Natural Habitats

organic products grown in a sustainable habitat

CARBON FOOTPRINT REPORT

NATURAL HABITATS GROUP
CPO – PKO PRODUCTION AND COMMERCIAL OFFICES

2017

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1 INTRODUCTION

Oil palm is a productive and efficient crop. It has become a major source of vegetable oil in the world, this is due to its low price and high yields, the demand for it is continuously growing. Typically, oil palm is cultivated as a monoculture, using conventional agricultural techniques. According to the Intergovernmental Panel on Climate Change (IPCC)[1], monoculture agriculture currently accounts for 10-12% of global greenhouse gas (GHG) emissions and this figure is expected to rise.

GHGs attributed to monoculture by the IPCC include: emissions from soils, biomass burning and manure management. Sources with lesser mentions, include those generated from land-use change, the use of fossil fuels for mechanization, and agrochemical and fertilizer production. The most significant indirect emissions are changes in natural vegetation and traditional land use, including deforestation and soil degradation[2]. Deforestation has been a common land preparation practice in many palm oil regions that leads to significant losses of carbon stocks and considerable CO2 emissions. This contributes to climate change, whilst at the same time, threatening the long-term sustainability of the palm oil production and agriculture in general.

Natural Habitats Group (NHG) produces organic palm oil, promoting different sustainable and organic production practices where biodiversity and natural cycles adapted to local conditions, rather than the use of chemical inputs with adverse effects. “It combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved”[3].

The company operates a strict forest conservation policy that prohibits the conversion of primary and secondary natural forests into agricultural production areas, tree plantations, or other depredating land uses. The policy stipulates the necessary precautionary actions for forest preservation and describes the Zero Burning Technique.

This report presents the results of the calculation and evaluation of the GHG emissions generated from operational and commercial activities of Natural Habitats Group in 2017. The company is strongly committed to minimize its environmental impact and work towards carbon neutrality. Hence, the estimation will serve as a baseline for the future initiatives to reduce the carbon footprint and will help to monitor the progress.

2 OBJECTIVE

The main objective of the report is to estimate the total carbon footprint of Natural Habitats Group commercial and operational activities and to determine the total carbon offset to achieve neutrality.

Additionally, the index of the greenhouse gas emissions for the products produced is calculated to set offsetting targets for the following years.

1 http://www.ipcc.ch

2 J Germer, J. & Sauerborn, J. Environ Dev Sustain (2008) 10: 697. https://doi.org/10.1007/s10668-006-9080-1

3 Infoagro – IFOAM case study.

3 SCOPE

The scope of the study covers the operational and commercial activities of Natural Habitats Group in Ecuador, Sierra Leone, the Netherlands and the United States of America. The estimation of the GHG emissions is prepared for 2017 from the plantation level up to the sale of the final products. The study does not consider emissions associated with the shipment of the products from the production countries to the customers in Europe and North America.

3.1. Supply Chain Overview

- In 2017, the company sourced Fresh Fruit Bunches (FFB) from 136 independent farmers covering 6,525 hectares in Ecuador and from 1,842 independent smallholders on 4,681 hectares in Sierra Leone.

- In both countries, farmers manage their plantations following organic production practices, including: no deforestation (plantations were settled in agriculture land), no use of synthetic fertilizers, neither machinery for maintenance.

- FFB or loose fruits are delivered by trucks to the Natural Habitats mills. The mills produce one main product: crude palm oil (CPO), and three by-products: palm kernel (PK), empty fruit bunches (EFB) and fiber.

- EFB are sent back to the farms and the fiber is used as fuel in the milling process.

- In Ecuador, palm kernel is transported by trucks to a subcontracted kernel mill in which palm kernel oil (PKO) is produced.

- The oil is kept in storage tanks before shipment orders arrived.

- Natural Habitats Group has three commercial offices, located in Quito (Ecuador), Rotterdam (the Netherlands), and Boulder (USA).

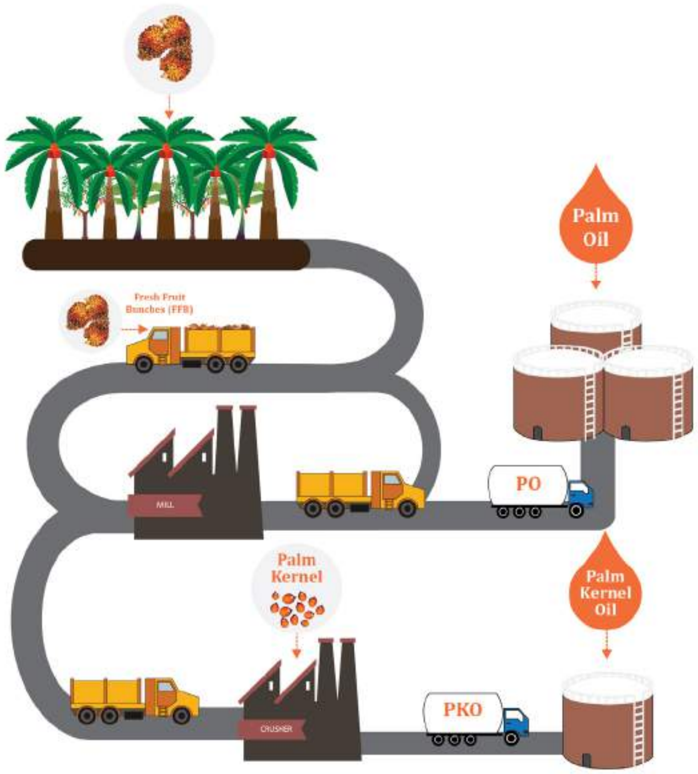

Figure 1 Graphic Representation of Ecuador Operational Activities

Data was collected on direct emissions (Scope 1), energy indirect emissions (Scope 2) and the indirect emissions (Scope 3). The study is limited to the production of main products: Crude Palm Oil and Palm Kernel Oil and the emissions associated with the commercial activities of the group.

4 DESCRIPTION OF OPERATIONS

Natural Habitats Group started its operations in Ecuador in 2013. Since then, the operations have been certified with the highest production and business sustainability standards[4], and several programs have been created to guarantee a positive social impact, biodiversity enhancement, and environment protection.

In 2014, NHG replicated its organic and fair trade business model in Sierra Leone, by taking over a small CPO mill, Nedoil Limited. The mill is located in Yele Town, in the center of Sierra Leone. Natural Habitats started the certification process right after the acquisition, with a field assessment and validation of the farmers supplying to the mill. In 2017, 1842 smallholder farmers have been supported in participating in an Internal Control System (ICS) scheme and obtaining organic certification.

Fresh Fruit Bunches

FFB and loose fruits are supplied by independent farm holders. In Ecuador, the farmers are located in the province of Esmeraldas. The organization has a team of agronomists who visit the plantations on a regular basis to advise and teach producers about organic fertilization, use of organic inputs, Integrated Pest Control Systems, harvesting, pruning, and general good agriculture practices. Additionally, most of the farmers in Ecuador have primary and secondary forest preserved in conservation areas, and as part of their organic management practices, are continuously replanting native trees as buffer zones to protect nearby water courses (Figure 2).

In Sierra Leone, independent smallholders are organized in Farmer Field Schools, these are clustered into Farmer Based Organizations. Each school has a demonstration farm, which serves as an educational platform, where farmers can learn aspects of organic agriculture. Deforestation of primary and secondary forests and burning are strictly prohibited by Natural Habitats Group.

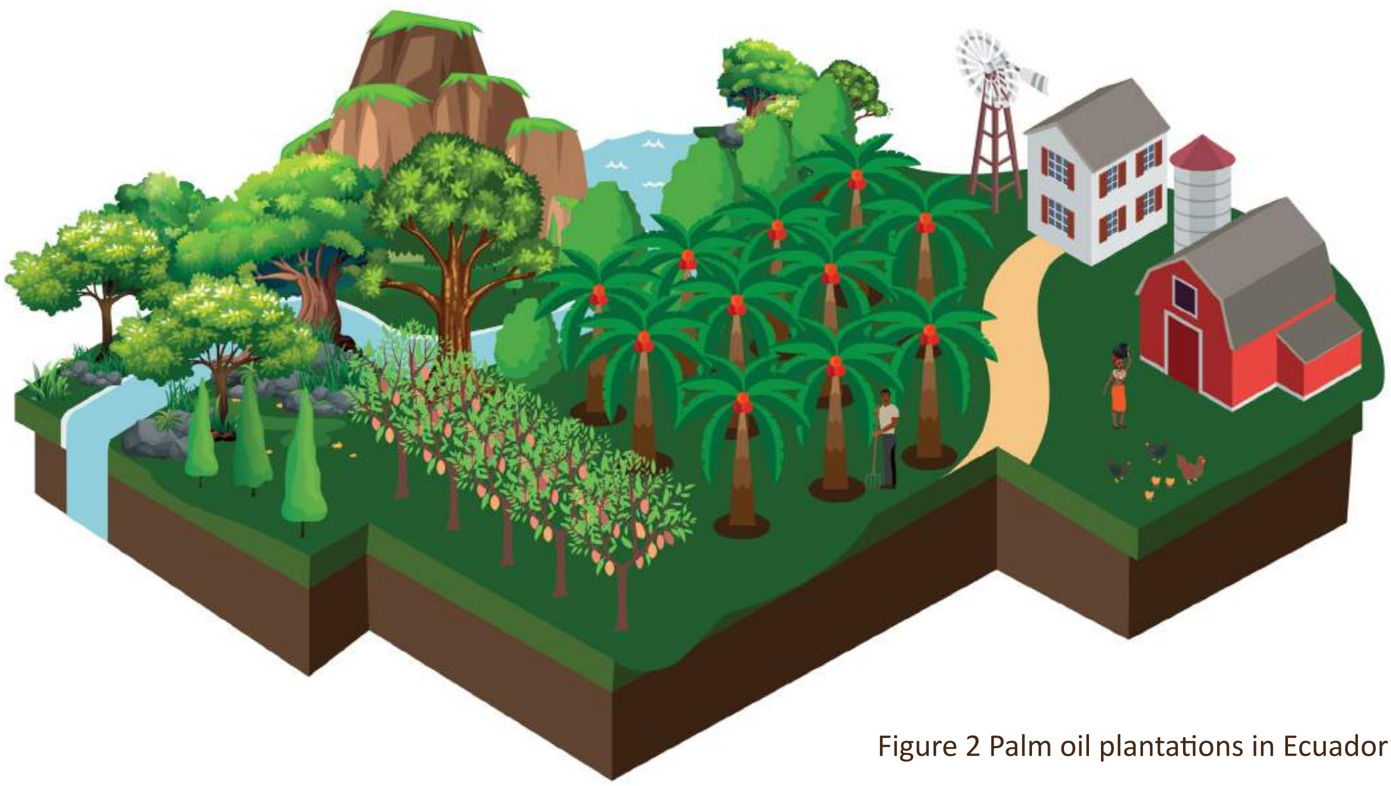

Figure 2 Palm oil plantations in Ecuador

[4] Organic, Fair for Life, RSPO P&C and SCC, HACCP, GMP+, Kosher, Rainforest Alliance.

4 DESCRIPTION OF OPERATIONS

FFB Transport

Once harvested, FFBs are transported to the mill where they are pressed to extract the oil. There are several ways to transport FFBs to the mill. In Ecuador, some farmers deliver their fruit to the special collection points, where the purchasing manager registers and collects the fruits. Other farmers deliver their fruits directly to the mill. In Sierra Leone, both loose fruits and fresh fruit bunches are collected directly from the farmers. The fruits are transported by the company's trucks and local transport that use diesel fuel. Figure 2 illustrates the transportation and production flow of Nedoil.

Extraction Process

At the Viche mill, in Ecuador, the fruits are processed to produce crude palm oil, which later is exported to the EU and US markets, or is processed by a partner refinery, La Fabril in Ecuador. The extraction process is depicted on Figure 4. At the Nedoil mill, the production flow slightly differs. The fruits are taken out from the bunches manually and then they are pressed to produce the crude oil (Figure 3). Both mills follow strict policies on health and safety, waste management and energy use, which were developed to ensure safe production and to minimize any environmental impacts.

Additionally, after fruits are pressed, the kernels of the fruits are transported to a crusher-mill, Aexav, to produce kernel oil. Currently, NHG only produces palm kernel oil in Ecuador.

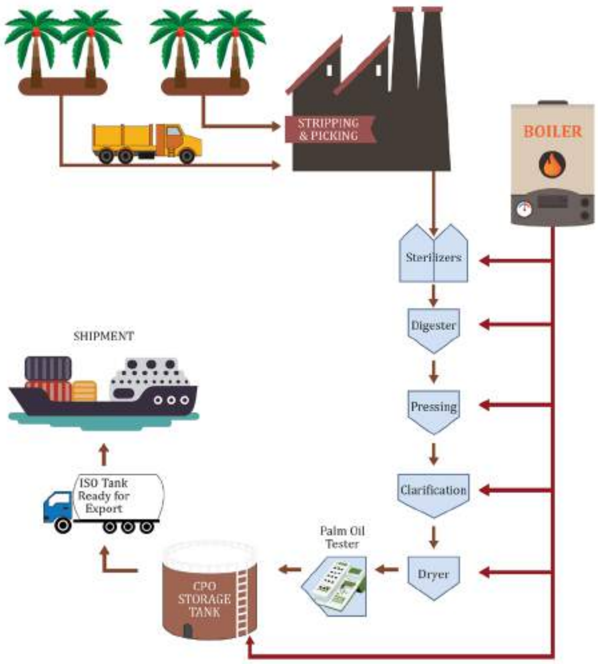

Figure 3 Nedoil's Production Flow

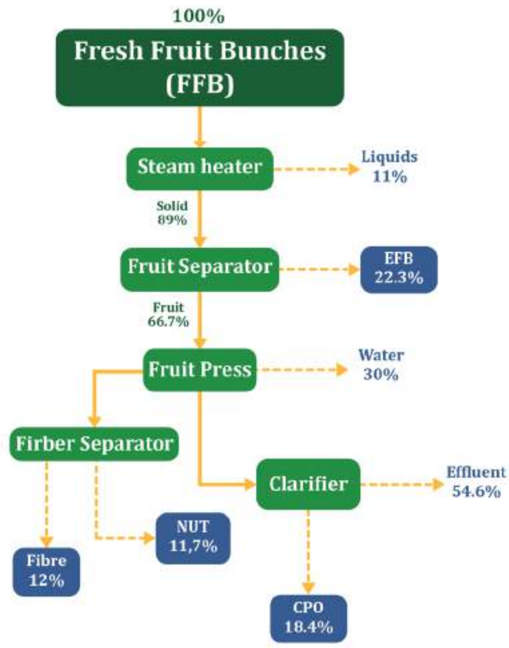

Figure 4 Extranatu's Crude Palm Oil Extraction Scheme

Shipment

NHG then ships the palm oil and its derivatives from Guayaquil port to Europe (Rotterdam), Canada (Toronto), and the USA (Oakland, Portland, Savannah, New York, New Jersey, Long Beach and Port Elizabeth). Where it is either stored in a specific warehouses or sold directly to the customers. The oil produced at Nedoil is currently shipped only to Rotterdam. NHG works only with partners who are certified with organic standards.

Commercial Offices

Natural Habitats Group has three commercial offices in Quito, Rotterdam and Boulder. These offices provide trading, logistical, administrative, and monitoring support to the operational sites.

5 METHODOLOGY FOR ESTIMATION AND CALCULATION

5.1 Plantation Level Emissions

5.1.1 Emissions Related to the Use of Fossil Fuels for Plantation Internal Transport

Fossil fuel consumption mainly comprises of diesel used by transportation employed in maintenance, harvesting and collection of the fresh fruit bunches. Additionally, the fuel consumption of the Internal Control System inspectors, who visit the farmers through the year to perform internal audits, was considered. For this report, the guidelines of the Intergovernmental Panel on Climate Change (IPCC) of 2006 for National Greenhouse Gas Inventories were used. Table 1 presents emissions factors used to calculate the emissions from the fuel consumption on the plantation level.

5.1.2 Emissions Related to the Use of Fertilizers

Typically used palm oil fertilizer inputs comprise of nitrogen fertilizers (either ammonium nitrate, ammonium sulphate, urea and/or ammonium chloride), phosphate rock (P2O5), potassium chloride (K2O) and kieserite (MgO). ERIA[5] have estimated that overall CO2e emissions related to the use of the fertilizer mix equal 17.3 kg CO2-eq /ton FFB or, at 15 tons FFB/ha*yr, 330 kg CO2-eq /ha*yr.

Natural Habitats only works with the producers who apply organic agricultural practices. To fertilize the soil, the growers apply natural compost such as empty fruit bunches and palm fronds. At the moment, there are no quantitative data available to calculate the GHG effects of these practices.

5.2 Transport, Mill and Operational Emissions

To calculate operational emissions in Ecuador, Natural Habitats contracted the services of Sambito[6] S.A., a consultancy company dedicated to environmental projects. This is a well-established agency in Latin America that supports companies with the environmental studies and planning of the efficient use of resources, social responsibility and environmental commitment. For the calculation of the emissions in Sierra Leone, a similar methodology was used, with slight adaptations for the local circumstances.

The calculation of the emissions of each GHG (CO2, CH4, N2O, etc.) is expressed in Ton CO2-eq / year, using methods and calculation tools created and approved by experts of the Intergovernmental Panel on Climate Change (IPCC 2006); Protocol of greenhouse gases (GHG Protocol 2000), and National Centre for Energy Control (CENACE). The methodology used for calculation the operational emission is as follows:

- To estimate emissions from air travel, the guidelines of UNEP for calculating Greenhouse Gas Emissions for businesses and Non-Commercial Organizations were considered[7].

- For the calculation of fuel emissions, the guidelines of the Intergovernmental Panel on Climate Change (IPCC) of 2006 for National Greenhouse Gas Inventories were used. Volume 2: Energy: *Chapter 2: Stationary Combustion and Chapter 3: Mobile Combustion.*

- To estimate wastewater emissions the 2006 IPCC guidelines for national greenhouse gas inventories, Volume 5, *Chapter 6 Wastewater treatment and Disposal was used.*

- To estimate waste emissions, the 2006 IPCC guidelines for national greenhouse gas inventories were used. Volume 5. Waste. P 2.15

- The emissions from the use of electric power were calculated based on data from the CENACE (National Center for Energy Control), updated to 2015.

Table 1 summarizes the emission factors used for calculation of the operational activities that were derived from the aforementioned guidelines.

[5] ERIA Joint Research Project Series 2007, No. 39

[6] http://www.sambito.com.ec/es_ES/

[7] Thomas, C; Tennat, T; Rolls, J. 2000. UNEP Guidelines for Calculating Greenhouse Gas Emissions for businesses and Non Commercial Organizations. United Kingdom.

Emission category	Methodology used	Emission source	Unit of measure	Emission factor
Direct	IPCC 2006	Gasoline light vehicles	Liters	Density of the fuel: 0.73 VCN: 44.3 TJ / Gg F.E CO4: 69,300 F.E CH4 of Gasoline: 25 Global warming potential of methane: 25 FAITH. of N2O of gasoline: 8 Global warming potential of N2O: 298
Direct	IPCC 2006	Diesel light vehicles	Liters	Density of the fuel: 0.832 VCN: 43.00 TJ / Gg F.E CO4: 74,100 F.E CH4 of Diesel: 3.90 Global warming potential of methane: 25 FAITH. of N2O of diesel: 3.90 Global warming potential of N2O
Direct	IPCC 2006	Diesel machinery	Gallons	Density of the fuel: 0.832 CO2 FE: 74100 (kg CO2 / TJ) FE CH4: 4,15 (kg CH4/TJ) FE N2O: 28,60 (kg N2O/TJ) VCN: 43 TJ/Gg
Indirect	CENACE	Electricity	Mwh	Extranatu: 0,6712 t CO2/Mwh Nedoil: 0.2148 t CO2/Mwh
Direct	RSPO Palm GHG	Industrial wastewater	M3	13,1 Kg CH4/m3 wastewater
Indirect	GHG Indicator	Air Travel	Km	≥ 1500 Km: 0,00018 t CO2/Km <1500 km: 0,00011 t CO2/Km
Direct	IPCC 2006	Biological waste	No. of workers	BOD: 0.40g / person / day 65 Kg protein / person / day 0.16 Kg N / Kg Protein 0.10 adjustment factor unconsumed proteins 1.25 industrial proteins. and eat. co eliminated 0.005 Kg N2O / Kg N (N separated residual sludge)
Direct	IPCC 2006	Diesel stationary combustion	Gallons	FE CO2: 74100 (kg CO2/TJ) FE CH4: 3(kg CH4/TJ) FE N2O: 0,6 (kg N2O/TJ) VCN: 43 TJ/Gg
Direct	IPCC 2006	Palm oil fiber combustion	Tons	Percentage of dry matter: 33.24 Carbon fraction 0,5697 Factor to change from C to CO2: 3.67

Table 1 Emission factors considered for the calculation of operational GHG emissions

5.3 Emissions Associated with the Operation of Commercial Offices

To calculate the emissions associated with the operation of the commercial offices of the group, the following activities that release greenhouse gases were considered:

- Electricity/gas use;
- Water consumption;
- Business travel;
- Owned or controlled vehicles;
- Employee business travel.

To calculate the greenhouse gas emissions associated with each activity, the data werecollected from the administrative records and then converted into emissions. For conversion of the data, the emission conversion factors, specific for each country, were used.

Data x Emission Factor = Greenhouse gas emissions

The Environmental Protection Agency of the United States provides national emission factors on their website specific to each region of the country[8]. In the Netherlands, the CO2 emission factors used in are all slightly different. For the report, the standardized list of the factors, which was developed by the group of Dutch environmental experts and governmental institutions, was used[9].

The information about emissions from employee air travel was provided to the group by the travel agency that registers all the trips by the group employees.

[8] EPA, Emission Factors for Greenhouse Gas Inventories, Last Modified: 19 November 2015

[9] https://co2emissiefactoren.nl

6 GHG EMISSIONS ESTIMATION AND CALCULATION

6.1 Farms

Figure 5 Farmer Inputs

Natural Habitats only works with producers who apply organic agricultural practices. To fertilize the soil, the growers apply natural composts such as empty fruit bunches and palm fronds. At the moment, there are no quantitative data available to calculate the GHG effects of these practices. However, various studies have concluded that the application of a mulch is carbon neutral and it has potential to improve carbon sequestration in the soil and soil organic matter.[10] Therefore, for this report, the emissions from organic compost application are disregarded. Literature reference on quantities of fertilizer inputs have been summarized in the Table 2.

Input	ERIA conventional	NH Organic Plantations
Ammonium nitrate (kg N/ha/yr)	93	0
Ammonium sulphate (kg N/ha/yr)	-	0
Phosphate rock (kg P2 O5 /ha/yr)	114	0
Potassium chloride (kg K2 O/ha/yr)	200	0
Potassium chloride (kg K2 O/ha/yr)	27	0

Table 2 Fertilizer inputs in oil palm plantations according to ERI

10 Brinkmann Consultancy, Greenhouse Gas Emissions from Palm Oil Production, Literature Review and Proposals From the RSPO Working Group on Greenhouse Gases, October 2009

6.2 Mill: Transport, Extraction, Management and General Logistics

6.2.1 Extranatu

Extranatu produces CPO and three main by products: EFB, fiber and palm kernels. All those by-products have different uses. In Ecuador, EFB is distributed among the suppliers for application as mulch on their plantations, the fiber is used to generate steam in the boilers, and finally, palm kernels are transported to the Aexav crusher-mill to produce palm kernel oil and palm kernel cake.

In 2017, the footprint of the Extrantu mill was 15,424.41 t CO2e to produce 7,257.03 Mt of crude palm oil. The main emission sources of Extranatu are wastewater (11,634.21 t CO2e), followed by oil palm fiber (3,291.83 t CO2e), electric power (263.56 t CO2e), and fuel used in vehicles-machinery and the generator (234.14 t CO2e). To a lesser extent, biological waste (3.33 t CO2e), and air travel (0.66 t CO2e) contributed to the final emissions. Table 3 summarizes the total emissions of Extranatu in 2017.

Figure 6 CPO Mill

No	SOURCE OF EMISSION	Emissions 2017 (TON CO2e)
01	Electric Power	263.56
02	Wastewater	10,018.34
03	Biological Waste	3.33
04	Transportation of FFB	81.71
05	Fuel Consumption	152.43
06	Air Travel	0.66
07	Use of Fiber	3,291.83
	Total	13,811.87

Table 3 Extranatu's Carbon Footprint Summary

Figure 4 stipulates the extraction process and provides an overview on the proportional distribution of the final products through the production process. Total emissions are calculated on an annual basis and for the annual mill production. The total annual emissions are assigned to each product according to the percentage of energy used to produce it. EFB and fiber emissions are accounted to crude palm oil because they are not considered in the plantations estimation, and both require offsetting. Palm kernels are a by-product used to produce a different oil, for that reason the emissions are assigned as an independent product based on the extraction rate. Table 4 shows the total emissions by product.

Description	%	Emissions 2017 (CO2e)	Production 2017	MT Emissions 2017 per MT product (CO2e)
Production of CPO (Mt)	88,3%	12195,88	7,257.03	1.68
Production of Palm kernel (Mt)	11,7%	1615,98	4,599.83	0.35

Table 4 Total Emissions Per Product Produced (Extranatu 2017)

6.2 Mill: Transport, Extraction, Management and General Logistics

6.2.2 Kernel Mill

Since Palm Kernel Oil (PKO) is produced at a different plant, the emissions were calculated separately. Table 5 summarizes the results of carbon footprint calculation for Aexav crusher-mill:

No	SOURCE OF EMISSION	Emissions 2017 (TON CO2e)
01	Wastewater	2,043.6
02	Biological Waste	1.11
03	Fuel Consumption	41.17
04	Electric Power	795.36
	Total	2,881.24

Table 5 GHG Emissions of Aexav (2017)

Organic production accounts for 38% of the total operations of Aexav. Therefore, the emissions that attributed to the production of Natural Habitats products are 1,093.35 tCO2e. Additionally to that, the emissions from the production of palm kernels, a raw material for PKO and Palm Cake, make up 1,615,98 tCO2e. So, the final emissions to produce organic PKO and Palm Cake equal to 2,709.33 tCO2e. The table below depicts the calculation of the total emissions of PKO and Palm Cake production in 2017.

Description	2017
Total Emissions of Aexav (tCO2e)	2,881.24
Total Emissions Accounted to Organic Production (tCO2e)	1,093.35
Emissions from Kernel Production (tCO2e) +	1,615.98
Total Emissions from Production of Organic PKO and Palm Cake (tCO2e)	2,709.33

Table 6 Total Emissions of Organic PKO and Palm Cake Production (2017)

Description	%	Emissions 2017 (CO2e)	Production 2017	MT Emissions 2017 per MT product (CO2e)
Production of PKO (ton of oil/year)	46%	1,259.46	720	1.75
Production of Palm Cake (ton of palm cake/year)	54%	1,449.87	830	1.75

Table 7 Total Emissions Per Product Produced (Kernel mill-AEXAV 2017)

6.2 Mill: Transport, Extraction, Management and General Logistics

6.2.3 Nedoil

Nedoil's mill produces CPO and three main by-products. However, in Sierra Leone, due to the absence of the kernel crusher in the area, fiber and the nuts are used to feed the boiler to generate the steam, which then distributed throughout the extractor pipe. Excess fiber is used in the plantation as natural organic fertilizer. Figure 7 shows the Nedoil CPO mill.

Figure 7 Nedoil CPO Mill

No	SOURCE OF EMISSION	Emissions 2017 (TON CO2e)
01	Electric Power	0.23
02	Wastewater	553.48
03	Biological Waste	3.32
04	Transportation of FFB	6.88
05	Fuel Consumption	4.53
06	Use of Fiber and PKS	477.11
	Total	1,045.55

Table 8 Summary of Nedoil's Emissions

In 2017, total emissions of Nedoil accounted to 1,042.23 t CO2e. As for Extranatu, the main source of emissions is wastewater (553.48 t CO2e). Another significant emitting source is the use of by-products as a fuel for the boiler (477.11 t CO2e), followed by the emissions associated with the fuel consumption (11.21 t CO2e). Notably, at Nedoil the electricity consumption is very low, so the total emissions associated with electric power are insignificant (0.23 t CO2e).

Considering that Nedoil produces one main product and all by-products are used as fuel and mulch for the farms, emissions of EFBs, fiber and nuts are accounted to crude palm oil. Table 9 shows the total emissions of Nedoil for production

Description	%	Emissions 2017 (CO2e)	Production 2017	MT Emissions 2017 per MT product (CO2e)
Production of CPO (Mt)	100%	1,045.55	425.08	2.45

Table 9 Total Emissions of Nedoil

6.3 Commercial Offices

For the calculation of the emissions of commercial offices that following activities were considered

- Electricity/gas use
- Water consumption
- Owned or controlled vehicles
- Employee business travel
- Biological waste

The major source of the emissions is associated with air travel. Employees of the company Natural Habitats group often fly to the operational sites to support local teams and visit various conferences and tradeshows. In 2017, the total emissions related to the air travel accounted to 438.27 t CO_2e. Other sources of the emissions are electricity and natural gas consumption (27.56 t CO_2e), fuel consumption (4.78 tCO_2e), and to the lesser extent, biological waste (1.71 tCO_2e) and water consumption (0.08 t CO_2e). Table 10 summarizes the results of the emissions calculations for commercial offices of Natural Habitats Group.

No	SOURCE OF EMISSION	Emissions 2017 (TON CO_2e)
01	Electric and Natural Gas Power	27.56
02	Water Consumption	0.08
03	Biological Waste	1.71
04	Fuel Consumption	4.78
05	Air travel	438.27
	Total	472.4

Table 10 Emissions Associated with Commercial Offices of NHG

7 CARBON SEQUESTRATION

7.1 Farm Level Sequestration

There is not much information available about the potential sequestration level of organic palm oil plantations. In order to estimate the amount of carbon for this report which is sequestrated by oil palms on the organic plantations of the company's suppliers, the biomass approach studied and applied by Carlos Castilla, Ph.D., in Colombia was taken as reference[11]; this will only provide a close estimation, the organization plans to conduct the biomass analysis in a sample of the organic plantations in 2018.

In order to estimate the amount of carbon sequestrated by a single oil palm tree, the biomass of the tree was estimated. The resulting biomass is converted to C by a factor that varies between 0.45 to 0.5, a percentage of C in the dry matter.

For the calculation of the biomass of the stem of the palm, DR Castilla examines various studies and calculations and standardizes the approach by making the following assumptions for his calculations:

- The height of the palm is 12 meters high.
- The age of the palm is 25 years
- The diameter of the stipe does not increase
- The density of the stipe varies: it is greater in the periphery than in the center
- The biomass of the crown: the rachis, the petiole and the leaves do not vary after eight years of age.

Using these assumptions, the minimum coefficient of carbon sequestration is calculated 80 tC /ha, using a density of 143 palms per hectare. That can be expressed as 0.559 tC per 25-year-old palm. Consequently, it can be concluded that an oil palm tree sequestrates 0,0224 tC per year.

The average density of palms in the plantations associated with Natural Habitats Group is 123 palms per hectare. In order to calculate the total carbon sequestrated, the number of hectares with palm in 2017 was considered. The results of the calculation are summarized in Table 11.

PALM TREES	COEFFICIENT tC / palm * year	PALM DENSITY IN NHG palms / ha	Coefficient per hectare de NHG tC / ha *year	Has in NHG ha	Annual capture in NHG tC / year
	0.022376	123	2.752248	6525	17958,42

Table 11 Carbon Sequestered by Organic Oil Palm Plantations

[11] Castilla E.C., Potencial de captura de carbono por la palma de aceite en Colombia, Revista Palmas, Vol. 25, Núm. especial, (2004)

7 CARBON SEQUESTRATION

7.2 Primary Forest in Conservation

NHG suppliers have almost 780 hectares of forest, which is categorized as "tropical forest", under conservation. To calculate the carbon, which was sequestrated in 2017 by this forest, a coefficient of 2 tC/ha has been used[12]. Table 12 summarizes the calculation. Figure 8 shows one of the conservation areas.

Figure 8 Pablo Rosales protected area

FOREST	COEFFICIENT tC / palm * year	Has in NHG ha	Annual capture in NHG tC / year
	2	779.5	1,559.00

Table 12 Carbon Sequestered by Tropical Forest Under Conservation

[12] Land Use, Land-Use Change and Forestry, The Intergovernmental Panel on Climate Change (IPCC), http://www.ipcc.ch/ipccreports/sres/land_use/index.php?idp=28

8 RESULTS

In 2017, Natural Habitats Group emitted 16,945.86 tCO_2e. Table 13 represents the summary for the calculation of the group's emissions in 2017.

No	SOURCE OF EMISSION	Extranatu Emissions (TON CO2e)	Nedoil Emissions (TON CO2e)	Offices Emissions (TON CO2e)	Total NHG Emissions 2017 (TON CO2e)
01	Transportation of FFB	81.71	6.88	-	88.59
02	Electric and Natural Gas Power	263.56	0.23	27.56	291.36
03	Wastewater	11,634.21	553.48	0.08	12,187.76
04	Biological Waste	3.51	3.32	1.71	8.53
05	Fuel Consumption	152.43	4.53	4.78	161.74
06	Air Travel	0.66	-	438.27	438.94
07	Use of Fiber and PKS	3,291.83	477.11	-	3,768.86
	Total	15,427.91	1,045.55	472.40	16,945.86

Table 13 Summary of NHG CO2e Emissions

A significant part of carbon dioxide emissions (3,768.94 Ton CO2e) came from the combustion of biomass (biological material composed of carbon, hydrogen and oxygen). The burning of biomass produces emissions considered neutral with respect to carbon, since it is generated in the natural cycle of carbon. In the current Kyoto Protocol, and in several programs of greenhouse gas emissions, the use of biomass and biomass by-products as alternative fuels can be classified as emission reductions. For this reason, it is not considered within the emissions to be compensated by the company. Additionally, total emissions from the PKO a production were added to the total emissions offset of the group.

Total offset, excluding biogenic emissions and including PKO for NHG (Ton CO2e)	**16,121.60**
Carbon captured on organic oil palm plantations (Ton CO2)	- 17,959.42
Carbon captured by forest in conservation (Ton CO2)	- 1,559.00
Total	- 19,518,42
Additional carbon capture after offsetting (Ton CO2e)	(3,395.82)

Table 14 Total Emissions Offset of Extranatu

8 RESULTS

	CPO (EC)	PKO (EC)	CPO (SL)
Total Production (Mt)	7257.03	720	425.08
Total CO2e offset after consideration of annual sequestration	(3,395.82)		
GHG Emissions Per Mt	- 0.40	- 0.40	- 0.40

Natural Habitats

organic products grown in a sustainable habitat