



**Securing Permanent Forests to Combat Climate Change
and Enhance Sustainable National and Local Economies in
Cameroon**

ANNEX 22B

**ANALYSIS OF THE DRIVERS AND
AGENTS OF DEFORESTATION AND
FOREST DEGRADATION**

VERSION DATE: 27/05/2026

ACRONYMS

AAC	Annual Cutting Allowance
ACEFA,	Programme for the Improvement of Competitiveness of Family Agro-pastoral Farms
ASGIRAP	
BAU	Business as usual
CFC	Compagnie Forestière du Cameroun
CO2	Carbon dioxide
COMIFAC	Central African Forests Commission
CPF	Comité Paysan Forêt
ETC	Cameroon Tea Estate
DSCE	Growth and Employment Strategy Paper.
EIES	Environmental and Social Impact Assessments
FAO	Food and Agriculture Organization of the United Nations
FCFA	Franc of the French Community of Africa
GCF	Green Climate Fund
GHG	Greenhouse gases
GFW	Global Forest Watch
GIZ	German Cooperation
HCR	Office of the United Nations High Commissioner for Refugees-United Nations Refugee Agency
FMU	Forest Management Unit
IUCN	International Union for the Conservation of Nature
MINADER	Ministry of Agriculture and Rural Development
MINEPDED	Ministry for the Environment, Protection of Nature and Sustainable Development
MINEPIA	Ministry of Livestock, Fisheries and Animal Industries
MINFOF	Ministry of Forestry and Wildlife
NOSO	North West-South West
IOM	International Organisation for Migration
PCD	Council Development Plan
PDVRTP	Inclusive and Resilient Cities Development Project
NTFPS	Non-Timber Forest Products
PIDMA	Agricultural Investment and Market Development Project
NIPA	National Agricultural Investment Programme
PRODEL	Livestock Development Project
PSE	Payments for Environmental Services
RCA	Central African Republic
SNADDT	Cameroon's National Spatial Planning and Sustainable Development Plan
SDSR	Rural Sector Development Strategy
SRADDT	Regional Land Use and Development Plan
SGSOC	Sithe Global Sustainable Oils Cameroon
WRI	World Resources Institute
ZAE	Agro-Ecological Zone

EXECUTIVE SUMMARY

IUCN (an agency accredited to the Green Climate Fund) is supporting the Ministry of Forestry and Wildlife (MINFOF) and, subsidiarily, the Ministry of the Environment, Protection of Nature and Sustainable Development (MINEPDED), and more generally Cameroon, in the process of submitting a project for Cameroon to the Green Climate Fund, the concept note for which has already been validated. As a result, IUCN and MINFOF have undertaken to carry out some studies that will eventually inform the final proposal for the "Securing permanent forests to combat climate change and strengthen sustainable national and local economies in Cameroon" project. This study which reported on the analysis of drivers and agents of deforestation and forest degradation (DD) in the Waza, Bakossi-Bamboutos, and Dja-Lobéké landscapes is one of the three main studies that will help to inform the process. Based on the identified drivers of deforestation and degradation, the document aims to propose options for the three landscapes selected by the project. Proposing solutions or options presupposes prior work identifying the direct and indirect drivers of deforestation and degradation. After an in-depth review of MINEPDED and MINFOF reports, as well as key reports from technical and financial partners, project reports from national and international NGOs, scientific articles, and specialized websites (GFW, Sepal), efforts focused on processing satellite images to identify the drivers of deforestation and degradation, as well as to identify deforestation hotspots based on land use changes. However, field surveys carried out in the three landscapes helped supplement the previously collected secondary data.

The three landscapes had characteristics in terms of biogeographical environment, climatic parameters, and socio-cultural aspects. These peculiarities suggested a diversity of DD drivers, DD control options, and DD control barriers.

In the first landscape (Waza), the direct causes of deforestation were in order of importance: exploiting wood for energy and timber, carbonization (charcoal), agriculture, and bushfires. Livestock rearing and hunting were the direct causes of forest degradation in this landscape. The underlying drivers of DD were mainly demographic pressures, insecurity linked to attacks by the Boko Haram sect, prevailing poverty, low levels of schooling, and the demand for wood on the Chadian market. The options proposed for reducing DD in this landscape were mainly based on reforestation for wood energy and carbonization, improved carbonization techniques, and the promotion of improved stoves. The marking out of pastures, the production of improved fodder, and the marking of cattle migration corridors (transhumance corridors) could reduce the pressure of livestock farming on the Waza National Park (WNP). However, agro-pastoral conflicts, human-wildlife conflicts, and the lack of human resources in the WNP were the main obstacles to implementing DD reduction options in this landscape.

In the second landscape (Dja-Lobéké), the political crisis in CAR, road development (Ketta-Djoum), national and international market demand, mining sector development programmes, and logging were indirect drivers of DD. Logging was identified as an indirect cause of deforestation insofar as it contributes to weakening forests through roads (logging tracks), infrastructure (timber yards), and living bases, but also works to encourage hunting and subsistence farming activities. Logging was a major contributor to forest degradation because of the harvesting carried out during logging operations in the AACs. Furthermore, we have identified several direct drivers of

deforestation in this bimodal zone. These were mainly cash crop farming (rubber, oil palm, pineapple, cocoa), food crop farming (cassava, banana, plantain), and artisanal and mechanized mining. The direct drivers of degradation are industrial logging and slash-and-burn agriculture. Several options have been put forward by stakeholders to reduce DD in this landscape, including optimizing and making profitable use of waste wood, securing protected areas, creating school fields to teach best agricultural practices, and promoting cocoa-based agroforestry. However, several obstacles have been encountered, including a lack of collaboration between institutional players and public and private partners, a lack of coordination between technical and financial partners, and the marginalization of indigenous peoples.

The third landscape Bakossi-Bamboutos was threatened indirectly by North West and Southwest conflicts, growing regional and national market demand, and demographic pressure. The main direct drivers of deforestation in this landscape include (intensive) subsistence farming, logging for wood energy, and bushfires. The direct drivers of forest degradation in this landscape are livestock rearing and logging. The options proposed to mitigate/reduce the threats to forests include landscape restoration, promulgation of the grazing code, fodder production, and promotion of service trades. But these options may be hampered by land grabbing by elites, conflicts between herders and farmers, and land pressure.

DEFINITIONS OF KEY CONCEPTS

Forest

According to the FAO (2001), Forest is land with tree cover of more than 10% and an area of more than 0.5 hectares (ha). Trees should be able to reach a minimum height of 5 metres (m) at maturity in situ. These may be either dense forest formations in which the various storeys and the undergrowth cover a large proportion of the ground; or open forest formations with a continuous herbaceous stratum in which the tree synusis covers at least 10% of the ground. Young stands and all plantations established for forestry purposes which have not yet reached a crown density of 10% or a height of 5 m are included in this category, as are areas normally forming part of the forest zone which are currently deforested because of human intervention or natural causes, but which are likely to revert to the forest stage¹.

According to Cameroon's forestry law (Law No. 94/01 of 20 January 1994), a forest is a land with a vegetation cover dominated by trees, shrubs, and other species capable of producing non-agricultural products (MINFOF, 1994).

According to the United Nations Framework Convention on Climate Change (UNFCCC), forest is defined as a minimum area of 0.05 to 1 hectare with tree crown cover (or equivalent stocking level) of more than 10% to 30% of trees with the potential to reach a minimum height of 2 to 5 metres at maturity in situ" (UNFCCC, 2002).

In the context of the REDD+ process in Cameroon, the forest is characterised by a forest cover of 10%, a minimum height of 3 metres and a minimum area of 0.5 hectares (MINEPDED, 2018). This is the definition used in this study.

Deforestation

According to the FAO (2015), it is the conversion of forest to other land uses or the permanent reduction of forest cover below the minimum threshold of 10%. Deforestation involves the long-term or permanent loss of forest cover and the conversion of land to another use. It includes forest areas converted for agriculture, grazing, and the creation of water reservoirs or urban centres. The term specifically excludes areas where trees have been removed during logging or harvesting activities, and where the forest is expected to regenerate naturally or through silvicultural measures unless logging is followed by clearing of the remnants of the felled forest to introduce alternative land uses. Deforestation also includes areas where, for example, the impact of disturbance, overexploitation or changing environmental conditions affect the forest so much that it cannot maintain a forest cover above the 10% threshold.

Forest degradation

¹ According to FAO (2001), forest includes: nurseries and seed orchards which are an integral part of the forest; forest roads, cleared areas, firebreaks and other small open areas; forests in national parks, nature reserves and other protected areas such as those of specific scientific, historical, cultural or spiritual interest; windbreaks and shelterbelts formed by trees and covering an area of more than 0.5 ha and a width of more than 20 m; plantations used primarily for forestry purposes, including rubber plantations and cork oak stands. Excludes: Land used primarily for agricultural purposes

This refers to changes in the forest that adversely affect the structure or function of the forest stand or site, thereby reducing the forest's capacity to provide products and/or services (FAO, 2001). Forest degradation can be measured in terms of loss of biodiversity, forest health, production or protection potential, or aesthetic value. For a specialist in environmental protection, any modification of the natural forest induced by human action may represent degradation (FAO, 2011).

Direct drivers of deforestation/forest degradation

For Geist and Lambin (2001), the direct drivers of deforestation and forest degradation are actions that directly affect forest cover. These can be grouped into three broad categories: expansion of agro-pastoral activities, timber extraction and infrastructure expansion. In their view, the direct drivers generally operate on a local scale.

Indirect drivers of deforestation/forest degradation

The indirect drivers of deforestation and forest degradation, i.e. the underlying causes of deforestation, are those that contribute to amplifying the occurrence and intensity of the direct drivers of deforestation/forest degradation. Indirect drivers include social, political institutional, economic, technological and cultural causes (Geist and Lambin, 2001). They operate on a local scale, but also on a national or even international scale.

1. INTRODUCTION

1.1. BACKGROUND AND JUSTIFICATION FOR THE STUDY

Cameroon is one of those countries in Central Africa that expressed interest in the REDD+ mechanism. As a result, a series of initiatives and institutions have been designed to advance its implementation (See figure 1). Important among these initiatives and institutions is the REDD+ Steering Committee. The Committee has a Technical Secretariat, other important members like Cameroon's Focal Point of the United Nations Framework Convention on Climate Change (UNFCCC), and the country's National REDD+ Coordinator (FCPF 2012).

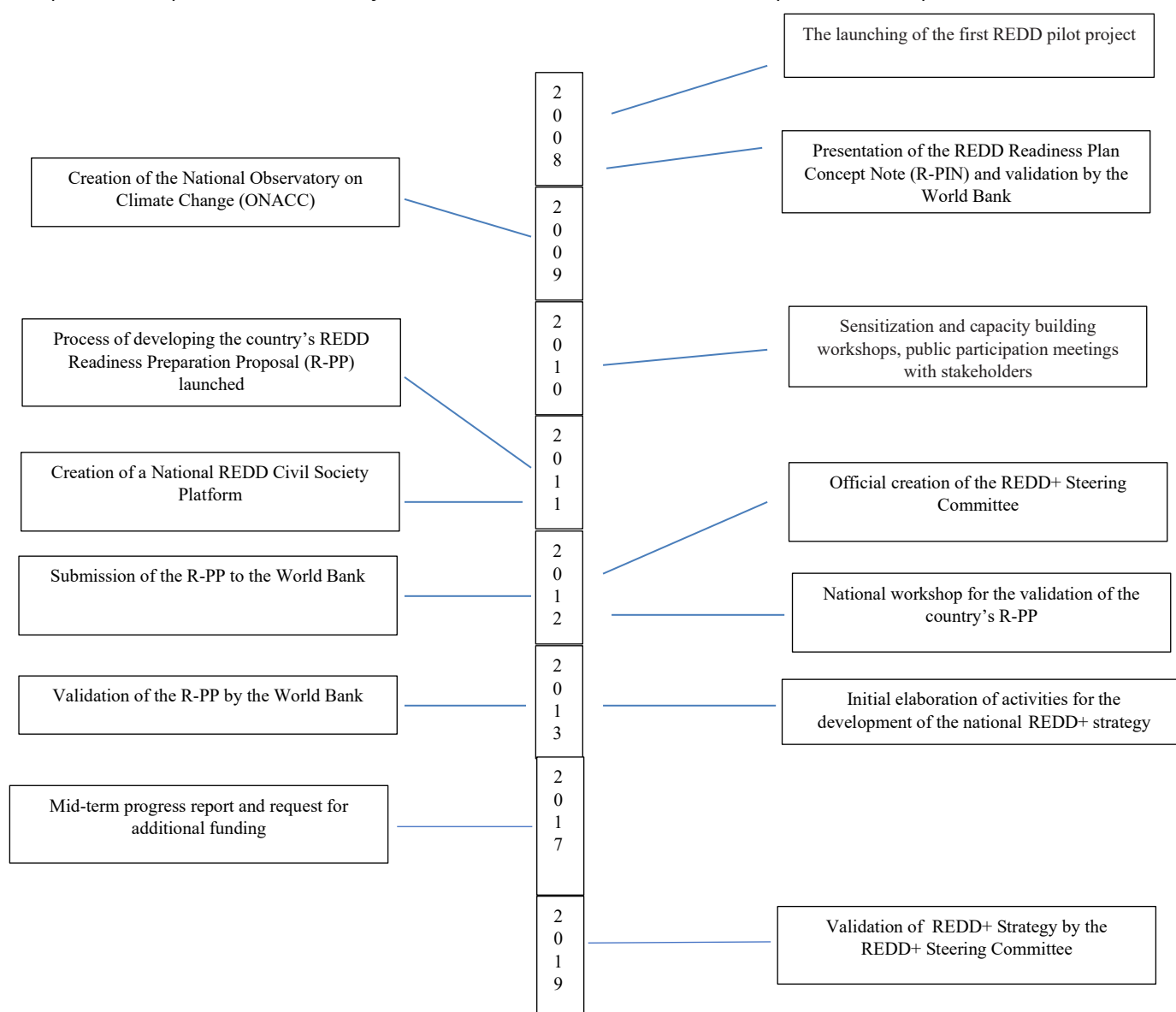


Figure 1. Timeline of the fundamental initiatives and institutions formulated to advance the REDD+ in Cameroon (Source: Adapted from Alemagi *et al.*, 2014 and Alemagi *et al* 2023).

Furthermore, Cameroon is also an important member of the Central African Forest Commission (COMIFAC) and has participated in REDD+ negotiations at the international level since its

inception in 2005. Cameroon has also contributed to formulating several country submissions to the UNFCCC that have played a fundamental role in advancing REDD+ implementation, especially from an international negotiation perspective (REDD+ Countries Database 2011).

The Forest Carbon Partnership Facility (FCPF) readiness funds provided policy inputs such as information and knowledge, resources, facilitation of private sector engagement in REDD+ and the capacity building of relevant REDD+ actors (civil society organization networks, indigenous people organization networks, public administration) that feed into the REDD+ policy making process (Chia *et al.* 2019). As Chia *et al.* (2019) further opine, the funds further supported related processes such as stakeholder consultations to define procedures, processes, institutional organization, strategic targets, objectives and instruments to achieve policy goals. It is important to underscore that Cameroon is at the end of its REDD+ readiness phase first commitment period with a REDD+ national strategy that has been developed and underscores the role of transformational change in achieving emission reductions in the forestry sector through REDD+ (MINEPDED 2018; Chia *et al.* 2019).

Two-thirds of Cameroon's national territory is covered by forest. This justifies the country's commitment to several programmes aimed at reducing greenhouse gas emissions since the mid-2000s. This commitment has enabled Cameroon to restructure its territory. One of its objectives is to classify 30% of its territory as permanent forest (MINFOF 2009). Although the overall rate of deforestation remains low, there are significant differences between the country's different agro-ecological zones (MINEPDED 2017a). Efforts by sectoral ministries to reduce deforestation and degradation remain unsuccessful. MINEPDED and MINFOF, the sectoral ministries at the heart of the deforestation reduction process, have been working for around ten years to help Cameroon meet its national and international commitments in terms of climate change. The actions envisaged for the development of this sector will focus on (i) the development of forest plantations; (ii) the strengthening of the wood processing industry up to the third stage of processing, with a view to the manufacture of furniture, the construction of housing and buildings and industrial uses (MINEPAT 2021).

To meet these commitments, the state of the forests needs to be known, and the drivers of deforestation and degradation need to be clarified. Moreover, according to the recent 2020-2030 national development strategy, the government has identified 9 industrial sub-sectors as drivers, including the "forestry-wood sector" strategic perimeter (MINEPAT 2021). Cameroon is also committed to the FCPF and has followed all the stages to date. Under the Readiness Fund, since the submission of its first Readiness Plan Idea Note (R-PIN) in 2008, there has been a follow-up of the submission of other documents; notably the Readiness Plan in 2013, the mid-term progress report and the request for additional funds 2017 and the Readiness Package R-package in 2019. In addition, under the carbon funds, the Emission Reduction Programme Idea Note (ER-PIN) was submitted in 2016, followed by the Letter of Intent in 2017, the Emission Reduction Programme Document (ERPD) and the Emission Reduction Payment Agreement (ERPA) in 2019. In addition, several other REDD+ readiness activities have been launched, including REDD+ pilot projects based on avoided deforestation, agroforestry, landscape restoration, and protected areas.

Understanding the direct and indirect drivers is one of the foundations for formulating key options for reducing emissions and implementing viable projects and programmes. Understanding the drivers of deforestation is also a fundamental basis or prerequisite for developing and implementing effective policies. Based on knowledge of the sources of forest-related CO₂ emissions, clear and realistic options must be formulated for better transformational change.

Research has been carried out on the drivers of deforestation in certain agro-ecological zones (Robiglio et al. 2010, Ordway, Asner, and Lambin 2017, Ordway et al. 2019, Mertens and Lambin 2000). But the MINEPDED (2017a). They provide an important database for a detailed understanding of the causes of deforestation in Cameroon. The MINEPDED report (2017a) sheds valuable light on deforestation hotspots. These areas under pressure are in non-permanent forests, particularly in agricultural areas, community forests and other types of land use where land conversion is permitted. However, in permanent forests, there is some pressure on the margins of protected areas and communal forests. The threats to permanent forests from artisanal or mechanised mining, logging and agriculture are most apparent in ZAE 1 and ZAE 2. Maintaining the forest in and around the permanent forests remains a major challenge. MINFOF, in collaboration with international institutions such as IUCN, has been working for around three decades to preserve biodiversity in these enclosed areas. The capacities of the IUCN at both sub-regional and national levels, and its enormous network, give it an aura in the conservation sector.

Its role in the classification of protected areas no longer needs to be demonstrated. It is therefore logical that the IUCN has positioned itself to secure permanent forests as part of the preparation of the GCF for Cameroon's Ministry of Forests and Fauna.

The analysis of the drivers of deforestation and forest degradation focuses mainly on Cameroon's permanent forest estate. Cameroon's forestry sector is classified into two areas: the non-permanent forest estate and the permanent forest estate. The non-permanent forest estate is made up of community forests, timber sales, timber exploitation permits, timber recovery authorisations, private forests, and agroforestry areas. The classified forests in the permanent forest estate that interest us here are national parks, wildlife reserves, wildlife sanctuaries, forest reserves and production forests (FMUs)².

This report first presents an overview of the SD drivers in Cameroon by EAZ. It then highlights the results of the SD drivers identified during the consultations and field surveys carried out in the three project landscapes. In addition, it analyses the options and activities for reducing DD in the project landscapes. Finally, it presents the constraints that may hinder the implementation of the options identified for each landscape.

1.2. AIMS OF THE STUDY

The overall objective of this study is to contribute to the development of the feasibility study for the project "Securing permanent forests to combat climate change and strengthen sustainable national and local economies in Cameroon" by developing information on the drivers of deforestation and degradation of permanent forests in order to refine the final project proposal to be submitted to the Green Climate Fund.

The specific objectives of the analysis are as follows:

- Identify the agents, direct and indirect drivers and underlying causes of deforestation and forest degradation in the project landscapes;
- Analyse agricultural practices and the dynamics of the extension of agricultural land and other land uses in the project landscape;
- Propose options/activities/sub-activities to mitigate the forestry SD drivers identified in the project landscapes;
- Identify the barriers to the implementation of the various options for mitigating the SD drivers in the project landscapes.

² These FMUs must have management plans. Some of these FMUs are certified, while others are not.

2. GENERAL METHODOLOGY OF THE STUDY

The methodological approach used in this study was based firstly on a review of strategic and sectoral documents and scientific articles, and secondly on an analysis of satellite images which enabled the identification of deforestation/forest degradation hotspots which were then the subject of information gathering.

2.1.1. INTERVENTION AREAS

The areas targeted by the project are

- (i) The Dja-Lobéké landscape (rainforests surrounded by mining operations and large agricultural enterprises - rubber, palm and cocoa plantations, etc.);
- (ii) The Bakossi - Bamboutos landscape (traditional agriculture and industrial tea plantations) and;
- (iii) The Waza landscape (Sudano-Sahelian) (cotton/rice plantations and large herds of cattle).

The choice of these project areas was based firstly on the intervention sites proposed in the project idea note, and secondly through a workshop which enabled the spatial delimitation of the project implementation sites to be refined. This workshop took place in Mbalmayo with the participation of key players from the Ministry of Forests and Fauna (MINFOF), the Ministry of the Environment, Nature Protection and Sustainable Development (MINEPDED) and certain NGOs and civil society. The selection criteria were essentially permanent forest landscapes under threat from various human activities (agriculture, poaching, livestock farming, logging). In addition to these threats, the spatial delimitation of the intervention sites was also guided by the presence of permanent forest sustainable management programmes and projects in the project landscapes.

Figure 1 shows the project's various impact and intervention zones.

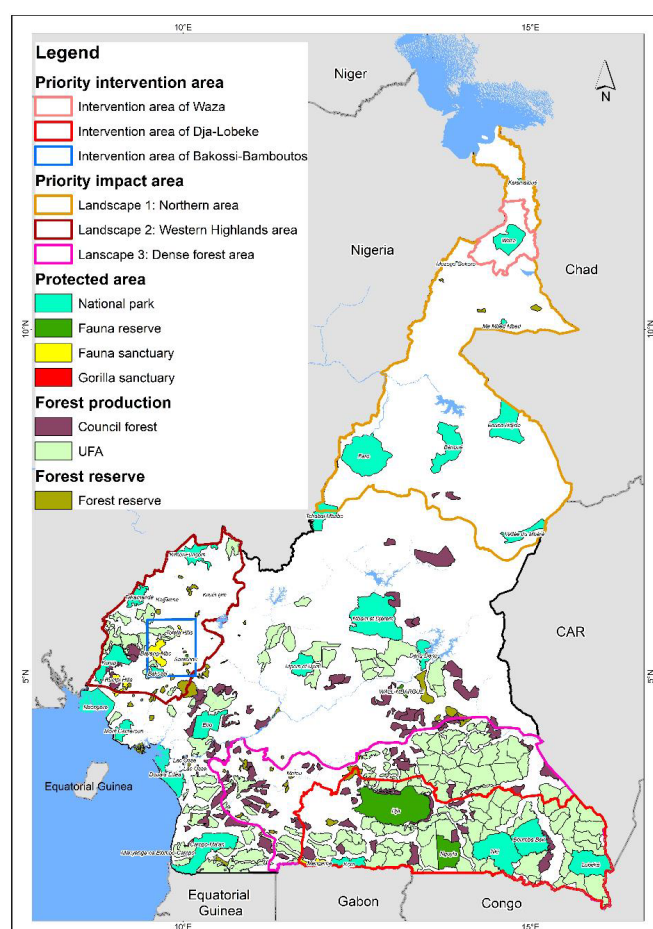


Figure 1 Geographical location of the various project areas

2.1.2. SURVEY AREAS AND SAMPLING

Field surveys targeted the major areas of deforestation in the various project landscapes. These surveys made it possible to collect both qualitative and quantitative information on the drivers of deforestation and forest degradation, to confirm or refute their significant role in each of the project areas.

In the Waza landscape, surveys were carried out with key players involved in the management of permanent forests, in particular, the decentralised services of MINFOF, MINEPDED, MINADER, MINEPIA, the Conservator of the Waza National Park (WNP), technical partners (IUCN, GIZ), NGOs and civil society. Focus groups were also held with local officials responsible for permanent forests and with communities in localities located in the main areas of deforestation: Mora, Waza, Lougouma, Tchédé, Diegueré, Zina, Andini, Badaday and Maroua (figure 2). Focus group discussions in these localities were conducted according to social categories and by type of activity: indigenous peoples (women and men), wood and charcoal producers, fishermen, and herders, to get a holistic view of the drivers of DD, mitigation options and barriers in this landscape.

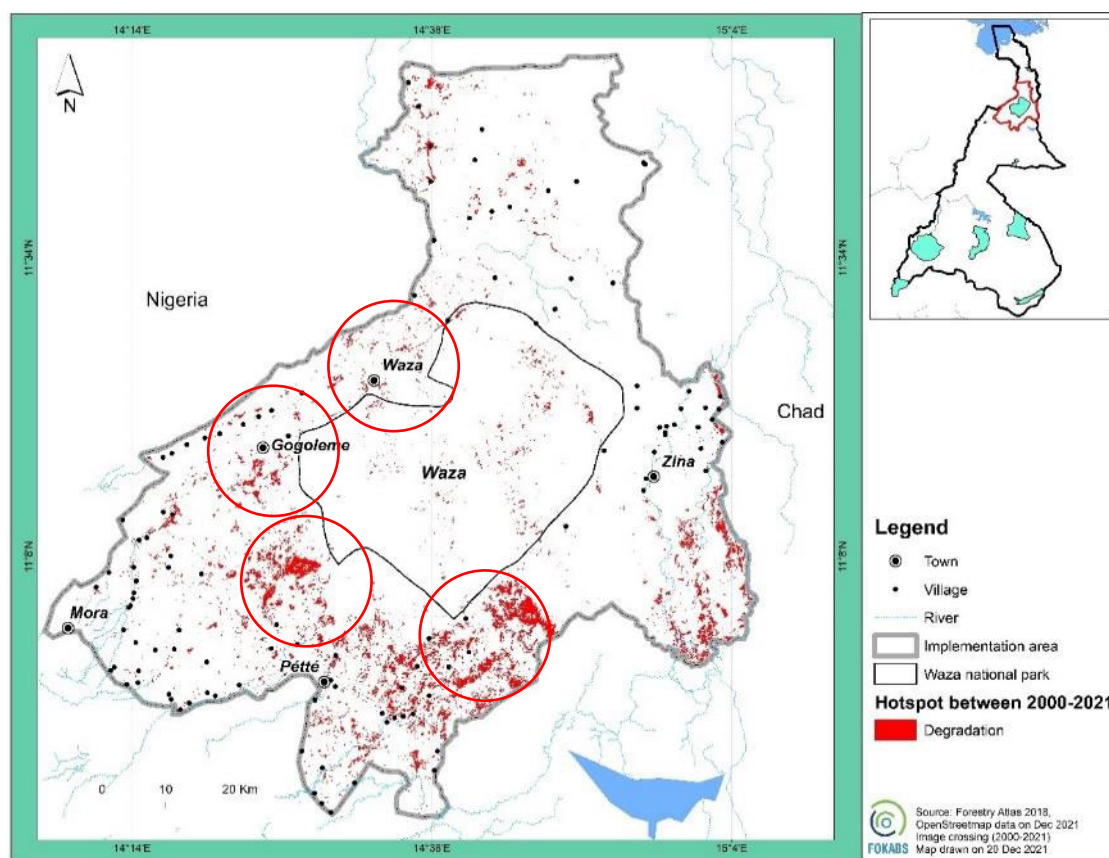


Figure 2 Locations in the deforestation hotspots of the Waza landscape³

In the Dja-Lobéké landscape surveys were carried out with key players involved in the management of permanent forests, in particular the deconcentrated services of MINFOF, MINEPDED, MINADER, MINEPIA, the Conservators of the parks (Dja, Ngoyla, Lobéké, Nki, and Boumba Bek), the Mayors or technical managers of the four communal forests, the managers of the FMUs, and technical partners (GIZ) and non-technical partners (CSOs and NGOs). Group discussions were also held in villages located in deforestation hotspots, in particular: Batika, Baka Gbiné, Legoué, Banana, Mambélé, Salapoumbé, Lokomo, Kika, Ngato, Mikel, Mimbo Mimbo, Yenga, Messock, Djadom, Ajela, Ngoyla, Zoulabot (figure 3).

³ The red circles represent high-pressure areas where field surveys have been more incisive.

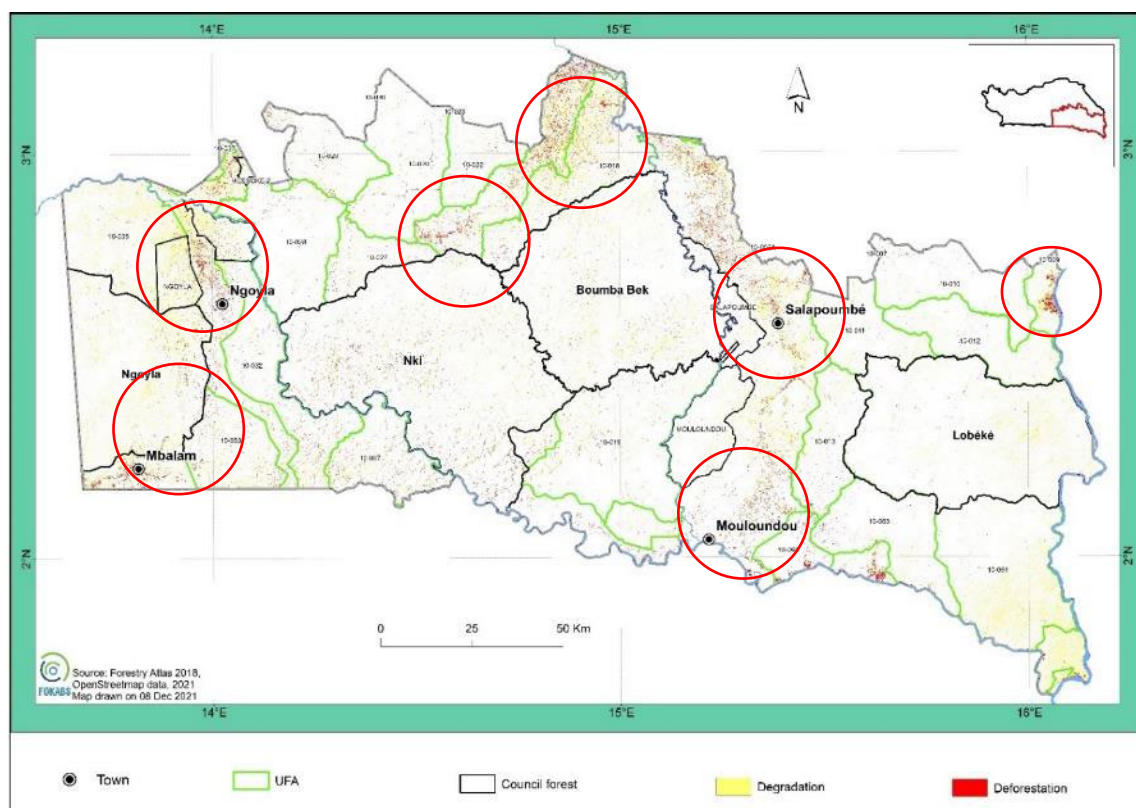


Figure 3 Locations in deforestation hotspots in the Dja-Lobéké landscape⁴

In the Bakossi-Bamboutos landscape, surveys were conducted with key players involved in the management of permanent forests, in particular the decentralised services of MINFOF, MINEPDED, MINADER, MINEPIA, technical partners (GIZ) and non-technical partners (CSOs and NGOs). Group discussions were also held in villages in deforestation hotspots, notably: Bafou Ndzihi, Aghouong, Djutsitsa, Femoc, Baranka, Babajou, Balatchi, Mmuock Fossimondi. However, a stratification was adopted to substitute the social components involved in the focus groups and by type of activity. Surveys were also carried out with administrative and traditional authorities (district or village chief), farmers and Mbororo herders on both the English- and French-speaking sides (Figure 4).

⁴ The red circles represent high-pressure areas where field surveys have been more incisive.

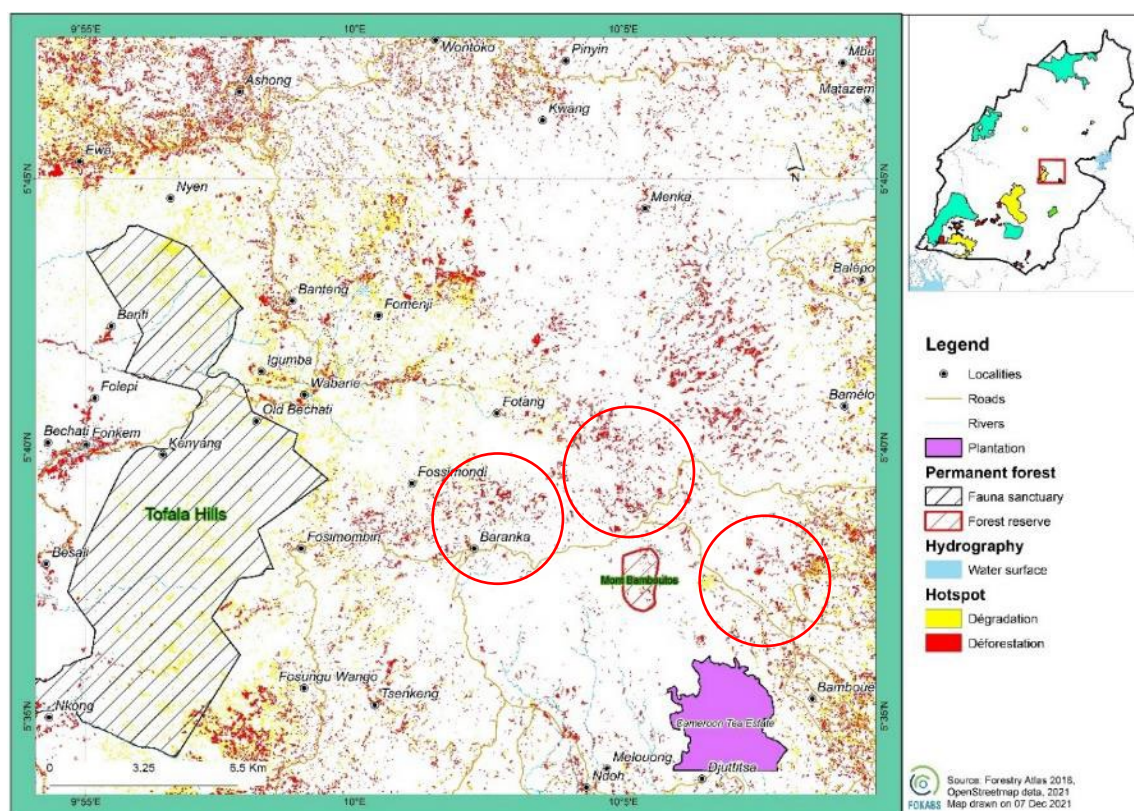


Figure 4. Locations in deforestation hotspots in the Bakossi-Bamboutos landscape⁵

2.1.3. APPROACH TO DATA COLLECTION

Data collection took place in 4 phases:

2.1.3.1. Preparatory phase

This phase enabled 06 activities to be carried out:

- Documentary review of existing qualitative and quantitative studies on the drivers of deforestation and degradation in the landscapes targeted by the project. This literature review helped to identify indicators that facilitated the design of collection tools for the field phase and fed into the analyses;
- The areas to be surveyed were identified based on a preliminary literature review and consultation with key experts, as well as the use of available mapping data;
- The collection tools were designed after the literature review, with the aim of gaining an overview of all the potential drivers and agents of deforestation and forest degradation in the different landscapes.
- The itinerary or timetable for data collection in the various project landscapes served as a roadmap for the teams in charge of data collection. This itinerary listed all the localities to be surveyed according to the days and the list of people to be consulted (appendix 1).
- Contact with the community facilitators and organisations that helped organise the field mission played a significant role in mobilising local stakeholders.

2.1.3.2. Field survey phase

This phase aimed to collect qualitative and quantitative information on the drivers of deforestation and degradation, to: (i) refute/confirm their significant role in each of the zones, (ii) identify options

⁵ The red circles represent high-pressure areas where field surveys have been more incisive.

and activities to combat or mitigate deforestation and forest degradation in the project landscapes, (iii) identify barriers to the implementation of deforestation mitigation options.

2.1.3.3. Analysis phase

This phase began by digitising the results of the field surveys in the project's various landscapes, followed by formatting and quality control of the data, and then analysis (Excel). These analyses consisted of cross-referencing the data to identify the main drivers of deforestation by the landscape, the priority options and the barriers to their implementation.

The characterisation of these drivers of deforestation has been developed according to the framework of Geist and Lambin (2001), which has the double advantage of being exhaustive and internationally recognised (figure 5). This framework guided us through the sections devoted to analysing the drivers of deforestation and forest degradation. These drivers were then quantified using the Driver, Pressure, State, Impact and Response framework (DPSIR).

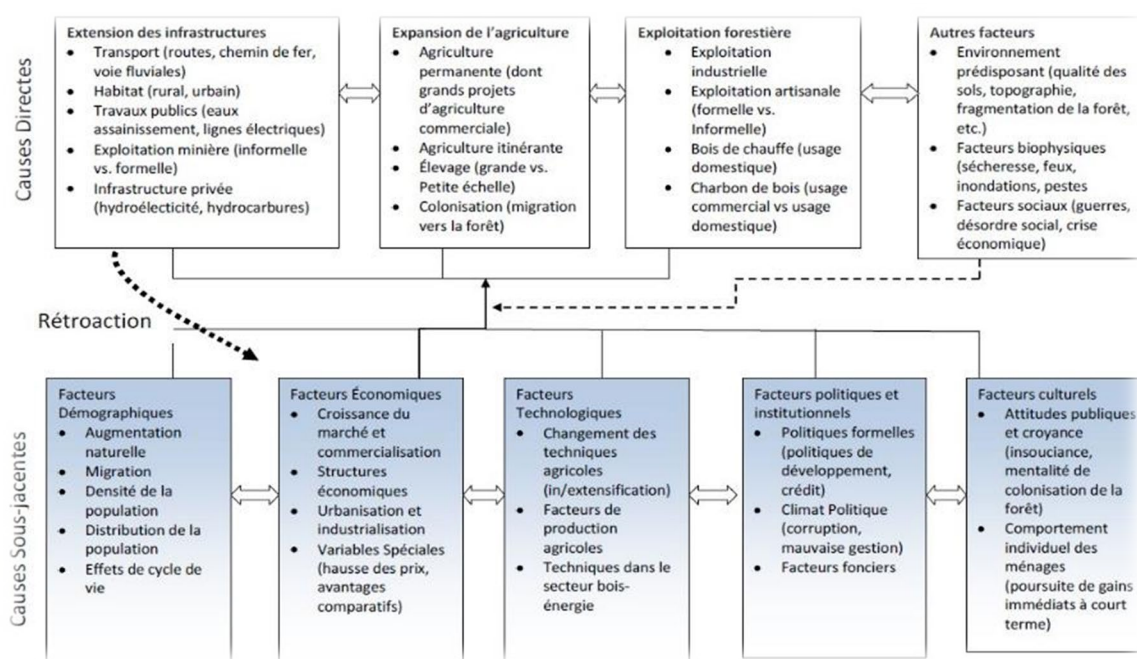


Figure 5. Geist and Lambin Logical Framework (2001)

2.1.3.4. Validation phase

A technical workshop was held on 12 March 2022 at the Hôtel Départemental in Mbalmayo with a view to gaining an overview of the initial results on DD drivers in landscapes. This workshop enabled the various participants to provide broad guidelines for better characterising these DD drivers. This work should culminate in a workshop to validate the results.

3. OVERVIEW OF DD DRIVERS IN CAMEROON

Before looking at the three landscapes identified in this project, it is crucial to have an overview of the existing drivers of DD in Cameroon, to identify options and activities to reduce DD, as well as barriers to the implementation of options to reduce the drivers of DD. This section aims to provide

first the drivers of DD in all the EAZs in Cameroon, then a selection of proposed options to reduce DD and finally the institutional, economic and social barriers to the implementation of these options.

3.1. OVERVIEW OF DD DRIVERS IN CAMEROON

Although biodiversity loss is low in the forests of the Congo Basin compared with other major tropical forest basins (De Wasseige et al. 2013) the rate of deforestation has been increasing since the beginning of 2005 (FAO 2020). The development of public policies and development strategy documents considers the data produced in the analysis of the direct and indirect drivers of deforestation and forest degradation. To do this, it is crucial to identify the drivers of deforestation, which then becomes decision-making information. Cameroon is an important player in the mitigation policy of COMIFAC member countries because of its high forestry potential. With around 29 million hectares of forest in 2010 (including dry forests), Cameroon accounts for around 10% of the forest cover in the Congo Basin sub-region. (Eba'a Atyi et al. 2022). This makes it the 3^{ème} largest forest massif behind the DRC and the CAR. The Congo Basin lost 600,000 hectares of primary forest in 2020, an increase of 9% compared with 2019. Moreover, Cameroon and the DRC are among the 10 countries that have lost the most primary forest in the world (WRI, 2021). The main areas of pressure are found around large conurbations, major roads, agro-industrial plantations, and mining areas (Figure 6). Institutional and political factors are more important than any other type of underlying DD driver in Cameroon (Tegegne et al. 2016).

National development plans, regional master plans, and local development plans are among the reference documents that guide growth but are expected to have a negative impact on vegetation.

In concrete terms, the Cameroonian government's SND30 plans to develop several sectors that will have a direct impact on forest areas. Furthermore, food crop agriculture should record average annual growth of 5.5% and 6.5% respectively over the periods 2021-2025 and 2026-2030. Furthermore, growth in the industrial export farming sub-sector is expected to rise from 3.9% in 2018 to an average of almost 5.6% between 2021 and 2030. In the long term, agricultural activities are expected to make inroads into secondary and previously undisturbed forests (MINEPAT 2021).

Cameroon's National Spatial Planning and Sustainable Development Plan (SNADDT) is multi-sectoral. The Regional Spatial Planning and Development Schemes (SRADDT) for the South, West, and Far North aim to boost development and accelerate decentralization. The broad outlines foresee the development of the agricultural, mining, industrial, and livestock sectors, all of which require space. Other, much more sector-specific master plans are guiding the investment process in the livestock and timber sectors. The master plan for the development of livestock sectors in Cameroon provides for the development of grazing land around Waza Park and Monts Bamboutos (MINEPIA 2010). The cattle industry requires the most space for the development of forage fields. In order to satisfy the demand for land and maintain a constant level of production, some projects and programmes such as ACEFA6 , ASGIRAP7 , PRODEL8 have been implemented. The latter, subdivided into zones (zone 1, zone 2 and zone 3), has restored around 30,000 ha of grazing land.

The 2022 project plans to asphalt or rehabilitate numerous stretches of road that do not have a significant impact on the forests. For example, 458 km in the Far North region, and 250 km of road in the East Region. Efforts are also being made to reforest the communal forests of Kaelé and Guerre in the far north; Moloundou in the East; and Fokoué and Fouban in the west. These

⁶ Project to Improve the Competitiveness of Agropastoral Family Farms

⁷ Support Project for the Securing and Integrated Management of Agropastoral Resources

⁸ Livestock Development Project

forests, located on project landscapes, will each receive 20 million Francs to carry out reforestation activities.

The various communal development plans (CDPs) of the communes located on the project sites advocate a range of agricultural, pastoral, and forestry projects that contribute to forest degradation or deforestation. In concrete terms, around the Waza park, all the PCDs (Mora, Pétté, Waza) envisage the development of pastures as well as support for livestock breeders, farmers, and fishermen. In addition, the SCIs (Yokadouma, Mintom, Djoum, Ngoyla, Salapoumbé, Lomié, Moloundou) in the communes of the Dja-Lobéké landscape are focusing development on support for the creation of cocoa plantations, the creation and rehabilitation of roads, and reforestation of degraded areas. The SCIs for Babadjou, Bafou, Wabane, and Bangang focus on support for livestock breeders and farmers (food crops), but also on creating Eucalyptus forests and supervising Bororo livestock breeders in their areas.

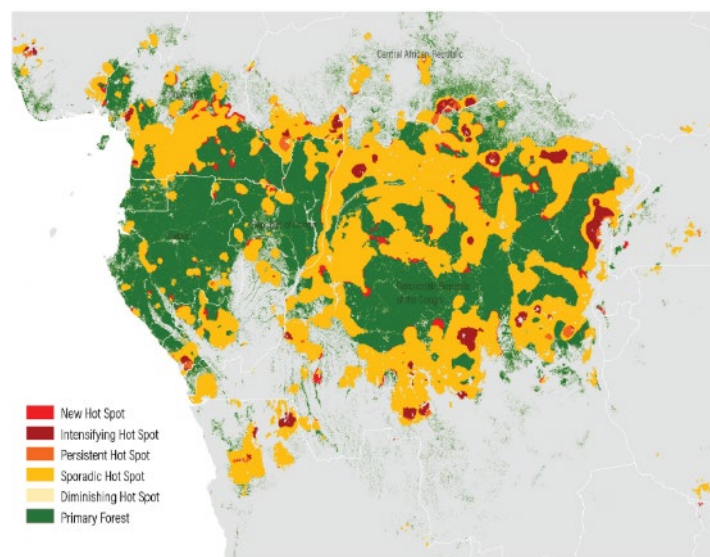


Figure 6 Hotspot of primary forest loss in the Congo Basin
Source: WRI, 2021

The 'drivers of deforestation' have been defined as elements that have an explicit and direct cause-consequence link with the destruction of forest cover (Pfaff et al. 2007). They may be direct or indirect. Underlying factors refer to indirect forces that are far removed from geographical environments, or that have no direct links with the actors producing the observed DD. They refer to complex interactions between profound social, economic, political, cultural, and technological processes, which can indirectly influence DD. They may be economic, cultural, institutional, technological, or demographic, sometimes supported by external policies (Geist and Lambin 2002). These underlying drivers most often explain the disparities that may exist between regions. The direct causes are geographically localized and are linked to local players who act directly to convert land use types. They correspond to human activities or immediate actions that directly affect forest cover and carbon loss. All these factors interact to have a lasting impact on the forests of the Congo Basin. Cameroon is a special case because of its level of economic development and high population growth rate.

According to WRI (2021), Cameroon is one of the countries where the loss of primary forests is steadily increasing. Cameroon lost more than 100,295 ha in 2020, making it the 7^{ème} country⁹ with the greatest loss of primary forest in the tropical zone. The average annual rate of loss of vegetation cover between 2000 and 2014 is estimated at 0.12%. (Hansen et al. 2013). This rate is constantly increasing. Projections to 2035 due to major projects show that the rate of deforestation could triple by then (MINEPDED 2018). More than 60% of these losses have been recorded in the Centre, South, and East regions, the country's main forest areas.

Agriculture is the main cause of deforestation and degradation in Cameroon (MINEPDED 2017a). Cameroon has a high demand for agricultural land, timber, and wood energy due to its high population (Schure et al. 2012). With a population density of over 45hbts/km², and a population growth rate close to 3% Cameroon has a DD largely influenced by the demographic factor. Cameroon's economic development strategies are based on the promotion of primary economic sectors, based on the exploitation of natural resources (agriculture, forestry, mining, and oil extraction). These underlying drivers combine with demographic pressure, political and institutional factors, economic aspects, international market demand, and the availability of fertile land to create a set of factors that can boost DD.

There is a disparity between the country's different AEZs in terms of deforestation dynamics (Figure 7). ZAEs 1 and 3 have had a low and stable rate of DD, averaging 0.06% and 0.04% per year since 2000. ZAE 2 shows the highest rate of deforestation on average per year with 0.32%, or 68,900 ha. ZAEs 4 and 5 show a gradual increase in deforestation, particularly since 2010. Between 2000 and 2015, more than 346,000 ha, or 0.29% per year, were converted in ZAE 4 and 209,000 ha, or 0.23%, in ZAE 5 (MINEPDED 2017a). In terms of surface area, ZAE 4 and 5 are therefore home to almost 75% of the total deforestation observed in Cameroon over the period. Deforestation increased by 50% between 2005-2010 and 2010-2015.

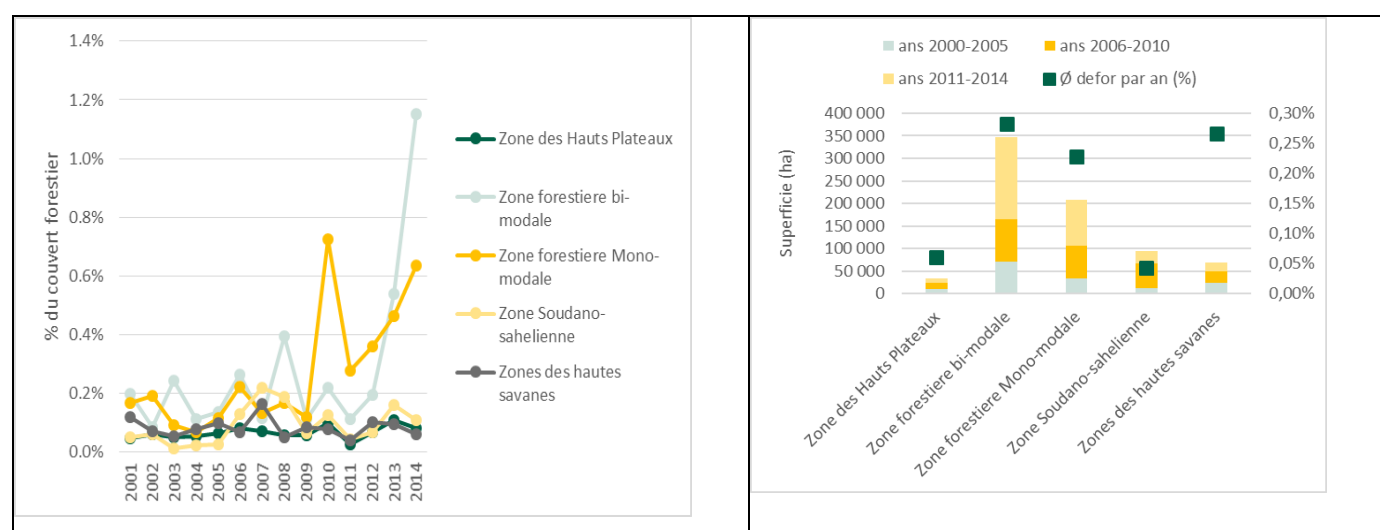


Figure 7: Change in deforestation over the years (left) and in the area since 2000 by agroecological zone.

Source: MINEPDED (2017) based on Hansen et al (2013).

9 Behind Brazil, DRC, Bolivia, Indonesia, Peru and Colombia (Mikaela Weisse and Elizabeth Goldman, 2021, the Forest Pulse: The Latest on the World's Forests https://research.wri.org/gfr/forest-pulse?utm_medium=media&utm_source=article&utm_campaign=globalforestreview

In Cameroon, the direct drivers of deforestation and forest degradation are the expansion of agriculture (shifting and permanent); timber extraction (commercial, fuelwood, charcoal); and the expansion of infrastructure (transport, housing, private companies, and public services) (see Figure 7). These drivers vary within and between the different agro-ecological zones of the country. In Cameroon, six areas of high DD pressure (hotspots) have been identified based on the superposition of different activities, deforestation areas, and towns (MINEPDED 2017a). These include the Buea-Douala, Garoua-Ngaoundéré, Kribi, Bafia-Yaoundé-Ayos, Bertoua, and Yokadouma hotspots (Figure 8).

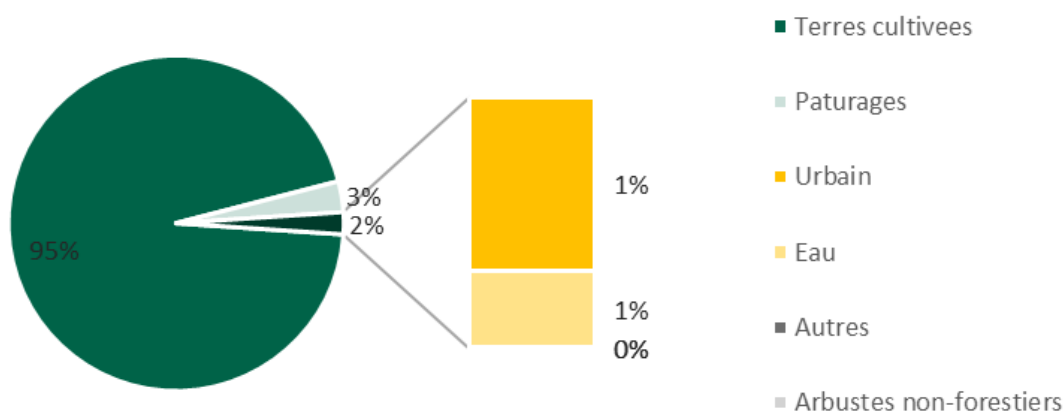


Figure 8 Destination of areas cleared between 2000 and 2015 in Cameroon
Source: MINEPDED (2017) using data from Defourny et al. 2017

Since agriculture is the main source of DD, the main players can be identified based on the surface areas opened up.

Five categories have been established:

- Less than one hectare, which corresponds to the area cleared by a small producer,
- Between 1 and 2 hectares, which also corresponds to small-scale farming,
- Between 2 and 20 hectares, which corresponds to the average size of a farm,
- Between 20 and 100 hectares, which tends to come from "elite" farms
- Over 100 ha, which corresponds to large-scale deforestation such as an agro-industrial concession.

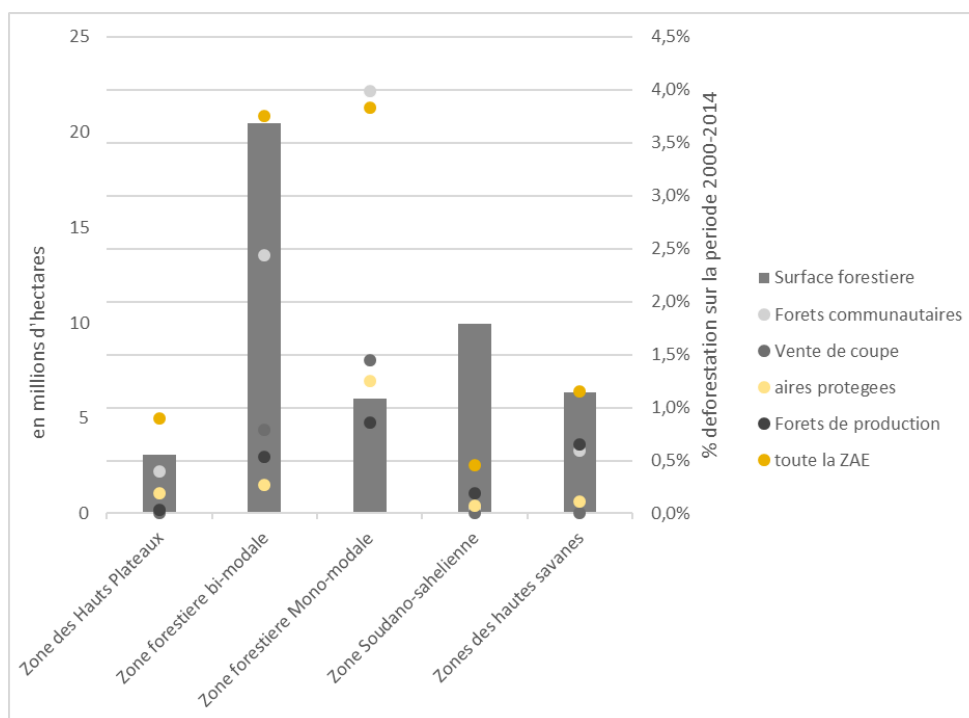


Figure 9 Forest area and rate of deforestation in the different elements of forest zoning by EAZ.
Source: MINEPDED (2017) based on Hansen (2013)

Understanding the drivers of deforestation also depends on the definition of forest itself. In Cameroon, the forest is defined as "land with a vegetation cover dominated by trees, shrubs, and other species capable of providing products other than agricultural products". However, within the framework of REDD+ in Cameroon, forests are extended to shrubs over 3m in height. The reformulation of these definitions has a particular impact on the dry forests of northern Cameroon. Indeed, the consideration of forest cover percentages of 10 to 30% has a significant impact on forest areas and the resulting deforestation.

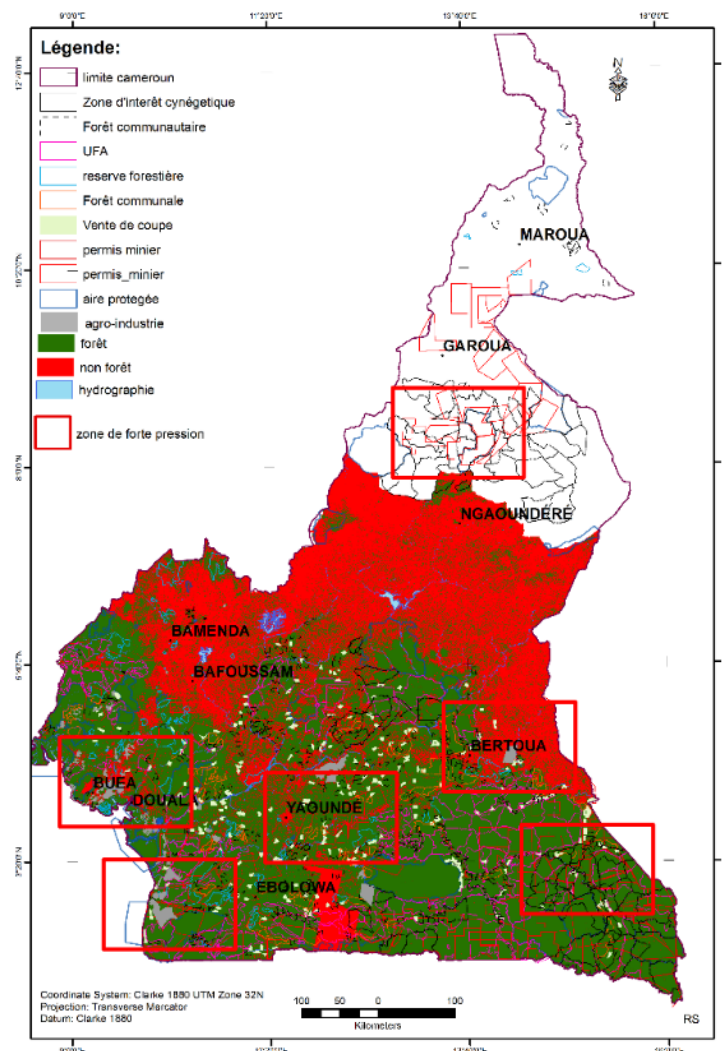


Figure 10 Deforestation pressure zone in Cameroon (source: MINEPDED 2016)

The combination of direct and indirect drivers influences land use types and the whole forest mosaic differently. There is a notable disparity of DD observed in the different AEZs. Indeed, if you look closely at the Pressure Zones, the expected impact may be insignificant in one zone and very pronounced in another. But overall MINEPDED (2017a) defines the following drivers in order of importance: the conversion of forest into agricultural land (food crops, agro-industry), the extraction of timber resources, illegal logging, and major structural projects such as ports, hydroelectric dams, and roads.

Overall, the MINEPDED (2017a) that the main direct drivers of DD at the national level are agriculture, mining, and infrastructure. Indirect causes include demographic pressure, and development policies in different sectors.

The MINFOF/MINEPDED (2021) concluded that there had been an increase in the number of deforestation alerts (127,804 GLAD alerts). A total of 10.5% of deforested areas, i.e. 381.03ha, are found in the Permanent Forest Estate (deforestation rate of 0.0027%). Because of the definition of forests, there is a multitude of alert zones (figure 11).

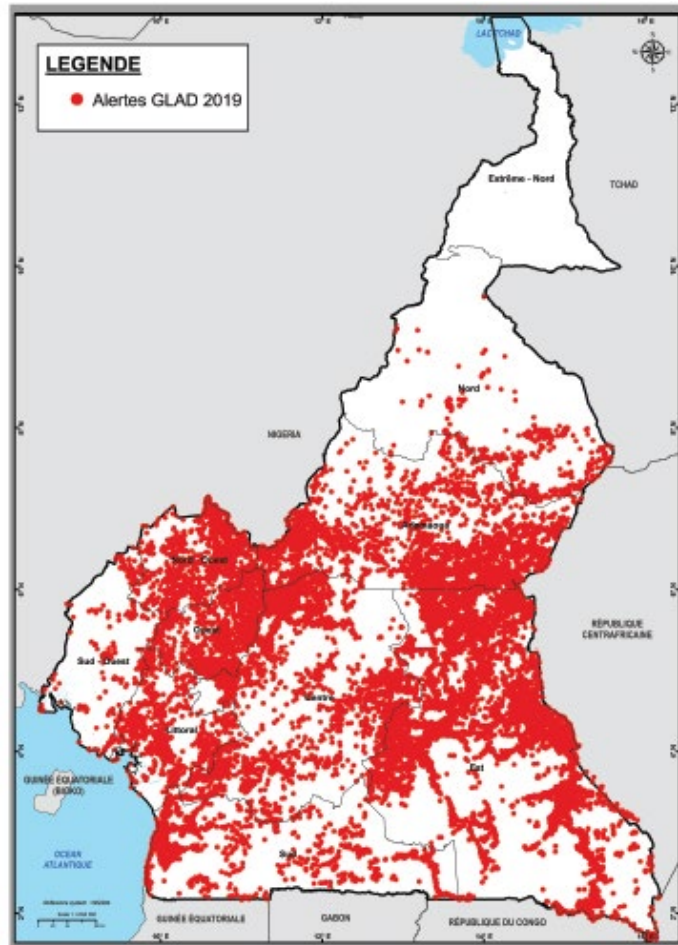


Figure 11 GLAD deforestation alert (source: MINFOF/MINEPDED, 2021)

2.1. OVERVIEW OF OPTIONS AND ACTIVITIES TO REDUCE SD DRIVERS AT THE NATIONAL LEVEL

Reducing DD involves identifying concrete actions that will help to influence the agents as well as the direct and indirect drivers. Once the drivers have been identified, it is essential to carry out consultations to identify activities capable of acting directly on the causes of deforestation. However, it should be pointed out that the priorities are focused on interventions and activities that have demonstrated their feasibility in the field. What's more, the options are mainly based on the achievements of existing projects at the local level.

Despite the disparity of the direct and indirect drivers identified, Cameroon has opted for a "jurisdictional" approach that considers the differences between the ZAEs while tackling the solutions at the national level. The effectiveness of the options depends largely on their overall legitimacy and their ability to deliver concrete results. Their formulation must not be incompatible with national growth policies. Those that have already been formulated must be aligned not only with the DD drivers but also with the strategic options. Angelsen (2008) recommends that they should meet several criteria. These include the 3E + criteria (Effectiveness, Efficiency, Equity, and Co-benefit), as well as feasibility, governance, coordination, compatibility, and legitimacy. Several strategies (four) can lead to a reduction in deforestation: those that would reduce forest rent, strategies aimed at increasing and capturing forest rent, strategies aimed at directly regulating land

use, and cross-sectoral policies underlying the first three. More concretely, comprehensive strategies that address the deeper causes will have a better chance of success.

This work by Angelsen (2008) introduces Von Thunen's land rent model, according to which land is used by those who exploit it in such a way as to provide them with the highest possible land rent (surplus). Landowners clear land for non-forestry purposes such that agriculture is more profitable (higher rent) than a use based primarily on forestry. The options must take account of this economic profitability, for example by finding ways of reducing the profitability of farming in forests or increasing the profitability of forestry or agroforestry models. In agriculture, the agricultural rent and all the underlying causes of this rent should be reduced, and agricultural intensification should be stepped up.

After producing the report on "in-depth analysis of the drivers of deforestation and degradation taking into account the five agro-ecological zones", MINFOF developed another on "in-depth analysis of strategic options likely to regulate deforestation and degradation in each agro-ecological zone" (MINEPDED 2017b).

Following on from the DSCE 2020 and Vision 2035, the SND30 envisages sustainable development based on the use of natural resources. The proposed options must contribute to achieving these objectives or at least adhere to the government's wishes. Similarly, these options must propose activities that respect the specific social, economic, and environmental requirements of each of its various ZAEs.

The MINEPDED report (2017) proposes three main types:

- Cross-cutting policy options that involve policy and institutional adjustments in each jurisdiction, which may be national or sub-national. Cross-cutting options aim to address the underlying drivers of deforestation and forest degradation. Resolving problems of natural resource governance, land tenure security, and land management all work towards resolving cross-cutting issues.
- Sectoral strategic options, which involve adjustments to sectoral strategies and action plans to sustainably increase productivity without DD. The infrastructure, mining, agriculture, and forestry sectors require the most attention.
- The strategic options, i.e. local investment, each have their value chain.

This report focuses mainly on the options that can have an impact on the direct drivers in the areas of intervention indicated. However, before doing so, we would like to remind you of a few options that will influence the underlying drivers at the national level.

At the national level, governance plays a central role in that it is necessary to encourage cross-sectoral coordination, coordination of project registers, promotion of a Regional Plan for Sustainable Land Use and Development that reduces deforestation in comparison with the BAU, reinforcement of land tenure security, coordinated zoning of the territory, improvement of Payments for Environmental Services (PES) in the service of "zero deforestation" agriculture.

The sectoral options will have a greater impact insofar as they affect the sectors that have the greatest impact on forests, such as infrastructure, mining, and forestry. These national options will not only make it possible to better manage the overlapping issues (mining, forestry, hunting), but also, of the options proposed, the most important relate to the main value chains in the ZAEs (Table 1).

Table 1 Main value chains and their ZAEs

ZAE	Regions	Main sectors	Main cash crops grown on large plantations
ZAE1 Sudano-Sahelian	- North and Far North	Millet, sorghum, groundnuts, maize, beans, cowpeas and cotton.	Cotton,
ZAE2 - Hautes savanes	Adamaoua and part of the East	Maize, sweet potatoes, manioc and groundnuts	no big plantations
ZAE3 - high plateaux	The West, the North-West, and a small part of the South-West and the Coast	Maize, beans, groundnuts, plantains, manioc, coffee and oil palms	no big plantations
ZAE4 - monomodal rainfall	- South-West and Littoral and a small part of Centre and South	Banana, maize, cassava, macabo, cocoa, coffee and oil palm trees	Oil palm, rubber, and banana.
ZAE5 - bimodal rainfall	-- Most of the Centre, South, and East of France	Groundnuts, bananas, cassava, macabo, maize, cocoa, oil palm, and coffee	Oil palm, rubber, and sugar cane

Source: MINEPDED (2017)

3.1.1. BARRIERS TO IMPLEMENTING OPTIONS AT THE NATIONAL LEVEL

Numerous obstacles have been identified at national, cross-cutting, and sectoral levels. These barriers hinder the deployment of options that can contribute to the reduction of DD. At the national level, the main difficulties are those of governance, cross-sectoral coordination, and building the technical capacity of experts.

The main barriers relate to poorly defined and disputed land rights, measurement procedures, insufficient administrative capacity and governance, corruption, etc.

However, the work of Chia et al (2020) identified and assessed the barriers to the adoption of sustainable forest management practices in the context of reducing forest carbon emissions. The fifteen or so barriers identified were grouped into 4 categories: economic barriers, governance-related barriers, barriers related to the knowledge and technical capabilities of stakeholders, and barriers related to the legislative and regulatory framework (see Table 2).

Table 2 *Barriers to the adoption of sustainable forest management practices*

Categories of Barriers	Sl no	Sub/key barriers	References
Economic related barriers (E)	1	High opportunity cost of maintaining forests as compared to other land uses (E1)	Nasi et al., 2011, Sabogal et al., 2013
	2	High transaction cost for improved forest management (E2)	Nasi et al., 2011, Nasi et al., 2012, Sabogal et al., 2013
	3	Limited financial benefits from adopting improved forest management (E3)	(Nasi et al., 2011, Nasi & Frost, 2009, Nasi et al., 2012, Sabogal et al., 2013
Regulatory and legislative frameworks related barriers (R)	4	Inadequate incentives (E4)	Nasi et al., 2011, FAO and EFI, 2018
	5	Inadequate regulatory framework (R1)	Cerutti et al., 2008, Sabogal et al., 2013
	6	Inadequate political will and incentive to enforce regulations (R2)	Cerutti et al., 2008, Ewane et al., 2015, Nasi et al., 2011, MINEPDED, 2016, Sabogal et al., 2013, Cerutti et al 2017
	7	Impracticable technical directives from legislation (R3)	Nasi et al., 2011, FAO and EFI, 2018
Governance related barriers (G)	8	Unclear tenure and resource rights (G1)	Ewane et al., 2015, Nasi et al., 2011, Nasi et al., 2012
	9	Poor transparency and accountability (G2)	Ewane et al., 2015, Cerutti, Tacconi, Lescuyer, & Nasi, 2013, Cerutti et al., 2016
	10	Corruption (G3)	Ewane et al., 2015, Nasi & Frost, 2009, Cerutti et al., 2013
	11	Limited participation of relevant actors in the development of management plans (G4)	Nasi et al., 2011
Knowledge and capacity related barriers (K)	12	Limited understanding on the benefits to improve forest management (K1)	Nasi et al., 2011
	13	Limited financial and material resources (K2)	Cerutti et al., 2008, Ewane et al., 2015, Nasi & Frost, 2009, MINEPDED, 2016, Cerutti et al 2017
	14	Inadequate human resources to implement and monitor regulations (K3)	Cerutti et al., 2008, Ewane et al., 2015, Nasi & Frost, 2009, MINEPDED, 2016, Sabogal et al., 2013; Cerutti et al 2017
	15	Lack of successful examples and poor disclosure of what is known (K4)	Cerutti et al., 2008, Ewane et al., 2015, Nasi & Frost, 2009, MINEPDED, 2016

Source: Chia Loh et al 2020

A categorisation of Chia et al (2020) leads to a subdivision of barriers into four:

- Barriers linked to the legislative and regulatory framework, involving impracticable technical directives and inadequate regulatory and political frameworks;
- Barriers related to economic aspects mainly focused on inadequate incentives, the high opportunity cost of maintaining forests compared to other land uses, the high transaction cost of improved forest management, and limited financial benefits for adopting improved forest management;
- Barriers related to technical knowledge and skills, including inadequate human resources, lack of success stories, lack of understanding of the issues, and limited material and financial resources;
- The barriers linked to governance are based on corruption, the lack of participation of all stakeholders, and low transparency.

Ewane, Ewane, and Heon-Ho (2015) instead identified the failure to prioritize effective options and proposed ways out, the corruption of some officials and local community leaders. In addition, Neba sina and Fonjong (2002) highlight the difficulties experienced by the state and conservation stakeholders in coordinating efforts, the lack of interest shown by local populations, survival strategies that take precedence over conservation, and the unsuitability of projects for the local context.

4. RESULTS OF THE STUDY

3.1. WAZA LANDSCAPE

This section focuses on the Waza landscape. It first presents: (i) the direct and indirect drivers of deforestation and forest degradation, as well as the underlying causes, (ii) identifies options and activities to combat or mitigate deforestation and forest degradation and finally (iii) identifies barriers to the implementation of options to mitigate deforestation and forest degradation.

3.1.1. DIRECT DRIVERS OF DEFORESTATION IN THE WAZA LANDSCAPE

Historically, deforestation and forest degradation have always been very high in the far north in general and in the Waza landscape in particular. The MINEPDED study (2017) shows that there has been a significant disappearance of woodland formations. According to Jiagho (2021), anthropogenic factors, natural factors, bioecological factors, and political-institutional factors are the main groups of factors driving deforestation and forest degradation in the Waza landscape. According to analyses of satellite images, forest loss in Landscape Waza is estimated at 93686.49 hectares between 1998-2010 and 65043.81 hectares between 2010-2021. Overall, between 1998 and 2021, forests suffered a significant loss of 158730.3 ha, resulting in an annual deforestation rate estimated at 4.46% each year. The SND30 also plans to increase national cotton production to 600,000 tonnes by 2026 and one million tonnes by 2030. This increase will require a demand for fertile land if no action is envisaged to improve and settle farmers.

The main driver of deforestation in the Waza landscape is agriculture, which can be divided into two types: cash crops and food crops.

3.1.1.1. Agriculture

Maize, groundnuts, rice, onions, beans, cowpeas, and millet-sorghum have been identified as the main crops impacting forests in the Waza landscape. These crops are grown not only in areas formerly used for farming but also in woodland and floodplains. In the Waza landscape, it is clear that the conquest of new land is eating away at the park's surface area, especially on its periphery. Cultivated land has increased from 117,025 ha in 1998 to 205,939 ha in 2021. Agriculture in the WAZA landscape is subdivided into cash or perennial crops and food crops.

Cash crops

Cotton

Cotton is the main cash crop for export in the Far North region. Around the Waza National Park, cotton plots cover an average of 0.5 ha. Smallholders have an average of 3 ha per farmer and produce a yield of 1.2 tonnes of seed per hectare (Devèze, 2006).

In terms of agricultural yields in the villages consulted cotton is the crop with the highest yields, as shown in the figure below:



Figure 12 Annual cotton yields in the villages surveyed

For decades, cotton growing has been the driving force behind development and economic stability in this region of Cameroon (Devèze 2006, Levrat 1984). Although it is one of the sectors that attacks the forest cover, it is not the main threat. In fact, between 2000 and 2015, the area under cotton declined. Nevertheless, SODECOTON continues to supervise producers (Roupsard 2005). The cotton sector is in crisis, with production falling from 220,844 tonnes in 2005/2006 to around 125,000 tonnes in 2009/2010. What's more, the cotton sector, which had 313,000 producers in 2004, had only 100,000 by 2010. Similarly, the area under cultivation fell from 231,993 ha in 2005/2006 to 133,000 ha in 2008/2009 (Manyacka 2013). Farmers are increasingly turning to more profitable food crops. The rural sector development strategy document (SDSR) plans to double production from 250,000t to 600,000t of seeds between 2020 and 2030 (MINADER 2020).

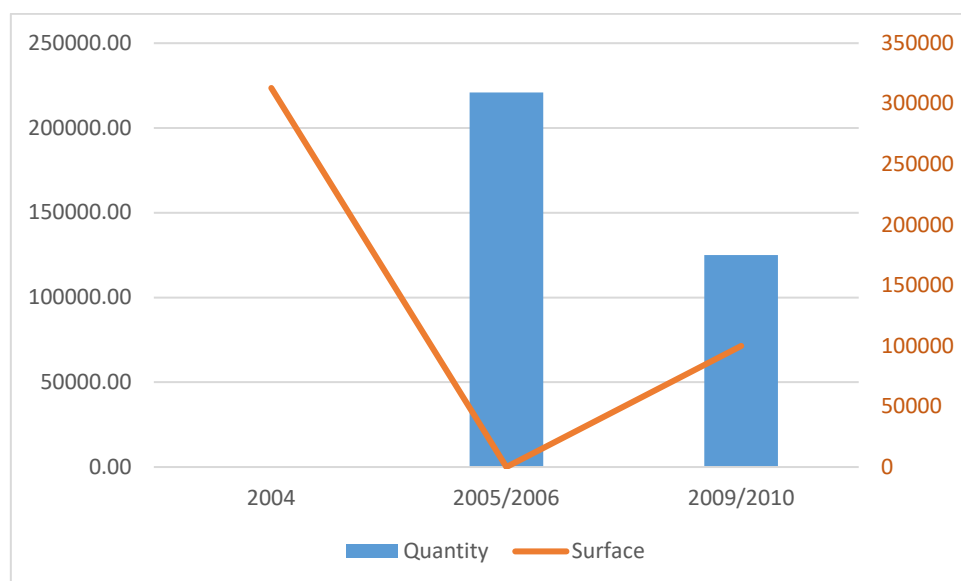


Figure 13 Evolution of cotton production in the Waza landscape

The SODECOTON system of supervising and purchasing cotton does not encourage farmers to make transactions with SODECOTON (200F/kg), but rather to refer to neighboring Nigeria, where the price per kilogram is higher (500F/kg). Moreover, calculating the opportunity cost of cotton growing shows that the net present value does not encourage risk-taking in cotton growing. In Cameroon's cotton-growing zone as a whole, there has been a marked reduction in the area under cotton (Taïkou et al. 2009; Manyacka 2013, Taïda 2017).

Food crops

Food crops include a number of speculative crops. Some, such as rice and millet/sorghum, are part of culinary traditions, while others, such as maize and beans/niébé, are sold on the national and regional markets. We are interested here in millet/sorghum and onions.

Mil-sorgho

Millet-sorghum is the main source of income for the local population. Cotton growers have abandoned cash crops (cotton) in favor of this more profitable crop. Sorghum millet is the most profitable crop (900 kg/ha for sorghum and millet) and offers a high opportunity cost ratio (Jiagho 2018). This crop, which is managed by farmers' organizations, is not only the most profitable economically but also forms part of the food staple (photo 3). Figure 14 shows trends in millet/sorghum production in the Waza landscape for the period 2020-2021, and projections for 2025 and 2030. The trends show a clear increase every 5 years.

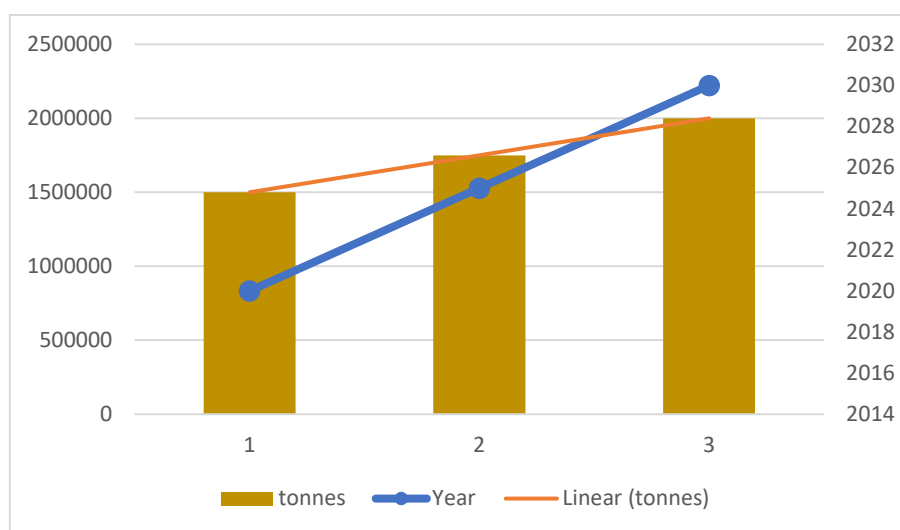


Figure 14 Evolution of millet-sorghum production in the Waza landscape



Photo 1: Off-season sorghum cultivation in the village of Andirni
Source: Terrain, 2022

The historical crop par excellence of North Cameroon, millet-sorghum has established itself in the dietary habits of the peoples of North Cameroon (Seignobos 2005). It is the most widely produced and consumed crop in the far north of Cameroon (Adamaoua, North and Far North). This sector is

as important as Garine (2002) speaks of a millet civilization. National millet/sorghum production takes place mainly in ZAE 1, which accounts for around 95% of national production. The SDSR document forecasts an improvement in production from 1,500,000 tonnes in 2020 to 1,750,000 tonnes in 2025 and 2,000,000 tonnes in 2030. (MINADER 2020). This improvement in production will contribute in one way or another to the loss of biomass. Annual demand is around 2,000 tonnes on average per year, as this crop is the main source of nutrition in the Far North and is also used to produce beer and poultry feed (MINEPDED, 2017).

As a result of competition from more profitable crops such as cotton and maize, millet/sorghum is increasingly being pushed into less favorable areas (mountain slopes, areas at risk from land tenure, flood-prone areas, mayo interfluvies). (MINADER 2020). Figure 13 shows the annual yields of the main crops grown in the Waza landscape. It shows that red millet, onions, and maize are the crops with the highest yields, ranging from 5 to 20 million tonnes.

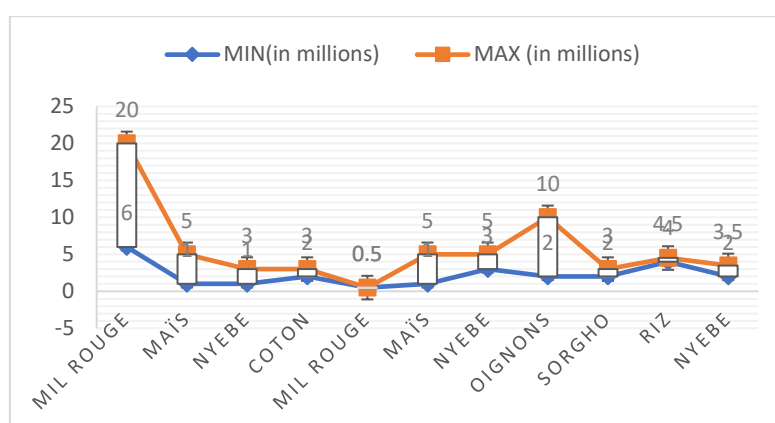


Figure 15 Annual yields of the main crops in the villages consulted

Onions

In recent years, the profitability of onion growing has prompted some farmers to switch to this crop. Farmers in the localities of Pétté and Mora in particular, and in other villages around the WNP, are increasingly growing onions (see photo 4). Average production varies between 7.9 t/ha and 11 t/ha.

However, the introduction of high-productivity varieties could bring hope to farmers. For example, the *Chagari* variety (50.48 t/ha) and the Goumadi variety (49.24 t/ha) have been put forward as the most promising. (Sakatai, FolefacK, and Vandi 2021).

Farmers' organizations provide a framework for new growers, and the supply chain has developed considerably in recent years, based around growers, traders, and transporters. Major new areas of production have emerged around the WNP, even though these crops were confined to flood-prone areas: other types of land use, such as forest relics, are being reclaimed.



Photo 2 Growing onions in *Pétté* (source: Field, 2022)

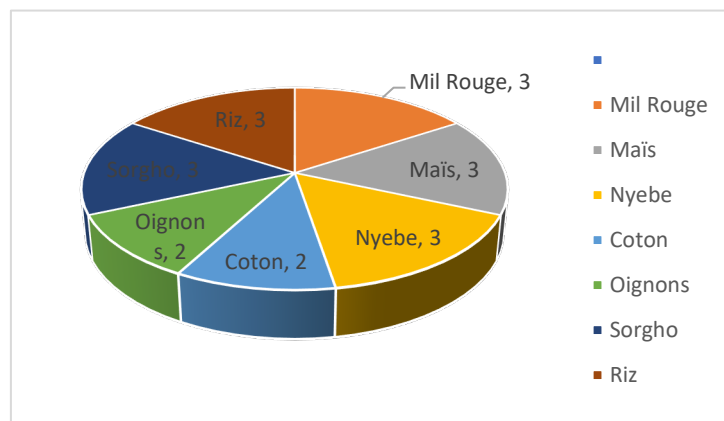


Figure 16 Main agricultural crops and cycles

3.1.2. DEFORESTATION AGENTS IN THE WAZA PAYSAGE

The main agents of deforestation in the Waza landscape are small-scale producers and sellers of the local wine known as "bilibili". The growing demand for Mil-sorgho has encouraged small producers to form cooperatives. To meet growing demand, growers are increasingly turning to woodland, where they are opening up areas of up to 1 hectare. In total, there are more than 187 hectares of sorghum around Waza Park. All woody species are systematically clear-cut in preparation for growing muskwaari sorghum. (Jiagho 2018). In one year, a total of 9,680 trees of all species were cut during the preparation of flood recession sorghum fields. This systematic cutting is linked to the fight against birds, locusts, and caterpillars.

Table 3 DDD agents in the Waza landscape.

Engine category	Agent category	Deforestation or degradation	Main chain value	Size of contiguous zones (hectare)	Forest area affected
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Wood energy ;	Small and large producers, refugees, households, (for cooking bill, soya, braised fish, cooking bricks, drying fish)	Degradation leading to deforestation	Charcoal (carbonization)	Over 100	Approximately 50 ha per year ¹⁰
Food crops	Small producer	Deforestation (through bushfires)	millet/sorghum, onions, rice, maize,	Less than 1	Approximately 4,200 ha per year
Permanent agriculture	Medium-sized producers	Deforestation	Cotton	Between 2 and 100	Approximately 1,500 ha per year
Breeding	Small producer, Breeder, Transhumant stockbreeders, foreign stockbreeders oudahs	Degradation	Cattle and sheep farming/pasture	Between 1 and 2	Around 700 ha per year
Hunting	Traditional hunter	Degradation	Bush or forage fires	From 1 to 10 ha	Approximately 5 ha

Sources: 2022 field data adapted from MINEPDED (2017)

3.1.3. DRIVERS OF DEGRADATION IN THE WAZA LANDSCAPE

In the Waza landscape, the demand for firewood combined with economic crises and the demographic boom are having an impact on the degradation of plant cover. (Tabopda 2012). Livestock rearing, hunting, and the installation of fishing canals are the main activities contributing to forest degradation in this landscape.

3.1.3.1. Bush fires

In some cases, bushfires contribute to deforestation; in others, they contribute to forest degradation. People living on the edge of the WNP set fires in areas of interest without any prior coordination of these activities. Farmers say they use the fires for farming and hunting. Farmers set fires voluntarily at the beginning of the dry season (early November) to accelerate the regrowth of new grass. The late fires set by farmers are frowned upon and make a real contribution to degradation, as well as being a devastating factor for the forest relics around the WNP. In 2010, between 15 and 18 ha of forest land inside the park burnt as a result of fires started by local communities near the park entrance. (IUCN 2011).

In addition, off-season fires set by water and forestry officials after the first rains to protect sensitive forests destroy roughly equivalent areas. One of the impacts of uncontrolled fires is the loss of plant resources, reducing their availability for human needs and the ecosystem balance. Bush fires

¹⁰Less than one contiguous zone of this category was visible in the reference period

also lead to the loss of biomass in wooded savannahs. Uncontrolled fires set by hunters and farmers are the most devastating, unlike those set by herders to regenerate their pastures (Jiagho 2018). Although forest fires are recognised as necessary for maintaining savannahs, the fact remains that this practice requires rigorous monitoring and supervision (Tabopda 2008). The influence of forest fires on the intra- and inter-annual dynamics of plant cover is considerable (Tabopda 2012).

3.1.3.2. Wood energy and charcoal supplies

To date, there has been a dramatic increase in charcoal burning, which is threatening the forests of the Waza landscape. Charcoal burners, mainly IDPs, refugees, and certain local communities, use *Balanites aegyptiaca* or wild date palms to produce charcoal because of its high density in the landscape. People interviewed in the villages say that the wood harvested supplies the towns of Maroua, Mora and Kousseri. The charcoal produced is sold in neighboring countries such as Chad and Nigeria, where a 100kg bag costs 15,000 CFA francs. As for fuelwood, on average, a household harvests 1 bundle of wood per day, containing around 25 branches. The wood harvested (photo 1) is used not only for domestic cooking but also for baking bricks (photo 2) and smoking fish. When the wood is not used, it is sold for 300 FCFA per bundle.



Photo 3: Sale of fuelwood by the roadside in the village of Ndiguina and bags of charcoal impounded by the Mora Forestry Administration

The far north of Cameroon is one of the regions most affected by the challenges of access to wood energy. The exploitation of forests for fuelwood, slash-and-burn agriculture, and grazing are the vectors of the degradation of forest ecosystems and deforestation, particularly in peri-urban areas. Wood energy supplies 95% of households in Cameroon's Far North region. More than 75% of Cameroon's population still depends on wood fuels for cooking, and a large number of small businesses use firewood and charcoal as their main source of energy for activities such as baking, tea processing, or brick making.

In 2003, a significant proportion of supplies to the regional capital Maroua came from the localities around the WNP. For example, Pétte 8.8% or 261.3 m³, Bogo 7.5% or 221.2 m³, Mora 2% or 58m³. In addition, 12% of the wood from the WNP is supplied to Kousseri (Madi, Huub, and Sali 2003). The report already concluded that in 2022, if nothing is done (BAU scenario), the balance between supply and demand for wood energy and service wood will be very unbalanced. A potential supply of 1,030,111m³/year compared with consumption of 1.859 million m³ of wood, i.e. an annual deficit of 829,439m³ (MINFOF 2014).



Photo 4: A brick kiln in the village of Djéguéré
Source: Terrain 2022

Deforestation for drying fish also represents an additional source of pressure on resources. In addition, the strong demand for timber and energy wood in Chad is a source of pressure on forests in the far north in general and in the Waza area in particular, because of its proximity. Indeed, the tightening of Chadian laws on forest harvesting in the 2000s has reinforced this trend towards timber imports.

3.1.3.3. Breeding

The creation of pastures, transhumance corridors, and the demand for fodder or feed has a significant influence on plant cover. In 1974, the total surface area of pastureland was 7 million hectares for 160,000 head of cattle. This surface area, which includes hardened land where pastoral resources are negligible, would be reduced to 3.5 million hectares for 1.3 million head of cattle. The main species are cattle, goats, sheep and donkeys. Figure 15 below shows an estimated proportion of each of these domestic species.

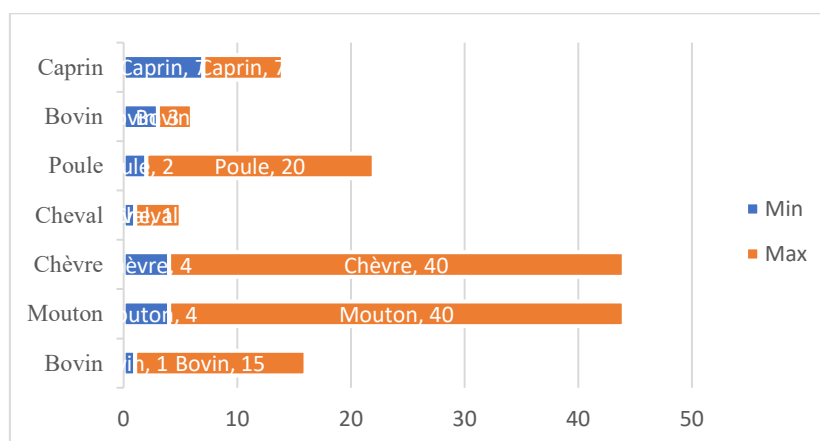


Figure 17 Average number of head for each livestock species.
Source: Terrain, 2022

In addition, tree pruning and grazing maintenance by early bushfires reduce biomass and weaken the soil. The lack of fodder during dry periods leads herders to focus on edible trees. The stakeholders consulted in the WNP confirm the incursions of livestock farmers during transhumance or the long dry seasons. As a result, transhumance and livestock encroachment within the WNP pose serious problems. Figure 15 shows the comparative evolution of pasture area and cattle numbers.

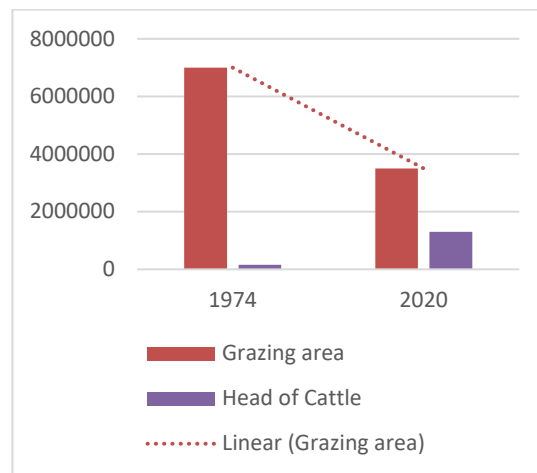


Figure 18 Comparative change in pasture area and cattle numbers: 1974 and 2020
Source: Terrain, 2022

Pastures affected by early fires regenerate and produce shrubs that are often resistant to recurrent fires. The trend shows that grazed areas have been decreasing over the years in favor of wooded savannah areas (Photo 5). These fires, recommended by grazing experts, help the vegetation to regenerate rapidly when they are controlled. Bush fires are used as a method of managing agro-pastoral landscapes and are a factor in forest degradation¹¹. The use of firebreaks during these operations demonstrates a desire to manage fodder resources. The extensive and transhumant system is a production system that has the greatest impact on landscapes (MINEPDED 2017). In contrast, the intensive system is more advisable. Increasingly heavy livestock grazing contributes to soil degradation (Cessat 1998).

¹¹ There are many different views on bushfires. While environmentalists advise against the practice, livestock professionals highlight its virtues.



Photo 5: Transhumance movement in the peripheral zone of the WNP. Source: Field, 2022

3.1.3.4. Hunting

Traditional hunting and poaching activities in the WNP contribute significantly to the degradation of the forest cover. Hunters use fire to stalk animals, and this method of hunting causes considerable loss of forest cover. This situation persisted around the park in 2008, with the incursions into wooded areas producing catastrophic results. The hunting of mammals and monitor lizards is most practiced by non-Muslims, mainly of the animist faith. Sport hunting on safari has no impact on degradation, as it is controlled.

3.1.3.5. Fishing channels

The installation of fishing canals is a significant cause of forest degradation in the landscape. The installation of these fishing canals (Zina, Logouma, Diéguéré, Zouang) is a real obstacle to transhumance. It is estimated that there were more than 8,000 fishing channels between 2000 and 2014 in the large wet savannah bordering the WNP¹². The percentage of these canals quadrupled between 1986 and 2006 due to the drop in rainfall and demographic pressure from populations looking for space for rice-growing extensions (Jiagho 2018). The Ramsar site, which constitutes the landscape's major wetland, is subject to unsustainable fishing that is developing to the detriment of biodiversity conservation and sustainable land management. This unsustainable fishing is characterized by the installation of fishing channels up to 2 meters deep and 600 meters long, the purpose of which is to retain fish after the flooding period. As these canals constitute an obstacle to the passage of the herds, the herders are obliged to turn towards the WNP to carry out their transhumance movements, during which they prune trees and remove tree bark, which contributes to the degradation of the forests. Photo 6 shows an example of a fishing channel installed in the Zouang village very close to the WNP.

¹³ According to a study by Ordway et al (2017) nearly 92% of cocoa production in Cameroon is found in systems shaded under secondary forest canopies or cultivated with food crops, making it indistinguishably spectral from forest, mixed crop or monoculture systems at 30m resolution.



Photo 6: Fishing channels installed in the Zouang village. Source: Field, 2022

3.1.4. UNDERLYING DRIVERS OF DD IN THE WAZA LANDSCAPE

The destruction of forest cover is indirectly linked to demography, infrastructure, migration, and the context of insecurity in the Waza area. All the stakeholders met during the focus groups and interviews in 2022 confirm that market demand, demographic pressure, insecurity, and internal migration contribute to deforestation.

Insecurity, the institutions interviewed in the far north confirm that insecurity linked to Boko Haram, internally displaced persons, and Chadian and Nigerian refugees are indirect drivers of deforestation. More locally, it has been noted that the construction of fishing canals is obstructing migration corridors, forcing herders to retreat to the forests around the WNP. Latent or open conflicts are created along these areas of tension. These conflicts over natural resources have an impact on forest ecosystems. One example is the clashes between Musgoum and Kotoko fishermen that took place in February 2007 inside the Waza National Park. This locality had already experienced similar clashes in November 2004. They resulted in around ten deaths and thirty injuries (Tabopda 2008). Moreover, the recent inter-community conflicts based on religion and ethnicity, which have resulted in some 44 deaths, have only exacerbated the pressure and caused waves of encroachment on natural resources. Indeed, these conflicts between fishermen and herders have created a tidal wave towards the south and consequently around the WNP.

In addition, the prevailing poverty in the Waza landscape means that local people have no alternative but to exploit natural resources.

According to stakeholders, the influx of refugees around Waza Park is one of the indirect causes of deforestation. These refugees are creating new fields, cutting wood for energy (for use and sale on the roads and in the towns) or for timber or charcoal. Their only source of income is from cutting forest remnants for firewood. Carbonization and deforestation for drying fish also represent an additional source of pressure on resources.

In addition, the strong demand for timber and energy wood in Chad is sucking the forests out of the far north in general, and the Waza area in particular, because of its proximity. Indeed, the tightening of Chadian laws on forest harvesting in the 2000s has reinforced this trend towards timber imports.

Demographically, the average annual population growth rate is 5.8%, one of the highest in the country. Strong demographic pressure is a major factor affecting the forests. Its population rose from 4 million in 2000 to almost 6 million in 2010, and projections forecast 9.3 million inhabitants in 2025 (MINEPDED, 2017). The population of the Far North region accounts for 17.9% of the

country's total population, making it the second most populous region in the country after the Centre. The average population density is 108 inhabitants/km². The vast majority of the population of the Far North use wood as their main source of domestic energy and will remain dependent on this resource for a long time to come. Around 95% of the urban population uses wood energy (MINFOF 2014). There is a close link between sorghum production, culinary habits, and market demand, which has risen in this zone from 430,000 tonnes in 2000 to 1.3 million tonnes in 2015, but it should also be noted that in this ZAE there has been an expansion in the area cultivated for millet-sorghum of 540 thousand hectares in 15 years (MINEPDED 2017). Population growth in the 7 communes of the intervention zone increases the need for firewood, charcoal, and foodstuffs, but also greatly increases the demand for natural resources (Jiagho, 2016).

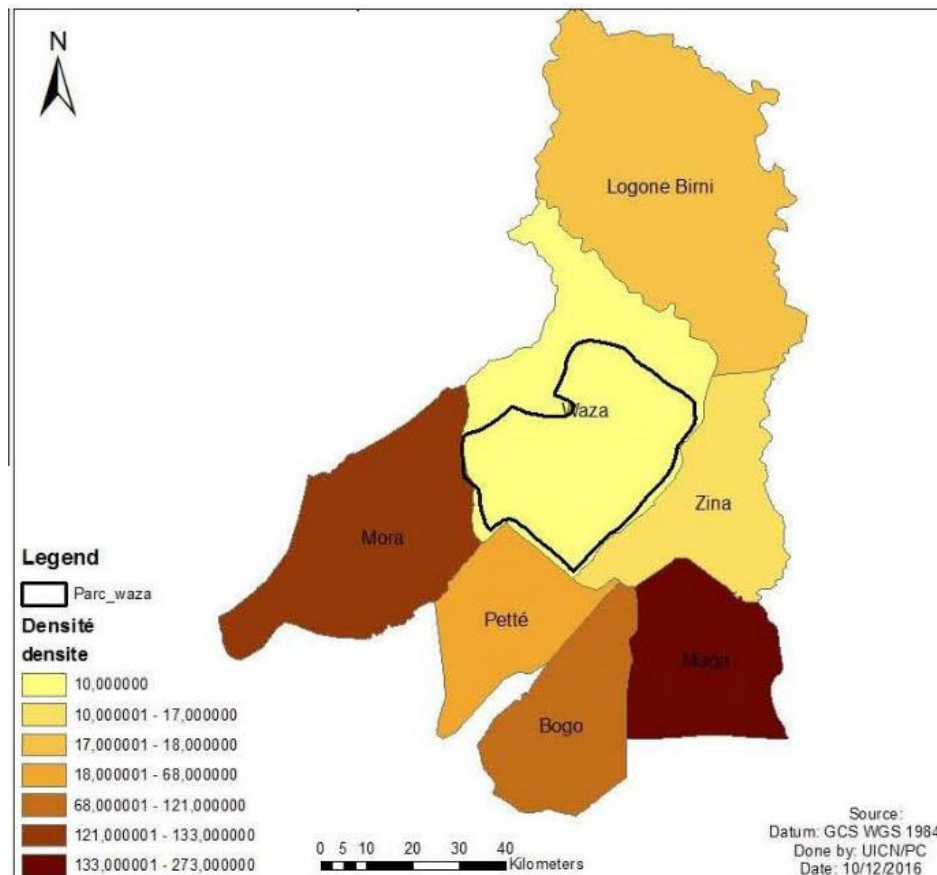
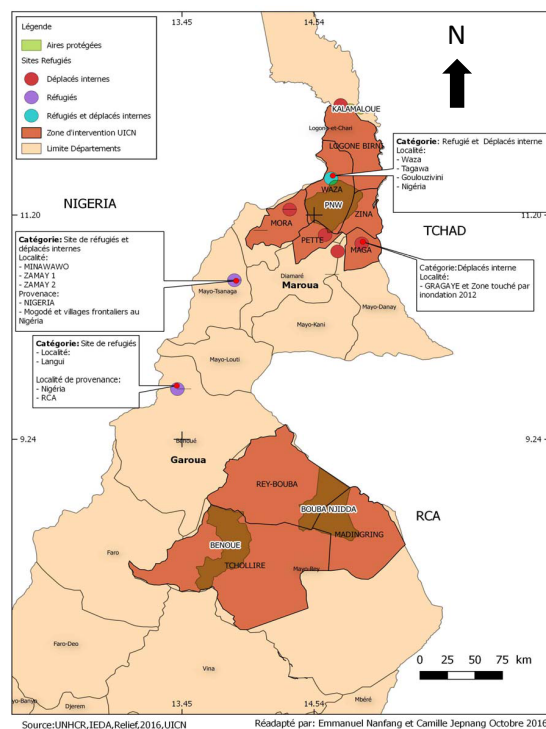


Figure 19 Population density around Waza (Jiagho, 2021)

In terms of migration, population displacement or internal migration is an undeniable indirect driver of forest cover conversion. The report by the International Organisation for Migration estimates that, as a result of armed conflicts, community conflicts, and natural disasters, there are 341,535 internally displaced persons, 48,901 of whom are outside the camps. (IOM, 2021). Military conflicts with Boko Haram terrorists are an indirect cause of deforestation insofar as people from threatened villages have moved to refugee camps around forested areas. The settlement of more than 50,000 people, made up of refugees and internally displaced persons, following attacks by terrorist groups and natural disasters (floods) is an aggravating factor. Refugee camps such as Minawo are putting considerable pressure on resources. (Basile 2019, Manet 2020).



Infrastructure and transport. Infrastructure and transport drive and encourage deforestation. The permanent forests along the main roads close to Chad (Ndjamena) are an additional factor due to the high demand for wood for energy and timber (Lescuyer and Tal 2016). Moreover, the restriction on timber harvesting in Chad has only increased logging in the far north of Cameroon, where law enforcement is sometimes non-existent. The Douala-Ndjamena corridor is a major source of wood energy. The official, informal, and clandestine flow of energy wood and charcoal to Chad (MINFOF 2014) is significant and uncontrolled. In addition, the other types of infrastructure that support growth in the far north are poorly developed. Very few structuring projects are included in the region's planning.

Finally, it was noted that a range of pressures and forces are threatening the permanent forests of the WNP landscape. The change in land use over the last twenty years can be seen in cultivated land, wet savannahs, and wooded savannahs. The results of the report on forest land-use change from the same study show that the rate of deforestation in the forests of the Waza landscape varies every year. Forest loss is estimated at 93686.49 hectares between 1998-2010 and 65043.81 hectares between 2010-2021. Overall, between 1998 and 2021, forests suffered a significant loss of 158730.3 ha, resulting in an annual deforestation rate estimated at 4.46% each year. Deforestation is concentrated on the periphery of the park, particularly in the villages of Waza and Loundouma.

Figure 14 shows all the direct and indirect drivers of deforestation/degradation in the Waza landscape. It shows that deforestation is fuelled by the need for wood energy and charcoal, agriculture, bushfires, livestock systems and unsustainable hunting techniques. In addition, other factors/drivers play a significant role in deforestation, notably: internal and external migration, insecurity linked to Boko Haram, population growth, regional market development, and transport infrastructure.

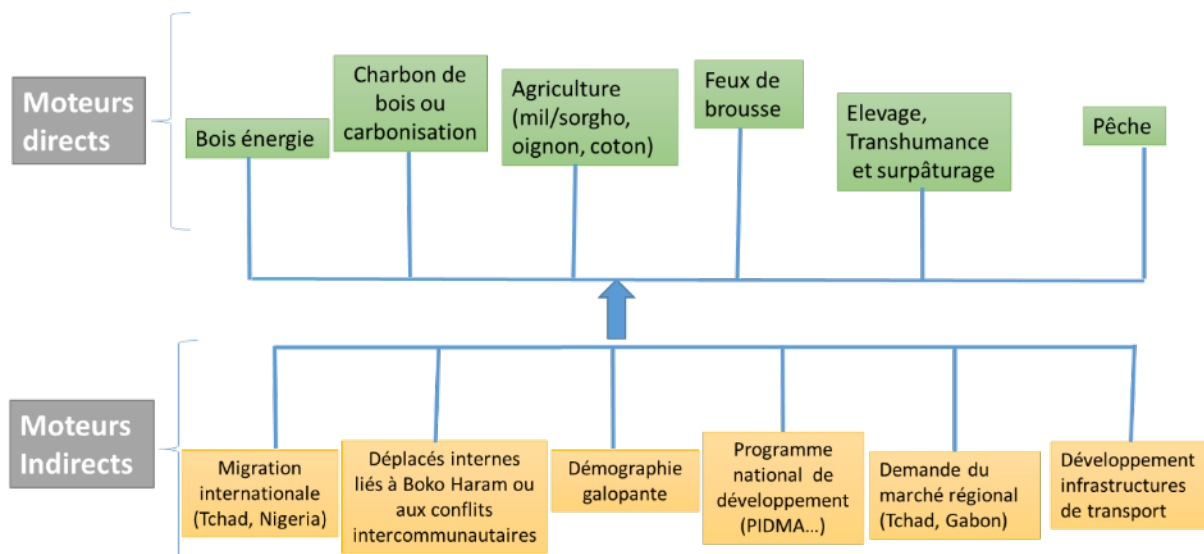


Figure 21 Drivers of deforestation and degradation around the WNP

3.1.5. OPTIONS AND ACTIVITIES TO REDUCE DD IN PAYSAGE WAZA

To reduce deforestation and degradation in the Waza landscape, actions must mainly target those sectors that have a strong impact on forests. These include cash crops such as cotton and food crops such as millet-sorghum, groundnuts, maize, beans, and cowpeas. Furthermore, in the forestry sector, GIZ, in partnership with MINFOF and the local authorities, has developed options for the creation of communal and community forests that would supply the major towns of Maroua, Mora, and Kousseri (MINFOF, 2014). To tackle the issue of wood energy, these new forest areas will meet the growing needs of the population.

The options proposed by the various stakeholders consulted are all in line with those developed by the MINEPDED report (2017). Thus, the options proposed are those that contribute to a sustainable supply of wood energy and charcoal, but also those that will guide sustainable agriculture, livestock farming, and hunting. In addition, cross-cutting options addressing indirect drivers are proposed. In addition to adaptation techniques, the populations considered the following adaptation options:

The proposed options collected during field surveys in 2022 are based on:

- Reforestation and restoration of degraded areas in the WAZA landscape;
- The creation of acacia-based community plantations
- Restoring community forests;
- Extension of sustainable agricultural practices;
- Relocation of displaced persons camps;
- Production of fodder for livestock ;
- Delimitation of transhumance trails ;
- Reforestation of fruit trees in flood-prone areas (mango, guava, acacia, lemon and balanite);
- Training in fish farming and the creation of fish ponds;
- The creation of new reforestation zones;
- Promoting the use of improved stoves; popularising the use of renewable energies, even in the most remote areas;
- Promoting environmental education to encourage people to love trees;
- Implement rational bush/forest management strategies ;

- Set up a dialogue platform to regulate the creation and use of fishing canals that disrupt the hydrographic regime
- Drawing up a micro-zoning plan for the WNP

Indeed, to stabilize the permanent forests, it is crucial to create supply zones that could satisfy the demands of the surrounding towns. Stakeholders also recommend diversifying income-generating activities into livestock rearing and fishing. The GIZ project, which focuses on supporting community forests in the Sudano-Sahelian zone, is an opportunity for the options envisaged here.

The community forests can meet a large part of the demand in the town of Maroua. But the demand for wood on the roads to Chad could also be met, at least in part. The multiplication of options proposed in the villages of Pétté, Cheude Gauali, Djegueré, Dautarou, Karaltane, and Amm-Hairi relies on sources of timber other than in the WNP. Otherwise, local people will have to be helped to improve their incomes through activities that do not focus on natural resources. The WNP conservator supports activities such as making ecological charcoal from grasses and reviewing the WNP management plan with a focus on micro-zoning.

The administrative services unanimously proposed environmental education and more incisive repression to avoid repeat offenses. Indeed, if the administrative and judicial authorities are lax in their repressive actions, this will have a major impact on other users, who will rely on the lack of action by those involved in repression to repeat prohibited actions. In addition, these proposed options are in agreement on the need to establish synergy between the sectoral ministries, but also on the pooling of technical and financial support, and also the concertation of funding.

MINFOF (2014) recommends the following options: Provision of improved stoves, sustainable wood energy supply, improved cropping systems, improvement of the wood energy value chain and value chains, development of an information system on the wood energy value chain, dissemination of best practices (MINFOF, 2014; MINEPDED, 2017). Jiagho (2016) suggests that local stakeholders should work together to conserve forest resources. Concerning pastoral resources, securing pastoral areas and organizing herders to defend the interests of the profession at all levels of negotiation is a priority (Labonne, Magrong, and Oustalet 2003). Furthermore, the marking out of pastures, the production of fodder and the marking of cattle migration corridors can improve the management of these endangered areas. The combination of agriculture and grazing can also be encouraged, as can the total rehabilitation of degraded pastures (Tielkes, Schlecht, and Hiernaux 2001). Conflict reduction can be a primary solution to reduce overgrazing pressures (Koussouma Liba'a, Dugue P., and Tourkebiau E 2012, , Kossouma Liba'a 2003).

3.1.6. BARRIERS TO IMPLEMENTING DD REDUCTION OPTIONS IN THE WAZA LANDSCAPE

As mentioned in the previous sections, the main barriers at the local level are much more economic and linked to the lack of technical capacity of the players. These barriers at the level of the intervention zones are linked to the culture of the populations but also to the level of education.

In 2022, most of the players we met recommend almost genuine barriers to implementation:

- Public reluctance to accept alternatives and innovations.
- Conflicts between farmers, livestock breeders, and fishermen;
- The influence of the agreements and conventions of the member countries of the Lake Chad Basin Commission, which authorize cross-border transhumance;
- Lack of public support.
- Pruning the branches of tree species;

- Human-wildlife conflicts;
- Insufficient developed water points or artificial ponds ;
- The marginalization of women;
- Low technological level ;
- Poor media coverage of the image of the WNP (Red Zone)
- Insufficient human resources in the WNP.

The table below summarises the drivers of deforestation/degradation in the Waza landscape.

Table 4: Summary of DD drivers, options and barriers to combating DD

Direct drivers of deforestation	Agents and institutions involved
- Cash crops (cotton) and food crops (millet-sorghum, onions) -	-small producers, large producers refugees, internally displaced persons, households -
Direct drivers of degradation	
- Wood energy and carbonization - Bush fires - Breeding - Hunting - Fishing channels	- Small producer, Breeder, Hunter fisherman - Transhumant stockbreeders, foreign stockbreeders - oudahs -
Underlying drivers of DD	
- Demographic growth - Context of insecurity (Boko Haram) - Inter-community conflicts (Choa Arabic) - Internal migration - Transhumance - Local and regional market demand - Development programme - Development of transport infrastructure	- First ministry - MINEPAT - Business partners
Options/activities to combat DD	
- Restoring community forests, - Promoting sustainable agricultural practices - Production of fodder for livestock - Delimitation of transhumance tracks - Promoting improved stoves	- MINFOF, - MINEPDED - MINAGRI - MINEPIA - MINRESI
Obstacles to implementing the options	
- Public reluctance to accept alternatives and innovations - Conflicts between farmers, livestock breeders and fishermen	Breeder, Hunter

- **The influence of international agreements and conventions**
- Lack of public support
- Pruning branches
- Human-wildlife conflicts
- Insufficient water points or artificial ponds
- The marginalisation of women
- **Insufficient human resources in the WNP**

3.2. DJA-LOBEKE LANDSCAPE

The Dja-Lobéké landscape is considered to be a biodiversity conservation area par excellence because it beats the record for high density, protected areas, FMUs, and communal forests. This area is home to some of the best-preserved protected areas in Cameroon. The types of land use are quite disparate, insofar as the forest zoning includes 5.7 million hectares of forest under concessions or a communal forest title, 2.25 million hectares in protected areas, and finally 1.3 million hectares of community forests and 150,000 ha of timber sales (WRI, 2016). Around 86% of the surface area of this landscape is covered by forest (MINEPDED, 2017).

Long cocooned by degradation due to its remoteness and isolation, south-east Cameroon has for the past three decades been subject to heavy deforestation mainly for agricultural activities (cash crops and food crops). According to the results of the same study's land-use change analysis, deforestation in this landscape is more or less low. Of the 6,413,488.35 hectares of forest in 1992, 30,240.67 hectares were deforested between 1992 and 2021, representing an annual deforestation rate of 0.2%, or 5.8% in 29 years. This low rate of deforestation can be explained by the fact that this area abounds in exceptional biodiversity and is the subject of increased conservation efforts by the Cameroon government and other NGOs. However, it should be noted that this low annual rate of deforestation in this area could change in a context where agricultural yields are lower and by the granting of forest land by certain partners. This is the case, for example, with the SUDCAM rubber plantation on the outskirts of the Dja Wildlife Reserve, which could contribute to the fragmentation of wildlife habitats and thus break the ecological connectivity in this area.

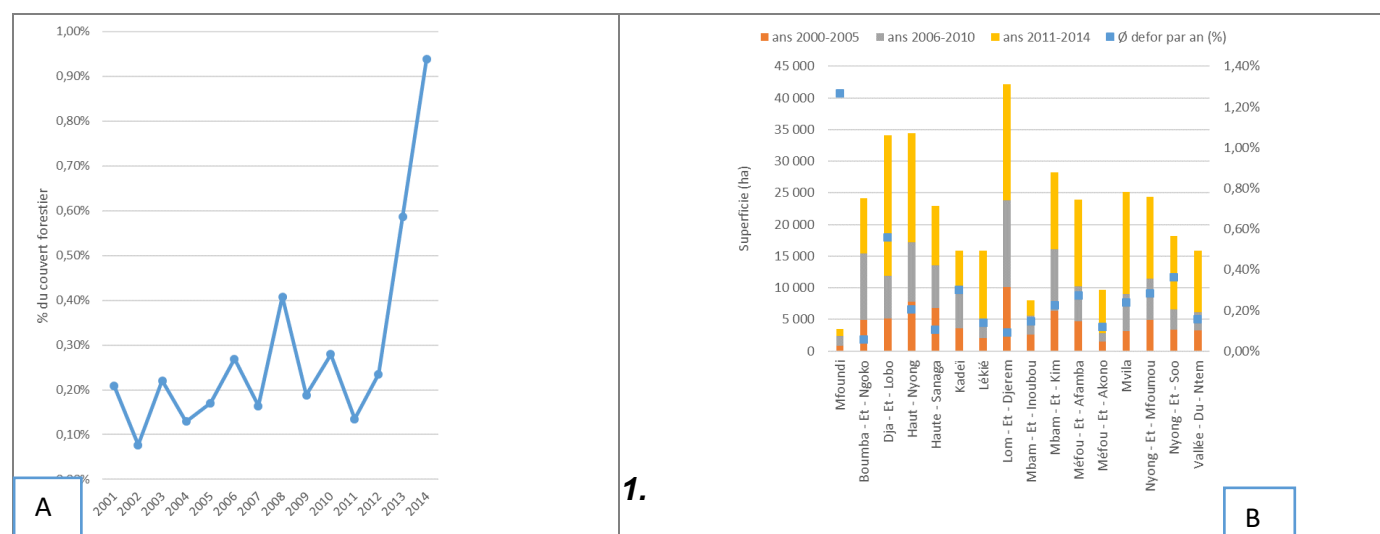


Figure 22: Changes in deforestation in % per year (A) and area (B) since 2000 by department in ZAE 5 (MINEPDED, 2017)

3.2.1. DIRECT DRIVERS OF DEFORESTATION IN THE DJA- LOBEKE LANDSCAPE

Surveys of the project's key stakeholders identified the direct drivers of DD. These drivers are ranked in order of importance: agriculture (industrial and slash-and-burn), mining (artisanal and industrial), logging, and bush fires. The main drivers of deforestation include farmers, agro-industrialists, and small-scale miners.

3.2.1.1. Agriculture

3.2.1.2. Cash crop farming

The Dja-Lobéké landscape is home par excellence to agro-industries and small and medium cash crop producers (Figure 16). A large proportion of deforestation in this area is due to commercial crops such as cocoa, rubber, and oil palm. Agricultural activities around the major towns and satellite towns have a significant impact on the deforestation process. Cocoa is at the forefront of the speculation that influences deforestation (Onsgsabien Efombo et al. 2019, Oishi 2012). The development of agro-industrial plantations (rubber, oil palm, banana) in Cameroon is greater than in the other countries of the Congo Basin (Hourticq et al. 2013). More recently, in its SND30, the government plans to triple national production by 2030, from 600,000 tonnes before 2025 to 1,200,000 tonnes by 2030 (MINEPAT 2021).

Cocoa

The people in the field consider cocoa to be the main source of deforestation. Most of the populations surveyed own cocoa plots of between 1 ha and 3 ha. Each household in this landscape may clear an average of 2 ha of forest in the course of its lifetime to create cocoa plantations (Figure 21). A significant proportion of the men interviewed in the focus groups claim to expand their cocoa plot by at least 1,000 m² each year. However, isolated villages such as Legoué and Kika are less inclined to develop plantations or increase their plots. The average size of cocoa farms varies from 1-5 ha, with minimums of 1 ha and maximums of up to 10 ha (currently being farmed). The workforce is mainly family-based, with an average production of 4 to 8 bags per hectare.

This situation is the result of the increase in the price of cocoa over the last few decades has accelerated the withdrawal of the urban elite and civil servants towards the cultivation of this speculation. People's wealth is now measured in terms of the number of plots of land they own. New plantations are being opened at the instigation of urban dwellers, who are taking over plantations to provide additional income, a pension, or a source of land. Cocoa farming practices depend largely on the type of plantation. Small plantations without shade destroy 80-90% of the forest cover, while small plantations with shade retain 70-80% of the trees. The trees conserved are mainly fruit trees (avocado, mango) and NTFPs (djansang, wild mango). The most important trees are Sapelli, Ayous, and fromager.

The area under cocoa cultivation in Cameroon rose from 250,000 hectares (MINADER, 2019) to around 670,000 hectares in 2014. Projections show that in just a few years we could have more than 900,000 hectares of cocoa land. Cocoa accounts for around 19% of the total value of the country's exports and is the second most important export product after oil. It employs more than

600,000 cocoa-farming families. Nearly 8 million people live directly or indirectly from the cocoa economy (Jagoret, 2012). Recent work by Lescuyer et al (2020) have confirmed these figures. They state that small farmers own 2.5 ha, medium farmers 12 ha, and large farmers 25 ha.

The growth of the cocoa-growing area contributes largely to forest degradation rather than deforestation and is therefore not detected by remote sensing¹³. But it does considerably reduce carbon stocks in forests (Klarer, 2014). New cocoa varieties that can grow under shade are helping to reduce the impact on forests. Overall, Cameroon plans to increase production by 308,851 tonnes, which would require deforestation of around 205,900 ha over ten years.

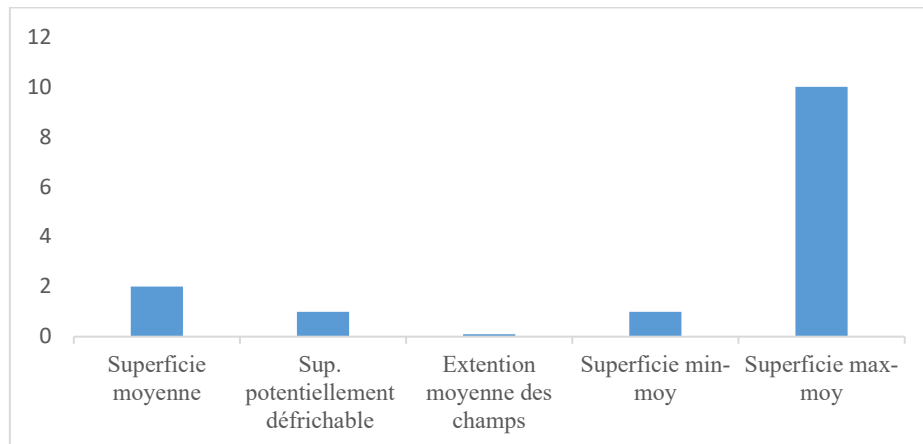


Figure 23: Data on cocoa farm area per household

Oil palm

Oil palm plantations are rarely found in the Boumba and Ngoko departments but are more visible along the Lomié-Mballam-Djoum axis. While the average size of plots around Djoum is around 1 ha, plots in the southeast are smaller, less than 500 m², and are used for domestic consumption.

The share of oil palm in the landscape's economy is fairly small. The more productive Tenera variety is the most widely planted, with the support of technical and financial partners. Oil palm expansion requires clear-cutting the forests, then recovering the useful wood, and finally burning the woody residues to create nurseries or direct planting.

It should be noted that urban elites continue to monopolise the most fertile areas. This has already been confirmed by (Nkongho, Feintrenie, and Levang 2014). In 2008, oil palm crops alone occupied 136,180 ha of previously forested land, and the demand for more land for palm plantations continues, putting real pressure on the forests (Nnah Ndobe et al., 2014). The government continues to sign agroforestry concession contracts. Hundreds of thousands of hectares of land are being negotiated for the next 5 years and some contracts have already been signed between the Cameroon government and investors interested in oil palm. The SDSR-PNIA 2020-2030 document forecasts an increase of 413,003 tonnes or 103,250 hectares of forest to be opened up, and the SND30 plans to double current production by 2027.

¹³ According to a study by Ordway et al (2017) nearly 92% of cocoa production in Cameroon is found in systems shaded under secondary forest canopies or cultivated with food crops, making it indistinguishably spectral from forest, mixed crop or monoculture systems at 30m resolution.

Hevea

In the Dja-Lobéké landscape, very few large plantations have developed, but those that have had the greatest impact (SudCam Hevéa, a subsidiary of the Halcyon Agri group) have razed thousands of hectares since the 2010s. To the west and southeast of the Dja reserve (a UNESCO World Heritage site), around 15,000 hectares of forest have been cleared for rubber cultivation. This incursion into this part of the forest not only hinders the ecological continuum but also reduces biodiversity.

The results produced by the WRI (2021) data show that deforestation is greatest in non-permanent forests (community forest and agro zone). Overall, small producers with less than 1 ha are the most important agents (Figure 16). If we refer to the SDSR-PNIA 2020 document, which forecasts growth of 40,000 tonnes by 2030, we can expect deforestation to increase by around 20,000 ha in ten years.

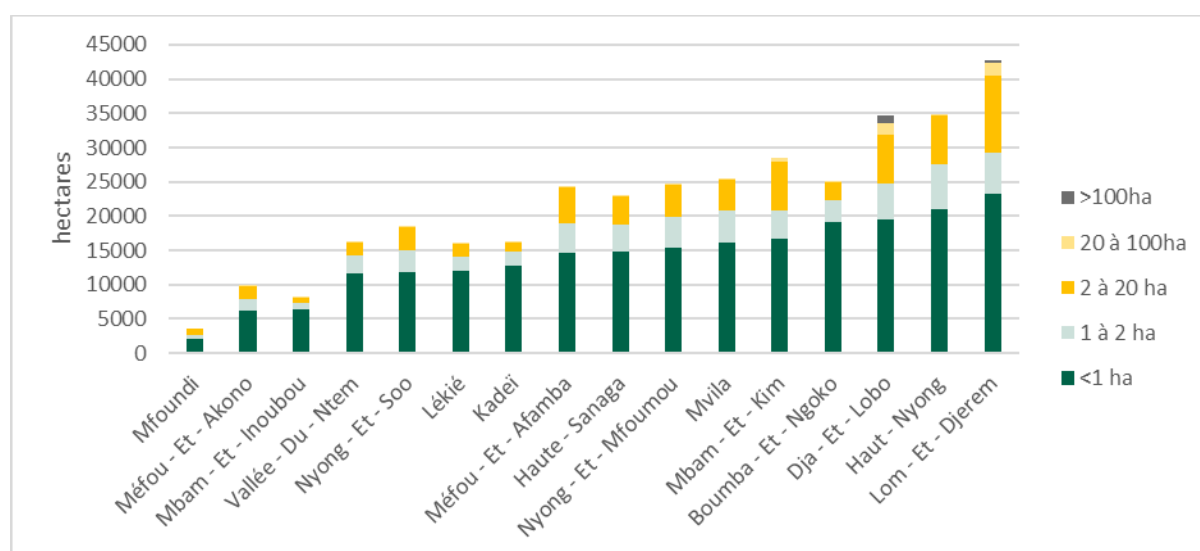


Figure 24: Size of contiguous zones converted by department in ZAE 5

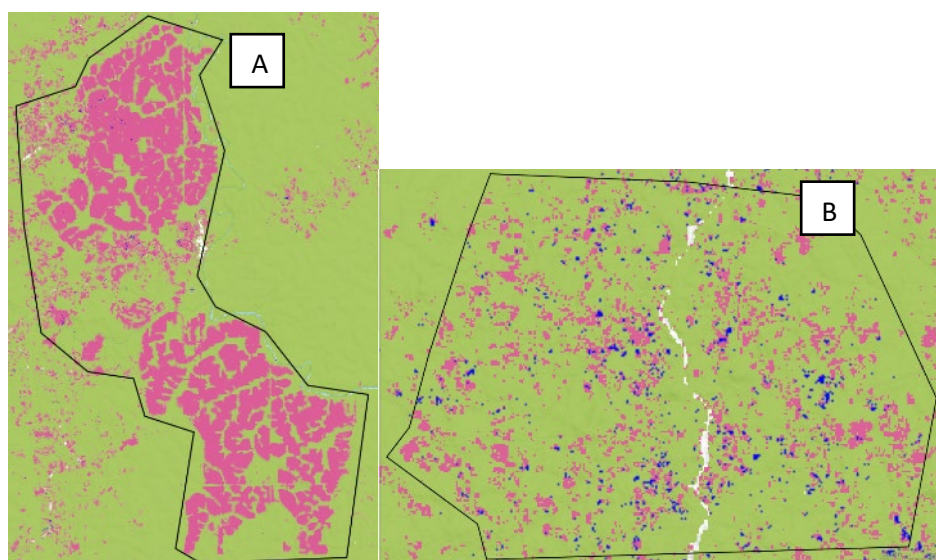


Figure 25: Rubber plantation (15,000 ha) around Sangmelima (A) and small cocoa plantations (B) around Yokadouma (WRI, 2021)

The awarding of new agro-industrial concessions requires vast clear-cutting and lightning deforestation in the various departments. Numerous multinational subsidiaries covet Cameroon's millions of fertile hectares. Figure 17 shows that in the agro-industrial plantation zone, forest openings are more incisive (in red) and there is an absence of reforestation, whereas in the small village plantation zone, there are areas of fallow towns (in blue).

3.2.1.3. Food crops

Small-scale shifting cultivation linked to subsistence agriculture has been identified as one of the main drivers of deforestation and degradation in the Dja-Lobéké landscape. Small-scale producers are the most important agents. MINEPDED (2017) recommends that conversions of less than one ha account for almost 65% of conversions and those between 1 and 2 ha are 15%.

Cassava

Around 29% of households grow cassava. As well as being an important part of cooking habits, cassava also generates significant income. Farmers own between 0.5 and 1.2 hectares of land, most of which is sold on the local market as by-products. Pure cassava is grown on a small scale, in association with beans, taro, macabo, and maize. The new areas cleared for cassava cultivation show an advance over the forest in the Dja-Lobéké landscape. Cassava by-products (cassava-based bread flour, starch, tapioca, cossettes, bobolo or myondo, etc.) provide a major source of income, and are undoubtedly prompting farmers to seek out new areas of forest to clear. The crop is also of industrial interest for its starch and bioethanol. The exponential rise in the price of wheat flour has increased interest in cassava tenfold, making it a substitute product.

The SDSR- PNIA 2020-2030 document envisages the development of the food-producing agricultural sectors and plans to increase from 5,492,522 tonnes in 2020 to 10 million tonnes in 2030. The area planted between 2013 and 2035 should increase from 281,250 ha to 346,463 ha. Cassava has gone from being a family crop to a commercial crop because of the profitability and labour required. As this crop does not grow under shade, it needs light to develop. If we forecast an average of 40 tonnes/ha, this would mean opening an additional 112,687 ha of forest. The PIDMA, PDVRTP, and all the other sectoral policies and initiatives represent a potential for the development of the cassava sector. The area planted between 2013 and 2035 should increase from 281,250 ha to 346,463 ha. Cassava has gone from being a family crop to a commercial crop because of the profitability and labour required. As this crop does not grow under shade, it needs light to develop.

Plantain

Plantain is part of the dietary habits of people in the sub-region, and the ever-increasing demand for it could help to increase the demand for arable land. Moreover, this crop was one of the first to be planted when the forests were opened up. In the Dja-Lobéké landscape, plantations occupy an average area of 2.2 ha. Production per harvest season varies between 700 and 1,000 bunches on average. Plantain accounts for around 650,000 tonnes of production, and between 2013 and 2035 the area under plantain will increase from 250,000 ha to 695,685 ha (MINADER, 2020).

3.2.1.4. Industrial mining

With the arrival of the Chinese, mining has exploded in the bimodal forest zone in recent years, particularly diamond and gold mining. These mining activities are hurting forest ecosystems. Ngoyla-Mintom is a perfect example of this (Anyu and Moki 2013). Artisanal mining and related activities in the Ngoyla-Mintom forest massif have negative impacts on the environment, such as

the destruction of fragile forest ecosystems, particularly swamps, the diversion, sedimentation, and pollution of small waterways, and the destruction of soils.

The proliferation of mining permits in protected areas, FMUs, and communal forests represents a threat to permanent forests and has contributed to an increase in the rate of DD. Deforestation to a greater or lesser extent may occur when camps are set up, as well as during mining operations. The main players are increasingly Asian (Malaysia, China), as they have significant technical and financial resources and carry out excavations and stripping of watersheds. Forestry machinery strips the soil, eliminating the forest and, in turn, carbon stocks.

In addition to industrial mining, which encroaches on forests, artisanal mining also contributes to forest degradation.

3.2.2. DD AGENTS IN THE DJA-LOBÉKÉ LANDSCAPE

There are several types of deforestation agents in the Dja-Lobéké landscape: large producers or agro-industries with more than 5,000 ha of land, who produce and supervise other producers. Then there are the medium-sized producers, supported by the urban elite, who can own their oil presses and whose plantations can cover around 100 ha. Finally, there are small-scale producers, who own just 1 to 2 hectares of plantations.

Table 5: Categories of stakeholders in the rubber sector in the Dja-Lobéké landscape

Producers	Type of player	Surface area (ha)
Large producers	Industrialists	5000
Means Producers	Urban elites	100
Small Producers	Rural households	1,5

Source: Field data, 2022

3.2.3. DRIVERS OF DEGRADATION IN THE DJA-LOBÉKÉ LANDSCAPE

3.2.3.1. Logging

In the Dja-Lobéké landscape, the degradation process is more or less linked to the governance of permanent forests, in particular the four protected areas and the Communal Forests that surround them: with an Annual Cutting Area (ACA) of 5,000 ha to be logged per year and Forest Management Unit (FMU); the volume of timber logged is 20,000m³ /FMU. Already in 2017, Cerutti et al. 2017 estimated the volume of timber harvested per year and per ACA at 1503 m³, and 20,508 m³/year for FMUs.

Table 6 Impacts of forest concessions on ecosystems in Dja-Lobéké

Logging	Lead authors	According to in situ observations	Depending on the community
The opening of roads, timber yards, skidding tracks, and felling areas	(Sufo Kankeu et al. 2016, Nitchou Tchiade et al. 2016)	Amplification of DD, Destruction of future stems and NTFPs	Loss of floral diversity, imbalance in ecosystems, reduction in agricultural land
Fragmentation through infrastructure construction	Tamungang R. 2011, Neba S. G. 2014	Weakening ecosystems	Remoteness from the game, scarcity of NTFPs,

Logging	Betti 2004	Influence on protected areas	Influence on the distribution of fauna,
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Photo 7 Logging truck with logs on the river Dja ferry (source: field data, 2022)

3.2.1. ARTISANAL MINING

Artisanal mining began to proliferate after the economic crises of the 1990s. Unemployed young people mobilized and organized themselves into cooperatives. Their ability to damage the forests increased tenfold with the purchase of semi-motorized equipment (motor pumps and mats). However, most of the logging takes place along watercourses. Disturbances, albeit significant, are damaging the forests along the rivers. Prohibited chemicals (mercury, cyanide) pollute biodiversity and land near watercourses. Most artisanal logging is illegal. Practices such as the clearing of primary forests, the construction of dams, the building of camps, and the drilling of wells contribute to the degradation of the forests.

3.2.2. UNDERLYING DRIVERS OF DD IN THE DJA-LOBEKE LANDSCAPE

The results of the interviews show that international migration linked to the civil war in CAR, major development projects, and urbanization are the indirect drivers of DD in this Dja-Lobéké landscape.

Infrastructure. The new 575 km Ketta-Djoum road, cited as an example of sub-regional integration, represents a danger for the forests. Potential incursions on the Mbalam-Lomié axis are possible in the medium term, not only for agriculture but also for NTFP and timber harvesting. This road, which has been a source of hope for the local populations and elites, is a source of fragmentation of the permanent forests. The effects are already being felt on the outskirts of Mbalam and in the villages of Ngoyla and Zoulabot.

The major mining project at Mbalam, despite the delays in its implementation, is a potential source of conflict and tension, but also of land grabbing in anticipation of potential future investment. More specifically, over the last twenty years or so, the demarcation of mining sites has not only created interest in the area but has also had adverse environmental effects, with potential pressures still expected. The village of Mbarga will potentially be affected, with around 80,000 ha of potential mining site. The railway project linked to this project is another potential source of enormous deforestation on the Ngoyla reserve (Figure 18).

The fragmentation of forest ecosystems by infrastructure (roads, dams, factories) is a constant threat. Roads are always singled out as a source of ecosystem degradation and biodiversity extinction (Laurance 2014, Laurance, Goosem, and Laurance 2009). In recent years, the authorities in Cameroon and Congo have congratulated each other on the completion of 321.5 km of roads. The construction of the Sangmelima-Bikoula (85 km), Bikoula-Djoum (38 km), Djoum-

Mintom (98 km), Mintom-Lélé (67.50 km) and Lélé-Ntam-Mbalam (53 km) roads has largely encroached on the forests. Similarly, facilitating access to resources could have a perverse effect linked to ease of transport. What's more, the construction of the Meking, Memve'ele, and Lom Pangar dams has led to deforestation, with a consequent loss of 3,220 hectares of forest. The Memve'ele Dam covered an area of around 1,900 ha (Tchatchou et al. 2015).

On the economic front. The Dja-Lobéké landscape is facing enormous pressure on its resources. Pressure on forest resources is caused by the interaction of macroeconomic policies, market demand, and monetary policies (Dkamela, 2011). National, regional, and international demand for timber is rising sharply. At the regional level, transactions are dominated by flows to Chad, Gabon, Equatorial Guinea, and Nigeria, while the arrival of Chinese companies has created new market destinations and increased the volumes of timber, food products, and cash products exported (MINEPDED 2016) Most DD takes place outside the region.

Indeed, growing international demand for commodities could change the situation by boosting insidious deforestation (Megevand, 2013). Moreover, the establishment of agro-industrial companies such as Sud hévéa, and other Indo-Malaysian or Chinese groups, is quite striking. This expansion is due to increased consumption in certain countries (China, India, and other emerging Asian countries), where palm oil is widely used as cooking oil. Global demand is currently outstripping supply, a trend that is set to continue shortly, making the sector particularly attractive to investors (Hoyle and Levang, 2012). Domestic and international market demand for timber, cash crops (cocoa, rubber, oil palm), and mining products are sources of DD. For example, the value of Cameroon's timber exports to China doubled from USD 100 million to USD 200 million between 2006 and 2012 (Weng et al., 2014). In agriculture, deforestation is partly driven by the growing demand for agricultural products in local, national, and regional markets (Mertens et al., 2000, Brown and Ekoko, 2001).

Economic crises and structural adjustments in the 1990s led to the devaluation of the FCFA, resulting in impoverishment and a fall in household incomes among the urban population. Returning to natural resources (agriculture and timber exploitation) was a solution for many urban households, who retreated to rural areas, creating large plantations. Structural adjustment has led to population migration to rural areas (Sunderlin et al., 2000, Ndoeye and Kaimowitz, 2000). Similarly, urban households have opted to create plots in the urban periphery or to open up larger plots for cash crops in their home villages.

In terms of international migration. The political instability of CAR and the sociological similarities between the cross-border populations have encouraged Central African refugees to settle along the border towns. The settlement of refugees in the towns of Kentzou, Yokadouma, Ndélé, Garigombo, Garoua boulaï, and Meiganga has not only triggered new needs but has also led to serious forest degradation. Despite the precarious stability in the CAR, according to the UNHCR, thousands of refugees are still pouring into the country in search of a place to live. The political instability in the CAR is hardly conducive to the return of exiled citizens in the short or medium term. The migration crisis not only affects displaced persons and refugees, it also upsets the balance of society as a whole (Mahamat 2021). For the camp inhabitants, finding wood has become a source of concern. Around every camp (e.g. Gado) there is a halo of deforestation due to demographics and the needs they create.

On the other hand, the weakness of State control operations around protected areas, conflicts between institutional players and resource users, and the lack of awareness can be seen as underlying drivers (Figure 19).

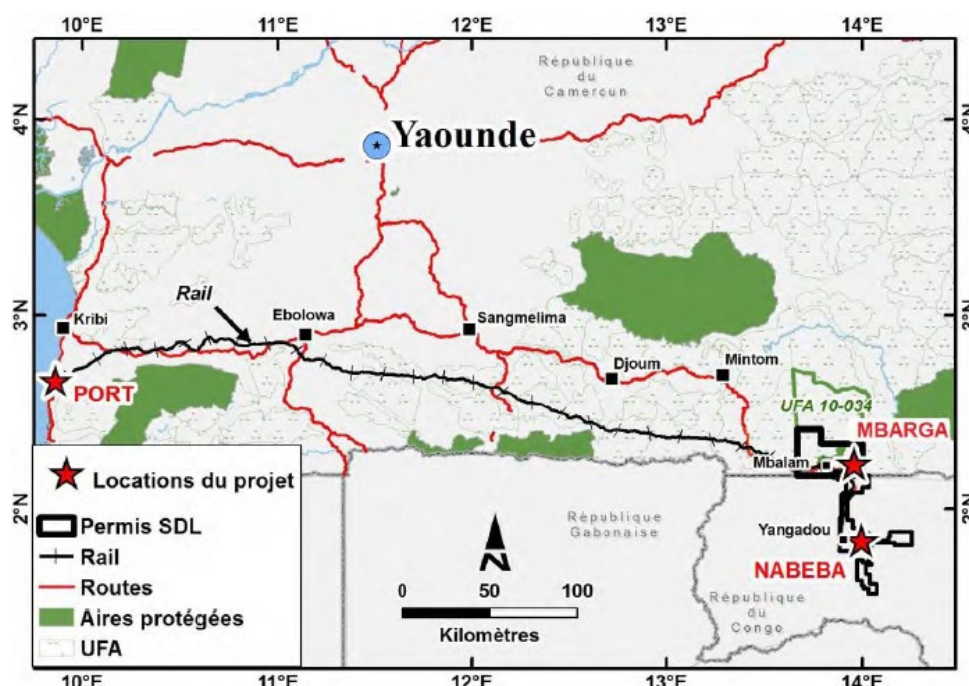


Figure 26 Location of the mining project in the Dja-Lobéké landscape

Table 7: DD actors in the Dja Lobéké landscape

Engine category	Agent category	Deforestation or degradation	Main value chain	Size of contiguous areas converted (hectare)	Forest area cleared
Small-scale farming	Small producer	Deforestation	Cassava, plantain, oil palm	Minus 1	Around 15,000 ha per year
	Small producer	Deforestation		Between 1 and 2	Approximately 3,700 ha per year
Medium-scale agriculture	Medium-sized producers	Deforestation	Plantain, oil palm, rubber, pineapple	Between 2 and 100	Approximately 4 75 ha per year
Agro-industry	Large producers	Deforestation	Hevea, Oil palm,	Over 100	Approximately 95 ha per year
Logging	Illegal	Deforestation/degradation	Logs/boards	Approximately 10 ha	Approximately 1000ha/year
	Industrial	degradation	Logs/boards	2500 ha	
	Artisanal	Deforestation/	Logs/boards	1000ha	

		degradation			
Mining	Artisanal	Deforestation	Gold/diamond	Between 1 and 50 ha	
	Industrial/mechanized	Deforestation	Gold/diamond	Between 5 and 100 ha	

Source: MINEPDED (2017) adjusted to the Dja-Lobéké landscape

Figure 19 shows all the direct and indirect drivers of deforestation in the Dja-Lobéké landscape. It shows that deforestation is fuelled by mining (industrial and artisanal), logging, and agriculture (cash and food crops). In addition, other factors/drivers play a significant role in deforestation, notably: political and social instability in CAR, development projects, national and international market demands, and the 1990 economic crisis.

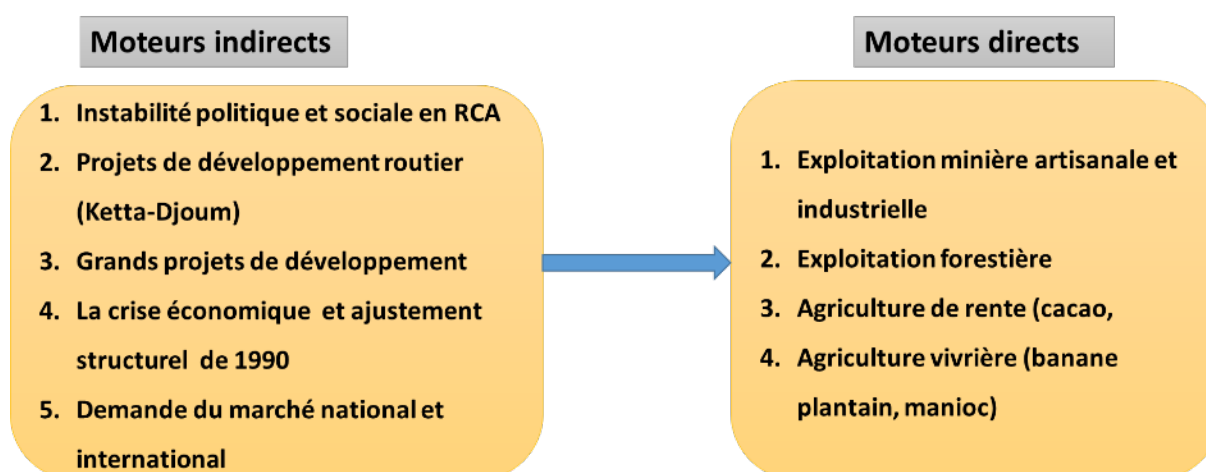


Figure 27 Drivers of deforestation in the Dja-Lobéké landscape

3.2.3. OPTIONS IN THE DJA-LOBEKE LANDSCAPE

The options proposed are based on all the activities linked to sustainable forest management through low-impact logging, controlled felling and forest certification. What's more, the optimisation and profitability of waste wood can be put back on the agenda.

The mining sector, which is one of the excavating activities, requires the restoration of sites or extensive reforestation. In addition, the sector can be boosted by encouraging Kimberley certification. Strengthening the implementation of existing ESIA measures in Cameroon represents a viable option (MINEPDED, 2017). Mobilong's industrial mining permits and multiple artisanal mining permits will be analysed to identify the most effective options. In addition to adaptation techniques, populations have considered the following adaptation options:

- Securing forest reserves by visual demarcation (visible paint), refreshing the 2 to 3-metre wide boundaries.
- Monitoring and restoration of degraded areas;
- Domestication and exploitation of a few NTFPs of high commercial value [*Gnetum sp.* (okok), *Ricinodendron heudelotii* (Djanssang), *Baillonella toxisperma* oil (Moabi), *Irvingia gabonensis* kernel (wild mango), *Garcinia cola* (Bitta cola), Plum (*Dacryodes edulis*)].
- Development of income-generating activities (fish farming, poultry farming, etc.) ;

- Development of lowland agriculture (market gardening) ;
- Creation of school fields for learning the best agricultural practices;
- Sustainable harvesting in agri ;
- Creation of service activities (sewing, hairdressing) in the landscape;
- Promoting fish farming and small livestock rearing (pigs, small ruminants and poultry) to reduce the impact on wildlife resources;
- Promoting sustainable cocoa under the canopy.
- Sedentarisation of farmers: this measure advocates agricultural intensification, improved yields, reduced effort on plots and shorter fallow periods, which will inevitably lead to a reduction in pressure on wood resources.
- Organising the mining sector necessarily involves restoring mining sites, whether they are illegal artisanal or mechanised. Involving the local population and using endogenous forest species is a priority to be considered in the process of restoring exploited mining sites.

These proposals are likely to reduce the pressure on forest resources in protected areas while increasing the standard of living of residents. It is only by creating alternative activities which would be of interest to local people and which would help them to satisfy their needs, while at the same time limiting the pressure on natural resources, that the attention and energy of local people can be diverted away from protected areas. In particular, the creation of service activities, poultry farming, fish farming and small livestock rearing could reduce the pressure on forests. More concretely, the recommended options must have feasible objectives and be accepted by politicians and local stakeholders through free, prior and informed consent (FPIC).



Photo 8 (example of a nursery created by the CPF in Nampela and financed by a CFC forest concession)

3.2.4. BARRIERS TO THE FIGHT AGAINST DD ENGINES IN THE DJA-LOBEKE LANDSCAPE

Apart from the problems associated with infrastructure and the lack of technical and financial resources, the lack of synergy between the sectoral ministries and the technical and financial partners are the main obstacles to implementing the alternatives. As mentioned above, the most recurrent barriers identified in 2022 are mainly the lack of collaboration between institutional players and public and private partners. The lack of coordination between technical and financial partners is the soft underbelly of efforts to secure permanent forests. Despite the closer links between stakeholders and the various parks, there have been few significant results. MINFOF, which is responsible for the entire management process, is trying to bring all the players together around the issue of conservation.

Economic problems, access to capital and technological resources, and the capacity of the teams working in forest landscapes are the most important issues. (Sabogal et al. 2013). In addition, institutional issues, the marginalisation of indigenous peoples and techniques (Mbairamadiji 2009).

The Dja-Lobéké landscape also faces recurring obstacles such as :

- Lack of involvement of Indigenous peoples in project development;
- Overlapping issues in the same areas;
- Illiteracy among Indigenous populations;
- dilapidated road infrastructure;
- Weak policy frameworks and institutional coordination for more sustainable forest and land use management ;
- Human-wildlife conflicts around protected areas;
- The marginalisation of women, who are often relegated to the background;
- Insufficient human resources in protected areas.
- Poor governance is characterised by widespread corruption among administrative officials.

Table 8: Summary of DD drivers, options and obstacles to combating DD in the Dja-Lobéké Landscape

Direct drivers of deforestation	Agents and institutions involved
- Cash crops (cocoa, oil palm, pineapple, rubber), food crops (cassava, plantain) - Industrial operations - Mechanised mining	- Mining company, - Small producer - Agro-industry - Farmer
Direct drivers of degradation	
- Legal and illegal logging - Artisanal mining - Sport hunting	- Artisan miner - Safari - Forestry company - Wild sawyers -
Underlying drivers of DD	
- Political instability in the CAR - Economic crises and structural adjustment - Major mining project (Mbalam) - International and regional market demand - Infrastructure development (roads, dams, factories) -	- Financial backers - Globalisation - MINEPAT
Options/activities to combat DD	
- Securing forest reserves by visual demarcation - Monitoring and restoration of degraded areas - Domestication and exploitation of some NTFPs with high commercial value - Development of income-generating activities - Creation of service activities	MINFOF, - MINEPDED - MINAGRI - MINEPIA - MINRESI - Civil society - Private partner

- Promotion of fish farming and small livestock breeding - Promoting sustainable cocoa under the canopy -	- Financial backers
Obstacles to implementing the options	
- Public reluctance to embrace alternatives and innovations - Overlapping issues in the same areas - Illiteracy among Indigenous populations - Outdated road infrastructure - Human-wildlife conflicts around protected areas - Marginalisation of women, who are often relegated to the background - Insufficient human resources in protected areas - Poor governance	- Artisan miner - Safari - Forestry company - Wild sawyers - Agro-industry - Farmer
-	-

3.3. BAMBOUTOS-BAKOSSI LANDSCAPE

The Bamboutos-Bakossi landscape in ZAE 3 has the highest population density in the country at 110.5 inhabitants/km². The deforestation rate in this zone is the lowest at 0.12%. This situation is linked not only to the low level of forest cover (around 1.7 million hectares, or 35% of the surface area of the EAZ) but also to the land pressure already present. There is a trend towards reforestation in the Bamboutos-Bakossi Landscape.

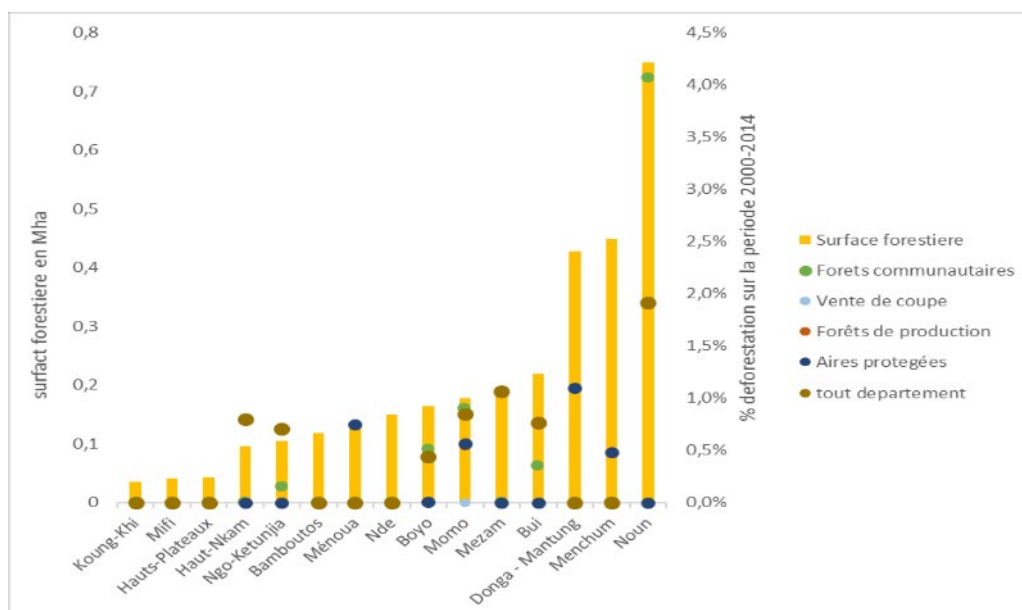


Figure 28 Deforestation trends by department in ZAE 3

3.3.1. DIRECT DRIVERS OF DEFORESTATION IN THE BAMBOUTO-BAKOSSI LANDSCAPE

3.3.1.1. Agriculture

3.3.1.2. Food and vegetable farming

In the highlands of western Cameroon, the race to occupy land has become a major preoccupation. People have long colonised the slopes of Mont Bamboutos, becoming farmers and breeders. The use they have made of this natural environment is at the root of the sequential mosaic of degradation. All that exists in this landscape in terms of plant cover corresponds to relics of ancient forests. This landscape is one of the most important granaries in the West and South-West regions of Cameroon. It supplies all the towns in Cameroon and neighbouring countries with market garden produce (cabbage, beetroot, potatoes, carrots, leeks, peppers and tomatoes). Agriculture is the main activity contributing to the loss of forest cover.

The forest remnants of the Bamboutos-Bakossi landscape are under the influence of agriculture, livestock farming and human settlements (Ewane et al. 2021). In Bafou, Tchékoté, Melachio, and Siyapdje (2018) speak of the complexity of land appropriation and the end of the land to describe the scarcity of arable land and the reclaiming of the hills (photo 9).

Indeed, the scarcity of arable land contributes directly and indirectly to deforestation and even the degradation of forest remnants. Analysis based on satellite images shows changes in agricultural land. Between 2000 and 2010, farmland increased from 28,173.6 ha to 28,315.35 ha; between 2010 and 2021, farmland almost doubled from 28,315.35 ha to 45,726.31 ha. This reflects strong pressure on forest remnants.

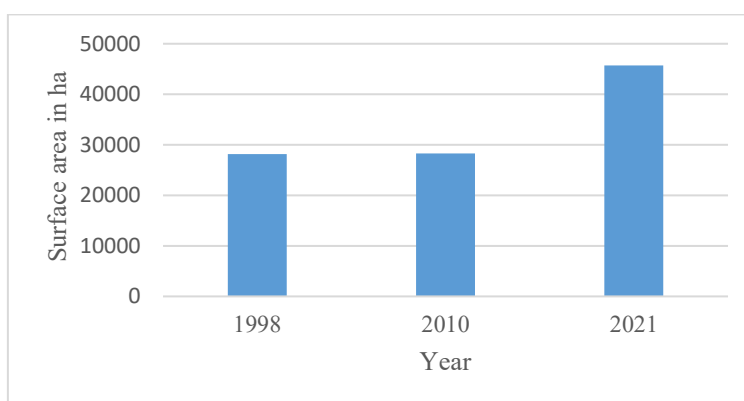


Figure 29 Change in agricultural area in the Bamboutos-Bakossi landscape between 2000, 2010 and 2021



Photo 9 Intensive market gardening landscape)

Source: Terrain, 2022

Land use in mountain areas can be dominated by human production activities when adjacent communities rely solely on mountain resources for their livelihoods. Between 1980 and 2018, there has been a significant conversion and consequent reduction in areas of forest and grassland to farmland and built-up areas. Market gardening has been the main cause of deforestation in recent decades (Photo 10). Despite the intensity of agriculture on the slopes of the Bamboutos Mountains, communities face a multitude of social, economic and institutional challenges (Toh et al. 2018).



Photo 10: Bags of cabbage and bunches of leeks are ready for transport at the roadside (Feumock). Source: Field, 2022

Potatoes

The localities around the Bamboutos-Bakossi landscape are potato-growing areas, producing a significant proportion of national output. Potatoes, one of the main food crops, are grown in mountainous areas and irrigated lowlands. MINADER has promised to double production in this area from 395,961 tonnes in 2020 to 900,00 tonnes in 2030. Culinary habits in the Menoua department revolve around the potato, with an estimated consumption of 4-10kg/inhabitant/year. The Ndzieh basin in Bafou produces 6 t/ha. The Projet National d'Amélioration de la Production de la Culture Maraîchère, which aims to improve market garden productivity (Photos 11 and 12).



Photo 11: Packing sacks of potatoes at M'mouck Aghong in Wabané. Source: Field, 2022



Photo 12: Loading sacks of potatoes at the Nzdi market. Source: Field, 2022



Photo 13: Market garden crops at Babadjou. Source: Field, 2022

The Cameroon Tea Estate (CTE) at Djutsitsa is the only agro-industry in the Bamboutos-Bakossi landscape. This structure is heavily criticised by local stakeholders following expropriation in the context of land tensions. This 1,660-ha agro-industrial concession, accused of land grabbing, promotes its model of self-sufficiency through the production of wood energy for drying tea leaves (Photo 14). Eucalyptus plantations are available in the concession to supply the drying plant (Photo 14).



Photo 14 Harvesting at the Djutsitsa ETC tea plantation

Younger households occupying higher altitudes are more recent settlers and have shorter fallow periods. This is consistent with the trend towards greater use of the upper slopes for intensive horticulture, using local irrigation techniques and chemical fertilisers during the dry seasons. The crops concerned are cabbage, potatoes, tomatoes, carrots and leeks. These products are grown intensively as monocultures and in series, and all have the same impact on the forests. Around 80% of plots are between 0.1 and 1 ha in size. Plots larger than 5 ha are virtually non-existent, having been broken up as a result of demographic pressure. New areas are being created in the steeply sloping wooded hills bordering the reserve.

3.3.1.3. Wood energy

The supply of energy wood to the towns of Dschang, Mbouda and Bafoussam represents a threat to the forest ecosystems in and around the Mont Bamboutos reserve. Wood is harvested from forest relics or planted forests (Eucalyptus Forest). If we look at the harvesting process, sawing mainly eucalyptus for timber produces wood debris (photo 15) which is used mainly for firewood.

Between 1998 and 2021, the forest area increased from 574148.79 ha to 15075.1 ha in 2021, representing a deforestation rate of 0.12%. Since 1998, the rate of occupation of the Bamboutos-Bakossi landscape for cultivation has increased from 17.86% to 19.71% of the total area. This pressure on the forests is explained by a galloping increase in the population in this landscape as a result of the socio-political crisis in the North-West and South-West Regions. The main quantities of energy wood exploited (mainly eucalyptus sp) come from these planted forests. Field surveys revealed that 60% of the wood harvested is used for household cooking and 40% for timber. An example of energy wood derived from sawn Eucalyptus is shown in Photo 15 below.



Photo 15: Wood energy from sawing eucalyptus planks in the village of Tsopeua. Source: Fieldwork, 2022

3.3.2. DRIVERS OF DEGRADATION IN THE BAMBOUTO-BAKOSSI LANDSCAPE

3.3.2.1. Breeding

The environment is conducive to livestock farming: cattle, sheep, goats and poultry. In recent decades, there is land grabbing by elites who see themselves as breeders. The degradation of the forest reserve has been accelerated over the last half-century by cattle rearing by the Mbororo people. Indeed, forest areas have become increasingly scarce as a result of pressure from farmers and also from Mbororo herders, who carry out their activities on the summits.

The investment of urban elites in the livestock sector is thus increasing pressure on forest relics. Bush fires on grazing land, which are considered by livestock farmers to be regenerating elements, have a bad image in the eyes of neighbouring farmers. Nevertheless, there is a sustainable cohabitation between forest relics and animal grazing (photos 16 and 17). Visits to the pastures on the outskirts of the Bamboutos reserve show that, overall, the management processes are sustainable.

3.3.2.2. Bushfires

In the Mbororos camps of Tsopeua, livestock farmers claim to use bushfires to regenerate pastures. At the end of the dry season, these fires allow them to burn the grassy relics, allowing the grass to regenerate. In most cases, these uncontrolled fires contribute to the loss of a significant proportion of the forest cover, but they also disturb the ecosystem balance in the wooded savannahs.



Photo 16: Livestock in the Mbororo village of Tsopeua on the outskirts of the Mount Bamboutos reserve (source: Field, 2022)



Photo 17: Livestock in the Bororo village of Babadjou (source: Field, 2022)

3.3.3. UNDERLYING DRIVERS OF DD IN THE BAMBOUTO-BAKOSSI LANDSCAPE

Overall in the Bamboutos-Bakossi landscape, deforestation is linked to state development policies, correlated with the demographic boom and national and sub-regional market demand.

On the economic front. National and sub-regional market demand is one of the main indirect causes of DD. The Bamboutos Mountains provide most of the market garden produce for Cameroon's major cities and neighbouring countries such as Gabon and Equatorial Guinea. The various PIDMA and market gardening development programmes have led to the development of this new crop. The towns of Douala and Yaoundé absorb most of Mount Bamboutos' production. Land pressure has greatly intensified land transactions in the Mont Bamboutos reserve (Nzoffou, Fongang Fouepe, and Kuete 2019) This is increasing pressure on the resource.

On the security front. The conflict between English-speaking people in the North-West and South-West regions poses a definite threat to the forests because of the massive displacement of people from the conflict regions towards the outskirts of the Mount Bamboutos reserve. The suspicions aroused by our teams' investigations in this area have given the impression that the relics of the forest that have remained intact until now are in danger.

Demographics. Population growth leads to an increase in the need for agricultural produce and timber, which often results in an increase in the area under cultivation to the detriment of the forest, or in the degradation of the forest due to the increase in timber harvesting. The average population density on the slopes of the Bamboutos mountains is estimated at 400 inhabitants per km². This area has five towns with more than 50,000 inhabitants: Kumbo in the Bui department, Bamenda in the Mezam department, Dschang in the Menoua department and Bafoussam in the Mifi department (MINEPDED, 2017).

3.3.4. DD AGENTS IN THE BAMBOUTOS-BAKOSSI LANDSCAPE

The main drivers of deforestation are livestock breeders, energy wood collectors and farmers. The urban elites have taken over the pastoral areas and later transformed them into agricultural land. These elites act indirectly by recruiting farm labourers to work their plots. The people of the Ndzihi, Feumock and Tsopeua neighbourhoods are also demanding the return of unused CTE land.

Table 9 Summary of DD agents in the Bamboutos-Bakossi landscape

Engine category	Agent category	Deforestation degradation	or Main value chain	Size of contiguous areas converted (hectares)	Forest area affected
Agriculture	Small producer	Deforestation	Market gardening (carrots, cabbage, peppers, etc.), maize,	Minus 1	Approximately 1,560 ha per year
	Small producer	Deforestation	Food producer	Between 1 and 2	Approximately 250 ha per year
	Medium-sized producers	Deforestation	Food and market gardening	Between 2 and 100	Approximately 450 ha per year
	Large producers	Deforestation	tea	More than 1,660 ha	
Breeding	Small ruminant breeder Livestock farmers	Degradation	Cattle breeding		
Wood energy	Small producer, collector	Degradation/deforestation	Charcoal, Firewood		A few hectares

3.3.5. OPTIONS FOR REDUCING DD IN THE BAMBOUTOS-BAKOSSI LANDSCAPE

In this agroecological zone, and more particularly in the Bamboutos-Bakossi area, the agricultural, wood energy and livestock sectors are the ones that are most damaging to the existing forest relics. So the law needs to be strengthened and forest management instructions enforced. But, more concretely, the Mbororos livestock farmers in the Mount Bamboutous caldera need not only to be supervised but also to be coordinated so that they can join forces. The Djuttitsa breeding company also needs to be revitalized in this environment. In addition to adaptation techniques, the local people considered the following adaptation options:

- Restoring mountainous areas,
- Better distribution of land allocated to agro-industries ;
- Training young people in service trades or activities other than agriculture (livestock farming, fish farming, mechanical workshops)
- The promulgation of the grazing code ;
- The production of fodder and the training of the Mbororo minorities, breeders of the Bamboutos Mountains, represent promising approaches to conserving the reserve and sustainably managing pastoral areas;
- Securing these grazing areas can also help prevent pressure on the reserve;
- Training young people in service professions.
- The development of avocado-based agroforestry systems between the limits of peasant plantations

3.3.6. OBSTACLES TO THE REDUCTION OF DD ENGINES IN THE BAMBOUTOS-BAKOSSI LANDSCAPE

In the Bamboutos-Bakossi area, the barriers to implementing options to reduce pressure on the forests are:

- Illegal logging,
- Difficulties in drying agricultural products
- Recurring land issues
- High post-harvest losses
- Lack of effective collaboration between institutions
- Low levels of awareness,
- Inadequate governance of resources
- Inadequate infrastructure in rural communities,
- Insufficient human resources, but also human pressure on the resource (Ackom et al. 2013, Fonjong 2002).

Furthermore, land grabbing by elites, conflicts between herders and farmers, and above all conflicts in the North-West and South-West are identified by stakeholders as the main obstacles in 2022. In addition to these obstacles, stakeholders criticized the lack of concerted management and poor relations between sectoral ministries.

Table 10 Summary of DD drivers, options, and obstacles to combating DD in the Bamboutos-Bakossi landscape

Direct drivers of deforestation	Agents and institutions involved
- Food and vegetable farming (cabbage, beetroot, potatoes, carrots, leeks, peppers, tomatoes) - Cash crops (tea) - Wood energy	- Farmer - ETC - Retailer
Direct drivers of degradation	Mbororo breeder
- Breeding - Bush fires	-
Underlying drivers of DD	
- Conflict in the North-West and South-West - Demographic pressure - International, national, and regional market demand - Development policy	- MINEPAT - First ministry - International trade
Options/activities to combat DD	
- Restoring mountainous areas - Better distribution of land allocated to agro-industries - Fodder production, training of Bororo minorities - Securing these pastoral areas - Training young people in service professions	- MINEPIA - MINADER - MINFOF - MINEPDED - MINEPAT
Obstacles to implementing the options	

- Poor governance - The absence of forests, - Illegal logging, - Difficulties in drying agricultural products - Recurring land issues - High post-harvest losses - Lack of effective collaboration between institutions - Low levels of awareness, - Inadequate governance of resources - Inadequate infrastructure in rural communities, Insufficient human resources	Breeder, Farmer Government
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Table 1 Summary of DD drivers in the three landscapes

Landscape	Indirect motors	Direct drives
Waza landscape	Demographic explosion, Internal migration Terrorism Boko haram Regional demand (Chad)	Perennial farming (cotton) Food crops (millet-sorghum) Wood energy harvest Livestock and transhumance National and sub-regional
Landscape Mount Bamboutos	Demographic boom National and sub-regional market demand (Gabon, Equatorial Guinea) Development programme (PIDMA) Land grabbing	Agriculture (industrial, food crops) Wood energy, Breeding Bush fires
Ngoyla-Lobéké landscape	National and international market demand Development programme (PIDMA), Political instability in the CAR Development of the road sector (Ketta-Djoum) The Mballam mining project	Cash crops (oil palm, rubber, cocoa, pineapple) Food crops (cassava, banana, plantain, etc.) Mining (small-scale and industrial) Logging

CONCLUSION

At the end of this study, to identify the drivers of deforestation and degradation of permanent forests, identify and analyze the means of combating the loss or reduction of permanent forests, and analyze the obstacles that may hinder the implementation of the options, it should be said that the literature review and the consultations brought out results according to the different project landscapes.

As far as the Waza landscape is concerned, the main underlying causes of forest loss are, firstly, demographic pressures and insecurity in the WNP (insecurity linked to Boko Haram). There is also a low school enrolment rate and a lack of collaboration between state and private players. The direct drivers of deforestation are mainly the harvesting of fuelwood, food, and cash crops (cotton, millet/sorghum, etc.) and overgrazing. In the Dja-Lobéké landscape, the underlying drivers include insecurity around the FPs (war in CAR), infrastructure development (road building), and galloping demographic pressure. The direct drivers of deforestation/degradation are agriculture, mining, and logging. In the Bamboutos-Bakossi landscape, the underlying drivers of forest loss include insecurity around the FPs (NOSO war) and demographic pressure. The direct drivers of deforestation in the Bamboutos-Bakossi landscape are agriculture, overgrazing, and illegal logging.

Whether in the Waza, Bamboutos-Bakossi, or Dja-Lobéké landscapes, the mitigation options identified called for landscape restoration and reforestation of energy wood to reduce pressure on permanent forests. There has also been renewed interest in training and capacity-building, as well as concerted action by stakeholders to pool efforts. The many obstacles to implementing the recommended options lie in the prevailing insecurity in the three landscapes. What's more, the low level of school enrolment around the WNP and in the Dja-Lobéké landscape is hampering training and capacity-building in the context of multiple projects.

To achieve success, the options identified are mixed. However, the efforts made in recent years by the Cameroonian government are bearing fruit, particularly in terms of building the capacity of technical experts through synergy of action. Nevertheless, it remains essential to continue in this vein by focusing on cooperation between the sectoral ministries concerned. Capitalizing on the achievements of the projects in the selected sites is also essential. In the Monts Bamboutos site, the GIZ, ERUDEF, and Rainforest Alliance have already implemented projects that are helping to reduce the pressure on this conserved area.

The national strategy for Reducing Emissions from Deforestation and forest Degradation and considering sustainable management, increasing carbon stocks, and conservation (REDD+). In parallel with the post-CSD planning work, the Government has drawn up a national plan and ten regional plans for land use and sustainable development (MINEPAT 2021). These various commitments should guide stakeholders towards more conscious management of forest resources and thus reduce the pressure on forests.

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APPENDICES :

Appendix 1: WAZA team itinerary for 6 days from 18 to 25 January (07 days)

Date	Activities	Remarks
18/01/2022	Journey Yaoundé -Maroua	Night Maroua
19/01/2022	1. Meeting with DR MINFOF 2. GIZ/WWF/WCS (Discussion) 3. DR MINEPDEDD (Discussion) 4. DR MINADER (Discussion) 5. DR MINEPIA (Discussion) 6. DR MINEPAT (Discussion) 7. DR MINAT (Discussion) 8. Interviews with NGOs and projects (SAILD/IUCN, PRODEL) (Discussion) 9. Interview with research institution (IRAD) (Discussion) 10. Education training interview (CEDC annexe UD) (Discussion)	Overnight in Maroua
20/01/2022	1. Meeting with DD MINFOF Logone et Chari 2. Interview Agricultural Station Manager 3. Interview DA MINEPIA 4. Interview with CSOs 5. Interview with GIC and women's association (02) 6. Interview with GIC and indigenous peoples association (02) 7. Interviews with sector-based ICGs (agriculture (02), fisheries (02), livestock (02), NTFPs (02), ecotourism (02) 8. Interview Conservateur Waza 9. Interview with Mayor Waza 10. Focus groups in the following localities: Waza (12),	Overnight in WAZA
21/01/2022	1. Meeting with DD MINFOF Mayo Sava 2. Interview DD MINADER 3. Interview DD MINEPIA 4. Interview with CSOs	Overnight in Mora

	1. Interview with GIC and women's association (02) 2. Interview with GIC and indigenous peoples association (02) 3. Interviews with sector-based ICGs (agriculture (02), fisheries (02), livestock (02), NTFPs (02), ecotourism (02) 4. Focus groups in villages: Zgagué (12), Mouzgoum (12), Mora (12)	
22/01/2022	1. Interview with Mayor Zina 2. Interview Agricultural Station Manager 3. Interview with GIC and women's association (02) 4. Interview with GIC and indigenous peoples association (02) 5. Interviews with sector-based ICGs (agriculture (02), fisheries (02), livestock (02), NTFPs (02), ecotourism (02) 6. Focus groups in the following localities: Zina (12)	Overnight in Zina
23/01/2022	1. Interview with Mayor Pétté 2. Interview Agricultural Station Manager 3. Interview with CSOs 4. Focus groups in the following localities: Andirni (12), Fadéré (12), Niwaji (12), Babaday (12)	Overnight in Pétté Value Chain Team returns to Maroua
24/01/2022	1. Interviews with Value Chain players 2. Interview with the people in charge of Community Forests in Pétté (02) 3. Back to Maroua	Overnight in Maroua
25/01/2022	1. Travel Maroua-Yaoundé	Night Yaoundé

APPENDIX 2: ITINERARY TEAM DJA-LOBEKE AND BAMBOUTOS-BAKOSSI FOR 12 DAYS FROM 16 TO 28 JANUARY 2022

Landscape 1 (7 days):

	Activities	Remarks
16/01	trip Yaoundé -Bertoua	Bertoua night
17/01	1. Meeting with DR MINFOF 2. CTFC/GIZ (Discussion) 3. DR MINEPDEDD (Discussion) 4. DR MINADER (Discussion) 5. DR MINEPAT (Discussion) 6. DR MINAT (Discussion) 7. DR MIMIDT (Discussion) 8. Interviews with NGOs and projects (SAILD, PIDMA, OKANI, FODER etc.)	Travel Bertoua Yokadouma Overnight at Yokadouma/Ngola 35

18/01	1. Meeting with DD MINFOF Boumba and Ngoko 2. Interview with curator Boumba Bek, Nki, Lobéké, 3. Interview WWF Yokadouma, WWF Mambélé 4. Interview Site Manager CFC Ngola 35, Site Manager SEBC lokomo 5. Interviews with CSOs (CFAID, ROSE, CPF) 6. Interview with GIC and the women's association 7. Interview with GIC and the indigenous peoples' association 8. Interviews with sectoral ICGs (agriculture, fisheries, tourism, ecotourism) 9. IRAD Station Manager	Journey Yokadouma-Moloundou Overnight in Moloundou/Lokomo
19/01	1. Interview with FC Moloundou manager 2. CSO meeting with indigenous peoples in Banana and Yenga 3. Interview Mayor Moloundou	Overnight in Lokomo
1. Focus group in the village of Kika, Batika, Yenga, Membélé; Legoué, lokomo; Banana, Guillili, Baka GBiné 2. Interview Mayo oldiri safari, Boumba safari		
20/01	1. Interview with Mayor Salapoumbé 2. Interview with FC Salapoumbé manager 3. Focus group in Salapoumbé village, Mimbo Mimbo, Mikel, Ngato	Overnight in Yokadouma
21/01	1. Conservative interview with Ngoyla	Voyage Yokadouma Mbalam,
22/01	1. Commune of the mayors of Messock, Ngoila, 2. Interview with FC Ngoyla 3. Focus group in the village of Mbalam, Adjela, Eta, Ngoyla 4. Interview WWF Ngoyla 5. Interview with GIC and the women's association 6. Interview with GIC and the indigenous peoples' association 7. Interviews with sectoral ICGs (agriculture, tourism, ecotourism)	Overnight in Ngoyla
23/01	1. OSC interview in Ngoyla 2. Interview OSC indigenous people in Ngoyla	Journey Ngoyla Yaoundé Overnight in
24/01	1. Return journey	

Landscape 2 (5 days)

Activities		Remarks
24/	1. Travel	Overnight in
25/01	1. Meeting with MINFOF West 2. Meeting with DD MINFOF Bamboutos/ Menoua 3. DR MINADER (Discussion) 4. DR MINEPDEDD (Discussion) 5. Interviews with NGOs (Saild, CIPCRE , ERUDEF) 6. Interview with the PIDMA West project manager	Travel Yaoundé - Bafoussam Overnight in Bafoussam
26/01	1. Interview with the curator/manager of the Bamboutos reserve 2. Interview with CERHT laboratory researcher (University of Dschang, FASA laboratory, IRAD) 3. Interview with OSC Dschang and OSC Mbouda 4. Mayor	Overnight in Bafoussam
27/01	1. Focus group in Bangang village, Baranka, Djutsitsa, Bafou, Mock fossimondi,	Overnight in Bafoussam
28/01	1. Interview with the head of the COBALAM project (RainForest Alliance)	Overnight in Bafoussam
	1. GIZ 2. Interview with GIC UGICPROPOTEM, Akwantemgong GIC in Ndoh-Djuttitsa, The GIC Tehguigning de Mba'a (Bangang) 3. Village focus groups: Balépo, Bamélo, Ndoh Tsenkeng, Menka ☐	
29/01	1. Interview UCCAO, Caplame and Caplabam	JourneyBafou ssam-

Appendix 3: INTERVIEW GUIDE FOR FIELD SURVEYS

ANALYSIS OF DEFORESTATION DRIVERS AND ACTIVITIES

INTERVIEW GUIDE FOR FOCUS GROUPS AND INTERVIEWS

Landscape identification

1. Intervention site _____ 1= WAZA, 2=Bamboutos, 3= Ngoyla-Lobéké

Identification of the respondent (resource persons)

Name :	
Quality :	

Email address :	
Telephone contact:	
Collection date :	
Location:	
Team :	

1. **Community identification (Villages/Localities)**

Municipality :	
Name of the Community/Village :	
Collection date	
Team	

1. **Identification of the drivers/agents/options for reducing SD in the intervention sites**

In your opinion, what are the causes and agents responsible for the destruction of forests, as well as the potential options for reducing DD?

Types of forest	Engines		Agents	SD reduction activities/options	For options/activities		
	Direct	Indirect			Target area	Area if tree planting	Potential partners
Protected areas							
FMU							
Communal forest							
Forest reserves							
ZICS							
Other							

Direct drivers : Agro-industrial plantations, Slash-and-burn agriculture, Industrial logging, Mining, Artisanal logging, Fuelwood production, Livestock (small and large livestock),

Indirect drivers : Urbanisation, Migration, Poor governance, Poverty, Increase in population density, Infrastructural development, Non-compliance with logging specifications, Overlapping land uses,

Discount options :

1. **Cross-cutting options:** Strengthening governance (coordination and participation), land use planning, strengthening land tenure security, strengthening the gender approach and social equity.
2. **Option for the forestry sector:** Improving policies, regulations and standards for sustainable forest management and their application, Promoting investment in the sustainable production of wood energy and charcoal, Implementing strategies to reduce demand for wood energy, Restoring degraded forest landscapes, Promoting agroforestry in areas surrounding permanent forests, Developing firebreaks,
3. **Options for the agricultural sector:** agricultural intensification, development of sustainable value chains for agricultural products, strengthening agricultural certification, improving agroforestry and mixed farming.

Options for the livestock sector: Support for improved fodder production and the sedentarisation of livestock farming; Securing pastoral areas and reforestation perimeters.

4. **Options for the mining sector:** Reduction of the footprint of mining investments, design of compensation systems by investors in mining projects, support for the rehabilitation of exploited sites.

-

Prioritising engines

N°	Engines	Prioritisation (Scale: 1 to 5, with 1 the most important value)
1		
2		
3		
4		
5		
6		
7		
8		
9		

Between 2010 and 2020, what major events have led to deforestation in your community?

5. Prioritisation of reduction options

N°	Reduction activities/options	Prioritisation (Scale: 1 to 5, with 1 the most important value)
1		
2		
3		
4		
5		
6		
7		
8		
9		

4. Constraints/barriers that may hinder the implementation of DD reduction activities/options

What constraints may hinder the implementation of activities/options to reduce DD?

Types of forest	SD reduction options/activities	Barriers
Protected areas		
FMU		
Communal forest		
Forest reserves		
ZICS		
Other		