% of the trees has a diameter comprises between 10 to 40 cm. Also,

it has been noticed that, there is 2.5 times more big trees (diameter greater or equal to 40 cm) in the plantations than in the low to medium density forest. This has translated in the estimated carbon per hectare.

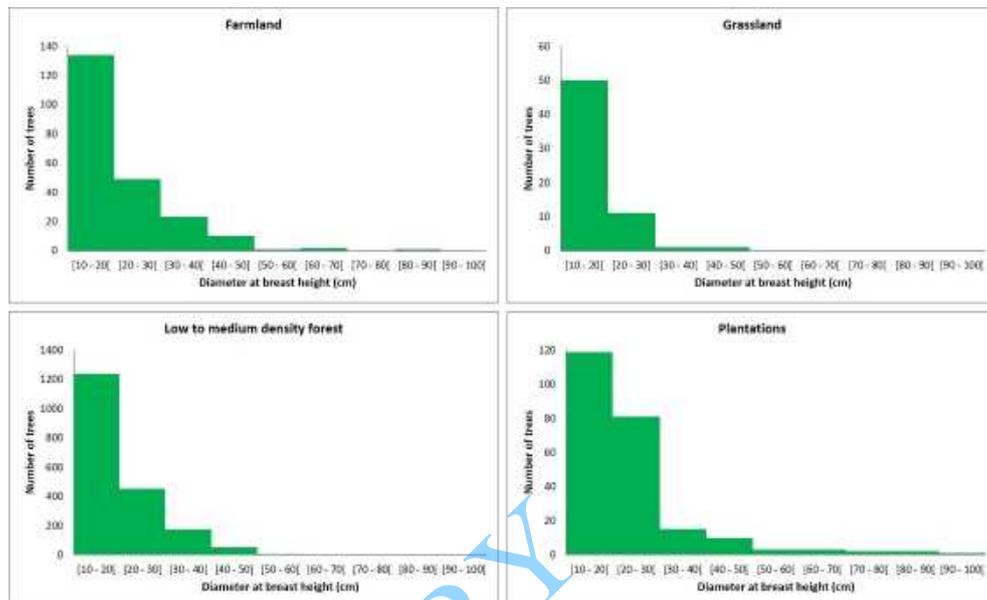


Figure 5: Pooled dbh-distribution of trees in the secondary forest.

Regardless of the vegetation type, *Havea brasiliensis* was the species with the highest total carbon stock. 90% of the abundant species identified were present among the top 10 species that contributed for 80.9% of the estimated carbon (Figure 6). *Chrysophyllum albidum* happened to have the highest carbon stock per tree (2.30 tC/tree).

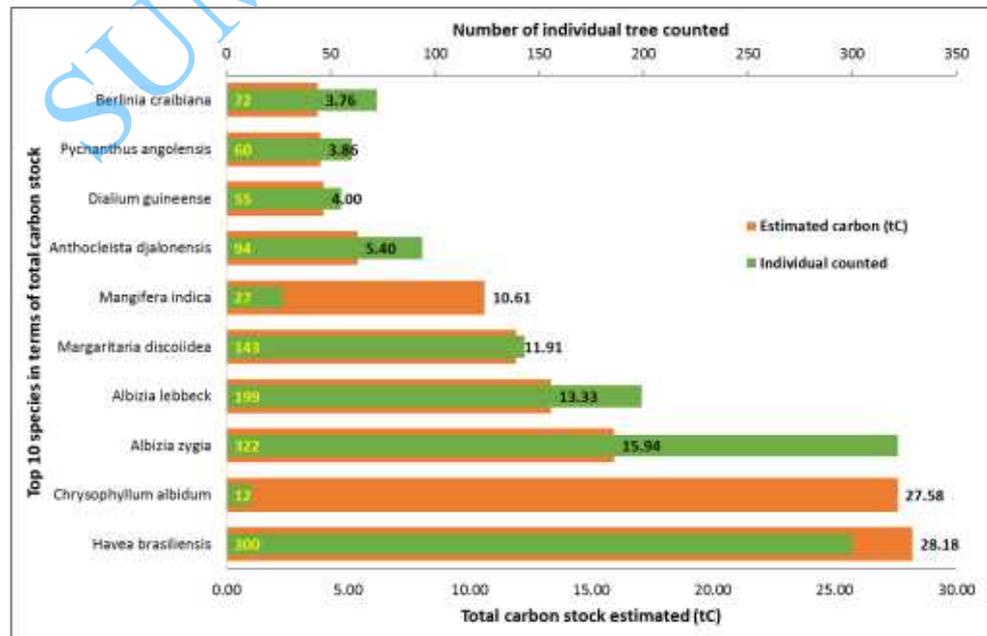


Figure 6: Top ten tree species in terms of total carbon stock with their abundance.

3.3 Summary of carbon assessment

The proposed concession does not contain any primary forest. Its vegetation is dominated by grassland and farmland.

Mean carbon stock is 1.32 tC/ha. This low carbon stock recorded can be attributed to the low density of trees (21.5 trees/ha) as well as the higher proportion of small trees and the vegetation types of the proposed concession's landscape.

Based on the proportion of each vegetation type in the concession, the total carbon stock of trees is 19,208.06 tons of carbon (Table 7).

Table 7: Total carbon stock estimated as function of tree diameter classes and site.

Diameter classes (cm)	Estimated total carbon stock (tC)	
	Sampled area	Total concession
[10 - 20[	31.09	3880.57
[20 - 30[	34.21	4269.70
[30 - 40[	30.17	3765.31
[40 - 50[	19.60	2446.35
[50 - 60[	4.67	582.51
[60 - 70[	7.21	900.42
[70 - 80[	4.67	582.85
[80 - 90[	17.61	2197.54
[90 - 100[	4.67	582.81
Total	153.91	19208.06

3.4 Location map

The Presco's Sakponba proposed concession is located in a highly degraded landscape which is characterised by grassland and farmland that represent 70.68% of the total area of the concession.

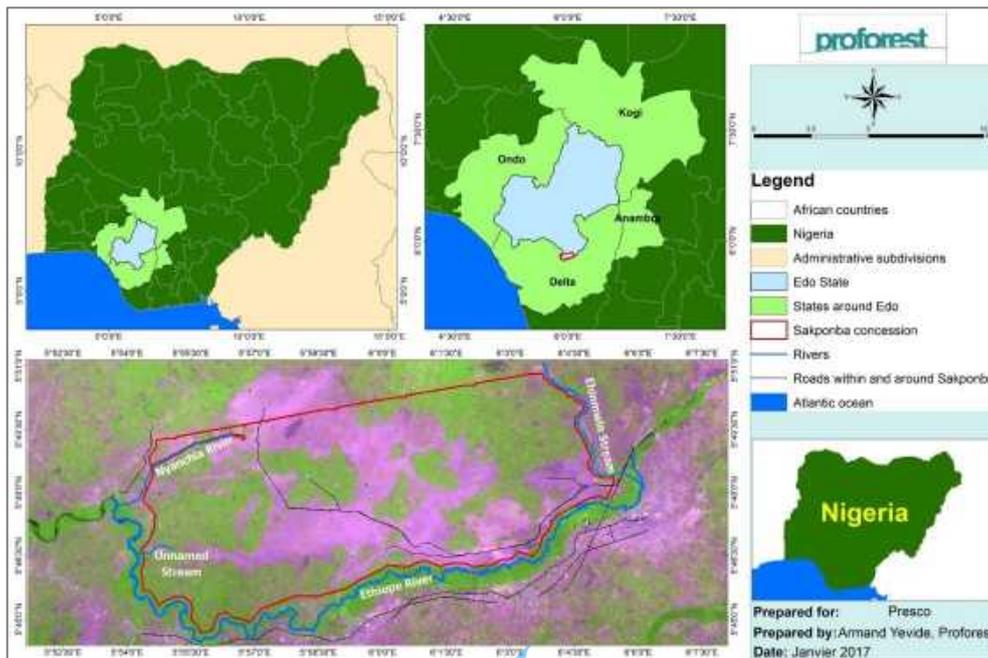


Figure 7: Location maps indicating area of new plantings at landscape level and property level.

3.5 Carbon stock and HCV map

The figure below shows an outline of the area proposed to be set aside as HCVs.

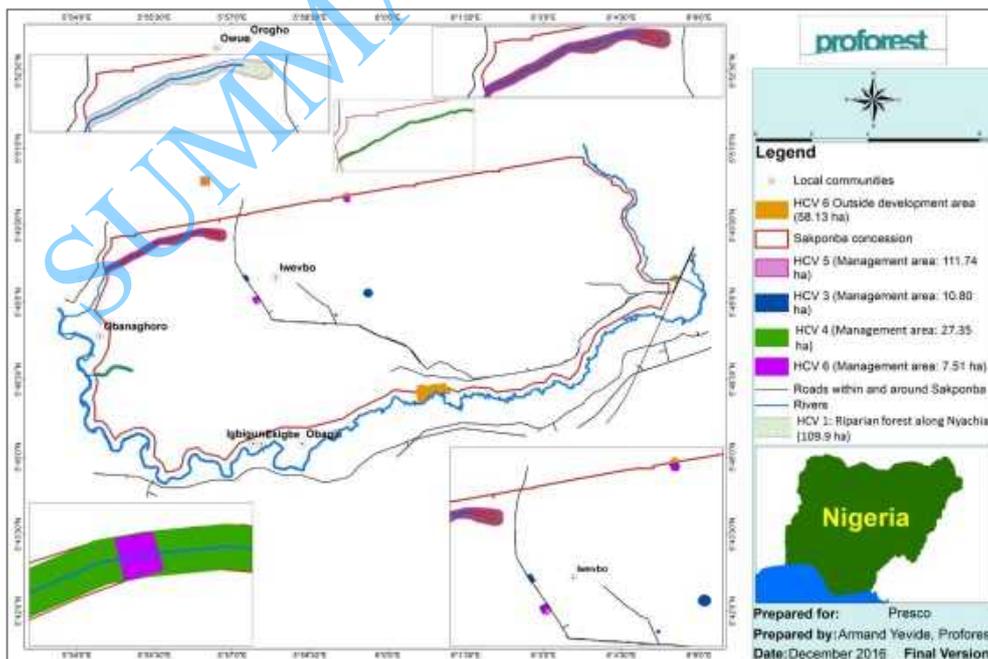


Figure 8: HCVs and HCVs management areas for Presco’s Sakponba proposed concession.

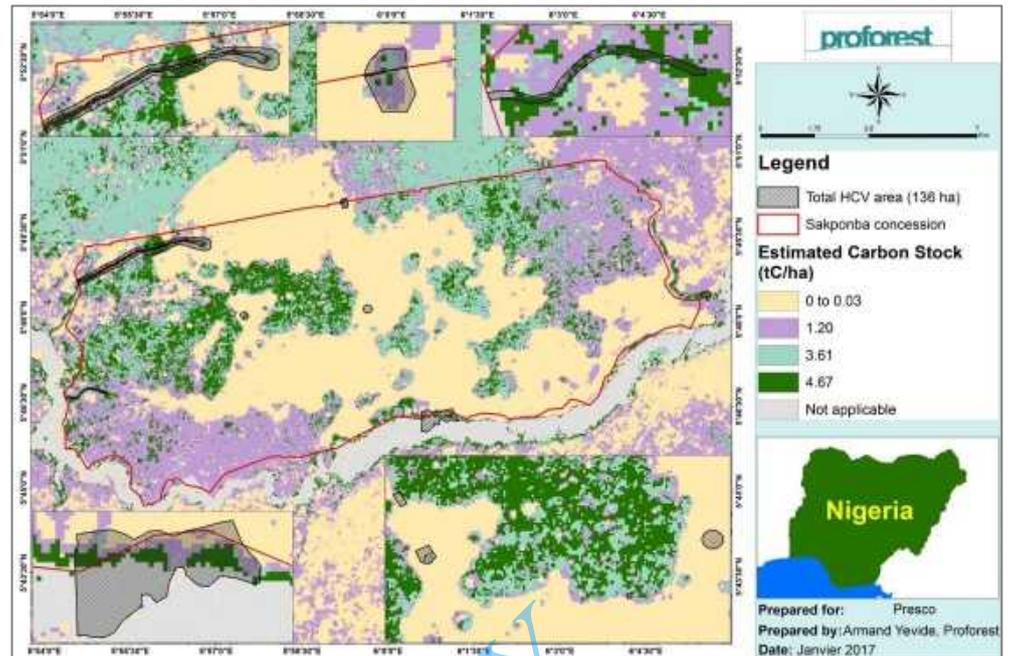


Figure 9: HCVs and HCVs management areas overlaid with the estimated carbon stock for Presco's Sakponba proposed concession.

A total of 136 ha including 109.9 ha of riparian forest was recommended to be set aside as HCVs. The areas recommended to be set aside are based on findings from the assessment, consultations and engagement with experts as well as local communities. Since none of the vegetation types recorded more than 30 tC/ha, no significant carbon area is present in the proposed concession. Therefore, setting aside the identified HCVs would ensure a sustainable and responsible production.

4 Summary of GHG emissions

The preceding section makes recommendations for set-aside areas for protection as HCV management areas and has pointed out the inexistence of high carbon stocks areas within the proposed concession. Therefore, an area of 136 ha (representing 0.94% of the total concession areas) has been set aside as HCV management areas for protection. Therefore, the remaining land of 14,300 ha (99.06% of the total gross concession areas) may be used for oil palm development.

The section below categorises the anticipated emissions under the recommended scenario into two categories: field emissions and mill emissions. The summary of the total estimated emissions and sequestration is presented below sections.

For the Presco's Sakponba proposed concession, the establishment of the new oil palm plantation, through land preparation operations, seedlings transportation, and plantation maintenance will certainly contribute to the emission of GHG into the atmosphere. Furthermore, in the future, the transportation of fresh fruit bunches from the estate plantations to the mill as well as the use of fertilizers will add to this GHG emissions.

However, protecting natural carbon sinks like forests and oceans, or creating new sinks through silviculture or green agriculture contribute to sequestering 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.

4.1 Field emissions

The main sources of emissions are expected to emanate from:

- Landuse change
- Transport fuel
- Fertiliser usage

The concession does not contain any peatlands, and largely consist of mineral soils. Therefore, there are no anticipated emissions from decomposing peat. The figure below summarises the expected emissions from land clearance, fuel usage and fertilisers. Default values have been used for estimating fertiliser use, fossil fuel usage and transportation.

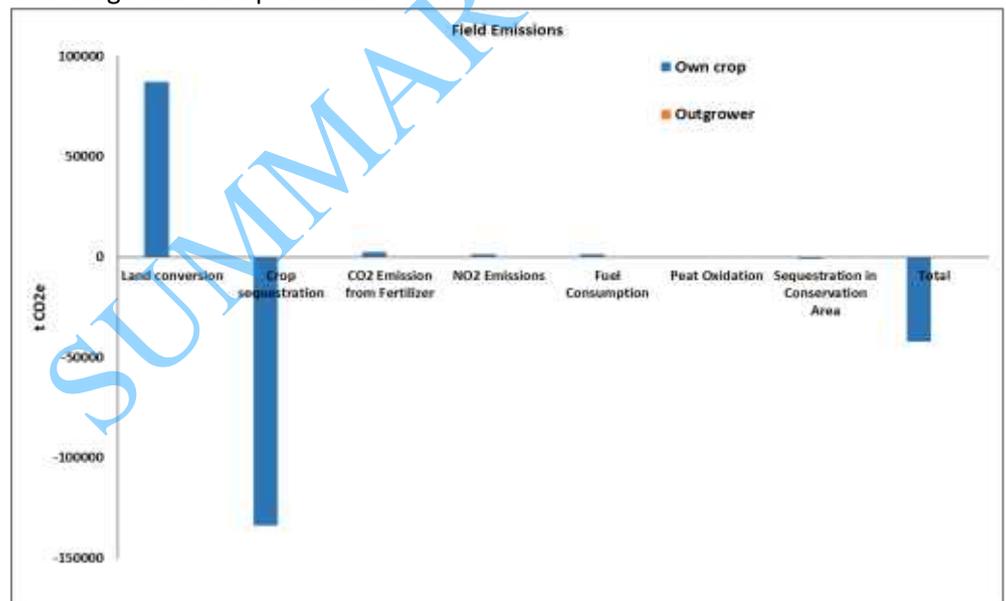


Figure 10: Field emissions from the proposed project.

The findings from this assessment demonstrate that the concession area consists of grassland, farmland, low to medium density forest or shrubland, plantations, riparian forest and water bodies, with an average carbon stocks of 1.32 t/ha. The carbon sequestration potential of the current vegetation at Sakponba is very low and converting the proposed concession to oil palm could yield a potential gain in carbon stocks. In addition to this, recommendations have been made for setting aside of areas for conservation purposes. It is expected that this would also serve to store some additional carbon of up to 972.4 tonnes.

4.2 Mill emissions

This operation does not come with any new mill establishment. All FFB produced from the new concession would be sent to the existing mill at Obaretin.

5 Management and mitigation plans

5.1 Project description

The Presco's Sakponba project will entail oil palm plantation development only. No new mill will be established, as it is expected that the FFB produced from the operation will be transferred to the existing mill at Obaretin which is roughly located at 41.25 kilometres from Sakponba proposed concession in the same Edo State (Figure 11).

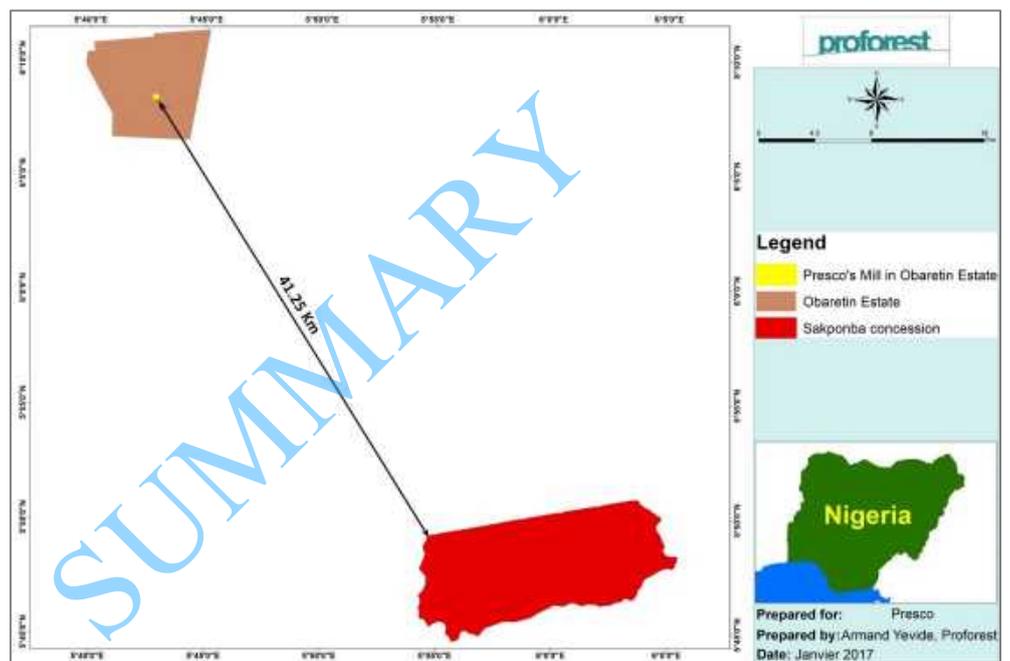


Figure 11: Location of the company's mill from the proposed concession.

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

Other major emission sources are not considered to be relevant in this case, given that the project does not include the creation of a new mill:

- Emissions from Palm Oil Mill Effluent
- Emissions associated with fossil fuel and electricity

5.2 Scenario analysis

Since no significant carbon sink was identified, two main scenarios were considered and analysed. The estimation of the GHG emissions were done using

the RSPO PalmGHG Calculator Version 3.0.1. The table 8 and the figure below present the results of the analysis.

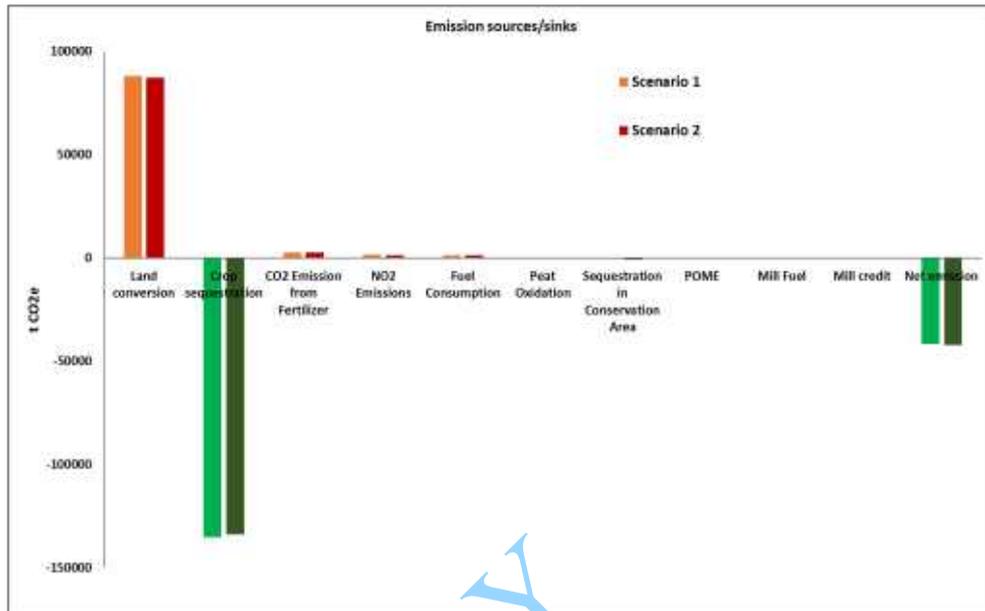


Figure 12: Expected emissions from proposed development.

Scenario 1

This first scenario is based on the recommendations of the HCV assessment and assumes that there is a minimum set aside area of 136 ha. The remainder of the concession is planted. The analysis shows that with this scenario, there would be a net sequestration of 42,324.19 tCO2e. This scenario assumes that the planted area will be able to sequester about 133,872.8 tCO2e, whilst the land clearance would emit 87,230.0 tCO2e. The conservation credit in this scenario is about 972.4 tCO2e.

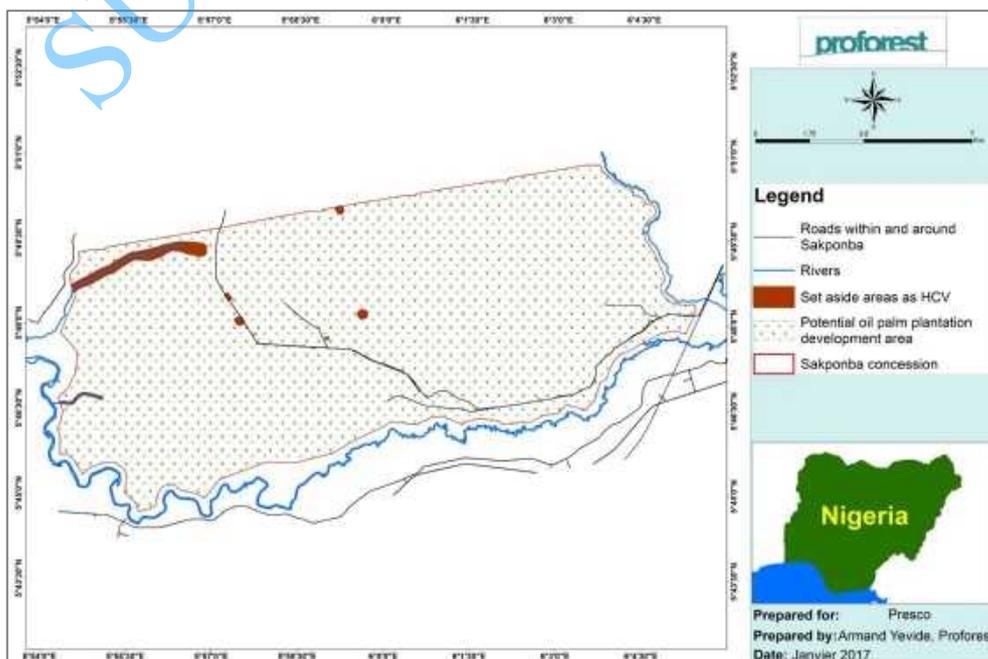


Figure 13: Scenario 1 illustrating the minimum of 136 ha recommended HCVs to be set aside and the potential oil palm development area.

Scenario 2

The scenario two is based on the assumption that there are no set aside areas in the concession and that the entire areas will be replaced with oil palm plantations. This increases the amount of emissions from land preparations from 87,230.0 tCO₂e in Scenario 1 to 88,059.6 tCO₂e. The crop sequestration under this scenario would be slightly higher, the additional emissions from fertiliser and fuel use means that this option would yield a net sequestration of 41,745.06 tCO₂e.

Table 8: Carbon emissions/sequestration under two different scenarios.

	Scenario 1	Scenario 2
Set aside areas	0 ha	136 ha
	t CO ₂ e	t CO ₂ e
Land conversion	88,059.6	87,230.0
Crop sequestration	-135,145.98	-133,872.79
CO ₂ Emission from Fertilizer	2,598.48	2,574.0
NO ₂ Emissions	1,443.6	1,430.0
Fuel Consumption	1,299.24	1,287.0
Peat Oxidation	0	0
Sequestration in Conservation Area	0	-972.4
POME	0	0
Mill Fuel	0	0
Mill credit	0	0
Net emission	-41,745.06	-42,324.19

Because the landscape of the proposed concession is dominated by grassland and farmland, the sequestration potential of the vegetation at Sakponba is very low. Based on the obtained results, the two scenarios were not significantly different from each other. The two scenarios would contribute to a net sequestration of a minimum of forty-one thousand tonnes of CO₂. It appears that, the Oil palm development at Sakponba will contribute to sequester more carbon than the current vegetation of the concession 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 40 times the carbon sequestration potential of the current grassland and farmland dominated vegetation of Sakponba.

5.3 Management recommendations

5.3.1 Set-aside areas

The assessment has recommended for the setting aside and protection of a minimum of 136 ha of natural areas including 109.9 ha of riparian forest along the Nyanchia river in the North-Western part of the Sakponba concession. 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 9: Recommended buffer zones for rivers and streams in the concessions

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

5.3.2 Managing emissions from fertiliser

Emission from fertilisers is a major source of GHG on the plantation. In order 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.

5.3.3 FFB transport

In order 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.

SUMMARY

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