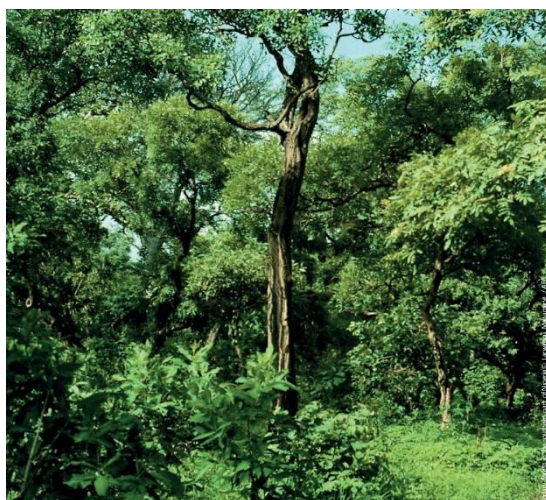




African Forest Forum

A platform for stakeholders in African forestry



Trans-boundary forest resources in West and Central Africa

Report (2018)



TRANS-BOUNDARY FOREST RESOURCES IN WEST AND CENTRAL AFRICA

Report (2018)

Martin Nganje, PhD

© African Forest Forum 2018. All rights reserved.
African Forest Forum
United Nations Avenue, Gigiri
P.O. Box 30677-00100
Nairobi, Kenya

Tel: +254 20 722 4203
Fax: +254 20 722 4001

E-mail: exec.sec@afforum.org
Website: www.afforum.org

TABLE OF CONTENTS

LIST OF FIGURES.....	v
LIST OF TABLES.....	vi
ACRONYMS AND ABBREVIATIONS.....	vii
EXECUTIVE SUMMARY.....	ix
1. INTRODUCTION.....	1
1.1 Objective.....	2
1.2 Specific tasks.....	2
1.3 Methodology.....	3
2. GENERAL DESCRIPTION OF SHARED-FORESTS OF WEST AND CENTRAL AFRICA.....	5
2.1 Shared forests of West Africa.....	5
2.1.1 West Africa Guinean Mangroves (WAGM).....	5
2.1.2 Western Guinean Lowlands Forest (WGLF).....	6
2.1.3 Eastern Guinean Lowland Forests (EGLF).....	7
2.1.4 Guinean Montane Forests (GMF).....	8
2.1.5 Guinean Forest-Savanna Mosaic (GFSM).....	8
2.1.6 West Sudanian Woodland Savanna (WSWS).....	9
2.1.7 Sahelian Acacia Savanna (SAS).....	10
2.2 Shared Forests of Central Africa.....	10
2.2.1 Central African Mangroves (CAM).....	10
2.2.2 Atlantic Equatorial Coastal Forest (AECF).....	11
2.2.3 Western Congolian Forest-Savanna Mosaic (WCFSM).....	12
2.2.4 Northwest Congolian Lowland Forest (NWCLF).....	12
2.2.5 Northern Congolian Forest Savanna Mosaic (NCFSM).....	13
2.2.6 Western Congolian Swamp Forests (WCSF).....	13
2.2.7 Northeastern Congolian Lowland Forests (NECLF).....	14
2.2.8 Lake Chad Flooded Savanna Ecological Region (LCFS).....	14
2.3 Summary characteristics of shared forests of West and Central Africa.....	15
3. RESULTS.....	15
3.1 Types of collaboration agreements in trans-boundary landscapes management.....	16
3.1.1 Informal agreements.....	16
3.1.2 Low level formal agreements.....	16
3.1.3 High level formal agreements.....	17

3.1.4 Role of collaboration agreements in the establishment of trans-boundary forest management landscapes in West and Central Africa	18
3.2 Current efforts in the management of trans-boundary forests and woodlands, challenges and lessons.....	19
3.2.1 Trans-boundary forest landscapes with bilateral or multilateral agreements	19
3.2.2 Trans-boundary water basins with bilateral or multilateral agreements	26
3.3 Landscapes Offering Potential for Trans-boundary Management.....	33
3.4 Analysis of shared threats and main driving forces of degradation in trans-boundary forests, woodland and watersheds, and measures of containment	44
3.4.1 Shared threats.....	44
3.4.2 Driving forces	46
3.5 Evidence and extent of management of degradation, wildfires, tree and forest pests and diseases in potential trans-boundary landscapes.....	50
3.5.1 Evidence and extent of management of land degradation	50
3.5.2 Evidence and extent of management of wildfires.....	55
3.5.3 Evidence and extent of management of tree and forest pests and diseases.....	60
3.6 Trends in forest and land management policies, practices, systems and impacts on sustainability of trans-boundary forest and woodland resources	63
3.6.1 Situation analysis and trends at the national policy levels.....	63
3.6.2 Policy trends of regional institutional frameworks on trans-boundary forest management landscapes	67
3.6.3 Trends in decentralization on the management of trans-boundary forests and savanna woodlands.....	69
3.6.4 Trends in research and best practices for trans-boundary forest landscape management	70
3.7 Proposed mechanisms for effective management of trans-boundary forests and woodlands	72
3.7.1 Collaboration towards harmonization of policy differences and improved collaboration.....	72
3.7.2 Collaboration on policy related to the solution of land-use conflicts and challenges of tenure and tenure insecurity	73
3.7.3 Collaboration in the management of wildlife related crime and poaching	74
3.7.4 Collaboration in the management of unplanned cutting of wood and over-logging.....	75
3.7.5 Collaboration in the management of incompatible mining and quarries	76
3.7.6 Collaboration on challenges related to transhumance, excessive grazing and wildfire.....	77
3.7.7 Collaboration in managing the extension of subsistence farmlands and cash crops in trans-boundary management landscapes	77
3.7.8 Collaboration on challenges related to unmarked boundaries and internal migration	79

3.7.9 Collaboration towards development of trans-boundary management plans	79
3.7.10 Collaboration to improve trans-boundary technical management capacity	80
4.0 CONCLUSION AND RECOMMENDATIONS	81
4.1 Conclusions	81
4.2 Recommendations	82
ACKNOWLEDGEMENTS.....	84
REFERENCES.....	85
ANNEX 1: KEY INFORMANT QUESTIONNAIRE.....	93
ANNEX 2: FOREST DATA FOR WEST AND CENTRAL AFRICAN COUNTRIES FROM 1990 TO 2015 IN 1,000 HECTARES.....	96

LIST OF FIGURES

Figure 1 : Map of the Western Guinean Lowland Forest.....	6
Figure 2 : Map of the Eastern Guinean Lowland Forests.....	7
Figure 3 : Map of Guinean Montane Forests.	8
Figure 4 : Illustration Map of Shared Moist and Dry Forest Mosaics, Woodlands and Parkland Vegetation.....	9
Figure 5 : Map of Shared Forests of Central Africa.....	11
Figure 6 : Signing ceremony and inauguration of the Gola trans-boundary forest landscape by the Presidents of Sierra Leone (Ernest B. Koroma) and Liberia (Ellen J. Sirleaf) at the Sierra Leone / Liberia border village of Lalehun in 2009.....	18
Figure 7 : Map of the W, Arly and Penjari Trans-boundary landscape	20
Figure 8 : Map of the Sangha Tri-national Landscape (TNS).....	21
Figure 9 : Map of the Dja-Minkebé-Odzala Tri-national Landscape.....	23
Figure 10 : Map of Lac Télé Lac Tumba Trans-boundary Landscape	24
Figure 11 : Map of Gamba-Mayumba-Conkouati Landscape.....	25
Figure 12 : Map of the Mayombe trans-boundary landscape	26
Figure 13 : Illustration of the Lake Chad Basin.....	27
Figure 14 : Illustration of the Congo River Basin	28
Figure 15 : Map of the Niger River Basin.....	29
Figure 16 : Illustration of the Senegal River Basin.	30
Figure 17 : Map of the Volta River Basin	31
Figure 18 : : Map of the Gambia River Basin	32
Figure 19 : Map of the Korup-Cross River Trans-boundary Landscape.....	33
Figure 20 : Map of Lope-Chaillu-Louesse Trans-boundary Landscape.....	34
Figure 21: Map of the Leconi-Batéké-Léfini Trans-boundary Forest Landscape	35
Figure 22 : Map of Monte Alen-Mont de Cristal Inselbergs Trans-boundary Landscape.....	35
Figure 23 : : Map of Potential Trans-boundary Moist, Mangrove and Montane Forest Landscapes in West Africa.....	36
Figure 24 : Map of the Gola Trans-boundary Landscape between Sierra Leone and Liberia.	39

Figure 25 : Map of the Tai – Grebo Trans-boundary Landscape between Côte d'Ivoire and Liberia.....	40
Figure 26 : Localisation of the Mt. Nimba Trinational Landscape in West Africa (Guinea and Côte d'Ivoire sections shown).....	41
Figure 27: Mole / Nazinga - Kaboré-Tambi Landscape.....	42
Figure 28: Map of Potential Watersheds for Trans-boundary Conservation and Management between Niger and Nigeria.....	43
Figure 29 : Ranking of threats and weaknesses to sustainable management of trans-boundary dry forests, parklands and related watersheds, {according to the experiences of experts for the W Regional Park, WAP, Liptako-Gourma, Niger-Nigeria watersheds and Chad-Niger (including Lake Chad) conservation landscapes}.....	45
Figure 30 : Ranking of threats and weaknesses to sustainable management of trans-boundary moist forests and related water basins, according to experiences of experts of the TNS, TRIDOM, Korup-Cross River, Lac Télé-Lac Tumba and Greater Virunga landscapes.	46
Figure 31 : Map of Potential Trans-boundary Forest Landscapes in the Congo Basin.....	51
Figure 32: Forest fires in early farmland clearing. Visible-light images taken from NASA-NOAA's Suomi NPP satellite on Dec. 05, 2015.	57
Figure 33 :Post-fire regeneration of <i>Protea madiensis</i> var. <i>occidentalis</i> at 1, 200 meters.....	58

LIST OF TABLES

Table 1 : Officials encountered and respondents of the study	3
--	---

ACRONYMS AND ABBREVIATIONS

ABN / NBA	Niger Basin Authority
ALG	Liptako-Gourma Authority
AFF	African Forest Forum
AFRISTAT	Economic and Statistical Observatory of Sub-Saharan Africa
AGRHYMET	Regional Agro-Hydro Meteorological Centre
ANBO	African Network of River Basin Organizations
AWF	African Wildlife Foundation
AWF	Africa Water Facility
CAR	Central African Republic
CARPE	Central African Regional Program on the Environment
CAWHFI	Central Africa World Heritage Forest Initiative
CBD	Convention on Biological Diversity
CBFP	Congo Basin Forest Partnership
CEFDHAC	Conference on Dense and Humid Forest Ecosystems of Central Africa
CEMAC	Economic and Monetary Community of Central Africa (French)
CEEAC	Economic Community of Central African States (French)
CEPF	Critical Ecosystem Partnership Fund
CICOS	International Commission of the Congo-Oubangui-Sangha Basin
CILSS	Permanent Interstate Committee for Drought Control in the Sahel
CIFOR	Center for International Forestry Research
CNPN	National Council of National Parks of Gabon
COMIFAC	Central African Commission on Forests (French)
CORAF	West and Central African Council for Agricultural and Development
CSSL	Research
DOPA	Conservation Society of Sierra Leone
DRC	Digital Observatory of Protected Areas
ECCAS	Democratic Republic of Congo
ECOFAC	Economic Community of Central African States
ECOWAS	Ecosystèmes Forestiers d'Afrique Centrale
EGLF	Economic Community of West African States
FAO	Eastern Guinean Lowland Forests
FDA	Food and Agricultural Organization of the United Nations
FFI	Forestry Development Authority of Liberia
FRA	Fauna and Flora International
GCLME	Forest Resources Assessment
GEF	Guinea Current Large Marine Ecosystem Program
GFSM	Global Environment Facility
GMF	Guinean Forest-Savanna Mosaic
GRASP	Guinean Moist Forest / Guinean Montane Forests
GSEAF	Great Apes Survival Partnership
IBA	African Elephant Specialist Group (French) / AfESG in English
ICCN	Important Bird Area
ICRAF	Congolese Institute for Conservation of Nature
ICRISAT	International Center for Research in Agro-forestry
INSAH	International Crops Research Institute for the Semi-Arid Tropics
ITTO	The Sahel Institute
IUCN	International Tropical Timber Organization
LAMCO	International Union for Conservation of Nature / UICN in French
LAMINCO	Liberia Mining Company
LCBC	Liberia National Mining Company

MAFFS	Lake Chad Basin Commission
MIKE	Ministry of Agriculture, Forestry and Food Security
MINEPDED	Monitoring of the Illegal Killing of Elephants
MINFOF	Ministry of Environment, Protection of Nature and Sustainable
MLNR	Development, CMR
MOU	Ministry of Forests and Wildlife, Cameroon.
MRU	Ministry of Lands and Natural Resources, Ghana
OBAPAC	Memorandum of Understanding
OCFSA	Mano River Union
OFAC	Observatory of Protected Areas of the Congo Basin
OMVG	Organization for the Conservation of Wildlife in Africa
OMVS	Central African Forest Observatory
PACEBCo	Organization for the Management of the Gambia River
PGIE	Senegal River Development Organization
PNIA	Support Program for the Conservation of Congo Basin Ecosystems
POMIGER	Project for Integrated management of Niger/ Nigeria Trans-boundary
PRADD	Ecosystems
PRCM	National Program for Agricultural Investment (French)
PRIA	Post-Mining Income Generating Environmental Rehabilitation / CAR
RAPAC	Property Rights and Artisanal Diamond Development Project / CAR
REBAC	Regional Program for Conservation of the Coastal and Marine Zone of
REFADD	West Africa
	Regional Program for Agricultural Investment (French)
REJEFAC	Central African Protected Areas Network
	Central African Botanists Network
REPALEAC	Network of African Women for Sustainable Development around Central
	Africa's Forest Ecosystems
REPAR	Forest Youth Network for the Sustainable Management of Central African
	Forest Ecosystems
RERAC	Network of Indigenous and Local Populations for the Sustainable
	Management of
RIFFEAC	of Central African Forest Ecosystems
SAP	Network of Parliamentarians for the Sustainable Management of Forest
SCNL	Ecosystems in Central Africa
SEEAC	Community Radio Network for good governance, conservation and
UEMOA	sustainable management of natural resources in Central Africa
UNCCD	Network of Forest and Environmental Training Institutions of Central Africa
UNESCO	Structural Adjustment Program
VBA	Society for the Conservation of Nature of Liberia
WA-BICC	Central African Secretariat for Environmental Evaluation
WAP	West Africa Economic and Monetary Union (WAEMU)
WCFSM	United Nations Convention to Combat Desertification
WCS	United Nations Educational, Scientific and Cultural Organization
WGLF	Volta Basin Authority
WRM	West Africa Biodiversity and Climate Change Initiative
WSWS	W Arly and Penjari (Trans-boundary landscape)
WWF	Western Congolian Forest-Savanna Mosaic
	Wildlife Conservation Society
	Western Guinean Lowland Forest
	World Rainforest Movement
	West Sudanian Woodland Savanna
	World Wildlife Fund

EXECUTIVE SUMMARY

This report presents the results of a study carried out in 2017 through visits to sampled West and Central African countries, namely: Niger, Sierra Leone, the Democratic Republic of Congo and Cameroon. It investigated the challenges of managed trans-boundary forest landscapes of West and Central Africa and perspectives for shared forest ecosystems to integrate this management category. It describes shared forests as, sub-biomes of forests with similar functional ecological processes crossing borders and shared by two or more countries. They are referred by some conservation organizations as ‘ecological regions’, by others as ‘forest hot-spots’ and others as ‘forest conservation heartlands’. The study describes trans-boundary forest management landscapes, different from shared forests, as naturally connected forest areas sustaining similar functional ecological processes, crossing one or more international boundaries that include *both protected areas and multiple resource use zones, and involve some form of cooperation in their management*. Their objective is to promote land use policies and practices on each side of a border that do not adversely affect ecosystem function and resilience, the composition and persistence of species as well as economic revenues and human survival on the other side of the border (Vasiljević *et al.* 2015).

Trans-boundary forest landscape management (also trans-boundary forest landscape conservation and management) is an extension of the limited trans-boundary biodiversity protection approach. It fundamentally seeks to improve the chances of forest and biodiversity conservation by extending beyond biodiversity protection to include watershed management, and local economic development through participatory land-use planning for extractive resource zones, and community areas on a larger scale. The approach is characterized by rolling institutional agreements in an adaptive management fashion, extensive land-use planning and sustainable or long term funding through the establishment of trans-boundary forest management trust funds.

The study upholds the results of previous researchers (Wood *et al.* 2000) that: poverty, population growth, skewed market arrangements and environmentally insensitive policies including their inadequate sector level coordination constitute major pressures and root causes of degradation of trans-boundary forest management landscapes. While the study identified several threats and weaknesses to the sustainable management of such landscapes, the top four, common to both trans-boundary moist forest landscapes and savanna woodlands were: policy differences and problems of collaboration, wildlife related crime and poaching, unplanned cutting of wood and over-exploitation through logging, and incompatible mining and quarries. The report advocates the development of partnerships taking account of political and socioeconomic pressures and threats on the resources of the landscape.

Further, the report highlights the pertinent role of regional intergovernmental economic commissions, regional programs, regional networks and technical development partners in advancing trans-boundary forest landscape conservation and management to the current level of ‘keen interest’ in West and Central Africa. The report also underscored the following:

- a) Informal or formal low-level conventions usually exist at the trans-boundary landscape level between cross border communities or conservation areas administrations across the border. These low-level conventions usually predate the formal bilateral agreements signed between countries, providing the broad operational legality to the trans-boundary initiative. It is this legal agreement that attracts the attention of pertinent international partners, notably aid agencies.

- b) The trans-boundary forest management landscape provides an opportunity to apply adapted research results and good cultural practices in areas such as wildfire management, tree and forest pests and diseases, appropriate tree germplasm for restoration, forest rehabilitation techniques, forest product certification, among others.
- c) As local conservation and sustainable forest management partnerships mature, trans-boundary management initiatives will be able to help in checking the gross illegal trans-boundary trade in forest products between countries. Experience-sharing forums on the merits of legality by transformed landscape actors will constitute an asset for up-scaling.
- d) Collaboration in trans-boundary landscape management through public private partnerships is taking root. This may help establish sustainable production hubs of bio-merchantable products that could be branded for regional and/or international markets. The advantage is to diversify from ecological tourism as the mostly single revenue source of the landscape and safeguard from any possible decline of this source.
- e) The study noted the existence of several opportunities for trans-boundary forest management, including: the political will towards decentralization and establishment of trans-boundary management initiatives, supportive intergovernmental commissions, a large number of well adapted regional networks, available research results from several centers of excellence, and experience ready to be shared by functional trans-boundary forest management initiatives.

The study identified potential trans-boundary forest management landscapes as initiatives, which (a) do not yet exist under comprehensive bilateral agreements; (b) have signed limited agreements covering only a few areas of cooperation and; (c) have signed comprehensive agreements but are awaiting a change of designation of key forest blocks to the international standard eg. to National Park status in order to become fully operational. Those identified by this study include:

- (a) For mangrove landscapes, the Niuni-Saloum between Gambia and Senegal.
- (b) For mangroves with high forests, the Mayombé tri-national landscape between Angola, the DRC and Congo.
- (c) For moist forests in watersheds, the Korup – Cross River landscape between Cameroon and Nigeria; the Lope - Chaillu - Louesse landscape between Gabon and Congo; the Leconi-Batéké-Léfini landscape between Gabon and Congo, and the Monte Alen - Mont de Cristal Inselbergs landscape between Gabon and Equatorial Guinea.
- (d) For high, Guineo-Congolian forests, the Gola landscape between Sierra Leone and Liberia, and the Taï – Grebo landscape between Côte d'Ivoire and Liberia.
- (e) For Sudan-Guinean forests, the Niokolo-Badair landscape between Guinea and Senegal; the Kyabobo-Fazao/Malfakassa landscape between Ghana and Togo; the Outamba-Kilimi / Madina-Oula landscape between Sierra Leone and Guinea and the Wonegizi-Ziama landscape between Liberia and Guinea.
- (f) For Sudanian Sahel forests, the Mole/ Nazinga – Kaboré Tambi landscape between Ghana and Burkina Faso.
- (g) For Montane, forests: the Nimba tri-national landscape between Guinea, Liberia and Côte d'Ivoire.
- (h) For special trans-boundary watersheds, the Niger – Nigeria trans-boundary catchments and watersheds (Maggia-Lamido, Gada-Gulbin Maradi, Tagwai-El Fadama, Komadugu Yobe, and Lake Chad Basin), and
- (i) For Sahelian woodlands, the Termit / Tin-Touma and Ouadi Rimé-Ouadi Achim / Manga-Eguy landscape between Niger and Chad.

In addition, this study makes clear that threats and weaknesses to the sustainable management of trans-boundary forest landscapes are being addressed in varying degrees and with different levels of success, and that success will be greater if such initiatives established well oriented and targeted partnerships with relevant aid agencies, regional organizations and specialized networks. The following recommendations are proposed based on the findings of the study:

- a) Considering the change in orientation from trans-boundary landscapes, solely focused on conservation, through protected areas to multipurpose landscapes that include conservation of biodiversity through the sustainable management of a large number of socioeconomic challenges on a broader landscape, government departments responsible for policy development and supervision of such landscapes should modify the terms of references of their responsible services accordingly.
- b) Socioeconomic studies undertaken before establishment of trans-boundary forest management landscapes or prior to updating the management plans of functional trans-boundary landscapes should include research into available and potentially useful partnerships taking account of political and socioeconomic weaknesses and major threats on the resources of the landscape.
- c) Other sector level government departments that intervene in the rural domain with reportedly conflicting objectives to biodiversity conservation and sustainable forest landscape management should be sensitized and the terms of references of their services updated as part of the trans-boundary agreement process.
- d) National governance platforms for exchanges between government sector ministerial departments likely to affect the management outcome of trans-boundary forest landscapes should be instituted to ensure adequate coordination and avoidance of conflicts.
- e) A regional clearing-house for trans-boundary forest landscape management initiatives should be established at the level of each regional intergovernmental economic commission to facilitate coordination and conformity with the regional standard. It should also serve as a consultation and facilitation center for the certification of trans-boundary forest management initiatives.
- f) Governments sharing trans-boundary landscapes under concerted management should promote and facilitate the development of useful partnerships between their initiatives and other organizations. Technical development partners supporting implementation of these initiatives should also promote and facilitate such partnerships.
- g) At the field level, operational plans of trans-boundary forest landscape initiatives should include capacity building in the management of partnerships. When developing budgets, provisions should be made for the creation and servicing of such partnerships.
- h) Networks should be promoted between trans-boundary landscape management initiatives in West and Central Africa taking account of the similarity of threats and weaknesses on the landscape, and vegetation type i.e. moist forests, savanna woodlands, mountains, mangroves and watershed areas with the goal of improving livelihoods and consequently contributing towards attainment of the UN Sustainable Development Goals.

- i) Networks of municipal authorities / principal traditional leaders with forest trans-boundary management landscapes in their administrative jurisdictions should be promoted to facilitate exchange of experiences including on planning, partnerships and fundraising.
- j) Appropriate forest trans-boundary management landscapes should be identified and promoted as “peace and collaboration landscapes” in line with the ‘free zone’ concept, in high forest conservation border areas where military conflict prevails or is likely to prevail, with the collaboration of all factions.

1. INTRODUCTION

Forests in West and Central Africa covered an area of 313,998,000 hectares in 2015 (FAO, 2015) and remain one of the most diverse types on our planet (Conservation International, 1999). They include the mangroves on the Gulf of Guinea, the Guinean and Congolian forests from Sierra Leone to the Democratic Republic of Congo enclosing the mountain forests of Guinea and Cameroon, and the Acacia parklands of the Sahel. Based on biological assessments, the level of endemism attained by mammals, vertebrates, birds, plants, reptiles and amphibians of these forests is exceptional (Conservation International, 1999). For example, the Central African forests host more than 9,946 species of plants, 552 species of mammals, more than 1,017 species of birds, about 460 species of reptiles, and 2,391 species of butterflies (de Wasseige *et al.* 2010) and it is still turning in new species.

These forests sustain the livelihood of more than 300 million residents constituting the biological, economic, social, cultural and political capital of West and Central African nations. However, between 1990 and 2015, the sub-region lost 32,581,000 hectares of forests (FAO, 2015) and Annex 2 of this report, representing 9.4% of its forest area in 1990. It is evident from these statistics that more collaboration is required to secure, protect and sustainably manage the sub-region's forests, woodland and related resources. Trans-boundary forest landscape management tends to offer such an opportunity. The trans-boundary management landscape, also referred in this report as the trans-boundary conservation and sustainable forest management landscape is defined as an ecologically connected area that sustains functional ecological processes, crosses one or more international boundaries and includes both protected areas, multiple resource use zones, and involves some form of cooperation in its management (Vasilijević *et al.* 2015).

Trans-boundary conservation and sustainable forest management has its origin in Africa when in 1925, the Belgian colonial administration created the Albert National Park to protect mountain gorillas on the border between Ruanda-Urundi (now Rwanda and Burundi) and the Congo (van der Linde *et al.* 2001). After independence of the these countries in the 1960s, components of the Park became the Volcanoes National Park (Rwanda) and Virunga National Park (Democratic Republic of Congo). Together with a number of Uganda's national parks, these areas now form part of the Greater Virunga Trans-boundary landscape (Vasilijević *et al.* 2015). Elsewhere, in August 1925, the Waterton- Glacier International Peace Park was established between Canada and the USA to celebrate their long-lasting and peaceful relations and to further their friendship (Vasilijević *et al.* 2015). Now however, with advancing globalization and regional integration, trans-boundary landscape management is increasingly advocated not just for the protection of species or to foster peace between nations but also to generate and expand conservation and sustainable resource management partnerships.

The current study on trans-boundary forest resources in West and Central Africa was undertaken through visits to sampled countries of the two sub-regions in 2017 during which experts identified threats and weaknesses to the trans-boundary management landscapes. These challenges are not unrelated to the root causes of forest and biodiversity degradation and loss in the sub-regions. An increasingly challenging cause is *skewed market arrangements which take advantage of weaknesses and differences in policies between countries*. This is based on the belief that countries with good forest policies will lose market opportunities to those with less rigorous policies as "cut and run" or illegal forest exploiters with links to environmentally insensitive markets move from countries with comprehensive policies into those that are still to discover the value of their forest resources. Also, the porous frontiers of countries of the West and Central Africa sub-regions and the prevalent transhumant tendency of the population do not help to diminish irrational forest exploitation. As a result, people across

the border illegally exploit resources on the other side of the border. It is a combination of these factors that makes national planning of forest use more complex and leads to ever increasing poverty of societies whose wealth and health is intricately linked to existing natural resources.

Trans-boundary landscape management initiatives, implemented based on collaboration between countries, can be effective in checking unplanned exploitation of forests, including illegal cross border trade in forest products. Moreover, they focus attention on the most remote areas where natural resources may still be abundant and therefore more liable to be adequately planned and sustainably managed.

In West and Central Africa, such landscapes include a long list of operational initiatives such as the W-Arly-Pendjari (WAP) tri-national landscape between Burkina Faso, Benin and Niger, and others, as well as an increasing list of potential ones such as the Korup – Cross River trans-boundary landscape between Cameroon and Nigeria, and several others. The difference between the operational and potential trans-boundary forest management landscapes are that: the former are under active management based on comprehensive country agreements, while the latter do not yet exist under comprehensive bilateral agreements; have signed limited agreements covering only a few areas of cooperation or have signed comprehensive agreements but are awaiting a change of designation of key forest blocks to the international standard i.e. to National Park status, in order to become fully operational.

This study undertook an extensive investigation into these landscapes in the West and Central African sub-regions. It encourages accession to the relevant bilateral agreements and proposes collaborative mechanisms for their effective management. The study includes a review of shared forest ecosystems of West and Central Africa.

1.1 Objective

The study seeks to generate information that will help appreciate the achievements and gaps, and to evaluate trends in land management practices and systems and how they impact on the sustainability of trans-boundary forest resources.

1.2 Specific tasks

The specific tasks of this study included:

- Provision of a general description of trans-boundary forests of West and Central Africa;
- Identification and documentation of efforts in managing trans-boundary forests and woodlands in West and Central Africa including policies guiding mechanisms employed, challenges faced, and other experiences gained.
- Identification and documentation of any other forest and woodland resources with potential for trans-boundary forest management not covered above, guided by issues such as: distribution and management of forest biodiversity conservation; existence and management of watersheds originating from such forests; prevalence and management of invasive species; prevalence, history and management of wild fires; extent and management of land degradation cutting across countries.
- Identification and analyses of the driving forces on destruction of trans-boundary forests and woodlands in West and Central Africa and proposals on ways for containing them.

- Evaluation of trends in forest and land management policies, practices and systems, and other factors in West and Central Africa and how they impact sustainability of trans-boundary forest and woodland resources.
- Identification of mechanisms for managing identified trans-boundary forests and woodlands in West and Central Africa, with links to existing policies and practices guiding forestry and socio-economic development in West and Central Africa as dictated by ECOWAS and ECCAS.

1.3 Methodology

The approach adopted for collection and presentation of data for this study, undertaken in West and Central African countries, was harmonized by the Secretariat of the African Forest Forum (AFF) in May of 2017, in Entebbe, Uganda, with a similar study for Southern and Eastern Africa. The harmonization process involved determination of countries to be visited and refinement of the study approach. The selected countries for the current study, based on forest vegetation type and geographical location, were Niger, Sierra Leone, the Democratic Republic of Congo and Cameroon.

Three non-quantitative research methods were employed to collect information, namely:
(a) Consultation of secondary data on shared-forests and trans-boundary management landscapes along with supportive and inhibiting policies at national and regional levels.

(b) Visits to the selected countries in June 2017 during which discussions and interviews with officials and experts were held. In all such countries, the data gathering process was undertaken in two phases: the first concerned general discussions with senior level personnel in government ministerial departments; semi-autonomous state agencies responsible for forests, conservation areas and wildlife; intergovernmental actors; national and international development partners; centers of excellence and the private forest sector (Table 1).

Table 1 : Officials encountered and respondents of the study

Affiliation	Number of officials and trans-boundary experts	Professional constituency of officials and trans-boundary experts
Government	27 (Experts: 18)	Environment, Sustainable Development, Wildlife & Protected Areas, Forests & Waters
Intergovernmental organizations and Affiliates	12 (Experts: 2)	ECOWAS ¹ , ECCAS ² , AfDB ³ , UEMOA ⁴ , COMIFAC ⁵ , NBA ⁶ , AGRHYMET ⁷ , RAPAC ⁸
Centers of excellence	2 (Experts: 1)	University of Buea, University of Dschang (Cameroon)

¹ Economic Community of West African States

² Economic Community of Central African States

³ African Development Bank

⁴ Union Economique et Monétaire Ouest-Africaine / West Africa Economic and Monetary Union (WAEMU)

⁵ Commission des Forêts d'Afrique Centrale

⁶ Niger Basin Authority

⁷ Regional Agro-Hydro Meteorological Centre

⁸ Central African Protected Areas Network

Affiliation	Number of officials and trans-boundary experts	Professional constituency of officials and trans-boundary experts
Technical development partners	8 (Experts: 3)	IUCN ⁹ , WWF ¹⁰ , UNEP ¹¹ (Project - Niger), CARPE ¹² , EIP ¹³
Private sector	2 (Experts: 0)	Afrique Vannerie (Cameroun), APFNP ¹⁴

The officials encountered identified experts with clear knowledge of one or more trans-boundary conservation and sustainable management landscapes in their country, making sure that all trans-boundary areas in the country had at least one respondent. The interview of these experts constituted the second phase of the data gathering process.

More specifically in Niger, twelve experts were identified and interviewed on the following five trans-boundary landscapes: WAP (between Niger, Burkina Faso and Benin), W (between Niger, Benin and Burkina Faso), Liptako-Gourma (between Niger, Burkina Faso and Mali), Niger-Nigeria trans-boundary basins, and the Niger-Chad trans-boundary conservation landscape.

In the DRC, six experts were identified and responded on the following trans-boundary landscapes: Lac Télé – Lac Tumba (between DRC and Congo), and the Greater Virunga (between the DRC, Rwanda and Uganda).

The same process was pursued in Cameroon where another six experts provided responses for the TNS (between Cameroon, the Central African Republic and Congo), TRIDOM (between Cameroon, Gabon and Congo), and Korup – Cross River (between Cameroon and Nigeria).

The configuration of 12 experts for trans-boundary woodland savanna and parklands and another 12 for trans-boundary mangrove and moist forest landscapes was adopted to facilitate comparison. While Sierra Leone was not visited this, however, did not result in a major data gap due to the extensive knowledge on the country's trans-boundary management landscapes by the researcher of this study.

(c) Restitution of preliminary results and collation of contributions from professionals was undertaken during an AFF regional workshop that brought together forest experts from West and Central African countries in Accra, Ghana in July of 2017. During the workshop, the study received contributions from professionals of ECOWAS, ECCAS, AfDB, a former RAPAC Executive Director and others.

Analysis of responses was qualitative. An effort to enhance reliability was pursued with adequate systematic and sequential documentation during the data collection. Responses for each question were coded. The coded categories were described through narratives. Their numerical compositions were plotted in matrices. The matrices led to the development of graphs. The graphs provide trends of the most and least important categories against exploratory factors.

⁹ International Union for Conservation of Nature

¹⁰ World Wildlife Fund

¹¹ United Nations Environment Program

¹² Central African Regional Program on the Environment

¹³ Ecole Instrument de Paix (Environmental NGO in Niger)

¹⁴ Association des Propriétaires des Forêts Naturelles et Plantations

2. GENERAL DESCRIPTION OF SHARED-FORESTS OF WEST AND CENTRAL AFRICA

In this study, shared forests are sub-biomes of forests with similar functional ecological processes crossing borders and shared by two or more countries. They are referred to by some conservation organisations as ‘ecological regions’, by others as ‘forest hot-spots’ and by others as ‘forest conservation heartlands’. Shared forests of West Africa include the moist forest types of Guinean and Guinea-Congolian origin, as well as the dry forest types represented by savannah woodlands and Sahel parklands. In Central Africa, they are mainly of Congolian origin, bordered on their northern margins by the less prominent dry and woodland forests. Results of studies on these forests are presented following the distinct administrative set-up between the West and Central African sub-regions.

2.1 Shared forests of West Africa

The Guinean Moist Forests (GMF) of West Africa comprises the Upper Guinea and Lower Guinea forest types. The Upper Guinea shared forest extends from Guinea into eastern Sierra Leone, and eastward through Liberia, Côte d'Ivoire and Ghana into western Togo. The Lower Guinea shared forest extends from western Nigeria to the Sanaga River in southwestern Cameroon, and encompassing the islands of Bioko and Pagalu, both part of Equatorial Guinea, and São Tomé and Príncipe. These two major forest ecological systems are separated by the Dahomey Gap, a mixture of savanna and dry forest in Togo and Benin (CEPF, 2005). The Guinean Moist Forest ecosystem is divided into four smaller shared forest ecological classes, as follows:

2.1.1 West Africa Guinean Mangroves (WAGM)

The WAGM extends from Mauritania on the west to the Dahomey Gap beyond the Ghanaian coastline on the east. This coastal marine forest is broken at various locations depending on the nature and topography of the coastline and the availability of silt and deep sand, necessary for mangrove survival (Saenger and Bellan, 1995). From Cape Verde to Liberia, the coastline presents a mosaic of inward branching estuaries of sandbanks with low silt. Moreover, from the east of Liberia to Ghana and beyond, the coastline is low and littered with islands that shield and enclose lagoons parallel to the beach at the back of which rivers empty into the sea creating deltaic and fluvial conditions for Mangrove survival. This prevails between Mauritania and Liberia where the mangroves are essentially deltaic i.e. estuarine and fluvial or frontal (Saenger and Bellan, 1995), while in Benin, the mangroves are lagoonal due to the absence of deltas, a situation that is common for Guinean mangroves with exceptions at the mini deltas of the Mono and Volta rivers of Togo and Ghana respectively (Saenger and Bellan, 1995).

Mangrove species range from the smaller and shorter *Avicennia germinans* and *Conocarpus erectus* in Mauritania, constituting the most westerly mangroves on the West African coastline, to the red mangrove (*Rhizophora racemosa*), which reaches heights of up to 40 meters in mudflats and silt-rich deltas. This ecosystem is an important habitat for migratory birds and endangered species such as the West African manatee and the pygmy hippopotamus. Mangroves however are threatened by urban development i.e. in-filling for new settlements,

mining for sand and salt, and cutting to smoke fish. The mangrove habitat is also used as disposal grounds for all types of wastes, which occasionally leads to the death of species.

2.1.2 Western Guinean Lowlands Forest (WGLF)

The WGLF stretches from the eastern margins of Guinea, through Sierra Leone and Liberia to the Sassandra River in Côte d'Ivoire (Fig. 1). It ranks among the most westward rainforest stands in Africa, inhabiting the wettest parts of the sub-region, where the annual rains surpass 3,300 mm (Lebbie, A.R. Unpublished). The WGLF can be classified into moist evergreen, and moist semi-deciduous types (Mayers *et al.* 1992). It is characterized by canopy trees reaching beyond 30 m, and emergent stock up to 50 or 60 m. The shared



Figure 1 : Map of the Western Guinean Lowland Forest. Source: Modified from www.en.wikipedia.org

forest's swamp and riparian types are part of the evergreen and semi-deciduous forest, where degraded secondary growth is evolving from slash-and-burn agriculture and increasingly constituting the dominant vegetation type.

Tree composition is rather uniform over a long range, with *Strombosia glaucescens*, *Dacryodes klaineana*, *Allanblackia* spps, *Diospyros* spps, and *Coula edulis* constituting the most common species (Davies 1987; Lebbie, A.R. Unpublished).

Moreover, plant associations have been reported with recent estimates indicating more than 200 species endemic to the WGLF. The fauna is reportedly diverse with about 1,000 vertebrates recorded (Martin 1991, Happold 1996, Bakkar *et al.* 1999, Lebbie, A.R. Unpublished). Herpetofauna – indicators of the impact of climate change are also diverse (Welch 1982; Lebbie, A.R. Unpublished) with strict endemics that include the rare Merlin's clawed frog (*Pseudhymenochirus merlini*) (Chabanaud 1920; Menzies, 1967; Lebbie, A.R. Unpublished), the Freetown long-fingered frog (*Cardioglossa aureoli*), and a new species of frog (*Hyperolius nienokouensis*) discovered in 1997. Large forest tracts have been lost with Côte d'Ivoire and Ghana taking the lead for forest conversion to cocoa plantations, Liberia for rubber and Sierra Leone for log exports dating from the colonial era. Fuel wood cutting for domestic energy supplies in urban centers constitutes an increasing threat as well as commercial logging and artisanal mining.

2.1.3 Eastern Guinean Lowland Forests (EGLF)

The EGLF extends from the Sassandra River in western Côte d'Ivoire to the edge of Lake Volta in Ghana. There is an extension east of Lake Volta to the Togo Hills, which fades into a mosaic of forest patches and tall grass of the Guinea forest-savannah mosaic. There is also an outlier in Benin (Fig. 2). The dry lowland on the eastern edge of the EGLF is referred as the Dahomey Gap, a major bio-geographical barrier (McGinley, 2014). The Eastern Guinean lowland forest (EGLF) can be classified as moist evergreen and a wet subtype of the dry semi-deciduous forest. Its representative tree species in Ghana include:

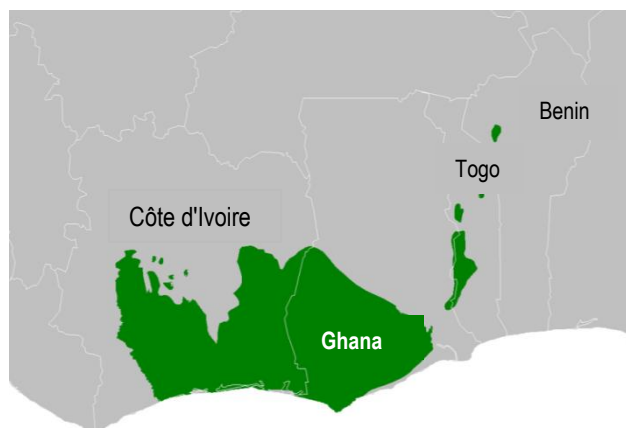


Figure 2 : Map of the Eastern Guinean Lowland Forests
Source: Modified from www.en.wikipedia.org

Entandrophragma utile, *Khaya ivorensis*, and *Triplochiton scleroxylum* while those for Côte d'Ivoire include: *Piptadeniastrum africanum*, *Parkia bicolor*, *Erythrophleum ivorense*, *Anthonotha spp.*, *Parinari excelsa* and *Klainedoxa gabonensis*. *Entandrophragma spp.*, and *Khaya spp.* are prevalent in both forest types.

Hymenostegia afzelii, is a representative of the wet subtype of the semi-deciduous forest in Ghana with representatives of the drier semi-deciduous sub-type including *Diospyros mespiliformis* and *Anogeissus leiocarpus*. In Côte d'Ivoire, dominant species of the semi-deciduous forest include *Celtis spp.*, *Mansonia altissima*, *Pterygota macrocarpa*, *Nesogordonia papaverifera*, *Sterculia rhinopetala*, and *Milicia excelsa*. In Togo and Benin, only semi-evergreen or deciduous forests prevail represented by *Milicia excelsa*, *Triplochiton scleroxylon*, *Antiaris africana*, *Diospyros mespiliformis*, *Azelia africana*, and *Ceiba pentandra*. Other trees common in these regions include *Cola grandifolia*, *Vitex spp.*, *Celtis spp.*, *Khaya grandifolia*, and *Holoptelea spp* (McGinley, 2014).

In terms of strict biodiversity endemics, four small mammals qualify namely, a species of Dephua mouse (*Dephomys eburnea*), a rodent (*Malacomys cansdalei*), a white-throated shrew (*Crocidura wimmeri*), and the Togo mouse (*Leimacomys buettneri*). Small populations of forest elephants also exist, acting as seed dispersers for species such as *Balanites wilsoniana* and *Tieghemella heckelii*.

The area of EGLF under protection is relatively small, while pressure to extract resources, i.e. timber, fuel wood, charcoal and bush meat is quite high due to readily available markets and increasing urban population in Abidjan, Accra, Lomé and Cotonou. Habitat loss and hunting has reportedly caused the extinction of the Miss Waldron's colobus (*Piliocolobus badius waldroni*), even as the endemic Togo mouse (*Leimacomys buettneri*) may also be extinct (McGinley, 2014).

2.1.4 Guinean Montane Forests (GMF)

The GMF consists of a number of isolated mountains from Guinea on the west to Côte d'Ivoire on the East. They support a range of vegetation types, from lowland to montane intermixed with bamboo, grasslands and wetlands. Parts of the forest are situated in Guinea, Sierra Leone, Liberia and Côte d'Ivoire lying upwards of 600 meters above sea level and include the Fouta Djallon plateau, the massifs of Ziama, Simandou, Tétini, Béro, and Kourandou, all in Guinea. They also include the Loma mountains peaked by Bintumani, and the Tingi Hills peaked by the Sankan Biriwa, all in Sierra Leone.

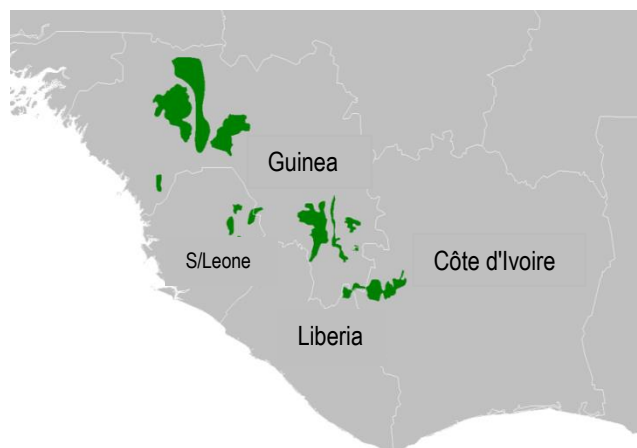


Figure 3 : : Map of Guinean Montane Forests.
Source: Modified from www.en.wikipedia.org

The GMF also includes the Nimba Range shared by Guinea, Liberia, and Côte d'Ivoire as well as the Monts du Toura in Côte d'Ivoire (Conservation International, 1999). These highlands are characterized by distinct vegetation based on altitude, enclosing up to 35 species of endemic plants. They include a Rhipidoglossum orchid located only on the Nimba. Common plants in the humid valleys include *Piptadeniastrum africanum*, *Cola lateritia var. maclaudii*, *Uapaca togoensis*, *Parinari excelsa*, and *Canarium schweinfurthii*. Higher altitudes of ranges such as Loma and Tingi are covered in the savanna of *Syzygium*, *Monechma depauperatum*, *Kotschya ochreatea*, and tree ferns i.e., *Cyathea subg. Cyathea manniana* and *Cyathea dregei*. The high gallery forests, meanwhile, are dominated by *Parinari excelsa*, the tree fern, *Cyathea camerooniana* and the *Oxytenanthera abyssinica* bamboo. The montane forests support the endangered Western chimpanzee (*Pan troglodytes verus*) and near-endemic birds in Sierra Leone i.e. the prinia (*Prinia leontica*) and iris glossy-starling (*Coccycolius iris*). Strictly endemic amphibians include the Western Nimba toad (*Nimbaphrynoides occidentalis*), which is totally viviparous. *Ptychadena submascareniensis* is another frog species found only on Mt. Nimba and in the Loma Mountains.

The GMF has been drastically modified by mining on Mount Nimba and general clearance for farming. The Loma Mountains are reported as the best preserved part of this shared forest ecosystem (Conservation International, 1999).

2.1.5 Guinean Forest-Savanna Mosaic (GFSM)

The Guinean forest-savanna mosaic cuts across West Africa from Senegal in the east to the Cameroon highlands on the west (Fig. 4). It is bordered on the south, from east to west, by the western Guinean lowland forests, the eastern Guinean lowland forests and the Nigerian lowland forests. It is bordered on the north consistently by the extensive west Sudanian woodland savanna. Its' interlacing forest and savanna habitats are reportedly dynamic throughout the forest type, presenting alternations between 'forest riparian types' and 'savanna riparian types'. In the forest riparian types, strips of middle slope savanna penetrate and persist along streams and on hilltops, whereas in savanna riparian types, savanna dominates most of the topography except for fringing forests along streams, with savanna sometimes found deep in the continuous forest areas (Poorter *et al.* 2004). The savanna types vary in their presentation, taking the forms of grass, open shrub, dense shrub and woodland savanna, while forest types take the forms of gallery forests and plateau forests (Konaté *et al.* 2010). The tallest tree species reach up to 30 meters in height and include; *Alstonia boonei*, *Aubrevillea*

kerstingii, *Bombax buonopozense*, *Ceiba pentandra*, *Stereospermum accuminatissimum*, *Pycnanthus angolensis*, *Fagara zanthoxyloides*, *Borassus aethiopicum* and others. The mosaic landscape is the area *par excellence* for the existence of both forest and savanna wildlife such as the forest and savanna buffalo, baboon, antelope, and others (Kelman *et al.* Unpublished). The major threats to the GSFM include traditional agricultural expansion, fires introduced by cattle herders, collection of firewood for making charcoal and logging of timber. The protected area system of this landscape is reportedly under-funded and only covers two percent of the area of the ecosystem (Kelman *et al.* Unpublished)

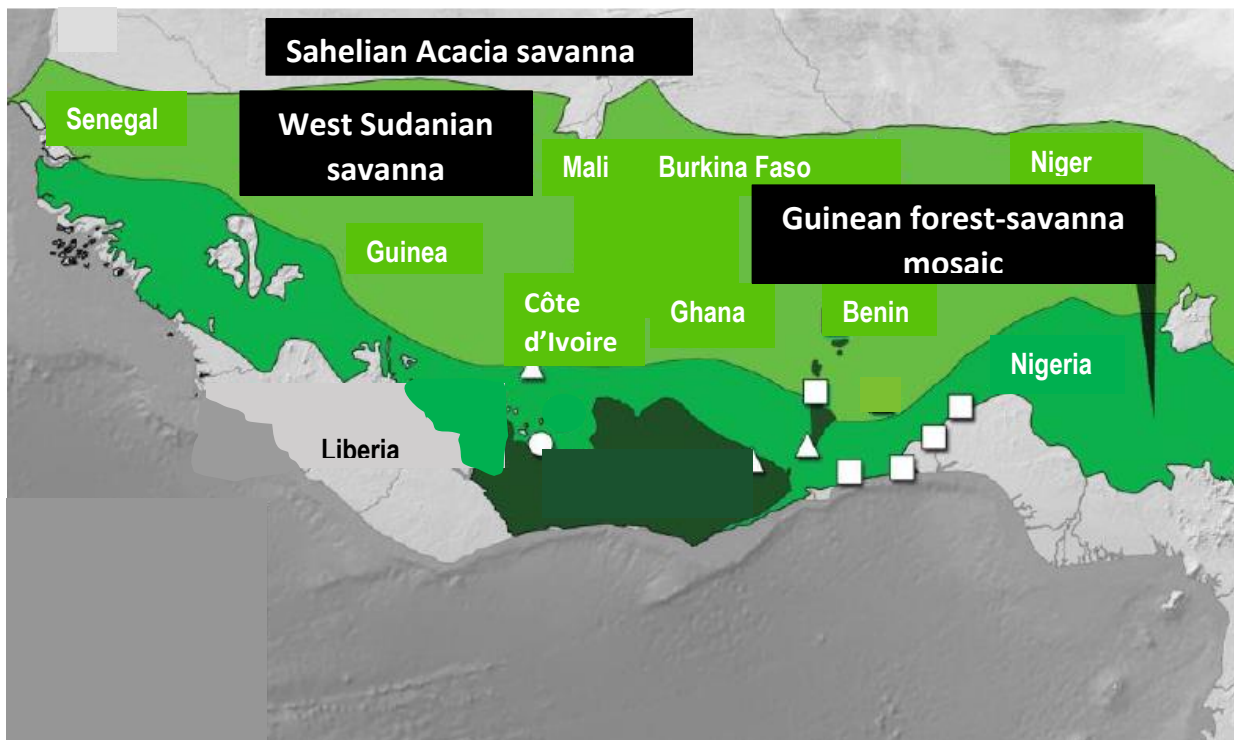


Figure 4 : Illustration Map of Shared Moist and Dry Forest Mosaics, Woodlands and Parkland Vegetation
Source: Modified from www.en.wikipedia.org

2.1.6 West Sudanian Woodland Savanna (WSWS)

The WSWS is a band of woodland savanna composed mainly of medium-sized tree species and hyparrhenia prairie commonly known as "elephant grass". This shared dry forest lies between the Guinean forest-savanna mosaic to the south and the Sahelian acacia savanna to the north, from Senegal and Gambia on the east to the eastern border of Nigeria on the west (Fig. 4). It is described as mainly flat on an altitude of 200 and 400 meters in height (White, 1983; Magin, Unpublished). Rainfall is seasonal with the dry season usually lasting several months as most tree species lose their leaves and inflammability of the grass to wildfire reaches a peak. The dry woodland is usually less than 10 m in height and dominated by *Anogneissus spp.*, in association with acacia species, *Balanites aegyptiaca*, *Combretum glutinosum*, *Commiphora africana*, *Prosopis africana*, *Tamarindus indica*, and *Ziziphus mucronata* (White, 1983; Magin, Unpublished). In the wetter woodlands, *Azelia africana*, *Burkea africana*, *Combretum spp.* and *Terminalia spp.*, prevail as well as Sudanian isoberlinia woodland in pockets on outliers further south. The WSWS is also characterized by small grassy floodplains or fadamas and gallery woodlands (White, 1983). Strictly endemic wildlife include, two small mammals i.e. the white-toothed shrew (*Crocidura cinderella*) and the zebra mouse (*Lemniscomys linulus*) (Happold 1987; Magin, Unpublished). There are also large mammal

species, some of which are threatened with extinction i.e., the western sub-species of giant eland (*Taurotragus derbianus derbianus*), (East, 1999; Magin, Unpublished), the wild dog (*Lycaon pictus*) the lion (*Panthera leo*), leopard (*Panthera pardus*) and cheetah (*Acinonyx jubatus*). West African elephant populations (*Loxodonta africana*) and remnant populations of the western giraffe (*Giraffa camelopardalis peralta*), are of significant conservation interest for maintaining the ecotourism potential of protected areas.

The WSWS has been reduced, degraded and fragmented by especially subsistence agriculture, fire for pasture improvement and to facilitate hunting, as well as cutting for wood and charcoal production. Although several protected areas exist, most are under-resourced and referred simply as "paper parks". The area of protected lands is reported to be over 90,000 km², but only represents 6.7% of this large shared dry forest ecosystem. The protected areas include; Niokolo-Koba in Senegal, Boucle du Baoulé National Park in Mali, Kainji Lake in Nigeria, Mole in Ghana, Comoe in Côte d'Ivoire, the trans-boundary 'W' National Park in Niger, Burkina Faso and Benin, and others (Magin, Unpublished).

2.1.7 Sahelian Acacia Savanna (SAS)

The SAS constitutes the transition zone between the wooded or Sudanian savannas of the south and the southern Saharan steppe and woodland on the north. It is essentially Sahel acacia wooded grassland and deciduous bushland stretching from the northern part of Senegal and Mauritania, west, on the atlantic coast of West Africa to Sudan, east, on the red sea (Fig. 4). Its width varies from several hundreds to over a thousand kilometers between altitudes of 200 to 400 meters high. The main woody species include *Acacia (Vachellia) tortilis*, *A. laeta*, *Commiphora africana*, *Balanites aegyptiaca* and *Boscia senegalensis* with continuous grass cover (MH/E, WWF and IUCN, 1996; Magin, Unpublished). Wildlife includes the scimitar-horned oryx (*Oryx dammah*), the dama gazelle (*Gazella dama*), dorcas gazelle (*Gazella dorcas*) and red-fronted gazelle (*Gazella rufifrons*) (East, 1999). Predators such as the wild dog (*Lycaon pictus*), cheetah (*Acinonyx jubatus*) and lion (*Panthera leo*) are now very rare on this landscape. Conservation areas include the Chad Basin National Park in Nigeria, the Aïr and Ténéré National Nature Reserve in Niger, Diawling in Mauritania, Djoudj in Senegal, Sahel Partial Faunal Reserve in Burkina Faso, and the Waza and Kalamaloue National parks in Cameroon.

Rain-fed agriculture with sorghum and millets constitute a threat to the the landscape of the ecosystem while poaching is reportedly rife even in the managed conservation areas of the landscape.

2.2 Shared Forests of Central Africa

2.2.1 Central African Mangroves (CAM)

The CAM comprises mangrove areas along the coastline east of the Dahomey gap from the west of Ghana, through Benin and Togo, to Nigeria, Cameroon, Equatorial Guinea, Gabon, Democratic Republic of Congo (DRC), and Angola. Structurally, they vary from the lagoon systems found in the western part of this marine shared forest landscape to systems modified by complex patterns of sediment deposition at the mouths of rivers such as the Niger Delta (Nigeria), the Bakassi peninsula on the west coast of Cameroon to the mouth of the Congo River. Mangrove species include the red mangroves, (*Rhizophora racemosa*), but also (*R. mangle*), and (*R. harrisonii*), and the white mangroves (*Avicennia germinans*) and (*Laguncularia racemosa*). The Nypa palm (*Nypa fruticans*) is an introduced and colonizing species. Southwards in the Democratic Republic of Congo (DRC) where mangroves are found around lagoons, the dominant species is *Rhizophora mucronata* (Makaya, 1993). In terms of

biodiversity, CAMs provide habitat to the manatee (*Trichechus senegalensis*, (Hughes and Hughes 1993), the soft-skinned turtle (*Trionyx triunguis*), and isolated populations of pygmy hippos (*Hexaprotodon liberiensis heslopi*). Seasonal visitors include endangered species of marine turtle; leatherback (*Dermochelys coricea*), loggerhead (*Caretta caretta*), olive ridley (*Lepidochelys olivacea*), hawksbill (*Eretomychelys imbricata*), and green turtles (*Chelonia mydas*) (Sackey *et al.* 1993).

About 10.68% of CAMs exist as protected areas, which include the Douala-Edea Faunal Reserve in Cameroon, the Anlo-Keta Lagoon Complex and Songor Lagoon in Ghana (Diop, 1993). Threats to the mangroves include urbanization, industrialization, agriculture, timber and petroleum exploitation, use of poison and dynamite for fishing, canalization, discharge of sewage and other pollutants, siltation, sand mining, construction of embankments (Isebor and Awosika, 1993). Oil spills alone have reportedly led to the death of both mangrove fauna and flora (NDES, 1997).

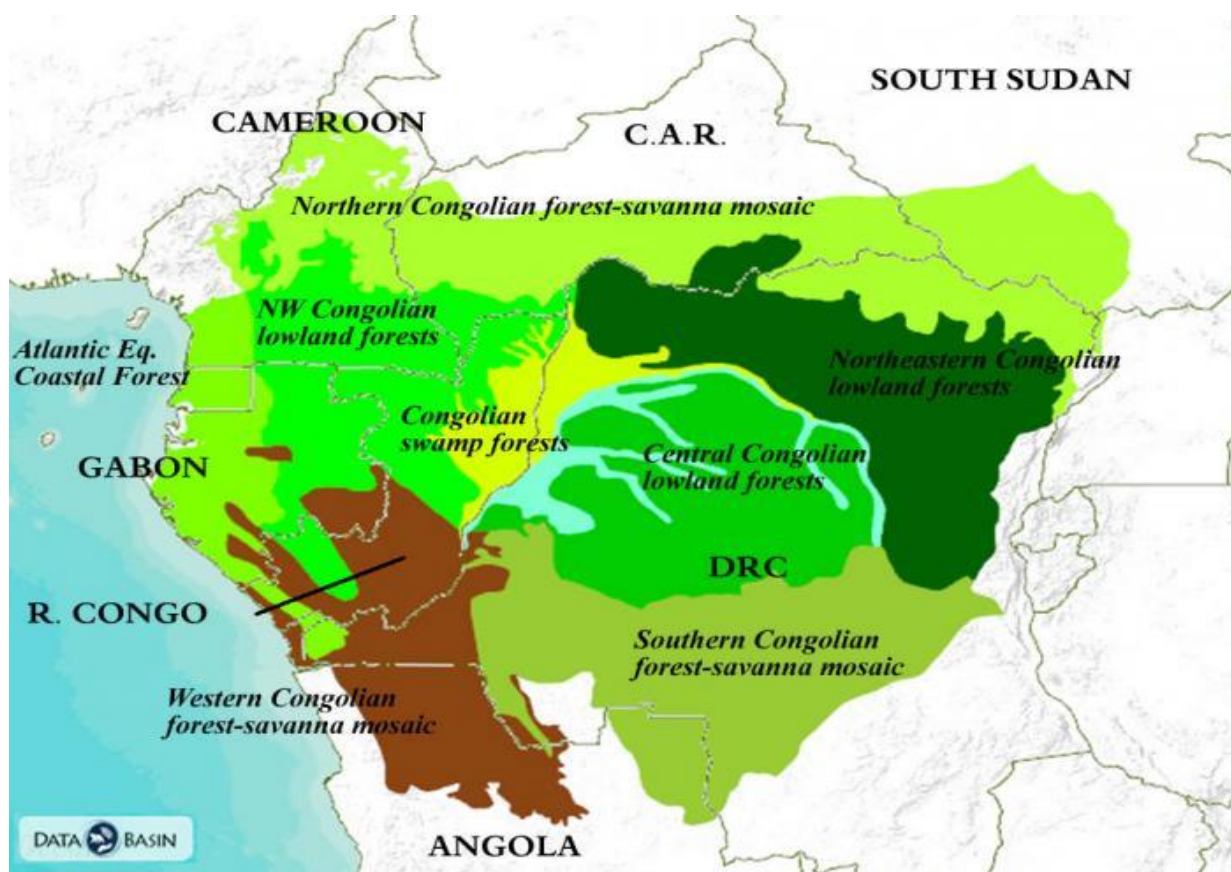


Figure 5 : Map of Shared Forests of Central Africa
Source: modified from www.en.wikipedia.org

2.2.2 Atlantic Equatorial Coastal Forest (AECF)

The AECF has as its northern limits, the River Sanaga in the west-central part of Cameroon extending southwards through Equatorial Guinea, the coastal and inland areas of Gabon, to the Republic of Congo, and into the Cabinda Province of Angola. It terminates in the extreme western part of the DRC, just north of the mouth of the River Congo (Blom, Unpublished) as

can be seen in Fig 5. The lowland forests present a multi-layered type, with trees reaching heights of 60 m in certain areas. The forest also contains large strips of a coastal savanna mosaic especially in Gabon, known as Guineo-Congolian edaphic grassland (White, 1983). The coastal savannas exist in a mosaic with low coastal forests and scrub, which eventually give way to continuous moist forest further inland (Blom, Unpublished). Important plant conservation areas include the Monts de Cristal and Monts Doudou in Gabon, and the Mayombe region, which occur along the borders of the Republic of Congo, through the Cabinda Province in Angola to the western DRC. Well-represented tree families include the Apocynaceae, Caesalpiniaceae, Euphorbiaceae, and Rubiaceae (WWF and IUCN, 1994; Blom; Unpublished). Large forest mammals include gorillas (*Gorilla gorilla gorilla*), chimpanzees (*Pan troglodytes*) and the forest elephant (*Loxodonta africana cyclotis*) (Blom, Unpublished), among others. Strictly endemic Herpetofauna include the apouh night frog (*Astylosternus schioetzi*), perret's shovelnose frog (*Hemisus perreti*), and others. Main protected areas include; Campo-Ma'an National Park and the Douala-Edéa Wildlife Reserve in Cameroon, Monte Alén National Park in Equatorial Guinea., Lopé Reserve in Gabon, the Gamba complex of protected areas and the Wonga-Wongué Presidential Reserve as well as several areas proposed for gazettment in Gabon. Protected areas in the Republic of Congo include the Conkouati and Dimonika-Mayombe Reserves. Threats to these forests are from the logging and oil industries, which facilitate hunting, and poaching, thereby providing linkages with markets, and access to remote forests.

2.2.3 Western Congolian Forest-Savanna Mosaic (WCFSM)

The WCFSM is parallel to the Atlantic Ocean at the western extremities of Congo and the DRC. It transits four Congo Basin countries, from north to south, namely; Gabon, Congo, DRC and Angola. It is bordered on the north in Gabon and on the North West and North East in Republic of Congo, by the north-west Congolian lowland forest, with extensions on the west, projecting into Gabon's section of the Atlantic equatorial coastal forests. It is bordered on the east in DRC by the southern Congolian forest savanna mosaic (brown patch on map in Fig 5). The WCFSM covers the capitals of Kinshasa in the DRC and Brazzaville in the Republic of Congo. Species display a mosaic of moist forests, and high savanna. Spectacular wildlife include the endangered Bouvier's red colobus and the black mangabey, which live in the forest canopy along waterways, elephants, lions, forest buffaloes, warhogs, and a variety of antelopes including waterbuck, reedbuck, common duiker, and swamp-dwelling sitatunga. Endemic birds include the white-headed robin-chat and the orange-breasted bush-shrike. Threats of this mosaic forest include urbanization, especially from Kinshasa and Brazzaville, where inhabitants depend on the forest for livelihood including firewood for the supply of domestic energy, bush-meat for protein, and wood for construction. The navigability of the Congo River and other local roads provide easy access to the forest. Another major threat has been civil wars plaguing the DRC and Angola (not in too distant past) producing frequent movements of internal migrants and refugees as well as occasionally armed militia who devastate the forests' resources (Tata *et al.* 2012)

2.2.4 Northwest Congolian Lowland Forest (NWCLF)

The NWCLF shared forest extends across four countries, namely; Cameroon, Gabon, Congo, and the Central African Republic. It is bordered on the south by the western congolian forest savanna mosaic, on the north by the northern congolian forest savanna mosaic, on the west by the Atlantic equatorial coastal forest and on the east by the congolian swamp forest (Fig. 5). This shared forest reportedly has one of the highest species count per unit area of land for any vegetation in the world (WWF and IUCN, 1994). Some of its representative species include emergent trees that grow to 60 m tall such as: *Entandrophragma congoense*, *Pentaclethera eetveldeana*, *Pericopsis elata*, and *Gilbertiodendron dewevrei*. The NWCLF is renowned for its indigenous human communities of BaAka, BaKa, BaKola, and smaller groups of traditional

forest people, habitually called pygmies (Luling and Kenrick, 1998; Blom, Unpublished). Richness in mammals is reportedly amongst the highest of any forest ecological region in Africa. They include; gorillas, chimpanzees and buffalo (Blake 2002a; Blom, Unpublished forest elephants (Strohmayr and Ekobo, 1992). Strict endemic mammals include the Dollman's tree mouse (*Prionomys batesi*), Remy's shrew (*Suncus remyi*), and *Sylvisorex konganensis* (Ray and Hutterer, 1996) and an endemic forest robin, (*Stiphornis sanghensis*) (Beresford and Cracraft, 1999). Protected areas include; Lobéké, Nouabale-Ndoki, Odzala, Dzanga Ndoki, Mbam-Djerem, Dzangha-Sangha, Minkébé, Dja, Boumba-Bek, Nki, and Ngotto. The NWCLF contains the famous Sangha Trinational landscape (TNS). Main threats to these forests include forest concessions and logging roads which facilitate forest degradation through immigration into logged forests, infrastructural development and depletion of wildlife in logging concessions through hunting for bushmeat and poaching for ivory (Wilkie and Laport 2001; Blom, Unpublished).

2.2.5 Northern Congolian Forest Savanna Mosaic (NCFSM)

The NCFSM is a shared ecological region that extends east of the Cameroon highlands through the CAR, northeastern DRC and into southwestern Sudan with an outlier into north-western Uganda (Fig 5), (Kelman, Unpublished). Semi-evergreen lowland rain forests intergrade with secondary wooded grassland that constitute the higher latitude Sudanian sub-landscape (Millington *et al.* 1992; White 1983; Kelman, Unpublished). Gallery forests provide corridors for forest species into the northern grasslands and constitute the dominant forest type as they grow wherever there are watercourses, sufficient rain, available groundwater and low fire frequency (Mayaux *et al.* 1999; Kelman, Unpublished). Gallery forest species include; *Berlinia grandiflora*, *Cola laurifolia*, *Cynometra vogelii*, and others. The forest elephant (*Loxodonta africana cyclotis*) is adapted to the forest part of this mosaic forest, where it assists forest regeneration by spreading large seeds, contrary to the savanna sub-species (*Loxodonta africana africana*), which denudes trees and suppresses sapling growth in savanna woodlands, creating a fire-prone system (Belsky and Amundson, 1992; Kelman, Unpublished). Mammals in the savanna forest mosaics include the black rhino (*Diceros bicornis longipes*), giant eland (*Taurotragus derbianus*), and others, while northern savanna animals include giraffes (*Giraffa camelopardalis congoensis*), lion (*Panthera leo*), and others. Strictly endemic amphibians include the Mauda River frog (*Phrynobatrachus albomarginatus*), Bouda River frog (*P. scapularis*), and others (Kelman, Unpublished). Threats to the forests include; civil wars in CAR, Sudan, the DRC, large-scale clearing and high intensity fires which alter the light and hydrologic regimes, thereby transferring dominance from woody plants to grasses causing some poorly adapted species to disappear (Longman and Jenik 1992; Kelman, Unpublished). Gallery forests serve as both refuge for rain forest species and mode of conveyance and dispersal and hence facilitate survival despite climate change. Protected Areas in this landscape include the Garamba National Park in the DRC and Mbem-Djerem National Park in Cameroon.

2.2.6 Western Congolian Swamp Forests (WCSF)

The WCSF ecological region, represented by the yellow patch in Fig. 5, referred to as congoian swamp forests, is asymmetrical, and characteristic of riparian habitats and includes areas ranging from the east of Congo to the west of the DRC and on to the CAR (Blom, Unpublished). More specifically, it is located on the west of the Congo River, which acts as a biogeographic barrier to the neighboring ecological regions, i.e. the eastern congoian swamp forests and the central congoian lowland forests (see Fig. 5). The Congo River and its tributaries constitute barriers to species dispersal between the ecological regions and provide water for the swamp forests, which meander along its tributaries i.e. the Giri, Mangala, Likouala

aux Herbes, Sangha, Likouola, and the Kouyou Rivers (Blom, Unpublished). The forests are flooded to a depth of 0.5 to 1 meter during the rainy season and dry out in the dry season.

They include species tolerant to seasonal swamps i.e. *Symphonia globulifera*, *Guibourtia demeusei*, and others. Permanently flooded areas mainly contain raphia palms, while species on the higher ground with fewer floods contain more biodiversity and host lianas such as *Gilbertiodendron dewevrei* and *Daniellia pynaertii* (Forests Monitor, 2001; Minnemeyer, 2002). Wildlife includes important populations of western lowland gorilla (*Gorilla gorilla gorilla*), chimpanzee, forest elephant and few forest buffaloes which all feed in the grassland swamps. The ecological region is increasingly under threat from logging in Congo and DRC, where large concessions have been awarded and roads increased, enabling hunting in previously inaccessible areas (Blom, Unpublished).

2.2.7 Northeastern Congolian Lowland Forests (NECLF)

The NECLF is a shared ecological region sprawling between two countries i.e., the CAR, where its northwestern fringes abuts the northern congolian forest savanna mosaic, and the DRC's northeastern portion where the bulk of the landscape is located, and extending to the country's eastern border, bounded by the albertine rift montane forests. Its southern part and the bulk of its western margin is delimited by the Congo River's tributaries, mainly the Elila River (Blom & Schipper, Unpublished). Its northern margin displays a transition to savanna and woodland habitats but generally, the vegetation transitions gradually from sub-montane to lowland forests with patches of swamp forests located throughout. While most of the landscape is covered in a mixture of moist evergreen and semi-evergreen rainforest species, there exist single-species dominated forests in fairly large patches with the most common mono-dominant stand largely represented by *Gilbertiodendron dewevrei* (Hart 1990; Blom & Schipper, Unpublished). Four endemic species of shrew are found only in these forests, i.e., the mountain shrew (*Sylvisorex oriundus*), African foggy shrew (*Crocidura caliginea*), Congo shrew (*C. congobelgica*), and the fuscous shrew (*C. polia*) (Hilton-Taylor, 2000). Avifauna includes two strict endemics i.e., the Neumann's coucal (*Centropus neumanni*) and the golden-naped weaver (*Ploceus aureonucha*).

A major threat to these forests is mining for gold, diamond, and coltan (Hart and Mwinyhali, 2001). Other threats include logging, large-scale movements due to war, as well as bush-meat and wildlife use, usually associated with the preceding threats. Protected areas include the Okapi Faunal Reserve, the Kahuzi-Biega National Park, the Maïko National Park and the Yangambi Reserve (WWF, 2003). Potential areas for protection include the Rubi Tele Domaine de Chasse, the Maika Penege Reserve (close to Isiro) and the Domaine de chasse de Bili-Uere (Schipper, Unpublished).

2.2.8 Lake Chad Flooded Savanna Ecological Region (LCFS)

Lake Chad is shared by four countries, with borders in the lake, namely: Cameroon, Chad, Niger, and Nigeria. It is the largest lake in Central and West Africa and the fourth largest in Africa; however, it has dwindled, covering only one-tenth of the area covered in the 1960's (FEWS 1997; Mockrin & Thieme, Unpublished). Water input to the landscape is based on rainfall brought by the Chari and Logone Rivers, which together account for 95% of the riverine inflow. The Yobe River in Nigeria brings in less than 2.5% (Hughes and Hughes, 1992). Woody trees are dominated by acacia species, intermingled with bushy grasslands, woodlands and thickets (Mockrin & Thieme, Unpublished). Sahelian woodland species around the lake include baobabs, desert date palms, African myrrh, Indian jujube and 'firki' vegetation in areas with reduced flooding but also *Acacia nilotica* in low-lying areas. Grass species between trees grow to 3 meters tall and include; *Caperonia palustris*, *Echinochloa colona*, *Hibiscus asper*, and

others, (White 1983; Mockrin & Thieme, Unpublished). Meanwhile, lake floating species are represented by the Nile lettuce (*Pistia stratiotes*) (Denny, 1991). The landscape is also renowned for the large number of migrant birds like the wader ruff (*Philomachus pugnax*), the white-faced whistling duck (*Dendrocygna viduata*), garganey (*Anas querquedula*), and others (Dodman *et al.* 1999; Mockrin & Thieme, Unpublished). A reduced hippo population is still available including otters (Hughes and Hughes 1992; Mockrin & Thieme, Unpublished). The Lake Chad Game Reserve is currently the only protected area on Lake Chad. The Lake Chad Basin Commission (LCBC), made of the landscape's watershed countries declared all of the lake a trans-boundary Ramsar site of international importance, since 2000.

2.3 Summary characteristics of shared forests of West and Central Africa

A common characteristic of shared forests of West and Central Africa is their transit over one or more national borders. They also contain endemic, threatened and endangered species of fauna and flora with the potential for turning out species new to science. Moreover their links to water conservation and flow is emblematic in the Volta and Fouta Djallon highlands for West African countries; and the Congo basin for Central African countries. Though broken in some sections, this forest mass is pertinent as it upholds the microclimatic conditions of the moist air carried by the southwest monsoon winds inwards, towards the territorial landmass, a condition necessary to perpetuate reasonable climate change adaptation at the local, national, regional levels and beyond. These forests are however subject to socioeconomic pressure, weaknesses of their management policies, and local level threats. The gloomy picture is of degrading forests which encourage migration to increasingly fragile forestlands thereby provoking their overuse. In turn, the overused and degraded forest causes further migration causing an irrational cycle of forest degradation followed by popular movements to other ever fragile forest landscapes. This is partially responsible for the socio-political conflicts in these sub-regions.

A key solution is for countries to join forces towards the conservation and sustainable management of these forests at the trans-boundary level where they can be found. When under bilateral or multilateral agreement between nations, and operational, this study considers shared forests as trans-boundary conservation and sustainable forest management landscapes. The following section constitutes a review of the different types of agreements for establishing such landscapes.

3. RESULTS

The results in this section are based on documentary consultation and country visits to investigate the status and perspectives of trans-boundary forest management initiatives. Such initiatives are different from shared forest ecosystems narrated in the previous section. According to this study, the trans-boundary forest management landscape is a naturally connected area sustaining similar functional ecological processes crossing one or more international boundaries that include both protected areas and multiple resource use zones, and involves some form of cooperation in its management (Vasiljević *et al.* 2015). The objective is to promote land use policies and practices on one side of a border that do not adversely affect ecosystem function and resilience, composition and persistence of species, economic revenues and human survival on the other side of the border.

The study found out that there is a multiplicity of trans-boundary management types and related agreements, and starts by explaining the differences between such collaboration mechanisms.

3.1 Types of collaboration agreements in trans-boundary landscapes management

Operational trans-boundary forest management initiatives in West and Central Africa as well as those with good will intentions for their creation are associated to different types of management agreements. They range from informal and unwritten local conventions such as between traditional cross-border communities, to low level collaboration agreements such as between the national park administrations of trans-boundary conservation areas, to high level bilateral agreements where heads of state meet to agree on management orientations. This section examines trans-boundary landscape agreements, inspired by the Biodiversity Support Program's 2001 work by van de Linde and others.

3.1.1 Informal agreements

In this study, informal agreements are essentially unwritten local conventions. Such conventions have guided the use of natural resources in West and Central African societies for centuries, and still do so in several trans-boundary landscapes. In this case, traditional authority and local cult institutions are the knowledge keepers. They uphold resource-use arrangements i.e. between their communities and transhumant populations. The unwritten local convention is a traditional agreement. Van de Linde, *et al.* (2001) reports that traditional agreements are important in the management of trans-boundary resources and include cases where communities on one side of the border recognize the right of those on the other side to exploit resources located on their own side of the border. A case in point reported by Oats *et al.* (2004), is the trade collaboration between the Erat community, an enclave within the Korup National Park in Cameroon and the Ekonganaku community at the edge of the Cross River National Park in Nigeria. Van de Linde *et al.* (2001) indicate that informal arrangements should be assessed for their impact on sustainable resource management since they risk not being considered when formal trans-boundary management arrangements are developed.

3.1.2 Low level formal agreements

In this study, low-level formal agreements include: written and signed local conventions, declarations of intent, signed protocols and memorandums of understanding.

Signed local conventions are an evolved form of the informal and unwritten type described in the preceding section. While unwritten conventions are based on tradition and administered by local cult institutions and traditional authority, the signed local convention is a modern tool, usually recognized and approved by government authority. It stipulates the roles, responsibilities, benefits and sanctions of resource users from the traditional perspective. It is signed by heads of communities on both sides of the border, between sedentary and transhumant communities or between host and migrant communities. Such conventions abound and govern transhumance and cattle grazing in landscapes such as the Liptako-Gourma between Niger, Burkina Faso and Mali.

Declaration of intent for collaboration in trans-boundary resource management is another low form of agreement that can result from meetings when officials i.e. government ministers meet and agree to collaborate. They may later confirm their commitment in writing. Areas of possible collaboration are usually narrow in scope and mentioned in the joint declaration. To give life to

the declaration, one or both ministers can give instructions to their border project level personnel to start limited collaboration with conservation personnel on the other side of the border i.e. to share, allow or block access.

Across the border protocol for collaboration in trans-boundary management, within the context of this study, concretizes the 'declaration', usually on a narrow number of practical issues. Van de Linde, *et al.* (2001), describes it as "an agreed course of action to address specific incidents, and may engender a sound working relationship". It results from more study and adopts timelines for implementation, i.e. joint monitoring to track the movement of elephants. It is such protocols between national park managers of the Sangha Tri-national landscape, followed by regular meetings between 1995 and 2000 that led to the drafting of a collaboration agreement for joint management of the three trans-boundary National Parks of the landscape, and then to the Yaoundé Declaration by Central African Heads of State and governments, and eventually to the birth of COMIFAC.

The memorandum of understanding (MoU) is described by Van de Linde, *et al.* (2001) as an administrative arrangement that functions well when the level of consultation is sufficiently advanced for representatives to agree on their common objectives and then set out provisional institutional arrangements and delegations to pursue accomplishment of specific activities on the trans-boundary landscape. Because of the complexity of trans-boundary management, and in a bid to avoid contradictions, the MoU may include other active parties already implementing strategic activities on the landscape. The MoU starts with a 'Purpose', and then a 'Preamble', followed by the 'Resolution' presented in 'Chapters', each of which is broken down into 'Articles or Lines'.

3.1.3 High level formal agreements.

This section describes two high-level formal agreements for collaboration in trans-boundary forest management, namely; bilateral agreements and treaties.

The bilateral or multilateral agreement is a high level formal accord which comes into play when negotiations have matured and legal experts engaged to develop a collaborative tool at the highest level of policy-making between States or Governments (Fig.6). Van de Linde, *et al.* (2001) describes it as an international agreement, which is formally ratified by the country representatives, going beyond the memorandum of understanding (MoU) to set out clear legal arrangements between the signing parties. It includes aspects such as the partial renunciation of sovereignty over national parts of the trans-boundary landscape, harmonization of policies and important practices, setting of multi-level and specialized concerted management entities to facilitate sector-level cooperation between countries, and the possibility to incrementally produce legal instruments binding to the parties. There is always such an agreement when Heads of State or of Government or when sector level ministers of government on both sides of the border meet, to deliberate on collaboration around the management of trans-boundary resources of the landscape. While such high level collaboration is advocated, success of trans-boundary resource management depends on available funds and stakeholders on the ground.



Figure 6 : Signing ceremony and inauguration of the Gola trans-boundary forest landscape by the Presidents of Sierra Leone (Ernest B. Koroma) and Liberia (Ellen J. Sirleaf) at the Sierra Leone / Liberia border village of Lalehun in 2009. Photo credits: John Moribah & Martin Nganje.

The Treaty or Convention is another form of high-level formal agreement. Van de Linde, *et al.* (2001) describe it as different from the bilateral agreement in that it formally resolves a dispute or binds the signing parties to an agreed course of action. Some regional frameworks described in section 3.2.3.2 of this report, are examples of treaties or conventions.

3.1.4 Role of collaboration agreements in the establishment of trans-boundary forest management landscapes in West and Central Africa

From informal and unwritten local conventions to formal bilateral and multilateral treaties, trans-boundary forest management agreements follow the longstanding lead of river basin management processes. As an example, it is habitual for communities to install local trans-boundary water management committees to supervise written or unwritten agreements among them on both sides of exit and entry, where important rivers cross a national border. While they are known to exist, this study documented a few cases of informal local conventions in trans-boundary forest management. In addition to such conventions associated to trade between trans-boundary communities (Korup – Cross River trans-boundary landscape) and transhumance related grazing (W-Arly-Pendjari trinational landscape), this study noted the existence of a local level corridor management committee (CORMCO). Located in the Sekoti community on the Ghanaian side of the eastern ecological corridor of the Mole / Nazinga – Kaboré Tambi trans-boundary landscape between Ghana and Burkina Faso, CORMCO oversees the respect of local agreements for the sustainable management of the corridor's resources (Borrini-Feyerabend *et al.* 2005).

Pertaining to bilateral conventions in West and Central Africa, this study noted in several instances that international support predated trans-boundary forest management agreements in the form of pilot projects. This is probably because the trans-boundary process is perceived as a practical approach of globalization in the management of forest resources. As an example; although the contiguous W conservation areas between Niger, Burkina Faso and Benin were all declared National Parks since 1954, there was no agreement between the three countries towards their concerted regional management until 2008. Before then however, the three parks were already hailed internationally as a regional trans-boundary conservation landscape and declared by UNESCO as a regional trans-boundary Biosphere Reserve in 2002. The three National Parks were also receiving a W-ECOPAS project funding from the European Union starting early 2000, which promoted development of a Declaration by the three countries to collaborate towards a regional trans-boundary initiative, known as the Tapoa Declaration of May 2000 (Programme Régional Parc W / ECOPAS, 2005). When the agreement was signed in 2008, it provided the legal basis to expand partnerships to non-pilot funding sources.

A similar process is reported for the Gola trans-boundary forest landscape between Sierra Leone and Liberia. The signing and inauguration of the trans-boundary landscape as a Peace Park in May 2009 (Fig. 6), received European Union support, and immediately provided the legal basis and opportunity to enlist more partnerships from the international community. Some of these include: the French Environment Fund (FFEM), the Global Conservation Fund at Conservation International, the Royal Society for the Protection of Birds (RSPB) and others (Notes taken during field mission to Gola in 2010). It should also be mentioned that while trans-boundary landscape agreements provide legitimacy to the initiative, they also place pressure on country parties to raise the forest conservation categories of some of their trans-boundary forest blocks to the international standard i.e. to National Park status. In the preceding case, Sierra Leone upgraded its Gola National Forest Reserve to the Gola Rainforest National Park in 2012 and Liberia was poised to do the same.

3.2 Current efforts in the management of trans-boundary forests and woodlands, challenges and lessons

3.2.1 Trans-boundary forest landscapes with bilateral or multilateral agreements

Trans-boundary forests with bilateral or multilateral agreements are comprehensive in scope and implemented through concerted management effort. They include the following areas:

(a) The W-Arly-Pendjari (WAP) Tri-national Landscape

The WAP is West Africa's emblematic landscape by virtue of its adjacent network of cross-border conservation areas straddling three countries, namely; Burkina Faso, Benin and Niger. Protected areas in the landscape include: the "W" tri-national conservation area established in 1954 and divided between Burkina Faso, Benin and Niger. The "W" was classified by UNESCO as a Trans-boundary Biosphere Reserve in November 2002, making it the first of this type in Africa. The landscape is transited by the Niger River with sections in Burkina Faso and Niger classified as important Ramsar sites. It is also classified as an important bird area (IBA). Together with the Arly Faunal reserve in Burkina Faso and the Pendjari National Park in Benin, the three areas constitute the "W – Arly – Pendjari" or WAP tri-national landscape spanning more than 31,000 km² (map on Fig 7).

The WAP is located in the West Sudanian Woodland Savanna, whose species composition and threats are narrated in section 2.1.6. Since the signature of the regional collaborative agreement in February 2008 between the Ministers of tutelage of the WAP countries,

measures to reduce conflicts according to questionnaire responses from this study, include; a ministerial council of orientation, an inter-municipal framework to resolve challenges, a steering committee for all projects on the landscape, a technical monitoring committee, mixed regional surveillance patrols, free movement of Park Managers in the regional space, harmonized tariffs for tourism, an established system of alert for the management of trans-boundary crises and harmonization of management practices in the three landscape blocks.

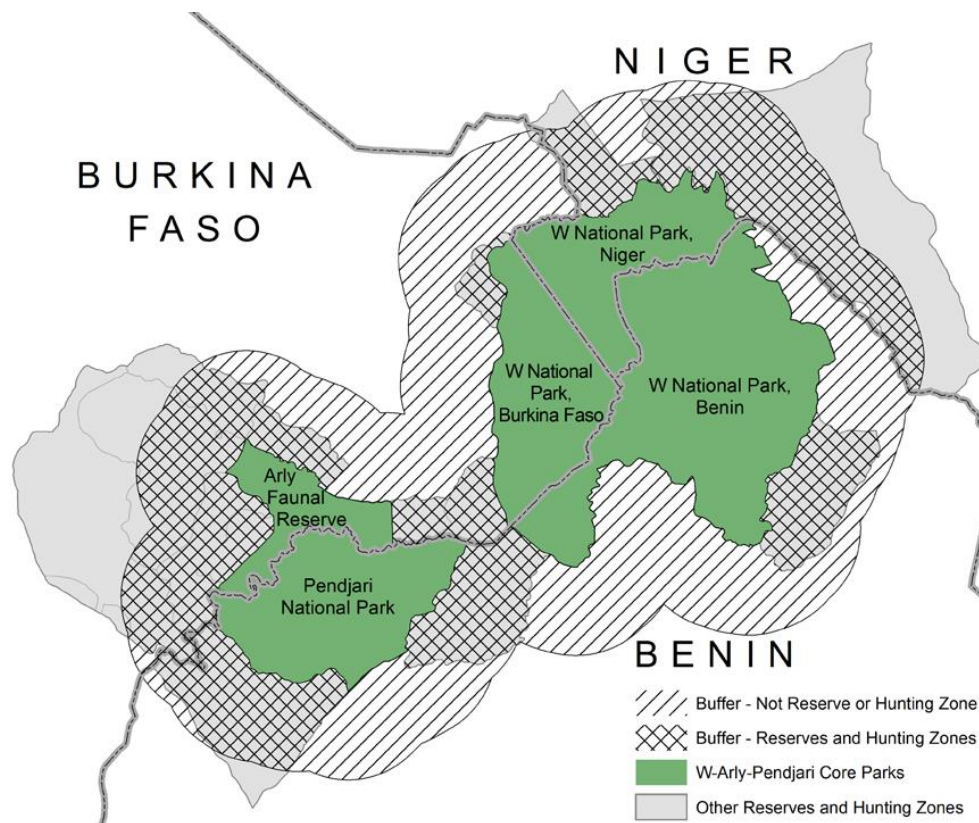


Figure 7 : Map of the W, Arly and Pendjari Trans-boundary landscape
Source: WAP Website documents.

Pertaining to poverty reduction around the landscape, the trans-boundary initiative uses community labor as eco-guards, park management, and they benefit from community projects, for example through the high labor intensity projects (HIMO) and exchange visits. Additionally, communities receive part of the levy from scientific visits, as well as from taxes and payments obtained from infractions sanctioned by the conservation area management. Each tourist camp is managed by an autonomous village management committee and the revenue from tourists goes to communities.

(b) Djoudj-Diawling Trans-boundary Mangrove Landscape

The Djoudj – Diawling landscape is a trans-boundary mangrove zone between Senegal (where the Djoudj National Park, created in 1971 is located) and Mauritania (where the Diawling National Park created in 1991 is located). Covering an area of 6,417.68 km², this is the second trans-boundary Biosphere Reserve in Africa (Vasilijević *et al.* 2015). Also known as the Delta of the Senegal River trans-boundary landscape, the area has long been characterized by two different management systems. While the local population was relocated during establishment of the Djoudj National Park in Senegal in 1971, Mauritanian communities were not relocated during establishment of the Diawling National Park twenty years later.

The Mauritanian approach was integrative, involving local communities at all stages of management, while the Senegalese approach was exclusive although this is changing due to local community pressure on the Park's resources. The droughts of the 1970s and '80s led to a reduction in the mangrove area to 10% of its 1960 extent and loss of: hundreds of hectares of *Acacia nilotica*, an important source of tannin for leather; of *Sporobolus robustus*, a perennial grass used in making traditional fishing gear and mats; *Echinochloa colona*, a grass of high pastoral value whose hay gives higher returns per hectare than groundnuts; *Nymphaea lotus*, a water lily whose seeds are used as a staple food in place of cereals; and the elimination of *Oryza barthii*, a wild rice species (Hamerlynck, 1999).

The development of agro-industrial activities in Saint Louis, and construction of the Diama dam, both in Senegal, constitute threats to this landscape. The dam has generated a freshwater lake and colonization by reed-mace (*Typha domingensis*) as well as Pistia (*Pistia stratiotes*) causing shrinkage of Djoudj National Park's resources (Vasilijević *et al.* 2015). However, local collaboration is good and restoration of lost functions of the landscape is pursued by management partners on both sides of the border through the Regional Program for Coastal and Marine Management in West Africa (PRCM). The successful collaboration encouraged the two countries to propose the Delta of the Senegal River to UNESCO as a trans-boundary Biosphere Reserve, and it was designated as such in 2005.

(c) Sangha Tri-national Landscape (TNS)

The Sangha Tri-National Landscape (usually referred as TNS) is the most emblematic trans-boundary forest landscape of the Congo basin by virtue of its adjacent network of cross-border conservation areas straddling three countries, namely: Cameroon, the Central African Republic (CAR) and the Republic of Congo (yellow enclosure on map: Fig 8).

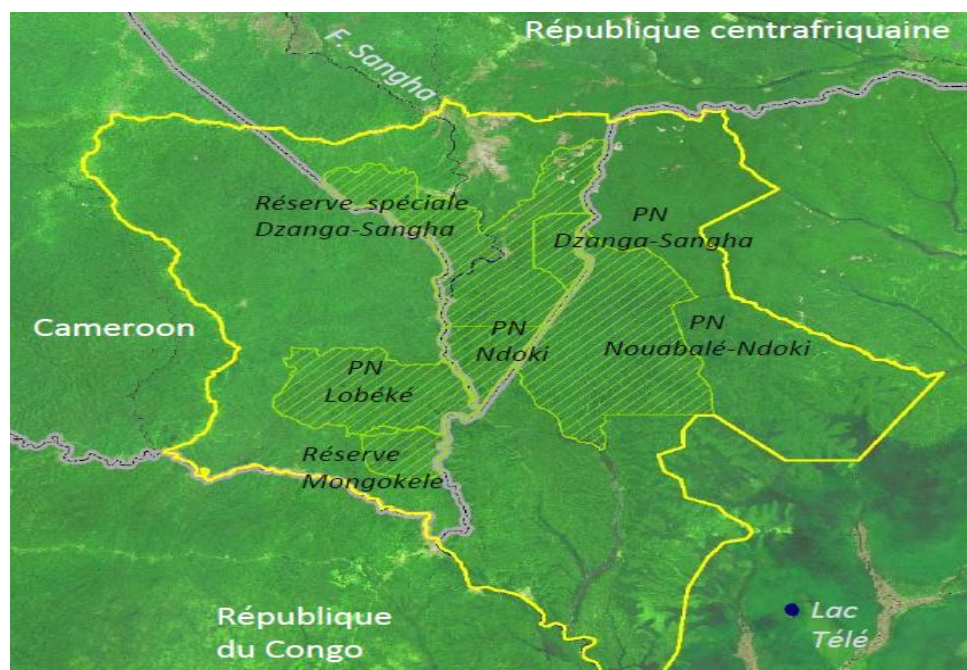


Figure 8 : Map of the Sangha Tri-national Landscape (TNS)

Source: TNS Project documents

It is also the experimental grounds whose results led to the Central Africa Heads of State summit in Yaoundé in 1999 and eventually to the birth of the Central African Commission on Forests (COMIFAC) in Brazzaville, Congo, in 2005. With a total area of approximately 36,236

km², the TNS landscape is located in the northwest congolian lowland forest ecological region whose species composition and threats are captured under section 2.2.4.

Major protected areas in the landscape include: the Nouabalé-Ndoki National Park (Republic of Congo), Lobéké National Park (Cameroon), (Dzanga-Ndoki National Park (CAR) and the Dzanga-Sangha Special Reserve (CAR) (CBFP, 2005). Concretization of the TNS into a trans-boundary landscape can be partially traced to the results of studies in the 1990s, during which researchers of the 'root causes of biodiversity loss project' revealed that commercial hunting in south-east of Cameroon (Sangha Trinational landscape – TNS) "was facilitated by people with special status in society, such as senior administrators, politicians and members of the armed forces..." (Wood *et al.* 2000). Publication of the results of the studies led to the beginning of genuine collaboration among the countries concerned. The revelations led to the Yaoundé Heads of State summit and Declaration in 1999, signing of institutional collaboration agreements among the three countries concerned, development and implementation of land-use and business plans, creation of a trust fund and more. By 2010, many of those promoting degradation of the landscape had abandoned their activities or become collaborators of sustainable TNS management. Usongo, in Yanggen *et al.* (2010) reports that: "the systematic disappearance of forests and biodiversity in most parts of the TNS landscape has come to a halt...and the level of extraction of timber from the natural forest has stabilized to a somewhat more sustainable level".

The process of partial renunciation of national sovereignty over the TNS involved the following steps: (a) the Declaration of the First Summit of Heads of State of Central Africa on Forests in Yaounde 1999, which made creation of trans-boundary protected areas one of the priority actions for the conservation and sustainable management of forest resources of Central Africa; (b) the tri-national cooperative agreement of December, 2000, which authorized cross-border management of forest resources between the three contiguous conservation areas of TNS in order to reduce poaching (c) an MoU to fight poaching signed in June 2002, (d) Treaty on the Conservation and Sustainable Management of Central African Forest Ecosystems signed in Brazzaville in 2005 to adopt a legally binding instrument on forest management (e) an MoU signed in February 2005 on the free movement of TNS personnel within the tri-national landscape (Mandjem *et al.* in Ebodé, 2012). The TNS has also transited through the creation of multi-level specialized and concerted management entities to facilitate sectorial cooperation.

Article 11 of the TNS cooperation Agreement includes: (i) a Tri-national Supervision and Arbitration Committee (CTSA), which is the supreme decision-making organ composed of the ministers in charge of forests and wildlife of the different States, (ii) a Tri-National Scientific Committee (CST), (iii) a Tri-National Monitoring Committee (CTS), (iv) a Tri-national Planning and Implementation Committee (CTPE). According to experts responding to the questionnaire of this study, conflict solving mechanisms at the landscape level include; a framework meeting of all Park Conservators, a framework meeting of the different Park planning officers, a meeting of all landscape administrative authorities during national events celebrated in any of the trans-boundary countries, a tri-national brigade against poaching, frequent bi or tri-national meetings, occasional training of magistrates, and the TNS Trust Fund, which seeks to ensure long-term financing of TNS activities and sustainability of the initiative.

(d) Greater Virunga Trans-boundary Collaboration Landscape (GVTC)

The Greater Virunga Trans-boundary Collaboration landscape (GVTC) initiative was established in 1925 by the Belgian colonial administration on 7,727 km² (Misser, 2013). The landscape includes the Virunga National park in DRC, the Volcano National Park in Rwanda and a number of National Parks in Uganda including the country's Bwindi impenetrable forest. Among the landscape's emblematic species is the mountain gorilla (*Gorilla beringei beringei*), the insectivorous otter-like Ruwenzori wild boar, the okapi (*Okapia johnstoni*), several palearctic bird species and endemic ones such as the kivu thrush (*Zoothera tanganyicae*) and

others (Misser, 2013). The landscape has been occasionally under military rebel attack with large parts of the wooded section reportedly burnt some twenty five years ago (Sournia, 1998).

The DRC's and Rwanda's sections of the landscape are managed by a public private partnership (PPP), where the private actor is represented by African Parks and the public actor in the case of the DRC by the Congolese Institute for Conservation of Nature (ICCN) (Misser, 2013). Despite the occasional warfare, DRC, Rwanda and Uganda still collaborate towards protection of this emblematic landscape. According to experts responding to the questionnaire of this study: trans-boundary committees have been formed; joint patrols are carried out, and park managers make decisions jointly with administrative authorities and local communities; a well-designed strategy exists for managing human-wildlife conflicts; training courses are occasionally offered to magistrates, judicial personnel and senior public service officials on wildlife crime; there is also a framework for exchange of experience at the regional trans-boundary level. In addition to the public private partnership for management of the landscape, another innovation of the Virunga is its use of the REDD+ process across borders to link communities, and enlist their support through benefit sharing and confidence building measures, thereby checking existing conflicts.

(e) Dja-Minkebé-Odzala Landscape (TRIDOM)

The Dja-Minkebé-Odzala or TRIDOM landscape (red enclosure: Fig 9) falls within the northwestern congolian lowland shared forest. It extends over the heavily forested parts of Cameroon (south-east), Gabon (north-east) and Congo (north-west). A summary of its species composition and threats is captured in section 2.1.4. The main protected areas include: Odzala-Koukoua National Park (Congo), Minkébé National Park (Gabon), Ivindo National Park (Gabon), Mwagna National Park (Gabon), Boumba-Bek National Park (Cameroon), Nki National Park (Cameroon) and the Dja Faunal Reserve (Cameroon). Another important forest block of the TRIDOM landscape upgraded in 2006 is the Mengame Gorilla Sanctuary and the Kom National Park in Cameroon constituting a complex of 98,800 ha, which directly abuts the Minkébé National Park in Gabon (Ngoufo *et al.* 2012). The total area of the TRIDOM landscape meanwhile is approximately 141,000 km² (CARPE, 2007).

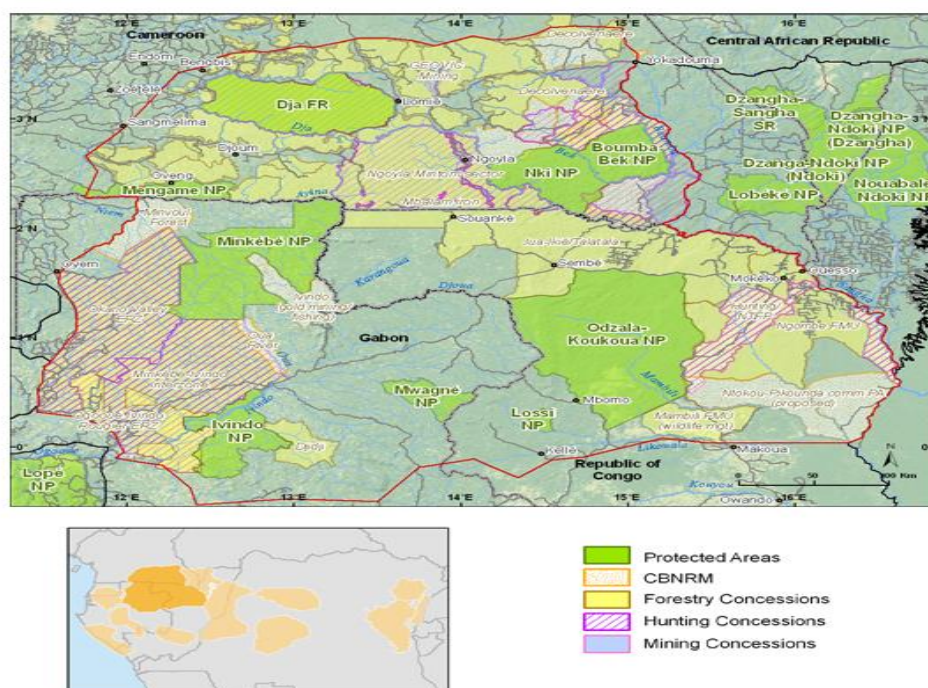


Figure 9 : Map of the Dja-Minkebé-Odzala Tri-national Landscape
Source: CARPE, 2011

The TRIDOM cooperation agreement was signed between the ministers responsible for forestry of Cameroon, Gabon and Congo in Brazzaville, in February of 2005. Following the agreement, Cameroon introduced a moratorium on the logging of 800,000 ha in the Ngoïla-Mintom forest, where logging was originally planned according to the country's southern forests zoning plan, this, pending results of negotiations concerning the definitive use of the area where REDD+ activities have also been proposed. At the Landscape level, customary zoning of hunting areas have been established with new rules through local conventions. Local conventions have also been reached concerning the panning for gold in the Minkébé region, with the potential to inspire similar agreements in Congo. Another local convention for the management of the Oua River in Minkébé could inspire other river-related agreements. Other land-based experiments include the community managed hunting concessions (ZICGC) and community-based fauna resources committees (COVAREF) around the Boumba-Bek and Lobéké National Parks in southeast Cameroon. These could be replicated elsewhere in the TRIDOM landscape. Other innovative agreements include the Mambélé convention with the private sector to combat poaching. Moreover, several logging companies have committed to sustainable planning and certification. In Cameroon, Decolvenaere, PALLISCO and the TTS-SCFS groups are in the process of FSC certification for the timber from their forest management units. Others are collaborating actively with key landscape promoters to improve conservation of wildlife, including IFO with WCS, and Rougier, PALLISCO and Decolvenaere with WWF (CARPE, 2007).

(f) Lac Télé Lac - Tumba Trans-boundary Landscape

The Lac Télé -Lac Tumba Landscape straddles between the RDC and Congo, focusing around lakes Télé, Tumba, and Mai-Ndombe in both countries (red enclosure: Fig. 10). Most of the landscape is located in the congolian swamp shared forest. A summary of its species composition and threats is captured under section 2.2.6. Protected areas in the landscape include the lake Télé Community Reserve (Congo), Mabali Scientific Reserve (Congo), Tumba-Lediima Reserve (DRC) and a number of proposed conservation areas (Fig. 10). The total area of the landscape is approximately 126,440 km² (CARPE, 2015). In 2017) it was recognized as a trans-boundary Ramsar Site (CBFP, 2005 & CARPE, 2011).

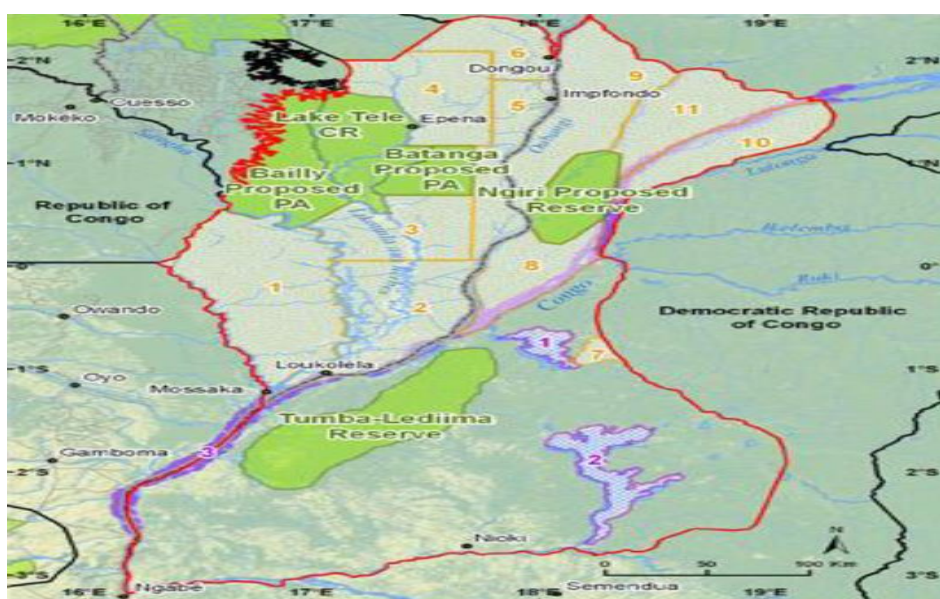


Figure 10 : Map of Lac Télé Lac Tumba Trans-boundary Landscape
Source: CARPE, 2011.

The following narrative describes how WCS and the Ministry of Forest Economy (MEF) are working to shape conservation on the landscape. In a bid to transform communities around the Lake Tumba into conservation constituencies, WCS in collaboration with MEF investigated their traditional land management practices in pre-colonial times. The communities' ancestral rights over traditional territories through lineage for fishing, hunting, collection of NTFPs and agriculture had eroded over time. WCS and MEF sought to reinvigorate such rights through a land-use planning process around the Likouala Swamp communities of the Lake Tumba in order to develop a vision based on traditional management. This ended up with community natural resource management plans whose main objectives were (a) to create a sense of ownership over territories thereby encouraging a long-term view of natural resource management, (b) provide security of tenure over traditional territories, and (c) reduce the threat of marginalization and eviction by immigrants, politicians, land-grabbers and commercial interests. Following socioeconomic surveys, participatory maps were developed based on traditional use with no-go areas representing the National Parks. The outcome was integrated in the management plan of the trans-boundary landscape (Hugo *et al.* 2010).

According to experts responding to the questionnaire of this study, the preceding experience has resuscitated confidence with local communities participating alongside local authorities and administrative officials in the joint management of special areas such as the Cocosi landscape.

(g) Gamba-Mayumba-Conkouati Landscape

The Gamba-Mayumba-Conkouati landscape (red enclosure: Fig. 11) sprawls between Gabon and Congo, within the shared Atlantic equatorial coastal forest and the western congoian forest-savanna mosaic. With an area of approximately 34,258 km², the landscape probably has the most diverse vegetation of all landscapes in Central Africa, ranging from the coastline type on the west, to dense forests on its eastern and hinterland fringes (CBFP, 2005 & CARPE, 2011).



Figure 11 : Map of Gamba-Mayumba-Conkouati Landscape
Source: CARPE, 2011.

A summary of its species composition and threats is captured in sections 2.2.2 and 2.2.3. Its protected areas include; Loango National Park (Gabon), Moukalaba-Doudou National Park (Gabon), Mayumba National Park (Gabon), Conkouati-Douli National Park (Congo), Ngové-Ndogo Hunting Area (Gabon), Iguéla Hunting Area (Gabon), and Ouanga Plain Wildlife Reserve (Gabon).

(h) Mayombe Trans-boundary Landscape

The Mayombe trans-boundary landscape (Fig. 12) is contiguous with the gamba-mayumba-conkouati landscape to the south and located in the western congolian forest-savanna mosaic (section 2.2.3). Its moist forests are surrounded by mosaics of dry forests and woodland savanna, all covering an area of about 36, 000 km², which extends along the coast from Gabon on the north, southwards through Congo, the DRC and Angola (Mayombe project documents).

The landscape's protected areas in the Republic of Congo include the Dimoneka Biosphere Reserve, the Mont Bamba Forest Reserve, and the Conkouati Reserve. The DRC and Angola each have one protected area within the landscape, namely; the Luki Forest Reserve and the Cacongo Forest Reserve respectively. These three countries signed a tripartite memorandum of understanding for the sustainable management and conservation of the landscape in 2009, acknowledged as the Cabinda Agreement. Later however, Gabon expressed desire to join the Cabinda Agreement and contribute its Mayumba National Park (also in the Gamba-Mayumba-Conkouati landscape) to the Mayombe trans-boundary initiative. The stakes of the Mayombe landscape are high firstly, by virtue of its coastal location where its tree species most, reaching beyond 60 meters in height provide a buffering effect to the negative impacts of climate change. Its diverse biodiversity includes endemic and threatened species of international repute such as the lowland gorilla and chimpanzee (Tata *et al.* 2012).

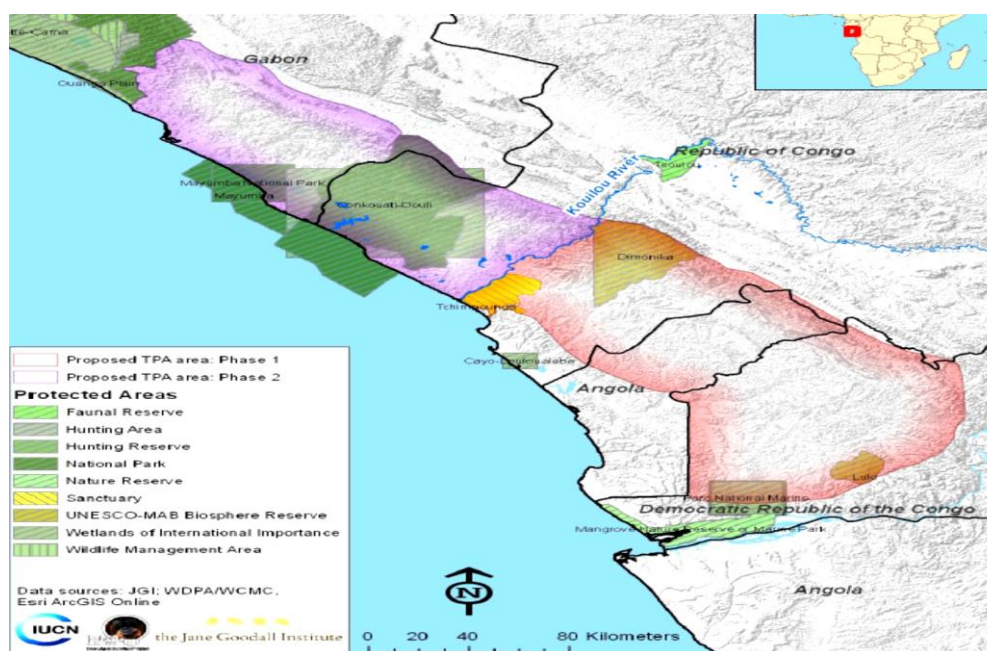


Figure 12 : Map of the Mayombe trans-boundary landscape

Source: UNEP-GRASP and IUCN project documents.

In addition to the poverty, warfare and extensive logging, another challenge is the recent discovery of oil and gas reserves in the landscape. International partners such as UNEP, IUCN, WWF and others are working with the governments of the landscape towards implementation of a trans-boundary landscape project.

3.2.2 Trans-boundary water basins with bilateral or multilateral agreements

Trans-boundary watersheds considered in this section are cross-border rivers or lakes with forest or woodland resources, for which bilateral or multilateral agreements have been developed. They are usually associated with water basin commissions or authorities, and include the following:

Lake Chad Basin (LCB)

The Lake Chad Basin encompasses the dwindling confines of the lake, shared by 8 riparian countries: Chad, Cameroon, Nigeria and Niger, Algeria, Libya, the Central African Republic and Sudan. The core area of the lake lies in the lake Chad flooded savanna ecological region (section 2.2.8) while the riparian areas lie in the west sudanian woodland savanna, and the sahelian acacia savanna shared forest (sections 2.1.6 and 2.1.7). The basin, meanwhile, covers a total area of 2,388,700 km², representing 8% of the surface area of the African continent (ANBO, 2007). The Lake Chad Basin sustains a dependent population of more than 22 million people from Cameroon,

CAR, Chad, Niger and Nigeria. These 5 core basin countries constitute the Lake Chad Basin Commission (LCBC), whose executive secretariat is located in Chad. The mandate of the Commission, amongst others, is to promote cooperation and coordination of regional programs; planning, mobilizing and following up national projects with regional implications. The LCBC's main decision-setting organ is the Summit of Heads of State, which appoints the Executive Secretary. The Executive Secretariat runs the LCBC like a program.

Its environmental trans-boundary diagnostic analysis (Bdliya *et al.* 2010) revealed extensive water pollution from chemicals used in the cultivation of cotton; reduced viability of biological resources due to inability of the rate of regeneration of floral and faunal species to match the high levels of removals; extensive biodiversity degradation; destruction and modification of ecosystems due to insufficient policy and programs targeting sustainable development; high levels of sedimentation and reduced water inflow to the lake as a result of artisanal canalization of water resources and invasive species; and lake intrusion by invasive species i.e., rushes, reeds, water hyacinth and quelea birds (Bdliya *et al.* 2010).

Conservation programs implemented by the LCBC include the Mega-Chad project, which seeks to control land degradation, promote use of renewable energy and conservation of flora on the dry lands of mega Chad; monitoring to ensure that member states refrain from contributing towards water losses, and habitat or functional processes that support the fauna and flora of the Basin without referring to the Commission beforehand. Challenges of a general nature include: the dwindling size of the lake due to environmental and anthropogenic factors, as well as issues related to collaboration among member States and inadequate funding.

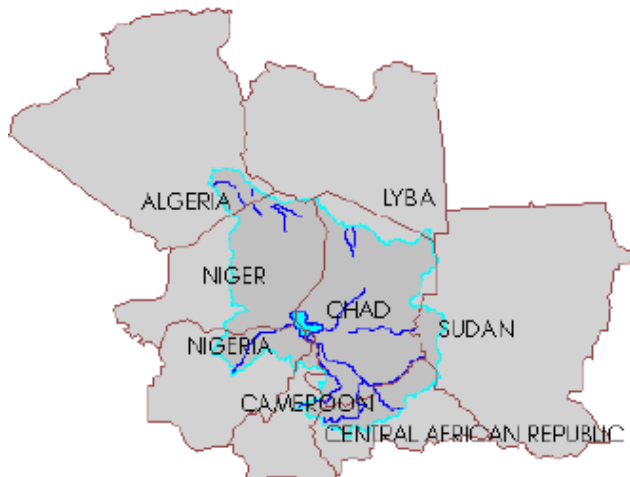


Figure 13 : Illustration of the Lake Chad Basin
Source: ANBO. 2007.

Congo-Oubangui-Sangha River Basin

The Congo-Oubangui-Sangha Basin also known as the Congo River Basin, includes the water resources and drainage system around the Congo river and its tributaries namely; the Oubangui, Kasai, Sangha, Kulu, Kwango, Ruki, Lamami, Lulonga, Amwini and other smaller rivers and streams. Riparian countries sharing the basin include: Angola, Burundi, CAR, Cameroon, DRC, Congo, Gabon, Malawi, Rwanda, Tanzania and Zambia. The whole basin lies within several shared forests, namely: north west congolian lowland forests, congolian swamp forests, western congolian forest-savanna mosaic, southern congolian forest-savanna mosaic, central congolian lowland forests, and the north-eastern congolian lowland forests. The basin meanwhile, covers an area of 3,699,100 km², approximately 12% of the surface area of the African continent,

(ANBO, 2007), with a dependent population of more than 70 million inhabitants. Management of the Basin is delegated to the International Commission of the Congo-Oubangui-Sangha Basin (CICOS). CICOS was created in 1999 as an arm of the Economic and Monetary Community of Central Africa (CEMAC). It has its headquarters in the DRC with a currently updated membership of six countries, namely; Cameroon, Congo, CAR, DRC, Gabon and Angola. CICOS' main decision-setting organ is the Summit of Heads of State, which appoints the Executive Secretary.

CICOS operates like a program. Its mandate among several others is to integrate all forms of water use in regional planning. It has conducted an environmental trans-boundary diagnostic analysis of the Basin on amongst others: control of the proliferation of invasive aquatic species, and state of trans-boundary conservation of natural resources and preservation of the environment in the Basin. Its environmental projects include "monitoring for Environment and Security in Africa (MESA)" with support from the EU and the African Union; "trans-boundary water resource management in the Congo Basin (GETRACO)" with support from GIZ, including a climate change evaluation in the Basin in 2013. The project revealed, amongst others, a high probability for prolonged and frequent periods of drought in the Basin (CICOS, 2015). Major challenges include insufficiency in planning and technical capacity for such a large area; sociopolitical conflicts that generate displaced communities and refugees with negative impacts on the landscape; and inadequate funding (CICOS, 2015).

The Niger River Basin

The Niger River originates from Guinea, undertakes a 4,200 km journey and empties in the Niger Delta of Nigeria. Its tributaries include the Bani, Gouroval, Dargol, Sirba, Gouroubi, Diamamgou and Tapoa; which originate from Burkina Faso, Mekrou, Alibori and Sota from Benin and Benue from Chad (ABN, 2013). The Basin is shared by 11 riparian countries, namely: Guinea, Mali, Niger, Nigeria, Burkina Faso, Benin, Cameroon, Chad, Côte d'Ivoire, Sierra Leone and Algeria. It lies mainly within two shared dry forest groups: the west sudanian savanna and the sahelian acacia savanna.

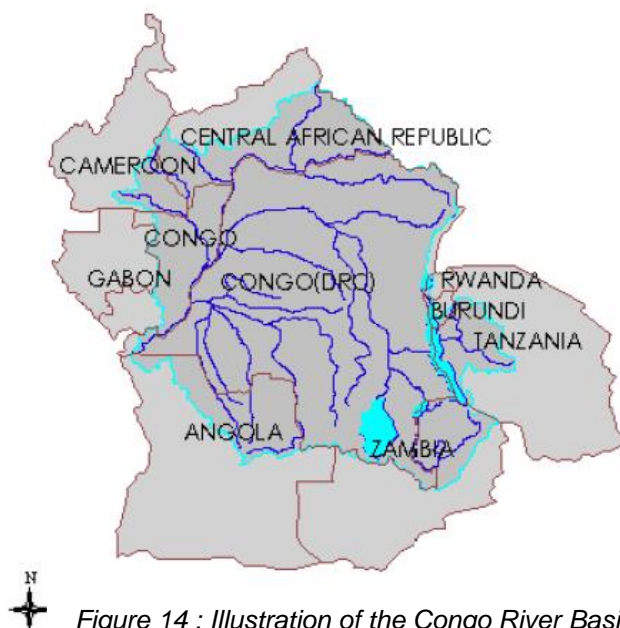


Figure 14 : Illustration of the Congo River Basin
Source: ANBO, 2007.

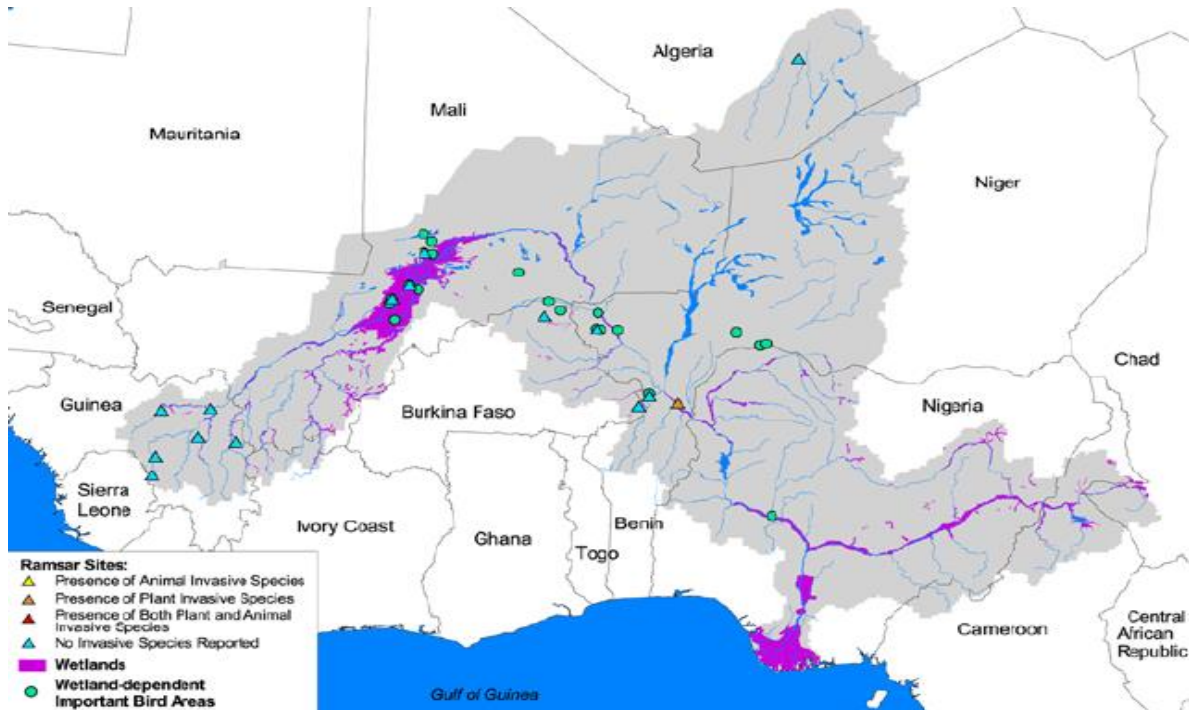


Figure 15 : Map of the Niger River Basin
Source: RAMSAR and Niger Basin Authority (NBA), 2005.

A summary of its terrestrial species of fauna and flora are reported under the referred shared forests (sections 2.1.6 and 2.1.7). The Basin covers an area of 2,113,200 km² and a dependent population of more than 109 million inhabitants (ABN, 2013). Nine of the core riparian countries constitute the Niger Basin Authority (NBA), namely: Guinea, Mali, Burkina Faso, Niger, Nigeria, Benin, Cameroon, Chad, and Côte d'Ivoire, with its Executive Secretariat located in Niger.

The NBA promotes cooperation among its member States by pursuing integrated development through improvement of their resources in the areas of energy, water resources, agriculture, forestry, transport, communications, and industry. Its decision-making organ is the Summit of Heads of State, which appoints the Executive Secretary. The Executive Secretariat operates like a program, implementing trans-boundary projects within the portfolio of the ECOWAS Forest Convergence Plan. An example is the project to inverse degradation in the Sankarami forest basin between Guinea, Mali and Côte d'Ivoire. About 5.5% of the Basin i.e. 75,000 km² is covered by gazetted or reserved forests (ABN, 2013). Major challenges of the NBA, include the dwindling size of the Niger River and its tributaries due to environmental and anthropogenic factors, inadequate collaboration among member States, inadequate funding, and also insufficient capacity in the area of forestry.

Senegal River Basin

The Senegal River Basin is made of the areas and territories drained by the Senegal River and its main tributaries, namely: the Bafing, the Bakoye and the Fелеme with head-waters in the Fouta Djallon highlands of Guinea, and the Karakoro and Gorgol Rivers with head-waters in Mauritania. The Basin is shared by four riparian countries, i.e., Guinea, Mauritania, Mali and Senegal. It lies in the west sudanian woodland savanna shared forest and covers an area of 490,000 km² with a dependent population of more than 3,5 million inhabitants. Three of the riparian countries constitute the Senegal River Development Organization (OMVS), namely: Senegal, Mauritania and Mali, with its Executive Secretariat located in Senegal (OMVS, 2007). The mandate of OMVS ranges from policy-making, through regulation to project implementation.



Figure 16 : Illustration of the Senegal River Basin.
Source: ANBO, 2007.

Projects likely to modify the river regime, state of its water resources, the biological feature of its fauna and flora, its conditions of navigability, and agricultural and industrial exploitation must be approved by OMVS member States. Its decision-setting organ is the Conference of Heads of State and governments, which appoints the Executive Secretary. The Executive Secretariat operates like a program, implementing projects such as the Environmental Impact Mitigation and Monitoring Program (PASIE) which seeks to buffer the environmental impacts of Dams on the River and its tributaries (OMVS, 2007).

PASIE has established an observatory on environmental data collection, and a database to support decision making. Another environmental project is the Senegal River basin water and environmental management project implemented with funds from the GEF. It is operational in Guinea, Mali, Mauritania and Senegal and seeks to establish a framework for a strategic and participatory environmental management of resources of the Senegal River basin. The environmental trans-boundary diagnostic analysis (OMVS, 2007), revealed amongst others, that conservation of biological diversity in the basin is hampered by the massive presence of aquatic invasive species especially bulrushes (*Typha australis*), whose propagation is facilitated by large dams and artisanal irrigation canals. Wildfires and desertification were also captured as serious trans-boundary environmental problems. Challenges of a general nature include inadequate capacity to manage complex water and biodiversity related issues, data and information management and issues related to cooperation for basin management and development.

Volta River Basin

The Volta Basin is drained by four main systems, namely: (a) the Sourou River (with headwaters in Mali) and the Mouhoun River with headwaters in Burkina Faso. These become the Black Volta in Ghana, (b) the Nakambe River in Burkina Faso, known as the White Volta in Ghana, (c) the Pendjari River in Benin, known as the Oti River in Togo and Ghana, and (d) the Lower Volta system in Ghana. These river systems flow into Lake Volta (UNEP-GEF Volta Project, 2013). The Basin is shared by 6 riparian countries, i.e., Burkina Faso, Ghana, Benin, Côte d'Ivoire, Mali and Togo (Fig. 17). From south to north it transits threeshared forests, namely: eastern guinean lowland forest, the guinean forest savanna mosaic, and the west sudanian wood-land savanna. It covers an area of 400,000 km² with a dependent population of 20 million people (UNEP-GEF Volta Project, 2013). The riparian countries signed the collaborative Convention known as the Volta Basin Authority (VBA) in 2007 (Côte d'Ivoire in 2011), with headquarters in Burkina Faso. The VBA's decision-setting organ is the Conference of Heads of State and government, which outlines the general policy and framework for cooperation and development of the Authority (UNEP-GEF Volta Project, 2013).

The VBAs Secretariat in Burkina Faso is managed by an Executive Director, with the mandate, among others, to contribute to poverty reduction, sustainable development of States and Parties, and better socioeconomic integration within the sub-region.

The environmental trans-boundary diagnostic analysis of the Basin undertaken in 2013 revealed, among others, the proliferations of invasive aquatic species i.e., water lettuce (*Pistia stratiotes*), the giant salvinia or kariba weed (*Salvinia molesta*) and very notably the water hyacinth (*Eichhornia crassipes*). Principal causes for the spread of these pests include, amongst others, inadequate technology for wastewater treatment. Another problem is sedimentation, which causes wetlands not to adequately perform their water purification function, a reduction in their flood mitigation capacity, loss of biodiversity and habitat for migratory and resident species as well as a reduction of ecosystem productivity and related services. The underlying anthropogenic causes of siltation and loss of vegetation were identified, amongst others, as due to slow adaptation of cultural and social beliefs and practices to changing circumstances, change of societal values such as the drive to make profits at all costs, low levels of education and poor governance.



Figure 17 : Map of the Volta River Basin
Source : Volta River Project documents/PAGEV

Gambia River Basin

The Gambia River Basin has its headwaters in Guinea. Its management is associated with two neighboring trans-boundary river systems, namely: Kayanga-Geba and Koliba-Corubal. Four riparian countries share the larger basin, i.e. the Gambia, Guinea, Senegal and Guinea Bissau (Fig. 18). The Basin lies in the West Sudanian woodland savanna ecological region and covers an area of 69,900 km² (ANBO, 2007).

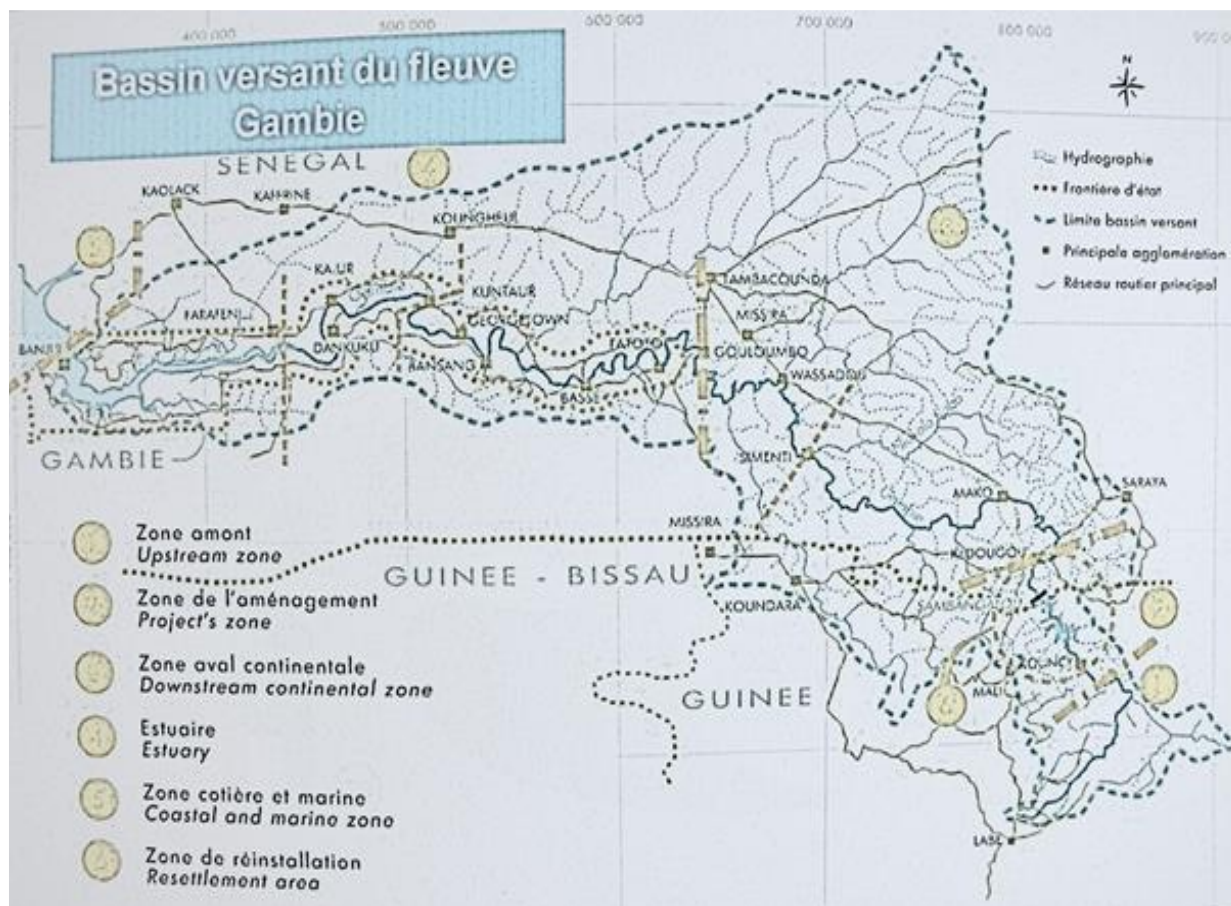


Figure 18 : Map of the Gambia River Basin
Source: Modified from Volta Basin Project documents

Through a convention whose last Party signed in 1983, the four riparian countries constitute the Organization for the Management of the Gambia River (OMVG), with headquarters in Senegal. The OMVG's decision-setting organ is the Conference of Heads of State and government, which outlines the policy and framework for cooperation and development of the Organization.

Like other water basin authorities, OMVG implements trans-boundary projects in its jurisdictional watershed areas, such as the AfDB and the World Bank funded 'rational use and management of natural resources project in the common trans-boundary areas of Senegal, Guinea, Guinea Bissau and Gambia'. The project seeks to increase agriculture, forests and livestock production, rationalize the use of natural resources and improve road infrastructure and social services.

3.3 Landscapes Offering Potential for Trans-boundary Management

Trans-boundary landscapes in this section benefit from the good political will of their neighboring countries and entertain some level of technical collaboration between personnel of the trans-boundary areas or were simply identified through high-level biodiversity conferences as conservation hot spots. Some trans-boundary landscapes mentioned in this section may have signed management protocols between two ministerial departments but no functional comprehensive bilateral agreement exists to ensure engagement of other relevant ministerial departments of the neighboring countries.

Other than a brief overview explaining how the selected landscapes came to be identified as potential sustainable trans-boundary management territories, this section does not provide a detailed scientific justification for their selection, considered beyond the scope of the study. Studies carried out in the forest ecosystems of Central Africa within the framework of the Congo Basin Forest partnership (CBFP) as well as by some international technical development partners identified high conservation value landscapes with the potential for trans-boundary management. These landscapes include the following:

(a) Korup – Cross River Trans-boundary Forest Landscape

The Korup – Cross River trans-boundary landscape is a continuous moist forest block which extends from the south eastern edge of Nigeria to the south western half of Cameroon. The area contains the Cross River National Park in Nigeria (3,640 km²) created in 1991 and the Korup National Park in Cameroon (1,260 km²) created in 1986. Recently, the Takamanda National Park has been created in Cameroon's side of the block (Fig. 19). The forest block is renowned for its emblematic and highly endemic species, available only within the landscape. Examples of highly endemic plants include:

Korupodendron songweanum and *Tetrabelina korupensis* (Litt & Chick, 2002; Oates *et al.* 2004). The landscape is also home to a small population of the rarest gorilla i.e. the Cross River gorilla (*Gorilla gorilla diehli*) and still contains villages in the National Parks. Landscape level meetings were held in 2016 on the possibility of instituting a trans-boundary landscape.



Figure 19: Map of the Korup-Cross River Trans-boundary Landscape
Source: Modified from Oates *et al.* 2004.

(b) The Lope - Chaillu - Louesse Trans-boundary Forest Landscape

The Lope - Chaillu – Louesse forest Landscape (red enclosure in Fig 20), overlaps sections of the Republic of Gabon and the Republic of Congo. It straddles two shared forests, namely; the north west congolian lowland forest and the atlantic equatorial coastal forests (sections 2.2.2 and 2.2.4). The landscape reportedly contains more than 1,500 plant species and more than 84 mammalian types (CBFP, 2005). It covers an area of 34,859 km² enclosing three National Parks (Fig. 20), which together account for 6,730 km² representing 19% of the total landscape area. About 61% of the landscape is dedicated to industrial logging concessions. (CBFP, 2005 & CARPE, 2011). Major threats include unsustainable logging by concessionaires and poaching. While the landscape is yet to operate under a trans-boundary agreement, major partners collaborating towards its sustainable management and conservation, include: the Ministry of Environment and Forests of Gabon (MINEF-G), Ministry of Environment and Forests of Congo (MINEF-ROC), Agency of National Parks of Gabon (ANPN), gorilla protection and reintroduction project of Congo (PPG – ROC), Centre International de Recherches Médicales de Franceville (CIRMF), Program for Conservation and Rational Utilization of Forest Ecosystems in Central Africa (ECOFAC), European Union, London Zoological Society, Missouri Botanical Garden, and the Wildlife Conservation Society (WCS).

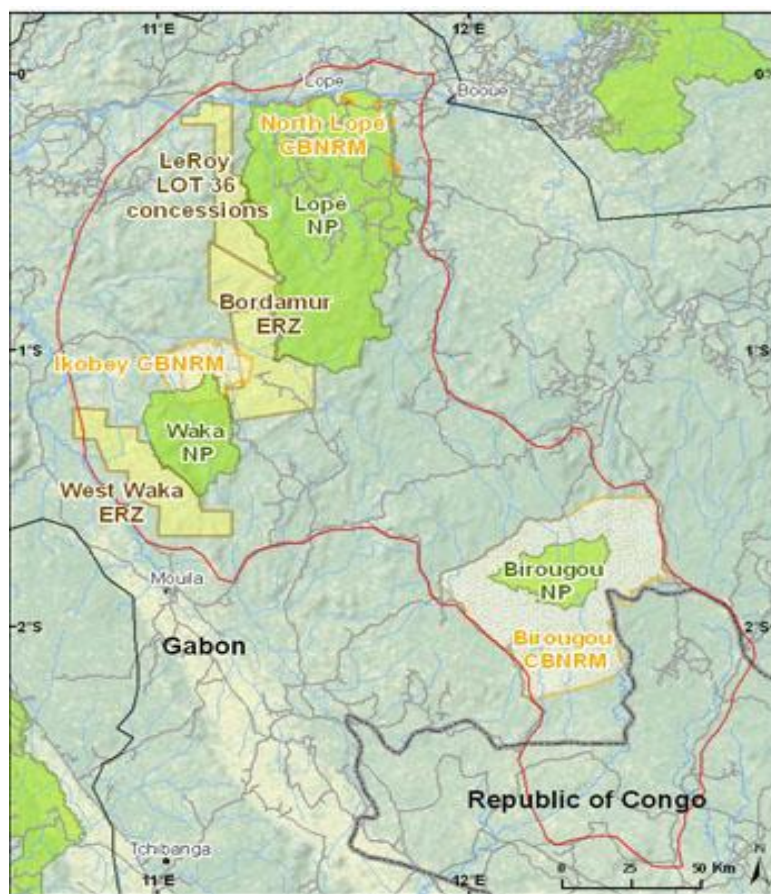


Figure 20 : Map of Lope-Chaillu-Louesse Trans-boundary Landscape
Source: CARPE, 2011.

(c) The Leconi-Batéké-Léfini Trans-boundary Forest Landscape

The Leconi-Batéké-Léfini forest landscape (red enclosure, Fig. 21), straddles between Gabon and the Republic of Congo. It lies in the shared forest of the western congolian forest-savanna mosaic, characterized by wooded savannas and dense gallery forests butting into river valleys. The landscape covers an area of 35,138 km² enclosing one National Park – 2,050 km², and another proposed National Park – 5,300 km² (Fig. 21), which together account for 8,350 km² or 23,8% of the total area of the trans-boundary landscape. The landscape is described as supporting one of the most important quasi-intact grassland ecosystems remaining in Central Africa's Congo Basin, constituting about 42% of the total landscape area (CBFP, 2005). Major threats of the landscape include unsustainable agriculture, wildfires and poaching.

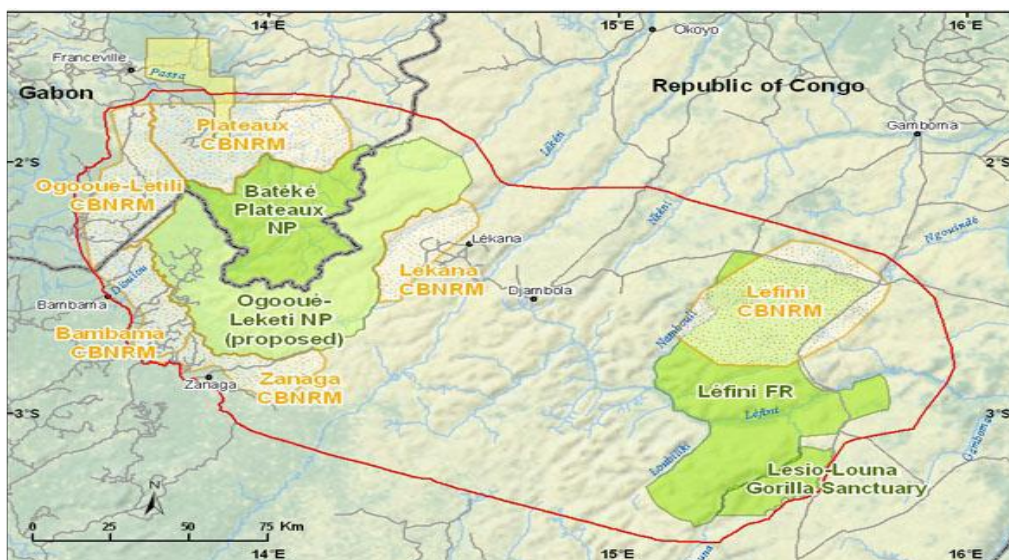


Figure 21: Map of the Leconi-Batéké-Léfini Trans-boundary Forest Landscape
Source: CARPE, 2011.

While the landscape is yet to operate under a trans-boundary management agreement, major partners collaborating in its sustainable management and conservation, include Ministry of Environment and Forests of Gabon (MINEF - G), Ministry of Environment and Forests of Congo (MINEF – ROC), Agency of National Parks of Gabon (ANPN), Intergovernmental Agency for Development (IGAD), National Cartographic Institute of Gabon (INC), gorilla protection and reintroduction project of Congo (PPG – ROC), gorilla protection and reintroduction project of GABON (PPG – G), and the Wildlife Conservation Society (WCS).

(d) Monte Alen - Mont de Cristal Inselbergs Trans-boundary Forest Landscape

The Monte Alen-Mont de Cristal Inselbergs landscape (red enclosure in Fig. 22), straddles between Gabon and Equatorial Guinea. It lies within the Atlantic equatorial coastal forest ecological region, where more than 3,000 plant species thrive (see section 2.2.2 for landscape importance). It covers an area of 26,747 km² enclosing three National Parks (Fig. 22), which together account for 3,900 km² or 15% of the total area.

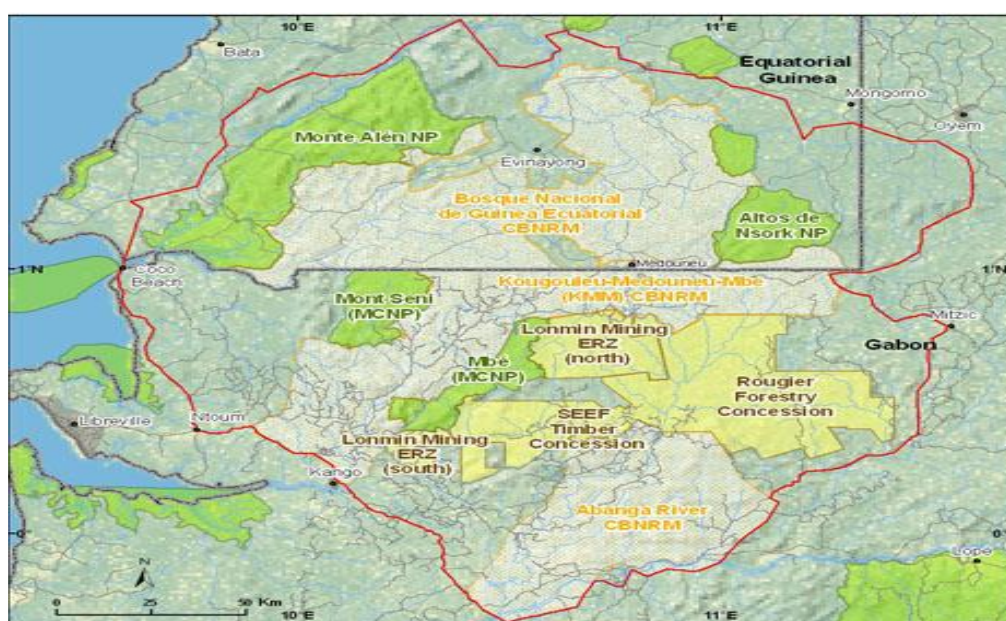


Figure 22 : Map of Monte Alen-Mont de Cristal Inselbergs Trans-boundary Landscape

Most of the landscape is exploited as forestry concessions i.e. 65% of the total area (CBFP, 2005 & CARPE, 2011). Major threats include unsustainable logging, poaching, artisanal gold and mineral mining. While the landscape is yet to operate under a trans-boundary management agreement, major partners collaborating in its sustainable management and conservation, include Ministry of Environment and Forests of Gabon (MINEF), Institute of Forest Development of Equatorial Guinea (INDEFOR), Agency of National Parks of Gabon (ANPN), Gabon National Herbarium, National University of Equatorial Guinea (UNGE), Wildlife Conservation Society (WCS), Conservation International (CI), University of Acalá, Missouri Botanical Garden, Boston College, Smithsonian Institution, Imperial College, Wageningen University, and others.

Potential Trans-boundary Forest Management Landscapes in West Africa

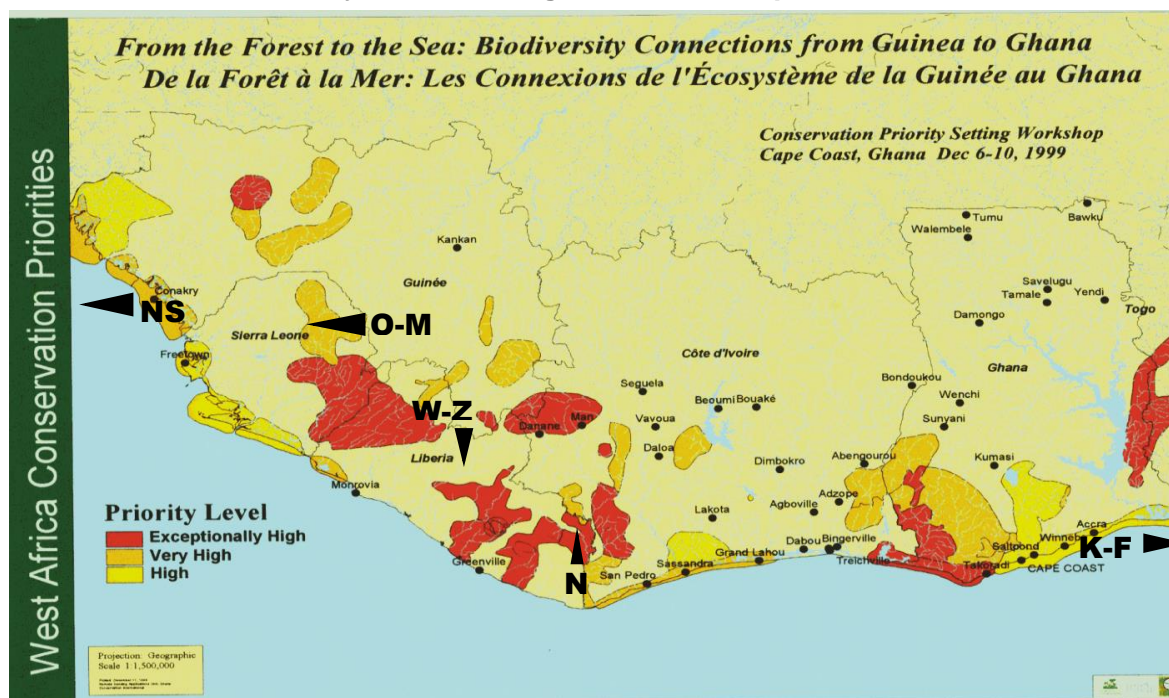


Figure 23 : : Map of Potential Trans-boundary Moist, Mangrove and Montane Forest Landscapes in West Africa

Source: Conservation International, 1999.

The Niimi – Saloum landscape is a trans-boundary mangrove zone between the Gambia (where the Niimi National Park is located) and Senegal (where the Saloum Delta Biosphere Reserve and National Park is located). The location of this mangrove landscape is displayed on Fig. 23 as NS. The Saloum Delta National Park was created in 1976 and elevated to a Biosphere Reserve in 1981, while the Niimi National Park, a southward extension of the Saloum in Gambian territory was gazetted as a National Park in 1986. After gazettement of Niimi, the Niimi-Saloum landscape was elevated to a Biodiversity World Heritage Site.

The international character of the delta complex, as a single ecological entity with vital environmental and ecological importance to the region and its people, prompted Senegal and Gambia to recognize the landscape's protection and sustainable management as critical for the long-term survival of the regional economy of the area. In addition to the rich mangroves, the area supports a complex fauna of great scientific interest and a bird-ringing program, operational since 1994. The governments of Gambia and Senegal have initiated discussions to harmonize their respective management strategies and plans but no high level agreement has been approved. The most common challenges are related to resource use conflicts, lack

of coherence and collaboration among the different initiatives on the landscape, weak bilateral and regional coordination especially related to trans-boundary movements as they concern resource exploitation, inadequate harmonization of institutional frameworks and insufficient involvement of local populations in conservation initiatives, among others. Consequently, the landscape suffers from overexploitation of its mangrove resources, pollution, and fragmentation due to tree death from sand mining, cutting and from climate change.

(f) Niokolo-Badiar Trans-boundary Landscape (N)

The Niokolo-Badiar landscape is a complex of two contiguous dry Guinean forest blocks in which the first i.e., the Niokolo Koba National Park, gazetted in 1981 with an area of 913,000 hectares is located in Senegal and the second, Badiar National Park with an area of 43,860 hectares is located in Guinea. The landscape is part of the west sudanian woodland savanna and was acknowledged as the Niokolo-Badiar trans-boundary Park since 1990. The landscape consists of 75% grass, shrub, tree and woodland savannas; 15% of clear forests; 6% of gallery forests, and 4% of marsh meadows (Sall *et al.* 2009). The biodiversity includes about 1500 species of flowering plants, 80 species of mammals, 330 species of birds, 36 species of reptiles, 20 species of amphibians, 60 species of fish. Among the mammals, 5 species are rare and endangered i.e, the Bay Colobus, the Chimpanzee, the Elephant, the Derby Eland and the Wild Dog (Sall *et al.* 2009). Moreover, the landscape contains over 63,000 inhabitants distributed in 208 villages within 14 rural communities in Senegal and 2 prefectures in Guinea.

Although recognized internationally, with the exception of local level collaboration, the landscape does not have a formal agreement between Senegal and Guinea. Moreover, since 2007, because of the landscape's poor state of management and increasing population pressure, UNESCO placed it on the list of world heritage sites in peril. It has however been proposed as one of the trans-boundary landscapes to receive support through ECOWAS' sub-component on trans-boundary forest resources within its regional program for agricultural investment – PRIA.

(g) Outamba-Kilimi / Madina-Oula Trans-boundary Landscape (O-M)

The Outamba-Kilimi / Madina-Oula landscape, identified in Fig. 23 as O-M, is a complex of two almost contiguous dry Guinean forest blocks in which the first i.e., the Outamba-Kilimi National Park (OKNK) is located in Sierra Leone and the second, the Madina-Oula Forest Reserve is located in Guinea, both constituting part of the guinean forest savanna mosaic. The O-M is characterized by alternations between 'forest riparian types' and 'savanna riparian types' i.e., a mosaic of grassland, closed woodland and gallery forests (section 2.1.5). In Guinea, the gazetted forests of Soyah and Pinselli are part of the Madina-Ouala landscape while in Sierra Leone, Outamba and Kilimi constitute the two parts of the OKNP. Local biodiversity is particularly rich, and recent surveys have shown that chimpanzee population density is high in the region between Mamou and Madina Oula - Kindia in Guinea and south across the border into north and north western Sierra Leone. It is reported that this area is sustaining one of the most important remnant populations of chimpanzees in all of West Africa. The complex also provides shelter to a localized population of elephants (*Loxodonta africana*), living mainly close to the OKNP, but also appears to move regularly across the border into Guinea. Remnant populations of other less common savannah and forest species, include the leopard, pygmy hippo, spotted hyena and others. Bird, mammal, reptile and amphibian populations are also reported to be high, particularly within the national park units (Conservation International, 1999)

The O-M landscape benefits from partnerships that support sustainable management of its natural resources, mostly from USFS-IP funding through its West Africa Biodiversity and Climate Change Initiative (WA-BiCC). Major partners operating in the area, include; OKNP,

Care International, BioClimate, Thompson Reuters, Ministry of Environment and Forests – Guinea, Njala University College of Sierra Leone and others. Despite this support, there is still ongoing illegal logging in the area observed by the researcher of this study in 2014. The landscape has however been proposed as one of the trans-boundary landscapes to receive support through ECOWAS' regional program for agricultural investment – PRIA. The landscape was identified as a biodiversity conservation hotspot by the Conservation International-led conference held in Elmina, Ghana in 1999. Collaboration is lukewarm because while Outamba-Kilimi is a full-fledged National Park, Madina-Oula is simply a state forest reserve with the potential for forest exploitation.

(h) Wonegizi-Ziama Trans-boundary Landscape (W-Z)

The Wonegizi-Ziama Landscape, identified in Fig. 23 as W-Z, is a complex of two contiguous dry Guinean forest blocks where the first i.e., Wonegizi is located in Liberia and the second, i.e., Ziama is located in Guinea, both constituting part of the guinean forest savanna mosaic. The landscape is characterized by alternations between 'forest riparian and 'savanna riparian types' i.e., a mosaic of grassland, closed woodland and gallery forests (section 2.1.5). It is essentially a continuous sub-montane range between Liberia and Guinea. The landscape was identified as a biodiversity conservation hotspot by the Conservation International-led conference held in Elmina, Ghana in 1999. The peculiarity of the landscape is its largely intact transition from lowland rainforest to semi-montane parinari-dominated forest, with the area remaining unlogged, largely due to the rough terrain. Wonegizi and Wologizi, both sub-montane ranges are located in the North Lorma National Forest of Liberia, which provides a corridor for wildlife exchange with Guinea (Conservation International, 1999).

On the Guinean side, the Ziama Massif, a biosphere reserve, reaches almost 1,400 meters above sea level. Its main habitat is primary montane forests dominated by *Lophira alata*, *Heritiera utilis*, and *Morus mesozygia*; and secondary montane forests dominated by *Pipadeniastrum africanum*, *Azelia africana*, and *Canarium schweinfurthii*. Following scientific exchanges, there are indications that Tai elephants in Côte d'Ivoire use the Grebo corridor to move upwards into the Wonegizi-Ziama landscape for seasonal feeding and to escape from climate and human related threats. Other species in the landscape include the African Buffalo (*Syncerus caffer*), Western Pied Colobus (*Colobus polykomos*) and others. Threats include unplanned agriculture and hunting most likely due to the more than 29,000 inhabitants who live in the Ziama Biosphere Reserve. Other threats include mining for iron ore and commercial hunting facilitated by the closeness of the N'Zérékoré town in Guinea (about 100 km from Ziama), and wildfires facilitated by the savanna vegetation. The landscape has received pilot project related support from RSPB, FFI, USAID, MIKE, KFW, CEPF, FDA, Great Apes Program, and others. Collaboration is also lukewarm because neither Wonegizi nor Ziama have a National Park status.

(i) Kyabobo-Fazao/Malfakassa Trans-boundary Landscape (K-F)

The Kyabobo-Fazao/Malfakassa landscape identified in Fig. 23 as K-F, is a continuous mountain range (just below 1,500 meters above sea level) constituting the eastern limit of the upper Guinea forest. It was identified as a biodiversity conservation hotspot by the Conservation International-led conference held in Elmina, Ghana in 1999. More specifically, it is an outcrop of the eastern Guinean lowland forest, surrounded by the Guinean Forest Savanna mosaic. The landscape is contiguous in geomorphology, topography, vegetation and species, from eastern Ghana to western Togo. On the Ghanaian side, the core conservation area i.e., the Kyabobo Range National Park (21,400 ha) is a relatively new protected area, while the Fazao/Malfakassa of Togo (192,000 ha) was gazetted as early as 1951. The landscape as a whole is host to a mixture of sub-montane forest and savannah woodland,

from the African Development Bank through the Mano River Union (MRU) and the European Union through the 'Royal Society for the Protection of Birds' (RSPB), the French Environmental Fund (FFEM), Conservation International and others. National partners include the Forestry Division of Sierra Leone, the Forest Development Authority of Liberia, Conservation Society of Sierra Leone (CSSL), and Society for the Conservation of Nature in Liberia (SCNL), among others.

(j) Taï – Grebo Trans-boundary Landscape

The Taï National Park (455,000 ha.) is situated between the Cavally and Sassandra rivers in the south west of Côte d'Ivoire and constitutes the largest consistent rainforest block and protected area in all of West Africa. The park was created in 1972, made a biosphere reserve in 1978 and transformed into a UNESCO world heritage site in 1982. It contains a large variety of endemic fauna, including the Chimpanzee, Elephant and Pygmy hippo. Main endemic flora include a wild coffee (*Coffea humilis*), a spectacular palm (*Raphia sassandrensis*), and an amorphous liana (*Amorphophallus staudtii*).

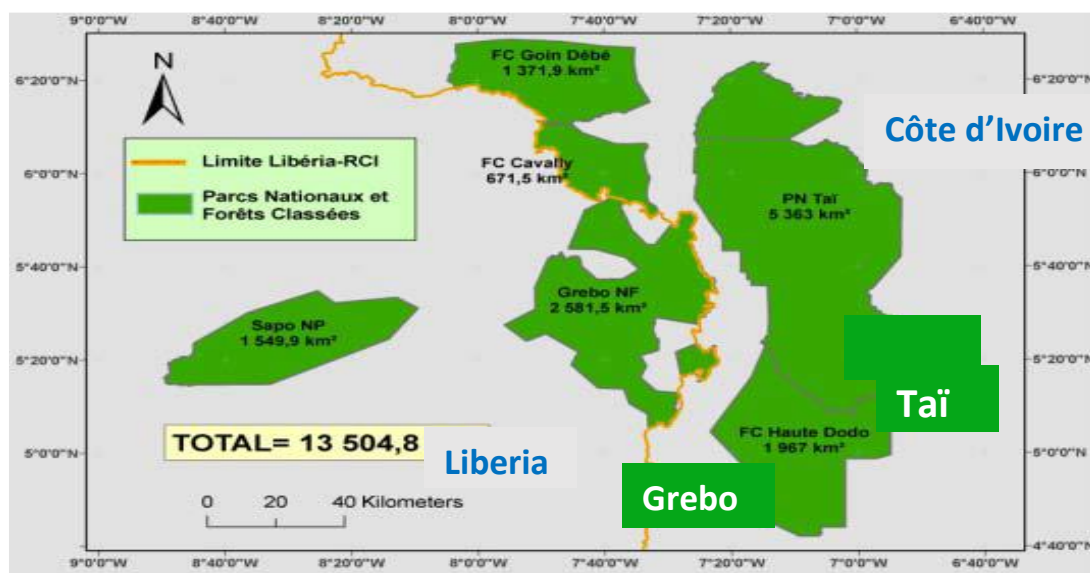


Figure 25 : Map of the Taï – Grebo Trans-boundary Landscape between Côte d'Ivoire and Liberia. Source: Modified from Taï National Park project documents.

Moreover, species new to science were discovered there as recent as 2001; including 2 species of frogs viz. *Phrynobatrachus spp.* and *Acanthixalus spp.* and one of snake (*Antheris hirsuta*). Subsistence agriculture around the park has developed through slash and burn at the expense of primary forests (Conservation International, 1999). Meanwhile, the Grebo National Forest, a wet evergreen forest mass situated in southeast Liberia was created in 1960 covering 260,326 hectares.

The area separating the Grebo National Forest and the Taï National Park is a fragmented narrow strip of dense human settlements mainly on the Ivorian side where farming is the main occupation of communities. Other threats to the area include logging and hunting. It is however still rich in biodiversity. An FFI inventory in 2005 recorded 484 plant species of which 37 were endemic, with a *Drypetes* and a *Leptoderris* likely to be new to science. The same mammal species of the Taï National Park have also been reported in Grebo (Conservation International, 1999). The Taï/Grebo landscape was identified as a biodiversity hotspot by the Conservation International-led conference held in Elmina, Ghana in 1999. It contains elephants in Taï National Park, which need a corridor to the Grebo forest, providing a larger landscape for seasonal feeding and to escape from climate and human related threats.

An agreement for collaboration exists at ministerial level between Côte d'Ivoire and Liberia. Collaboration is impaired because Taï is a National Park while Grebo is still a State Forest Reserve with the potential for forest exploitation.

(I) Mt. Nimba Tri-national Landscape

With a height of 1,752 meters above sea level, Mt. Nimba is the highest mountain in the upper Guinea forest region. The whole mountain is rich in iron ore (IUCN/UNEP, 1987; World Bank. Vol. 1. 1993) and transgresses the national boundaries of Guinea, Côte d'Ivoire and Liberia. Irrespective of the mineral wealth, the diversity of the landscape in terms of both morphology and vegetation, and the rarity of its endemic fauna and flora, 19,500 ha., of the landscape was gazetted in 1943 (14,500 ha., on the Guinean side, and 5,000 ha., on the Ivorian side). Another 13,669 ha, on the Liberian side was classified as a Nature Reserve in 2003.

The gazetted landscape (excluding the Liberian side) has successively been classified as a Strict Nature Reserve (1944), a Biosphere Reserve (1980) and a World Heritage Site (1981). Since 1991, the Nimba 'conservation area', was enlarged to the entire upper cavally river basin in Guinea, an area of 145,200 ha. The Nimba slope at between 500 and 700 meters contains a large number of species representing no fewer than 82 genera of trees and bushes. *Piptadeniastrum*, *Heritiera*, and *Lophira* are common. Between 700 and 900 meters, *Parinari* becomes increasingly common, as well as *Parkia* and associated species. The mountain is also renowned for its strictly endemic and highly threatened species such as the Nimba viviparous toad (*Nimbaphrynoides occidentalis*) – (Baillie *et al.* 2004) and chimpanzees that use stones as tools.

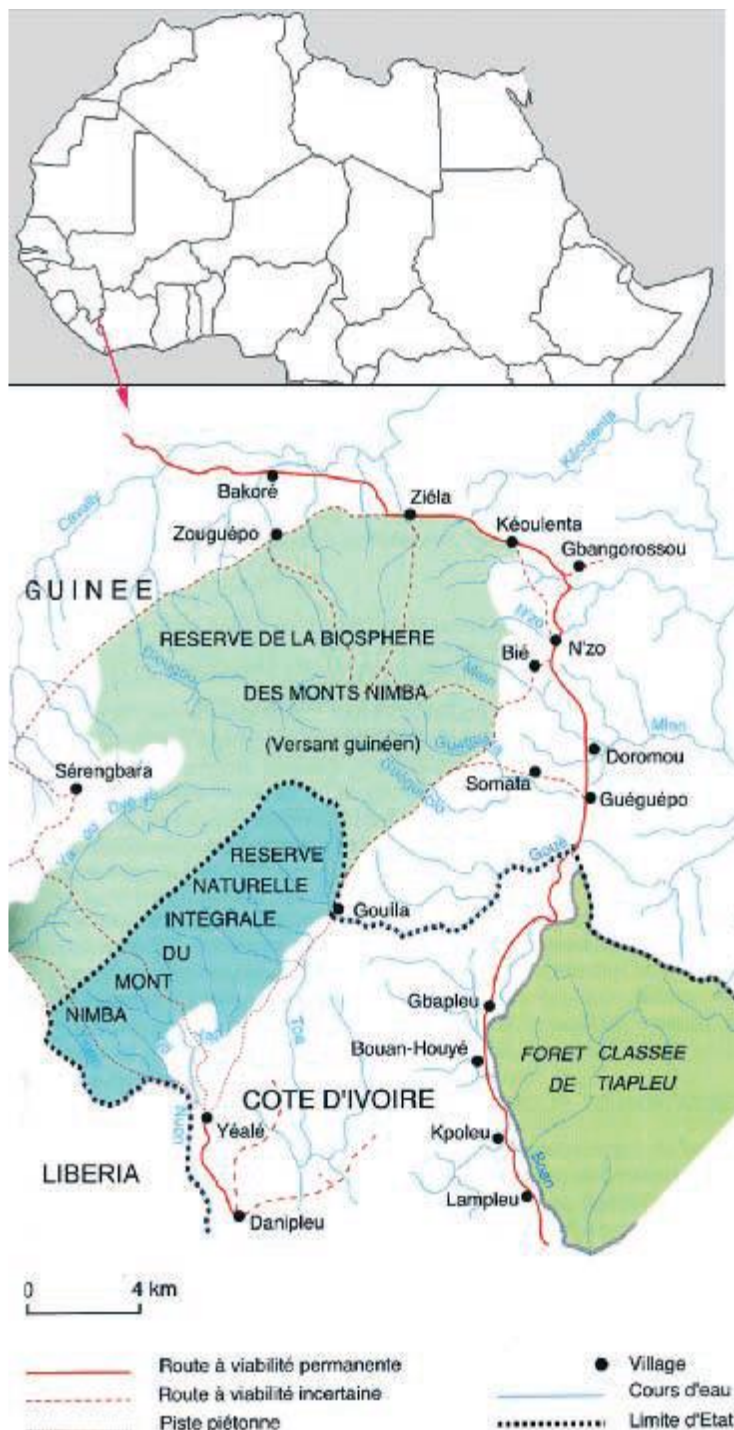


Figure 26: Localisation of the Mt. Nimba Trinational Landscape in West Africa (Guinea and Côte d'Ivoire sections shown).

Source: Poilecot *et al.* 2009.

The Nimba constitutes a conservation and sustainable landscape management priority as a convergent point of three climatic zones, i.e., equato-guinean, sub-guinean and, soudano-humid tropic. Main threats are mining by big extractive industries, hunting and poaching. The USAID West Africa Program (STEWART III) successfully brokered a tripartite management agreement for the area opening the way for cooperation in the conservation of this high-value landscape (USAID, 2014).

(m) Mole / Nazinga – Kaboré Tambi Trans-boundary Landscape

The Mole / Nazinga - Kaboré Tambi landscape (Fig. 27), extends from central south Burkina Faso into north eastern Ghana. It is located in the west sudanian woodland savanna shared forest and referred as the Nakambé – White Volta ecosystem. Its major features include the Mole National Park in Ghana (5,000 km²) and the Kaboré Tambi National Park in Burkina Faso (1,555 km²) as well as the Nazinga Game Ranch (3,000 km²) in Burkina Faso. The common effort is to link these National Parks, associated Reserves and Game Ranches with ecological corridors and restore degraded areas with local tree species to facilitate crossing-over of savanna elephants. The vegetation includes; *Vitellaria paradoxa*, *Parkia biglobosa*, *Tamarindus indica*, *Borassus aethiopicum*, *Adansonia digitata*, *Acacia senegal*, *Sclerocarya birrea*, *Parkia filicoidea*, *Khaya senegalensis* and others. Emblematic wildlife includes elephants and leopards.

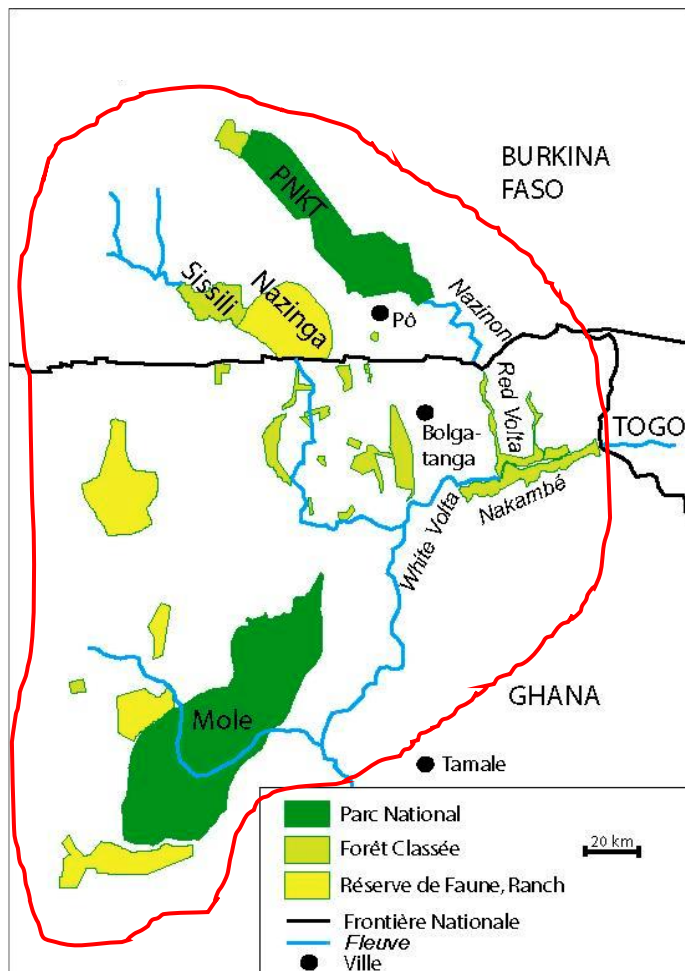


Figure 27: Mole / Nazinga - Kaboré-Tambi Landscape (Source: Modified from Borrini-Feyerabend *et al.* 2005).

A major cooperation hurdle is the difference in park management approaches between Ghana and Burkina Faso. Ghana favors a vision of protected areas as multi-purpose landscapes administered by byelaws, which recognize traditional forms of conservation and management. Burkina Faso, on the contrary, pursues protected area management with strict regulations managed directly by the State (Borrini-Feyerabend *et al.* 2005). In application of these rules, several communities were resettled out of the Burkina side of the landscape in favor of the conservation effort. There is a need to move closer by harmonizing approaches and legislation on both sides of the border. It was to kick-start such a process that in a meeting brokered by IUCN, the Minister of Environment and Livelihood of Burkina Faso met his counterpart; the Minister of Lands, Forests and Mines of Ghana in Accra in July 2008 and together they signed a declaration on the following three points: (a) protect wildlife migration corridors and develop cross-border migration corridors with appropriate status to ensure best protection of floral and faunal species (b) accelerate the prevention of species-damaging activities and apply deterrent measures and (c) undertake concerted actions to monitor conservation areas. A full collaboration agreement for the concerted management of the landscape is still awaited.

(n) Niger – Nigeria Trans-boundary Watershed Landscape

The Niger – Nigeria trans-boundary landscape has four shared watersheds straddling both borders, visible in Fig. 28, from left to right, as; the Maggia-Lamido watershed (red), Gada-Gulbin Maradi (blue), Tagwai-El Fadama (yellow) and Komadugu Yobe (green). The Lake Chad landscape, on the extreme right is also visible in grey.

In order to combat land degradation and mitigate chronic food insecurity in their shared trans-boundary ecosystems, the Federal Republic of Nigeria and the Republic of Niger agreed starting in early 2000s, within the NEPAD framework and with support from the GEF and UNEP to implement the “Integrated Ecosystem Management of Trans-boundary Areas between Nigeria and Niger – IEM project” (Mathu *et al.* 2011).

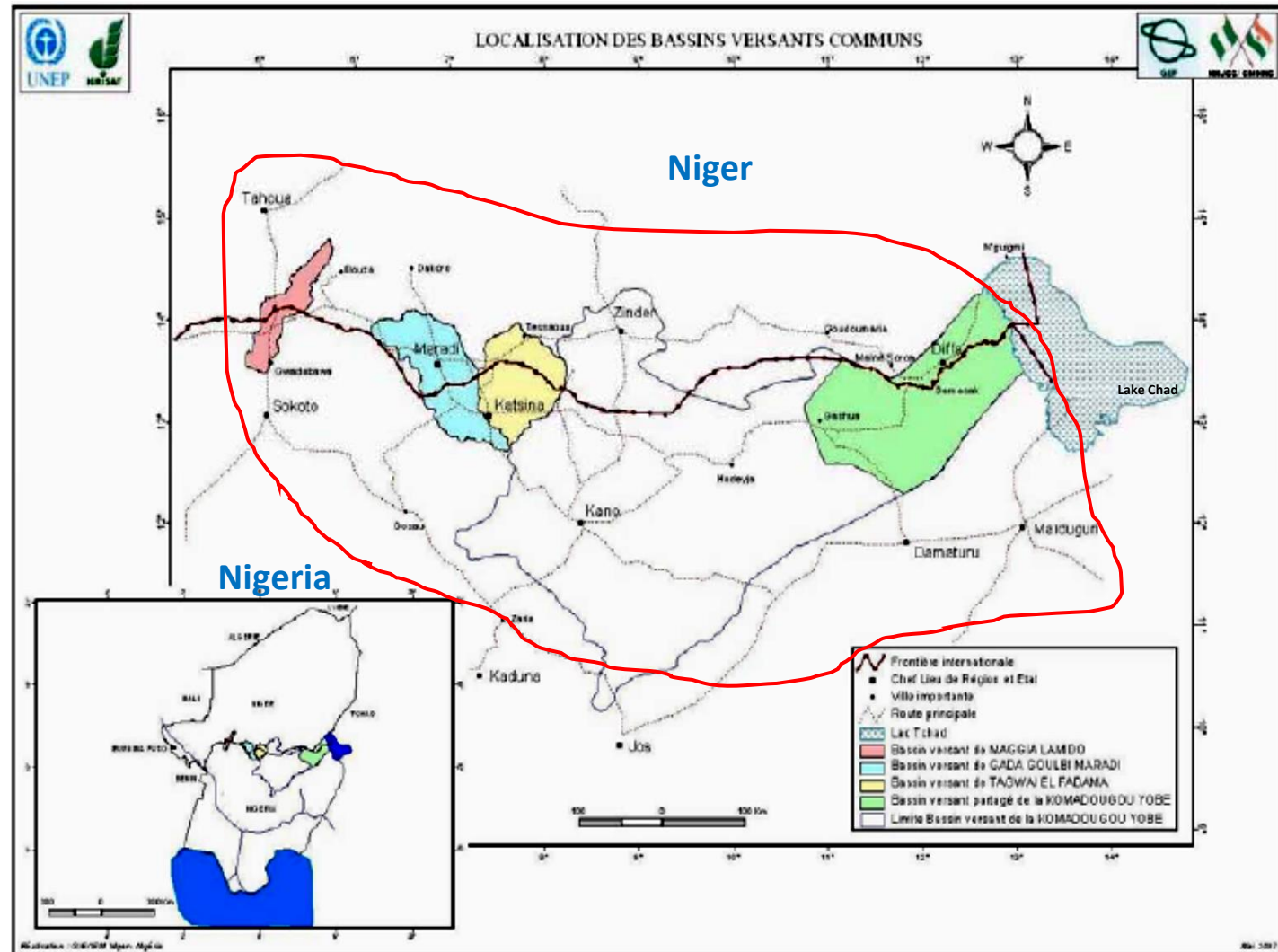


Figure 28: Map of Potential Watersheds for Trans-boundary Conservation and Management between Niger and Nigeria Source: PGIE, 2007. Project documents.

Backed by the Maiduguri Agreement between both countries as its political basis, the IEM project has been seeking to (i) develop an integrated legal and institutional framework for collaboration and to ensure coordinated financing from the Niger-Nigeria Joint Commission for Cooperation to community-based organizations; (ii) harness and improve research-based and indigenous knowledge, and cultural values to support natural resource management, conservation and productivity; and (iii) develop and implement sub-regional, watersheds and community level ecosystem management plans through participatory and inclusive processes. The project has now ended but some of its land and forest restoration approaches will likely continue with support through the Africa Great Green Wall of the Sahara and Sahel Initiative.

3.4 Analysis of shared threats and main driving forces of degradation in trans-boundary forests, woodland and watersheds, and measures of containment

3.4.1 Shared threats

This section reviews and displays results of responses to questionnaires administered in the sampled countries of the study, i.e. Niger, Democratic Republic of Congo, Cameroon and Sierra Leone. The fourth country, Sierra Leone was not visited. However, Sierra Leone's Ministry of Agriculture, Forestry and Food Security (MAFFS) received the study questionnaire and collaborated fully in its administration. Despite this effort, interpretation of the questions by experts in that country constituted a challenge. In order to avoid bias with the trends assessed and displayed in this section, the Sierra Leone threat responses, which were not fully received are not considered in this section.

3.4.1.1 Threats and weaknesses registered for trans-boundary dry forest landscapes, woodlands and watersheds

Experts interviewed for this study, mainly in Niger, provided responses based on their experiences on five trans-boundary landscapes, namely:

- The "W" Regional Park between Benin, Burkina Faso and Niger.
- The Liptako-Gourma Tri-national landscape between Mali, Burkina Faso and Niger.
- The W – Arly – Penjari (WAP) Tri-national complex between Benin, Burkina Faso and Niger.
- The Niger – Nigeria Trans-boundary watersheds and ecosystem management landscape.
- The Trans-boundary Termit / Tin-Touma and Ouadi Rimé-Ouadi Achim / Manga-Eguey conservation landscape between Niger and Chad.

Interview results revealed that: the type, intensity and extent of threats were different for each trans-boundary landscape. For example, while mining between the Niger and Chad trans-boundary landscape was its foremost threat, wildlife poaching including of elephant ivory, constituted the major threat of the W – Arly – Penjari tri-national landscape between Benin, Burkina Faso and Niger. Ranking by experts of the threats for their trans-boundary landscapes produced the following graph:

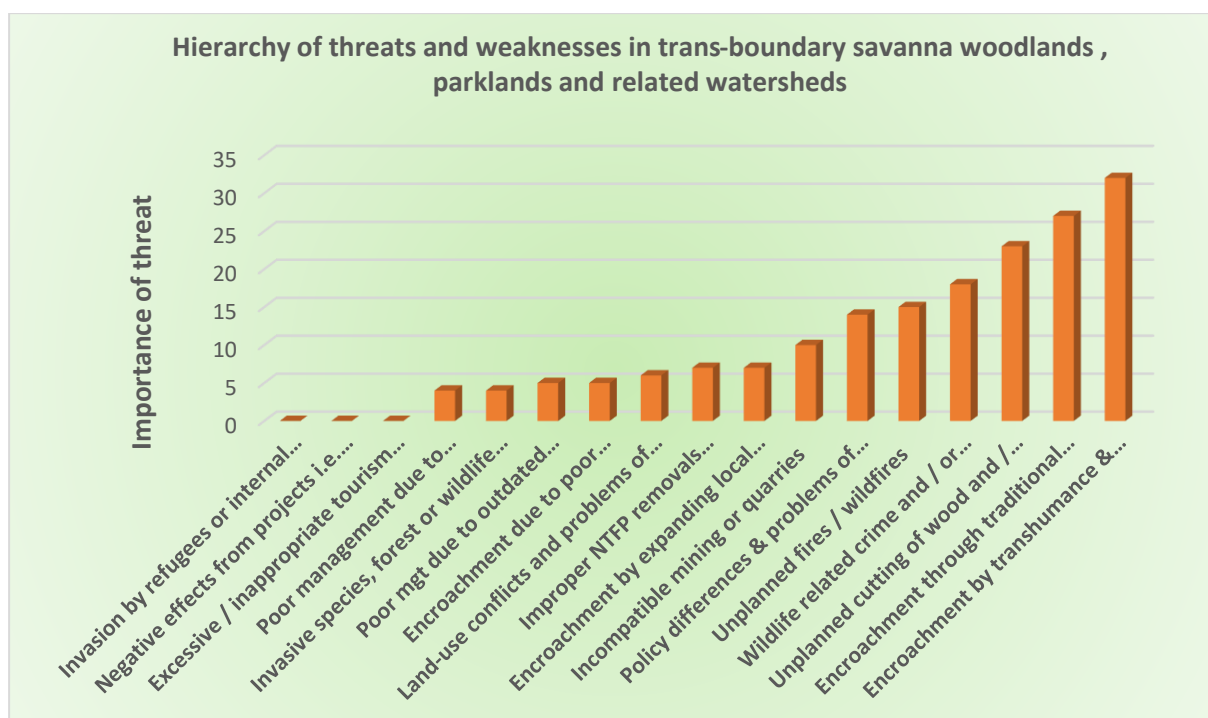


Figure 29 : Ranking of threats and weaknesses to sustainable management of trans-boundary dry forests, parklands and related watersheds, {according to the experiences of experts for the W Regional Park, WAP, Liptako-Gourma, Niger-Nigeria watersheds and Chad-Niger (including Lake Chad) conservation landscapes}.

Analysis of research results revealed the major threats and weaknesses to conservation and sustainable management in trans-boundary dry forests, parklands and related watersheds, in order of importance were as follows: (a) encroachment by transhumance and excessive grazing; (b) encroachment of traditional agriculture, including advance of the cotton frontier; (c) unplanned cutting of wood and over-logging (d) wildlife related crime and poaching; (e) wildfires; (f) policy differences and problems of collaboration; (g) incompatible mining and quarries; (h) encroachment by expanding local settlements; (i) improper NTFP removals facilitating forest fragmentation; (j) land-use conflicts and problems of tenure; (k) encroachment due to poor knowledge of boundaries; (l) poor management due to outdated or inexistent management plans; (m) invasive species, forest or wildlife diseases and pests and; (n) poor management due to inadequate capacity.

One main lesson is the near absence of threats related to: (a) inappropriate tourism and recreation and (b) development projects such as dams, roads, electricity, and telephone passage-ways.

3.4.1.2 Threats and weaknesses registered for trans-boundary moist forest landscapes and related watersheds

Experts interviewed for this study in moist forest countries i.e. the DRC and Cameroon, provided responses based on their experiences in five trans-boundary landscapes, namely:

- Sangha Tri-national (TNS) landscape between Central African Republic, Cameroon and Congo.
- Dja-Minkébé-Odzala (TRIDOM) landscape between Cameroon, Gabon and Republic of Congo.
- Lac Télé – Lac Tumba trans-boundary landscape between Republic of Congo and the DRC.

- Greater Virunga landscape between the Democratic Republic of Congo, Rwanda and Uganda.
- The Korup – Cros River trans-boundary landscape between Cameroon and Nigeria.

Similar to the results of trans-boundary woodlands, dry forests and watersheds, narrated above, interview results for moist forest landscapes, revealed that, the type, intensity and extent of threats were different for each trans-boundary landscape. For example, while wildlife related crime and commercial hunting constituted the major threat in the TNS landscape, over-logging was identified as the foremost threat of the TRIDOM landscape. The ranking by experts of the most pertinent threats of their trans-boundary landscapes produced the following graph.

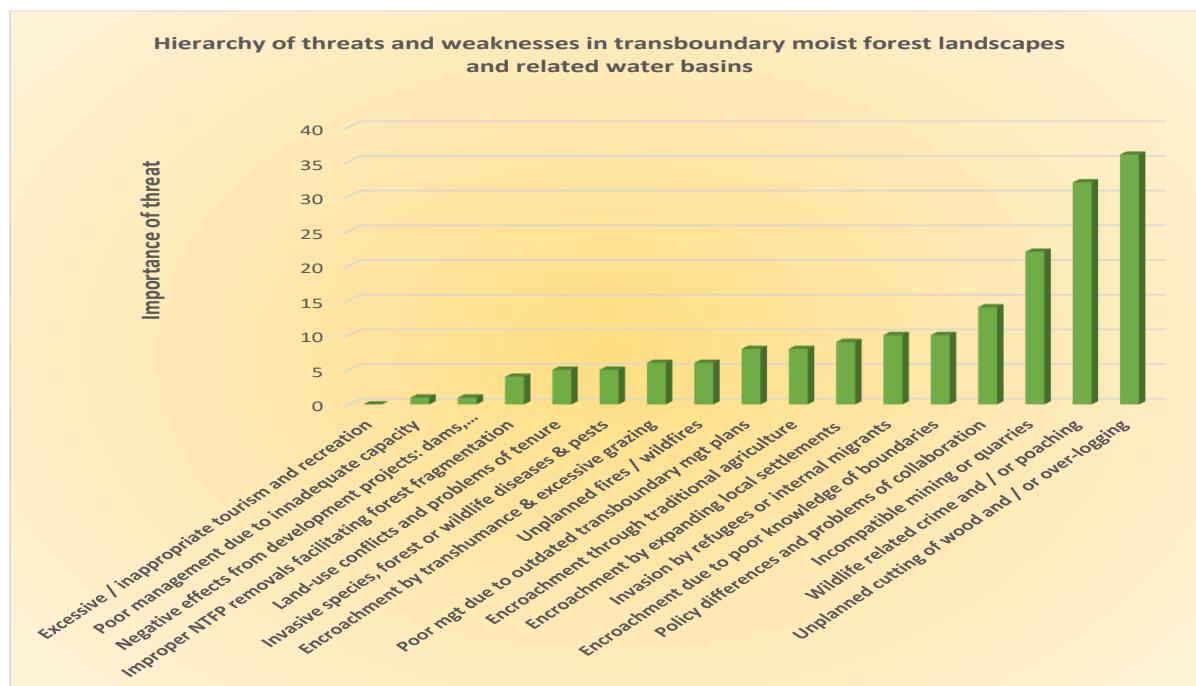


Figure 30 : Ranking of threats and weaknesses to sustainable management of trans-boundary moist forests and related water basins, according to experiences of experts of the TNS, TRIDOM, Korup-Cross River, Lac Télé-Lac Tumba and Greater Virunga landscapes.

Analysis of research results revealed the most pertinent threats to conservation in trans-boundary moist forest landscapes and related basin in order of importance include the following: (a) unplanned cutting of wood and over-logging; (b) wildlife related crime and poaching; (c) incompatible mining and quarries; (d) policy differences and problems of collaboration; (e) encroachment due to poor knowledge of boundaries; (f) invasion by refugees or internal migrants; (g) encroachment by expanding local settlements; (h) encroachment by traditional agriculture; (i) poor management due to outdated or inexistent trans-boundary management plans; (j) wildfires; (k) encroachment by transhumance and excessive grazing; (l) invasive species, forest or wildlife diseases and pests; (m) land-use conflicts and problems of tenure; and (n) improper NTFP removals facilitating forest fragmentation.

One main lesson is the near absence of threats from inappropriate tourism and recreation.

3.4.2 Driving forces

This section briefly describes the preceding threats and weaknesses within the context of their driving forces and proposes orientations for measures of containment. It should be understood that although the preceding threats and weaknesses are reported for trans-boundary landscapes, the socio-economic contexts around the landscapes, i.e. population growth and pressure, poverty and the desire for development, market arrangements, national institutional

set-up, culture and customs, policy and laws related to subsidies, incentives, land and resource tenure; are usually different for countries sharing the same trans-boundary landscapes. Incidentally, these are also the fundamental drivers of forest and forest watershed degradation.

(a) Population growth and pressure on trans-boundary landscapes

Growth in population, in the context of Sub-Saharan Africa is usually associated with an increase in consumption, degradation, expansion and intensification in the use of natural resources, as well as the invasion of hitherto unexplored or less exploited landscapes such as trans-boundary areas. Excess growth in population is a phenomenon associated with high fertility and birth rates, common in Sub-Saharan Africa, due mainly to poor family planning related to illiteracy and poverty. Growth however, when realized in the homogenous settings of rural remote communities, is less harmful to natural and forest resources due to the respect for traditional ecological norms and local social institutions. Such growth, however, develops into a challenge when young men leave their communities to colonize hitherto unexploited landscapes. "In some areas of the DRC, Cameroon, and Gabon, dependence on the forest has recently increased because of economic challenges, with many unemployed urban people returning to the forest to hunt in order to support themselves and their families" (CBFP, 2005).

The most dangerous population growth remains that which is introduced by industrial establishments such as logging and mining companies in rural remote settings. In a bid to improve efficiency, these companies build camps and install new laborers and their families close to their exploitation sites. For example, CBFP (2005), reports that substantial adverse impacts on the environment resulting from the negative effects of the oil and gas industry have been recorded in the Gamba-Mayumba-Conkouati trans-boundary forest landscape between Gabon and the Republic of Congo. For example, the TRIDOM trans-boundary landscape between Cameroon, Gabon and Congo, Poulin, (1999), recorded 6,570 new Cameroonian migrants into the area in 1999. The population density had passed from 6.7 inhabitants/km² in 1976 to 7.9 inhabitants/km² in 1987 (MINEPAT, 2002b) and to 13.45 inhabitants/km² in 2005 (Mbarga, 2010). CBFP (2007) states that:

"There is a danger that some gold panning or hunting camps (in the TRIDOM trans-boundary landscape) will one day be recognized as permanent villages, which would reduce the essential value of the TRIDOM as an area with significant connectivity between protected areas and vast continuous uninhabited areas. It should be possible to control this danger through well planned land usage in the medium term. In the short term, conservation departments must closely monitor this potential problem, because it is very difficult to revoke the status of a village once it has been accepted. Increasing the awareness of this matter to the administrative authorities is therefore essential to avoid the establishment of permanent camps in areas that are essential for connectivity".

(b) Poverty and the desire for socioeconomic development

Poverty exists when individuals or families cannot afford basic material needs such as food, clothing, housing and fundamental requirements for good health. Poverty also exists, not just because incomes are low, but also when the needs and desires are high for the social development of some low-income individuals or families. The second phenomenon is recent, encouraged by globalization. These two situations exist in West and Central Africa, including the four sample countries of this study and the populations around their trans-boundary landscapes. In the quest to alleviate poverty as well as satisfy desires of development, individuals or families invade forest landscapes and engage in wildlife poaching, extraction of wood for charcoal making, indulge in incompatible mining or quarries for minerals to sell, engage in extensive agriculture for subsistence needs etc. These unplanned activities

degrade forests around forest dependent communities thereby diminishing the goods and services that such forests would offer if their management was well planned.

The poverty – resource degradation nexus is exemplified around the “W” trans-boundary Park between Niger, Burkina Faso and Benin, where about 400,000 people have gradually moved to the first layer of the Park’s periphery to depend on its resources (Lauginie, 2008). The GNPs for 2007 of Niger, Burkina Faso and Benin were respectively 260, 460 and 540 US Dollars, compared to that for Northern Africa at 2,000 to 3,000 US dollars and that for South Africa at 5,000 USD. Poverty-related invasions of trans-boundary landscapes in West and Central Africa are not limited to the “W” complex. For example, while travelling between the Outamba-Kilimi / Madina-Oula landscape between Sierra Leone and Guinea in July of 2014, the researcher of this study observed extensive cutting of wood on the Sierra Leone side of the border (not in the Outamba Kilimi National Park) and the wood being loaded onto trucks with matriculation plates of the other country. Whether such interventions are complicit between responsible officials or not, they portray the desire for social development linked to inadequate governance.

(c) Skewed national and international market arrangements

Global market strategies such as Structural Adjustment Plans designed in 1988, proposed national internal adjustments that advocated liberalization of economic activities, dependence on markets, and competition in order to reduce domestic costs. In the sampled countries of this study, and in Sub-Saharan African countries generally, this translated into privatization of State enterprises, devaluation of national currencies, laying-off of government workers and more. Logging and mining companies benefited from the currency devaluation and related adjustments and started enjoying increased and highly profitable businesses (Wood *et al.* 2000). They needed more workers and therefore attracted migrants to their exploitation sites. In addition, governments had to borrow hard currency for development projects, and reimburse by cutting and selling more logs and mining more resources. Local business adventurers took advantage of these opportunities and started parallel archaic and artisanal exploitation processes, exporting their outputs across national borders. For example, de Wasseige *et al.* (2012) report that 80,000 m³ of wood is exported annually from Cameroon to Chad, of which 60% has its origin from informal artisanal sources with the possibility of this wood reaching North African markets (Cerutti & Lescuyer, 2011; de Wasseige *et al.* 2012). In addition, approximately 12,000 m³ of sawn wood is exported annually from Cameroon to Nigeria all of which is entirely informal (Cerutti & Lescuyer, 2011; de Wasseige *et al.* 2012). Finally, about 6,000 m³ of sawn wood is exported annually from Bangui in the Central African Republic to Chad most of which is illegal timber (de Wasseige *et al.* 2012). The situation is similar for mined diamond and gold sold illegally across national borders.

Quarrying for diamond and panning for gold in streams and riparian areas is exemplified on Central African Republic’s side of the TNS trans-boundary landscape between Cameroon, Central African Republic and Congo. A survey carried out by CIFOR in the Central African Republic’s side of the TNS in 2009 revealed that 97% of the miners used extraction methods devastating to the forests of the landscape, and such methods have not changed over the years (Matthysen *et al.* 2013). In 2013, due to civil unrest in the country, the CAR was suspended from the Kimberley Process’ Certification Scheme and from the Extractive Industries Transparency Initiative (Bermúdez-Lugo, 2016). This did not stop artisanal mining. On the contrary, smuggling across the TNS frontier with Cameroon intensified as numerous gold buying offices were found in Cameroon just across the border (Matthysen *et al.* 2013). According to CIFOR’s mining study referred to above, revenues from diamond mining account on average for 60% of artisanal miner’s total income pushing them further and deeper into the forest as trees are logged to make space for more mines (Matthysen *et al.* 2013).

(d) Environmentally insensitive policies (subsidies, incentives, taxes, land and forest tenure)

Until recently, most government policies in Sub-Saharan African countries were incentives for biodiversity and forest degradation. For example, to be granted ownership of forestland in the case of litigious circumstances, or even to prove ownership, one had to first clear the land, usually without prior consideration of biodiversity factors. Moreover, forest clearing was promoted, which is still the case in some countries, to plant cash crops associated with receiving subsidized fertilizers and other farm inputs, as well as free agricultural extension services. These environmentally perverse policies usually serve traditional development goals such as industrialization, expansion of exports, increased food production and the alleviation of poverty, with forests and biological resources generally bearing the brunt and providing a cheap way towards the expected socioeconomic growth. Environmentally insensitive policies and their impacts are exemplified on Burkina Faso's side of the "W" trans-boundary landscape. These concern the use of genetically modified cotton on the periphery of the referred landscape. According to a SOFITEX official (cotton development agency in Burkina Faso), a project involving 15,000 ha of genetically modified cotton was to start in 2008 and reach the periphery of the "W" Park in 2009 (Lauginie *et al.* 2008). According to the EU evaluation mission of the "W" ECOPAS project (Lauginie *et al.* 2008), no neutral information had been disseminated on GMO cotton in order to give the producers at the periphery of the "W" landscape a glimpse of the risks they were taking by adhering to this type of crop culture. In addition, the resultant potential effect on wildlife in the trans-boundary landscape. For the moment, GMO cotton was presented to farmers as a miracle solution to problems encountered with traditional chemical fertilizers (Lauginie *et al.* 2008). Moreover, several studies have revealed that the cropping system practiced by cotton producers results in degradation of soil fertility which, in the medium term, increases pressure on virgin forests in protected areas (Guibert and Prudent, 2005; Lauginie *et al.* 2008).

(e) Culture and local customs

Indigenous communities have lived in evolving ecological settings for generations during which they developed life-styles and belief systems drawing on their expert knowledge of wildlife, local plants and ecology (Xu *et al.* 2005). In West and Central Africa, this ecological experience led to the development of traditional regulations to perpetuate the use of natural resources such as prohibitions from killing or eating revered wildlife, permissions before felling special or revered tree species, abstention from forest or farm work for some days of the week or during certain seasons, setting aside sacred forests and groves whose sanctity and primeval qualities were upheld by local cult institutions, and more. While these appear favorable for the conservation or sustainable management of forests and wildlife, other cultural practices such as the traditional use of fire in slash and burn agriculture or its use to improve the quality of rangelands, are known to have contributed towards forests and related biodiversity loss over the years. Recently, due mainly to market forces and related policies, the environmentally sensitive components of local culture are threatened with dilution and erosion by another dynamic – migrant populations. The impact of migrants on the conservation culture of indigenous communities is exemplified on the CAR's side of the TNS. A case is reported about the Howe-Central Africa diamond and gold mining company. According to Mogba (1996), establishment of the company drew a wave of unemployed youth on CAR's side of the TNS landscape, disrupting local conservation culture. Wildlife that was revered and not hunted or eaten by local indigenous people was now hunted by natives and sold to the migrants. It is the forest and related biological diversity that bears the brunt of this gradual diffusion and erosion of local conservation mentality.

(f) Institutional set-up

Government agencies responsible for managing trans-boundary landscapes are oftentimes not the same institutional type across the border. In some West and Central African countries, trans-boundary landscape management is supervised and managed by personnel of Forestry Departments such as in Sierra Leone, in others by Wildlife and Protected Area Departments such as in Cameroon and in others by semi-autonomous government agencies such as the Congolese Institute for Conservation of Nature (ICCN) in the DRC. The management approaches and procedures are different for each of these institutional types. In addition, in some countries, the private sector is allowed to manage conservation areas such as in the DRC. In others, civil society organizations manage such landscapes such as in Burkina Faso, but in most of the countries, neither the private sector, nor civil society nor local communities can manage public conservation and sustainable management forests. Sometimes, agencies managing trans-boundary areas on both sides of the border do not speak the same official language such as between Sierra Leone and Guinea, or between Nigeria and Niger where English and French are their respective languages for official expression. These differences do not facilitate joint planning and execution of operational strategies. Moreover, national legislation on forests and wildlife are not consistent across countries, undermining trans-boundary conservation efforts. Sometimes, a species is protected in one country and exploited across the border or usufruct rights allowed in one country and disallowed across the border. In addition, the overly frequent turnover of staff in some of the national administrations, or even the downsizing and lack of selection criteria during replacements inevitably affects the stability and performance of the teams on which trans-boundary landscapes depend for effective operation. In the advent of globalization, the mission of agencies responsible for managing trans-boundary conservation and sustainable management landscapes is likely to undergo change. This is imposed by the dynamics of decentralization and the emergence of key themes such as local governance, forest and climate change, forests and water, as well as new partners e.g. civil society organizations, local elected officials and the private sector. Trans-boundary landscape management agencies will require different approaches and skills to engage these new orientations.

3.5 Evidence and extent of management of degradation, wildfires, tree and forest pests and diseases in potential trans-boundary landscapes

3.5.1 Evidence and extent of management of land degradation

A. Trans-boundary mangroves and moist forest landscapes

The level of degradation around trans-boundary mangroves and moist forest landscapes with potential for sustainable management has been observed to be directly linked to the presence of human population, its growth and activity. CBD (2005); describes degradation as:

“... any combination of loss of soil fertility, absence of forest cover, lack of natural function, soil compaction, and salinization that either impedes or retards unassisted forest recovery through secondary succession”.

“Local population growth directly affects the use of resources and their degradation and often drives habitat conversion in areas important for biodiversity conservation” (Wood *et al.* 2000). Forest degradation has also been linked to perverse government policies that give incentives for forest exploitation i.e., development of cash crops such as cocoa around the Tai-Grebo trans-boundary landscape, or rice around the Djoudj-Diawling trans-boundary mangrove landscape. Forest degradation is also enabled by market liberalization policies i.e., structural adjustment programs (SAPs), which promoted large-scale production patterns, where demand for foreign exchange earnings had to be met through large-scale exploitation of natural resources such as forests. This is manifested in the form of increased forest exploitation concessions around the 3 potential trans-boundary landscapes of “Monte Alen - Mont de Cristal Inselbergs,” “Lope – Chaillu – Louesse” and “Monte Alen-Mont de Cristal Inselbergs, in Central Africa (Fig. 31), as well as around the Tai-Grebo landscape between Côte d’Ivoire and Liberia.

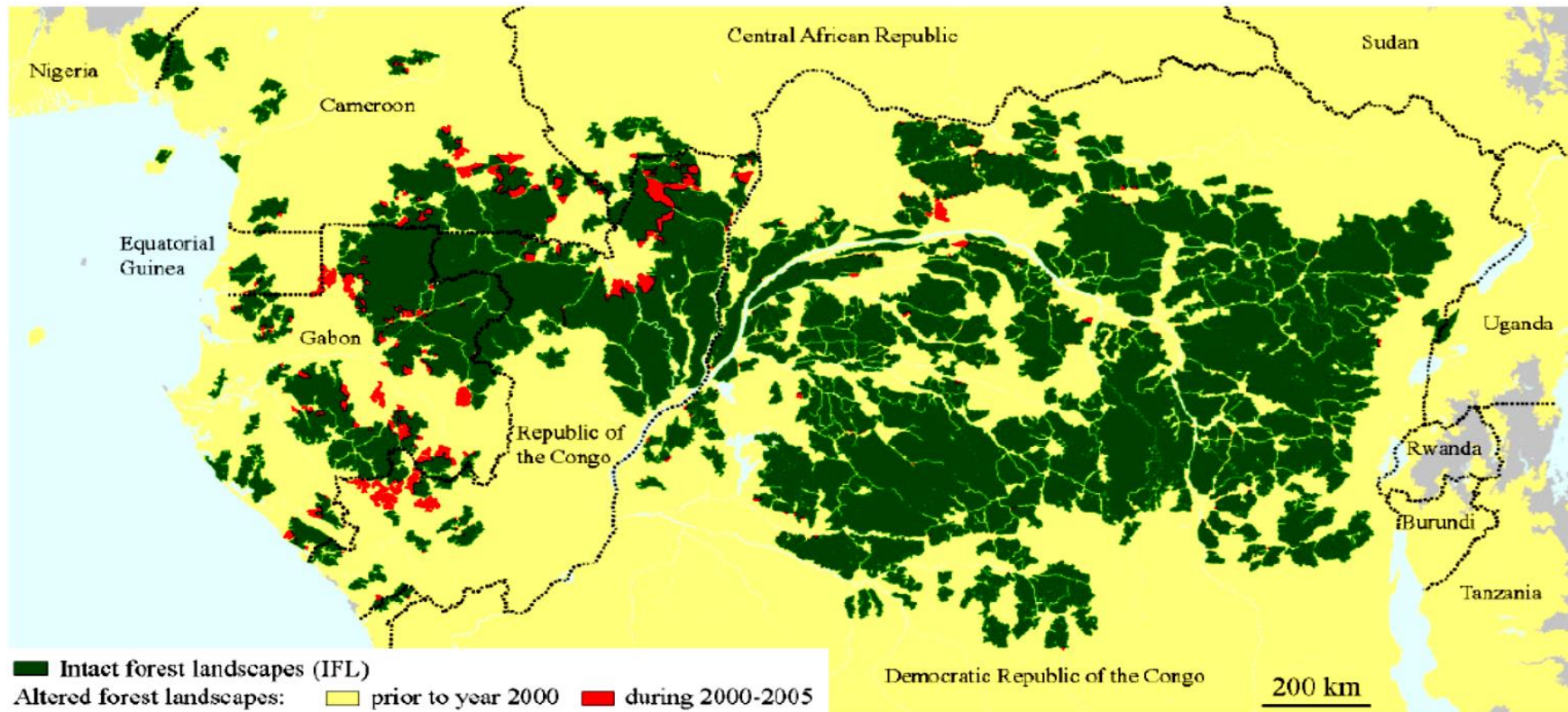


Figure 31 : Map of Potential Trans-boundary Forest Landscapes in the Congo Basin

Source: Modified from www.en.wiki.org

Also, globalization through the expansion of an advanced culture is progressively modernizing traditional societies in West and Central Africa; by introducing markets that are escalating consumption levels thereby losing traditional knowledge and conservationist modes of forest resource use around trans-boundary landscapes close to large population centers. Consequently, the potential trans-boundary landscape of “Lope – Chaillu–Louesse,” with low human population, no tradition of pastoralism and

no well-established road networks (Fig 31) is also the most conserved. With the exception of forest concession activities, such landscapes incur little forest degradation. The red spots i.e., altered forest areas, incircled landscapes, Fig 31 testify of the low to moderate degradation levels in the potential trans-boundary landscapes of Central Africa from 2000 to 2005 (CARPE, 2011).

In West Africa, where population pressure is a major challenge for conservation and sustainable management of potential trans-boundary resources, landscapes with large proximity-towns and consequently well-developed road networks, encounter the most pressure with resultant forest degradation. These include the Djoudj-Diawling trans-boundary mangrove landscape between Senegal and Mauritania, where the City of St. Louis in Senegal with a well-developed road network and a population of more than 277,000 inhabitants (2011) is located less than 40 km from the trans-boundary landscape. The Outamba-Kilimi / Madina-Oula trans-boundary forest landscape between Sierra Leone and Guinea, where the town of Kindia in Guinea with a well-developed road network and a population of more than 181,000 inhabitants (2008) is located less than 50 km from the trans-boundary landscape. The Wonegizi-Ziama trans-boundary forest landscape between Liberia and Guinea, where the town of Macenta in Guinea with a population of 43,900 inhabitants (2006) is only about 50 km from the landscape. The Kyabobo-Fazao/Malfakassa trans-boundary forest landscape between Ghana and Togo, where the town of Sotouboua in Togo on a well-developed south/north road axis and a population of more than 22,721 inhabitants (2014) is less than 50 km from the landscape. Finally, the Gola/Lofa/Mano trans-boundary forest landscape between Sierra Leone and Liberia where the town of Kenema in Sierra Leone with a well-developed road network and a population of more than 200,354 inhabitants (2015) is less than 70 km from the trans-boundary landscape (collated from various sources).

These towns are usually supplied with wood for making charcoal, for carving, making furniture and for construction, as well as non-timber forest products, by satellite villages located even closer to the trans-boundary landscapes. It is the degrading forest exploitation by such communities that has led to the near disappearance of tree species such as Ebony for sculpture; remarkable charcoal making species such as *Talbotiella gentii*; chewing-stick species such as *Garcinia epunctata*; species used for the sculpture of mortars and pestles such as *Blighia sapida* and *Celtis spp.*; species whose leaves serve in wrapping products in local markets such as *Marantochloa cuspidata* and *Thaumatococcus danielli*, and the disappearance of the Miss Waldron's Red Colobus from these landscapes.

The following national reports testify to the degradation in the referred trans-boundary landscapes.

For the Outamba-Kilimi / Madina-Oula, and Gola/Lofa/Mano trans-boundary forest landscapes:

“The Outamba-Kilimi National Park in Sierra Leone faces threats from hunters and poachers for game, moving into the unprotected area of Guinea (Madina-Oula) and cattle from Guinea have been known to move into the park for grazing. Similarly, the Gola Forest National Park in Sierra Leone lies close to the unprotected side of the Gola Forest in Liberia where park game is threatened by hunters. Effective park management in these areas is therefore achievable only if areas adjacent to these parks in neighboring countries are brought under protection to provide safe corridors for wildlife searching for favorable conditions.”
Ministry of Agriculture, Forestry and Food Security - Sierra Leone, 2011.

For the Wonegizi-Ziama Landscape and other trans-boundary landscapes involving Guinea:

“The impact of protected areas on pastoralists may be negative i.e., disappearance of passage corridors for cattle. Given the lack of adequate means (to maintain such trans-boundary areas), protection is often illusory and these areas are abandoned to poaching (mining and settlements), cultivation and illegal grazing. Effective collaborative management could alleviate these difficulties .
Ministère de l'Agriculture, de l'Environnement et des Eaux et Forêts de Guinée, 2011

For the Djoudj-Diawling and Niimi-Saloum trans-boundary mangrove landscapes involving Senegal and its neighbors:

“The successive rainfall deficit in the recent past has led to a decline in the level of rivers (Senegal, Saloum, Gambia and Casamance) thus allowing sea-water intrusion into terrestrial ecosystems. The resulting salinization, combined with the decrease in rainfall, is (one of) the main causes of ecosystem degradation (especially of non-mangrove resources) and weakening of production systems throughout the country. Senegal has several types of mineral resources. Unfortunately, the approach observed in mining and quarrying is causing irreversible deforestation. As a result, forest losses in the region of Thiès (limestone, basalt, phosphate, etc.) in the region of Louga (Zircon) and Kédougou (Gold, etc.) amount to about 3,000 ha / year.”

Ministère de l'Ecologie et de la Protection de la Nature, Sénégal, 2012.

B. Mountain landscapes

This section examines degradation as a case in point in the potential Nimba tri-national landscape, on the Liberian side, as testified by the Liberia country report on Mt. Nimba of September 2001 and others.

“The Liberian side of the Nimba range has undergone significant degradation due to mining, shifting cultivation and human settlements. Huge deposits of iron ore were discovered in the area around 1953, and the Government leased the landscape to a foreign mining concession, i.e. LAMCO. Mining began in 1962 and was disrupted only by the Liberian civil war in the late 80s. During those years, an area of about 8 kilometers by 0.5 kilometers was affected in the bid to dispose of 30,000,000 tons of waste. LAMCO was eventually replaced by a local company i.e., LIMINCO, which could not absorb all LAMCO employees thereby sparking unemployment. The civil war started in 1989 and mining workers fled the area, but returned sooner to engage in shifting agriculture, poaching for bushmeat while firewood and charcoal provided energy, and eventually income generating ventures. The semi-montane and deciduous forest associated with the mountain came under severe pressure from logging companies, contracted by the mining company to supply railroad sleepers from tropical hard woods. Although mining of iron ore no longer goes on in the area, water from surface run-off continues to wash down old dumps along ridges into valleys producing siltation. Mining of iron ore has been replaced by artisanal and unregulated alluvial mining for diamond and gold. Alluvial miners have dug pits in several plots along river flats thereby defacing most of the land. It is estimated that about sixty thousand (60,000) people are involved in the process (Fayia, 2001). Recently, the mining company – Acelor Mittal Liberia, has signed agreements with the government of Liberia for sustainable resource management around the area”.
Sambola, (2001), and STEWARD/MRU/Darwin Initiative (2010)

The Ivorian side of the Mt. Nimba landscape also suffered degradation from 2003, following the militarized socio-political crisis in the country. The following excerpt is translated from a regional study on the Nimba, undertaken within the framework of the ECOWAS Dialogue on Forests:

“The political instability and the civil wars that affected each of the three riparian countries (Liberia, Guinea and Côte d'Ivoire) had devastating consequences on the biodiversity of the Mt. Nimba landscape. The people we met indicated that combatants (militias) routinely use this forest as a rear base. They settle in the Reserve, including the central area that should have been fully protected, and destroy the forest and wildlife resources through the establishment of camps and for their supply of wood and game (bush-meat)”.

(Bonkougou *et al.* 2010)

Fortunately, the civil war in Côte d'Ivoire has ended and conservation efforts in the Nimba are currently pursued by several partners including the USAID WA-BiCC program.

C. Woodland Savanna and Sahel Parklands

This section examines degradation as a case in point, in the potential Mole/ Nazinga – Kaboré Tambi trans-boundary landscape in relation to population pressure and an agrarian system, which is strongly linked to the cultivation of cotton. The extensive farming system encourages more cultivation areas and an ever-advancing cotton-frontier due to decline in soil fertility from reduced fallow, strong wind and water erosion. According to the national report on forest genetic resources of Burkina Faso (2012), agricultural intensification in the cotton sector employs chemical fertilizers and pesticides, leading to environmental degradation and inefficiencies, which reach 13.7% of the value added, or about 8,9 billion FCFA / year or 0.24% of the country's GDP.

The trends observed over the past ten years reveal an accelerated degradation of forest resources, resulting in a significant imbalance between supply and demand for forest products (Burkina Faso, 2012). The Mole/ Nazinga – Kaboré Tambi landscape was not spared by the recurring droughts of the West African Sahel starting in the 1970s. The degradation and decrease in pastoral and forest resources due to local and transhumance related overgrazing (i.e. cross-border pastoralism) and overcutting of trees for energy are leading to an endless cycle of further invasion of forest reserves by local and transhumant populations and their livestock. In the Burkina side of the landscape, people who were resettled to make way for the National Park have not been adequately compensated, leading to changes in social structure of several communities accentuating inadequate conflict resolution and poverty, whose brunt is borne by trees producing non-timber forest products, and wildlife resources.

D. Trans-boundary watersheds

Land degradation follows a similar pattern in watersheds. This section focuses on the potential trans-boundary watersheds between Niger and the Republic of Nigeria. A trans-boundary diagnostic analysis undertaken around the four watersheds of the Niger – Nigeria trans-boundary landscape - in section 3.3, revealed that the population pressure is very high around the referred areas, as they constitute the only water sources for the highly populated parts of Northern Nigeria as well as about 75% of the total population of Niger, which is concentrated around the referred to watersheds (Mathu *et al.* 2011). The resident population engages in uncoordinated and over-exploitation of pastoral, forest and water resources leading to extreme degradation of these resources and an ever-increasing cycle of life-threatening poverty. Degradation of the ecosystems around the watersheds revealed a decrease in the density of trees and the disappearance of their regeneration; silting of land and in water bodies; disappearance of wildlife; drop in the level of the water table; modification of the hydrological regime of the rivers; early drying up of water bodies (floods during the rainy season and empty river beds during the dry season); reduction of the irrigable and water management potential of the land; decrease in the availability of water for the population, domestic animals and wildlife (PGIE, 2007).

As an example, project studies undertaken on one of three sites i.e. 'Doguerawa' in the first watershed, specifically the Maggia-Lamido in 2007, revealed that the following tree species have disappeared from the highlands (\pm 340 m altitude) of the site: *Combretum micranthum*, *Boscia senegalensis*, *Balanites aegyptiaca*, *Acacia radiana*; while the following have disappeared from the lowlands (\pm 200 m altitude) of the site: *Piliostigma reticulatum*, *Hyphean tabaika*, *Guiera senegalensis*, *Acacia radiana*, *Balanites aegyptiaca*, *Combretum glutinosum*,

Combretum micrantum, *Ziziphus mauritiana*, *Grewia bicolor* and *Boscia senegalensis* (PGIE, 2007). The PGIE project started restoration in these areas but it has now come to an end. The post-project individual restoration effort has been timid, but thanks to the Africa Great Green Wall of the Sahara and Sahel Initiative which is now stepping in.

Regional collaboration in the management of trans-boundary land degradation

The Great Green Wall for the Sahara and Sahel Initiative is the most robust field level program, which specifically addresses land degradation in West Africa, including around some potential trans-boundary landscapes such as the Niger – Nigeria border catchments. Other regional organizations, which restore degraded landscapes mainly around coastlines, watersheds and river basins, include (a) the Guinea Current Large Marine Ecosystem Program (GCLME) through contracts with civil society organisations on coastlines from Cameroon to Senegal; (b) the Regional Program for Conservation of the Coastal and Marine Zone of West Africa (PRCM) through contracts with local civil society partners in Mauritania, Senegal, Gambia, Cape Verde, Guinea Bissau, Guinea and Sierra Leone; (c) the Volta Basin Authority (VBA) on degraded river basin areas between Burkina Faso and Ghana; (d) the Niger Basin Authority (NBA) through large externally funded projects on degraded river basin areas especially between Guinea and Mali, Niger, Burkina Faso and Mali and in Nigeria; (e) the Senegal River Basin Authority (OMVS) on degraded river basin areas between Guinea, Mali and Senegal; and (f) the Lake Chad Basin Commission (LCBC) around the Lake Chad Basin, and others.

In COMIFAC countries, impact indicator N° 4.1 of Priority Axis n° 4 of the COMIFAC Convergence Plan states that “From 2015 until 2025, the rate of deforestation and degradation of forests should be stabilized in all Central African countries”. A Central Africa sub-regional Program of Action against land degradation and desertification (PASR-LCD) has consequently been developed, implemented at national level as ‘National Programs of Action (PAN)’. Notwithstanding the preceding provisions and interventions, collaboration against land degradation around trans-boundary landscapes is mainly undertaken through projects implemented by international technical development partners like WCS, WWF, AWF and others. This is partly due to the absence of collaboration between regional agencies that pursue degraded landscape restoration and trans-boundary ecosystem management initiatives.

3.5.2 Evidence and extent of management of wildfires

A. Trans-boundary mangroves and moist forest landscapes

While wildfires are rare in mangrove landscapes because of the high humidity levels, they can be rife inland beyond mangroves, when conditions are favorable for burning. FAO describes fire as a major disturbance factor that has both beneficial and harmful effects. Some forest ecosystems are adapted to fire and depend on it to maintain their vigor and reproductive capacity. Fires not only affect the functions and services of forests but also other assets, i.e., human lives and livelihoods (FAO, 2010). In West Africa and the northern landscapes of Central Africa, fires are set by grazers with the hope of better pastures for livestock. In both West and Central Africa, honey gatherers initiate fires to smoke bees out of tree hives and then recuperate the honey, while fire is used in the traditional farming practice of slash and burn as a tool for clearing land. These fires are usually left smoldering and unattended when the objective of their initiators is achieved. They end up escaping to burn larger areas and resources not initially intended, including faunal and floral species and their habitats. The uncontrolled expansion of agricultural and pastoral lands as well as the increased exploitation of forests for recreation and tourism, both increase the risk of forest fires (FAO, 2010).

Discussions during this study confirmed fire project reports that 95% of wildfires are caused by human activities and that efforts to develop mitigation strategies for such fires revolve around how to address the human causes of fire. Participation of local people in planning of fire management has long been identified as necessary for reducing the number and spread of wildfires even as socioeconomic and environmental data on fire occurrence and use is required for policy making (MLNR – Ghana, 2011).

The adjacent picture depicts a true colour moderate resolution imaging spectro - radiometer (MODIS) of week-old fires captured by NASA's Suomi NPP satellite on Dec. 05, 2015 over West Africa. From the upper left image, the trans-boundary land-scapes under the most threat from fire during the referred period, include; Niokolo-Badair landscape between Senegal and Guinea; Nimba between Liberia, Côte d'Ivoire and Guinea, and Kyabobo – Faza/Malfakassa landscape between Ghana and Togo. The concentration of fire spots over most of Guinea, southern Mali and the middle belts of Togo and Ghana, an area generally referred as West Africa's water basin, i.e., where the trans-boundary rivers of Niger, Senegal, the Gambia, Volta and several others take their rise is a cause for concern.

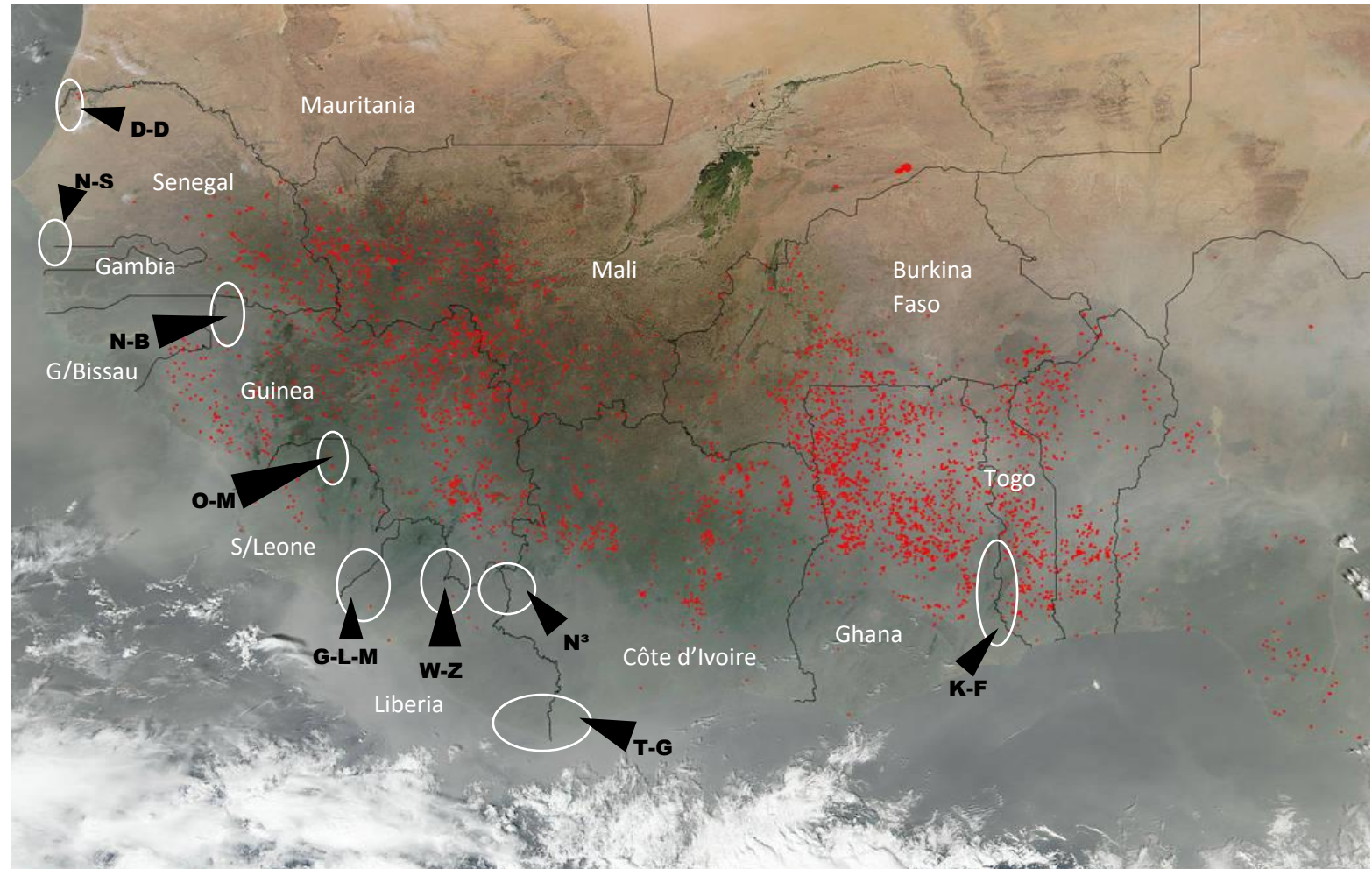


Figure 32: Forest fires in early farmland clearing. Visible-light images taken from NASA-NOAA's Suomi NPP satellite on Dec. 05, 2015. The VIIRS image shows heat signatures from fires (red) across West Africa. The following trans-boundary landscapes are visible: K-M =Kyabobo-Faza/Malfakassa; D-D = Djoudj-Diawling; N-S = Niumi-Saloum; W-Z = Wonegizi-Ziama; O-M = Outamba-Kilimi/Madina-Oula; G-L-M = Gola/Lofa/Mano; T-G = Tai/Grebo, N-B = Niokolo-Badair; N³ = Nimba. (Source: Adapted from Lynn Jenner 2017).

B. Mountain landscapes

This section draws from the results of a study on wildfires on the Guinean section of the Mt. Nimba trinational landscape conducted in 2009 by Poilecot and Loua. According to the study, surface fire, also referred as common wildfire is the more common type on the Nimba. Such fires are usually lit on the lower savannah vegetation of the landscape by graziers and hunters (case of early fires) starting November. They cross the herbaceous layer, into the forest savannah mosaic, causing little damage to shrubs (case of early fires). Such humus fires infiltrate underneath trees facilitated by recurring droughts during the dry season and because of their reduced intensity, provide fire resilience to local tree pioneers, such as; *Gaertnera paniculata*, *Harungana madagascariensis*, *Trema orientalis*, *Albizia zygia*, *Macaranga hurifolia*, *Alchornea cordifolia*.

However, the late and more severe fires lit by farmers clearing land for farming and graziers, start from February through early April. They are more aggressive towards trees and shrubs and their regeneration, even for trees considered "pyrotolerant" (Poilecot *et al.* 2009). They reduce the intensity of flowering and / or fruiting of trees. This results in lower seed production and reduction in the recruitment of young individuals within tree stands.



Figure 33 :Post-fire regeneration of *Protea madiensis* var. *occidentalis* at 1, 200 meters altitude on Mt. Nimba. (Source / Photo: Poilecot. P., in Poilecot *et al.* 2009).

Indirect effects also occur to wildlife that use pollen or consume fruit and seeds. Forests on flat areas and slopes of the Nimba landscape appear to be the most threatened by fires from land-clearing. However, several tree species i.e., *Protea madiensis* var. *occidentalis* captured in Fig. 33, have developed the capacity to regenerate from their rootstock. The margins of the gallery forests are not usually seriously affected by fires spreading from the savannah slopes and their survival is usually not threatened. Generally, the suppression of fires is favorable for the survival of montane forest stock (Poilecot *et al.* 2009) and the fires usually burn until they extinguish by themselves. The only fire prevention (sensitization) activities on the Nimba are assured by beneficiaries of USFS' WA-BiCC project and by personnel of the Mt. Nimba project. Week-old, smoldering fires on the Nimba were captured by a true color moderate resolution imaging spectro-radio-meter (MODIS) of NASA's Suomi NPP satellite on Dec. 05, 2015. The spots are presented on the Nimba landscape identified as N³ on Fig. 32.

C. Woodland Savanna and Sahel Parklands

In the absence of better agricultural technology, fire for clearing land is widely practiced in the farming systems of woodland Savanna and Sahel parklands such as around the potential trans-boundary Mole / Nazinga – Kaboré Tambi landscape between Burkina Faso and Ghana. The late uncontrolled fires are usually more intensive than the early fires and end up destroying forests, woodland and crops over extensive land areas (Brockley Combe Backwell, 2008). These fires decimate all organic matter including leaf litter predisposing the land to water and wind erosion. Nye and Greenland (1964) in Brockley Combe Backwell (2008), argue that although the ash produced through burning of the vegetation increases nutrients such as calcium, magnesium, potassium and phosphorus, the effect is transient. The nutrients are lost through leaching resulting in an increase in soil acidity and high levels of exchangeable aluminum, thereby limiting the range of crops that can be grown. According to Brockley Combe Backwell, (2008), late bushfires have contributed to the development of unpalatable forage which is not useful to the large numbers of livestock around the Burkina Faso / Ghana boundary. Moreover, biodiversity is lost and the whole habitat which supports wildlife and large numbers of ecologically interdependent species is destroyed. Notwithstanding the negative impacts, communities are now increasingly sensitized by the environmental awareness programs of the Mole and Kaboré Tambi National Parks, as well as vestiges of Ghana's Northern Savannah Biodiversity Conservation project, to use fire wisely and timely to improve agricultural and pastoral production and biodiversity conservation.

D. Trans-boundary watersheds

One of the most studied potential trans-boundary watersheds in terms of wildfire management is the Niger – Nigeria landscape. According to PGIE project studies, the problem of wildfires is mainly prevalent around the Komadugu Yobé trans-boundary watershed. This is because contrary to the other three basins where early fires are prevalent, those of the Komadugu Yobé are lit in the late dry season and acknowledged as a traditional practice by farmers taking advantage of the water resources to clear farms for a second crop, while grazers take advantage of available moisture to improve the roughened and unpalatable pastures. However, these fires burn intensively due to the abundantly available dry vegetative matter, raise soil temperature, destroy soil micro-organisms, denude the soil, reduce soil fertility and destroy organic matter (PGIE, 2007). PGIE studies indicate that the Komadougou Yobé basin registered 45 bushfires that burnt 25,000 ha, during the 2006/7 period when the studies were conducted. Sensitization efforts on wildfire management have now ended with the end of the PGIE project. It is hoped that the Great Green Wall for the Sahara and Sahel Initiative will take over this activity.

Regional cooperation in the management of wildfires

In West Africa, the ECOWAS Forest Policy does not have provisions for concerted wildfire management in the sub-region's humid forest zone. The policy however advocates concerted control of wildfire and grazing in its Sahelian zone. Based on this provision, and with technical support from CILSS and its affiliated regional agencies i.e., AGRYHMET and INSAH, it advocates and supports national wildfire management strategies in the national desertification programs (PASR-LCD) of Sahel countries. To remedy the oversight of fire management in the humid forest zone of West Africa in the ECOWAS Forest Policy, a general provision for the management of wildfire has been proposed under section 3.1.1.9 of the ECOWAS Forest Convergence Plan (2012), with advocacy for member States to develop specific mechanisms and strategies to confront the wildfire plague. Wildfire management is also targeted by regional programs engaged in concerted ecosystem restoration efforts such as the VBA, NBA, OMVS and others.

In Central Africa, wildfires are mainly caused by traditional land clearing for subsistence agriculture and receive relatively less regional and national attention although they constantly eliminate saplings and vulnerable wildlife species. The COMIFAC Convergence Plan for the period 2014 – 2025 has little emphasis on strategies for managing wildfires. The sub-regional action program on the fight against land degradation and desertification in Central Africa (PASR/LCD – AC) identifies wildfires as a problem only in its Sudano-Sahelian zone i.e. in Chad, and high altitude savanna areas but not in the forest zones. Notwithstanding these oversights, the COMIFAC program on forests and climate change (de Wasseige *et al.* 2015) proposes specific measures related to the promotion of good practices in fire management and training in the control of wildfires in all settings of the Congo Basin. Also, wildfire control is taken into account in the management of protected areas located within proposed trans-boundary landscapes in the Central Africa sub-region i.e. “Monte Alen-Mont de Cristal Inselbergs,” “Lope-Chaillu-Louesse” and “Leconi-Batéké-Léfini”.

3.5.3 Evidence and extent of management of tree and forest pests and diseases

A. Trans-boundary mangroves and moist forest landscapes

This section examines pests and diseases likely to infest and /or infect tree species in potential trans-boundary mangroves and moist forestlandscapes, as this may influence restoration with indigenous tree germ-plasm in such landscapes. In this regard, the section benefits from studies by the African Forest Forum (i.e. Gichora *et al.* 2017), on “the status and trends of forest and tree pests and diseases management in Africa”. The weakness of the section is portrayed by the recognition of diseases and pests of trees in Africa and other parts of the world recorded mainly in situations where they cause economic losses, either in commercially exploited natural stands or in plantations (Zwolinski *et al.* 1990; Gichora *et al.* 2017).

Pertaining to mangroves, they generally encounter relatively few pests and diseases due to their saline substratum. However, pests such as crabs i.e. the *Goniopsis pelii* species are known to cut and feed on mangrove seedlings (Rhizophora and Avicennia species), thereby constraining natural regeneration or assisted restoration efforts. Another predator of Guinean mangrove species is the larvae of the insect pest, *Charaxes castor* (Nymphalidae), which bores and feeds on the terminal tissues of mangrove foliage and inflorescence (Saenger *et al.* 1996). These pests are currently controlled by local user groups engaged in mangrove restoration efforts around the potential trans-boundary mangrove landscapes of Djoudj-Diawling between Senegal and Mauritania, and Niimi-Saloum between the Gambia and Senegal.

For the more extensive moist forest landscapes of West and Central Africa, the literature suggests that specific pests or diseases prefer particular tree species and at best attack the whole family rather than attack all tree species at random. Gichora *et al.* (2017) identified the several indigenous evergreen and deciduous forest species as hosts to corresponding pests and diseases on West and Central African forest landscapes. Iroko (*Milecia excelsa* / *M. regia*) is attacked by the insect gall maker - *Pytolyma spp.*, throughout West and Central Africa (Wagner *et al.* 2008; Gichora *et al.* 2017). The African Mahogany (*Khaya* and *Entandrophragma*) are attacked by the Mahogany shoot borer - *Hypsophyla robusta* throughout Côte d’Ivoire, Ghana, Togo, Nigeria, and Cameroon. The Afromosia tree (*Pericopsis elata*) is attacked by the insect pest - *Lamprosema lateritalis*. The Opepe tree (*Nauclea didirrechii*) is attacked by the insect pest - *Orygmophora medeofoveata*. The *Triplochiton scleroxylon* tree species is attacked by the insect pest - *Anafe venata*. Although rare, generalized attacks occasionally occur, as reported by (Bosu, 2016; Gichora *et al.* 2017), where an outbreak of the insect tree pest, *Achaea catacoloides*, from late 2009 to 2010 in

Sierra Leone, Liberia and Guinea, caused devastating environmental and socioeconomic effects on forests and agriculture.

Another occasional, though widespread disease of indigenous tree species in West and Central African moist forest landscapes, is the tree dieback. Dieback's causal pathogen for the Silk Cotton Tree, *Ceiba pentandra*, has been identified as a *Fusarium* spp., and *Lasiodiplodia theobromae* (Apetorgbor *et al.* 2003; Gichora *et al.* 2017). The disease also infects *Terminalia ivorensis*, and is attributed to environmental factors and nutritional stresses. The occurrence of dieback on *Terminalia ivorensis* in Ghana and Côte d'Ivoire during the early 1970s was a major setback to the progress of forest plantation development in the sub-region (Bosu, 2016; Gichora *et al.* 2017).

Indigenous tree species such as Bush Mango (*Irvingia gabonensis*), Cola (*Cola nitida*), (*C. acuminata*), and (*C. verticillata*), Bitter Cola (*Garcinia kola*), Sausage Tree (*Kigelia africana*), Prunus (*Prunus Africana*), Padouk (*Pterocarpus soyauxi*), Njansang (*Ricinodendron heudelotii*) Aidan Tree (*Tetrapleura tetraptera*) and others that produce commercially important fruits, nuts, latex, bark and foliage for medicinal purposes, confectioneries, direct consumption or for other purposes, are equally susceptible to dieback. They are infested and infected by a large number of unspecified pests and diseases, which are only now receiving research attention because of the desire to raise the species in plantations. For example, the *Guignardia citricarpa* pathogen is associated with the yellow or orange discoloration of the leaves of Cola Nut trees, while *Botryodiplodia theobromae* is associated with twig blight and a brown-colored blight on the leaves of Cola Nuts (Clark *et al.* 2004). Also, the stem-boring longhorn beetles (*Phosphorus virescens*) and (*P. gabonator*) have been reported to cause dwarfing of Cola trees in both Ghana and Nigeria (Clark *et al.* 2004), while the ant species (*Crematogaster buchneri*) reportedly attacks the flowers, leaves, young branches and pods of *Cola nitida* in Nigeria (Clark *et al.* 2004). No generalized treatment for these pests was recorded during this study.

B. Mountain landscapes

The mosaic and gallery forests and trees of the Mt. Nimba landscape are the subject of this section. They include; *Harungana madagascariensis*, *Trema orientalis*, *Alchornea cordifolia* and others mentioned in section 3.3 (I) having renowned pharmacological properties and used in advanced traditional medicine. Some of them have consequently been studied in order to enhance their protection and propagation. For example, *Trema orientalis* also called Pigeon Wood (whose leaves are reported to be a general antidote to poisons and more), is known to be occasionally infested by the larvae of *Sahyadrassus malabaricus* – a sapling borer, while a powdery mildew fungus (*Oidium udaiyanii*) also infects the tree species (Orwa *et al.* 2009). The Dove Wood - *Alchornea cordifolia* (whose leaves, roots and stem-bark contain terpenoids, steroid glycosides, flavonoids (2–3%), tannins (about 10%), saponins, carbohydrates and the imidazopyrimidine alkaloids alchorneine, alchornidine and several guanidine alkaloids) is acknowledged as a preferred feed plant of the desert locust *Zonocerus variegatus* (Mavar-Manga, *et al.* 2007); while the seeds of the Blood Tree - *Harungana madagascariensis*, (whose sap is used in the treatment of scabies, tapeworms, leaves as remedy for hemorrhages, diarrhoea, gonorrhoea, sore throats, headaches and fevers) are reported to be susceptible to insect attack (Orwa *et al.* 2009). Ecological functions of the referred tree species in mosaic, remnant and gallery forests of the Nimba landscape include watershed and biodiversity conservation, ecological corridors and wildlife protection, soil and head-water protection, and more. Unchecked, pests and diseases (as is currently the case), in addition to the negative effects of late intensive wildfires on the referred tree species of the Nimba landscape could mean the complete eradication of forest biodiversity and its related social and ecological functions from such a unique and fragile mountain ecosystem.

C. Woodland Savanna and Sahel Parklands

The forest and tree pests and diseases considered in this section are those of the major parkland species such as of the Mole / Nazinga – Kaboré Tambi trans-boundary landscape. They include important non-timber forest products species such as the Shear Butter tree (*Vitellaria paradoxa*), Dawa-Dawa tree (*Parkia biglobosa*), the Tamarind (*Tamarindus indica*), the Borassus Palm (*Borassus aethiopicum*), the Baobab tree (*Adansonia digitata*), the Arabic Gum tree (*Acacia senegal*), the African Plum tree (*Sclerocarya birrea*), the Savanna Mahogany (*Khaya senegalensis*) and others.

One of the most memorable pests of the Sahel vegetation is the migratory desert locust (*Shistocerca gregaria*) which infests almost all vegetation based on cycles of occasional outbursts (Gichora *et al.* 2017). With the exception of the locust, the Shear Butter tree is reportedly resistant to most pests and diseases excluding parasitic plants i.e. mistletoes of the *Tapinanthus* species (Orwa *et al.* 2009). They infest the tree and eventually take over its functions, producing “witches-broom” instead of shear butter. As for Dawa-Dawa, its leaves are reportedly infested by several Lepidoptera species, and its timber also attacked by termites, marine borers and fungi. The fungal attacks reportedly cause discoloration of the timber and reduce its quality, while a weevil and the pyralid moth eat the trees’ fruits, pulp and seed (Orwa *et al.* 2009). As for the Tamarind tree, according to Orwa *et al.* (2009), the most serious pests are scale insects; *Aonidiella orientalis*, *Aspidiotus destructor* and *Saisetia oleae*, mealy-bugs; *Nipaecoccus viridis* and *Planococcus lilacinus*, and a borer (*Pachymerus gonagra*). The pupae of white flies (*Aleyrodids sp.*) reportedly suck from under the leaves of the Arabic Gum tree as well as from the leaves of *Acacia nilotica*, *A. senegal*, *A. tortilis*, *Albizia lebbek*, and *Dalbergia sissoo* (Yousuf *et al.* 1993). The defoliating moth (*Taragama siva*) also reportedly infests and damages the leaves of *Acacia nilotica*, *A. senegal*, *A. tortilis*, *Moringa oleifera*, *Prosopis cineraria*, *P. juliflora*, and *Tamarindus indica* (Yousuf *et al.* 1993). The referred pests and diseases not only affect the quality of the timber and non-timber products of tree species but also reduce their ability to resist drought, climate variations and wildfires. Research results from the Forest Research Institute of Ghana (FORIG) and INERA of Burkina Faso, on how to manage some of these pests and diseases are hardly taken up in the field due mainly to the limited collaboration between the National Parks of the landscape and the research institutions.

D. Trans-boundary watersheds

The forest and tree pests and diseases considered in this section are those of the major parkland species such as found on the Niger – Nigeria trans-boundary watershed landscape. They include pests of important timber, non-timber and charcoal producing tree species around the four watershed areas as revealed by project studies (PGIE, 2007). These include; *Tamarindus indica*, *Faidherbia albida*, *Vachellia (Acacia) nilotica*, *Balanites aegyptiaca*, *Combretum nigricans*, *Pterocarpus erinaceus*, *Acacia seyal*, *Senegalia senegal*, *Prosopis juliflora*, *Ziziphus mauritiana*, *Sclerocaria birrea*, and *Diospyros mesmiliiformis*. The pests include the shoot infesting insect - *Oxyrachis tarandus*. The insect leads to the death of infested shoots of *Acacia nilotica*, *Albizia chinensis*, *A. lebbek*, *Cassia fistula*, *Dalbergia latifolia*, *Prosopis juliflora*, *P. cineraria*, and *Tamarindus indica* (Yousuf *et al.* 1993). Another widespread pest is the white fly – *Aleyrodids spp.* The pupae of white flies suck from under the leaves of *Acacia nilotica*, *A. senegal*, *A. tortilis*, *Albizia lebbek*, *Dalbergia sissoo*, *Prosopis cineraria*, and *P. juliflora* (Yousuf *et al.* 1993). Meanwhile the pale brown defoliating Lasiocampid moth - *Taragama siva*, infests; *Acacia nilotica*, *A. senegal*, *A. tortilis*, *Moringa oleifera*, *Prosopis cineraria*, *P. juliflora*, *Tamarindus indica*, and *Zizyphus mauritiana*. The referred pests not only affect the quality of timber and non-timber products of these tree species but also reduce their ability to withstand drought, climate variations and wildfires.

The basins of the Niger – Nigeria trans-boundary watershed are also infested by invasive wetland species i.e., bulrushes, reeds, water hyacinth (*Eichhornia crassipes*), *sida cordifolia*, and quelea birds. These favor silting, facilitate the installation of pests and diseases and compromise the tolerance of the landscape's ecosystems to the plights of climate change and its variability. There were no visible activities to combat tree diseases by the PGIE project.

Regional cooperation in the management of forest pests and diseases

There are no administrative frameworks for collaboration in the management of forest and tree pests and diseases for the West and Central African sub-regions. This is partly because of the absence of scientific information on pests and diseases for each of the several hundred species of indigenous moist forest trees and shrubs, as well as the geographical ranges of such plagues. Francophone countries of West and Central Africa however benefit from the forest research component of CORAF/WACARD, which undertakes, collates and shares research information on forestry themes including on pests and diseases of forest species with economically useful by-products such as those narrated in the preceding paragraphs.

3.6 Trends in forest and land management policies, practices, systems and impacts on sustainability of trans-boundary forest and woodland resources

3.6.1 Situation analysis and trends at the national policy levels

This section is an overview of the status and trends of conservation landscape management policies, and challenges in the four West and Central African countries visited, and assessed in the case of Sierra Leone. The analysis is in terms of how the assessed policy and related orientations facilitate or impede trans-boundary natural resource management with the objective to generate lessons.

(g) Niger

At the national level in Niger, the organ responsible for the development of forestry and environmental policies, by virtue of its cross-cutting orientation, is the National Council on Environment and Sustainable Development (CNEED). The CNEED is placed under the chairmanship of the Director of Cabinet at the Prime Minister's office. It is made of representatives of all government departments whose interventions are impacted by the environment. At the operational level, the Ministry of Hydraulics and Environment is responsible for the implementation of environmental and forestry policies with the collaboration of related agencies and partners. By Article 26 of Decree n° 2010-483/PCSRD/MEE/LCD2010-483/PCSRD/MEE/LCD of 10 June 2010, on the organization of the general department responsible for water, environment and the fight against desertification; the Department of Wildlife, Hunting and Protected Areas was established to oversee management of conservation landscapes in the country.

Niger has a number of renowned trans-boundary conservation and sustainable management landscapes, i.e. the "W" landscape, and the W-Arly-Pendjari (WAP). It also has a series of trans-boundary conservation watersheds under the integrated ecosystem management project between Niger and Nigeria and indulges in the joint management of the Lake Chad Basin with Nigeria, Chad, Cameroon and the CAR. It is also part of a trans-boundary rangeland restoration landscape i.e. the Liptako-Gourma, between Niger, Burkina Faso and Mali and entertains efforts towards establishing a trans-boundary ecological corridor between its

Termit/Tin Toumma National Nature Reserve and the Ouadi Rimé-Ouadi Achim / Manga-Eguey landscape in Chad. The country also participates in regional initiatives such as MIKE, NBA, Fouta Djallon Program and others. Article 172 of the Constitution of Niger authorizes the country to “enter agreement with any African country or regional community that may lead to partially or totally giving up its sovereignty in a bid to pursue African unity (Ministry of Hydraulics & Environment, Niger, 2012).

Despite significant planning effort at the national level, hindered by recurrent negative effects of climate change and drought, the combination of poverty and illiteracy constitute key inhibitors of sustainable forest and natural resource management, where the planned effort is not adequately pursued or reflected at the local natural resource management level. For example, the country’s target for managed forests by 2012 was 350,000 ha but by 2010, it had achieved only 7% of the target. In addition, its 2012 target for restored degraded land was 400,000 ha but by 2010, it had achieved only 16% of the target (Ministry of Hydraulics & Environment, Niger, 2012). Questionnaire results of this study revealed that while Niger has achieved significant strides in decentralization in natural resource management, there is an absence of simplified natural resource-based management plans at local level (component of communal development plans) to guide sustainable dependence by communities on natural resources. A keen interest in trans-boundary landscape management was noted during the field contacts of this study with experts proposing new trans-boundary landscapes such as the Madarounfo forest (Maradi area) and an agroforestry park (Zuinder) all between Niger and Nigeria.

(h) Sierra Leone

Sierra Leone is a post conflict nation whose recovery only began in 2000. The country’s Parliament promulgated an Act carried by the National Gazette Vol. CXLIII, n° 60 of 1st November 2012 creating: “The National Protected Area Authority and Conservation Trust Fund”. The new National Protected Area Authority of Sierra Leone (NPAASL) is headed by a Chairman, and accompanied by twelve members, nine of whom are representatives of government ministerial departments whose’ activities are impacted by protected area management. Responsibility for policy related to trans-boundary conservation landscapes, is captured in Section 2 (P) xiii of Part III of the Act, in which it authorizes the NPAASL to: “represent the Government of Sierra Leone in the negotiation of trans-boundary protected area agreements, and development and implementation of associated policies, strategies and management plans”.

At the operational level, responsibility for application of policies related to forest management, wildlife, and biodiversity conservation and management landscapes lies with the Forestry Division of the country’s Ministry of Agriculture, Forestry and Food Security (MAFFS). The country has two trans-boundary landscapes, both of which are fully gazetted on its side of the border but lack similar status on the other sides of the border. They include the Outamba-Kilimi / Madina-Oula landscape between Sierra Leone and Guinea, and the Gola forest complex between Sierra Leone and Liberia. The country is also implementing several trans-boundary ecosystem management initiatives with member countries of the Mano River Union. They include trans-boundary mangroves, trans-boundary watersheds, and trans-boundary species programs such as MIKE, GRASP, IBAs and others.

Despite the country’s high level of poverty, a general observation based on the comparative experience of the researcher of this study is that Sierra Leone has one of the highest levels of conservation consciousness in West and Central Africa. This is as a result of several decades of active sensitization at all levels of society by the Conservation Society of Sierra Leone (CSSL). For several decades, CSSL has played the key role of adviser to the country’s President on matters related to environment and conservation; and has been instrumental in

the gazettement of the country's national parks. It is currently a key member of the country's new National Protected Area Authority (NPAASL).

Despite the the environmental consciousness, section 2.4.3 of Sierra Leone's 2012 Forestry Policy states, that: "There are weak links with other institutions and a lack of coordination between government agencies at national and local levels to resolve conflicting policies, mandates and land use practices. This has contributed to ambiguity in land tenure, conflicting land uses, and unsustainable management practices". This is captured in the forestry policy which states as follows:

The Forestry Division is responsible for the management of Forest Reserves, however:

- Ministry of Mines and Mineral Resources is responsible for issuing licenses for prospecting and mining but no formal procedures or guidelines are in place for consultation with the Forestry Division before a prospecting or mining license is issued in the forest reserve.
- The Ministry of Lands recognizes individual rights to land under a 10 year adverse possession claim and grant titles without approval from the Forestry Division even when those lands are located in forest reserve areas.
- The Ministry of Tourism facilitates tourism development but there is no mechanism to consult with Forestry Division on site selection for potential tourism in Forest Reserves.
- District Councils have jurisdiction over activities in their districts and in some cases, have interpreted this to permit District Councils to negotiate concession agreements without consultation with the Forestry Division, etc.

Some of Sierra Leone's important forest reserves are located in trans-boundary conservation and sustainable management landscapes. Section 2.1 of the country's 2010 Conservation and Wildlife Policy, echoes the preceding conflict as follows: "Challenges to wildlife conservation are summarized as: ".....detrimental impacts on biodiversity of poor coordination, conflicting policies, conflicting mandates and land use practices at national, sub-national, local and community levels; Unclear and uncertain tenure arrangements of forest reserves, including those designated primarily for wildlife conservation....." This constitutes a handicap in monitoring and suppressing illegal activities around the country's trans-boundary management landscapes.

(i) Democratic Republic of Congo

In the DRC, forests, wildlife and conservation area policies are proposed by the Ministry of Environment and Sustainable Development, and then supposedly debated, approved and implemented by the National Consultative Council on Forests (CNCF). The CNCF and its provincial units were created by Ministerial Decision n°034/CAB/MIN/ECN-EF/2006 of October 2006 and completed by Decree n° 08/03 of January 2008. However, the CNCF is yet to become fully operational. It is made of representatives of other ministerial agencies, departments within the ministry of Environment and Sustainable Development as well as relevant partners whose interventions are directly impacted by forestry, biodiversity and conservation activities. The Ministry of Environment and Sustainable Development is made of two General Secretariats. 'Forest management' and 'conservation of nature' are two of eleven director-level departments located in the General Secretariat responsible for Environment and the Conservation of Nature. The Congolese Institute for the Conservation of Nature (ICCN), a semi-autonomous government agency under the tutelage of the Ministry of Environment and Sustainable Development supports implementation of conservation policies and administration of conservation areas. Funding of forest interventions including restoration is delegated to the

National Forest Fund (FFN). According to the country's Forestry Policy, the DRC contains 26 million hectares of forests in its network of protected areas covering 11% of the national territory.

The DRC has three trans-boundary conservation and sustainable management landscapes, namely: Lac Télé - Lac Tumba, Greater Virunga, and the Mayombe (Gabon has expressed desire to join). The country is also part of the trans-boundary Congo Basin watershed program within the framework of CICOS with COMIFAC countries as well as trans-boundary programs such as MIKE, GRASP, IBAs and others. Moreover, the DRC seeks to extend its conservation area coverage from 11% to 17% of the national territory in the medium term from 2012. In fact, the DRC has the largest forest area in Africa but lacks the human capacity to monitor its effective management. The country's forestry policy remarks that most of those intervening in the country's forests lack the technical management capacity and rarely work in harmony with the government department responsible for forests. The policy cites such sectors as responsible for the damage to the country's forests, notably: agriculture, rural development, lands and tenure, mines, hydrocarbons, territorial administration, energy, urbanization, public works and territorial management. New orientations in the management of conservation landscapes are captured in the country's 2012 Forestry policy, section 3.1.4, Strategic Axis n° 4 on biodiversity conservation as follows: to involve local populations in the management of conservation areas, and; to promote and use public-private partnerships in the management of the network of conservation areas. Involvement of the private sector in conservation area management is a welcome venture, with awaited lessons¹⁵. Experts filling questionnaires proposed new trans-boundary landscapes i.e. the Tshela region between RDC and Congo.

(j) Cameroon

In Cameroon, forestry, wildlife and conservation area policies are developed by the Ministry of Forests and Wildlife (MINFOF) and implemented by its decongested regional, divisional, sub divisional and district level components. Implementation is assisted by the National Forestry Agency (ANAFOR) – a semi-autonomous government agency associated to MINFOF, which undertakes forest restoration including around trans-boundary conservation and sustainable management landscapes. MINFOF, reorganized in 2004, initiated a reform process of the 1994 Forestry, Wildlife and Fisheries Regulations and submitted same to the country's Prime Minister in 2012. Funding for conservation area management is sourced from the "Special Fund for Management and Equipment of Conservation Areas and Wildlife Protection (FSP)" as well as from the "National Environmental and Sustainable Development Fund (FNEDD)". Cameroon has three trans-boundary forest conservation landscapes, namely; the Sangha Tri-National Landscape (TNS), the Dja-Minkébé-Odzala (TRIDOM) landscape and the potential Korup – Cross River trans-boundary landscape. The country is also implementing several trans-boundary ecosystem management initiatives with member countries of ECCAS, including: the Lake Chad trans-boundary basin between Cameroon, Chad, Niger, Nigeria and the Central African Republic; trans-boundary mangroves within the framework of the Gulf of Guinea Large Marine Ecosystem Program, and trans-boundary species programs such as MIKE, GRASP, CAWHFI, GSEAF, IBAs and others..

As in other countries of West and Central Africa, the country experiences a disconnect of coordination in the forest sector, where the Ministry of Forests and Wildlife (MINFOF) is responsible for issuing forest concessions and licenses for cutting timber, while the Ministry of Industries, Mines and Technological Development (MINIMIDT) is responsible for overseeing transformation of the cut timber, even as the Ministry of Commerce (MINCOMERCE) oversees

¹⁵ A public-private partnership was signed for the management of the Garamba conservation landscape starting in 2005 with ICCN representing the public partner and 'African Parks' representing the private sector partner (Misser, 2013). African Parks also manages the Virunga and other Parks in the Republic of Congo.

commercialization of the timber (MINEPDED – PNGE, 2009). Although a law on the management and development orientations of the Cameroon national territory has been promulgated by the country's National Assembly, the decrees for its application are still pending. Additionally, there is need to set up inter-ministerial platforms to coordinate land resource management challenges.

3.6.2 Policy trends of regional institutional frameworks on trans-boundary forest management landscapes

The first trans-boundary forest conservation landscapes in West and Central Africa were established long before the existence of intergovernmental regional policy frameworks as they are known today. The Greater Virunga trans-boundary landscape was established in 1925 and the "W" trans-boundary landscape in 1954 albeit as separate contiguous National Parks. From 1925 to 1965, a period of forty years, during which most West and Central African countries were still under colonial rule, there were no more than three recognized trans-boundary management landscapes in the referred sub-regions. From 1975 to 2015, forty years following independence however, there exists a relative proliferation of trans-boundary moist and dry forest landscapes, of which at least ten have procured high-level bilateral agreements and are currently operational, with several others on the verge of obtaining such agreements. It is obvious that regional policy frameworks, whose existence is relatively recent such as ECCAS/COMIFAC, ECOWAS, MRU, UEMOA and their regional program partners such as the Congo Basin Forest Partnership (CBFP), CARPE and others, have been instrumental in promoting these special collaboration landscapes by inciting strong national political will towards their creation. For example, there were no National Parks in Gabon prior to the year 2000 (European Commission, 2015), but by 2010 there were already 6 IUCN Categories 1 - IV National Parks, and by 2015, at least 3 trans-boundary conservation and sustainable management landscapes.

In West Africa, promotion of trans-boundary forest management landscapes by regional institutional frameworks is exemplified by the Regional Agricultural Investment Program of ECOWAS whose sub-program on 'improved management of other natural resources' includes trans-boundary forest ecosystems. Such landscapes targeted and promoted by the ECOWAS program include the Niokolo – Badair trans-boundary landscape between Guinea and Senegal, and the "W" trans-boundary landscape between Niger, Burkina Faso and Benin. ECOWAS proposes to invest 4.6 Million US Dollars into this initiative for five years, and seeks another 6.5 Million US Dollars from outside sources (Sall *et al.* 2009). Further west, the Mano River Union collaborates with the African Development Bank, the USFS and other partners towards the conservation and sustainable management of the Outamba Kilimi / Madina Ouala, the Nimba mountain complex, the Taï – Grebo landscape, and the Gola.

In Central Africa, ECCAS has delegated the development of regional forestry policy-making to COMIFAC. In its Strategic Axis n° 3 on conservation and sustainable use of biological diversity, COMIFAC's Convergence Plan proposes to: (a) improve the network of national and trans-boundary conservation landscapes to represent all terrestrial and aquatic ecosystems by 2025; (b) maintain integrity of trans-boundary conservation landscapes at 100% by 2025; (c) increase the number of trans-boundary conservation landscapes by 2025; (d) increase the surface areas of trans-boundary conservation landscapes by 2025; and (e) improve concerted management of trans-boundary conservation and sustainable management landscapes by 2025. This includes harmonization of policies and laws related to landscape management, pursuit of synergy in planning, synchronization of field methodologies, operational procedures, training and reporting. It also includes opportunities to share experiences through increased interactions and better relationships. Specialized institutions such as RAPAC together with the Congo Basin landscape partners i.e., CBFP, WWF, WCS, AWF, and others collaborate with COMIFAC to implement the afore mentioned policy directives.

A plethora of specialized technical regional agencies develop toolkits, methodologies, and conservation and sustainable forest management approaches made available to trans-boundary landscape partners. In Central Africa, such agencies include (a) the Forest Observatory of Central Africa (OFAC), which produces information on forest ecosystems of Central Africa through studies using special software, generating maps on forest cover changes and documents shared within the Congo Basin Forest Partnership (CBFP) framework; (b) the Observatory of Protected Areas of the Congo Basin (OBAPAC), which generates information on conservation areas including trans-boundary landscapes in Central Africa through studies that include exploitation of satellite data, producing specialized maps and related documents shared through the CBFP; (c) the Digital Observatory of Protected Areas (DOPA) which uses EU satellite data to generate pertinent information on conservation areas of the Congo Basin, shared through the CBFP; (d) the Intergovernmental Agency for the Development of Environmental Information (ADIE) – a COMIFAC affiliated agency which is the lead organization for the compilation of government related environmental statistics in the Congo Basin; (e) the African Water Facility (AWF), which finances operations in the Congo Basin towards improved knowledge and concerted management of water resources of the Basin on behalf of CICOS ;and (f) Organization for the Conservation of Wildlife in Africa (OCFSA), which tracks wildlife, undertakes monitoring studies and shares the information with RAPAC through the CBFP.

Other regional networks and programs likely to support trans-boundary landscape development and management affiliated to COMIFAC and the Conference on Dense and Humid Forest Ecosystems of Central Africa (CEFDHAC) include (a) the Support Program for Conservation of Congo Basin Ecosystems (PACEBCo); (b) Forest Youth Network for the Sustainable Management of Central African Forest Ecosystems (REJEFAC); (c) Network of Indigenous and Local Populations for the Sustainable Management of Central African Forest Ecosystems (REPALAC); (d) Network of African Women for Sustainable Development around Central Africa's Forest Ecosystems (REFADD); (e) Network of Parliamentarians for the sustainable management of forest ecosystems in Central Africa (REPAR); (f) Network of Forest and Environmental Training Institutions of Central Africa (RIFFEAC); (g) Community Radio Network for good governance, conservation and sustainable management of natural resources in Central Africa (RERAC); and (h) Central African Secretariat for Environmental Evaluation (SEEAC), etc.

In West Africa, specialized technical regional agencies that support or are likely to support trans-boundary conservation landscapes include (a) the Regional Agro-Hydro Meteorological Centre (AGRHYMET), a specialized agency of CILSS. AGRHYMET is specialized in agro-meteorological and hydrological monitoring at the regional level and produces cartographic, satellite and video-graphic resources for CILSS member countries; (b) the Economic and Statistical Observatory of Sub-Saharan Africa (AFRISTAT), which collects, processes and disseminates statistical information including on the rural and informal sectors such as cross border trade in charcoal or shear butter; (c) The Sahel Institute, (INSAH), which undertakes research on desertification and drought in the Sahel, and shares the results with member countries of CILSS; and (d) Thomson Reuters, which uses GIS data to undertake land tenure mapping for the promotion of biodiversity conservation and sustainable forest management at national and regional levels. Thomson Reuters specifically provides services to member countries of the Mano River Union through USAID's STEWARD and WA-BiCC programs. Other regional technical agencies providing and likely to provide information to enhance management of trans-boundary landscapes in West Africa include (a) the Liptako-Gourma Authority (ALG); (b) the West and Central African Council for Agricultural and Development Research (CORAF / WECARD); (c) Organization for the Conservation of Wildlife in Africa (OCFSA); (d) the Africa Water Facility (AWF); and (e) the West African Network of Parliamentarians for the Environment (REPES). Other observatories include those of the

Sahara and Sahel (OSS), of the Niger Basin, the Senegal basin, and the Fouta Djallon highlands.

These regional intergovernmental organizations, networks, programs and international technical development partners have contributed immensely: politically, technically and financially to get trans-boundary landscape management to its current state and level in West and Central Africa. As an example, independent consultants evaluating the CARPE II program in 2010 describe the Central African context at the start of the CARPE program in 1995 as follows: “The difficult social, political, and economic context at that time – not to mention the huge geographical area – presented such immense challenges that the CARPE program can only be thought of as - audacious. Large parts of the region suffered from wars and conflicts, and the countries were characterized by exceptionally low levels of institutional and human resource development, severe shortages of basic infrastructure, and pervasive problems of corruption”. The evaluation gives credit to the regional program as follows:

“One of the key lessons from CARPE I was that a narrow focus on protected areas (PA) was not sufficient for effective conservation of forests and biodiversity, so CARPE II initiated ...conservation and sustainable use strategies for the broader landscapes with their PA, extractive resource zones (ERZs), and community lands (CBNRM areas). CARPE has catalyzed a process in which these diverse stakeholders are brought together – very often for the first time – to develop a common vision for each landscape and set strategies and plans for their realization. NGOs have successfully developed new working partnerships with government services, local communities, logging, mining and oil companies, local authorities, traditional leaders and other local authorities in each of the landscapes. These diverse stakeholders --- use planning processes that divide each landscape into PA, ERZ, and CBNRM land use categories or macro-zones and create an overall framework plan for their conservation and sustainable use. This is followed by specific natural resource management plans for individual PA, ERZ and CBNRM macro-zones. The early successes of the landscape approach have rapidly attracted the attention of other donors, and CARPE has had such remarkable success in catalyzing very substantial additional financing that USAID quit counting the amounts. The most exceptional example is \$65 million in new funding for six of the landscapes from the African Development Bank.”

(ECODIT, 2010)

3.6.3 Trends in decentralization on the management of trans-boundary forests and savanna woodlands

According to Murombedzi *et al.* (2016), decentralization is an act by which a central government formally relinquishes powers to stakeholders and institutions at lower levels in a political-administrative and territorial hierarchy of government. It is specifically divided into democratic decentralization and de-concentration (Murombedzi *et al.* 2016). Decentralization in natural resource management engaged by West and Central African countries has its origin in the structural adjustment programs (SAPs) of the International Monetary Fund (IMF). The SAPs, initiated in the 1980s were designed with most of them emphasizing liberalization of economic activity, increased competition to reduce domestic costs, privatization, and more (Wood *et al.* 2000). The SAPs were followed by the World Bank-led Poverty Reduction Strategies (PRSPs). The PRSPs advocated decentralization in the management of natural resources as a governance strategy to ensure transparency, poverty reduction and economic development. Several constitutions and forestry policies in West and Central African countries were developed or modified to enshrine the strategy. These led to the birth of government ministerial departments whose role was to ensure effective devolution of government powers to provincial, regional, communal or community entities. For example in Cameroon, the Ministry of Territorial Administration and Decentralization (MINATD) took the challenge (a new

ministerial department focusing only on decentralization and related reforms was created recently in 2018), so did the Ministry of Decentralization and Territorial Management in the Democratic Republic of Congo (DRC), among others. The general observation however is that decentralization in natural resource management and devolution of powers to democratically elected institutions in West and Central African countries remains weak twenty years after the process was inscribed in their national policies. Research into why the process has been so slow revealed the following:

- One of the requirements for decentralization, especially when natural resources are concerned, is that institutions and entities to be empowered must be legal and democratic with clearly defined geographical jurisdictions. While geographical jurisdictions between regions, divisions, municipalities and communities within the same country may be known on paper, conflicts on tenure persist at the local level such as between community farmlands, grazing lands, national forests and other land uses. It is only now dawning on governments that, it is a daunting exercise to materialize such boundaries physically, especially for vast territorial expanses such as the DRC.
- Another major challenge facing decentralization is the reform required to support the process, especially related to public finances and macroeconomic sectors abiding on the levels of salaries, taxes, subsidies, incentives, etc. These may need to be harmonized for the country or remain different for each democratic entity based on the resources generated by the entity. Experience reveals that resource-wealthy entities usually resist sharing their natural wealth with poorer entities. It is for this reason that national level reform in the fiscal and macroeconomic sectors is strategic for success of devolution of powers. Such reform requires intimate knowledge of the extent and value of natural resources of the units to be empowered, as well as appropriate models and scenarios to guide the transfer of financial resources. Rather unfortunately, capacity to generate such knowledge is still in short supply.
- Another issue of contention is elite capture. Because of insufficient knowledge and lack of capacity and skills to explore opportunities at the level of decentralized units, elites take advantage to pursue ownership of large expanses of land for their personal exploitation. For example, when Decree of Application n° 95/531 PM of 23 August 1995 in Cameroon outlined procedures for the attribution of community forests, an investigation narrated in Wood *et al.* (2000), reports that "...the Law is also being subverted by civil servants who are registering community forests for their own use – generally for the sale of logging concessions".
- There is also the challenge of trust of local institutions. The fact that someone is voted to represent an institution may not imply that they are trustworthy and transparent. According to Murombedzi *et al.* (2016), the accountability and transparency of local chiefs was in doubt concerning the management of Ghana's Bontori Community Resource Management Area (CREMA), established in 2004. The chiefs were later accused of 'mismanagement and embezzlement'.

3.6.4 Trends in research and best practices for trans-boundary forest landscape management

This section assesses the existence of some adopted research and best practices and how they may affect managed trans-boundary forest and woodland resources.

Pertaining to wildfires, results from the ITTO funded: "Fire management and post-fire restoration with local community collaboration project, in Ghana", specify that one part of fire

prevention is to make an analysis of the fire risk and its causes on the landscape. Fires from agriculture such as in shifting cultivation, and those in rangelands to control vermin, insects and to encourage the growth of new pastures, are major causes of wildfire. Such wildfire is often the result of a failure to select the proper time, place, and method of burning or in the supervision and control of the burning operation. In order to minimize the number of escaped fires, there ought to be local regulations or bye-laws which require that: (a) a burning permit or other form of authorization is obtained; (b) burning is carried out only in designated areas; and (c) burning is carried out only under certain weather conditions (MLNR – Ghana, 2011). Wildfire management byelaws for trans-boundary landscapes need to integrate such prescriptions.

As concerns traditional agriculture in Sahel parklands; results from ICRAF research in Niger, Burkina Faso, Mali and Senegal, starting in the mid-nineties noted that the traditional agricultural system that had sustained the livelihood of several generations of Sahelian households was breaking down due to increased population pressure. Field research results in Niger discovered that integrating *Faidherbia albida* with cereals i.e. millet underneath the tress produced better crop yields. The research revealed that the nitrogen availability under *F. albida* trees compared to the open field was: 54.3 vs 22.7 kg N/ha while the phosphorus availability under *F. albida* tress compared to the open field was 7.57 vs 5.83 kg P /ha. Putting such results in practice has the potential to reduce extensive farming in trans-boundary management landscapes.

Pertaining to traditional farming in the humid tropics of Central Africa; research results of ICRAF's program on 'alternatives to slash and burn agriculture' starting in the nineties in the sub-region, revealed that improved fallow systems that could enhance food crop production, make it sustainable, and help mitigate declining soil fertility. The research revealed the agroforestry tree / shrub species with the highest demand for intercropping with staple crops of cassava, maize, and cocoyam to be *Calliandra equisetifolia*. In addition to improving soil fertility, providing fodder to livestock, stabilizing the soil against water erosion, serving as stakes for agricultural vines, further research on *Calliandra equisetifolia* revealed its high fuelwood value index (FVI) due to the species' provision of wood energy at the highest efficiency i.e., it has a shorter rotation cycle and high adaptability to different habitats and climates (Puri *et al.* in Nair *et al.* 2004). Adopting the use of this species in climate smart agricultural systems in trans-boundary landscapes of the Congo Basin has the potential to reduce the expansion of slash and burn agriculture and its negative effects.

In relation to overgrazing; while cattle husbandry plays an important role in poverty alleviation, the repeated movement and grazing of large quantities of livestock on any landscape leads to soil compaction, disturbance of the rooting system of vegetation and modification of the floristic composition of plants. Moreover when large quantities of cattle are trooped permanently or only overnight, their fecal release, if poorly located and not harnessed for agricultural production, is likely to be transported by erosion to contaminate the water sources of local populations or wildlife, leading to the spread of human and wildlife illnesses. Initiatives such as "Information Systems on Pastoralism in the Sahel (SIPSA)" is working in Sahelian countries to improve the image of livestock husbandry and reduce conflicts between grazers and farmers and in conservation areas by ensuring that grazers know the law, develop and respect management plans etc. The activities of SIPSA need to be taken up in all trans-boundary woodland savannah and parklands experiencing challenges of overgrazing.

Pertaining to logging; forestry research carried out in countries of West and Central Africa by TROPENBOS, CIFOR, and ITTO with the collaboration of national forestry research institutions produced good practices such as reduced impact logging along with criteria and indicators for sustainable forest management, which are now used in forest and forest products certification processes. The Smithsonian Institution is building capacity in logging methods that

enhance regeneration and related techniques in landscapes of the Congo Basin (Smithsonian Institution, 2007). Logging in trans-boundary areas should necessarily be associated with forest landscape restoration based on the ecosystem approach using assisted natural regeneration and / or enrichment plantings as proposed by the research results of TROPENBOS and others.

3.7 Proposed mechanisms for effective management of trans-boundary forests and woodlands

Trans-boundary conservation area management is all about partnerships and collaboration (Griffin, *et al.* 1991).

The mechanisms proposed in this section are for trans-boundary initiatives with existing bilateral or multilateral agreements, without which they will not have the legal authority to pursue collaboration with authors of trans-boundary landscape threats. In this regard, the proposals suppose that planning in managed cross-border landscapes should be totally integrated and if not, that they pursue common objectives, joint decision-making as well as considered as one ecological block. It is also supposed that some level of joint management exists with cooperation extending to at least six activities, as well as the existence of a joint consultative committee for cooperation in trans-boundary matters (Sandwath *et al.* 2001). The proposed mechanisms confer a special role to trans-boundary landscape management initiatives i.e. to convert unusual groups i.e. threat enablers, into conservation and sustainable management advocates and thereby expand management partnerships. This remains a difficult role due to the acute problems of tenure and poverty around trans-boundary landscapes but it is not impossible as demonstrated by WCS and the Congolese Ministry of Forest Economy in communities around the Lac Télé Lac – Tumba trans-boundary landscape narrated in section 3.2 (f) of this report.

The most common threats to the sustainable management of trans-boundary forests and their related water basins have been reported in section 3.4.1.2. The following section narrates how States, trans-boundary initiatives and their partners can organize to minimize the effects of shared weaknesses and threats with the goal of improving the management of resources on such landscapes.

3.7.1 Collaboration towards harmonization of policy differences and improved collaboration

Weaknesses resulting from differences in policy and challenges related to collaboration in the management of trans-boundary landscapes and measures to contain such deficiencies are captured by the Environmental Policy of the Economic Community of Central African States (ECCAS), the Convergence Plan of the Central African Commission on Forests (COMIFAC) and the Forest Convergence Plan of the Economic Community of West African States (ECOWAS). The linkages are depicted below:

ECCAS Environmental Policy

Strategic Axis n° 4: Conservation and sustainable management of Central African forests

Operational objective: Regional harmonization of approaches and concerted management of trans-boundary areas are improved

☞ *Target: Increase and improve experiences in joint management of trans-boundary resources*

ECCAS/COMIFAC Forest Convergence Plan

Priority Axis 1: Harmonization of forest and environmental policies

Operational obj. 1.1.2: Strengthen and harmonize policies, institutional frameworks and legislations

☞ *Target Result: National policies and laws integrating new orientations of the forest and environmental sectors are revised in a concerted manner in all countries of Central Africa.*

ECOWAS Forest Convergence Plan:

Strategic Axis 1: Harmonization of policies, legislative and regulatory decisions

Objective 1 and 2: The policies and legislative and regulatory decisions are harmonized

☞ *Target Result: 1.1.1.3 Develop, adopt and implement decisions related to decentralization*

☞ *Target Result: 1.1.2.2 Develop and vulgarize common sub-regional directives related to the management and conservation of forest and wildlife resources in view of their implementation*

Pertaining to policy differences, countries of ECCAS have all subscribed to the harmonization of their forest policies through the ECCAS/COMIFAC Convergence Plan, while those of ECOWAS are in the process of fully subscribing to the ECOWAS Forest Convergence Plan. The policy harmonization process is pursued through national legislative decisions (parliament in some countries and sector level ministerial departments in others). From exchanges during this study, challenges of coordination at the government sectorial levels are best addressed by instituting multi-sectorial and multi-stakeholder platforms as high impact governance pathways, facilitated by federating government bodies such as the Presidency, the Prime Minister's Office, the Ministry of Planning or Foreign Affairs. At the landscape level, the trans-boundary initiative is more likely to enlist collaboration and promote the landscape's management vision to actors within and across the border if it possesses the appropriate agreement, enlists the right partnerships and has the budget to sustain implementation of planned interventions. In addition to regional intergovernmental organizations, potential collaborators with the capacity to support and advocate policy harmonization, include: the Network of Parliamentarians for the Sustainable Management of Forest Ecosystems in Central Africa (REPAR), and the West African Network of Parliamentarians for the Environment (REPES).

3.7.2 Collaboration on policy related to the solution of land-use conflicts and challenges of tenure and tenure insecurity

The weakness of policy related to land-use conflict and challenges of tenure and tenure insecurity at the national level and around managed trans-boundary landscapes are captured by the ECCAS/ COMIFAC Convergence Plan, the ECOWAS Forest Policy and the ECOWAS Environmental Policy, as depicted below.

ECCAS/COMIFAC Forest Convergence Plan

Priority Axis 2: Management and valorization of forest resources

Operational objective 2.1.1: Reinforce planning and safeguarding of the forest estate

☞ *Target Result 1: Zoning of forest domain is integrated to national land-use plans*

☞ *Target Result 3: Land tenure rights of local and indigenous people is taken into account in planning and in forest legislations*

ECOWAS Forest Policy

Section 5.5: Integrating forestry and land-use planning with watershed management

Objective 5.5.2: Forestry should be fitted to overarching land-use planning, land capability classes and integrated watershed management

☞ *Target Result / Strategy: 5.5.3 (I): Agro-ecological zoning should be a basis for planning of land-use, including forestry in general and protected areas*

ECOWAS Environmental Policy**Strategic area n° 2: Promote the sustainable management of resources to improve the sub-regional economy and its consideration of the environment.**

Section 2.1: Improve the sustainable management of natural resources on the basis of principles, criteria and indicators established for the purpose

☞ *Target 2.1.1: Work towards improved tenure security which encourages commitments and investments in sustainable management operations of restoration and renewal of natural resources*

This study identified challenges of collaboration at three levels, (a) the national policy and institutional level; (b) the different sectorial levels of government; and (c) the trans-boundary field level, where landscape actors pursue goals most often with conflicting objectives. In countries of West and Central Africa, generally, forests are located on land with multiple overlapping traditional and statutory rights. Except for a few countries with advanced decentralization in natural resource management such as Senegal and Ghana, statutory law does not recognize customary land rights and those seeking such rights must apply for them. Conflicts also exist at the government sector level where for example, the ministerial department responsible for mining, grants mining exploitation licenses in conservation areas or in forest concessions. Most policies in countries of the target sub-regions have been advocating land use planning and zoning for over twenty years without real progress, mainly due to reticence related to the large expanse of national territories and the cost of effectively undertaking the process. The mechanism advocated here is at two levels, (a) at the landscape level using participatory mapping with resource users to delineate different use zones and (b) at the national level, using the internet and satellite technology in a participatory and well-coordinated manner to designate landscapes for different use categories. In this regard, potential collaborators include: organizations specialized or associated with the generation of satellite imagery or spatial research institutions such as the U.S. Geological Survey Earth Resources Observation and Science (USGS EROS) Center, the Satellite Observatory of Central African Forests (OSFAC), the US National Aeronautics and Space Administration (NASA) and others. Potential collaborators on challenges related to tenure and tenure insecurity may include the parliamentary networks of REPAR and REPES, Rights and Resources Initiative (RRI), and others.

3.7.3 Collaboration in the management of wildlife related crime and poaching

Trans-boundary landscape threats pertaining to wildlife related crime and poaching are captured by the ECCAS/COMIFAC Forest Convergence Plan as well as the ECOWAS Forest Convergence Plan as depicted below.

ECCAS/COMIFAC Forest Convergence Plan**Priority Axis 3: Conservation and sustainable use of biodiversity**

Operational objective 3.1.3: Strengthen measures and monitoring capabilities to fight against poaching and wildlife crime

☞ *Target Result 1: National & sub-regional anti-poaching strategies are developed and implemented*

☞ *Target Result 2: An advisory process is in place for the fight against smuggling of ivory and wildlife crime at sub-regional and international levels*

ECOWAS Forest Convergence Plan**Strategic Axis 4 : Conservation of protected areas and biodiversity**

Objective 4: Promote sustainable hunting

☞ *Target Result: 4.4.1.2: Sensitize actors on sustainable hunting practices*

Strategic Axis 5: Valuation of timber and non-timber forest resources

Objective 1: Enhance wildlife, tourism and wood industries

☛ *Target Result: 5.1.1.8 : Gain support of local populations, NGOs, and private individuals in view of the sustainable development of wildlife resources and protected areas*

The actors and enablers of wildlife related crime and poaching include local and commercial hunters, wildlife pet collectors, specialized bush-meat transporters and sellers. Most of these groups have existing networks in commercial towns a long way from the trans-boundary landscape. With the collaboration of relevant administrative authorities and partners in the different national administrative jurisdictions of the trans-boundary landscape, these networks should be identified and their representatives notified for collaboration with the trans-boundary initiative. This could be followed by establishing the appropriate collaboration mechanism with the networks, like protocols, specifying amongst others; prohibited areas for their activities on the trans-boundary landscape, sanctions, etc. Special training programs should be conceived for the network members, starting in broad terms with sensitization on the relevant international conventions, national policies and laws, vision of the landscape, and general awareness of conservation and sustainable management of biological resources. Occasional meetings should be encouraged to evaluate the sustainable management and conservation related activities of the networks. Potential collaborators include regional programs and organizations such as: the Great Apes Survival Partnership (GRASP), Organization for the Conservation of Wildlife in Africa (OCFSA), the African Elephant Specialist Group (AfESG), TRAFFIC – organization that tracks and monitors trade in wildlife and wildlife products (associated to the CITES¹⁶ Convention), Monitoring of the Illegal Killing of Elephants (MIKE), IUCN Species Survival Commission (SSC), the System for Monitoring of Bush Meat in Central Africa (SYVBAC), and others.

3.7.4 Collaboration in the management of unplanned cutting of wood and over-logging

Trans-boundary landscape threats pertaining to unplanned cutting of wood and over-logging are captured by the ECCAS/COMIFAC Convergence Plan, as depicted below:

ECCAS/COMIFAC Forest Convergence Plan**Priority Axis 2: Management and valorization of forest resources**

Operational objective 2.1.3: Ensure management of forest ecosystems

☛ *Target Result 1: Permanent and all the other type of forests are placed under management*☛ *Target Result 2: The standards and regulations of sustainable management are developed in a concerted manner and implemented*

Operational objective 2.2.2: Improve value-added in exploitation & transformation of forest resources

☛ *Target Result 1: NTFP and artisanal sectors contribute in the development of the local and national economies*

Operational objective 2.2.3: Reinforce legality and promote forest certification

☛ *Target 1: Systems of legality and traceability of forest products are developed and operational*☛ *Target 2: Incitation mechanisms for forest certification are developed and implemented.*

At the local trans-boundary level, the first step will be to identify and collaborate with administrative sector and municipal level authorities in the different national administrative areas of the trans-boundary landscape to identify the actors or enablers of unplanned cutting of wood i.e. illegal logging companies, clandestine chainsaw operators, charcoal makers, commercial firewood collectors, as well as direct artisanal wood collectors of the rattan, carving

¹⁶ Convention on International Trade in Endangered Species of Wild Fauna and Flora

and chewing stick cottage industries. The next step will be to work with sector and municipal level officials to organize these informal groups into syndicates or cooperatives or strengthen them if they already exist. This could be followed by establishing collaboration mechanisms with the groups such as memorandums of understanding (MoU) specifying i.e. prohibited areas for their activities on the landscape, sanctions etc. Special training programs could then thereafter be developed and dispensed to the groups starting broadly with the relevant national laws and policies, vision of the landscape, general awareness of conservation and sustainable management of biological resources, and narrowed to relevant technical themes such as; reduced impact logging, forest restoration techniques, timing of wild collections and collection methods etc. The objective is to empower the groups and syndicates towards sustainable production of their products. The trans-boundary initiative may consequently promote occasional evaluation forums of the activities of the syndicates or cooperatives. In addition to decentralized sector level ministerial authorities and municipal representatives, potential collaborators include organizations that facilitate or promote forest and forest product certification and build capacity in sustainable forest resource management, such as: the World Wildlife Fund (WWF), the Forest Stewardship Council (FSC), Smithsonian Institution, the Pan African Forest Certification Scheme (PAFC), and others.

3.7.5 Collaboration in the management of incompatible mining and quarries

Linkages between incompatible mining and quarries with the planning of regional intergovernmental economic commissions are captured in section 3.7.7.

Actors of incompatible mining and quarries are industrial entrepreneurs and artisanal mining campers installed in trans-boundary landscapes such as the Central African component of the TNS. In addition to causing physical degradation of soils and forests through digging operations, miners use chemicals that pollute water sources, divert streams in the case of alluvial mining, and enhance sedimentation with potential negative effects to human populations downstream, and harmful to wildlife. Artisanal miners in the Congo basin are usually migrants into the landscape with many, in countries such as the DRC and Central African Republic, retaining some sort of license to mine (Matthysen *et al.* 2013). Collaboration targeting miners should also involve relevant decentralized sector level officials, administrative and municipal authorities with the collaboration of specialized initiatives such as USAID promoted PRADD¹⁷ and POMIGER¹⁸ projects in the Central African Republic and the DRC. Local conventions can be signed with installed miners and training provided, starting with information on national policies and laws, knowledge of the Kimberly Process Certification Scheme (KPCS), vision of the landscape, general awareness of conservation and sustainable management of biological resources, forest landscape restoration and more. Local conventions should provide for forums to share challenges and assess progress on the implementation of landscape management commitments. Other potential collaborators include: the Extractive Industries Transparency Initiative (EITI), and the Central African Secretariat for Environmental Evaluation (SEEAC). In West Africa, where river basin organizations have experience in restoring degraded landscapes, collaboration in restoring abandoned mining sites in trans-boundary landscapes can be sought with the NBA¹⁹, LCBC²⁰, OMVS²¹, VBA²², and others.

¹⁷ Property Rights and Artisanal Diamond Development Project

¹⁸ Post-Mining Income Generating Environmental Rehabilitation Project

¹⁹ Niger Basin Authority (covers : Guinea, Mali, Burkina Faso, Niger, Nigeria, Benin, Cameroon, Chad, and Côte d'Ivoire)

²⁰ Lake Chad Basin Commission (covers : Chad, Niger, Central African Republic, Cameroon and Nigeria)

²¹ Senegal River Development Organization (covers: Senegal, Mauritania and Mali)

²² Volta Basin Authority (covers : Burkina Faso, Ghana, Benin, Côte d'Ivoire, Mali and Togo)

3.7.6 Collaboration on challenges related to transhumance, excessive grazing and wildfire

Trans-boundary landscape threats related to transhumance and the movement of cattle as well as overgrazing and wildfire are captured by the ECCAS Environmental Policy, the ECOWAS Forest Policy and the ECOWAS Forest Convergence Plan, as depicted below:

<p><u>ECCAS Environmental Policy</u> <i>Strategic Axis n° 1: Fight against soil degradation drought and desertification</i> Objective: identify and address causes and mechanisms of human and climate induced soil degradation, drought and desertification ☞ <i>Target: Identify and address causes of wildfires</i> ☞ <i>Target : Identify and address causes of excessive exploitation of biological resources</i></p>
<p><u>ECOWAS Forest Policy</u> Section 5: Forest policy implementation strategies Objective 5.3: Sustainable management of forests and biodiversity ☞ <i>Target 5.3.1.2: Improve cooperation in control of forest fires awareness and poor practices</i></p>
<p><u>ECOWAS Forest Convergence Plan</u> <i>Strategic Axis 3 : Forest ecosystem and reforestation</i> Objective 1: Support the development of forest ecosystems ☞ <i>Target Result: 3.1.1.8: Elaboration and implementation of cross-border pastoral management plans to facilitate livestock movement</i></p>

Collaboration that addresses challenges of transhumance, excessive grazing and wildfire in trans-boundary landscapes starts by working with relevant administrative and municipal authorities and partners to identify actors of the referred challenges. They include in the case of transhumance and grazing: mobile and sedentary cattle grazers, but also local livestock management agencies and veterinary services as they exercise considerable influence over cattle grazers. The next step is to engage livestock sector officials, related agencies and partners starting at the different national jurisdictional levels to organize sedentary and transhumance grazers into networks, or strengthen existing ones. This could then be followed by establishing the appropriate collaboration mechanism with the rejuvenated networks, i.e. local conventions, specifying amongst others; prohibited areas for grazing, authorized and prohibited passage-ways, and in the case of fires in pasture management; conditions for obtaining a burning permit, illustrations or maps of areas for burning, sanctions etc. Special training programs could then be eventually developed and administered to the network members, starting with the relevant national laws and policies, vision of the landscape, conservation awareness and narrowed to relevant technical themes such as; organization of grazing, propagation of improved fodder species such as *Faidherbia albida*, paddocking, timing and organization of cattle movements, wildfire management and; support of network evaluation forums. A potential collaborator could be: the Information Systems on Pastoralism in the Sahel (SIPSA) which works to improve the image of livestock husbandry and reduce conflicts in conservation and sustainable resource management areas.

3.7.7 Collaboration in managing the extension of subsistence farmlands and cash crops in trans-boundary management landscapes

The following section captures collaboration mechanisms for addressing threats to the sustainable management of trans-boundary landscapes due to insufficiencies in coordination, information exchange, training and extension. In this regard, the section specifically targets challenges related to the extension of subsistence farmlands and use of chemicals in trans-boundary landscapes, unmarked boundaries and internal migration, and incompatible mining and quarries. The coordination related challenges are captured by the ECCAS/COMIFAC

Forest Convergence Plan, ECOWAS Forest Policy, ECOWAS Environmental Policy and ECOWAS Forest Convergence Plan, as depicted below.

<p><u>ECCAS/COMIFAC Forest Convergence Plan</u> Priority Axis 5: Socioeconomic development and multi-stakeholder participation Operational objective 5.2.1: Operationalize networks and sub-regional platforms for multi-stakeholder dialogue <i>☛ Target Result 1: Sub-regional networks and multi-stakeholder consultation frameworks are operational at local, national and sub-regional levels</i></p>
<p><u>ECOWAS Forest Policy</u> Section 5.9: Regional cooperation and partnerships Objective: Management of trans-boundary cooperation <i>☛ Target Result / Strategy: To foster cross-border cooperation, an integrated joint task force could be established among the member countries to combat encroachment, poaching and illegal logging</i></p>
<p><u>ECOWAS Environmental Policy</u> Strategic area n° 2: Promote the sustainable management of resources to improve the sub-regional economy and its consideration of the environment. Section 2.2: Promote conservation and sustainable development of forests, wildlife and pastures <i>☛ Target: Promote further sustainable integration of the forestry sector and its products in the sub-regional economy and help develop sustainable subsistence systems of populations making use of wood and non-wood from trees and forests</i></p>
<p><u>ECOWAS Forest Convergence Plan</u> Strategic Axis 4 : Conservation of protected areas and biodiversity Objective 2: Conserve biodiversity of protected areas <i>☛ Target Result 4.2.1.3: Create frameworks to promote the participation of rural populations in the formulation and implementation of activities related to the management of wildlife reserves and trans-boundary parks</i></p>

The actors of extensive agriculture in managed trans-boundary landscapes are traditional subsistence farmers, but commercial agricultural entrepreneurs are also known to expand cash crops such as cotton especially around trans-boundary landscapes of savanna woodlands and parklands. In the case of subsistence farmers, they can be identified and targeted through their traditional and municipal representatives. Commercial cash crop entrepreneurs meanwhile may not colonize conservation areas but they use chemicals most of which could be harmful to wildlife when transported through erosion into protected areas. They operate through producer cooperatives and are best targeted through such mediums. These groups are variously identified around the trans-boundary landscape with the support of relevant sector level, administrative, traditional, municipal authorities and partners. The process for engaging subsistence farmers is different from that of commercial entrepreneurs and starts with the participatory development of simple land-use maps for areas within their jurisdictions. When developed and authorized by sector level and administrative officials, these simple maps, which contain planned-use and no-go areas, serve as part of the local convention between the trans-boundary initiative and farming groups. Training, targeting the groups could include information on the relevant national policies and laws, vision of the landscape, general awareness of conservation and sustainable management of biological resources, and with support from relevant research partners; narrowed to adapted farm cultural practices such as the use of multipurpose agroforestry species i.e. *Calliandra equisetifolia*. Protocols may be necessary with commercial farmers, through their cooperatives to limit the use of chemicals in managed landscapes. Potential collaborators include: the International Center for Research in Agro-forestry (ICRAF), the International Institute of Tropical Agriculture (IITA), the International

Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the Sahel Institute (INSAH), the Regional Agro-Hydro Meteorological Centre (AGRHYMET), and others.

3.7.8 Collaboration on challenges related to unmarked boundaries and internal migration

The boundaries of most National Parks in West and Central African countries are rarely materialized/reflected on the ground and less so the ecological corridors linking them to other Parks and Reserves across the border. Marking borders permanently can be a daunting exercise especially for large landscapes. Enablers of the referred challenges include local and migrant communities around trans-boundary landscapes with traditional and municipal leaders acting as their points of contact. The latter are known to permit installation of new migrant settlements in unoccupied landscapes. With the support of sector level and administrative officials, the relevant community and municipal leaders could be identified and organized for the participatory development of simple land-use maps covering areas on the landscape where they may have the legal rights to operate. When authorized by the sector level and administrative officials, the maps, which would contain identified conservation area borders based on known local landmarks, serve as part of the local convention between the trans-boundary initiative and community groups. Municipal authorities and community representatives could be called upon to participate in adapted steering committees where ensuing problems may be addressed. Potential collaborators pertaining to the management of migration, include: the International Organization on Migration (OIM), the IUCN Commission on Ecosystem Management (CEM), the United Nations High Commission for Refugees (UNHCR), and others. Pertaining to the marking of boundaries and related activities, public private partnerships could be developed with communities, and the private sector represented by organizations such as African Parks, and Wildlife Works, which are already involved in landscape conservation and management in the DRC and Congo.

3.7.9 Collaboration towards development of trans-boundary management plans

Weaknesses of poor management due to outdated or inexistent trans-boundary management plans and proposals for their improvement are captured by the ECCAS Environmental Policy, ECCAS/ COMIFAC Convergence Plan and the ECOWAS Forest Convergence Plan, as depicted below.

ECCAS Environmental Policy

Strategic Axis n° 6: Conservation and sustainable management of trans-boundary natural resources of Central Africa

Objective: Strengthen trans-boundary network of protected areas

☞ *Target: Increase and diversity protected ecosystems and improve the quality of monitoring and biodiversity indicators.*

ECCAS/COMIFAC Forest Convergence Plan

Priority Axis 3: Conservation and sustainable use of biodiversity

Operational objective 3.1.1: Strengthen network of national and trans-boundary protected areas representative of all terrestrial, aquatic and marine ecosystems

☞ *Target Result: The management plans of protected areas (PA) and trans-boundary protected areas are developed and/or updated and implemented according to the sub-regional standard*

ECOWAS Forest Convergence Plan

Strategic Axis 4 : Conservation of protected areas and biodiversity

Objective 2: Conserve the biodiversity of protected areas

☞ *Target Result: 4.2.1.1: Development and implementation of management plans for parks, wildlife reserves and other border areas of ecological interest.*

The development of a trans-boundary or regional landscape management plan depends on an agreed justification for the necessity of the trans-boundary landscape, existence of National Parks or Reserves or proposed thereof on both sides of the border, minimum land tenure conflict, and a cooperation agreement between the landscape countries involved. The management plan is necessarily developed in a participatory manner with a core multidisciplinary team, and involving representatives of the different actors of the landscape at the different government sector levels, technical development partners, civil society, local communities and others. It can also be developed using the same sector-level framework and multidisciplinary team at the different national levels, and harmonized by experts at the regional trans-boundary level. The plan itself is a tool, which guides and regulates management interventions on the trans-boundary landscape for the medium to long term i.e. five to ten years. Annual operation plans could then be developed by trans-boundary landscape personnel to guide operations on a yearly basis, based on the management plan. The plan announces the vision of the landscape, the goals and objectives of its different geographical parts based on results of specialized studies, biological inventories, socioeconomic surveys and corresponding maps and sketches. The trans-boundary landscape is complex and different zones i.e. ecological corridors, forest reserves, forest concessions, community forests etc. require particular management interventions as well as detailed and distinct action plans. The mechanism for developing the action plans should necessarily be participatory.

3.7.10 Collaboration to improve trans-boundary technical management capacity

The weakness of inadequate technical capacity for the management of trans-boundary landscapes is captured by the ECCAS Environmental Policy, the ECCAS/COMIFAC Convergence Plan and the ECOWAS Forest Convergence Plan, as depicted below.

<p><u>ECCAS Environmental Policy</u> <i>Strategic Axis n° 7: Capacity building for implementation of international agreements</i> Objective : Support training and information exchange in the application of international agreements ☞ <i>Target: Capacity of human resources and national institutions is developed and strengthened to implement and comply with regional and international agreements.</i></p>
<p><u>ECCAS/COMIFAC Forest Convergence Plan</u> <i>Priority Axis 3: Conservation and sustainable use of biodiversity</i> Operational objective 3.1.1: Strengthen network of national and trans-boundary protected areas representative of all terrestrial, aquatic and marine ecosystems ☞ <i>Target Result: Human resources, materials and techniques for the management of Protected Areas and Trans-boundary Protected Areas have increased and/or strengthened</i></p>
<p><u>ECOWAS Forest Convergence Plan</u> <i>Strategic Axis 3 : Forest ecosystem and reforestation</i> Objective 1: Support the development of forest ecosystems ☞ <i>Target Result: 3.1.1.7: Support national teams in the development and implementation of wildlife management plans by countries with a shared and /or cross border</i></p>

In addition to the relevant technical training in landscape ecology, effective management of trans-boundary landscapes require knowledge and practical experience in the development of the landscape's management plan. Excellent interpersonal management skills are needed to facilitate collaboration in the effective administration of different interventions at all levels of the landscape. Each national component of the landscape is necessarily managed by a team capable of assuming rotating regional coordination of specific aspects of the whole trans-boundary landscape, according to agreed management arrangements between the bordering countries. This implies general operational knowledge of the institutional, administrative, judicial and social processes of the neighboring country or countries and specific knowledge

at the landscape level. Noteworthy that a national component of the trans-boundary landscape may have several directors i.e. one or two directors according to the number of National Parks, Chief Warden of a Forest Reserve, Manager of a Community Forest, head of a specific zoological or botanical Sanctuary etc. The management team should also be knowledgeable of the operations of the different components of a National Park i.e. administration, protection, ecological monitoring, research, recreation and tourism, public relations, education and sensitization, etc. The technical level of trans-boundary landscape management personnel at the national or regional level can be upgraded starting with a capacity needs assessment and fulfilled by using resource persons for internal trainings, seminars and workshops followed by iterative monitoring and evaluation processes. The Smithsonian Institution has been improving management capacity in landscapes of the Congo Basin (Smithsonian Institution, 2007).

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusions

This study reveals that the driving forces for the degradation of managed trans-boundary forest landscapes, namely population growth, poverty, skewed market arrangements and environmentally insensitive policies are common in countries of West and Central Africa. The top four weaknesses and threats common to both trans-boundary moist forest landscapes and savanna woodlands are: policy differences and problems of collaboration; wildlife related crime and / or poaching; unplanned cutting of wood and / or over-logging; and incompatible mining or quarries. These challenges are being addressed with different degrees of success. From highlighted cases, it can be deduced that success would be higher if trans-boundary initiatives created functional partnerships with relevant specialized programs and networks operating in the regions. Such collaboration would facilitate the trans-boundary initiative's role of expanding local sustainable forest management partnerships by building capacity and transforming enablers of forest degradation into advocates of sustainable forest management. Successful cases have been highlighted where together with technical development partners the Smithsonian Institution, POMIGER and others have been engaged to achieve such transformation.

The report highlights the pertinent role of regional intergovernmental economic commissions, regional programs, regional networks and technical development partners in advancing trans-boundary forest landscape conservation and management to the current level of 'keen interest' in West and Central Africa. The report also underscores the following points:

- Trans-boundary landscape management agreements exist between cross-border communities and between trans-boundary conservation units. These informal or formal low-level conventions usually predate the bilateral agreements signed between countries, providing broad operational legality to the trans-boundary initiative. It is this legal agreement that attracts the attention of pertinent international partners, notably aid agencies.
- Trans-boundary forest landscape management is an extension of the limited trans-boundary forest or biodiversity protection approach, whereby unlike the latter, the former targets biodiversity conservation, including watershed protection, and local economic development through participatory land-use planning on a larger scale. It includes protected areas of different categories; extractive resource zones; community

settlement and development areas; and plans for sustainable or long-term funding through the establishment of trust funds.

- The trans-boundary forest management landscape provides an opportunity to apply adapted research results and good cultural practices in areas such as wildfire management; tree and forest pests and diseases; appropriate tree germ-plasm for restoration; forest rehabilitation techniques, forest product certification, etc.
- As local conservation and sustainable forest management partnerships mature, trans-boundary management initiatives will be able to help in checking gross illegal trans-boundary trade in forest products between countries. Experience-sharing forums on the merits of legality by transformed landscape actors will constitute an asset for up-scaling.
- Collaboration in trans-boundary landscape management through public private partnerships is taking root. This may help establish sustainable production hubs of bio-merchantable products that could be branded for regional and international markets. The advantage is to diversify from ecological tourism as the mostly single revenue source of the landscape and safeguard from any possible decline of this source.

This study revealed considerable available capacity in terms of: results from centers of excellence ready to be used in trans-boundary forest landscape management; existence of political will towards decentralization and the establishment of trans-boundary management initiatives; the presence of several partners external to the regions ready to provide support; a large number of regional networks prepared to engage; a multiplicity of trans-boundary forest management initiatives with experiences to share; and intergovernmental regional frameworks with policies that promote concerted trans-boundary forest landscape management. The challenge is how to capture and channel these strengths and opportunities for the creation of new trans-boundary areas, and for the effective operation of existing ones.

4.2 Recommendations

1. Studies to be undertaken before the establishment of trans-boundary forest management landscapes or prior to updating the management plans of functional trans-boundary landscapes should include research into available and potentially useful partnerships taking account of political and socioeconomic weaknesses and major threats on the resources of the landscape.
2. Considering the change in orientation from trans-boundary landscapes solely focused on conservation through protected areas, to multipurpose landscapes that include the conservation of biodiversity through the sustainable management of a large number of socioeconomic challenges on a broader landscape; government departments responsible for the supervision of such landscapes should modify the terms of references of their responsible services accordingly.
3. Other government ministerial departments that intervene in the rural sector with reportedly conflicting objectives to biodiversity conservation and sustainable forest landscape management should be sensitized and the terms of references of their services updated as part of the trans-boundary agreement process.

4. National governance platforms for exchanges between government sector ministerial departments likely to affect the management outcome of trans-boundary forest landscapes should be instituted to ensure adequate coordination and avoidance of conflicts.
5. An office or regional clearing-house for trans-boundary forest landscape management initiatives should be established at the level of each regional intergovernmental economic commission in order to facilitate coordination and conformity with the regional standard. It should also serve as a consultation and facilitation center for the certification of trans-boundary forest management initiatives.
6. Governments sharing trans-boundary landscapes under concerted management should promote and facilitate the development of useful partnerships between their initiatives and other organizations. Technical development partners supporting implementation of these initiatives should also promote and facilitate such partnerships.
7. At the field level, operational plans of trans-boundary forest landscape initiatives should include capacity building in the management of partnerships. When developing budgets, provisions should be made for the creation and servicing of partnerships.
8. Networks should be developed between trans-boundary landscape management initiatives in West and Central Africa taking account of the diversity of species in moist forest landscapes and savanna woodlands as well as mountain, mangroves and watershed areas with the goal of improving livelihoods and consequently contribute towards attainment of the UN Sustainable Development Goals.
9. Networks of municipal authorities / principal traditional leaders with forest trans-boundary management landscapes in their administrative jurisdictions should be promoted to facilitate exchange of experiences including on planning, partnerships and fundraising.
10. Appropriate forest trans-boundary management landscapes should be identified and promoted as “peace and collaboration landscapes” in line with the ‘free zone’ concept, in high conservation border areas where military conflict prevails or is likely to prevail, with the collaboration of all factions.

ACKNOWLEDGEMENTS

This study was coordinated by the African Forest Forum Secretariat. It will not have been undertaken without the financial support of the Swedish International Development Agency (Sida), the administrative guidance of officials of government ministerial departments responsible for policy, program development and supervision of forestry, wildlife, environment, and conservation areas in countries visited. The countries include: Niger, Democratic Republic of Congo and Cameroon. A fourth country i.e. Sierra Leone was not visited but data was received through online exchanges and complemented by information from earlier visits to the country. In each of these countries, government representatives, specifically: Secretary-Generals, Directors-Generals of Forestry, Directors of Wildlife and Conservation Areas received the consultant, provided supportive documentation and identified government experts who responded to the consultant's questionnaire. The consultant expresses gratitude to these officials and experts.

Equally instrumental for the success of this study were representatives of regional economic commissions, semi-autonomous government agencies, technical development partners, centers of excellence and the private forest sector. These promote, supervise and or implement activities in trans-boundary forest management landscapes. They include, for Niger: the national Director-General of the Great Green Wall for the Sahara and Sahel Initiative – Mr. Maisharou Abdou and his collaborators, the Coordinator of the trans-boundary ecosystem management project between Niger and Nigeria – Mr. Souley Aboubakar and his collaborators, the forestry expert at AGRHYMET – Dr. Maguette Kaire, the environmentalist at the Niger Basin Authority (NBA) headquarters – Mr. Jean Abdias Compaore, the Coordinator of EIP-Niger – Mr. Salifou Assane and his collaborators, the technical adviser for FAO projects – Mr. Wata Issoufou Sama, the UEMOA Expert in Niger Mr. Salifou Mahamadou, the former Secretary-General at the Ministry of Environment and Sustainable Development of Niger and general facilitator of government responses for this study – Mr. Alassane Makadassou, and others. For the Democratic Republic of Congo: the Head of Cabinet at ICCN – Mr. Paul N'lemvo Budiongo and his collaborators of questionnaire-filling experts; Environmental Officer at CARPE – Mr. Toussaint Molenge; the Landscape Officer at the World Wildlife Fund (WWF) – Mr. Menard Mbende, and others. For Cameroon: the Executive Secretary of COMIFAC and his Environmental Officer – Misters Raymond Ndomba'a Ngoyé and Michel Djatsana respectively; the WWF Conservation Director, and Forest Officer – Mr. Cléto Ndikumangenge, and Mr. Nbert Sonné respectively; the IUCN Country Program Coordinator – Dr. Leonard Usongo and his collaborators, and others. The consultant expresses gratitude to all these and those who could not be named because of lack of space.

The preliminary report of this study was presented to an audience of experts during a regional forum organized by the African Forest Forum Secretariat in Accra, Ghana in July of 2017. It received clear and targeted contributions during the forum, from the Head of the Forestry Division of the Department of Environment at ECOWAS; the expert responsible for forest economy and sustainable management of forests at ECCAS, and the Officer in Charge of the African Natural Resources Centre of the African Development Bank (AfDB). Others providing targeted contributions during the experts forum included Mr. Yanick Nkoulou representing the private forest sector of Cameroon and Madame Watta Camara representing the N'Zérékoré Forest Centre of Guinea. To these, the consultant also expresses his appreciation and gratitude. Among the AFF Staff, the consultant particularly expresses gratitude to Drs. Doris Mutta and Paul Donfack Senior and Program Officer respectively at the African Forest Forum Secretariat in Nairobi, Kenya, for their effective and quality support, guidance and supervision during this study.

REFERENCES

ABN. 2007. Etude d'élaboration du programme et projet d'investissement nécessaires à la mise en œuvre de la vision partagée.

ABN. 2013. Domaines et centres d'intérêts et de convergence de l'ABN et de la CEDEAO en matière de forêts et de foresterie.

Ambler, J. 1999. Attacking Poverty while Improving the Environment: Practical Recommendations.

ANBO. 2007. Source book of Africa's River Basin Organizations. Produced by Warner Consultants Ltd of Kampala Uganda as a desk study on behalf of African Network of Basin Organizations (ANBO), African Ministers Council on Water (AMCOW) and GTZ.

African Wildlife Foundation. 2003. Study on the Development of Trans-boundary Natural Resource Management Areas in Africa: Kilimanjaro Heartland Case Study.

Baillie, J. E. M., Hilton-Taylor, C. & Stuart, S. N. (Eds) 2004. 2004 IUCN Red List of Threatened Species. A Global Species Assessment. IUCN, Gland, Switzerland and Cambridge, UK. A Publication of the IUCN Species Survival Commission. (SSC).

Bdliya, H. H., Bloxom, M. 2010. Projet d'Analyse diagnostique Transfrontalière du Bassin du Lac Tchad.

Bénin/Burkina Faso/Niger. 2008. Accord relatif à la gestion concertée de la Réserve de Biosphère Transfrontalière du W.

Bermúdez-Lugo, O. 2016. The Mineral Industry of the Central African Republic. 2013 Minerals Yearbook. USGS.

Billand, A., De Visscher, M.N., Kidjo F.C., Compaore, A., Boureima, A., Morel, A., Camara, L., Czesnik, F., Ahoyo Adjovi, N.R. 2004. "Plan D'aménagement et de Gestion de la Réserve de Biosphère Transfrontalière W - 2006-2010".

Blom, A. (Unpublished). Atlantic Equatorial Coastal Forests. Prepared for WWF.

Blom, A. (Unpublished). Western Congolian Swamp Forests. Prepared for WWF.

Blom, A. (Unpublished). Northwest Congolian Lowland Forest Ecoregion. Prepared for WWF.

Blom, A., Schipper, J. (Unpublished). Northeastern Congolian Lowland Forests. Prepared for WWF.

Bonkougou, E., Yao Gnabeli, R. 2010. Etude sous régionale sur les orientations potentielles pour le programme du Dialogue sur les Forêts en Afrique de l'Ouest.

Borrini-Feyerabend, G., Hamerlynck, O. 2005. Seconde mission d'appui à la Gestion des Ecosystèmes Transfrontaliers, Burkina Faso et Ghana : 22 février au 5 mars 2005. Rapport pour l'UICN.

Brockley Combe Backwell, 2008. Northern Savanna Biodiversity Strategy and Action Plan of Ghana.

CARPE. 2007. [Dja-Odzala-Minkébé \(TRIDOM\) Landscape](#).

CARPE. 2010. Evaluation of the Central Africa Regional Program for the Environment – Phase II. Made possible with the support of the United States Agency for International Development (USAID). Prepared by ECODIT.

CARPE. 2011. CARPE 2010 Annual Report (October 2009 – September 2010). USAID/CARPE Activities in the COMIFAC/PFBC Landscapes in Support of the COMIFAC Convergence Plan.

CARPE. 2015. Lac Télé Lac Tumba : Un paysage du Partenariat pour les Forêts du Bassin du Congo.

CBD. 2005. Report of the inter-sessional (second) meeting of the ad-hoc technical expert group on the review of implementation of the program of work on forest biological diversity. Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA). UNEP/CBD/SBSTTA/11/INF/2 of 28th April 2005.

CBFP. 2007. [Dja-Odzala-Minkébé \(TRIDOM\) Landscape](#). Landscape Document n° 15.

CBFP. 2005. The Forests of the Congo Basin: A Preliminary Assessment. http://carpe.umd.edu/products/PDF_Files/FOCB_APrelimAssess.pdf

CEPF. 2005. Guinean Forests of West Africa Hotspot. Upper Guinean Forest Briefing Book. Prepared for: Improving Linkages Between CEPF and World Bank Operations, Africa Forum, Cape Town, South Africa—April 25 –27, 2005.

CICOS. 2015. Schéma Directeur d'Aménagement et de Gestion des Eaux de la CICOS (SDAGE). Etat des lieux 2015.

Clamote-Rodrigues, D. & Fischborn, M. (eds) .2016. Solutions in focus: Trans-boundary Protected Area solutions. Gland, Switzerland: IUCN.

Clark, L.E., Sunderland, T.C.H. 2004. The Key Non-Timber Forest Products of Central Africa: State of the Knowledge. Technical Paper n° 122. SD Publication Series Office of Sustainable Development Bureau for Africa. U.S. Agency for International Development (USAID).

COMIFAC. 2014. Plan de Convergence pour la Gestion durable des Ecosystèmes Forestiersd'Afrique Centrale 2015-2025.

Conservation International. 1999. From the Forest to the Sea: Biodiversity Connections from Guinea to Togo. Regional Scientific Priorities for the Conservation of Biodiversity.

Denny, P., (ed). 1985. The ecology and Management of African Wetland Vegetation. Dr. W. Junk, The Hague.

Denny, P. In M. Finlayson, M. & Moser, M. (Eds). 1991. African Wetlands. International Waterfowl and Wetlands Research Bureau. Facts on File, Oxford, UK.

de Wasseige C., de Marcken P., Bayol N., Hiol Hiol F. et Mayaux Ph., Desclée B., Nasi R., Billand A., Defourny P., & Aba'a Atyi, R. 2012. Les Forêts du Bassin du Congo – états des Forêts 2010. Une production d'OFAC.

Diop, E.D. (ed.) 1993. Conservation and Sustainable Utilization of Mangrove Forests in Latin America and Africa Regions. Part II – Africa. International Society for Mangrove Ecosystems and Coastal marine Project of UNESCO. Mangrove Ecosystems Technical Reports N° 3.

East, R. 1999. African Antelope database 1998. IUCN/SSC Antelope specialist group. IUCN, Gland, Switzerland and Cambridge, UK.

Ebodé, J.V.N. (Ed). 2012. La gestion coopérative des ressources transfrontalières en Afrique centrale : Quelques leçons pour l'intégration régionale. Une production de Friedrich Ebert Stiftung, Yaoundé Cameroun.

ECODIT. 2010. Evaluation of the Central Africa Regional Program for the Environment (CARPE), Phase II,

ECOWAS. 2007. ECOWAS Forest Policy.

ECOWAS. 2007. ECOWAS Forest Policy – Developed in the Framework of ECOWAS Common Agricultural Policy (ECOWAP).

Erg, B., Vasiljević, M., McKinney, M. (eds.). 2012. Initiating effective trans-boundary conservation: A practitioner's guideline based on the experience from the Dinaric Arc. Gland, Switzerland and Belgrade, Serbia: IUCN Program Office for South-Eastern Europe.

European Commission. 2015. Larger than elephants : Inputs for the design of an EU strategic approach to Wildlife Conservation in Africa. Volume 4: Central Africa. Final report.

FAO – FRA. 2015. Global Forest Resources Assessment, 2015.

FAO, 2010. Evaluation des Ressources Forestières Mondiales 2010. Rapport Principale. FAO – Forêt n° 163.

Fund, W. 2014. Eastern Guinean forests. Retrieved from http://editors.eol.org/eoearth/wiki/Eastern_Guinean_forests

Gichora, M., Kojwang, H., & Bosu, P. 2017. The status and trends of forest and tree pests and diseases management in Africa. AFF Working Paper (3) 3. African Forest Forum, Nairobi.

Gouvernement du Cameroun. 2013. Loi N° 2011/008 du 06 mai 2011 d'Orientation pour l'Aménagement et le Développement durable du Territoire au Cameroun.

Government of Cameroon. 1994. Cameroon forest law N° 94-01 of 1994.

Government of Sierra Leone. 2010. Forestry policy.

Government of Sierra Leone. 2010. Conservation and Wildlife Policy.

Hamerlynck, O., Borrini-Feyerabend, G. 2006. Troisième mission d'appui à la Gestion des Ecosystèmes Transfrontaliers. Mali et Burkina Faso, 16 novembre – 4 décembre 2006. Rapport pour l'Union Mondiale pour la Nature (UICN).

Hamerlynck, O. 1999. The Diawling National Park: Joint Management for the Rehabilitation of a Degraded Coastal Wetland.

Hilton-Taylor, C. (ed). 2000. IUCN Red List of Threatened Species. IUCN, Gland, Switzerland and Cambridge, United Kingdom.

Hughes R.H. Hughes, J.S. 1992. A Directory of African Wetlands. IUCN, Gland Switzerland and Cambridge UK/ UNEP, Nairobi, Kenya/ WCMC, Cambridge, UK.

Hugo, R., Twagirashyaka, F. 2010. Case Study 1 - Community-Based Natural Resource Management Land Use Planning: Lessons Learned from the Lac Télé Community Reserve. Land-use planning Section 1.

Isebor, C.E. & Awosika, L.F. 1993. Nigerian Mangrove Resources, Status and Management. In: Diop, E.D. (ed.) Conservation and Sustainable Utilization of Mangrove Forests in Latin America and Africa Regions. Part II – Africa. International Society for Mangrove Ecosystems and Coastal Marine Project of UNESCO. Mangrove Ecosystems Technical Reports 3.

IUCN/PACO. 2013. Invasive plants affecting protected areas of West Africa. Management for reduction of risk for biodiversity. Ouagadougou, BF:IUCN/PACO.

IUCN/WCPA. 2015. Strategic Framework for Capacity Development in Protected Areas and other Conserved Territories 2015-2025.

Kelman, I. (Unpublished). Southern Congolian Forest-Savanna Mosaic. Prepared for WWF.

Kelman, I. (Unpublished). Northern Congolian Forest Savanna Mosaic. Prepared for WWF.

Kelman, I., Burgess, P. (Unpublished). Guinean Forest-Savanna Mosaic. Prepared for WWF.

Kelman, I. (Unpublished). Northern Congolian Forest Savanna Mosaic. Prepared for WWF.

Konaté, S & Kampmann D. (eds). 2010. Biodiversity Atlas of West Africa, Volume III: Côte d'Ivoire. Abidjan & Frankfurt/ Main.

Lauginie, F., Aveling, C., Chatelian, C. 2008. Evaluation Finale et Prospective du Programme Parc Regional Parc W/ECOPAS. Programme Union Européenne au Bénin, au Burkina Faso et au Niger.

Lebbie, A.R. (unpublished). Western Guinean Lowland Forests. <https://www.worldwildlife.org/ecoregions/at0130> .

Magin, C. (Unpublished). Sahelian Acacia Savanna. Prepared for WWF.

Magin, C. (Unpublished). West Sudanian Woodland Savanna. Prepared for WWF.

Makaya, J.F. 1993. Mangroves in Congo. In E.D. Diop, editor. Conservation and Sustainable Utilization of Mangrove Forests in Latin America and Africa Regions. Part II – Africa. International Society for Mangrove Ecosystems and Coastal Marine Project of UNESCO. Mangrove Ecosystems Technical Reports volume 3.

McGinley, M. 2014. Eastern Guinean Forests. Prepared for WWF.

Mathu, W., Namata, K., Salami, A. 2011. Terminal Evaluation of the UNEP GEF project:

“Integrated Ecosystem Management of Trans-boundary Areas between Nigeria and Niger (Phase I – Strengthening of Legal and Institutional Frameworks for Collaboration and Pilot Demonstrations of IEM)”.

Matthysen, K., Clarkson, I. 2013. Gold and diamonds in the Central African Republic. The country’s mining sector, and related social, economic and environmental issues. Produced with the support of ActionAid Nederland and Cordaid.

Mbarga, B. 2010. 3e Recensement Général de la Population et de l’Habitat. Rapport de présentation des résultats définitifs. Bureau Central des Recensements et des Etudes de Population. Yaoundé, Cameroun.

MH/E, WWF and IUCN. 1996. La Réserve Naturelle Nationale de l’Aïr et du Ténéré. Ministère de l’Hydraulique et de l’Environnement, World Wide Fund for Nature and World Conservation Union, Gland, Switzerland.

MINAEPAT. 2002b. Province du Sud. Schéma directeur régional d’aménagement et de développement durable du territoire (SDRADDT).

MINEPDED – PNGE. 2009. Diagnostic de la situation de l’Environnement au Cameroun.

Ministry of Hydraulics & Environment – Niger /Ministère de l’Hydraulique et de l’Environnement du Niger. 2012. Appui à la Préparation du Plan de Convergence pour la Gestion et l’utilisation durables des Ecosystemes Forestiers en Afrique de l’Ouest. Rapport Pays.

Minnemeyer, S. 2002. An analysis of access into Central Africa’s Rainforests. World Resources Institute, Washington DC.

Misser, F. 2013. Les Aires Protégées en République Démocratique du Congo : Menaces et Défis. Revue trimestrielle de conservation de la nature et de gestion durable d’Ardenne et Gaume. 3e trimestre 2013. Volume 68 Fascicule 3.

Mockrin, M., & Thieme, M. (Unpublished). Lake Chad Flooded Savannah. Prepared for WWF Prepared for WWF.

Mogba, Z., Freudemberger, M. S. 1998. Les Migrations Humaines dans les Aires Protégées de l’Afrique Centrale: Cas de la Réserve Spéciale de Dzanga-Sangha.

Mogba, Z. 1999. Etude des systèmes locaux de Gestion des Ressources Forestières a Djoum. Cameroun.

Mogba, Z. 1996. Evaluation participative de la dimension de la participation des Acteurs socio-économiques sur le bassin versant du Lac Tchad en République Centrafricaine. Global Environment Facility/PNUD. Bangui. 1996.

Murombedzi, J., Ribot, J., Walters, G. 2016. Responsive Forest Governance Initiative (RFGI): Supporting Resilient Forest Livelihoods through Local Representation. CODESRIA Council for the Development of Social Science Research in Africa. Avenue Cheikh Anta Diop, Angle Canal IVBP 3304 Dakar, CP 18524. <https://www.researchgate.net/publication/320170481>

National Geographic. (Undated). Western Congolian forest-savanna mosaic.

- NDES. 1997. The Niger Delta Environmental Survey (phase 1), Environmental and Socio-economic Characteristics, Lagos-Nigeria: Environmental Resources Managers limited.
- NEPAD/UNEP. 2003. Action Plan for the Environment initiative of the New Partnership for Africa's Development (NEPAD).
- Nianogo, A. 2008. Le Ghana et le Burkina Faso d'accord pour la gestion concertée des écosystèmes partagés. Rapport de facilitation de l'accord. UICN. Ghana.
- Ngoufo, R., Nouhou N. & Parren, M. 2012. État des lieux de la situation économique, écologique et sociale actuelle de l'espace Camerounais du TRIDOM. Tropenbos International – Programme du Bassin du Congo, Wageningen, Pays-Bas.
- Oates, J. F., Bergl, R. A. & Linder J. M. 2004. Africa's Gulf of Guinea Forests: Biodiversity Patterns and Conservation Priorities. *Advances in Applied Biodiversity Science (AABS) No. 6*, October 2004.
- OMVS/ Projet FEM/Bassin du Fleuve Sénégal. 2007. Analyse Diagnostique Environnementale Transfrontalière du Bassin du Fleuve Sénégal. Synthèse Régionale.
- Orwa C, A., Mutua, K. R., Jamnadass, R.S A. 2009. Agroforestry Tree Database: a Tree reference and selection guide version 4.0 (<http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp>)
- PGIE, 2007. Projet de Gestion Intégrée des Ecosystèmes entre le Niger et le Nigeria. Composante du Niger. Several / Various project reports.
- Poilecot, P., Loua, Nema-Soua. 2009. Les feux dans les Savanes des Monts Nimba, Guinée. *Bois et Forêts des Tropiques*, 2009, n ° 301 (3).
- Poulin, T. 1999. Plan d'aménagement du massif de Djoum-Mintom. Paysage Transfrontalière de Dja-Minkébé-Odzala (TRIDOM). Cameroun.
- Programme Régional Parc W / ECOPAS. 2005. Plan d'Aménagement et de Gestion de la Réserve de Biosphère Transfrontalière W. 2006-2010. Volume I : Etat des lieux.
- Ray, J.C., and R. Hutterer. 1996. Structure of a shrew community in the Central African Republic based on the analysis of carnivore cats, with the description of a new *sylvisorex* (Mammalia; Soricidae). *Ecotropica* 1: 85-97.
- Refisch J., Herbinge, I., Craig, R., Doumbé-Billé, S., Watson, C., Hammill, A., Jenson, J., Moussa, T. 2009. Final Report on the Workshop for a trans-boundary Initiative to create a landscape corridor between Côte d'Ivoire and Liberia in the Tai-Sapo Complex.
- Sackey, I., Laing, E. & Adomako, J.K. 1993. Status of the Mangroves of Ghana. In: Diop, E.D. ed. Conservation and Sustainable Utilization of Mangrove Forests in Latin America and Africa Regions. Part II – Africa. International Society for Mangrove Ecosystems and Coastal Marine Project of UNESCO. Mangrove Ecosystems Technical Reports 3.
- Saenger P. & Bellan M.F. 1995. The Mangrove vegetation of the Atlantic Coast of West Africa. A review. Laboratoire d'Ecologie Terrestre. Centre National de la Recherche Scientifique. Université de Toulouse III.

Sall, P.N., Kagone, H., Saine, A., Alinon, K., Boye, O., Bengaly, Z. 2009. Formulation et mise en œuvre d'un Programme Régional d'Investissement Agricole (PRIA). Sous-programme gestion améliorée des autres ressources naturelles partagées de la CEDEAO.

Sambolah, R. 2001. Information focusing on Mount Nimba as it relates to the Liberian side presented at the Tri-national meeting 12-14 September 2001, Man, Cote d'Ivoire. (Unpublished).

Sandwith, T., Shine, C., Hamilton, L., Sheppard, D., Phillips, A (ed). 2001. Aires Protégées Transfrontalières pour la paix et la coopération. Une Production de la Commission Mondiale des Aires Protégées (CMAP). Collection *Guides des meilleures pratiques pour les aires protégées* N° 7.

Sandwith, T., Lockwood, M. & Gurung, C. 2006. Linking the Landscape. In: Lockwood, M., Worboys, G. & Kothari, A. (Eds). *Managing Protected Areas: A Global Guide*. UK & USA. Earthscan.

Smithsonian Institution. 2007. Building Capacity for Science-Based Conservation Management across the Congo Basin. CARPE Phase II A/SI/Reports/Final Report.

Sournia G. 1998. Les Aires Protégées d'Afrique Francophone. Editions Jean-Pierre de Monza.

STEWARD/MRU/Darwin Initiative. 2010. Workshop Report on Trans-boundary Harmonization for Biodiversity Conservation: Policy and Management. Sanniquellie, Nimba County, Liberia 4 – 8 October 2010.

The World Bank. 1993. Ecologically Sensitive Sites in Africa. Volume 1: Occidental and Central Africa. Compiled by the World Conservation Monitoring Center for the World Bank, Washington DC, USA.

Tognetti, S. (Unpublished). Guinean Mangroves. Prepared for WWF.

Tognetti, S. (Unpublished). Central African Mangroves. Prepared for WWF.

Twagirashyaka, F., Bila-Isia, I. 2009. Lake Télé-Lake Tumba Landscape. A land-use planning document for CARPE.

UICN/PACO. 2010. Parcs et Réserves du Niger : Evaluation de l'efficacité de gestion des aires protégées. Ouagadougou, BF: UICN/PACO.

UNEP-GEF Volta Project. 2013. Volta Basin Trans-boundary Diagnostic Analysis. UNEP/GEF/Volta/RR 4/2013.

UNEP. 2007. Mangroves of Western and Central Africa. UNEP-Regional Seas Programme/UNEP-WCMC. Available online at: http://www.unep-wcmc.org/resources/publications/UNEP_WCMC_bio_series/26.htm.

UNEP-GEF Volta Project, 2013. Volta Basin Trans-boundary Diagnostic Analysis. UNEP/GEF/Volta/ RR 4/2013. Ghana.

USAID. 2014. Mid Term Performance Evaluation of Steward III: Sustainable and Thriving Environments for West Africa Regional Development.

Usongo, L., Nzooh, Z. 2009. Sangha Trinational Landscape. A land-use planning document for CARPE.

van der Linde, H., Oglethorpe, J., Sandwith, T., Snelson, D., & Tessema, Y (with contributions from Anada Tiéga and Thomas Price). 2001. *Beyond Boundaries: Trans-boundary Natural Resource Management in Sub-Saharan Africa*. Washington, D.C., U.S.A. Biodiversity Support Program.

Vasilijević, M., Zunckel, K., McKinney, M., Erg, B., Schoon, M., Rosen Michel, T. 2015. Trans-boundary Conservation: A systematic and integrated approach. Best Practice Protected Area Guidelines Series No. 23, Gland, Switzerland: IUCN.

White, F. 1983. The vegetation of Africa, a descriptive memoir to accompany the UNESCO/AETFAT/UNSO Vegetation Map of Africa.

Wood, A., Stedman-Edwards, P., Mang, J. 2000. The Root Causes of Biodiversity Loss. A WWF Publication. Produced by Earthscan Publications Ltd., London and Sterling, VA.

WWF. 2001. Central African Mangroves (AT1401). WildWorld WWF Full Report. http://www.worldwildlife.org/wildworld/profiles/terrestrial/at/at1401_full.html.

WWF. 2003. Biological Priorities for Conservation in the Guineo-Congolian Forest and Freshwater Region. Proceedings of a Workshop held on March 30 - April 2, 2000 in Libreville, Gabon. Kamdem Toham, A., Olson, D., Abell, R., D'Amico, J., Burgess, N., Thieme, M., Blom, A., R. W. Carroll, R. W., Gartlan, S., Langrand, O., Mikala Mussavu R., O'Hara, D., Strand, H., & Trowbridge, L. (Eds). Available from: <http://www.worldwildlife.org/ecoregions>.

WWF and IUCN. 1994. Centers of plant diversity, a guide and strategy for their conservation. WWF and IUCN, Oxford, UK.

Yousuf, M., Gaur, M. 1993. Some noteworthy Insect Pests of 'Prosopis juliflora' & other species.

ANNEX 1: KEY INFORMANT QUESTIONNAIRE

Study on trans-boundary forest resources in West and Central Africa

Objective: This questionnaire seeks to answer the question: “What have we learnt from trans-boundary forest resources and their management in Africa, and what scientific elements can we document for the future?”

Introduction

This study is commissioned by the African Forest Forum (AFF) – a Pan-African institutional platform that undertakes independent and objective analysis, advocacy and advice on policy and technical issues related to sustainable management, use and conservation of Africa’s forests. Its major goal is to secure and ensure sustainable management of the continent’s forest capital so as to reduce poverty, promote gender equality and economic and social development in the continent. AFF is implementing an initiative, titled: “Strengthening Sustainable Forest Management in Africa”. The venture seeks to generate and share knowledge on policy options and capacity building for improved forest management that better addresses poverty eradication and environmental protection in the continent. It is within this context that AFF has commissioned this study on trans-boundary forest and woodland vegetation and related environmental issues in Africa. Through this study, AFF seeks to appreciate the achievements and gaps, and to evaluate trends in land management practices and systems and how they impact sustainability of trans-boundary forest resources with recommendations for the way forward.

The results of this study will be made public through the AFF website (www.afforum.org). They will also be presented and debated in professional forums to include amongst others, the main economic commissions of Africa with a forestry mandate, in order to reach a wider audience.

Subjects: This questionnaire contains 5 questions and a matrix. The subjects are managers, promoters and institutional stakeholders of trans-boundary forest / watershed initiatives (for all questions) and if possible local communities at the trans-boundary landscape level for questions 1, 2 and 4.

Please answer only the questions whose answers you are at least 50% sure to be correct. Do not attempt questions about which you are unfamiliar.....please leave them blank.

Personal Information

Name of respondent _____ Date: _____

Country _____

Agency _____

Trans-boundary conservation area (if any) _____

Questions

1a. Based on your experience, what are the 5 major threats to trans-boundary forests? Choose the first 5 threats from list below, starting with N° 1 as the most important and N° 5 as least important.

N°	Encroachment through traditional agriculture
	Encroachment through expanding local settlements
	Encroachment by transhumance and excessive grazing
	Unplanned fires / Wildfires
	Unplanned cutting of wood and or over-logging
	Incompatible mining or quarries
	Invasion by refugees or internal migrants
	Improper NTFPs removals facilitating forest fragmentation
	Land-use conflicts and problems of tenure
	Poor management due to outdated trans-boundary management plans
	Poor management due to inadequate capacity
	Negative effects from development projects: dams, roads, pathways
	Excessive / inappropriate tourism and recreation
	Invasive species, forest or wildlife diseases and pests
	Encroachment due to poor knowledge of boundaries
	Policy differences and challenges of collaboration
	Wildlife related crime and poaching
	Other

1b. Which among your five choices of threats to trans-boundary ecosystems above, can best be resolved mainly through collaboration from both sides of the frontier?

2. Based on your experience, select 2 mechanisms or platforms used by the trans-boundary initiative to eliminate conflicts or to collaborate with stakeholders. Indicate N° 1 as most successful mechanism.

N°1	

3. Based on the experience of your organization, indicate 2 major achievements or results of the trans-boundary initiative. Indicate N° 1 as the most important achievement.

N°1	

4. Based on your experience, indicate 3 ways in which the trans-boundary initiative has helped to improve the livelihoods of local people. Indicate N° 1 as the most important success.

N°1	

5. Based on your intimate knowledge, what are the 3 major outcomes / effects of the Research & Development Component / Technical & Scientific Committee of the trans-boundary initiative? Indicate N° 1 as the most important outcome. Are there other landscapes that you envisage as new trans-boundary areas? Which and why?

N°1	

Actors / Institutions	Requested Information	Responses
	<ul style="list-style-type: none"> • What is your institution's experience in managing wildfires in cross-border areas? • What is your institution's experience in restoring degraded or fragmented trans-boundary ecosystems? • What is your institution's experience in managing conflicts on trans-boundary land? • What is your institution's experience in popularizing or building capacity on (appropriate) cultural techniques in a cross-border area? • How has your institution managed the illegal exploitation of natural resources in cross-border areas (woodcutting, gold panning, quarries, etc.)? 	
	<ul style="list-style-type: none"> • What is your institution's experience in managing the ecosystem in cross-border refugee reception areas? 	
	<ul style="list-style-type: none"> • What is the impact of national policies on trans-boundary ecosystems? 	
<ul style="list-style-type: none"> - Municipal Authorities - Development Partners - Civil Society 	<ul style="list-style-type: none"> • What is the impact of decentralization on the management of trans-boundary ecosystems? 	

Thank you for your participation in this study

ANNEX 2: FOREST DATA FOR WEST AND CENTRAL AFRICAN COUNTRIES FROM 1990 TO 2015 IN 1,000 HECTARES

	1990	2000	2005	2010	2015
Benin	5761	5061	4811	4561	4311
Burkina Faso	6847	6248	5949	5649	5350
Cape Verde	58	82	84	85	90
Cameroon	24316	22116	21016	19916	18816
CAR	22560	22404	22326	22248	22170
Chad	6705	6326	6141	5508	4875
Congo Braza	22726	22556	22471	22411	22334
Côte d'Ivoire	10222	10328	10405	10403	10401
DRC	160363	157249	155692	154135	152578
Equat Guinea	1860	1743	1685	1626	1568
Gabon	22000	22000	22000	22000	23000
Gambia	442	461	471	480	488
Ghana	8627	8909	9053	9195	9337
Guinea	7264	6904	6724	6544	6364
G. Bissau	2216	2120	2072	2022	1972
Liberia	4929	4629	4479	4329	4179
Mali	6690	5900	5505	5100	5715
Niger	1945	1328	1266	1204	1142
Nigeria	17234	13137	11089	9041	6993
Senegal	9348	8898	8673	8473	8273
S/Leone	3118	2922	2824	2726	3044
Togo	685	486	386	287	188
S/T-Principe	56	56	56	54	54
Burundi	289	198	181	253	276
Rwanda	318	344	385	446	480
	346579	332405	325744	318696	313998

Source: FAO (2015). Pages 9 – 14.



African Forest Forum

A platform for stakeholders in African forestry



For more information contact:

The Executive Secretary
African Forest Forum
United Nations Avenue, Gigiri
P.O. Box 30677-00100, Nairobi, Kenya
Phone: +254 20 722 4000, Fax: +254 20 722 4001
Email: exec.sec@afforum.org; Website: www.afforum.org

