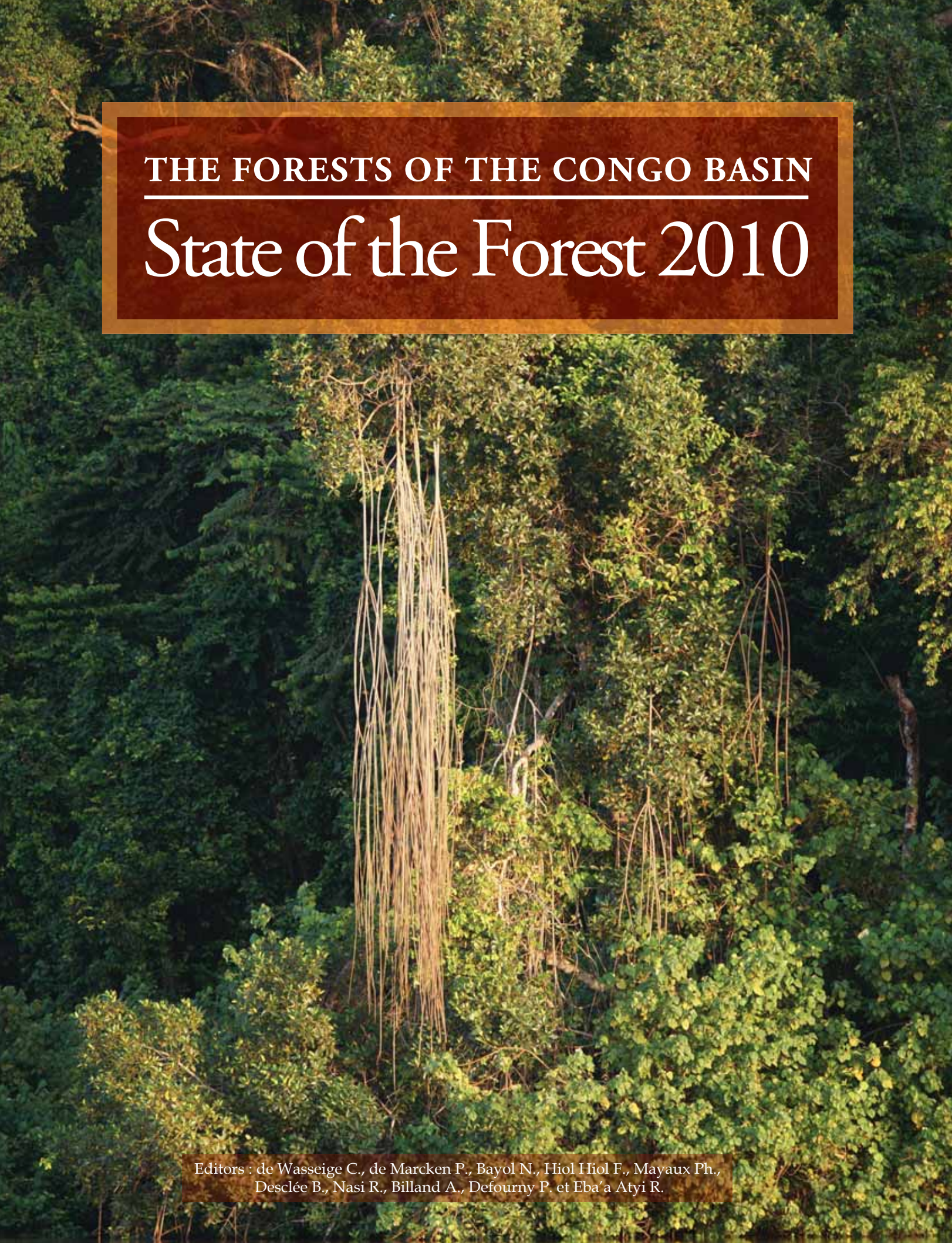


THE FORESTS OF THE CONGO BASIN

State of the Forest 2010

Editors : de Wasseige C., de Marcken P., Bayol N., Hiol Hiol F., Mayaux Ph., Desclée B., Nasi R., Billand A., Defourny P. et Eba'a Atyi R.

The Forests of the Congo Basin – State of the Forest 2010

Editors: de Wasseige C., de Marcken P., Bayol N., Hiol Hiol F., Mayaux Ph., Desclée B., Nasi R., Billand A., Defourny P. and Eba'a Atyi R.

Cover picture: Riparian forest, Gabon. © Bruce Davidson – provided by RAPAC

The State of the Forest 2010 is a publication of the *Observatoire des Forêts d'Afrique centrale* (OFAC) and the Congo Basin Forest Patnership (CBFP)
http://www.observatoire-comifac.net/ - http://www.cbfp.org

The required citation is: The Forests of the Congo Basin - State of the Forest 2010, Eds: de Wasseige C., de Marcken P., Bayol N., Hiol Hiol F., Mayaux Ph., Desclée B., Nasi R., Billand A., Defourny P. and Eba'a Atyi R – 2012. Publications Office of the European Union. Luxembourg. 276 p. ISBN: 978-92-79-22716-5, doi:10.2788/47210

Cataloguing data can be found at the end of this publication.

Luxembourg: Publications Office of the European Union, 2012

ISSN Collection: 1018-5593
ISBN 978-92-79-22716-5
doi:10.2788/47210

Printed in Belgium

Printed on recycled paper

THE FORESTS OF THE CONGO BASIN

State of the Forest 2010

Table of contents

List of contributors

Coordination

de Wasseige Carlos - OFAC *

Text review and revision

Bedoret Brigitte
de Marcken Paya - WWF
de Wasseige Carlos - OFAC *
Desclée Baudouin - JRC
Bayol Nicolas - FRM (France) *

Translation

Clarke Susan
Lebeau Christine
d'Huart Jacqueline
Heuse Emmanuel - BTC

Map design

Wala Alphonse - OFAC
de Wasseige Carlos - OFAC *

Page design and setting

Peter Lasu Fataki
de Wasseige Carlos - OFAC *
Bedoret Brigitte

Scientific committee

Michel Baudouin - ERAIFT/UNESCO
Lumbuenamo Raymond - WWF *
Mankoto Samy - UNESCO
Methot Pierre - WRI
Delvingt Willy - ATIBT
Tsagué Louis - EFG (Cameroon) *
Justice Chris - UMD (United States)
Lejoly Jean - ULB (Belgium)

Authors

Abernethy Katharine - Stirling University
Angu Kenneth - IUCN
Assembe Samuel - CIFOR (Central Africa)
Bassaler Nathalie - Futuribles
Bayol Nicolas - FRM (France) *
Beck P. James - USFS (United States) *
Bélanger Lyna - WRI
Billand Alain - CIRAD (France)
Boesch Christophe - Max Planck Institute for Evolutionary Anthropology
Boundzanga Georges Claver - CNIAF (Congo) *
Bouyer Olivier - ONFI
Carr-Dirick Brigitte - FTNS
Cerutti Paolo Omar - CIFOR
Creighton Ken - WWF
de Wasseige Carlos - OFAC *
Defourny Pierre - UCL (Belgium)
Delhage Celine - UCL (Belgium)
Demarquez Benoît - TEREA *
d'Huart Jean-Pierre - Conservation Consultancy Service SPRL
Dirou Sophie - TEREA (Gabon) *
Drigo Rudi - FAO
Dupain Jef - AWF
Eba'a Atyi Richard - CIFOR *
Ernst Céline - UCL (Belgium)
Fargeot Christian - CIRAD (France)
Fisher Jean-François - WRI
Fomete Thimothée - FTNS
Fondjo Thomas - CAWHFI/UNESCO
Guay Bruno - REDD National Coordination (DRC)
Hamel Olivier - CIRAD (France)
Hansen Matthew - SDSU (United States) *
Heuse Emmanuel - BTC
Hubert Didier - PARPAF (CAR)
Hugel Bruno - REDD National Coordination (DRC)
Ingram Verina - CIFOR
Junker Jessica - Max Planck Institute for Evolutionary Anthropology
Kanu Mbizi Léon - REDD National Coordination (DRC)
Karsenty Alain - CIRAD (France)
Kasulu Vincent - DRC Climate Focal Point
Kirchgatter Johannes - NASA Jet Propulsion Laboratory (JPL)
Kühl Hjalman - Max Planck Institute for Evolutionary Anthropology
Kümpel Noëlle F. - ZSL
Lanata Francesca - National Botanical Garden (Belgium)
Languy Marc - AGRECO GEIE
Legault Faustin - PAPPFG (Gabon)
Leprohon Robert - MECNT (DRC)

Lescuyer Guillaume - CIFOR/CIRAD *
Lusenge Thierry - WWF
Maïdou Hervé - PARPAF (CAR) *
Makoloh François - WWF
Malele Sébastien - DIAF/MECNT (DRC)
Mankoto Samy - UNESCO
Marien Jean-Noël - CIRAD (France)
Mayaux Philippe - JRC
Mendoula Essiane Edouard - CIFOR (Central Africa) *
Methot Pierre - WRI
Michel Baudouin - ERAIFT / UNESCO
Midoko Iponga Donald - IRET
Milliken Tom - WWF
Möbius Yasmin - Max Planck Institute for Evolutionary Anthropology
Nackoney Janet - UMD (United States)
Nakoé Gaston - CDF (CAR) *
Nasi Robert - CIFOR
Nchoutpouen Chouaibou - COMIFAC Executive Secretariat
Ndong Obiang Anne-Marie - ANPN (Gabon)
Ndoye Ousseynou - Regional Project NTFP/FAO *
Nkoua Méthode - CRDPI
Noiraud Jean-Marie - JMN Consultant
Pasquier Alexandra - FRM (France)
Pélissier Cyril - WWF
Pénelon Alain - CIRAD
Pérodeau Bruno - WWF
Raondry Noëline - ERAIFT
Ringuet Stéphane - University of Copenhague, TRAFFIC
Rossi Xavier - FRM (France)
Saatchi Sassan - NASA Jet Propulsion Laboratory (JPL)
Salbitano Fabio - University of Florence (Italy)
Schure Jolien - CIFOR (Central Africa) *
Shapiro Aurélie C. - WWF
Sidle John G. - USFS (United States)
Steil Matthew - WRI
Tadoum Martin - COMIFAC Executive Secretariat *
Tchamou Nicodème - CARPE *
Tieguhong Chupezi Julius - FAO (Cameroon) *
van Vliet Nathalie - University of Copenhague, TRAFFIC
Verhegghen Astrid - UCL (Belgium)
Vivien Catherine - FRM (France)

Other contributors

Altstatt Alice - UMD (United States)
Bakanseka Jean - Marie - OFAC *
Bararwandika Astère
Battini Jean-Luc - CIRAD (Central Africa) *
Begoto Grégoire - PARPAF (CAR) *
Bonassidi Grégoire - DFAP/MEF (Congo) *
Daraste Gérard - KfW (Cameroon) *
Davies Diane - UMD (United States)
Delvingt Willy - ATIBT
Desclée Baudouin - JRC
Dubois Grégoire - JRC
Dupanloup Jacques - GFBC (Cameroon) *
Edjang Jose Rafael - MFA (Equatorial Guinea)
Edjang Nsue - MFA, COMIFAC (Equatorial Guinea) *
Esono Fidel - MFA (Equatorial Guinea) *
Essiben Yvette Claude - CPR/CEFDHAC (Cameroon) *
Flynn John - CARPE-USAID (United States) *
Fouth Danièle - GIZ (Cameroon) *
Haman Adama - MINFOF (Cameroon) *
Hart Terese - Consultant
Hiol Hiol François - OFAC *
Ibara Marcel - WRI (Congo) *
Justice Chris - UMD (United States)
Kamdem Toham André - WWF-CARPO (Cameroon) *
Ko Jason - USFS (Cameroon) *
Kondjo Shoko André - DIAF/MECNT (DRC) *
Koy Kondjo Héritier
Makak Jean-Sylvestre - WRI (Gabon)
Makon Samuel - GIZ (Germany)
Marelli Andrea - JRC
Mbitikon Raymond - COMIFAC Executive Secretariat *
Mendomo Biang Jean-Daniel - MINFOF (Cameroon) *
Mertens Benoit - IRD - France
Moulnang Tal - MERH-COMIFAC (Chad) *
Mukongo Rémy - ATO (Gabon)
Musampa Christophe - DIAF/MECNT (DRC) *
Mwamba Philomène - DGF (DRC) *
Nana Céline - COMIFAC Executive Secretariat *
Ncogo Motogo Roberto
Ndjebet Cécile - Cameroon Ecology NGO (Cameroon) *
Ndomba Ngoye Raymond - MEF- COMIFAC (Gabon) *
Neba Shu Gidéon - WRI (Cameroon) *
Ngandjui Germain - TRAFFIC (Central Africa) *
Ngengabanyikwa Félix - MEEATU-COMIFAC (Burundi) *
Njifakue Isaac - IMCS (Cameroon) *
Nkolo Martial - GIZ (Cameroon) *
Nkoumakali Bruno - MEF/ DGEF (Gabon) *
Ntsame Célestine - ITTO (Gabon) *

Nyare Nathalie - AGRECO Consultant (Gabon) *
Nzala Donatien - MEF/DGEF-COMIFAC (Congo) *
Ouissika Chérubin Brice - MEF/CNIAF/MDDEFE (Congo) *
Pokem Dany - CBFP Facilitation *
Sahmo Calvin - Cameroon Ecology NGO (Cameroon) *
Saracco Filippo - EU
Schauerte Peter - GIZ (Cameroon) *
Schorlemer Dietmar - GIZ (Cameroon) *
Sepulchre Frédéric
Sionneau Jean-Michel - ECOFAC
Tchuante Tite Valerie - COMIFAC Executive Secretariat *
Tunguni Jacques - DIAF/MECNT (DRC) - COMIFAC *
Usongo Léonard - WWF *
Wala Alphonse - OFAC
Yalibanda Yves - MEFCP (CAR) - COMIFAC *

*participant of the validation meeting of the SOF 2010 held in Douala the 29th and 30th March 2011

Acronyms

AAC	Annual cutting range
ACP	Africa, Caribbean and Pacific
ADF	African Development Forum
ADIE	International Agency for the Development of Environmental Information
AED	African Elephant Database
AETFAT	Association for the Taxonomic Study of the Flora of Tropical Africa
AFD	French Development Agency
AfDB	African Development Bank
AfESG	African Elephant Specialist Group
AFREF	African Geodetic Reference Frame
ANDEGE	Amigos de la Naturaleza y el Desarrollo de Guinea Ecuatorial
ANPN	National Parks Agency
ANU	Australian National University
AOSIS	Alliance of Small Island States
API	Aménagement Pilote intégré
ATIBT	Association technique internationale des Bois tropicaux
ATO	African Timber Organization
AWF	African Wildlife Foundation
AWG-KP	Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol
AWG-LCA	Ad Hoc Working Group on Long-term Cooperative Action under the Convention
BASIC	Brazil, South Africa, India and China
BDEAC	Central African States Development Bank
BGCI	Botanic Gardens Conservation International
BSBY	Bi national Sena Oura - Bouba Ndjidda-Yamoussa
BTC	Belgian Technical Cooperation
BVQI	Bureau Veritas Certification
C2D	Debt reduction and Development Contract
CABGAN	Central African Botanic Gardens Network
CAMES	African and Malagasy Council for Higher Education
CAR	Central African Republic
CARPE	Central Africa Regional Program for the Environment
CARPO	Central African Regional Program Office
CAWHFI	Central Africa World Heritage Forest Initiative
CBD	Convention on Biological Diversity
CBFF	Congo Basin Forest Fund
CBFP	Congo Basin Forest Partnership
CBG	Compagnie des Bois du Gabon
CBNRM	Community Based Natural Resource Management
CdC	Cadres de Concertation
CDF	Centre des Données forestières
CDM	Clean Development Mechanism
CEB	Compagnie Équatoriale des Bois
CEFDHAC	Conference on Central African Moist Forest Ecosystems
CEI	Centre d'Échange d'Informations
CFA	Communauté financière d'Afrique
CFAD	Forest Concession under Sustainable Management
CI	Conservation International
CIB	Congolaise industrielle des Bois
CIFOR	Center for International Forestry Research
CIRAD	Centre de Coopération internationale en Recherche agronomique pour le Développement
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNIAF	Centre national d'Inventaire et d'Aménagement des Ressources forestières et fauniques
CNPZF	Comité national de Pilotage du Zonage forestier
CoC	Chain of Custody
COMIFAC	Central African Forests Commission
COP	Conference of the Parties
COVAREF	Comité de Valorisation des Ressources fauniques
CPAET	Provisional Convention of Management, Exploitation and Processing
CRDPI	Centre de Recherche sur la Durabilité et la Productivité des Plantations industrielles
CTFT	Centre technique forestier tropical
CUREF	Conservación y Utilización Racional de los Ecosistemas Forestales
DC	Developing Countries
DDEF	Direction départementale de l'Économie forestière
DDICB	Direction du Développement des Industries et du Commerce du Bois
DEP	Direction des Études et de la Planification

DESS	Degree of Higher Specialized Studies
DFAP	Direction de la Faune et des Aires protégées
DFS	Deutsche Forest Service
DGEF	Direction générale des Eaux et Forêts
DGF	Direction de Gestion forestière
DIAF	Direction des Inventaires et Aménagements forestiers
DIARF	Direction des Inventaires, de l'Aménagement et de la Régénération des Forêts
DLH	Dalhoff Larsen and Horneman
DRC	Democratic Republic of Congo
DRH	Direction du Reboisement et de l'Horticulture
EC	European Commission
ECCAS	Economic Community of Central African States
EC-JRC	Joint Research Centre of the European Commission
ECOFAC	Écosystèmes forestiers d'Afrique centrale
EDF	European Development Fund
EFC	Eucalyptus et Fibres du Congo
EFG	École de Faune de Garoua
ERAIFT	Regional Post-graduate Training School on Integrated Management of Tropical Forests and Lands
ERZ	Extractive Resource Zone
ESMAP	Energy Sector Management Assistance Program
ETIS	Elephant Trade Information System
EU	European Union
FACET	Forêts d'Afrique centrale évaluées par Télédétection
FAO	Food and Agriculture Organization
FAOSTAT	FAO Statistics Division
FCPF	Forest Carbon Partnership Facility
FIB	Fédération des Industriels du Bois
FIP	Forest Investment Program
FLEGT	Forest Law Enforcement, Governance and Trade
FMU	Forest Management Unit
FOB	Free On Board
FORENET	Forestry Research Network
FOT	Free On Truck
FRA	Forest Resources Assessment
FRM	Forêt Ressources Management
FSC	Forest Stewardship Council
FTI	Forest Transparency Initiative
FTNS	Sangha Tri-National Foundation
GBIF	Global Biodiversity Information Facility
GDP	Gross Domestic Product
GEB	Gabon Export Bois
GEF	Global Environment Facility
GFBC	Groupement de la Filière Bois du Cameroun
GHG	Greenhouse Gas
GIS	Geographic Information System
GLC	Global Land Cover
GPS	Global Positioning System
GRASP	Great Apes Survival Partnership
GIZ	German Agency for International Cooperation
HIV	Human Immunodeficiency Virus
ICASEES	Institut centrafricain de Statistiques et d'Études économiques et sociales
ICCN	Institut congolais pour la Conservation de la Nature
ICRAF	International Centre for Research in Agroforestry
IFB	Industries forestières de Batalimo
IFO	Industrie forestière de Ouesso
IMCS	International Media, Conseils & Services
INC	National Institute of Cartography
INERA	Institut national d'Études et Recherches agronomiques
INPE	National Institute for Space Research
INS	Institut national des Statistiques
IPCC	Intergovernmental Panel on Climate Change
IRD	Institut de Recherche pour le Développement
IRET	Institut de Recherche en Écologie Tropicale
IRSC	Institut de Recherches scientifiques au Congo
ITTA	International Tropical Timber Agreement
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
JERS	Japanese Earth Resources Satellite
JPL	Jet Propulsion Laboratory
JRC	Joint Research Centre
KfW	German Development Bank
KP	Kyoto Protocol
LDC	Least Developed Countries
LIDAR	Light Detection and Ranging

LMC	Local Management Committee
LNPC	Local and National Partner Committee
LPG	Liquefied Petroleum Gas
LULUCF	Land Use, Land Use Change and Forestry
MA	Monte Alén
MAB	Man and the Biosphere
MC	Monts de Cristal
MDDEFE	Ministère du Développement durable, de l'Économie forestière et de l'Environnement
MECNT	Ministère de l'Environnement, Conservation de la Nature et Tourisme
MEEATU	Ministère de l'Eau, de l'Environnement, de l'Aménagement du Territoire et de l'Urbanisme
MEF	Ministère de l'Économie forestière
MEFCP	Ministère des Eaux, Forêts, Chasse et Pêche
MERH	Ministère de l'Environnement et des Ressources halieutiques
MERIS	Medium Resolution Imaging Spectrometer
MINDAF	Ministry of State Property and Land Tenure
MINEF	Ministry of the Environment and Forests
MINEPAT	Ministry of Economy, Planning and Regional Development
MINFOF	Ministry of Forestry and Wildlife
MLW	Maringa-Lopori-Wamba
MNHN	Muséum national d'Histoire naturelle
MOCAP-CIG	Mount Cameroon Prunus Management - Common Initiative Group
MODIS	Moderate Resolution Imaging Spectroradiometer
MPI	Max Planck Institute
MRV	Measurement, Reporting and Verification
MTKB	Maiko-Tayna-Kahuzi-Biega
NAMAs	Nationally Appropriate Mitigation Actions
NASA	National Aeronautics and Space Administration
NGO	Non Governmental Organization
NP	National Park
NR	Natural Reserve
NST	Nord Sud Timber
NTFP	Non-Timber Forest Product
OCFSA	Organization for Wildlife Conservation in Central Africa
OFAC	Observatory for the Forests of Central Africa
OKNP	Odzala-Kokoua National Park
OLB	Origin and Legality of Timber
ONFI	Office national des Forêts International
OSFAC	Observatoire satellital des Forêts d'Afrique centrale
PA	Protected Area
PACEBCo	Congo Basin Ecosystems Conservation Programme
PAFC	Pan African Forest Certification
PAGEF	Projet d'Appui à la Gestion des Forêts du Congo
PAPPFG	Projet d'Aménagement des petits Permis forestiers gabonais
PARPAF	Projet d'Appui à la Réalisation des Plans d'Aménagement forestier
PASR-LCD	Sub-Regional Action Programme to Combat Land Degradation and Desertification
PEA	Exploitation and Management Permit
PEVi	Virunga Environmental Programme
PNVi	Virunga National Park
PROGEPP	Projet de Gestion des Écosystèmes dans la Périphérie du Parc national de Nouabalé-Ndoki
PRSP	Poverty Reduction Strategy Paper
PTMC	Parc transfrontalier Mayumba - Conkouati
PZF	Forest Zoning Plan
RAPAC	Central Africa Protected Areas Network
RDZ	Rural Development Zone
REBAC	Central African Botanists Network
REDD	Reducing Emissions from Deforestation and Degradation
REDIFAC	Network of Forest Directors in Central Africa
REFADD	African Women's Network for Sustainable Development
REJEFAC	Youth Network for the Forests of Central Africa
REPALEAC	Network of the Local and Indigenous People for the Sustainable Management of Central Africa's Forests Ecosystems
REPAR	Network of Parliament members in Central Africa
RFA	Redevance forestière annuelle
RIFFEAC	Network of Forestry and Environmental Training Institutions in Central Africa
RIL	Reduced Impact Logging
RIP	Regional Indicative Programme
R-PP	Readiness Preparation Proposal
RWE	Round Wood Equivalent

SBSTA	Subsidiary Body for Scientific and Technological Advice
SCAD	Société Centrafricaine de Déroulage
SDSU	South Dakota State University
SEFAC	Société d'Exploitation forestière et agricole du Cameroun
SEFCA	Société d'Exploitation forestière centrafricaine
SEPBG	Société d'Exploitation des Parcs à Bois du Gabon
SFID	Société forestière et industrielle de la Doumé
SFM	Sustainable Forest Management
SGS	Société générale de Surveillance
SIAF	Service des Inventaires et Aménagement forestiers
SIBAF	Société industrielle des Bois Africains
SIFORCO	Société industrielle et forestière du Congo
SIGIF	Système informatique de Gestion des Informations forestières
SIV	Simian Immunodeficiency Virus
SNBG	Société nationale des Bois du Gabon
SNR	National Reforestation Service
SODEFOR	Société de Développement forestière
SODETRAN-CAM	Société de Transport et de Négoce du Cameroun
SOF	State of the Forest
SOFOKAD	Société Forestière de la Kadéi
SOFORMA	Société forestière du Mayumbe
SPIAF	Service permanent d'Inventaire et d'Aménagement forestier
SPOT-VGT	SPOT - Vegetation
SSC	Species Survival Commission
STBK	Société de Transformation de Bois de la Kadey
SYVBAC	Système de suivi de la filière Viande de Brousse en Afrique centrale
TBPA	Transboundary Protected Area
Teq	Equivalent ton
TEREA	Terre Environnement Aménagement
TFT	The Forest Trust
TLTV	Timber Legality and Traceability Verification
TNS	Sangha Tri-National
TRIDOM	Dja-Odzala-Minkébé Landscape
UCECAF	Central Unit of Forestry Cartography
UCL	Université catholique de Louvain
UK	United Kingdom
ULB	Université libre de Bruxelles
UMD	University of Maryland
UN Comtrade	United Nations Commodity Trade Statistics Database
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNIKIN	University of Kinshasa
UNIKIS	University of Kisangani
UN-REDD	United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation
US	United States
USA	United States of America
USAID	United States Agency for International Development
USFS	United States Forest Service
USGS	United States Geological Survey
VAT	Value Added Tax
VLC	Verification of Legal Compliance
VLO	Verification of Legal Origin
VPA	Voluntary Partnership Agreement
WCMC	World Conservation Monitoring Centre
WCS	Wildlife Conservation Society
WISDOM	Woodfuel Integrated Supply / Demand Overview Mapping
WRI	World Resources Institute
WWF	World Wide Fund for Nature
ZCV	Village Hunting Zone
ZIC	Zone d'Intérêt cynégétique
ZICGC	Zone d'Intérêt cynégétique à Gestion communautaire
ZSL	Zoological Society of London

Preface

Secular equilibriums between man and nature seem today to be disturbed: climate change presses forward under the influence of critical levels of greenhouse gas emissions, biodiversity is being lost at a rate never before seen, and rural populations of countries in the South are having increasing difficulty feeding themselves and finding suitable living environments. The challenge facing us ahead is to ensure decent living conditions for the 8 billion inhabitants of the planet, starting with the poorest, without jeopardizing the welfare of future generations by over-exploiting natural resources.

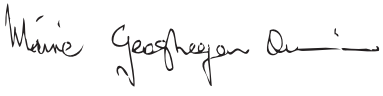
Given this perspective, who can still doubt the important role tropical forests have to play in the resolution of these major ecological and economic crises? The Congo Basin forests cover 200 million hectares in the heart of Africa. They support the livelihoods of 60 million people, generate funds for States in the region through timber exploitation, absorb huge amounts of carbon, comprise a unique biodiversity and regulate the flow of the major rivers across Central Africa. Nevertheless many questions and uncertainties persist on the services the forests provide, their spatial evolution, the opportunities they represent and the threats they face.

To overcome the lack of reliable information, numerous stakeholders in the region and beyond, from government departments, non-governmental organizations, the private sector and the scientific community, came together in 2005 to produce a first concise State of the Forest report. This report was followed by more comprehensive editions in 2006 and 2008, with support from the United States, the European Union, France and Germany. This State of the Forest report, produced by the Central African Forests Commission (COMIFAC) and its partners, has become the gold standard for those looking for a comprehensive and detailed assessment of the status of the tropical forests of Central Africa.

Since 2007, the Observatory for the Forests of Central Africa (OFAC), funded by the European Union and supported scientifically by the Joint Research Centre, has collected the necessary data for the development of the State of the Forest report and coordinated the writing. The release of the State of the Forest through 2014 is assured by OFAC, a permanent body under the auspices of COMIFAC, in collaboration with the Congo Basin Forest Partnership (CBFP). This 2010 report, co-authored by numerous stakeholders with complementary skills, has also been supported through long-standing COMIFAC partners: the United States, France, Germany and UNESCO.

The forests of Central Africa are the subject of intense debate worldwide. This report aims to provide decision-makers in Central Africa a comprehensive base of high value information to best serve the interests of the States and the people of the region. Central Africa can be proud of this initiative, built in a remarkable spirit of cooperation and often cited in international meetings as an example to emulate in other parts of the world.

José Endundo Bononge
Minister / President of the Council of Ministers of COMIFAC



Máire Geoghegan-Quinn
European Commissioner for Research, Innovation and Science

Andris Piebalgs
European Commissioner for Development

Introduction

Context

Central Africa contains the second largest expanse of tropical forest in the world. For the most part, it fares better than many other forests. Apart from intermittent areas of heavy deforestation, the overall level of deforestation remains relatively low. However, the increasing pressure that is being exerted on the forests of the Congo Basin could lead to quite considerable degradation and increased poverty for the very large number of people who are still heavily dependent upon the readily-available resources they provide.

Countries in the region have launched a number of initiatives in order to: (i) protect biodiversity; (ii) preserve their economic resources; and (iii) avoid forest-origin greenhouse gas emissions. Despite introducing legislation and creating protected areas, results have not lived up to expectations nor do they satisfactorily reflect investments to date.

Nevertheless, one of the most interesting results of the initiatives that have been developed in the sub-region has been the outcome of regional coordination efforts made by Central African States for biodiversity conservation and the sustainable management of forests across the entire Congo Basin. In 1999, the Heads of State of the six Congo Basin forest countries signed the Yaoundé Declaration in Cameroon, thereby confirming their will to collaborate. This was consolidated with the establishment of the Central African Forests Commission (COMIFAC), which drew up a Convergence Plan to monitor all activities under its coordination. The Convergence Plan defines the framework for the elaboration of common objectives for forest conservation and encourages the development of new regional and trans-border conservation efforts.

Finally, in order to rationalize these efforts and optimize investments, the Congo Basin Forest Partnership (CBFP) was established on 4 September 2002 at the Earth Summit on Sustainable Development in Johannesburg, South Africa. The CBFP brings together all public and private partners wishing to support the achievement of the Yaoundé Declaration's objectives.

In January 2004, after being in existence for two years, the CARPE program – one of the key partners of the CBFP – produced a first summary report on the State of the Forest in Central Africa. The report was published in January 2005 and disseminated at the Summit of Heads of State in Brazzaville in February 2005. It was not a detailed scientific report nor a document to solicit additional funding. Instead, it represented a first effort to present, and where feasible quantify, the various steps needed to be taken collectively by all CBFP partners in order to achieve the sustainable management of forest resources. As a first step, the preliminary report did not comprehensively reflect the important efforts deployed in the region, the pressures being exerted on the forests or the overall state of the Congo Basin forests. Accurately reflecting these dynamics is challenging as the pressures and the understanding of the pressures on the forest are not uniform across the region.

It became clear that a more comprehensive and detailed report was needed in order to provide a more balanced and objective picture of regional efforts that had been made by States, various international donors and NGOs. Hence, the 2006 report followed on from the 2005 report and was entitled "The Forests of the Congo Basin: State of the Forest 2006". Many partners (over 110 experts) contributed to the report, making it a CBFP flagship activity. The 2006 report is considered as a benchmark – a point zero – as regards this process to collectively assess the biodiversity and renewable natural resources in the Congo Basin.

The 2006 report provided a clearer picture of the overall state of the forests and was pivotal in guiding effective policy making and strategy development, and constitutes a base for future periodical evaluations. The 2006 report launched a more systematic process, which has since been further developed. It also responded to Axis 2 of the COMIFAC Convergence Plan, which provided for the establishment of a regional observatory. In 2007, the European Union backed this process with the following main objectives: (i) establish a system to monitor the natural and socio-economic environment of forest ecosystems in Central Africa based on a series of indicators; (ii) coordinate the publication every two years of a "Report on the State of the Forests", and (iii) launch the establishment of the Observatory for the Forests of Central Africa (OFAC) for the benefit of COMIFAC member countries.

This observatory allows COMIFAC and CBFP members to have at their disposal an essential steering tool and knowledge-sharing system for improved governance and sustainable management of forest ecosystems. To respond to the above objectives, OFAC coordinated the 2008 State of the Forest Report. The report provided an update on the economic and biodiversity components of the forest as well as on changes in the amount of forest cover in the 6 forested COMIFAC member countries. The part that consisted of cross-cutting chapters dealt with environmental services provided by the forest. Among these, particular emphasis was placed on factors affecting biodiversity, water resources, fuelwood production and climate. The third and last section of the report addressed zoning developments in the 12 CBFP landscapes.

OFAC continues to coordinate the State of the Forest reports, including this 2010 edition. As in the case of the 2008 report, this means providing a review as comprehensive as possible of the Congo Basin forest, its ecosystems, biodiversity and socio-economic situation. The current report seeks in particular to provide an update on the state of the Central African dense moist forests. With this in mind, it covers the 6 countries where this type of forest exists, i.e. Gabon, Republic of Congo, Democratic Republic of Congo, Equatorial Guinea, Cameroon and the Central African Republic. Future editions of the report will also include the four other COMIFAC member countries (Burundi, Rwanda, São Tomé and Príncipe and Chad).

The design of the 2010 State of the Forest Report

The design of the 2010 State of the Forest report does not differ fundamentally from that of the 2008 report and relies on indicators decided on collectively by about sixty contributors. Data collection was organized from 2009 to 2010 using national groups consisting of four to ten members, depending on the countries, all of whom worked for public administrations dealing with forest issues. Data collected, covering for the most part 2008 and 2009, was validated during national workshops for public administration officials, environmental NGO representatives, the private sector and development projects. The data served to support the inputs provided by contributors of chapters for the current report, under the supervision of internationally recognized scientific committees. Furthermore, a State of the Forest 2010 sub-regional validation workshop was organized from 29 to 30 March 2011 for about 100 participants working in forest management, comprising representatives from the ten COMIFAC member countries, and several of its partners.

Content of the 2010 State of the Forest Report

The report is divided into four main sections:

- Part I: The Central African forests: regional synthesis of monitoring indicators;
- Part II: Impact of the informal sectors on forest management in Central Africa;
- Part III: Current challenges facing forest management in Central Africa;
- Part IV: Landscape management.

The first part of the 2010 State of the Forest Report, consists of three chapters. The first chapter presents the most recent results available on spatial distribution and on developments in Congo Basin forests based on the use and analysis of a large number of satellite images that have been acquired over the past twenty years. The second chapter summarizes the current status of forest management and the timber sector in Central Africa, based on data collected by OFAC and on surveys and discussions undertaken in the field with the principal actors involved in the forestry sector. This chapter highlights the developments in this sector since the publication of the 2008 State of the Forest Report. The third chapter summarizes information on the main groups and families of fauna and flora and on work that has been carried out on biodiversity conservation in Central Africa.

The second part of the report consists of four chapters. Chapter 4 analyzes the economic and social impact of small scale sawmills in the Congo basin, concentrating on sawn wood from the whole region that is being sold on domestic markets. Chapter 5 provides an overview of the

wood energy sector in Congo Basin countries, with particular emphasis on areas where woodfuel exploitation threatens its sustainability and the livelihoods of those who depend on it. Chapter 6 addresses the issue of bushmeat and is in itself an introduction to this subject. It seeks to provide a summary of the main information available on bushmeat in the Congo Basin since the beginning of the 1980s. Chapter 7 provides an overview of non-timber forest products in the Congo Basin and suggests possible ways to develop strategies for their sustainable management.

Part III includes two chapters. Chapter 8 is the logical follow-up to chapter 11 in the 2008 State of the Forest report which explained how the COMIFAC position was developed during the international negotiations on the 1997 Kyoto Protocol up until the end of the Poznań COP-14 in December 2008, on the eve of the Copenhagen COP-15. This chapter continues to explain this development from Copenhagen onwards, including Cancún COP-16, prior to the Durban COP-17. Chapter 9 analyzes the impact of the 2008-9 world economic crisis on sustainable forest management and outlines measures taken by the Governments of the 6 Congo Basin forest countries.

Finally, part IV of the 2010 report comprises chapters 10 and 11. Chapter 10 provides an overview of the management of protected areas in CBFP countries. It completes the description of national systems for protected areas presented in previous editions of the State of the Forest reports. It also provides a brief insight into the threats faced by the protected areas (PAs) in Central Africa, describes the role to be played by the Congo Basin PA network in the context of broader conservation by COMIFAC and its series of priority conservation landscapes, and analyzes the current constraints for the establishment of functional and sustainable management of the protected areas in Central Africa. Chapter 11 reviews experiences in forest zoning in Central Africa, presenting two case studies that illustrate national experiences: the first was in Cameroon several decades ago and the second shows the efforts currently being undertaken in DRC. This chapter also updates zoning concepts and planning at the local level.

PART 1

THE CENTRAL AFRICAN FORESTS: REGIONAL SYNTHESIS OF MONITORING INDICATORS

CHAPTER 1

Central african forest cover and cover change mapping

**Céline Ernst, *Astrid Verhegghen, **Philippe Mayaux, ***Matthew Hansen,*Pierre Defourny*

With the contribution of : Astère Bararwandika, Grégoire Begoto, Fidel Esono Mba, Marcel Ibara, André Kondjo Shoko, Héritier Koy Kondjo, Jean-Sylvestre Makak, Jean-Daniel Mendomo Biang, Christophe Musampa, Roberto Ncogo Motogo, Gidéon Neba Shu, Bruno Nkoumakali, Chérubin Brice Ouissika

**UCL, **JRC, ***SDSU*

Introduction

Central Africa contains the second largest area of contiguous moist tropical forest in the world, covering about 2 million km^2 (Mayaux *et al.*, 1998). The Congo Basin is occupied by vast and still uninterrupted tracts of rainforests from the Gulf of Guinea to the Albertine Rift. Salient features include the presence of the world's largest tropical swamp forest in the central part of the Congo Basin, and two mountainous regions in Cameroon and in eastern Democratic Republic of Congo (DRC).

The central region is characterized by low deforestation rates resulting from small localized clearings usually associated with shifting agricultural activities (Mayaux *et al.*, 2003; Hansen *et al.*, 2008). The situation can be explained by the absence of a significant local market for wood products and a poor transportation infrastructure. However, coastal Central Africa has experienced more intensive forest exploitation. Here, population growth and agricultural expansion, as well as emerging marketing opportunities have exerted a strong pressure on forest resources.

This has been the general understanding of forest change in the Congo Basin but until the mid 1990s this was based on patchy and anecdotal information, without spatially explicit delineation of forests and statistically robust estimates of forest cover change. The lack of up-to-date and accurate information on the current state and evolution of forested areas in Central Africa has often been cited as a limiting factor in the design of efficient forest management policies. Efforts to improve regional and national capabilities to address the problem of forest and land use monitoring have thus received particular attention in recent years (Mayaux *et al.*, 1998; Duveiller *et al.*, 2008).

Photo 1.1: At the fringes of their geographical coverage in Cameroon, forests mix with savannas

The accurate delineation of Congo Basin forests is also needed to provide information for global scientific applications and regional environmental policies. It establishes the boundary conditions for General Circulation Models simulating climate and for land surface process models used for Earth system energy, water and material transport studies as well as biogeochemical cycle modelling. The improved accuracy with which such maps depict actual land cover at some specified time could increase the reliability of the regional scenarios generated by the models.

Policy users also need information on the state of the world's land cover to develop sustainable development policies and strategies at scales ranging from local projects to the global perspective of multilateral environmental agreements such as the UN Framework Convention on Climate Change (UNFCCC), the UN Convention to Combat Desertification (UNCCD), the Convention on Biological Diversity (CBD) and the Ramsar Wetlands Convention. The reporting mechanisms under the terms of multilateral environ-

Photo 1.2: Logging roads provide the primary means of access to forest areas

mental agreements ask for assessments of natural resources, including land cover. In particular, the prominent role of forests in the carbon cycle was underlined during the recent negotiations on climate in Copenhagen and Cancún. Concrete mechanisms are now under development by the Convention of Parties (such as REDD+ and CDM) and require detailed information on the land cover and the land cover changes.

Land cover information is also needed to measure the impact and effectiveness of management actions associated with sustainable development policies. Addressing issues such as sustainable management and use of forests and other land resources in developing countries, forest conservation and restoration, extension of surfaces dedicated to agriculture, desertification and watershed degradation will all substantially benefit from the availability of accurate baseline land cover information (FAO, 2005).

This chapter presents the most recent available results on the spatial distribution and the evolution of Congo Basin forests, based on the processing and analysis of a vast amount of satellite images acquired over the last two decades. First, it will detail a new map of the forest types built upon previous studies and taking advantage of a combination of the best satellite data available. Then, the best available estimation of land cover change is described thanks to two complementary land cover change studies respectively based on: (i) a sample of Landsat sub-scenes covering the entire territory of the 6 forested countries, and (ii) a wall-to-wall coverage of Landsat mosaics for the DRC.

A new Congo Basin vegetation map

Satellite-based mapping of forest cover in the Congo Basin is challenging due to the persistent cloud cover, the fragmentation and variability of the landscape, while field based inventories are limited by the vast extent and inaccessibility of the territory. Previous State of the Forest (SOF) reports relied on the fusion of the different available maps. For the 2006 SOF report, a synthesis of two maps was performed, GLC2000 (Mayaux *et al.*, 2004) was merged with a forest/non-forest map obtained from MODIS time-series analysis (Hansen *et al.*, 2003). For the 2008 SOF report, five sources of information were merged to establish the best available map at the time, mainly focusing on the humid forest.

Capitalizing on the previous results and taking advantage of much more recent satellite time series, a new forest map covering consistently the 8 countries of Congo Basin has been produced (figure 1.1). The production of this new map relied on a semi-automatic method combining statistical classification, expert consultation and manual editing (Verhegghen & Defourny, 2010). The methodology developed takes advantage of the spatial resolution of MERIS (300 m resolution) and the time-series of 8-years of SPOT-Vegetation (SPOT-VGT), providing a better delineation of the small features and improved discrimination of the vegetation type respectively. This vegetation class discrimination relied on a systematic analysis of the different seasonal spectral profiles in order to split classes showing differences in terms of seasonal dynamic of green biomass.

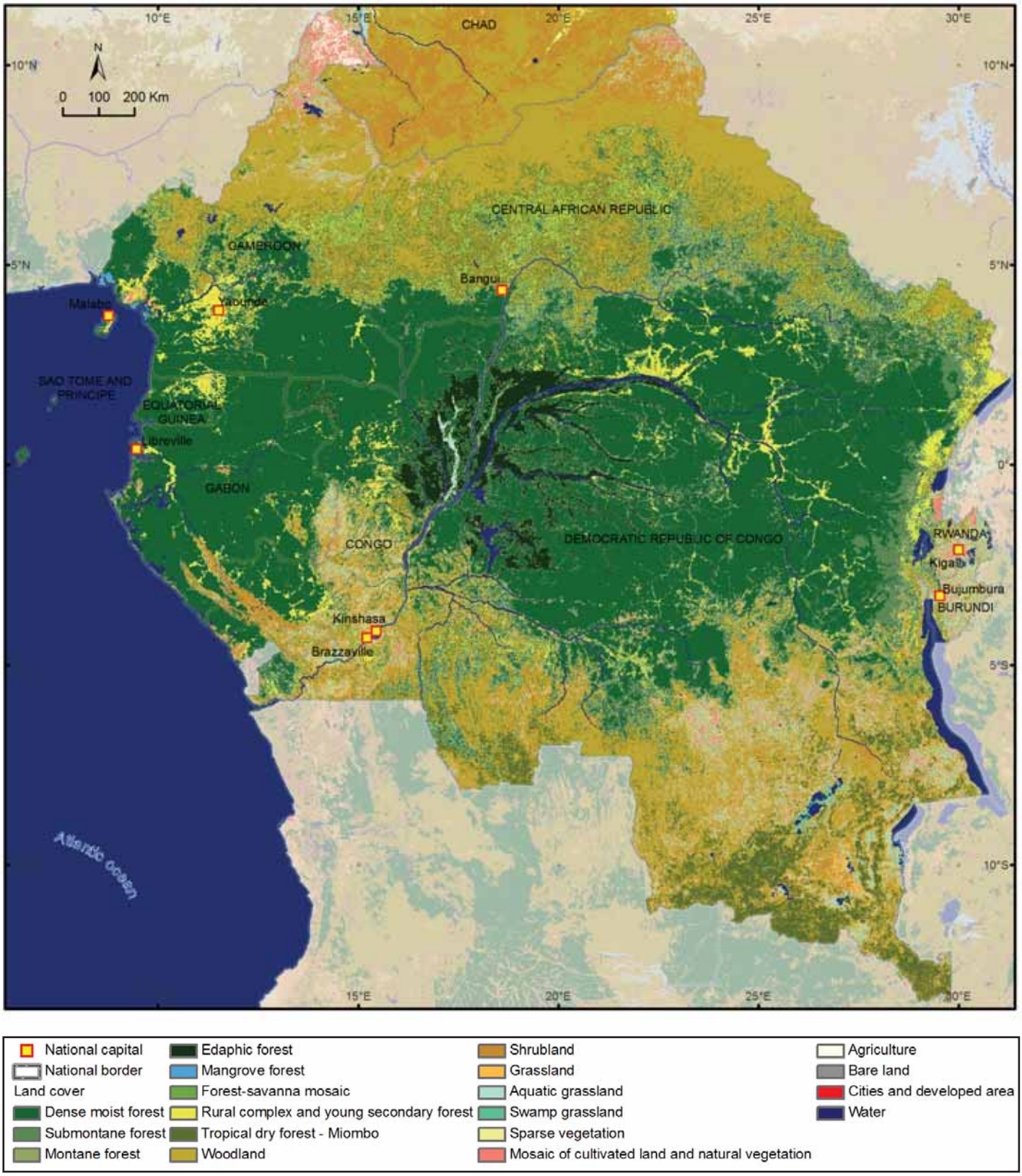


Figure 1.1: Congo Basin land cover map derived from 300 m resolution data
Source: Verhegghen & Defourny, 2010

The following land cover classes were mapped for the Congo Basin at 300 m resolution for the first time:

- Dense moist forest
- Submontane forest
- Montane forest
- Edaphic forest
- Mangrove forest
- Forest-savanna mosaic
- Rural complex and young secondary forest
- Tropical dry forest - Miombo
- Woodland
- Shrubland
- Grassland
- Aquatic grassland
- Swamp grassland
- Sparse vegetation
- Mosaic of cultivated land and natural vegetation
- Agriculture
- Irrigated agriculture
- Bare land
- Cities and developed area
- Water

Map description (based on Mayaux *et al.*, 1997)

The dense moist forest is found in the western part of Cameroon and covers the major portion of the Congo Basin from Gabon and Equatorial Guinea to Kivu (DRC). Submontane (1,100 - 1,750 m) and montane forests (> 1,750 m) exist in the Albertine Rift. Small forest blocks are also found in the west of Cameroon (i.e. foothills of Mount Cameroon, Bamenda and Bamiléké highlands). Given the high density of the river network, edaphic forest (semi deciduous tall trees on permanently or seasonally flooded land) occupies very large areas in the central Congo Basin (also known as the "*cuvette*").

In the DRC, Cameroon and Equatorial Guinea, the dense moist forest is fragmented along road networks and around villages. "Rural complex and young secondary forest" is a mixture of forestry fallows, personal gardens, subsistence crops and plantings. Mapping the state of tropical forest degradation of the Atlantic countries is improved because of the increased availability of satellite images (including almost 3,000 images daily SPOT-VGT observations). From these data it is possible to detect (at that scale) patterns of settlements and road impacts in the forests in Equatorial Guinea, Cameroon and Gabon (figure 1.2).

[1]Data available on http://www.esa.int/esaEO/SEMGSY2IU7E_index_1.html

[2]Data available on http://bioval.jrc.ec.europa.eu/products/glc2000/glc2000.php

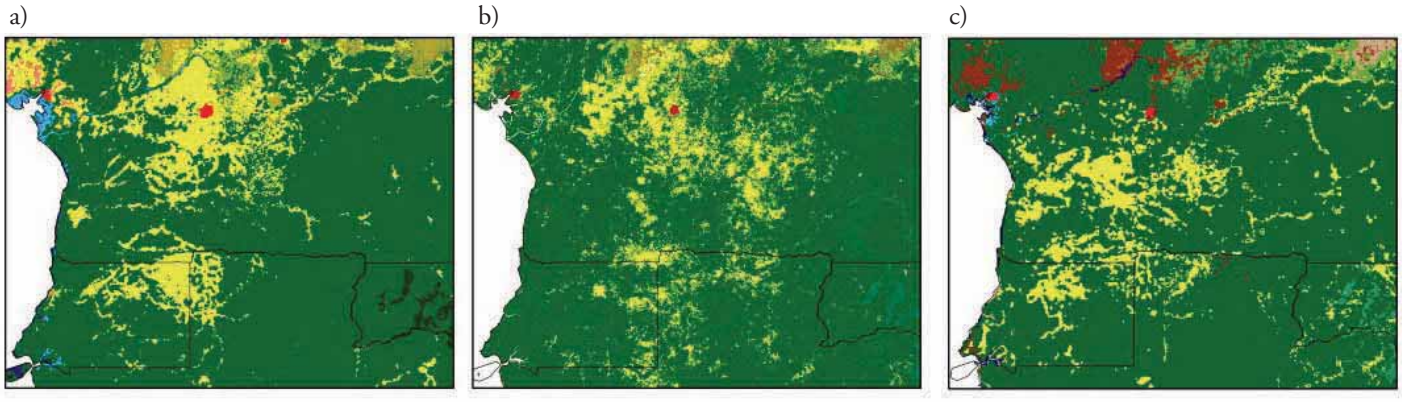


Figure 1.2: Example of the improved discrimination of vegetation classes using the 8-years SPOT-VGT time-series analysis depicting networks of deforested areas usually not detected due to the persistent cloud coverage. a) 300 m resolution Congo Basin land cover map; b) Globcover[1] (300 m resolution); c) GLC 2000[2] (1 km resolution).

Sources: Verhegghen & Defourny, 2010; Defourny et al., 2009; Mayaux et al., 2004

The dense dry forests in Central African Republic (CAR) (relics of dense moist forests) and Miombo woodlands in southern DRC have been combined into the "Tropical dry forest - Miombo" class. This formation can be defined as a mixed vegetation formation of a sparse herbaceous stratum under a 15 to 20 m tall forest stand. Miombo woodland is often subject to fires and covers southern province of Bandundu and large parts of the province of Katanga (both in DRC).

The "forest-savanna mosaic" contains forest and savanna elements. Gallery forests are tree formations occurring along the river banks in the middle of shrub or grass vegetation. The mapping of the forest-savanna transition zones in CAR as well as the southern savannas in DRC is well depicted by the higher spatial resolution of the MERIS (Medium Resolution Imaging Spectrometer) instrument. The precise delineation of the forest gallery network in CAR clearly illustrates this improvement (figure 1.3). The improved spatial resolution also enables a more accurate depiction of the "rural complex" class in the humid forests.

Photo 1.3: Land use mosaïc of natural forest, plantations and farms

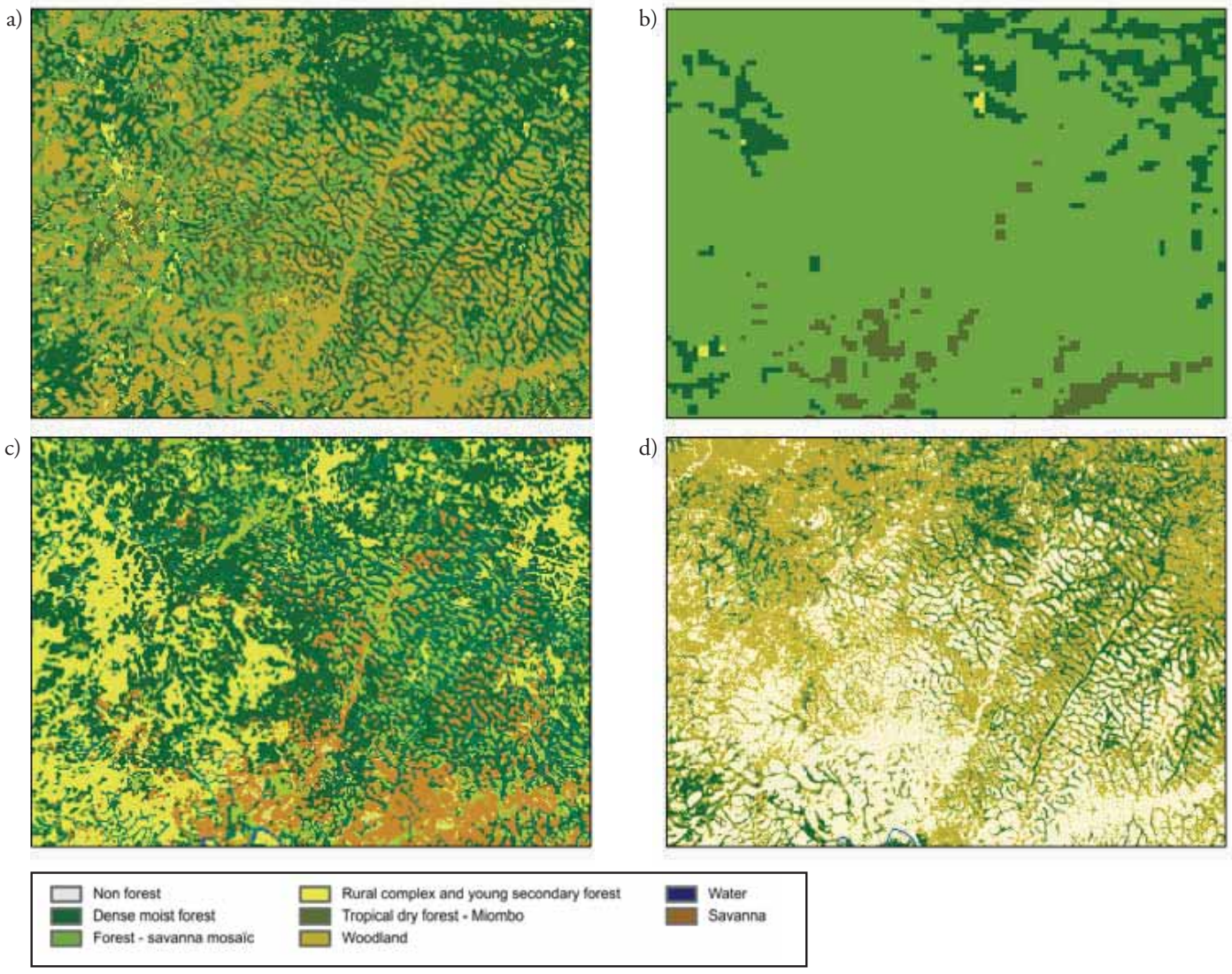


Figure 1.3: Visual comparison of the new Congo Basin land cover map with earlier maps in a forest-savanna zone where the improvement is related to the higher spatial resolution. a) 300 m resolution Congo Basin land cover map (see figure 1.1); b) GLC 2000 (1 km resolution); c) Globcover (300 m resolution); d) 60 m resolution DRC FACET Atlas (OSFAC, 2010)

Sources: Verhegghen & Defourny, 2010; Mayaux et al., 2004; Defourny et al., 2009; OSFAC, 2010

Photo 1.4: A mangrove in Gabon, linking the terrestrial and marine environment

Mangroves are remarkable, highly productive forest ecosystems comprised of small groups of trees, shrubs, palms and ferns adapted to survive in the harsh interface between land and sea. These species are characterized by physiological traits which overcome the problems of anoxia, high salinity and frequent tidal inundation. These fragile ecosystems are present mainly in Cameroon, Equatorial Guinea and Gabon.

The "woodland" covers large areas in CAR, Cameroon and in the DRC provinces, Katanga, southern Bandundu, Kasai Occidental and Oriental. In this formation, the herbaceous layer is continuous, while the tree layer is sparse but very rich in species.

Derived forest areas

Area estimates of the 20 land cover classes have been reported in table 1.1. For some countries, area estimates of some classes are significantly different than previous estimates. This apparent discrepancy is due to the effect of improved spatial resolution. Indeed, while a 1 km pixel identified a mosaic of forest-savanna in a transition zone or in a forest gallery landscape, the 300 m pixel can often delineate each class and map them separately. Furthermore, the dense moist forest area of CAR, as reported here, is drastically higher than in the 2008 SOF report, since it includes many gallery forests outside the Congo-Guinean domain at the fringes of the large forest block and up to the "Bongo" forests.

Photo 1.5: Village on the shore of the Lukénie River, DRC

Forest cover change

Local and regional forest cover dynamics impact climate, biodiversity and ecosystems services. National and international decision makers need reliable, objective, verifiable (according to international standards) and up-to-date information to define and monitor forest policies and to report to international conventions. Satellite remote sensing is currently the most adapted system to measure deforestation in vast and inaccessible forests such as in Central Africa.

To address the challenge of monitoring forest dynamics over the last few decades, two complementary strategies have been pursued, both of which rely on satellite data. On one hand, a sampling approach has been designed over Cameroon, Congo, Gabon, Equatorial Guinea, CAR and DRC in collaboration with national experts. The sampling approach captures four forest cover change processes (i.e. deforestation, degradation, reforestation and regeneration). On the other hand, vast amounts of satellite data have been processed to deliver a spatially explicit wall-to-wall map of forest cover and deforestation for the entire DRC.

Table 1.1: Area estimates (in hectares) of the land cover types for the 8 countries as derived from the Congo Basin land cover map

Land cover class	Cameroon	Congo	CAR	DRC	Gabon	Equatorial Guinea	Burundi	Rwanda
Lowland dense moist forest	18,640,192	17,116,583	6,915,231 (*)	101,822,027	22,324,871	2,063,850	8,412	172
Submontane forest	194,638	0	8,364	3,273,671	0	24,262	36,311	39,061
Montane forest	28,396	10	0	930,863	19	6,703	57,212	180,259
Edaphic forest	0	4,150,397	95	8,499,308	16,881	0	0	0
Mangrove forest	227,818	11,190	0	181	163,626	25,245	0	0
Total dense forest	**19,091,044**	**21,278,180**	**6,923,690**	**114,526,051**	**22,505,397**	**2,120,060**	**101,936**	**219,492**
Forest-savanna mosaic	2,537,713	517,068	11,180,042	6,960,040	51,092	0	70,465	54,405
Rural complex and young secondary forest	3,934,142	3,664,609	713,892	21,425,449	1,405,318	507,281	297,748	304,699
Tropical dry forest - Miombo	1,292,106	297,824	3,430,842	23,749,066	31,337	172	35,127	4,344
Woodland	11,901,697	2,659,375	34,381,438	36,994,935	787,231	4,669	297,137	373,999
Shrubland	2,561,163	2,101,556	4,002,258	6,705,478	619,347	1,308	222,700	146,936
Grassland	177,385	1,191,956	62,015	4,372,677	341,688	86	201,875	153,696
Aquatic grassland	20,156	328,254	96,531	75,888	18,857	1,060	0	258
Swamp grassland	128,622	0	0	701,308	0	0	0	2,206
Sparse vegetation	0	95	0	2,129	0	0	0	0
Mosaic of cultivated land and natural vegetation	3,475,766	1,794,050	977,811	12,907,360	304,097	1,098	1,251,030	1,297,014
Agriculture	667,918	60,239	8,994	0	19,535	172	0	50,538
Irrigated agriculture	60,669	0	26,362	181	0	0	0	831
Bare land	0	0	0	41,935	0	0	0	95
Cities and developed area	38,507	2,941	7,199	41,716	18,332	401	0	286
Water	276,637	296,726	35,452	3,944,206	325,017	27,861	20,433	142,591
Total	**46,163,526**	**34,192,873**	**61,846,529**	**232,448,418**	**26,427,250**	**2,664,168**	**2,498,451**	**2,751,390**

(*) For CAR, 3,994,399 ha of the 6,915,231 ha of lowland dense moist forest belong to the Congo-Guinean domain as defined by Boulvert (1986), the rest belonging mainly to the edaphic domain.

Source: Verhegghen & Defourny, 2010

Forest cover change sampling

Based on the lessons learned from the study presented in the 2006 SOF report (Duveiller *et al.*, 2008), study objectives were twofold. The first one was to deliver a valid estimate of complex forest dynamics at the national level. The second purpose was to enhance national capacity for monitoring, assessing and reporting on forests and land use changes.

National forest remote sensing involvement was considered by all parties as an essential dimension of the overall process. While several steps, such as image selection, pre-processing and automated classification were completed by the Joint Research Centre of the European Commission (EC-JRC) and a team of the *Université catholique de Louvain* (UCL), 15 national experts (photo 1.6) were invited for a 2-weeks workshop to validate the automatic pre-interpretation for land cover mapping and forest change detection. In joint collaboration with the Forest Resources Assessment (FRA) 2010 remote sensing survey, this regional validation workshop was organized at the Regional Post-graduate Training School on Integrated Management of Tropical Forests and Lands (ERAIFT) in October 2009 in Kinshasa (DRC). The workshop was designed based on a preliminary test with the *Direction des Inventaires et Aménagements forestiers* (DIAF, ex-SPIAF) team in February 2009. For consistency, a final visual check was completed by the UCL team and results were returned to the experts during a 1-day post-processing meeting in Brazzaville in February 2010.

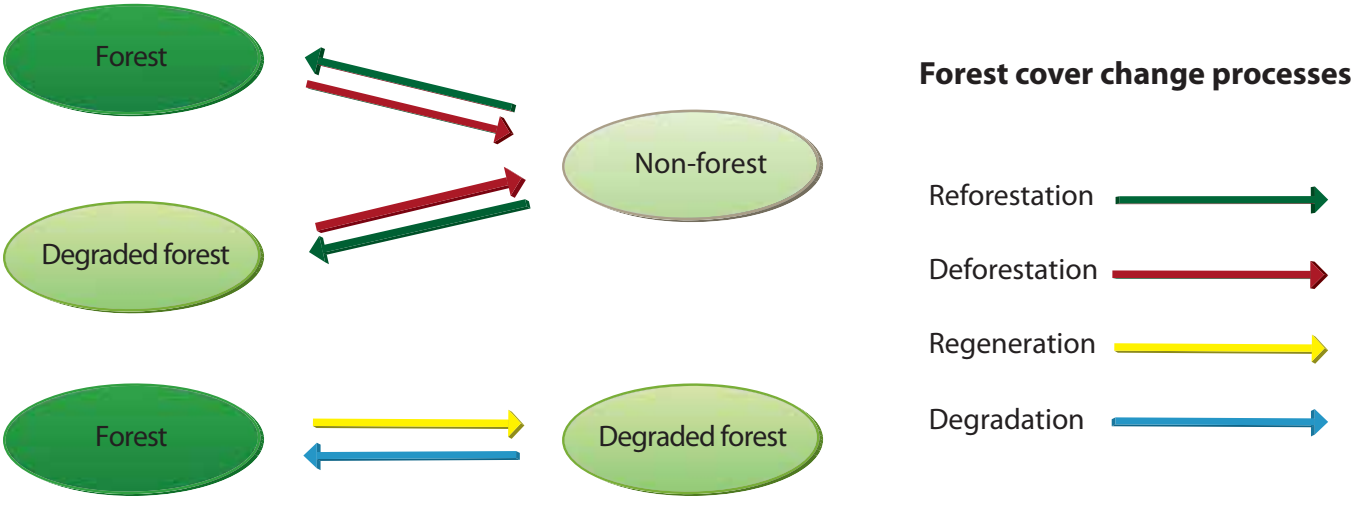
Photo 1.6: Participants of workshop organized at ERAIFT (Kinshasa - DRC) in October 2009. From left to right: André Kondjo Shoko (DRC), Roger Mambeta, Fidel Esono Mba (Equatorial Guinea), Jean-Daniel Mendomo Biang (Cameroon), Eddy Bongwele (OSFAC), Florence Bwebwe, Andre Mateus (Angola), Grégoire Begoto (CAR) Fransisca Mande (Angola), Christophe Musampa (DRC), Astrid Verhegghen (UCL), Philippe Mayaux (JRC), Roberto Ncogo Motogo (Equatorial Guinea), Cherubin Brice Ouissika (Congo), Bruno Nkoumakali (Gabon), Martin Mbemba (OFAC), Marcel Ibara (Congo), Gidéon Neba Shu (Cameroon), Carlos de Wasseige (OFAC), Céline Ernst (UCL), Pierre Defourny (UCL), Jean-Sylvestre Makak (Gabon), Confiance Mfuka (OFAC), Erik Lindquist (FAO). Missing: Héritier Koy Kondjo (DRC), Astère Bararwandika (Burundi) and Patrick Lola Amani (OSFAC)

The statistical approach proceeded with a systematic grid sampling of 0.5° over the dense and edaphic forests of the 6 countries of the Central African Forests Commission (COMIFAC). As the number of cloud free images was not sufficient to deliver relevant statistics at the national level, Equatorial Guinea and Gabon were oversampled every 0.25°. Each sample unit of observation corresponds to a 20 by 20 km sub-scene extracted from Landsat imagery (30 m resolution) acquired around 1990, 2000 and 2005. This resulted in 547 sample sites over the Congo Basin.

The overall method (Ernst *et al.*, 2010) consisted of four stages:

- image selection and pre-processing;
- automatic image processing including object segmentation and pre-labeling of seven land cover classes jointly defined with FRA2010;
- editing and validation by national experts using a specific visual interpretation tool;
- harmonization of the land cover maps for each sample, date normalization of forest cover change according to the image acquisition date and statistics extraction.

The forest cover dynamic was quantitatively assessed for each country by computing the annual rates of the forest cover change, i.e. deforestation, degradation, reforestation and regeneration as illustrated in figure 1.4. Deforestation is the sum of two sub-processes: the conversion of forest cover to non-forest cover and the conversion of degraded forest cover to non-forest cover. In order to reflect actual loss of forest area, a weight was given to each of these sub-processes. Reforestation is the inverse process of deforestation. Degradation is the transition from dense forest to degraded forest through canopy openings.



Forest: at least 70 % of the segment area corresponds to a continuous layer of trees, either in "green" stage or in "leafless" stage. The tree height is 5 m or more.

Degraded forest: a part of the segment or several spatially separated portions of the segment are covered by a continuous tree layer. The total area of tree cover in a segment ranges between 40 % and 70 % for the high tree mosaic class and between 10 % and 40 % for the low tree mosaic class. The tree height is 5 m or more.

Non-forest/other land cover: contains land cover other than tree cover (e.g. herbaceous vegetation cover, bare land, artificial surfaces, agricultural crops…).

Minimum mapping unit: the minimum mapping unit, corresponding to the smallest segment area, is 5 hectares.

Figure 1.4: Forest cover change processes: reforestation, deforestation, regeneration and degradation.
Source: Ernst et al., 2010

Changes in forest cover between 1990 – 2000 and 2000 – 2005

The results of the forest change sampling method estimate that for the Congo Basin, the gross deforestation annual rate is 0.13 % for the period 1990-2000, and this rate doubled for the period 2000-2005. A similar trend is observed for the net deforestation as well as for the gross and net degradation. These new estimates at the basin scale indicate a doubling of the forest cover change rate between both periods. Fortunately, this increase is observed for the deforestation/degradation and for the reforestation, indicating a more dynamic forest landscape. Table 1.2 details the forest change rates for each country, except for Equatorial Guinea for 2000-2005 due to the lack of cloud free data. The evolution of gross deforestation between 1990-2000 and 2000-2005 is quite significant for DRC, Cameroon and Congo while it becomes stabilized in Gabon and CAR. Net deforestation decreases in Cameroon and Gabon, it remains stable at 0.6 % per year in CAR and increases in Congo and DRC.

National annual degradation and regeneration rates are estimated as well (table 1.3). On the Congo Basin scale, the annual net degradation rate is 0.05 % between 1990 and 2000 and 0.09 % between 2000 and 2005. In Cameroon, Congo and CAR, there is almost no evolution in net degradation rate between both periods of time, unlike in DRC. It is important to remind that this quantified measure of degradation is based solely on detected change in forest cover as defined in figure 1.4 and not in qualitative terms (e.g., change in species composition).

Table 1.2: National annual deforestation and reforestation rates in the dense forest zones of the Congo Basin between 1990 and 2000, and between 2000 and 2005. The number of processed samples (n) and their confidence interval are mentioned for each country

Country	1990 - 2000				2000 - 2005			
	n	Gross deforestation (%)	Gross reforestation (%)	Net deforestation (%)	n	Gross deforestation (%)	Gross reforestation (%)	Net deforestation (%)
Cameroon	51	0.10 ± 0.05	0.02 ± 0.01	0.08	20	0.17 ± 0.14	0.14 ± 0.19	0.03
Congo	70	0.08 ± 0.03	0.04 ± 0.02	0.03	40	0.16 ± 0.06	0.08 ± 0.05	0.07
Gabon	58	0.08 ± 0.03	0.03 ± 0.01	0.05	12	0.07 ± 0.05	0.07 ± 0.07	0.00
Equatorial Guinea	8	0.13 ± 0.09	0.11 ± 0.18	0.02	0	-	-	-
CAR	26	0.09 ± 0.05	0.02 ± 0.02	0.06	23	0.10 ± 0.06	0.04 ± 0.05	0.06
DRC	334	0.15 ± 0.02	0.04 ± 0.01	0.11	242	0.32 ± 0.05	0.10 ± 0.03	0.22
Congo Basin	547	0.13 ± 0.02	0.04 ± 0.01	0.09	337	0.26 ± 0.04	0.09 ± 0.02	0.17

Source: Ernst et al., 2010

Table 1.3: National annual degradation and regeneration rates in the dense forest zones of the Congo Basin between 1990 and 2000, and between 2000 and 2005. The number of processed samples (n) and their confidence interval are mentioned for each country

Country	1990 - 2000				2000 - 2005			
	n	Gross degradation (%)	Gross regeneration (%)	Net degradation (%)	n	Gross degradation (%)	Gross regeneration (%)	Net degradation (%)
Cameroon	51	0.08 ± 0.06	0.02 ± 0.01	0.06	20	0.14 ± 0.12	0.07 ± 0.08	0.07
Congo	70	0.04 ± 0.02	0.01 ± 0.01	0.03	40	0.08 ± 0.03	0.05 ± 0.03	0.03
Gabon	58	0.05 ± 0.02	0.01 ± 0.01	0.04	12	0.04 ± 0.05	0.05 ± 0.08	-0.01
Equatorial Guinea	8	0.05 ± 0.03	0.02 ± 0.02	0.03	0	-	-	-
CAR	26	0.04 ± 0.02	0.01 ± 0.01	0.03	23	0.05 ± 0.03	0.02 ± 0.02	0.03
DRC	334	0.07 ± 0.01	0.02 ± 0.00	0.06	242	0.16 ± 0.03	0.04 ± 0.02	0.12
Congo Basin	547	0.07 ± 0.01	0.01 ± 0.00	0.05	337	0.14 ± 0.02	0.04 ± 0.01	0.09

Source: Ernst et al., 2010

For each time-interval, the spatial distribution of deforestation, reforestation, degradation and regeneration processes over Congo Basin is illustrated (figures 1.5 and 1.6). Between 1990 and 2000, it is apparent that deforestation, reforestation and degradation phenomena are more important in accessible areas such as the forest fringe or along the Congo River. This seems to be less pronounced with the annual regeneration rate. Between 2000 and 2005, deforestation and degradation processes tend to reach less accessible areas.

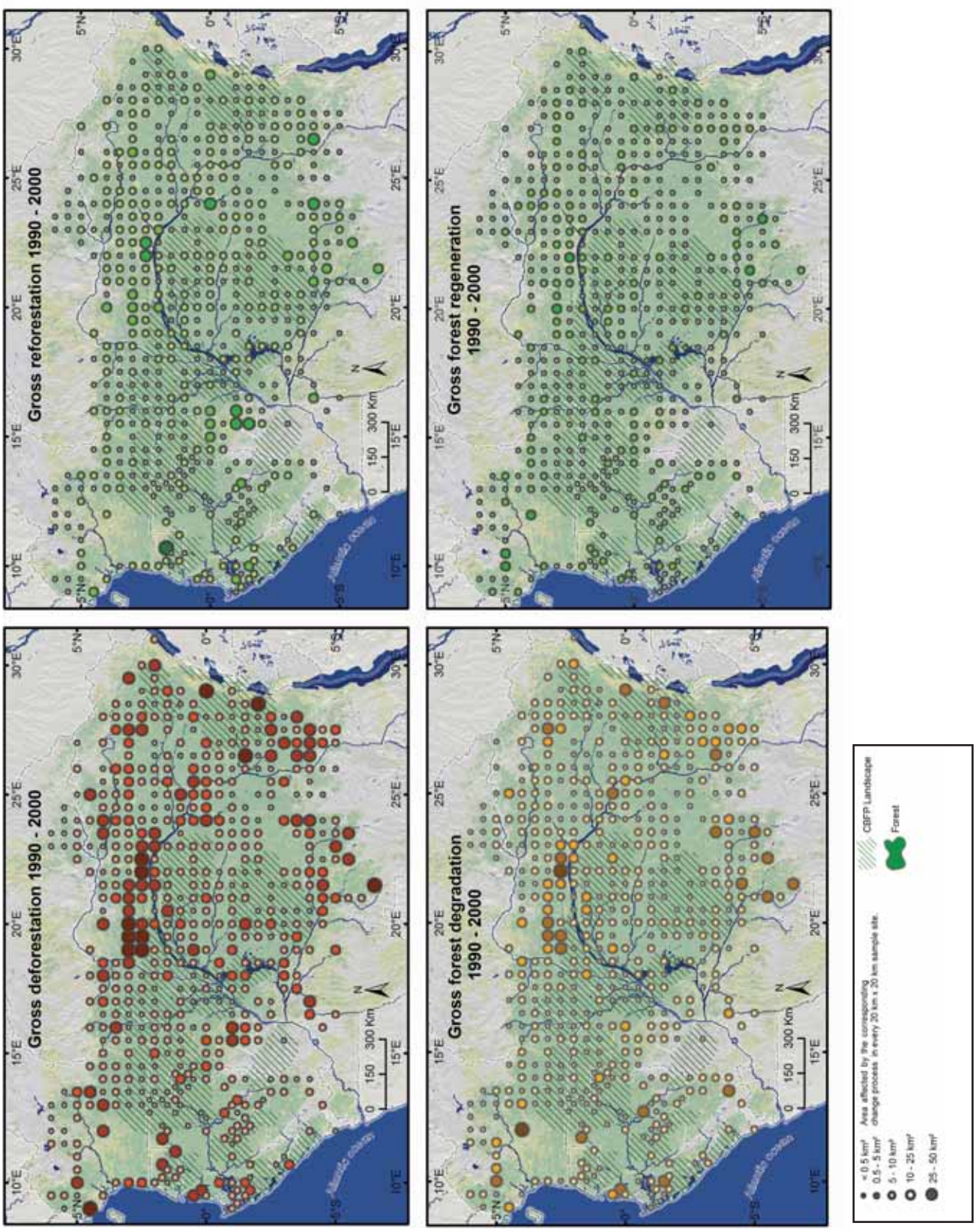


Figure 1.5: Spatial distribution of forest change dynamics that occurred between 1990 and 2000 over the Congo Basin. The circle size is proportional to the surface affected by the corresponding forest cover change process.

Source: Ernst et al., 2010

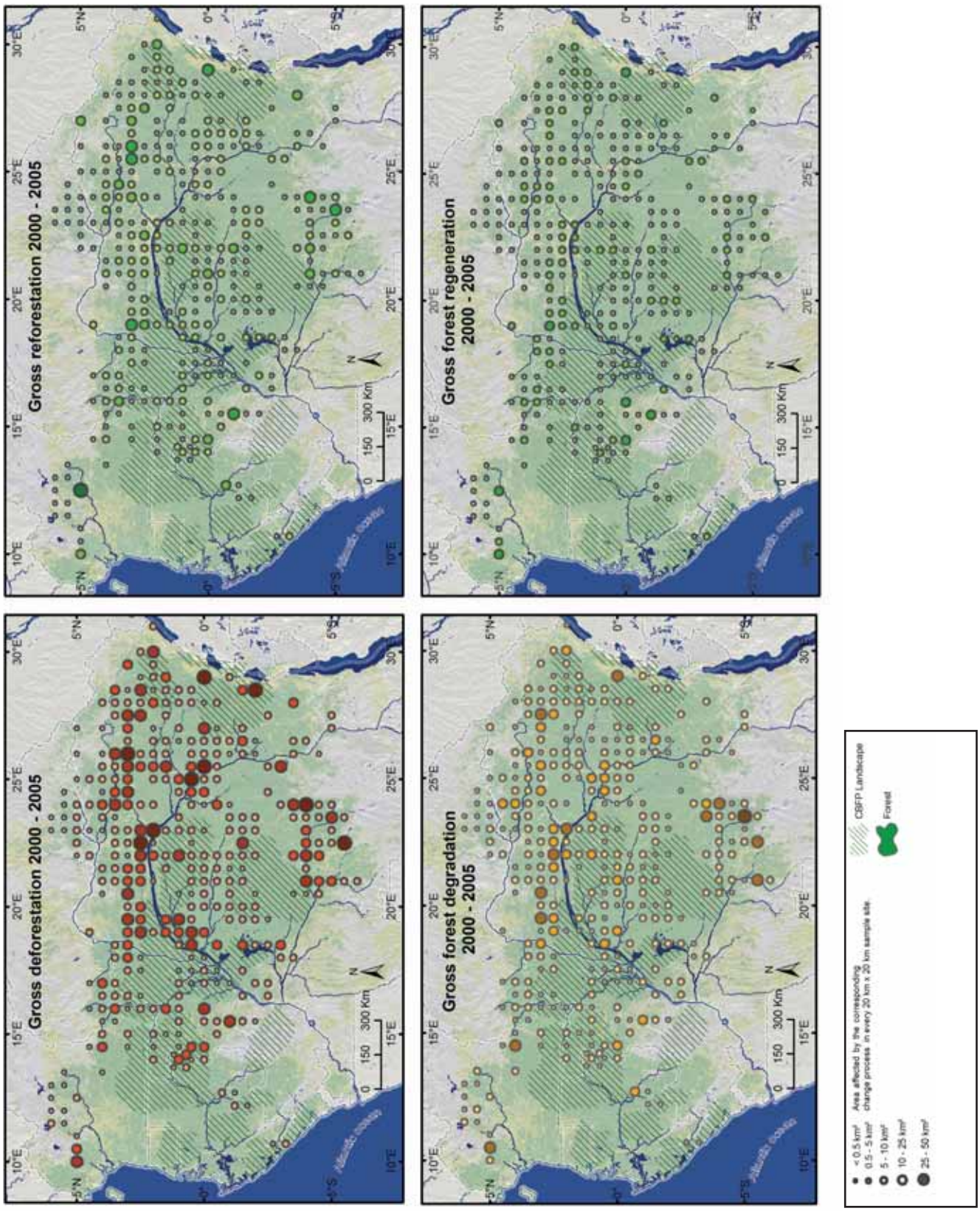


Figure 1.6: Spatial distribution of forest change dynamics that occurred between 2000 and 2005 over the Congo Basin. The circle size is proportional to the surface affected by the corresponding forest cover change process.

Source: Ernst et al., 2010

Photo 1.7: Water and forests are intricately linked in the Congo Basin

The regional and national figures presented here are slightly different from the SOF 2008 estimates. While the previous study processed the same Landsat data set for 1990-2000, the number of samples and their increased size (4 times larger) have contributed to much better sampling rate (increasing the sampling rate from 3.3 % to 13.6 %) and more robust results. The confidence intervals associated with the estimates are lower than those obtained by Duveiller *et al*. in 2008, indicating a more reliable study. The legend has also been simplified to reduce subjectivity in the visual interpretation. Furthermore, in this study, national experts with local knowledge have been involved in the validation process to help ensure better results, thus the outcome benefitted greatly from individual country contributions.

The Global Forest Resources Assessment (FRA) 2010 (FAO, 2010) also reports net loss of forests in COMIFAC countries. The reported rates of loss are different from those calculated in this study. Care needs to be taken when comparing the results of the two studies, as the FRA estimates are derived from statistics delivered by each country and the approach can vary from one country to another. There is no global approach as the one offered by remote sensing. Furthermore, the FAO statistics take into account the whole national territory including all woody vegetation, whereas we only consider the dense forest as defined in figure 1.4. A global remote sensing survey is currently being carried out for FRA 2010 to obtain more detailed and more comparable information on forest change dynamics. These results are expected at the end of 2011 (FAO, 2010) and will be based on the same Landsat data used in this study.

Forest cover and change mapping for DRC

The *Observatoire satellital des Forêts d'Afrique centrale* (OSFAC), South Dakota State University (SDSU) and the University of Maryland have implemented wall-to-wall mapping at moderate spatial resolution (60 m) to better quantify spatio-temporal trends in forest cover change for Central Africa. A new product, the initial result of OSFAC's *Forêts d'Afrique centrale évaluées par Télédétection* (FACET) product suite, quantifies forest cover and forest cover loss from 2000 to 2010 for the DRC using Landsat imagery.

The method is the first to exhaustively mine the Landsat archive in an attempt to overcome the persistent cloud cover found within the Congo Basin. A total of 8,881 Landsat images were processed to create a decadal time-series data set around 2000, 2005 and 2010. The mass-processing of Landsat imagery enabled cloud-free quantification of forest cover extent and loss for 99.6 % of the land area of the DRC. Three forest types were mapped: (i) primary forest (mature forest with a canopy cover > 60 %), (ii) secondary forest (regrowing forest with a canopy cover > 60 %) and (iii) woodlands (woodland formations with a canopy cover between 30 % and 60 %). Year 2000 total forest cover was estimated to be 159,529 thousand hectares with gross forest loss from 2000 to 2010 totaling 2.3 % of forest area. Total forest cover loss (table 1.4) increased by 13.8 % between the 2000-2005 and 2005-2010 intervals, with the greatest increase occurring within primary tropical forests. Forest cover loss intensity (figure 1.7) was distributed unevenly and was most correlated with areas of high population density and mining activity. While gross deforestation for all protected areas increased by 64 % between the 2000-2005 and 2005-2010 intervals, protected areas and Congo Basin Forest Partnership (CBFP) landscapes had lower rates of gross deforestation than areas outside of protected areas or CBFP landscapes. Additional FACET products for other Congo Basin countries are forthcoming.

Photo 1.8: Raphia stands are rich in biodiversity, but difficult to access

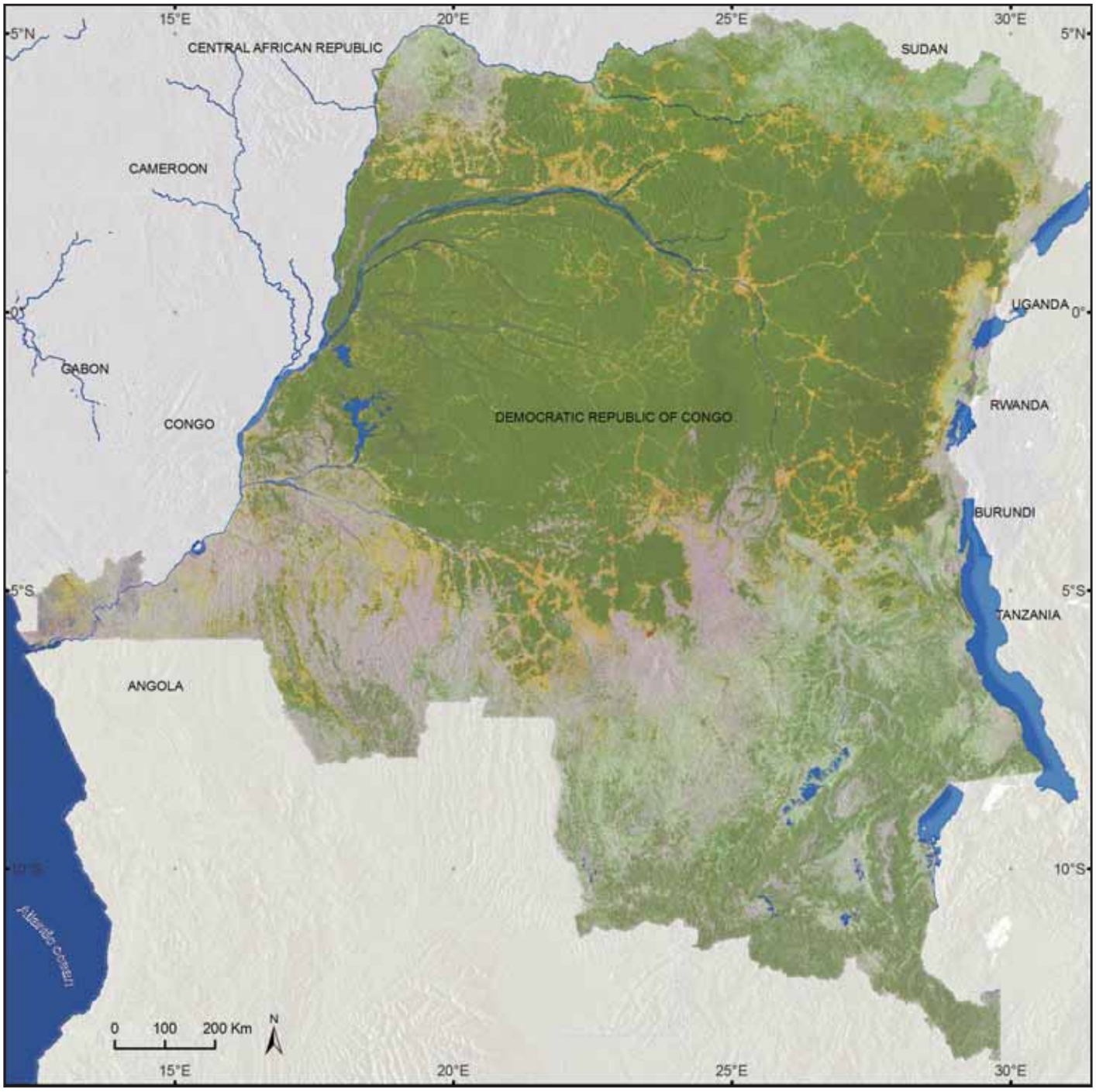


Figure 1.7: Landsat-scale forest cover loss for 2000-2005 (orange) and 2005-2010 (red) for the DRC
Source: OSFAC, 2010

Table 1.4: Forest cover and loss in DRC (thousands hectares)

Forest type	2000 Forest cover (x 1,000 ha)	2000 - 2005 Forest loss (x 1,000 ha)	2005 - 2010 Forest loss (x 1,000 ha)
Primary forest	104,455	367	701
Secondary forest	18,293	1,168	947
Woodland	36,781	201	328
Total	**159,529**	**1,736**	**1,976**

Source: OSFAC, 2010

Gross deforestation rate derived from the forest change maps (table 1.4) is apparently different from the one obtained using the samples validated by the national experts (table 1.2). The difference between the forest legends and the methods respectively used fully explains this apparent discrepancy. Furthermore, for the 2000-2005 period shared by both studies, a detailed comparison showed that the harmonization of legends and approaches provided a gross deforestation rate as high as 0.323 % per year from the mapping products (OSFAC, 2010) which is very similar to the 0.32 % estimated by the sampling approach.

Box 1.1: Causes of deforestation: a spatial model applied to the DRC

Céline Delhage, Pierre Defourny

Earth and Life Institute / Environmental Sciences (UCL)

Within the framework of the UN-REDD programme (The United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation), led by the DRC REDD National Coordination, a quantitative study covering the periods 1990-2000 and 2000-2005 was carried out on the causes of deforestation and forest degradation. This statistical and spatial model gauges the different variables that explain changes in forest cover over the entire DRC. It establishes the link between deforested areas, mapped by remote sensing, socio-economic factors and associated infrastructures on the ground.

An overview of literature on the subject, a bibliographic study of material specifically related to the DRC and expert opinion, all provide the theoretical reasons for deforestation and forest degradation. These potential variables are grouped together in nine subsets: agriculture, infrastructures, forest logging, economic factors, transport communications, demographic factors, socio-cultural factors, institutional factors and biophysical factors. Nevertheless, the causes for deforestation that are covered in the study are limited to those that can be derived directly or indirectly from available cartographic data. It was not possible to model causes such as governance or insecurity. As a result of geographic data collected by different partners, the variables were calculated and assembled into a Geographic Information System (GIS).

Two different levels of modeling were used, national and sub-national. The sub-national scale corresponds to a set of zones defined in terms of large biomes in DRC (according to WWF eco-regions) and to a map of land cover at 1/3,000,000 (Vancutsem *et al.*, 2006). For these two levels, an objective and quantitative approach, based on multivariate statistical analysis calculated from the most detailed information on deforestation available, provided a national model that explains nearly 50 % of deforestation and degradation for the period 1990-2000 and nearly 40 % for the period 2000-2005. On the sub-national scale, each model's explanatory power varies by 40 to 80 % for the two periods and uses five different variables. The models are however limited by the availability of data. This rigorous scientific approach provides an objective evaluation of the different factors affecting deforestation, quantifying their respective importance and excluding a certain number of them. At the national level, the study shows that the diminishing but significant influence of surrounding villages, the increase in population, the presence of degraded forests and roads, and forest fragmentation play a key role in the process of deforestation. On the sub-national scale, differences appear according to the specificities of the different zones, depending on their respective contexts.

The REDD National Coordination has provided for a land survey protocol to be drawn up with national partners to validate the results of the model. This validation is intended to contribute towards collectively building a national consensus on the dynamics of deforestation and forest degradation.

Threats on forest cover

The coming years will be critical for forest resources of the Congo Basin. Population growth, immigration, economic development in the region plus increasing demand at the global level will inevitably increase the pressures on natural resources. The evaluation of threats remains a delicate exercise with many uncertainties. Primary direct threats to forest cover (not to biodiversity) are detailed below. For more information, a statistical analysis of drivers of deforestation in DRC has been conducted by UCL in the framework of UN-REDD (see box 1.1).

Fuelwood

Fuelwood is the main energy source for people in developing countries (see chapter 5). Wood energy in Africa represents over 80 % of total domestic energy consumption across all countries and Africa is the only continent where wood energy should continue to grow in the coming decades (Marien, 2009). Forests, most notably peri-urban forests, play a key role in providing fuelwood or charcoal. Fuelwood collection has a major impact on deforestation and degradation particularly in heavily populated areas. Developing forest plantations for wood energy, developing sustainable management of forests, and improving energy processing will have major positive impacts on the state of the forests, especially peri-urban forests.

Agriculture

Limited access to improved agricultural technologies has long led farmers to practice shifting cultivation in most tropical African communities. This practice has been part of the ecosystem for many centuries but it becomes a problem when fallow periods are shortened as more land is required for production, leading to a decline in the regeneration of trees, soil fertility and agricultural yield (Boahene, 1998). This generally occurs along main roads, near villages and on the outskirts of urban centers (Devers & Vande weghe, 2007). Without support for modernizing food production in these communities, the threat of deforestation and degradation will increase in the future.

Mining and oil extraction

Africa has extensive mineral resources, constituting approximately one third of global mineral resources. This proportion rises to 89 % for platinum, 81 % for chromium, 61 % for manganese and 60 % for cobalt. The subsurface strata of the Congo Basin contain very important oil and mineral resources, including iron, copper, manganese, uranium as well as diamonds and gold (Reed & Miranda, 2007). These resources currently provide significant revenues for the region's countries. According to many experts, this leading position should strengthened by 2015. Much of these resources are exploited in artisanal and small scale operations but even so mining is a significant threat to forest ecosystems.

Resource extraction not only has direct impacts such as deforestation, pollution and natural resources degradation but also precipitates indirect impacts linked to infrastructure development. Failure to apply better practices for appropriate mitigation of environmental impacts and a lack of compensatory measures are clearly a threat for forests within the Congo Basin. Promotion of coherent and integrated land use planning and resource governance must be a priority in order to reduce the adverse effects of mining and oil extraction.

The Congo Basin lies above and close to major oil deposits. The oil industry is important in the Gulf of Guinea and in the forests of the coastal sedimentary basin. The economies of Equatorial Guinea, Gabon and Republic of Congo are heavily dependent on this industry. In DRC, the recent discovery of large reserve of oil in the Albertine Rift (Kivu) and Mbandaka could be a new source of pollution particularly alarming close to some protected areas (in March 2011, the DRC government has put the brakes on oil exploration in Virunga National Park (bloc V)). As the global demand for oil increases, the pressure to extract oil will intensify.

Agrofuels

Agrofuels consist of a wide range of fuels which are in some way derived from biomass. Oil palm is a traditional native crop for Central Africa but in recent years, African communities are facing the expansion of large scale oil palm plantations (mostly in DRC and Cameroon). Forest areas in the Congo Basin have been converted to monoculture oil palm aimed at the production of agrofuels and at present, there is a very strong push for the establishment of even larger plantations. Poor transportation networks remain an obstacle for broad development of plantations within the central region. Land grabbing for monoculture agrofuel plantation is increasing but no reliable statistics are available.

Photo 1.9: Palm oil plantations compete for land with natural forests

Box 1.2: Land degradation in Central Africa: environmental, economic and social impacts

Martin Tadoum, Chouaibou Nchoutpouen
COMIFAC

Land degradation in Central Africa has led to the destruction of soil properties and has resulted in serious economic, social and environmental problems. It is a major concern for decision-makers and populations alike in the sub-region. In the context of water and land management, combatting land degradation is a matter of prime importance.

In order to deal with this problem, all Central African countries joined the United Nations Convention to Combat Desertification (UNCCD) and developed National Action Plans to combat desertification. In September 2008, the sub-region also drew up and adopted its Sub-Regional Action Programme to Combat Land Degradation and Desertification (PASR-LCD).

In most countries in the sub-region, sustainable land and natural resource management is an issue which cuts across several rural development areas of activity. Many ministerial departments involved in rural activities deal with the problem with budgets allocated to them by the State. However, each one acts independently of the other.

A study was commissioned by the Economic Community of Central African States (ECCAS) and COMIFAC, with financial support from the World Mechanism, in order to prepare an advocacy document on the economic, social and environmental impacts of land degradation in Central Africa.

The results of this study clearly show that land degradation in Central Africa has significant environmental, economic and social repercussions. While some areas are more affected than others, all ten COMIFAC member countries have to pay a high price. Overall, the following can be noted: (i) from an environmental perspective, land degradation leads to a decrease in natural vegetation, a fall in crop yields due to the loss of soil fertility, a reduction or even loss of biodiversity, a change in water quality due to various types of chemical pollution; (ii) from an economic perspective, consequences are noticeable in the agricultural sector where loss of production for seven subsistence crops (maize, rice, sorghum/millet, cassava, taro/yam, sweet potato, beans) are estimated at $ 2.4 billion yearly and $ 5 billion when this estimate covers both subsistence and cash crops; (iii) from a social perspective, populations in the sub-region suffer from energy and food crises, poverty, health problems and the lack of resources leads to conflicts.

In order to mitigate this problem in Central Africa, each country should (i) include matters relating to sustainable land management into policies and poverty reduction programs and give them national priority status; (ii) launch a detailed study on the costs of land degradation; (iii) develop a national land use plan and a national multi-sectorial policy document; (iv) establish monitoring mechanisms to monitor informal sectors of resource exploitation; (v) set up policy, institutional and incentive measures to promote technical and financial partners, farmers and breeders and many other stakeholders, to invest in sustainable land management.

Logging

Industrial logging temporally generates inevitable impacts (disturbance to the remaining trees) as well as avoidable impacts on the forests, including soil erosion, water pollution and reduction of the regeneration capacity. Logging increases human presence in the forest, from logging camps and providing access through road construction. Logging also removes nutrients and escalates forest fragmentation (Devers & Vande weghe, 2007). However, the direct impacts can be mitigated by (i) improving the legal and institutional frameworks, (ii) promoting a better forest governance[3], (iii) implementing forest management plans, (iv) forestry certification, and (v) by better local involvement (e.g. decentralization and benefit sharing).

The impact of informal or artisanal logging could be more serious than industrial logging as they are not subject to any kind of regulation. Despite its importance, there is a general lack of statistics, studies and information about this sector.

[3]In the framework of Forest Law Enforcement, Governance and Trade (FLEGT) three Voluntary Partnership Agreements (VPA) have been signed.

The forest cover change estimates delivered here in the context of the Observatory for the Forests of Central Africa (OFAC) are of critical importance for national forest policy as well as for the Reducing Emissions from Deforestation and Forest Degradation (REDD) programme. They may serve as reference for the period 1990-2000 and possibly for 2000-2005 for the countries covered by a sufficient number of samples. In the near future, the sampling approach will be repeated for 2010. Similarly, forest cover change mapping will be extended.

Photo 1.10: The vastness of the forest does not render it inaccessible

Conclusions

Forest cover monitoring in the Congo Basin is most practically achieved through remote sensing. However, the use of data from optical sensors is constrained by persistent cloud cover particularly over western parts of the basin, limited data acquisition strategies for the region, data costs, the absence of ground receiving stations in Central Africa, and the shortage of human and technical capacity for remote sensing in the region (COMIFAC, 2010). At the same time, the potential for systematic monitoring has increased over the past few years as a result of improved satellite data access (specifically the open and free access to the USGS Landsat archive as of December 2008), gains in computational power, development of automated and semi-automated methods and increasing capacity in the region.

As described above, increased global demand for mineral, energy and wood resources from Africa, the investment in infrastructure to access these resources, and increasing human population pressure (with commensurate increased demand for fuelwood and food production) are likely to accelerate deforestation and forest degradation. Both forest cover monitoring studies described here report deforestation increases in the Congo Basin: a doubling of the annual rates of gross deforestation between 1990-2000 and 2000-2005 from the sampling approach, and a near doubling in the loss of primary forest between 2000-2005 and 2005-2010 from the wall-to-wall approach.

Progress continues to be made in mapping forest and vegetation types at higher spatial resolutions, a necessary advance in forest cover monitoring. This can be achieved through making use of complementary satellite derived data sets (such as in the MERIS/SPOT-VGT mapping described here) and other initiatives such as the wetlands (including flooded forest and inundated grasslands) of the "*cuvette centrale*" recently mapped using a combination of Landsat data, JERS radar data and elevation data from the Shuttle Radar Topography Mission (Bwangoy *et al.*, 2010). Classifications of this type are critical for habitat delineation, understanding ecosystem functions and services, as well as for carbon monitoring.

CHAPTER 2

Forest management and the timber sector in Central Africa

**Nicolas Bayol, **Benoît Demarquez, ***Carlos de Wasseige, ‡Richard Eba'a Atyi, ##Jean-François Fisher, ‡Robert Nasi, *Alexandra Pasquier, *Xavier Rossi, ##Matthew Steil, *Catherine Vivien*

**FRM, **TEREA, ***OFAC, ‡CIFOR, ##WRI-FTI*

Introduction

The formal forestry sector plays an important role in the economy of Central Africa. This is not only due to the contribution it makes to the various gross domestic products (GDP) of Central African countries, a contribution which has fallen in recent years with the development of the petroleum and mining sectors, but also because of the advantages presented by two main characteristics of the forestry sector. First, the sector is based on developing a renewable raw material and, as such, it guarantees lasting revenues for as long as this resource is adequately managed. Second, it is largely integrated into a rural economy that has limited monetization. As such, the forestry sector often represents the main sector generating direct and indirect employment (see table 2.1), and also provides incomes for the local populations and funding for infrastructure in rural areas. In this way, the forestry sector undoubtedly contributes towards the fight against poverty.

The forest logging and industrial timber sector has significantly changed over the past two decades. At the center of the international debate on sustainable management and the fight against climate change, it has also needed to adapt to fluctuating markets and the growing demand for greater consideration of the social and environmental aspects of forest management.

This chapter summarizes the current situation with regard to forest management and the timber sector in Central Africa, using data collected by the Observatory for the Forests of Central Africa (OFAC) in addition to surveys and discussions in the field with the main actors involved in the forestry sector. The chapter highlights in particular the developments that have taken place in this sector since the 2008 State of the Forest (SOF) publication.

Photo 2.1: Wengé logs (Millettia laurentii) in an industrial yard in DRC

Table 2.1: Forestry sector's contribution to national GDPs and direct employment creation in Central Africa

Country	Forestry sector's contribution to GDP (*)		Number of direct employments (**)	
	Value (%)	Year	Value	Year
Cameroon	6	2004	13,000	2006
Congo	5.6	2006	7,424	2007
Gabon	3.5	2009	14,121	2009
Equatorial Guinea	0.22	2007	2,000	2007
CAR	13	2009	4,000	2009
DRC	1	2003	15,000	2007
Total			**55,545**	

(*) Figures given are those most recently available on the OFAC website.

(**) It is difficult to ascertain the number of indirect jobs as data in this area is heterogeneous.

Sources: Cameroon: the Ministry of Finance and Economic and Financial Audit of the Forestry Sector; Republic of Congo: Poverty Reduction Strategy Paper (PRSP) and MDDEFE; DRC: World Bank and Fédération des Industriels du Bois (FIB); CAR: Institut centrafricain de Statistiques et d'Études économiques et sociales (ICASEES); Gabon: Cellule économique; Equatorial Guinea: Documento de la seconda Conferencia Economica and Forestry Enterprises.

Photo 2.2: Bossé (genus Guarea with 8 species) is commonly logged in Central African forests, notably in the CAR

The institutional framework for forest management

Forestry legislation

While, forest regimes in Central African countries date from the colonial period, from 1990-2000, all countries in the region adopted new forest codes outlining the guidelines for forest management. These codes are relatively similar across most Central African countries.

Despite being the legal owners of their forests, Central African States are ill-equipped to manage them on a day-to-day basis, especially given their vast size, their inaccessibility and the fact that administrations lack the necessary equipment and human and financial resources. Forestry legislation has therefore allocated forest management to concession holders for parts of the forest, namely for long-term forest concessions or other forest logging titles. The State takes responsibility for these areas by: (i) elaborating technical standards; (ii) ensuring that management decisions are carried out; (iii) monitoring application of management decisions; (iv) ensuring follow-up and monitoring of production; and (v) ensuring receipt of fiscal revenues in the context of forest management activities.

Allocated areas

Table 2.2 presents forest areas allocated to logging in Central Africa. Only long-term forest concessions (over 15 years in duration) are mentioned. They account for the bulk of production forests in the area.

In recent years, allocated areas have been relatively constant with the notable exception of the DRC, where they have decreased compared to 2002 figures.

Table 2.2: Allocated areas by country (in hectares)[4]

Country	Forest area in 2010(*) (ha)	Total area of forest concessions (ha)	Year
Cameroon	18,640,192	6,381,684	2009
Congo	17,116,583	12,669,626	2010
Gabon	22,324,871	9,893,234	2009
Equatorial Guinea	2,063,850	0(**)	2010
CAR	6,915,231	3,022,789	2009
DRC	101,822,027	12,184,130	2011
Total	**168,882,754**	**44,151,463**	

(*) Area of lowland dense moist forest.

(**) In Equatorial Guinea, all the forest concessions were canceled in 2008.

Sources: Verhegghen & Defourny, 2010 – DRC Geodatabases; SIAF Congo; OFAC.

The case of DRC

The reason allocated areas in the DRC have decreased is that, since 2003, considerable effort has been made to validate forest titles granted to the private sector. The evolution of these allocated areas is presented below:

- Before 2002: 45.5 million hectares were allocated;
- In 2002: 25.5 million hectares of forest concessions were abrogated, resulting in a total allocated area of 20 million hectares; and a moratorium on granting new titles was put in place;
- Non-compliance with the moratorium and illegal provision of a large number of forest titles;
- In 2005: publication of a decree establishing the modalities for converting former forest titles into forest concession contracts (see below) and title holders submitted requests to convert 156 forest titles covering a total area of 22 million hectares;

[4] The administrative areas are different from the GIS calculated areas. For example, according to the WRI, in February 2011, in DRC, the administrative areas of allocated forests totaled 12,184,130 hectares while a GIS analysis calculated the total area as 14,491,935 hectares.

- As of 29 January 2011: 80 forest titles representing 12.2 million hectares had gone through the conversion procedure and were deemed suitable for conversion.

To obtain a forest concession contract, title holders applying for conversion of titles are first required to draw up a four-year management plan (the period seen necessary for drawing up a full management plan) and sign the Forest Administration's terms and conditions that regulate the modalities for land use, including social and environmental measures that will be implemented. They must also sign an agreement with local communities stipulating the socio-economic measures for the titles concerned (see box 11.4).

Photo 2.3: School constructed by a logging company

Managing forest resources

Developments in forest management

The gradual establishment of sustainable management of production forests has been one of the major developments in the forestry sector over the last fifteen years and has little by little replaced a more "mining" form of logging that extracts the available resources without any prior planning.

With the exception of the DRC, unallocated forest areas are becoming increasingly rare, which clearly shows that resources are not unlimited. Competition in demanding international markets and growing industrialization require more precise and reliable production planning at least over the medium term. Exact calculations for future production can only be achieved through forest management.

Following the 1992 Rio Conference, the international community and consumers have put pressure on countries and on private operators to establish good practices in forest management. In the Central African region, this has been implemented by adopting new forest legislation and providing the technical and financial supports required for a sustainable management process. The social and environmental functions of the forest have taken pride of place in forest management, which is no longer limited to planning sustainable timber extraction.

In the 1990s, the first management plans based on this new approach were drawn up within the framework of projects that were mainly funded by international donors. Although their implementation has not always been entirely effective, the new management plans laid the technical framework for the sustainable management of Central African forests and form the basis, through today, for the region's entire management process.

Reminders of key dates:

- 1993 – 1995: the API (*Aménagement Pilote intégré*) Dimako project establishes the foundation for what forest management in Central Africa should be. It not only includes requirements for sustained forest output, but also takes into account the environmental and social functions of the forest;
- 1998: IFB (*Industries forestières de Batalimo*) is granted Agreement of the Management Plan for Logging Permits (authorization No. 169). This management plan was drawn up in the context of the ECOFAC project;
- 2000: In Gabon, validation of the first management plan prepared by a private forest concessionaire;
- 2010: In the Congo Basin, over 14 million hectares under formal management and 4.5 million hectares granted FSC (Forest Stewardship Council) certification.

Photo 2.4: Implementing forest concession management in CAR

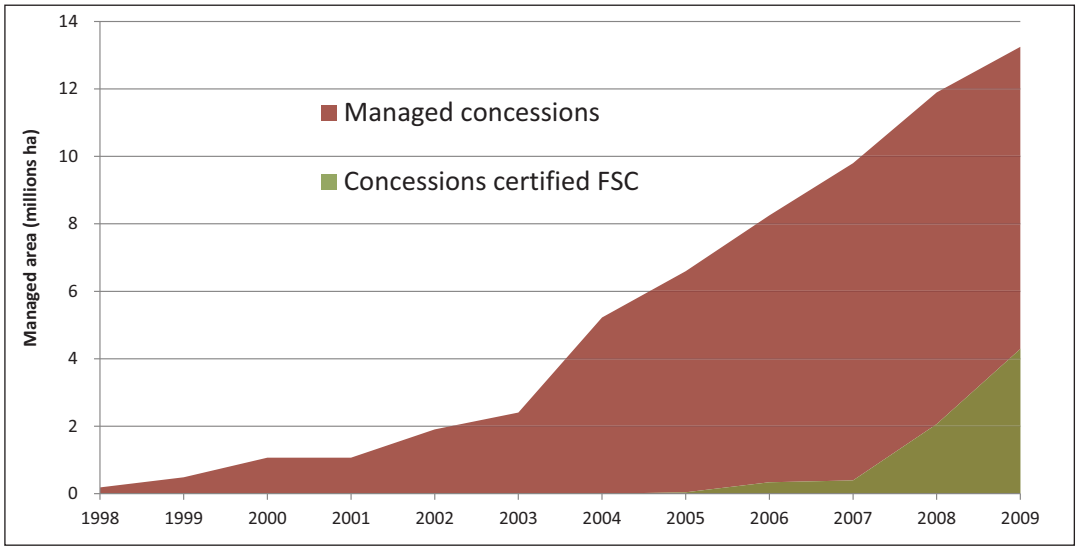


Figure 2.1: Evolution of managed areas with FSC certification in Central Africa (excluding Controlled Wood certificates[5])

Sources: FSC; Cameroon: Topa et al., 2010; Gabon: WRI Atlas; CAR: PARPAF Project; Congo: FRM.

While the management process is well under way in Cameroon, CAR, Congo, and to a lesser extent, Gabon, it has only just begun in DRC which is the biggest forest country in the sub-region. The delay in DRC is explained by the armed conflict that affected the country from 1999 till 2003, and then by the lengthy conversion process for forestry titles. Equatorial Guinea has not followed the management process initiated by other countries in the region.

[5] The "Controlled Wood" label aims to guarantee that timber with an FSC label are from a verified and approved FSC source, or that they contain FSC monitored material mixed with non-certified timber.

Box 2.1: Sustainable management of CAR's timber forests

Hervé Martial Maïdou, Didier Hubert

PARPAF

The Central African Republic (CAR) is a special case in the sub-region as regards forest management. In 1990, when the CAR Forest Code came into effect, it stated that "The Minister responsible for forests draws up the management plans". The Forest Code also stipulated that "all industrial exploitation/logging of the forest domain is subject to being in possession of a logging and management permit (PEA)".

From 2000 onwards, the forest administration has received support from the French Development Agency (AFD) through the Project to Support the Implementation of Forest Management Plans (PARPAF - *Projet d'Appui à la Réalisation des Plans d'Aménagement forestiers*) to assist with the development of management plans for forest concessions that had been allocated or were still to be allocated.

In CAR, PEAs are awarded by tender and requests are considered in the presence of an independent observer.

According to national norms for management, once a PEA has been awarded by presidential decree, a provisional management-logging convention is signed by the Ministry responsible for forests and the operator who has been awarded the PEA. In addition to identifying felling areas and drawing up technical logging specifications, the convention stipulates that the company must set up a management cell so as to gradually incorporate an overall management process. The cell should comprise at least one social affairs manager and one land planning manager to liaise between PARPAF and the company's management during the entire period necessary for elaborating the management plan.

Three months after signing the convention, and once PARPAF has drawn up the pre-inventory sampling plans and the management inventory, the forest company must start planning work. PARPAF trains the company's prospecting teams in the technical aspects of management inventories, and guides and monitors the management work during the whole duration of the provisional convention. During this phase, PARPAF also carries out further studies including socio-economic and felling monitoring studies.

Validating these studies and the management plan takes place in various stages that involve the administration, the operator and the local communities. Emphasis is placed on ensuring that the operator participates in the process and is made aware of the challenges, benefits and constraints of sustainable management. The signature of a final convention between the forest administration and the operator validates the management plan.

In CAR, the forest production zone in the south-west has 14 PEAs covering a total area of 3,695,716 ha. On 31 December 2010, management plans were approved for ten concessions and one concession, under a provisional convention, was on the point of obtaining validation for its management plan. Three PEAs had not yet been awarded.

The success of CAR's approach lies in the overall consistency of the management plans that are developed through a more uniform fashion where all concessionaires are provided the same support.

Unfortunately, the assistance provided by PARPAF to concession companies has not yet allowed concessionaires to establish the necessary capacity to carry out their planning and management activities independently.

Table 2.3: Status of forest management in CAR as of 31 December 2010

N°	Society	PEA	Total area (ha)	Exploitable area (ha)	Not allocated	Provisional convention	Final convention	Total area (ha)	Exploitable area (ha)
1	SCAD	171	475,589	333,692			10/06/2005		
2	SEFCA	174	395,856	335,031			17/06/2006		
3	SEFCA	183	325,563	241,860			17/06/2006		
4	IFB Ngotto	169	186,596	137,585			20/07/2007		
5	SCAF	185	270,005	200,853			03/12/2007	**2,864,540**	**1,960,968**
6	VICA	184	370,294	204,160			21/03/2008		
7	Thanry CA	164	225,321	205,100			21/03/2008		
8	SOFOKAD	175	188,691	92,057			21/03/2008		
9	IFB Batalimo	165	208,038	129,563			22/12/2010		
10	IFB	186	218,587	81,067			22/12/2010		
11	SCD	187	156,531	88,547		01/08/2007		**156,531**	**88,547**
12	?	A	229,025	193,420	X				
13	?	B	211,155	179,289	X			**674,645**	**565,812**
14	?	C	234,465	193,103	X				
Total			**3,695,716**	**2,615,327**					

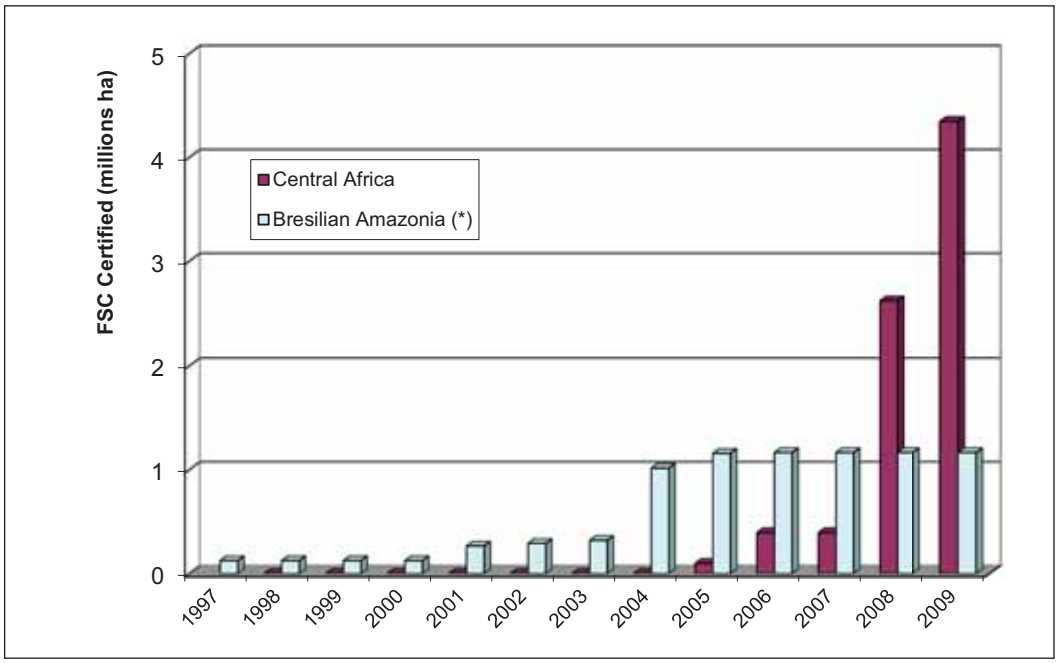
Source : PARPAF

In Republic of Congo, the Congo Forests Sustainable Management Support Project (PAGEF) to support forest management began in September 2009. The project's objective to extend the management process from the north to the center and south of the country was achieved in one year. In addition to finalizing the planning work, initiated during the first year, the project will improve the established institutional framework to assist with the establishment and implementation of management plans by developing national standards, establishing a permanent forestry domain and setting up an economic observatory.

Forest certification

Having been sensitized by informational campaigns and international debates, distributors and, to a lesser degree, consumers are becoming concerned about the origin of the timber they buy and the conditions in which the timber is produced. Independent certification systems for legal and good forest management have been established to ensure that producers adhere to legal and sustainable management procedures. For most producers, certification and verification (establishing systems to check validity and legal origin) are now a logical concluding step in the preparation of management plans, as demonstrated by the significant increase in certified area in Central Africa in recent years, even as compared to the Amazon Basin (figure 2.2).

Photo 2.5: Reduced impact logging (RIL) works to minimize the effects of tree felling on the surrounding environment



(*) Estimations based on Natural Forests and Plantation FSC data

Figure 2.2: FSC certified Natural Forests

Source: FSC.

Table 2.4: Progress of forest certification in the Congo Basin (February 2011)

Date	Country	Company	Name of FMU(*)	Area (ha)	Certification Body
08/12/2005	Cameroon	Wijma Douala SARL	FMU 09-021	41,965	Veritas
Total year 2005				**41,965**	
22/05/2006	Congo	CIB	FMU Kabo	297,000	SGS
Total year 2006				**297,000**	
03/07/2007	Cameroon	Wijma Douala SARL	FMU 09-024	55,078	Veritas
Total year 2007				**55,078**	
12/02/2008	Cameroon	Reef (TRC)]	FMU 00-004	125,490	Veritas
09/10/2008	Gabon	Rougier	Haut-Abanga	288,626	Veritas
09/10/2008	Gabon	Rougier	Ogooué-Ivindo	282,030	Veritas
09/10/2008	Gabon	Rougier	Léké	117,606	Veritas
09/10/2008	Gabon	CBG	FMU Kivoro	216,443	Veritas
09/10/2008	Gabon	CBG	FMU Mandji	166,400	Veritas
09/10/2008	Gabon	CBG	FMU Rabi	185,700	Veritas
09/12/2008	Cameroon	Pallisco	FMU 10-041	65,564	Veritas
09/12/2008	Cameroon	ASSENE NKOU (Pallisco)	FMU 10-044	65,755	Veritas
09/12/2008	Cameroon	Pallisco	FMU 10-030	76,842	Veritas
09/12/2008	Cameroon	Pallisco	FMU 10-039	48,042	Veritas
09/12/2008	Cameroon	SODETRANCAM (Pallisco)	FMU 10-042	45,184	Veritas
09/12/2008	Cameroon	SODETRANCAM (Pallisco)	FMU 10-031	41,202	Veritas
Total year 2008				**1,669,806**	
26/02/2009	Congo	IFO (Danzer)	FMU Ngombe	1,159,643	SGS
19/05/2009	Congo	CIB	FMU Pokola	452,200	SGS
02/06/2009	Gabon	CEB-Precious wood	CFAD	616,700	Veritas
Total year 2009				**2,228,543**	
19/01/2010	Cameroon	SFIL (Decolvenaere)	FMU 10-052	70,912	Smartwood
19/03/2010		CAFECO (WIJMA)	FMU 11-005	71,815	Veritas
		TRC	FMU 11-001	80,384	
Total year 2010				**223,111**	
Total				**4,515,503**	

(*) FMU: Forest Management Unit

Source: FSC.

In the first quarter of 2010, forest concessions with legal certificates amounted to about 4.5 million hectares in Central Africa (table 2.4). These certificates are granted by independent auditors of international repute (Timber Legality and Traceability Verification (TLTV) from SGS, Origin and Legality of Timber (OLB) from BVQI, Verification of Legal Origin (VLO) and Verification of Legal Compliance (VLC) from Smartwood).

In practice, legal certification usually constitutes the first step towards obtaining a certificate for good forest management.

As shown in figure 2.1, trends in certification usually follow management trends. Drawing up a management plan is an indispensable precursor to certification.

Gabon and Republic of Congo are the two most advanced countries as regards certification. Cameroon is in third position in terms of area, but has a greater number of certified operators.

CAR, while being very advanced with regards to management, is behind in the context of certification.

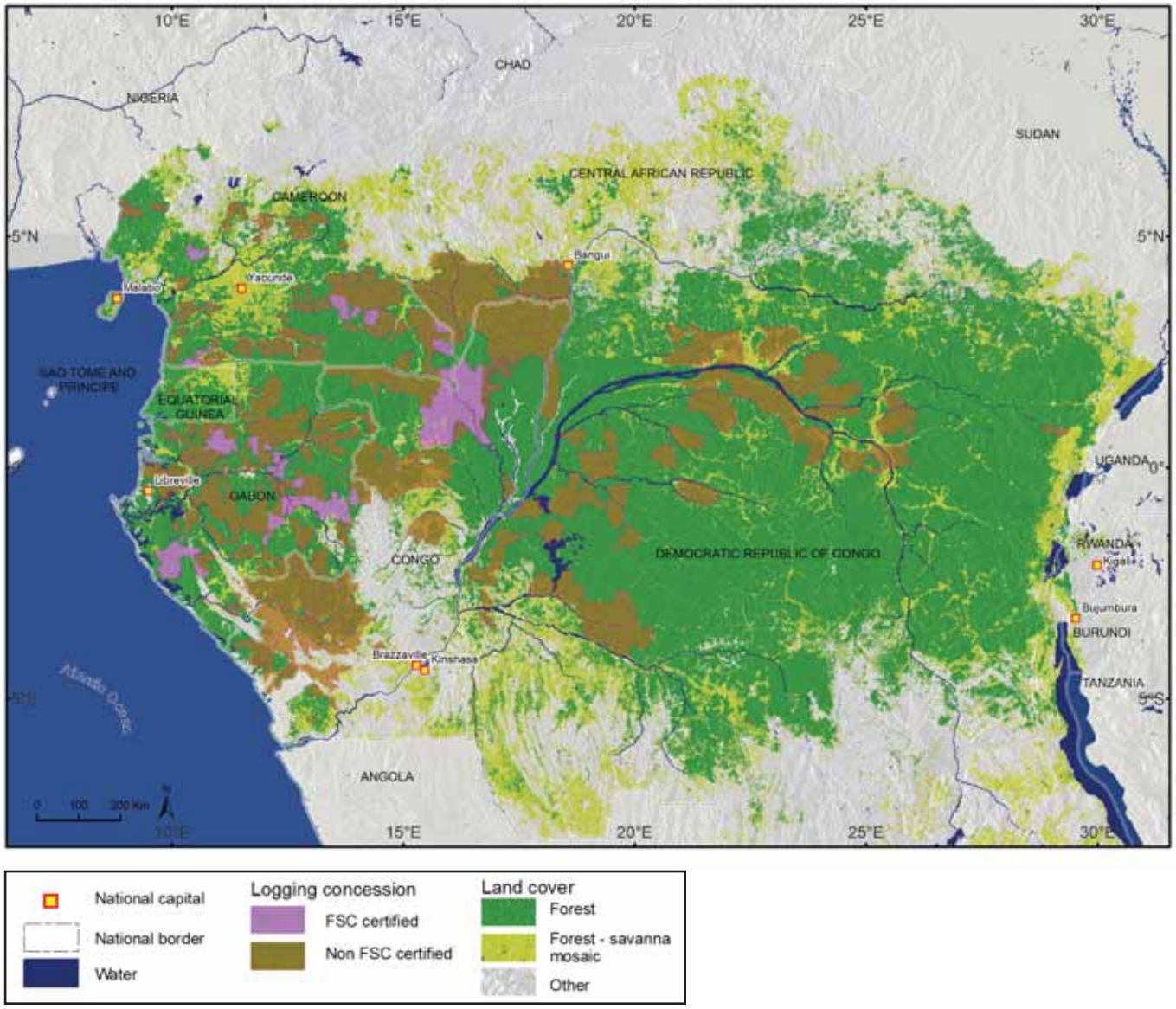


Figure 2.3: Progress of FSC certification for concessions across Central Africa
Sources: Verhegghen & Defourny, 2010; WRI Forest Atlas; FSC.

Box 2.2: Project to develop small-scale forestry permits in Gabon

Faustin Legault

PAPPFG

Project description

The project to develop small-scale forestry permits in Gabon (PAPPFG – *Projet d'Aménagement des petits Permis forestiers Gabonais*) was launched in May 2007 for a five-year period.

The project aims to consolidate the process to develop forest management in Gabon by supporting the incorporation of the use of small scale permits and national economic operators in the Gabonese timber trade. The project is designed to establish small scale permits over an area of 2.25 million hectares of forest. It also seeks to strengthen the capacity of the responsible Ministry and promote the use of national operators in the timber trade, thereby registering them in the formal sector and providing them with legal status and job security.

Organization of the project

The project was designed as a service platform for small scale permit holders and their partners. It consists of five components: (i) awareness-raising/extension/training; (ii) support for setting up permit holder groupings; (iii) technical assistance to establish development plans; (iv) support for sustainable forest management; and (v) a final cross-cutting funding and transfer component.

The project is being overseen by the Water and Forestry Ministry, represented by the Water and Forestry General Directorate. Project management is delegated to a management unit, assisted by the FRM/CIRAD/TEREA group.

The total budget for the project is € 15.7 million, which covers the entire cost of establishing the development plans (€ 13.3 million) and drawing up the planning inventories for the holders' concessions (€ 2.4 million).

Status in 2010

As of mid-2010, the project had registered 123 small scale permits for a total area of 1.6 million hectares. Eight groupings (500,000 ha) had signed provisional management-exploitation-processing agreement (CPAET) and were poised to draw up the management plans for their concessions. A first development plan had already been submitted to the Ministry for approval and a second plan was being finalized.

Nineteen other groupings (1,100,000 ha) were in varying stages of development. At the end of 2010, the areas covered by provisional agreements reached around 800,000 hectares.

In parallel with this planning work, the project provides numerous training sessions for private holders and the administration in order to strengthen their capacity (e.g. use of GPS, mapping with GIS, inventories…). It also develops various technical documents that provide direction on the elaboration and implementation of different components of development plans (i.e. socio-economic studies, timber, fauna and biodiversity inventories, management and exploitation plans, reduced impact logging, …).

Once completed, the project should have made a significant contribution to the sustainable management of Gabonese production forests and improved sector governance, which will certainly benefit the country, notably in terms of improving its image.

Establishing importation controls: the FLEGT rule and the Lacey Act

□ *The FLEGT Action Plan*

In 2003, the European Union launched its FLEGT (Forest Law Enforcement, Governance and Trade) Action Plan, in order to participate in efforts to eliminate illegal logging from the timber trade at the international level. FLEGT seeks to ban illegal timber trading on the European market.

□ *Voluntary Partnership Agreements*

One of the fundamental elements of the FLEGT Action Plan is to provide support to producing countries to improve their forest governance and establish effective methods to counter illegal logging. To achieve this, the Action Plan has designed Voluntary Partnership Agreements (VPA) to be signed by the European Union and timber exporting countries. The VPA commits countries to establishing an effective verification system regarding the legitimacy of their forest products. To date, of the three VPAs that have been signed at the international level, two are for OFAC countries – Republic of Congo (17 May 2010) and Cameroon (6 October 2010); the third signatory country is Ghana.

As far as other Central African countries are concerned, negotiations took place in CAR in November 2009 and led to the initialing of a VPA on 21 December 2010. DRC and Gabon have made official requests to start negotiations.

Box 2.3: Trends in forest governance: VPA-FLEGT

Alain Pénelon, Emmanuel Heuse

CIRAD, BTC

The 2003 FLEGT European Action Plan provides for the negotiation of commercial agreements with timber producing countries so that they can jointly combat illegal logging and the illegal trade of timber. FLEGT is having an increasingly positive impact on developments in logging governance in Central Africa, even if there is still a long way to go.

The five main forest countries in the Congo Basin (Cameroon, Congo, Gabon, CAR and DRC) are currently either formally engaged in negotiations or in the early stages of implementing a Voluntary Partnership Agreement (VPA) with the European Union in the framework of the FLEGT Action Plan. Congo and Cameroon signed their VPAs in May and October 2010 respectively. The CAR concluded negotiations in December 2010. Gabon and the DRC began negotiations in September and October 2010 respectively.

By establishing a strong and reliable legal verification system, cargoes of legally checked timber will obtain FLEGT authorizations for exportation to European markets. VPAs will make a solid contribution to strengthening sustainable management in Congo Basin forests. Such management is at the heart of legal and regulatory requirements in forest codes adopted by the five countries between 1994 and 2002, but which until now have not been effectively applied on-site.

Optimistic forecasts that timber with a FLEGT stamp of authorization will be exported as of 2011 to European markets do however seem unrealistic as requirements negotiated under the VPAs often involve introducing complex reforms to address how the administration and forest monitoring bodies operate. Experience gained in 2009 and 2010 is a good illustration that, once they reach the stage of their first FLEGT authorization, the five concerned countries in the Congo Basin will undoubtedly have taken a huge step in improving the entire functioning of their forest administration and the governance of their forest sector. Independent system audits will guarantee the solidity of the new devices that have been established.

The recent adoption by the European Council of a regulation on illegal timber will, in the meantime, provide further motivation of VPA's for Congo Basin exporting countries. By forcing all operators that export timber to European markets to ensure its legality (wherever it is from), this regulation will force processing countries, in particular the Chinese market which imports a lot of Central African timber but transforms much of it to send to Europe, to be concerned about the legality of supplies from the Congo Basin.

Based on a wide process of multi-stakeholder consultation, from the onset of the negotiating phase of the VPAs, the FLEGT Action Plan appears to be a very novel tool for the improvement of forest sector governance in Central Africa. Many aspects of its methodology serve to make it a model for other mechanisms, such as REDD+.

	Independent certification	**FLEGT Action Plan**
How voluntary is it?	Private Law *(it is up to **logging companies** to decide whether they go for certification or not)*	Public Law *(it is up to **timber producing countries** to decide whether they go for VPA negotiation or not)*
Goal	Demonstrate that the timber produced and traded **by a private company** has been logged responsibly and complies to commonly agreed principles of sustainable forest management (SFM) *(on the basis of SFM standards set up by civil society through a participatory process)*	Demonstrate that the timber produced and traded **in a country** complies to all relevant legal and regulatory provisions in force in that country *(on the basis of a definition of legality set up through a participatory process under the aegis of national authorities)*
How does it work?	**Contract** between a **logging company** and a **certification body** accredited by FSC for the audit of logging operations and chain of custody *(private law agreement)*	Negotiation of a **VPA** between **a timber producing country and EU** *(bilateral trade agreement)*
Control of legality	Compulsory for the candidate logging company *(1st principle of FSC International Standards)*	Compulsory for all logging and timber companies in the country where the VPA has been concluded *(national system of legality verification)*
Timber monitoring (Chain of custody - CoC)	CoC certificate compulsory **for certified companies** (internal CoC within the company) *The CoC certificate is distinct from the SFM certificate (but is a necessary condition for SFM certification)*	Control of origin and CoC compulsory for **all timber companies operating in the country** (national system of timber monitoring) *The FLEGT license is compulsory for all shipments exported to the EU market*

□ *European policies*

Another element of FLEGT Action Plan is to establish purchasing policies at the European level that seek to eliminate illegal timber supplies. The new law of Due Diligence, which should come into force in 2012, bans the import and trade of illegal timber on the European market. Most importantly, it lays out the obligations of operators who place timber (or timber products) on the European market (importers) as well as those of actors who are part of the European timber industry.

Importers, who are the main target of this new legislation, must ensure traceability upstream and a minimum verification of the legitimacy of the timber they are bringing into the European market: the principle of due diligence.

Box 2.4: The Lacey Act

World Resources Institute - Washington

On 22 May, 2008, the US Congress passed a landmark amendment to the 100 year-old Lacey Act, the United States' oldest wildlife protection statute. Although the statute has been amended several times since originally enacted, for several decades it has prohibited the importation into the United States, or interstate commerce, of wildlife or wildlife parts taken in violation of United States, state, tribal, or foreign laws. The new amendment extends this protection to plants and a variety of plant products - including timber, paper, and other forest products - thereby giving the US government a powerful tool to combat illegal logging.

The Lacey Act, as amended, contains several key components:

- It prohibits the import, export, transport, sale, receipt, acquisition, or purchase in interstate or foreign commerce of any plant or plant product (e.g., furniture, paper, or lumber), with some limited exceptions, taken or traded in violation of the laws of the United States, a US state, a US Indian tribe, or another country. This prohibition is fully in effect and applies to importers and exporters operating in the United States. Therefore, if a tree is harvested in violation of the law of the country of harvest, it is illegal to import timber from that tree into the United States. It is also illegal to import into the United States wood products made from that tree.
- It establishes a Plant Import Declaration that requires an importer to provide basic information about each shipment of plants or plant products, including the scientific name of the plant, value, quantity and the name of the country in which the plant was harvested. Falsification of this information is unlawful. Unlike the prohibition element of Lacey, which is fully in force, enforcement of the Declaration requirement is being phased in over time, to cover an expanding range of products moving from simpler products like lumber to more complex composite products.
- It establishes penalties for violations of the Act, including forfeiture of goods and vessels, fines and jail time.

Photo 2.6: A SEFCA logging truck transporting logs to a sawmill in CAR

Log production in the formal sector

Only production in the industrial and formal sectors is concerned in these processes. Production in the small scale sector and/or informal sector is also important and can even exceed production in the formal sector, as shown by recent studies undertaken in Congo, CAR and DRC. In most instances, this sector constitutes the main timber supply source for the domestic market. Chapter 4 of this report deals specifically with this sector.

In 2007, after a fifteen-year period of slow growth, the forest sector in Central Africa produced nearly 9 million m^3 of logs. Production dropped in 2008 because of the international economic crisis, which affected the tropical timber market (see chapter 9). Although a complete set of figures for 2009 is not yet available, production, which fell to about 6 million m^3 in 2008, most probably increased at the end of 2009 to a little above 8 million m^3. This was partly due to a significant increase in log production by Gabonese producers (see below).

This production level puts Central Africa at the bottom of the three big forest basins that produce tropical timber, representing only 3 % of global tropical timber log production and 0.4 % of global round wood production (table 2.5). Central Africa, however, produces a little more than 40 % of African timber.

Table 2.5: Global tropical timber production (x 1,000 m^3 per year) in 2008

	Logs	Sawnwood	Plywood
Congo Basin	7,815 (3 %*)	1,524 (2 %*)	117 (1 %*)
Africa out of Congo Basin	10,248	3,077	290
Asia-Pacific	94,413	29,346	12,834
Latin America / Caribbean	122,615	31,941	4,282
Total of the global production	**235,091**	**65,888**	**17,523**

(*) Part of the total of the global production. Figures of tables 2.5 and 2.6 are different because the source of data is different.

Source : ITTO.

Production by country

With more competitive production costs and high reserves of okoumé, **Gabon** has, since 1999, been the largest log producer in the Congo Basin, with an average annual production of over 3 million m^3 (table 2.6). According to official figures provided to OFAC, the 2008 crisis lowered production to 2 million m^3. The year 2009 showed a record production of nearly 4 million m^3. This record amount was linked to the entry into force of a ban on log exports, which boosted production at year end. It is still too early to judge the impact of the export ban on the Gabonese industry. Operators are in a period of adjustment and flexibility measures could be taken in 2011, including possible exemptions for log exports.

Over the past two decades, production in **Cameroon** has remained constant at a little over 2 million m^3 of logs (with the exception of the year most heavily impacted by the economic crisis). This is due to the relative socio-political stability in the country and superior logistical logging conditions, which include relatively good transport infrastructure over a large part of the country. Another reason is the diversity of its production, which means it can face market fluctuations more easily than forest areas that are largely dependent upon one or a few species.

Following these two leaders, the **Republic of Congo** has maintained its position at 1.3 million m^3 after almost the entire north of the country was put into production in early 2000.

Production in the **Central African Republic** remains limited at about 500,000 m^3 per year. As in the north of Republic of Congo, transport costs to the port of Douala (a distance of about 1,000 km) are high and can exceed € 150 per m^3. These costs limit diversification of the species that are produced. This area does however benefit from an abundance of high-value species such as sapelli, sipo and aniégré.

Table 2.6: Evolution of log production in the Congo Basin (in m³ per year)

Year	Cameroon	Congo	Gabon	Equatorial Guinea	CAR	DRC	Total
1991	2,290,000	572,000	1,300,000	121,327	114,081	391,000	**4,788,408**
1992	2,096,000	635,000	1,395,000	159,531	217,189	380,000	**4,882,720**
1993	2,815,000	511,000	1,815,000	191,236	167,752	288,000	**5,787,988**
1994	3,016,000	600,000	1,909,000	266,724	231,409	272,000	**6,295,133**
1995	2,628,000	638,437	2,450,000	364,158	243,859	204,868	**6,529,322**
1996	2,820,000	612,891	2,520,000	471,165	305,464	281,808	**7,011,328**
1997	3,378,000	595,742	3,010,000	757,174	461,046	235,963	**8,437,925**
1998	3,358,000	703,405	2,400,000	421,933	529,653	262,874	**7,675,865**
1999	1,937,778	519,929	3,635,000	788,575	522,808	34,003	**7,438,093**
2000	1,931,515	630,878	3,715,000	689,169	702,994	61,998	**7,731,554**
2001	2,004,028	985,116	3,225,000	475,795	671,239	38,045	**7,399,223**
2002	2,278,371	1,179,272	3,000,000	574,155	649,714	44,320	**7,725,832**
2003	2,448,147	1,350,408	3,161,000	350,675		76,062	
2004	2,366,144	1,448,033	2,511,000	464,979	513,352	183,103	**7,486,611**
2005	1,982,129	1,336,826	2,769,902	450,258	454,402	169,946	**7,163,463**
2006	2,296,254	1,322,322	3,220,957	602,854	624,861	155,009	**8,222,257**
2007	2,894,221	1,311,905	3,350,678	524,799	537,998	310,000	**8,929,601**
2008	2,166,364	1,212,118	2,057,537	88,097	555,143	353,247	**6,432,506**
2009	1,875,460	974,529	3,947,231	13,760	348,926	205,602	**7,365,508**
2010				309,849	324,283		

Sources: OAB, 2004; OFAC; Nasi et al., 2006; FRM, 2001; Gabon: Christy et al., 2003; SEPBG, DDICB, Direction de la production forestière, inspections provinciales des eaux et forêts, DGEF; Cameroon: Topa et al., 2010; Cerrutti & Tacconi, 2006; MINFOF/SIGIF; DRC: DGF; Republic of Congo: DDEF annual reports, Equatorial Guinea: Ministerio de Agricultura y bosques.

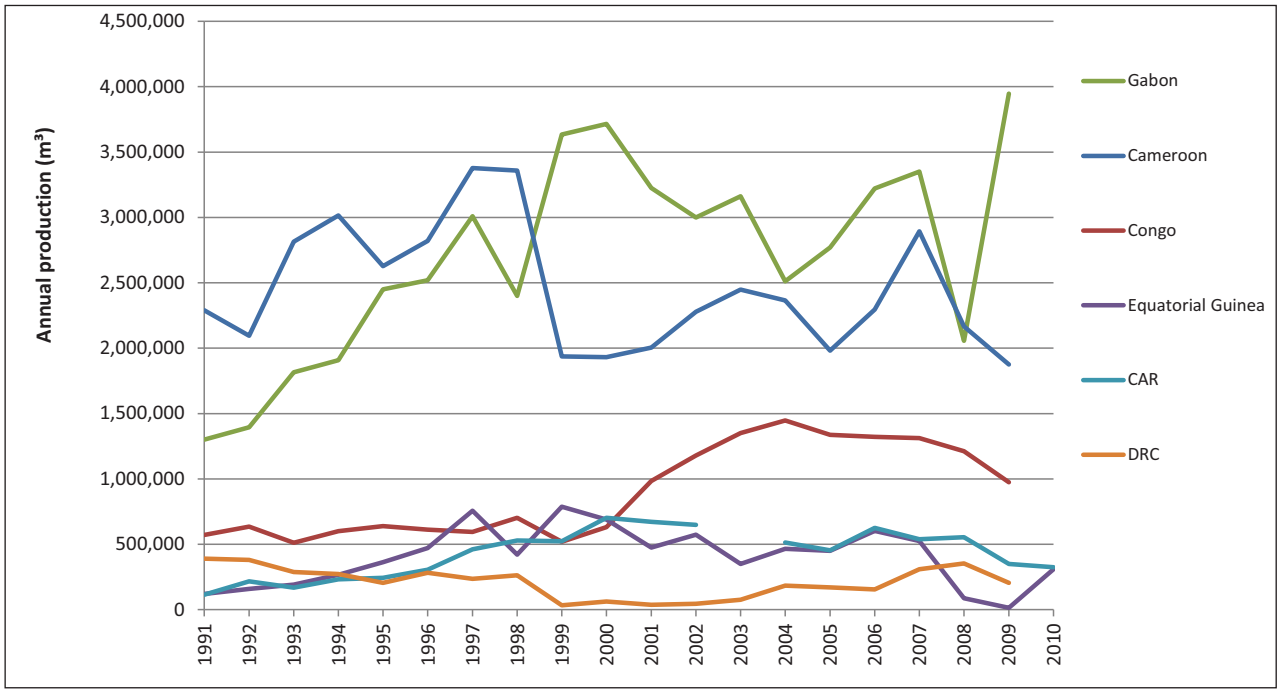


Figure 2.4: Evolution of annual log production by country (in m³ per year)
Sources: see table 2.6.

Between 2007 and 2009, production in **Equatorial Guinea** dropped significantly. This was predominantly linked to the departure of the Shimmer International enterprise (from the Malaysian group Rimbunan Hijau) and to the previously-taken decision to ban log exports in 2007 and then to cancel all forestry concessions to allow forest regeneration (de Wasseige *et al.*, 2009). In 2008, for the first time, Equatorial Guinea exported more logs (150,000 m^3) than it logged (100,000 m^3) as part of the 2007 production was carried over for export in 2008. Shimmer returned in 2009 and in 2010 log production reached nearly 310,000 m^3, 40 % of which was produced by Shimmer. The national market consumes between 5 and 10 % of total production. The rest is exported, mainly in the form of logs (85 %) (Obiang Mbomio, 2010).

With its 84 million hectares[6] of dense forest land, the **DRC** is the sleeping giant of the sub-region, with production in the formal sector struggling to regain the level it had reached before the 1999-2003 armed conflict. At around 300,000 m^3 per year, that level was already low. There are many challenges that prevent this activity from being developed. These are the relative low value of the forest, as well as logistical constraints including particularly poor transport infrastructure and the congestion of Matadi, which is its only export port.

Photo 2.7: Logging road in the south of CAR

Production provision by type of forest title

Forestry legislation provides for several types of forest title. Until today, production has mainly been through forest titles that have been granted to permanent forests. A very limited amount of production is provided by forests belonging to other forms of land tenure such as community forests, municipal forests or private forests.

In Cameroon, "timber recovery permits", initially conceived for specific situations requiring trees felling (agro-industry plantation, engineering works, road construction…), provide a large proportion of production. From 7 to 10 % between 2005 and 2008, this increased to 14 % in 2009 (OFAC), as more permits were granted during the crisis period. In all other countries in the region, long duration forest titles (more than 15 years) represent over 90 % of the formal sector's national log production.

[6]Source : compilation of UCL, JRC and SDSU data on land use.

Production by species

With 1.4 million m³ of logs produced in 2008, okoumé remains the most logged species in Central Africa (see figure 2.5). At the start of forest logging, more than a century ago, Gabon provided 100 % of the very low production of this species, falling to 70 % in 1999 and to 55 % in 2008 during the economic crisis. Republic of Congo, the second producer of okoumé, guarantees about 20 % of Central African production.

Sapelli is in second position with 1.3 million m³ per year with production spread across the whole of Central Africa, but with Republic of Congo and Cameroon as primary producers.

Ayous is the third most logged species with about 900,000 m³ per year that is essentially provided by Cameroon.

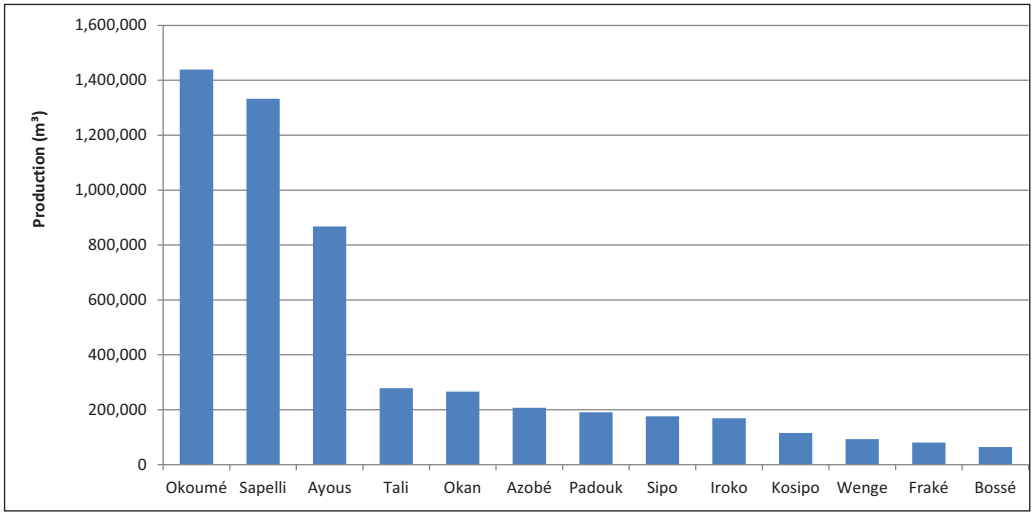


Figure 2.5: Production by species in the Congo Basin in 2008 (m³ per year)
Source: OFAC.

Other logged species do not exceed, or only just exceed, 200,000 m³ per year. There are various reasons for this relatively low level: some species offer a limited potential that has already been fully exploited (such as sipo or iroko) due to their wide dispersion over a vast area of forest. Species, such as wengé, which is mostly found in DRC, have a localized range or abundance. Some species are not fully exploited because there is no market for them and/or the price does not guarantee their cost-effectiveness for concessions that are far from ports. This is the case for tali, where production (about 200,000 m³ per year) could be higher if markets were stronger. The same holds true for okan and padouk.

As already mentioned, a major constraint with regards to product diversification is the unfavorable relationship between the sale price of so-called secondary species and the cost price of their production (transportation and FOB[7] costs included).

[7]FOB : Free On Board

Forest plantations

Forest plantations currently occupy a limited space in Central Africa, both in terms of area and in terms of production.

Table 2.7: Planted areas in Central Africa

Country	Planted areas (ha)	Year	Source
Cameroon	7,776	2008	
Gabon	46,767	2009	DIARF
Equatorial Guinea	13	1999	CUREF
CAR	Not available		
DRC	345	2007	SNR
Congo	70,000	2007	Annual reports of DDEF and SNR, for the EFC company

Source: OFAC.

Photo 2.8: Sawmill in northern Congo

At the regional level, it should be noted that EFC (*Eucalyptus et Fibres du Congo*) eucalyptus plantations in Pointe-Noire are still the exception to the rule. Given a long-term 99-year lease, they produced nearly 250,000 m^3 in 2007, which is about 16 % of national round wood production in the Republic of Congo (see box 5.2).

Several plantation programmes are under way on the Batéké plateau, to the north of Kinshasa in DRC. From 1987 to 1992, over 8,000 hectares of acacias were planted in Mampu and are now managed using an agro-forestry approach. Ibi plants comprise the first carbon sinks to generate carbon credits in Central Africa. Finally, the Makala[8] project specifically aims to encourage agro-forestry plantations in villages.

While forestry plantations currently occupy a limited space in Central Africa, they will most probably need to increase in the coming years given the high demand for woodfuel, availability of land, government awareness, and the interest of private investors. The government of the Republic of Congo has announced its intention to devote approximately one million hectares to forestry plantations. In Gabon, investors are currently evaluating the possibility of re-establishing and extending former okoumé plantations.

Industrialization of the timber trade

Legal requirements

Countries are increasingly making legitimate demands on operators in the sector to ensure better optimization of forest logging. The following list gives the current minimum conversion rates that States impose on each operator, i.e. the volume of logs to be processed in the country:

– Republic of Congo: normally 85 %, but exceptionally lowered to 70 % during international economic crisis (a measure that was extended to 2011), with the possibility for operators to exchange quotas;

– Gabon: 100 % since the end of 2009. It is possible that export quotas could be granted for 2011;

– Cameroon: the sale of some species in the form of unwrought logs is forbidden. The list of the concerned species appears under MINEF Decree No. 0872 of 16 October 2001;

– Central African Republic: 70 % since 2008;

– DRC: at least 70 % (quotas are fixed for each operator) for ten years for processing unit holders and national users;

– Equatorial Guinea: 100 % since 2008.

[8] http://projets.cirad.fr/makala

Real industrialization rates

The effective processing rate has significantly increased in recent years to reach 54 % for the period 2005-2008 (table 2.8). Nevertheless, Central Africa processes its tropical timber less than the rest of Africa, South America or Asia. It should be noted that there was a drop in processing rates in DRC because of the armed conflict in the country.

Table 2.8: Calculation of processing rates (%)

Country	1993-1999	2005-2008(*)
Cameroon	57	88
Congo	42	57
Gabon	15	37
Equatorial Guinea	Not available	11
CAR	77	59
DRC	69	39
Central Africa	42	54

(*) Calculations are based on available data for the period and on a case-by-case basis established using, either the proportion of timber in factory out of total exports + timber in factory, or non-exported timber out of log production.

Sources: 1993-1999: ITTO; 2005-2008: OFAC

Gabon went through a first phase of industrialization at the end of the 1990s. Domestic log consumption stagnated at between 20,000 and 50,000 m^3 per year during the period 1970-1998 (Christy *et al.*, 2003) but it has exceeded 100,000 m^3 per year in recent years. In the coming years, the country should increase its industrial capacity further so that it can adjust to the recent ban on log exports which led to the creation of a number of new industrial projects.

DRC is still suffering the consequences of the armed conflicts that seriously affected its industrial sector. Formal production remains very under-developed and factories are primarily in Kinshasa. With its large domestic market and dynamic small scale operators, the country should recognize potential advantages to be had through industrial development and promote a timber industry that combines the small scale and industrial sectors. The other challenge the country faces is to increase the overall level of contribution the formal industrial sector makes (which is currently very small when compared to other large tropical timber countries), by developing other species, in particular peeling species.

Industrial production

The main product in Central Africa, sawn wood, is a primary processing product. It amounts to an annual production of about 1.2 million m^3. A large proportion of products that are destined for export are artificially dried. In recent years, some secondary processing units for planed sawn wood have appeared, but this product is still relatively uncommon (in the range of 5 % of total sawn wood production). The main secondary processing product in Central Africa is plywood with an approximate annual production of 350,000 m^3.

Most secondary processing products constitute a small proportion of the industrial sector and are mainly destined for export. Local needs are mostly met by the small scale sector.

It should be noted that there has been a sharp decline in wood slicing. The largest production unit in DRC (SIFORCO factory in Maluku) and the only wood slicing factory in Gabon have ceased their activities. A small unit has just been established in Libreville by the Swiss group, Precious Woods.

Peeling is an activity that is still very present in Gabon due to the outstanding qualities of okoumé for this kind of processing. It is also very important in Cameroon (especially with the Italian group Alpicam).

Exports

Most industrial products are exported. The local market gets its supplies primarily from the small scale sector. With a few notable exceptions, industrial operators only occupy a small space in domestic markets. Such is the case for the plywood sector in DRC, which works only with the domestic market. The regional market is also still very under-developed in Central Africa, as it is on the rest of the continent, but it offers great potential.

The leading export destinations are the European Union and Asia. Asia is now the main exportation hub, receiving about 60 % of total exports during the period 2005-2008. It strengthened its position in 2009, at the height of the crisis, by exceeding 70 % of total exports.

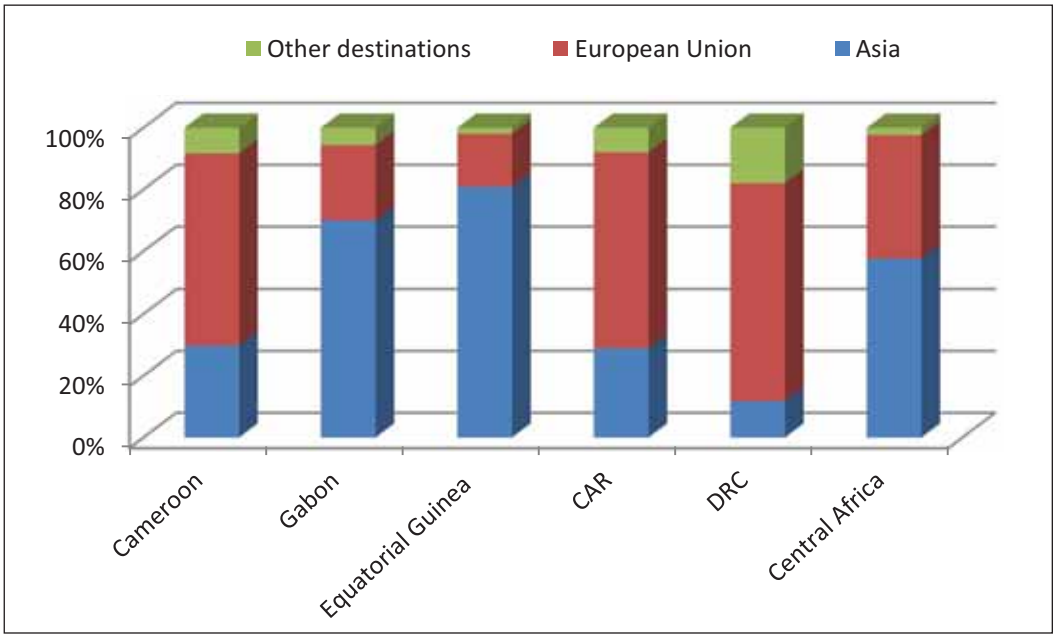


Figure 2.6: Destination of log exports by country for the period 2005-2008 (% exported by each country)[9]
Source: OFAC.

The main producers

For years the French Group Rougier has been the leading producer in this sector. In 2010, the group finished managing its nearly 2 million hectares of concessions.

Three main Asian groups are involved in the forestry sector in Central Africa: Vicwood (China), Taman and Rimbunan Hijau (Malaysia). Large Asian groups, including the Singaporian group OLAM, which has just acquired Timber International (TI) from the DLH group (active foresters and industrialists in the Republic of Congo and Gabon) are increasingly present on the Central African forestry scene.

The ten main operators account for between 40 to 50 % of sub-regional production. Alongside the big industrial operators in the sector, which are mainly financed from abroad, there is a group of small industrial operators with limited capacity and equipment that work on smaller areas of the forest. One of the challenges in the coming years is for these small operators to acquire professional status in forest management and industrial processing.

[9]Data for the Republic of Congo is not available. Data for other countries is not available for each year, preventing the presentation of detailed figures.

Table 2.9: The main producers of tropical timber in Central Africa

Group or company	Country of activity	Average level of log production(m^3 per year)
Rougier	Gabon, Cameroon and Congo	600 to 700,000
Rimbunan Hijau	Gabon and Equatorial Guinea	400 to 500,000
OLAM	Congo and Gabon	300 to 400,000
Vicwood	Cameroon, CAR and Congo	300 to 400,000
Danzer	Congo and DRC	250 to 350,000
Precious Woods[10]	Gabon	200 to 300,000
Taman	Congo	200 to 300,000
Alpicam	Cameroon	200 to 300,000
Asia Congo Industrie	Congo	150 to 250,000
SEFCA	CAR	150 to 250,000

Sources: OFAC, SEPBG, personal surveys undertaken by the authors. It is an evaluation of the post crisis production level for 2010. Available data does not allow more precise figures to be provided.

In Gabon, the government has shown an interest in becoming involved in forest management (from production to processing) through the State entity SNBG (*Société nationale des Bois du Gabon*) which has been allocated forest concessions that are currently going through the management planning process. In 2009, SNBG put in a bid to acquire the company "*Bois Tranchés du Gabon*".

Photo 2.9: Forest inventories involve both the identification of species, in this case a Manilkara in the CAR, and the taking of dendrometric measurements

Conclusion: Challenges to be met in the coming years

A review of the forestry sector in Central Africa and its evolution highlights the challenges that need to be met in the coming years.

In forest management:

– Provide the skills to allow forestry administrations to implement their policies;
– Extend sustainable forest management to all areas of production forests, while adapting to new situations (smaller concessions, new operators);
– Strengthen the capacity of forestry monitoring bodies to ensure that they can monitor the effective implementation of management plans;
– Revise management plans to include amendments that will strengthen planning requirements (better investigative tools, objectivity by being under a management plan);
– Continue to increase the awareness of industrial operators of what is at stake, i.e. the benefits and constraints of sustainable development.

In the timber industry:

– Meet the expectations of US and European markets to verify the legitimacy of imported timber by initiating or completing ongoing processes (FLEGT, Lacey Act);
– With a significant increase in local processing rates in recent years, the current challenge is to further diversify processed products by developing industrial processing and encouraging the use of timber in African countries;
– Publicize the advantages of tropical timber and the sustainable management of the forests that produce the timber.

[10]The Precious Woods Group has also a minority interest in the NST group but not taken into account in this table.

CHAPTER 3

Biodiversity in Central African forests: an overview of knowledge, main challenges and conservation measures

Alain Billand
CIRAD

Introduction

As in previous State of the Forest (SOF) reports, the term biodiversity is defined here as "the variability among living organisms in the terrestrial and aquatic ecosystems of the Central African forests". This definition includes diversity within species, between species and of ecosystems (according to Hooper *et al.*, 2005).

Such a broad definition of biodiversity necessitates great modesty on the part of anyone interested in acquiring knowledge of biodiversity and its sustainable management, including planners and researchers. Actually, there continues to be a significant shortage of scientific data on species and highly complex ecological systems.

This chapter is divided into two parts:

- The first part summarizes what is known about the main groups and families of fauna. It supplements information contained in previous State of the Forest reports (SOF 2006 and 2008). These reports placed particular emphasis on improving expertise in monitoring emblematic biodiversity as well as its conservation: this concerns a small number of animal species, mainly large mammals. Conservation leaders focus on these emblematic species as they are particularly vulnerable. They are in effect the only species to be systematically hunted to the point that they are threatened by extinction. We will refer to previous editions of the report to familiarize ourselves with the situation of elephants, primates and small monkeys, as well as large antelopes and duikers, especially those in the protected areas (PAs) and forest concessions. Here, they will only be addressed in terms of general numeric data.
- Work on biodiversity conservation in Central Africa has focused on PAs and, more recently, forest concessions and community forests. Together these represent about 40 % of the forested area in the Congo Basin. There are no specific biodiversity conservation measures, apart from "ordinary" law, for other areas that have no particular status, calling attention to the remaining 60 % of land where biodiversity is under the greatest threat:
  - These are the areas that are the least documented;
  - These areas are at the highest risk for deforestation;
  - These areas may have high economic potential for agricultural expansion or increasing urban sprawl, which may bring important social changes (e.g., urbanization);
  - These areas lack adapted planning tools.

Protected areas are the principal land use units dedicated to biodiversity conservation in the Congo Basin. This chapter does not present a complete overview of PAs in Central Africa, but it does provide recent information on their development, in particular as regards to transboundary protection. In addition, this chapter reviews the main principles associated with biodiversity conservation in forest concessions.

Photo 3.1: Area of swamp in Gabon

Understanding biodiversity in order to improve management

A partial assessment of biodiversity in Central Africa

Scientists are a long way from finalizing an exhaustive list of the species present in Central Africa's forest ecosystems. Additions are constantly being made to lists of species, genera and families. The OFAC website works to assemble the most up-to-date knowledge on species, which even at its best only addresses one of three components of biodiversity (diversity between species).

Quite a lot is known about large and medium-sized mammal species, even if the sun-tailed monkey (*Cercopithecus solatus)* was only described in 1984 and the false potto (*Pseudopotto martini),* which has been identified from a skeleton and skull found in Cameroon, still needs to be officially confirmed. For a long time the Salongo monkey (*Cercopithecus dryas)* was known through two samples; however, a recent study (Lokasola, 2008) of four groups of 15-31 individuals has provided more information on their diets and social and territorial behaviors. For small species, especially small rodents, shrews and bats, the state of knowledge is very different:

- Several species are only known from a single sample or a few samples collected in the same location;
- The aspects that differentiate some species are still badly defined and it is difficult to decide whether some forms should be considered as separate species or as sub-species;
- The specific affiliation of some populations is still a problem;
- The environment and behavior of these species are largely unknown.

Given this state of understanding, it remains very likely that additional species remain to be discovered. Furthermore, apart from a few dozen species, which have been widely studied and are generally very symbolic, the geographic distribution of the species described is still largely unknown.

Another important characteristic of biodiversity knowledge in Central Africa is that existing data depends to a large extent on the effort that has been spent on data collection. This means that the best known collection of bats (*Soricidae* and *Chiroptera*) is in Gabon as opposed to the Republic of Congo. This is likely due to the fact that more in-depth data collection has been carried out in Gabon.

It should also be highlighted that scientific understanding rarely captures the knowledge of local populations. A species that is labeled "new to science" can very well be known, named and even collected for different purposes, by local populations living in the forest. A complete inventory of local knowledge does not exist.

In order to try and assure accuracy by linking information presented with reliable sources of data, it was proposed that the State of the Forest reports should record and report on specific sites where faunal inventories have been implemented in the main areas of the sub-region. This approach permits an overview of areas where properly measured data exists, including the date and methodology implemented, as opposed to areas where data modeling has been employed using variable mathematical methods.

The African Mammals Databank (L. Boitani Institute of Applied Ecology, University of Rome, Italy, IUCN) gives an example of modeling which provides possible species distribution areas using recognized census points. Based on what is known about the biological needs (habitats) of the animals, this is extrapolated for the entire region, using a probabilistic model (http://www.gisbau.uniroma1.it/amd/). An example of the red river hog (*Potamochoerus porcus*) distribution area is presented at figure 3.1. It should be noted that this method has a certain number of limitations which are currently being addressed. In addition, IUCN intends to make another database available, this time at a global scale; however, this has yet to happen.

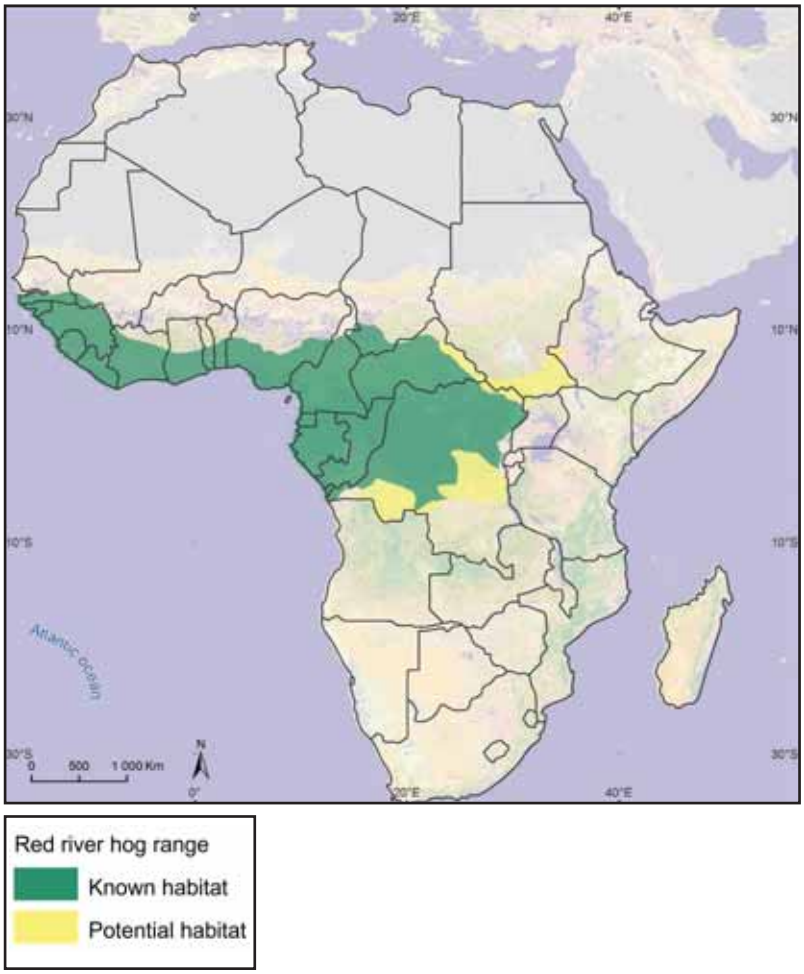


Figure 3.1: Example of cartographic modeling of recorded red river hog distribution and area of potential habitat
Source : African Mammals Databank

Current state of knowledge: from species lists to geographic distribution maps

A basic definition of biodiversity focuses on establishing lists of species, which simply identify the presence or absence of a species, normally from a national perspective. Obtaining information on a scale that is more precise than the national one requires lengthy research into site surveys and spatial extrapolation for areas where there are no inventories. In some cases, being listed is the result of a single sighting or specimen. Lists do not therefore necessarily provide an indication of species rarity.

Based on these lists, numbers of species and genera can be calculated and classified by country, giving an indication of the country's wealth in biodiversity. Numbers and geographical distribution of some of the largest animal species are presented below. Vande weghe prepared most of the data compilations on biodiversity. These are available on-line on the OFAC/COMIFAC website with a series of tables and distribution maps (http://observatoire-comifac.net/, under the heading "Biodiversity").

Photo 3.2: An orange-headed lizard of the genus Agama, very common in urban areas of Central Africa

Photo 3.3: Nile monitor (Varanus niloticus)

Reptiles

Approximately 460 reptile species have been recorded in the region. These are divided into three orders (chelonians, crocodilians and squamates). Chelonians (turtles) belong to 5 families, none of which are unique to Africa. The three types of crocodilians in the region all belong to the *Crocodylidae* family, which is also widespread outside Africa. The region's squamates belong to 17 families, of which only one - the *Cordylidae* - is unique to Africa.

The largest number of species in Central Africa has been recorded in the Democratic Republic of Congo (DRC). Of the 302 species that have been confirmed in DRC, 27 are endemic. This abundance is explained by the very large size of the country and the variety of its habitats. Proportionately, Cameroon, which is five times smaller than DRC, has the highest abundance and specific endemics, with 249 confirmed species, no less than 22 of which are endemic. This abundance can be explained by the wide variety of habitats, ranging from high mountain ranges (over 3,000 meters in altitude) to the sea and from the Sahel desert to dense moist forests.

Birds

For many bird families, DRC has the largest number of species. This is due to the size of the country and the fact that it extends across the Zambezi zone and the Sudanese savanna area (table 3.1). For some families, other countries, such as Chad, Cameroon or the CAR, with areas ranging from dense forests to arid or semi-arid habitats, are more diversified.

A study of species distribution per country, excluding occasional species, shows that numbers are practically proportional to the logarithm of the area (figure 3.2).

Mammals

There are 552 species of mammals in the 10 Central African countries. In descending order, the six biggest orders by number of species are:

- ***Rodentia*** (rodents)
- ***Chiroptera*** (bats)
- ***Soricomorpha*** (shrews)
- **Primates** (monkeys, galagos, pottos), consisting of 56 diurnal and nocturnal species:
  - 3 *Lorisidae*
  - 12 *Galagidae*
  - 37 *Cercopithecidae*
  - 4 non human *Hominidae*
- ***Cetartiodactyla*** (hippopotamuses, whales, dolphins, *suidae*, giraffes, *bovidae*). There are 48 known species in the 10 Central African countries:
  - 2 *Giraffidae*
  - 1 *Hippopotamidae*
  - 1 *Tragulidae*
  - 4 *Suidae*
  - 40 *Bovidae*
- ***Carnivora*** (cats, panthers, mongooses, jackals…). There are 41 known species of terrestrial carnivores in Central Africa:
  - 7 *Felidae*
  - 10 *Viverridae*
  - 1 *Nandiniidae*
  - 12 *Herpestidae*
  - 1 *Hyaenidae*
  - 4 *Canidae*
  - 6 *Mustelidae*

Table 3.1: Number of bird species in relation to the size of the country

Country	Size (x 1,000 km²)	Number of species (excluding occasional or unconfirmed species)
São Tomé and Príncipe (STP)	0.9	80
Chad	1,284	409
Cameroon (Cam)	475	725
CAR	623	690
Equatorial Guinea (Eq-G)	28	535
Gabon (Gab)	268	600
Congo	342	586
DRC	2,345	1,017
Rwanda (Rw)	26	614
Burundi (Bu)	28	606

Source: OFAC/COMIFAC

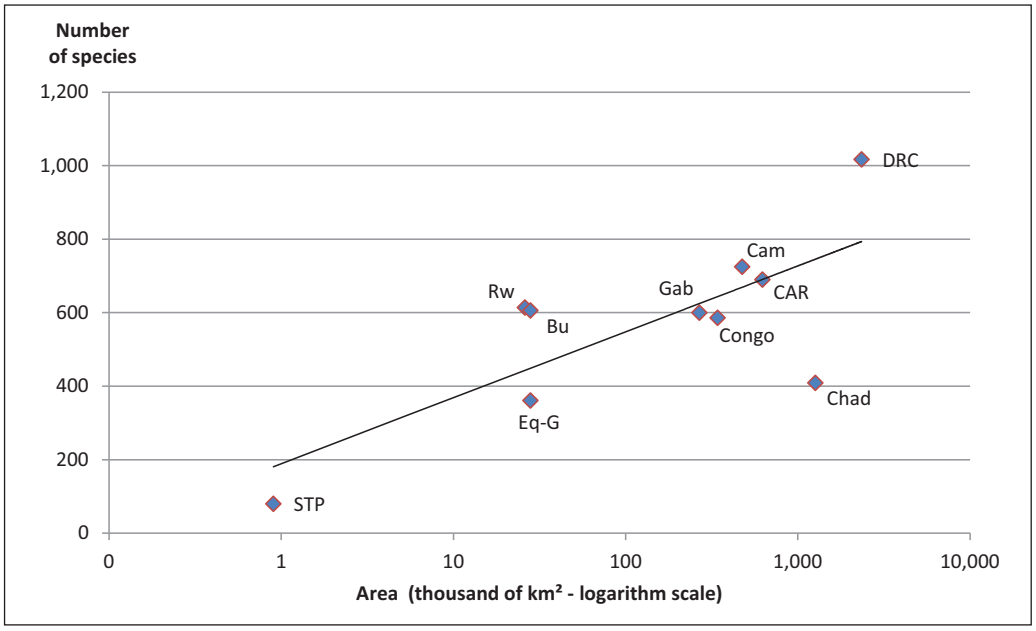


Figure 3.2: Relationship between the number of bird species and the logarithm of the size of the country.
Source: OFAC/COMIFAC

The great apes are the objects of special attention as they are extremely vulnerable and emblematic. As a result, the APES program (see box 3.1) and the Great Apes Survival Partnership (GRASP) (http://www.unep.org/grasp/index.asp), under the auspices of UNEP and UNESCO, research groups, NGOs and government authorities, were established to monitor and protect the great apes in their natural habitat. Apart from the orangutan and some sub-species of chimpanzees, the vast majority of great apes live in Central Africa.

Photo3.4: Blue-breasted bee-eater (Merops variegatus) watching for prey

Photo 3.5: African Jacana (Actophilornis africana) in flight

Photo 3.6: Male sitatunga (Tragelaphus spekei)

Detailed information on gorillas and chimpanzees is provided below.

Kingdom: *Animalia*
- **Phylum:** *Chordata*
  - **Class:** *Mammalia*
    - **Order:** Primates
      - **Family:** *Hominidae* (great apes and humans)
        - **Genus:** *Gorilla*
          - **Species:** *Gorilla beringei* (eastern gorilla)
            - **Sub-species:** *G. beringei graueri* (eastern lawland gorilla)
            - **Sub-species:** *G. beringei beringei* (mountain gorilla)
            - **Sub-species:** *G. beringei* spp. (Bwindi gorilla)
          - **Species:** *Gorilla gorilla* (western gorilla)
            - **Sub-species:** *G. gorilla gorilla* (western lowland gorilla)
            - **Sub-species:** *G. gorilla diehli* (Cross River gorilla)
        - **Genus:** *Homo* (Humans)
          - **Species:** *Homo sapiens*
        - **Genus:** *Pan*
          - **Species:** *Pan paniscus* (bonobo)
          - **Species:** *Pan troglodytes* (chimpanzee)
            - **Sub-species:** *P.t. verus* (western chimpanzee)
            - **Sub-species:** *P.t. velerosus* (Nigerian chimpanzee)
            - **Sub-species:** *P.t. troglodytes* (central chimpanzee)
            - **Sub-species:** *P.t. schweinfurthii* (eastern chimpanzee)
        - **Genus:** *Pongo*
          - **Species:** *Pongo pygmaeus* (Bornean Orangutan)
          - **Species:** *Pongo abelii* (Sumatran orangutan)

Figure 3.3: The classification of great apes

Source: GRASP, according to the University of Michigan, Museum of Zoology.

Gorillas

The eastern gorilla (*Gorilla beringei)* is composed of two sub-species:

a) The eastern lowland gorilla (*G. beringei graueri*) is only found in eastern DRC between the Lualaba River and the Burundi-Rwanda-Uganda border. Its distribution covers an area of about 90,000 km^2, within which the gorillas occupy an estimated total area of 15,000 km^2 covering four main areas: (i) Kahuzi-Biega National Park and the neighboring Kasese region; (ii) Maïko National Park and the adjacent forest; (iii) Itombwe Forest; and (iv) North Kivu. It is estimated that their population size amounts to between 3,000 and 5,000 individuals.

b) Mountain gorillas (*G. beringei beringei)* are only known to exist in two populations covering three countries: DRC, Rwanda and Uganda. One population which is estimated at about 380 individuals lives in the Virunga massif. The other population, estimated at 320 individuals, is to be found mainly in Bwindi National Park in the south-west of Uganda on the border with DRC. The mountain gorilla occupies about 375 km^2 in the Virunga massif and 215 km^2 in Bwindi National Park. These two areas are separated by a 25 km agricultural zone.

The western gorilla (*Gorilla gorilla*) is also composed of two sub-species:

a) The western lowland gorilla (*G. gorilla gorilla)* is the largest gorilla population with an estimated total of 94,000 individuals. From north to south, this sub-species can be found in the south and south-east of Cameroon, in the extreme south of the CAR, in continental Equatorial Guinea, in western Congo and in the landlocked area of Cabinda in Angola.

b) The Cross River gorilla *(G. gorilla diehli)*, in Nigeria and Cameroon, constitutes the most northern and western gorilla populations. Their total population is estimated at 200-250 individuals. In Nigeria, they can be found in the Mbe Mountains, in the sanctuary for the fauna of Afi Mountain, in the Okwangwo section of Cross River National Park and in the neighboring Takamanda Forest Reserve, as well as in the Mone Forest Reserve. In Cameroon, they live in the south-western Mbulu forest.

Chimpanzees

Chimpanzees consist of two main species, the bonobo and the chimpanzee, which itself consists of four sub-species.

The bonobo *(Pan paniscus)*

The bonobo only lives in the DRC. Most publications refer to a population of about 15,000 individuals. In 2001, Butynski increased this figure to 30,000 - 50,000 individuals but recent analytical inventories consider this estimation to be too high (Grossmann *et al.*, 2008).

The chimpanzee *(Pan troglodytes)*

The chimpanzee has a very wide-ranging but discontinuous distribution in Equatorial Africa, in 21 countries from Senegal to Tanzania. Estimations of total populations range from 172,000 to 301,000 individuals.

a) The eastern chimpanzee *(P.t. schweinfurthii)*

is found in a region that extends from eastern CAR, and the south-west of Sudan, to the Nyungwe and Gishwati forests in Rwanda and the extreme west of Tanzania. The estimated population is between 76,000 and 120,000 individuals.

b) The chimpanzee *(P.t troglodytes)*

The distribution area for this sub-species covers about 695,000 km^2. They can mostly be found in southern Cameroon to the west of the Sanaga River, in western CAR and in Equatorial Guinea. They are spread throughout Gabon and in northern Congo. Their most southern location is in the land-locked area of Cabinda and in the extreme west of the DRC. Population figures are estimated to be between 70,000 and 117,000 individuals.

c) The Nigerian chimpanzee *(P.t. velerosus)* This chimpanzee can only be found in southern Nigeria and along the border with Cameroon. Populations are fragmented and estimated to amount to between 5,000 and 8,000 individuals.

d) The western chimpanzee *(P.t. verus)* is found from the south-east of Senegal to the south-west of Mali to Guinea, Sierra Leone, Liberia, most of Côte d'Ivoire to western Ghana. Much uncertainty exists about the number of individuals, which is thought to be between 21,000 and 56,000.

Photo 3.7: Western lowland gorilla (Gorilla gorilla)

Box 3.1: Africa-wide great ape population surveillance

Hjalmar Kühl, Jessica Junker, Yasmin Möbius, Christophe Boesch

Max Planck Institute for Evolutionary Anthropology

African great ape populations are declining throughout their range due to poaching, disease and habitat loss. Well substantiated information on their status, threats to their survival, and conservation opportunities is scarce but urgently needed in order to develop sound conservation strategies. Only recently have attempts been made to collect data over entire landscapes (http://carpe.umd.edu/) or to synthesize and analyze existing site-level data to provide a more coherent picture across the geographic range of the different ape species. However, the latter approach is hampered by a lack of standardization in the data collection methodology and sampling intensity which leads to varying data quality.

The Department of Primatology at the Max Planck Institute for Evolutionary Anthropology (www.eva.mpg.de/primat/) and the Wild Chimpanzee Foundation (www.wildchimps.org) have therefore initiated a program which aims to provide standardized high quality data for evidence-based conservation of great ape populations. The information gained will allow identifying high priority populations, quantifying rates of population decline as well as global and site specific threats and opportunities, and evaluating the impact of extractive techniques on great ape populations.

Within five years, this program plans to obtain range-wide estimates of abundance and distribution of great ape populations and associated threats in order to assess their status and trends. Data are collected across the entire geographic range of African great apes, focusing on areas for which no recent and quantitative information is available: both within and outside of protected areas (figure 3.4). This initiative is implemented in collaboration with national wildlife authorities, as well as conservation and research projects in the respective countries.

Data are collected using a combination of classic and innovative monitoring methods to increase sensitivity in the information gained. Sampling effort per area is guided by prior estimation of great ape occurrence probability in the respective area to increase efficiency in data collection and accuracy in the abundance estimates. More effort is expended in areas where great apes are likely to occur at higher densities.

In small countries the program uses a fine grained systematic survey design and conduct interviews with the local human population to classify the immediate neighborhood into areas of high or low ape density. Results from a chimpanzee survey conducted by the Tacugama sanctuary in Sierra Leone in 2009 showed that the information gained from interviews with villagers almost perfectly predicts the probability of finding chimpanzee nests along line transects (http://www.tacugama.com/census.html).

In larger countries or countries with large and continuous forest cover, data collection is directed by the output of a habitat suitability model which predicts the probability of apes occurring based on available ape survey data.

Currently country-wide surveys are taking place in Liberia, Guinea and Côte d'Ivoire. By 2012, we would have a complete picture of chimpanzee abundance and distribution in West Africa and the associated threats, which will greatly facilitate priority setting for regional conservation strategies in terms of location and actions.

Data collection will start in Central Africa in 2011 with a national survey in Equatorial Guinea, in collaboration with Conservation International. The combined experience and results from West Africa and Equatorial Guinea will serve to evaluate and further develop the occurrence probability model and determine the data collection protocol for the other Central African countries. It will likely be a pre-stratification of the area according to the great ape occurrence probability model and gaps in survey data availability. A representative sample of data will then be collected in areas of high-, medium- and low-probability of great ape occurrence.

All data collected will be archived in the APES Database (http://apes.eva.mpg.de). The results and conservation opportunities will be provided via the different sources of the APES Database project and the interactive web-based interface which is currently being developed to inform conservation management.

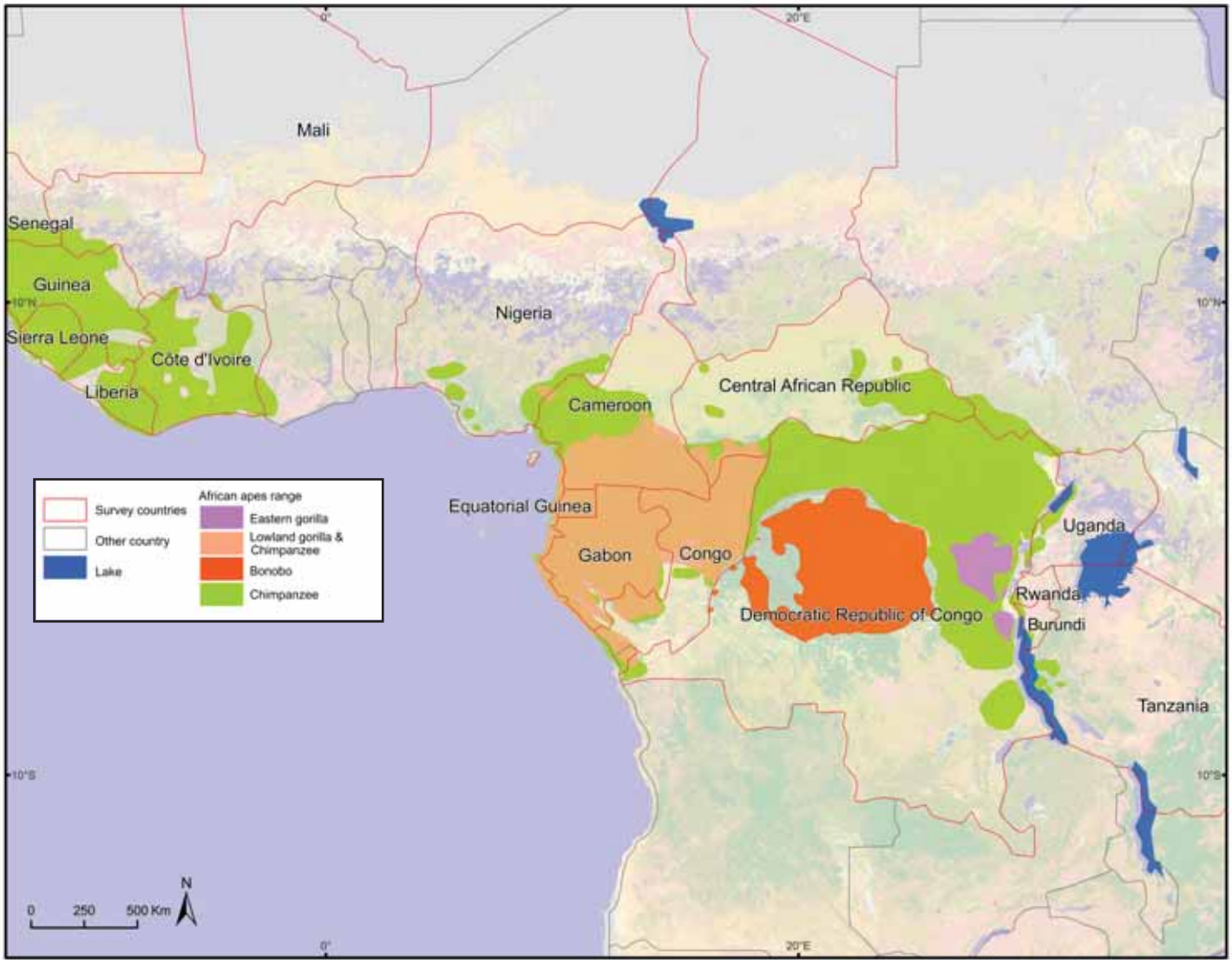


Figure 3.4: African ape range countries that will be surveyed within the following five years (red country borders) and geographical ranges (provided by the IUCN) of the different great ape species indicated in different colors.

Source: Max Planck Institute (MPI)

These six orders of mammal alone account for 525 species, or 95 % of the total number of species. The three countries that, relatively speaking, have the most fauna are Rwanda, Cameroon and the DRC. Yet again, this is due to the wide diversity of habitat and the presence of forested and non-forested land.

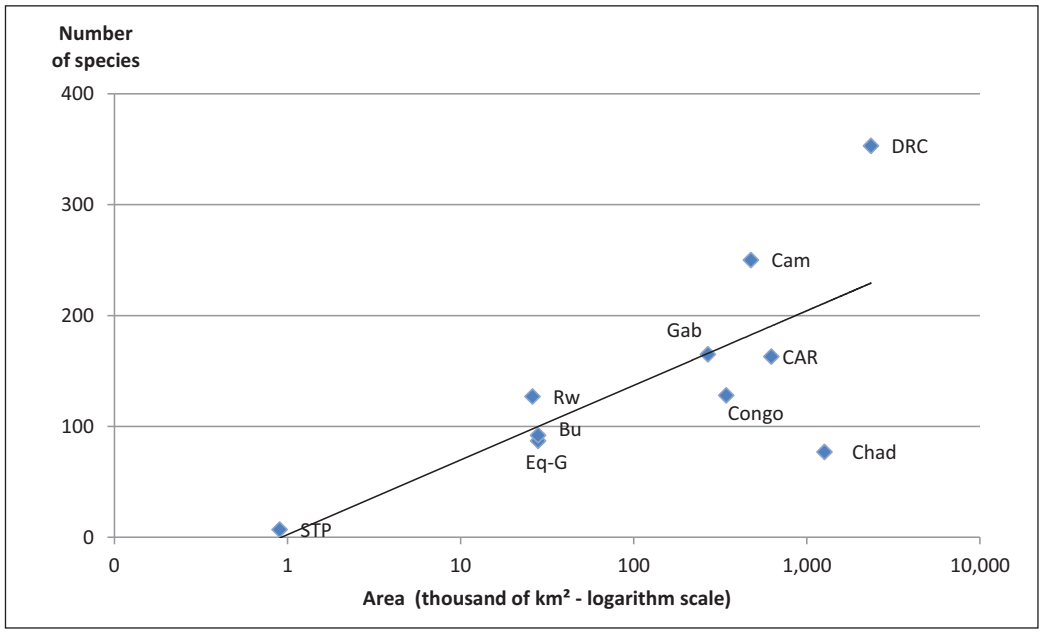


Figure 3.5: Relationship between the number of mammal species and the logarithm of the size of the country. Source: OFAC/COMIFAC

Looking at the ensemble of mammal species, it is possible to distinguish three "bio-geographical regions" within the forested regions in Central Africa, which can be further subdivided into "faunal regions" (Colyn *et al.*, 1987; Colyn & Deleporte, 2002; Grubb, 2001).

The bio-geographical region on the Atlantic coast:

- Faunal region of western Cameroon covers the Sanaga-Cross interfluves (1a);
- Faunal region of Rio Muni (1b) (Grubb, 2001);
- Faunal region of southern Ogooué (1c).

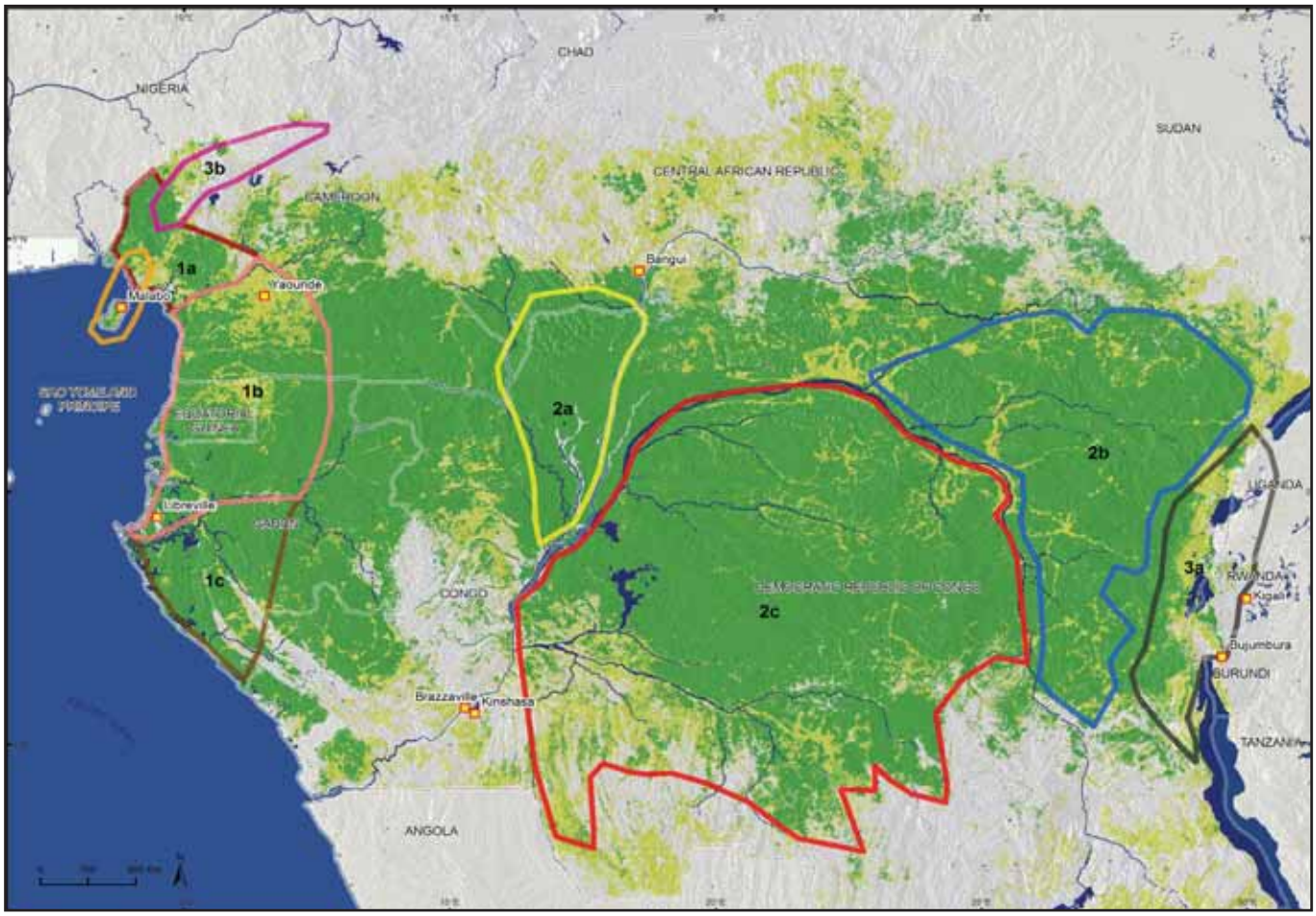
The Congolese bio-geographical region:

- The western Congolese region corresponds to the Sangha-Oubangui interfluves (2a);
- The eastern Congolese region extends to the east and the north-east of the Congo River (2b);
- The southern Congolese region extends to the south of the Congo River (2c).

The mountainous region:

- The Albertine Rift region (3a);
- The western Cameroon region (3b) which comprises two areas (western Cameroon and Mount Cameroon/Bioko).

The forests located between the various faunal regions are hybrid zones which do not have any endemic species.



National capital	Rio Muni Atlantic coastal (1b)	Congolese (Southern Congo) (2c)
National border	South Ogooué Atlantic coastal (1c)	Albertine Rift Afromontane (3a)
Faunal region	Congolese (Western Congo) (2a)	Western Cameroon Afromontane (3b)
Western Cameroon Atlantic coastal (1a)	Congolese (Eastern Congo) (2b)	Hybrid zone

Figure 3.6: Bio-geographical and faunal distribution zones for Central African mammals

Photo 3.8: Aerial view of a blind to view wildlife in Dzanga Bai, CAR

Another emblematic species is the forest elephant *(Loxodonta africana cyclotis)*

IUCN's African Elephant Specialist Group (AfESG) has prepared a summary of the situation of elephants in Central Africa dating from 2007. More precise maps exist for the various areas as well as for some protected areas in the Congo Basin. It is worth noting that the IUCN map shows the presence of elephants in very extensive areas in Central Africa to be "questionable" (figure 3.7). Comparison with survey areas (inputs zones) shows that no information on elephants exists for a large part of the sub-region. This is particularly the case for the DRC where this species seems to be confined to protected areas where its presence has effectively been documented. It would be interesting to consolidate the most recent data, in particular data from the inventories of forest logging concessions under management, which record in an extensive fashion the presence of all visible fauna, including elephants.

The 2008 State of the Forest report summarizes the situation of large mammals (great apes and elephants) in the context of protected areas and forest concessions.

Photo 3.9: Forest elephant (Loxodonta cyclotis)

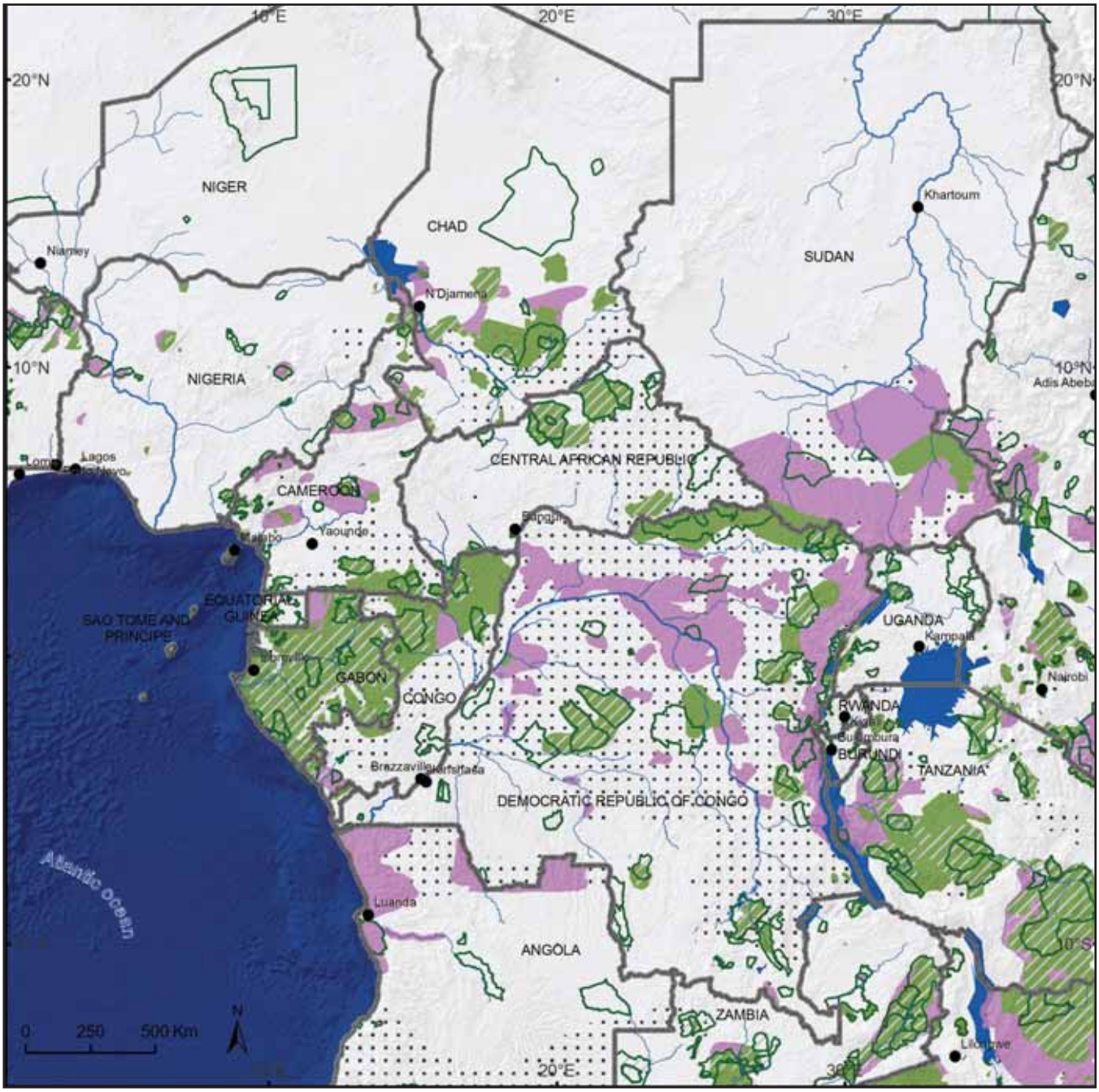


Figure 3.7: Map showing the presence of elephants in Central Africa
Source: AfESG database, IUCN, 2007

Fish

Only very sketchy information on fish is available for Central Africa. There has been quite a lot of research on the situation in Cameroon, Chad, Rwanda and Burundi but little if anything is known about vast areas in Gabon (particularly the Nyanga Basin) and the DRC. Much taxonomy (classification) work also remains to be done; information on fauna in DRC, for example, has not been revised for a long time (Teugels & Thieme, 2005). Several species still need to be described and even discovered. Information is still fragmented on species biology and the workings of aquatic ecosystems. This is a problem with regard to the design and implementation of sustainable exploitation.

The Congo Basin constitutes the richest aquatic ecosystem in Africa and, after the Amazon Basin, is the second richest in the world (Teugels & Thieme, 2005). The richest regions in Central Africa are Lower Guinea, the Malebo Pool and the central Congo Basin, Lake Tanganyika, Lake Edward, which forms part of the eco-region of Lake Victoria and Lake Albert, which is part of the eco-region of the Upper Nile. In contrast, the oceanic islands of the Gulf of Guinea are extremely poor. The richest areas for endemic species are Lake Tanganyika and the eco-region of Lake Victoria. The vast majority of endemic species belong to the *Cichlidae* family. Lower Guinea and the Kasai eco-region are also very rich.

Central Africa is made up of four ichthyological provinces (Stiassny *et al.*, 2007) which are sub-divided into aquatic eco-regions (Thieme *et al.*, 2005):

The Nilo-Sudan province consists of three distinct eco-regions: the Chad, Niger-Bénoué and Nile basins, which are represented by the Lake Albert aquatic eco-region (table 3.2).

Photo 3.10: Mangrove in Gabon

Table 3.2: Number of fish species per basin in the Nilo-Sudan province

Basin	Number of species	Number of endemic species	Endemic species (%)
Chad	140	4	3
Lower Niger-Bénoué	202	17	8
Upper Nile	115	16	14

Source: Thieme et al., 2005

The East Coast province comprises the aquatic eco-region of Lake Victoria and Lake Edward and the Akagera Basin in Rwanda and Burundi. It has 80 species of *Cichlidae,* of which about 60 are endemic. Lake Kivu, whose waters flow into Lake Tanganyika and then to the Congo Basin, is also part of this aquatic eco-region. Its fauna includes 28 species.

The hydrological basin of the Congo is divided into 17 aquatic eco-regions (table 3.3).

Table 3.3: Number of fish species and endemism level in the aquatic eco-regions of the Congo basin ichthyological province

Aquatic eco-region	Number of species	Number of endemic species	Endemic species (%)
Lower Congo	200	11	6
Lower Congo Rapids	162	26	16
Malebo Pool	231	14	6
Sangha	170	8	5
Congo-Oubangui	164	13	8
Kasai	224	49	22
Tumba	48	2	4
Mai Ndombe	30	3	10
Cuvette Centrale	238	14	6
Uele	149	9	6
Upper Congo Rapids	170	3	2
Upper Congo	182	10	5
Albertine Highlands	16	0	0
Upper Lualaba	101	11	11
Lake Tanganyika	288	231	80
Malagarazi-Moyowosi	88	15	17
Bangweulu-Mweru	111	31	28

Source: Thieme et al., 2005

Photo 3.11: River running through a forested area: a common sight in the Congo Basin

Lower Guinea includes the coastal river basins stretching from eastern Nigeria to Mayombe in DRC. The largest basins are Ogooué in Gabon and Sanaga in Cameroon. This area is sub-divided into four eco-regions: northern Lower Guinea, central Lower Guinea, the endorheic lakes of western Cameroon, and southern Lower Guinea (table 3.4).

The Oceanic Islands in the Gulf of Guinea: Annabón, São Tomé and Príncipe also constitute a distinct eco-region where there is a severe shortage of freshwater ichthyofauna.

Table 3.4: Number of fish species and endemism level in the aquatic eco-regions of the Lower Guinea

Aquatic eco-region	Number of species	Number of endemic species	Endemic species (%)
Northern coastal (Cross)	187	30	16
Cameroon lakes	38	27	71
Central coastal (Cam, Eq-G)	279	57	20
Southern coastal (Ogooué-Niari)	236	28	12

Source: Thieme et al., 2005

Insects

There is no overall summary of insects in Central Africa. Existing calculations vary considerably. Globally approximately 900,000 species have been described out of estimates ranging from 2 to 30 million, depending on the authors. Sub-Saharan Africa accounts for about 100,000 of the described insect species and likely a high number of the to-be discovered species. Insects represent an animal taxon that, on the whole, is under little threat with only 3,269 insect species on the IUCN Red List.

Ants

Inventories exist for some specific families. "The Ants of (sub-Saharan) Africa" database (http://antbase.org/ants/africa/) lists 1,968 ant species, including 158 in Cameroon, 21 in CAR, 50 in Congo, 51 in Gabon and 225 in DRC.

Butterflies

OFAC has prepared an overview of butterflies that lists 2,391 Rhopaloceres species (or day butterflies as opposed to Heteroceres or night butterflies), which is divided into 6 families across the 10 countries that are members of COMIFAC's Observatory. The figures presented are a good illustration of the challenges associated with developing comprehensive species lists when the information available is directly associated with the difficulty of collecting the data on the ground. As regards individual countries[11]:

- DRC, with 1,785 species, is the richest country in Central Africa and even in the whole of Africa;
- Chad has the least number of species (33), which is explained by the absence of a forest ecosystem, but also and above all, the lack of available data;

[11]No data identified for the Republic of Congo

Photo 3.12: River rich in sediments in the heart of the forest in Cameroon

- São Tomé and Príncipe has a small number of known species (47);
- Rwanda, with 327 species, and Burundi, with 300 species, are not as rich as other countries on the continent;
- Equatorial Guinea's continental component lists only 119 species, despite being the same size as Rwanda and Burundi. This is due mostly to the paucity of published data and also to the fact that much data lacks detail;
- Cameroon, with 1,557 species, is in second position behind the DRC;
- CAR, with 697 species, clearly lacks sufficient information;
- Gabon, with 935 known species, had little research in the past, but new data will significantly increase the number of known species in the country.

The website of the "*Association des Lépidoptéristes de France"* presents a page with links dedicated to the tropical African region (http://www.lepido-france.fr/liens/categorie/region-afrotropicale/).

Photo 3.13: The flora of Central Africa displays a wide variety of forms and colors

□ *Vegetation*

Lists and species inventories

Depending on the sources, estimates for vascular plant species in Central Africa vary considerably. OFAC could provide support and assistance to regional organizations and specialized networks, including REBAC (Central African Botanists Network), to enable them to establish a set of bibliographical references that could serve as an authoritative source for the region. In addition, available data varies greatly from one country to another. In 1998, a review of the situation was carried out by Lemmens and Sosef.

It is thought that Central Africa has the highest number of plant species per unit area of any region in the world. Reitsma (1988) found over 200 different plant species on a 0.02 ha plot in Gabon and, similarly, Letouzey (1985 and 1986) found 227 species on a 0.01 ha plot in Cameroon. A study carried out by Wilks (1990) in Gabon has shown that these forests are richer in plant species than those in West Africa.

Cameroon

According to Stuart *et al.* (1990), and World Conservation Monitoring Centre (WCMC, 1992), Cameroon has about 8,260 plant species. More recently, this estimate was lowered to 7,850 plant species, 815 of these are threatened with extinction (Onana & Cheek, 2011). The National Herbarium of Cameroon has produced 37 publications on flora in Cameroon. The first 20 issues were edited by the *Muséum national d'Histoire naturelle* (MNHN) in Paris.

Republic of Congo

An estimated 6,000 vascular plant species (Hecketsweiler, 1990) was recently revised to about 4,538 species, of which 15 are endemic (Sonke *et al.*, 2010).

Gabon

According to a check-list of vascular plants in Gabon (Sosef *et al.*, 2006), the most recent estimate is for 4,710 species, 508 of which are thought to be endemic (*Projet Sud Expert Plantes*, 2010). This figure is lower than previous estimates of 6,000 to 8,000 plants (Breteler, 1988; Lebrun, 1976) or 7,151 vascular plants (Stuart *et al.*, 1990; WCMC, 1992).

The Gabonese Flora series deals with about a third of these species. Founded in 1961, Gabonese Flora is published sporadically. Through 2002, 35 issues had been published before a relaunch resulted in the publication of volume No. 41 in 2010.

Central African Republic

Sources of a very general nature estimate that there are 3,600 known plant species (Stuart *et al.*, 1990; WCMC, 1992), of which 100 are endemic and two species are threatened with extinction.

Democratic Republic of Congo

A list of biodiversity references in DRC is available on the website of the DRC *Centre d'Echange d'Informations* (CEI) (http://www.biodiv.be/cooperation/). A database of the flora of Central Africa is maintained by the Belgian National Botanic Garden and covers DRC, Rwanda and Burundi (http://www.br.fgov.be/RESEARCH/DATABASES/FOCA/index.php?la=en).

Table 3.5: Inventory of plant species in the DRC

	Family	Genus	Species
Algae	30	71	249
Mushrooms (*Basidiomycota*)	41	174	655
Lichens	3	4	21
Bryophytes	48	87	154
Pteridophytes	39	89	378
Spermatophytes	216	1,731	8,867

Source: CEI-DRC

The "*Cuvette centrale*" is the main endemic region in the DRC. It has 952 endemic Spermatophyte species, which is 10.7 % of all the known species in this group (table 3.5). Two other endemic areas have been identified. One is in the mountainous region in the east (where the microthermal orophile species, that include the *Lobelia*, *Philippia* and *Senecio* genera, can be found) and the other is in the region of the Katanga high plains in the south-east of the country.

São Tomé and Príncipe

Global estimates indicate that there are 700 plant species, including about one hundred orchids. São Tomé has a level of endemism of 15.4 % and Príncipe 9.9 %, which contrasts with the islands of Bioko and Annabón in Equatorial Guinea that have endemism levels of 3.6 % and 7.7 % respectively. There are a total of 37 endemic plant species in Príncipe, 95 in São Tomé (with one endemic genus), and 20 endemic species in Annabón (Figueiredo, 1994b; Figueiredo *et al.*, 2011). Of the endemic species in the region, only 16 can be found on more than one island. This shows how remote this kind of vegetation is and suggests that the continent has influenced each island differently. The *Rubiaceae, Orchidaceae* and the *Euphorbiaceae* are characteristic of the islands' flora, and have a high level of generic diversity and endemism (Figueiredo, 1994b). There are also thought to be many Pteridophytes (ferns) (Figueiredo, 1998). These islands are known as "Centers of Plant Diversity".

Data collection and updating for biodiversity in Central Africa: examples of large scale mechanisms and processes

Via national herbaria, mechanisms have been established to identify the plant species in some countries. For example, the herbaria in Libreville, Wageningen, Missouri, Paris and Brussels are collaborating to collect specimens of all plants in Gabon. This initiative, called "**Plants of Gabon**", has already collected over 65,000 specimens (http://dps.plants.ox.ac.uk/bol/Gabon/Home/Index).

In a more targeted way, the online database "***Orchidacea d'Afrique Centrale***" (Central African Orchids) has listed 622 taxa, with 200 photos, and supports the maintenance of a network of shade structures for collection and reproduction in Gabon, Cameroon, Equatorial Guinea and São Tomé.

The **PROTA Foundation** summarizes information from a variety of sources on about 7,000 useful plants in tropical Africa and provides access to this information through databases on the web, books, and CD-Roms (http://www.prota.co.ke/en/home). Detailed data records for 1,070 plant species are available on the on-line data base http://www.prota4u.org/searchresults.asp.

In Central Africa, trees constitute the main plant species to have been documented on a large scale. The first forest inventories in the 1960s focused on about several dozen species of commercial value. Since 2000, a growing number of management inventories have included the total number of tree species contained in the concessions, which in certain areas means over 200 species are recorded. Nevertheless, particular care is required when using these inventories for scientific purposes (Réjou *et al.*, 2010). For plants in general, trees are relatively easy markers in terms of identifying ecosystems. Using reliable global and regional references, such as the plant map of Africa at 1/5,000,000 (White, 1983) or the Letouzey maps, 1978-9, which are still relevant, several recent initiatives have tried to summarize available information on a regional scale. A very broad estimate for the total number of tree species in Central Africa is between 700 (Vivien & Faure, 1995) and 1,000 (Vande weghe, 2004).

A cartographic atlas of commercial species from tropical humid Africa, **PhytoAfri**, has been jointly established by IRD (*Institut de Recherche pour le Développement)* and CIRAD (*Centre de Coopération internationale en Recherche agronomique pour le Développement*) (Chevillotte *et al.*, 2010). The data used is from the FAO historical series, including regular inventories of the Congo Basin carried out from1970-1980, and available botanical identification cards for all target species.

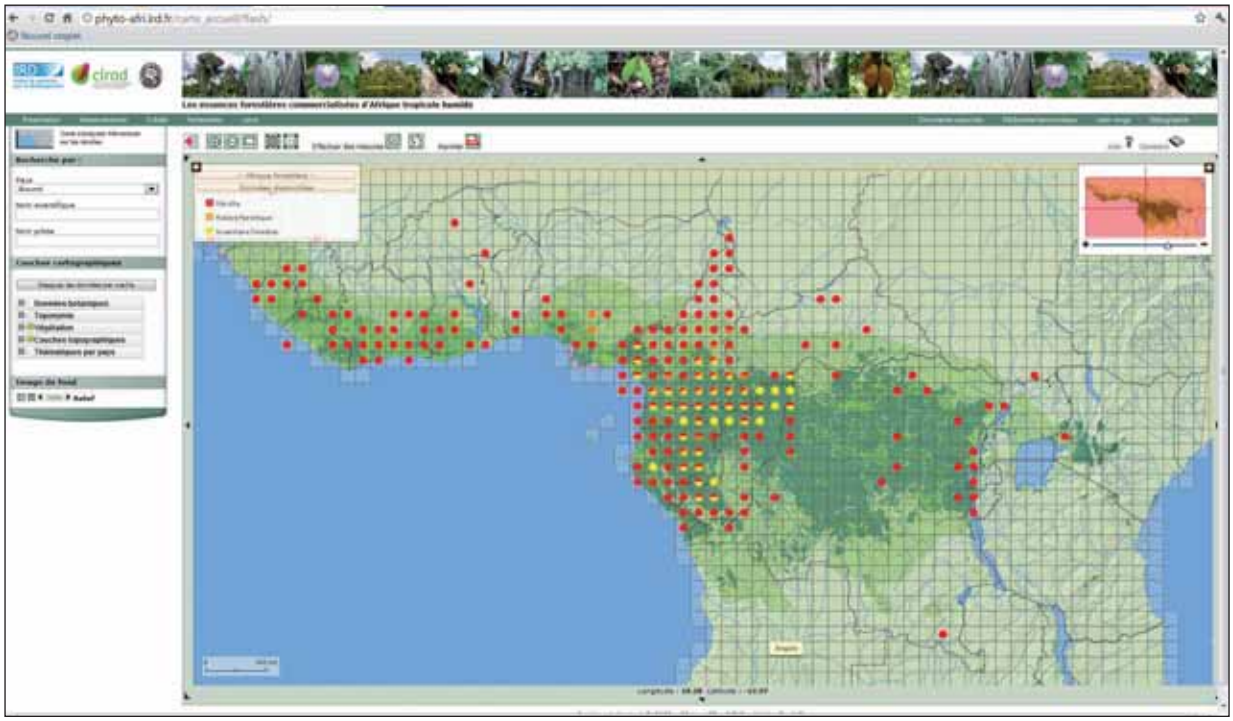


Figure 3.8: Example of a Phyto-Afri map for sapelli
Source: http://phyto-afri.ird.fr/carte_accueil/flash/

The **Coforchange Project** uses recent data gathered via management inventories for industrial forest concessions in Cameroon, Congo and in CAR. These inventories are based on systematic sampling, with a sampling rate of about 1 %. Inventories detailing over 5 million ha have been collected and standardized for scientific purposes. Field measurements are then combined with an analysis of a wide range of satellite imagery. This process results in a new means of mapping land cover, with plant classes defined using multiple criteria, such as trees, soil characteristics, climate and hydrology. This new representation of forest vegetation aims to provide natural resource managers with more precise information at a site specific scale (for example, a forest concession or a protected area). Coupled with historical climate information from the past 4,000 years, this representation provides a better means of understanding the crucial factors determining the current composition of flora in Central African forests and provides a basis for predicting what might happen in the case of future human pressure and climate change.

The **Association for the Taxonomic Study of the Flora of Tropical Africa (AETFAT)** has as its objectives to coordinate studies on African flora, harmonize methods and share results. AETFAT was established in 1950 by researchers from institutions working in Africa. The key members and founding organizations are the Royal Botanic Garden at Kew (UK), National Botanic Garden in Meise (Belgium), *Muséum national d'Histoire naturelle* in Paris (France), and the CTFT in Nogent-sur-Marne/CIRAD-Montpellier (France), Portugal and Spain.

The **Central African Botanists Network (REBAC)** (http://www.rebac-botanists.com) is a scientific group that was established in September 2000 following the AETFAT Congress in Meise, Brussels (Belgium). It acts as a coordinator for the network of Central African herbaria which are geographically distributed as follows:

- Burundi: Bujumbura
- Cameroon: Yaoundé, Garoua and Limbe
- Congo: Brazzaville (IEC) and Brazzaville (IRSC)
- Gabon: Libreville
- Equatorial Guinea: Bata
- CAR: Bangui and Boukoko
- DRC: Kinshasa, Yangambi, Lubumbashi (EBV), Lubumbashi (LSHI) and Kisangani
- Rwanda: National Herbarium of Rwanda
- São Tomé and Príncipe: *Herbário Nacional of São Tomé e Príncipe*
- Chad: N'Djamena

Networks and tools of a more general nature, that are not specific to Central Africa, are also available, such as:

The **Tela-botanica portal** (http://www.tela-botanica.org) disseminates information in French on botany world-wide.

Also of note is the **"BRAHMS" tool** which is a computerized database management system for herbaria and botanical researchers (http://dps.plants.ox.ac.uk/bol/).

With an even wider focus, the **Global Biodiversity Information Facility (GBIF)** (http://www.gbif.org/) is a meta-database of available datasets on biodiversity in most museums, herbaria, and other collections in the world.

The brand new biodiversity center of Kisangani in DRC is also to be mentioned (http://www.congobiodiv.org/en).

Status: threat or protection

Lists and numbers provide introductory information for natural resource managers. However, management measures must take account of (i) species status in relation to the threat of extinction (very real for some emblematic species such as the rhinoceros) and/or (ii) the level of protection offered to them by international conventions or the country's legal provisions.

□ *IUCN's Red List: threat level*

The IUCN is the world's reference organization for maintaining up-to-date lists per country of animal and plant species. The "Red List" (http://www.iucnredlist.org/), based on the recommendations of a panel of experts, provides an evaluation of the degree of threat for each species relative to seven standardized levels (box 3.2).

□ *CITES Lists (Appendix I, II and III) on trade limitations for wild species*

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) maintains a list of species whose trade must be controlled or limited with the aim of preventing their local or global extinction. Species are classified from Appendix I, which lists the species that are the most threatened and whose trade is very strictly regulated and must prove that its trade does not put the species in danger of extinction, to Appendix III, which simply requires verification that laws and conditions for adequate transportation are being followed. CITES lists, which are regularly up-dated, are available at http://www.cites.org/eng/app/appendices.php. Unfortunately, the appendices are not listed per country.

Box 3.2: IUCN Red List for threatened species: global figures (April 2010)

Total number of species evaluated: 55,926

Number of species according to the 7 degrees of threat:

- Extinct: 791
- Extinct in the wild: 63
- Critically endangered: 3,565
- Endangered: 5,256
- Vulnerable: 9,530
- Near threatened: 4,014
- Least concern: 24,080

– Total number for Low risk/depending on conservation measures: 269 (this is an old category that has gradually been eliminated from the Red List)

– Data insufficient: 8,358

In 2009, a "Red List" workshop on Central African plants was organized to update the level of threat status for plants in the sub-region. REBAC proposed that the following taxa and target groups be evaluated on a priority basis over the next three years:

- Endemic plants of São Tomé and Príncipe;
- Endemic plants of the Katanga copper outcrops;
- Endemic plants of Cameroon;
- Species of timber and non-timber forest products used in the sub-region of Central Africa;
- Some taxa of *Orchidaceae*;
- Some taxa of *Rubiaceae*;
- The *Begoniaceae*;
- Saprophytes plants;
- The *Podostemaceae*.

Box 3.3: Botanic gardens in Central Africa: roles and prospects

Francesca Lanata

National Botanic Garden of Belgium

According to the Botanic Gardens Conservation International (BGCI), "a botanic garden is an institution holding documented collections of living plants for the purposes of scientific research, conservation, display and education".

Botanic gardens are of primary importance in Central Africa which is home to about 14,000 listed plant species, many of which are threatened with extinction (including in parks and reserves).

Botanic gardens do not only serve to house collections of plant species. They are also (i) key awareness-raising instruments for matters related to environmental conservation; (ii) ideal settings for environmental education and tourism; (iii) centers for promoting activities related to biodiversity conservation in parks and reserves; (iv) centers for technical and scientific knowledge on flora usage and sustainable management.

Botanic gardens and arboretums therefore have a key role to play in:

- Educating the urban population whose first steps in learning about nature are no longer acquired by living in the forest as once was the case;
- Conserving species and providing for their reintroduction into their natural habitat;
- Restoring degraded habitats;
- Monitoring species migration and their vulnerability to climate change.

A growing number of people are realising that botanic gardens and arboretums play a vital role in Central Africa and that improving their management in what is the world's second largest tropical forested area is essential.

For all these reasons, botanic gardens (*ex-situ* conservation) should be thought of as privileged partners for governments and organizations responsible for *in-situ* conservation.

Today botanic gardens in Central Africa are symbols of both hope and resilience. For the past thirty years, botanists and technicians have worked in botanic gardens that lacked the necessary financial resources and had dilapidated collections and infrastructures. It is thanks to these devoted people that there has been limited loss of local knowledge on flora in the Congo Basin and the heritage of these institutions has been kept alive. Unfortunately, these gardens have worked in isolation, cut off from other conservation actors.

In 2003, representatives of botanic gardens, herbaria, arboretums and urban parks in Cameroon, Congo, CAR, DRC, Gabon and São Tomé and Príncipe established the "Central African Botanic Gardens Network" (CABGAN) in order to break this isolation and sensitize decision-makers on the importance of these gardens. This network aims to promote cooperation between members for biodiversity conservation and cultural heritage in the Congo Basin. In the network's official documents, CABGAN representatives made a point of emphasizing the fact that the majority of botanic gardens are protected areas and must therefore be prohibited from carrying out any activity that is not in line with this status. All the network's activities are focused on carrying out the Global Strategy for Plant Conservation adopted by the Convention on Biological Diversity (CBD). Since 2008, the Kisantu Botanic Garden[12], an *ex-situ* example and conservation model, and a showcase for conservation in the national parks, has, with the assistance of the National Botanic Garden of Belgium[13], provided secretariat services for CABGAN.

[12]The rehabilitation of the Kisantu Botanic Garden (http://www.kisantu.net) began in 2004. Following its success, the DRC Government helped to restore the Eala (Mbandaka) and Kinshasa botanic gardens which re-opened in June 2010.

[13]http://www.jardinbotanique.be

Biodiversity conservation: the formal process

Protected areas

Not enough effort is being spent on management planning for the protected areas (PAs) in Central Africa[14]. Having an approved management plan for a PA does not of course guarantee that all on-site problems will be resolved. However, the process has the advantage of: (i) specifying partnerships between the management team and all local actors; (ii) identifying an overall strategy and specific objectives for the short, medium, and long term; (iii) organizing all available resources (human, technical, financial) over an operational period of four to five years. Even without sufficient funding or staff, the management plan can optimize available and likely resources.

Also characteristic of PAs, and recurrent since their establishment, is the serious lack of resources at their disposal. Supervisory authorities allocate very limited annual amounts in terms of staff and funding. The international funding they receive is usually earmarked for a small number of PAs that are regarded as global public goods. Some sites that were already symbolic or have become symbolic, receive subsidies, and in some cases, continue to receive them for over twenty years. The sustainability of some approaches, or the tendency to replace the national administrations, can be questioned. However, it nevertheless remains true that, without this more or less regular funding, the global situation with regard to biodiversity would undoubtedly have deteriorated more than it has done.

A recent partial inventory of the Dja Faunal Reserve (Cameroon) shows that, despite the extreme pressure it is facing with regard to hunting, it still has significant populations of large mammals. This is among the rare but compelling examples that illustrate that it is possible to conduct (successful) biodiversity protection policies, notably by establishing an efficient system to counter poaching[15].

[14]Statistics on PAs in Central Africa can be found on OFAC's website under the heading "Biodiversity/ Protected Areas" – http:// observatoire-comifac.net/pa.php and per country under the heading "Maps and National Indicator" – http://observatoire-comifac.net/ indicators.php?lvl=cntr).

[15]A policy made possible by mobilizing the international community (notably through the EU/ECOFAC program) and the public authorities in Cameroon.

Box 3.4: Central Africa World Heritage Forest Initiative (CAWHFI[16])

Thomas Fondjo

CAWHFI / UNESCO

Africa is under-represented on the UNESCO World Heritage List, encompassing just 9 % of the listed sites. The CAWHFI program (see box 16.1 of the 2008 State of the Forest report) has as one of its objectives to promote protected areas by including them in the World Heritage List. In order to do this, it encourages State parties to promote their transboundary ecological sites. This objective is perfectly assimilated with the aspirations of the COMIFAC Convergence Plan.

Aware of the absolute need to involve administrations, communities, forest operators and NGOs to ensure that protected areas are properly managed, the CAWHFI program has established a "Consultation Framework" for conservation and world heritage site partners. Through activities to promote information and experience exchanges and facilitate communication between partners, CAWHFI seeks to improve:

- Effectiveness of support of partners in the field of conservation;
- Finding sustainable funding for activities;
- Strengthening the private sector and decentralized governmental services dealing with nature conservation in collaboration with partners in the field;
- The negotiation process between countries, which requires long-term strategy and vision.

According to a mid-term review (EU Evaluation ROM928770), the "Consultation Framework" provides an appropriate response to guarantee both the efficiency and effectiveness of the project.

In light of this, CAWHFI will pursue its goals to achieve improved management and conservation for ecological landscapes so that they are recognized as having outstanding universal value. It intends to implement new activities related to climate change concerns (i.e., adaptation, mitigation, carbon markets), or to other topics where ecological sites identified by CAWHFI, could serve as pilot areas (for instance in the implementation of REDD+ in the Congo Basin).

[16]The CAWHFI program is available on website http://whc.unesco.org/en/cawhfi/

Photo 3.14: Lopola village in northern Republic of Congo

□ *The threats*

Biodiversity in Central African forests is facing a number of threats of varying levels of severity.

Some threats are particularly prevalent and are the subject of more wide-spread studies.

Hunting

Hunting has the potential to be damaging for biodiversity. Three types of very different forms of hunting can be found in the sub-region: (i) hunting for food, which can be subsistence level or commercial, (ii) hunting for products that are unrelated to food (e.g. ivory, pelts) and (iii) hunting tourism.

Hunting tourism is a special case. This form of hunting only affects a very small number of animals that are killed each year. Sport hunting, whether managed by private enterprises or communities, is very seldom the subject of structured management plans. All in all, it has some direct impact on biodiversity (particularly if quotas for young or female animals are not properly respected) but it is of marginal importance on a global scale. Hunting tourism can, indirectly, have a positive effect on neighboring PAs because it can act as a buffer zone where illegal hunting is properly monitored. Community sites that are open to hunting tourism (e.g., COVAREF[17] in Cameroon) provide revenue for local populations from hunting taxes paid by tourists (in addition to revenue from entry fees/accommodation).

In nearly all countries, hunting for food, be it subsistence or commercial, is part of the informal economy. Countries do not account properly for this economic sector which mobilizes the equivalent of an annual turnover of CFA 2,000 billion or € 3 billion in Central Africa[18].

The laws in most countries in Central Africa authorize hunting for food under very precise conditions that govern (i) the type of weapon that can be carried; (ii) the hunting season; (iii) the number, sex and size of what can be hunted. These conditions are rarely respected and hunting can therefore be qualified in most cases as illegal.

Despite numerous reforms, these laws are still hardly applied as they are ill-adapted to the real practicalities of hunting. Neither are they used very much for purposes of monitoring and repression as administrations lack human, financial and material resources.

A number of projects have taken up the question of regulating hunting practices in commonplace sectors such as community zones, regulated spaces such as forest concessions or PAs and their peripheral zones. Some projects have shown interesting results which could reduce the impact of hunting on wildlife. However, no overall solution currently exists. Often, results are dependent upon budgetary concerns and the need for international expertise.

An approach that is frequently put forward consists of looking for ways to substitute bushmeat with other sources of protein. Breeding wild animals, game ranching, and in many cases breeding common domestic animals (e.g., chickens, fish, rabbits, goats) has been carried out in several areas without really spreading to forest areas. Bushmeat continues to be consumed as its acquisition (buying, hunting) requires less effort than the effort required to substitute it. This is noticeable where urbanization has changed the diets of populations that have moved away from the forest. However, eating bushmeat is also a traditional preference and some populations are therefore willing to make an extra effort (pay more, take risks to hunt illegally) in order to obtain it (see chapter 6).

Generating alternative revenues has been the subject of research through projects on ecotourism, but has not produced significant results with regard to bushmeat. It can be noted however that, despite about twenty years of attempts at ecotourism, revenues in Central Africa are still marginal. Potentially interesting products exist but problems in implementing them (e.g., transport, accommodation, security, visas, expense, availability of qualified staff) hamper the further development of this industry. While hunting tourism in the forest (see above) remains a niche activity, it is one of the activities that best manages to find a balance between economic development needs and biodiversity conservation objectives.

Approaches for organizing and formalizing hunting are also being implemented. The *Projet de Gestion des Écosystèmes dans la Périphérie du Parc national de Nouabalé-Ndoki* (PROGEPP) in northern Congo seeks to have the rights of hunting communities formally recognized in forest concessions. In addition to a zoning plan for the CIB concession (*Congolaise industrielle des Bois*), the project helped to organize community hunting in collectively designated village zones.

[17]COVAREF : *Comité de Valorisation des Ressources fauniques*.

[18]This figure is estimated on the basis of an annual consumption of 1 million tons and on the assumption that the price per kilo is CFA 2,000 (Bushmeat Crisis Task Force. Online at http://www.bushmeat.org/sites/default/files/FSeconomics.pdf).

Other threats seem to be much more difficult to tackle:

War or rebellion

In dealing with the threats faced by PAs, one of the main constraints is not being able to undertake any kind of land initiatives in zones where there is war or rebellion. National parks in northern CAR, as well as Garamba and Virunga national parks in DRC, are constantly in mourning following the violent deaths of staff who were carrying out their duties. In addition to human challenges of this kind, the consequences for biodiversity are also significant. Chad and CAR are the victims of unprecedented elephant massacres on territories that are impossible to control (Poilecot, 2010).

On the other hand, as far as health is concerned, be it human or animal, the region has not suffered any major new epidemic, such as the Ebola disease, for the past two years.

Mining, petroleum or agro-industrial exploitation

A disturbing trend that has been challenging the conservation world for some time now, and which is likely to grow, is the emergence of mining, petroleum or agro-industrial exploitation projects.

The economic development prospects and employment brought about by the exploitation of these natural resources are extremely important for the countries concerned. Such is the case, for example, of the vast iron ore deposits in Gabon (Belinga Mountains), in Cameroon and Congo, or the discovery of petrol in Virunga National Park in DRC. Protected areas should expect to undergo a significant increase in direct or indirect pressure. An influx of salaried workers, opening up channels of communication, deforestation, and hunting, all represent threats to the ecological integrity of PAs.

States sometimes employ legal instruments and procedures such as environmental impact assessments in order to reduce the negative ecological consequences. Nevertheless, the law that governs Gabonese national parks is one of the only laws that provide for compensation in cases of loss of land by the mining industry or others. A dialogue between supervisory administrations is absolutely necessary.

□ *Funding and management opportunities*

Economic Community of Central African States (ECCAS) has become increasingly important as the institution responsible for implementing regional policy on the environment and management of natural resources in Central Africa, as adopted by Heads of State in 2007. Consequently ECCAS was given the responsibility for two major regional programs dealing with natural resource management and support for PAs: (i) The Congo Basin Ecosystems Conservation Programme (PACEBCo), with financing of CFA 28.53 billion from the African Development Bank (AfDB) and ECCAS, and (ii) the ECOFAC Regional Indicative Programme (RIP) from 2011 to the end of 2014 with financing of € 30 million from the European Union. At the same time, the Central Africa Protected Areas Network (RAPAC) has confirmed its authority in the region by being given the role of coordinating PACEBCo and RIP/10th EDF programs, as well as the Project to Support Biodiversity Management in Salonga National Park in the DRC.

RAPAC has furthermore provided support and facilitated initiatives for Transboundary Protected Areas (TBPA), including participating in steering committees. Eight countries participated in the process of establishing TBPA, representing 19 protected areas and 7 cross-border complexes (table 3.6).

The most recent transboundary cooperation agreements relate to the establishment of the BSB Yamoussa TBPA and the Mayumba-Conkouati Transfrontier Park (PTMC). They were validated by the COMIFAC ministerial meeting which was held in Kinshasa from 8 to 11 November 2010.

TBPAs help to strengthen cross-border cooperation and security. They can act as incentives for the establishment of new PAs. One of the newest national parks in Africa is Sena Oura National Park in Chad which was legally established on 31 May 2010.

Table 3.6: Transboundary Protected Areas in Central Africa

Protected areas	Year of creation	IUCN category	Area (ha)	Country
PTMC				
Mayumba	2002	II	80,000	Gabon
Conkouati-Douli	1980/1999	II	505,000	Congo
TNS				
Nouabalé-Ndoki	1993	II	419,000	Congo
Lobéké	2001	II	43,000	Cameroon
Dzangha-Ndoki	1990	II	125,100	CAR
Special Reserve of Dzangha – Sangha	1990	IV	310,000	CAR
TRIDOM				
Odzala-Koukoua	1935/1999	II	1,350,000	Congo
Dja Faunal Reserve	1950	UTO cat.1(*)	526,000	Cameroon
Minkébé	1997/2000/2002/	II	756,700	Gabon
MA-MC				
Monte-Alen	1997	II	200,000	Equatorial Guinea
Monts de Cristal	2002	II	120,000	Gabon
Campo-Ma'an Rio-Campo				
Campo Ma'an	2000	I	771,000	Cameroon
Natural Reserve of Rio Campo		IV	33,000	Equatorial Guinea
BSBY				
Bouba Ndjidda	1968	II	220,000	Cameroon
Sena Oura	2010	II	73,890	Chad
TBPA project in the Mayombe Forest				
Biosphere Reserve of Dimonika				Congo
Biosphere Reserve of Luki				DRC
Natural Ecosystem of Cacongo				Province of Cabinda in Angola

(*) UTO: Technical Operational Unit

Source: RAPAC

Another key factor is the increase in the number of foundations involved in the funding and management of PAs in the region:

- The trust fund to support the establishment and management of the Sangha Tri-National (TNS – see box 10.3) completed the funding process for the first two financial contributions provided through German (KfW) and French (AFD) cooperation.
- Management of the national parks of Garamba in DRC and Odzala-Kokoua (OKNP) in Congo has been assigned to the African Parks Foundation. In DRC, management has been transferred by the ICCN national regulatory authority.

One more important point is the announcement made by the DRC in Bonn in 2008 to create 13 to 15 million hectares of supplementary PAs in order to have a protected area network that represents 17 % of its territory, which would bring it into line with its international commitments. The inclusion of local communities in this process is a crucial factor. This decision also means that difficult economic arbitration is required in protected areas with rich mineral or petroleum resources that the country would need to refrain from exploiting.

□ *Legal provisions*

The legal provisions that take biodiversity in Central African concessions into account are very heterogeneous. Some common components of these stand out:

- Although all countries have regulatory texts that govern forest management (law, forest codes), these texts are nearly always different from the texts that govern the management and conservation of fauna. These two types of text are very different; in general the texts on fauna appear to be older;
- National texts on the conservation of fauna, (in particular lists of protected species) can in every case be applied to logging areas, but they were not written with this in mind. They do not contain, or hardly contain, specific reference to concessions. Apart from standard measures applicable across national territories, texts on fauna most commonly refer to dedicated areas such as hunting areas or protected areas;
- Regulatory texts on forests are supplemented by national standards and terms and conditions that indicate the measures that need to be followed to protect biodiversity in concessions. These contractual documents become binding between the State and companies once they are signed. However, implementation and on-site monitoring are problematic and limited;
- National measures to safeguard biodiversity in concessions are still generally limited to some animal species or symbolic plants. Most national standards require companies to monitor hunting and the transportation of game in their concessions;
- In most countries, regulatory instruments (including the texts as well as the administrative services responsible for implementing them), are largely divided between administrations responsible for fauna and those responsible for forest production.

Specific safeguards exist for some species of interest for industrial logging, but that the State, CITES or IUCN recognize as being threatened (table 3.7). The main producing countries have drawn up lists that apply across their overall territory or to specific concessions on a case-by-case basis based on the findings of management inventories. Restrictions on the exploitation of these species depend on the overall richness of the areas to be exploited as well as the abundance of the specific species in classes of different diameter ranges.

In most countries, the zoning plans for concessions include special environmental protection measures under specific "management series". The two main categories of series include either a ban that only affects forest logging, but authorizes populations to carry out all forms of harvesting that is not damaging, or a total ban on all human activity. Supplementary measures relate to the protection of river banks and slopes that are prone to erosion.

Table 3.7: Commercial species with specific protection regulations in forest concessions in Central Africa

Species	Country	Status	Geographical zone
Afo	Gabon	Logging ban	In all CFAD[19]
Afrormosia (Assamela)	Cameroon	Appendix II CITES	The whole country
	Congo (*)	Threatened (IUCN)	FMU(**): Tala Tala, Bétou
Andock	Gabon	Logging ban	In all CFAD
	Equatorial Guinea	Under authorization	The whole country
Anigré	CAR	Partially protected	All concessions
Ayous	CAR	Partially protected	All concessions
Bubinga (Kevazingo)	Equatorial Guinea	Under authorization	The whole country
Douka	Gabon	Logging ban	In all CFAD
Ebony	Cameroon	"Special product"	The whole country
	Congo (*)	Threatened (IUCN)	FMU(**): Ngombé, Pokola
	CAR	Partially protected	All concessions
Kapok - Fuma - Fromager	Equatorial Guinea	Under authorization	The whole country
Iroko	CAR	Partially protected	All concessions
Kosipo	CAR	Partially protected	All concessions
Moabi	Gabon	Logging ban	In all CFAD
	Equatorial Guinea	Under authorization	The whole country
Ozigo	Gabon	Logging ban	In all CFAD
Padouk	CAR	Partially protected	All concessions
Prunus	Equatorial Guinea	Under authorization	The whole country
Sapelli	CAR	Partially protected	All concessions
Sipo	CAR	Partially protected	All concessions

(*) IUCN data for the Republic of Congo cannot be confirmed without a more detailed study.
(**) FMU: Forest Management Unit
N.B.: Currently, none species is under protection status in DRC.

Source: OFAC

□ *Voluntary measures*

In addition to legal obligations, companies are encouraged to include voluntary measures that take biodiversity into consideration in their industrial practices. Public and international recognition of such efforts is sought through voluntary eco-certification. Several certification mechanisms co-exist in Central Africa:

- Certificates of "legality" are based on criteria established by audit companies (see chapter 2). Despite this term, these certificates go beyond a legal designation, by further integrating criteria of good practices into social and environmental sectors. These certificates incorporate, for example, TLTV by SGS and VLO by Smartwood or OLB by Eurocertifor/BVQI;
- The "Controlled Wood" label aims to guarantee that timber with an FSC label are well and truly from a verified and approved FSC source, or that they contain FSC monitored material mixed with non-certified timber;
- Sustainable management certificates are established based on criteria and indicators that are issued by independent audit bodies, such as PAFC (Pan African Forest Certification) and FSC. In less than five years, there has been a rapid increase in the areas certified under the FSC label in Central Africa. The FSC encourages companies to designate areas of high conservation value in their concessions, in principle according to a national framework, where there is a total or partial ban on logging, and/or specific protection measures (box 3.5);
- The TFT (The Forest Trust) label plays an intermediary role by providing labels for progress achieved: it applies to a product whose timber has been taken from a forest "exploited in collaboration with the TFT, using a closely monitored forest management program that will steer it towards independent certification", primarily FSC certification.

[19] CFAD: Forest Concession under Sustainable Management.

Box 3.5: Main FSC Principles and Criteria having a direct or indirect link with biodiversity considerations

Principle 1- Compliance with laws and FSC Principles

Forest management shall respect all applicable laws of the country in which they occur, and international treaties and agreements to which the country is a signatory, and comply with all FSC Principles and Criteria.

Criteria 1.1 - Forest management shall respect all national and local laws and administrative requirements.

Criteria1.3 - In signatory countries, the provisions of all binding international agreements such as CITES, ILO Conventions, ITTA, and the Convention on Biological Diversity, shall be respected.

Principle 2 - Tenure and use rights and responsibilities

Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established.

Criteria 2.1 - Clear evidence of long-term forest use rights to the land (e.g. land title, customary rights or lease agreements) shall be demonstrated.

Principle 3 - Indigenous peoples' rights

The legal and customary rights of indigenous peoples to own, use and manage their lands, territories, and resources shall be recognized and respected.

Criteria 3.2 - Forest management shall not threaten or diminish, either directly or indirectly, the resource or tenure rights of indigenous peoples.

Principle 6 - Environmental impact

Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.

Criteria 6.1 - Assessment of environmental impacts shall be completed - appropriate to the scale and intensity of forest management and the uniqueness of the affected resources - and adequately integrated into management systems. Assessments shall include landscape level considerations as well as the impacts of on-site processing facilities. Environmental impacts shall be assessed prior to commencement of site-disturbing operations.

Criteria 6.2 - Safeguards shall exist which protect rare, threatened and endangered species and their habitats (e.g. nesting and feeding areas). Conservation zones and protection areas shall be established appropriate to the scale and intensity of forest management and the uniqueness of the affected resources. Inappropriate hunting, fishing, trapping and collecting shall be controlled.

Principle 8 - Monitoring and assessment

Monitoring shall be conducted - appropriate to the scale and intensity of forest management - to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.

Criteria 8.2 - Forest management should include the research and data collection needed to monitor, at a minimum, the following indicators:

… c) Composition and observed changes in the flora and fauna…

Principle 9 - Maintenance of High Conservation Value Forests

Management activities in High Conservation Value Forests shall maintain or enhance the attributes which define such forests. Decisions regarding High Conservation Value Forests shall always be considered in the context of a precautionary approach.

Criteria 9.1 - Assessment to determine the presence of the attributes consistent with High Conservation Value Forests will be completed appropriate to scale and intensity of forest management.

Criteria 9.2 - The consultative portion of the certification process must place emphasis on the identified conservation attributes, and options for the maintenance thereof.

Since 2009, the ATIBT (*Association technique internationale des Bois tropicaux*) has supported a regional initiative to refine the more generic FSC principles and criteria to suit the specific conditions of the industrial forest logging in Central Africa.

What contribution can concessions make towards biodiversity protection in Central Africa?

Several regulatory guidelines, as well as practical manuals and training materials, are available to assist companies to implement good practices. Parts of the "ATO-ITTO[20] Principles, Criteria and Indicators for the Sustainable Management of African Natural Tropical Forests" (2003) provided inspiration for certifiers. In 2006, the IUCN and the ITTO also produced "Guidelines for the Conservation and Sustainable Use of Biodiversity in Tropical Timber Production Forests".

The ATIBT (*Association technique internationale des Bois tropicaux*) has produced three practical manuals for timber companies in Central Africa, including one volume which is devoted to fauna (Billand, 2005). A vocational training guide has also been prepared and widely disseminated in the region.

How committed are companies? A regional survey carried out by the FAO and CIRAD in 2008 and 2009 among 26 companies (some of which have several concessions in one country, or concessions in several countries), showed that the degree companies are integrating biodiversity concerns into management of concessions is directly related to the awareness levels of entrepreneurs (figure 3.9). In a panel of four types of company ((i) with no management plan; (ii) with a draft management plan; (iii) with a management plan that is being implemented; (iv) with FSC certification), the survey showed that monitored and audited measures in favor of biodiversity were only being undertaken in certified concessions. In general, it therefore appears that simply adopting a management plan does not constitute a sufficient incentive to encourage companies to advance from purely stating intentions to actually undertaking regular and effective operational action in the field.

This observation shows that awareness-raising efforts remain essential. It also shows that, with the current set of regulations and their level of application, promoting legal monitoring mechanisms will not be sufficient to guarantee the implementation of good practices in favor of biodiversity. As eco-certification is by definition a voluntary approach, new regulatory measures will need to be developed to provide for auditing and the sanctioning of offenders.

[20] ATO-ITTO: African Timber Organization - International Tropical Timber Organization.

Photo 3.15: The canopy structures combined with local topography create a varied landscape pattern

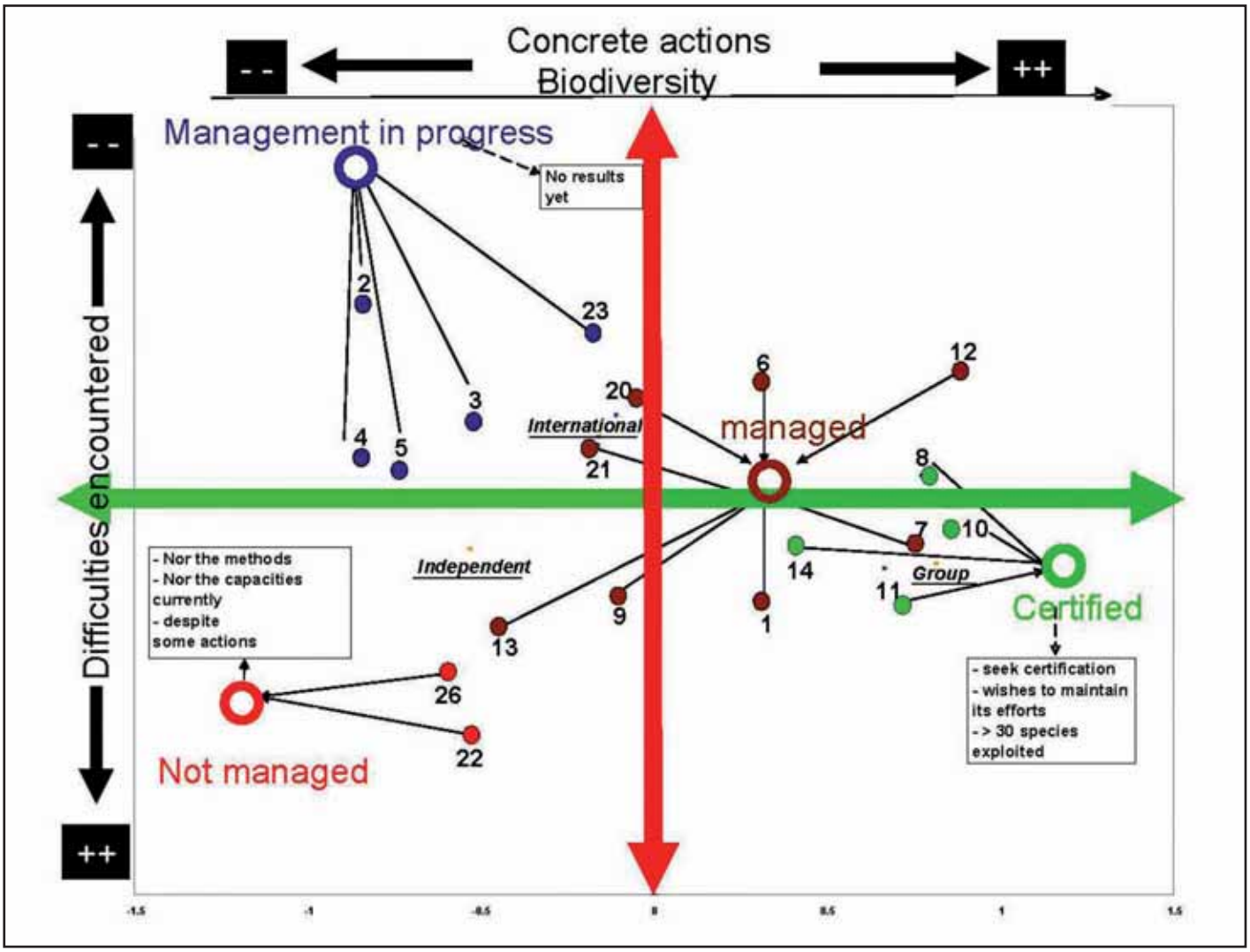


Figure 3.9: Distribution of four types of forest exploitation in accordance with action taken in favor of biodiversity and difficulties encountered
Source: Billand et al., 2010

The graphical representation of the 26 concessions studied (figure 3.9) shows a clear gradient of measures in favor of biodiversity. In addition, the certified concessions and the non-managed concessions expressed the greatest difficulty in integrating biodiversity concerns, but for different reasons: these were either due to highly demanding certification criteria or because they did not know how to obtain certification.

What are the measured impacts of the timber industry on biodiversity?

The direct and indirect impacts of forest logging on biodiversity have been widely written about (table 3.8). It is generally considered that selective logging[21] has a limited direct impact on ecosystems. The main impact that was noted was an indirect one and related to increased hunting by company personnel or non-native hunters, made possible by increased forest accessibility through the opening up of roads.

Table 3.8: Direct and indirect impacts of forest logging

Impacts	Direct	Indirect
Unavoidable	• Decreased biomass • Fragmented habitats • Loss of forest surface area; permanent (about 10 to 15 %) and temporary (about 20 %) • Noise, various disturbances • Change in the floral composition (trees and vegetation) • Local faunal disturbances • Increased heterogeneity	• Increase in human populations in the forest • Nutrient removal • Change in animal composition (e.g., in favor of herbivores) • To a certain extent, biodiversity diversification (mixed ecosystems)
Avoidable	• Damaged settlements • Soil erosion and pollution • Reduction in the number of seeds • Possible genetic erosion (has yet to be demonstrated)	• Increased access to isolated forests and means of transport • Increasing deforestation for agriculture • Increased hunting • Proliferation of exotic species • Increasing sanitary risks

Source: Billand et al., 2010

In recent years biologists have launched extensive regional surveys, based on harmonized protocols, on the status of some species of emblematic fauna (see de Wasseige *et al.*, 2009). These surveys have helped to measure the full-scale impact of logging. For example, a recent scientific publication by Clark *et al.* (2009) focused on studying four large mammals (elephants, gorillas, chimpanzees and bongos) across 3,450 km of transects in 1.2 million ha of logging concessions in northern Congo. The study showed that species abundance was often linked to how far removed they were from unexploited sectors and also that average abundance changed on the plots during the post-logging thirty-year regeneration period. Other determinant factors were the distance from roads and from natural forest clearings and villages. Finally, authors suggested that conservation policies could successfully work on concessions provided that hunting was monitored. On concessions that were sufficiently large, it would need to be organized so as to allow areas of forest to be left intact and plots to have periods of sufficiently diversified exploitation over time.

[21] A maximum disturbance of 20 % of the logged area and a rotation allowing forests to rest for 25 to 30 years.

PART 2

IMPACT OF THE INFORMAL SECTORS ON FOREST MANAGEMENT IN CENTRAL AFRICA

CHAPTER 4

An appraisal of chainsaw milling in the Congo Basin

***Guillaume Lescuyer, **Paolo Omar Cerutti, ***Edouard Essiane Mendoula, ***Richard Eba'a Atyi, ***Robert Nasi**
**CIFOR/CIRAD, **CIFOR/ANU, ***CIFOR*

Introduction

Over the last two decades, forest policies in the States of the Congo Basin have been devised and adopted with the aim to tackle and reduce poverty, notably among the rural population, as well as to contribute to the improvement of the States' economies and to foster the responsible management of biodiversity. Indeed, forest management in the region takes place in a context of widespread rural poverty, and it is estimated that over 58 % of the population lives below the poverty line – $ 2 a day – with the majority of them living in rural areas where the forest is predominant (World Bank, 2010). Over the years, the new laws brought real improvements in the way the forest was managed, with a strong increase in the number of logging concessions managed with newly approved forest management plans and, overall, larger amount of taxes entering the Treasury's coffers (Eba'a Atyi *et al.,* 2009).

The vast majority of policy reforms, however, targeted the large-scale, industrial, export-oriented forestry operations, while neglecting the smaller-scale, chainsaw timber production, largely sold on the domestic and regional timber markets. Small-scale logging titles that authorize citizens to harvest a limited number of trees, albeit for their personal and non-commercial needs, are indeed included in all the legal frameworks of the region, but such titles are generally not adapted to the current needs of chainsaw millers and, as such, they are rarely requested to, and recorded by, the administration. As a consequence, the domestic timber sector remains largely informal despite its importance. Its economic, ecological and social impacts are unbeknownst to the national ministries and unaccounted for in national and international statistics.

For instance, for the year 2007, official statistics reported timber production in Central Africa at about 8.4 million cubic meters (Eba'a Atyi *et al.,* 2009), with Gabon and Cameroon being the largest producers and the Democratic Republic of Congo (DRC) the smallest. However, all national data, as well as their international counterparts, such as the FAOSTAT, the UN COMTRADE[22] or the ITTO data, only included production from the formal, large-scale, and export-oriented industrial forestry sector.

Photo 4.1: Mill in Cameroon, transforming logs into wood planks

Photo 4.2: Informal market for Bétou on the Oubangui River in northern Republic of Congo

[22] UN COMTRADE : UN Commodity Trade Statistics Database.

What is meant in this chapter by domestic chainsaw milling sector? This sector is often considered in opposition to the industrial sector that processes the timber largely for export. Although there are instances where the dichotomy between domestic and industrial timber fades (some industrial scrap is sold on national market and some timber produced by chainsaw millers is sold on international markets) the two sectors present clear boundaries, as shown in table 4.1.

Table 4.1: Distinguishing characteristics between domestic and industrial sectors

	Domestic sector	Industrial sector
Felling permits	No (or very rarely)	Yes (concessions, community forests…)
Felling and processing techniques	Chainsaw (sometimes mobile saw) for felling and processing in the forest, small number of trees per operation	Heavy machinery, large number of trees per operation, processing plant after log skidding and transportation by trucks
Sales	Lower quality sawnwood for national market and neighboring countries	Logs, sawnwood, veneer, plywood, wooden floors, almost exclusively for export
Taxes and regulations	Largely informal	Largely formal

Source: Cerutti & Lescuyer, 2011

This chapter reports and discusses the preliminary results[23] of a systematic appraisal of the economic and social impacts of chainsaw milling in the Congo Basin, as gauged from a research conducted by the Center for International Forestry Research (CIFOR) over the period 2008-2009 in Cameroon, Gabon, DRC and Congo, and over the period 2010-2011 in the Central African Republic (CAR). In these countries, the research focussed on sawn products sold on domestic markets and sourced from all over the region using both legally produced timber, such as scraps from industrial sawmills or regularly attributed small scale logging titles, and illegally produced timber, such as the vast majority of the chainsaw production. Data have been collected on a weekly basis in select depots located in all districts of the main cities, as well as along the main transportation routes (roads, railways, and rivers). Also, interviews have been conducted in rural areas with informal chainsaw millers, and in urban centers with timber sellers, in order to analyze their activities and to quantify their costs and profit margins.

[23]The estimates presented below for Cameroon, Gabon, CAR and DRC are based on 12 months data collection, while estimates for Congo are based on 10 months data collection and extrapolated to the year.

[24]The assessment in Kinshasa regards the points of sales instead of the outlets. Most points of sales include only a few outlets, but there are also large points of sales with dozens of outlets.

Table 4.2: Sampled cities and depots

	Cameroon	Congo	Gabon	DRC	CAR
	Bertoua, Douala, Yaoundé, Limbe, Kumba	Brazzaville, Pointe-Noire	Libreville	Kinshasa, Eastern Province	Bangui
Total number of outlets	882	127	210	170[24]	140
Number of depots monitored	177	77	30	-	45
Number of supply routes monitored	-	4	6	3	5
Number of surveys in rural areas	340	60	212	35	151
Period of survey	July 2008 - June 2009	February - November 2009	September 2008 - August 2009	October 2008 - September 2009	July 2010 - June 2011

Source: CIFOR

Small scale logging in Central Africa: prior appraisals

In **Cameroon**, the amount of wood illegally harvested by individuals or small enterprises and mostly sold on the informal domestic market was roughly estimated at about 250,000 m^3 RWE[25] in 1996 (Enviro-Protect, 1997). A couple of years later, Plouvier *et al*. (2002) analyzed several timber markets in Yaoundé and Douala and estimated the national production of chainsaw millers at about 1 million m^3 RWE. Such estimates of the informal timber sector are not readily available in other countries of the region, but several documents show that it is at least not negligible.

In **Gabon**, for instance, rural citizens have been until recently using "family logging authorizations", albeit abolished by the 2001 Forest Code, to harvest and trade timber around their villages (Boevinger, 2008). Taking into account that many people have been employed and later dismissed by the industrial forestry sector as sawyers, fellers, prospectors, and have thus acquired the necessary skills, rural Gabon offers a large operational capacity and availability of resources for the production of informal timber (Mabiala, 2004). The law allows small scale operators to apply for legal logging authorizations, but the Forestry Administration has been very slow in implementing the granting of such titles; only in mid-2009 the first requests were reviewed by the administration.

In the **DRC**, the management of forest resources is strongly hampered by a difficult socio-economic environment, in a context of political and armed post-conflict. The last decade, characterized by widespread insecurity, has prompted a great number of people to turn to subsistence and informal activities. The forest sector is no exception. The logging volume produced by the informal sector is inherently difficult to quantify, but the number of rafts that can be seen on the rivers, the important volumes of sawnwood planks that can be found in many markets, or logs cut by axe visible for instance in Kinshasa clearly indicate that it covers an important role in the informal economy of the DRC. Djiré (2003) estimated that artisanal loggers produce between 1.5 and 2.4 million m^3 per year, i.e. between 3 and 6 times the official industrial timber production.

Photo 4.3: Barges on the Congo River transport logs from both the formal and informal sector across long distances

In the **Republic of Congo**, the law allows for "special permits" to be granted to small scale loggers to exploit timber and non-timber forest products. Regarding timber for commercial purposes, special permits allow the harvesting of three trees. It is issued only in areas where people face the difficulty in obtaining supplies of scraps from industrial sawmills. However, the administrative difficulty of acquiring this permit – mainly due to the costs and complexity of the procedure – pushes many operators to remain in the informal sector. The informal timber market in Brazzaville seems to have declined from the high levels of the early 90s thanks to the establishment of the checkpoints and to the provision of large amounts of timber scraps coming from the industrial sawmills located in the northern part of the country (Ampolo, 2005). However, for a decade, these companies have been exporting timber through the Cameroon border and this logging volume does not pass through Brazzaville anymore. The impact on the domestic market has not been documented for Brazzaville while the domestic consumption of sawnwood has never been studied for Pointe-Noire.

[25]RWE: Round Wood Equivalent.

In the **Central African Republic**, the Forest Law provides for "artisanal timber harvesting permits" issued for a period of one year renewable once, covering a maximum area of ten hectares, and only deliverable to Central African citizens. However, this legal provision has not yet been coupled by the required implementing decree, which means that formal chainsaw milling in CAR cannot take place. In addition, the total forest area is already licensed to logging companies in the form of concessions, and available forest areas to support legal artisanal logging or to create community forests are reduced. Like in Cameroon and DRC, the political and economic situation over the last decades has not allowed a real understanding and official acknowledgement of the domestic timber sector, while much effort has been put to promote sustainable forest management in industrial, export-oriented logging concessions. Two recent trends contribute to boost the domestic sector however, the political stability and the (relative) economic growth, on the one hand, and the international crisis, on the other hand, which drastically reduced timber exports and pushed some logging companies to turn to the urban demand, mainly in the capital city, Bangui. As of yet, however, this evolution has not been documented.

A recent study was carried out by the NGO ANDEGE (2010) in **Equatorial Guinea** to assess the scope of the informal chainsaw milling sector. Based on a six-month monitoring in the main cities combined with field surveys with chainsaw millers, the national production of informal timber amounts to 86,800 m^3 per year. Half of this informal production reaches Bata and Malabo while the other half fills rural demand. However, only 21,206 m^3 is recorded in the 102 sale points registered in Bata and Malabo. This means that roughly 75 % of the national production is consumed without passing by urban markets. Okoumé (*Aucoumea klaineana*) is by far the most harvested species as it covers 60 % of the total production. This activity remains largely informal; ANDEGE (2010) estimates that 250 chainsaws are today operating in the Equatorial Guinea's forest but very few are owned and used according to national regulations.

Photo 4.4: Urban market for wood products from the informal sector

Timber sales from chainsaw milling

In **Cameroon**, average annual sales, estimated over the period July 2008 – June 2009, total about 990,000 m^3 of sawn timber only for the cities of Yaoundé, Douala and Bertoua. Total consumption is estimated at about 860,000 m^3 (table 4.3), as about 130,000 m^3 are double-counted since sold from markets to other markets before reaching the final user. Timber sold is largely sourced from chainsaw milling operations in the forest. Nonetheless, about 23 % of sold products is sourced from industrial sawmills, with varying degrees among cities. Sawn timber sold on the market and sourced directly from chainsaw milling operations is thus estimated at about 662,000 m^3 for Cameroon, that is to say more than 2 million m^3 RWE. This suggests a twofold increase from 2002 values estimated by Plouvier *et al*. (2002) for the entire country. Most notably, domestic timber sales are larger than the industrial production and exports of sawn timber, which has been decreasing in recent years, from 580,000 m^3 in 2008 to 343,000 m^3 in 2009.

In **Gabon**, the amount of lumber consumed in Libreville alone is about 70,000 m^3 per year. This estimate is supported both by figures of outlets' sales and by monitoring the flow of supplies to the city by roads and waterways. Compared to the total official industrial production, at about 150,000 m^3 in 2009, the informal sector production remains more modest than in Cameroon.

Data collected in the **Republic of Congo** show sawnwood sales at about 110,000 m^3 per year on the domestic market. These figures surpassed the sawnwood exported in 2009 and represent about 25 % of the official industrial sawnwood production of 2006, irrespective of product.

Estimates for the **DRC** show that the city of Kinshasa alone consumes a volume of informal sawnwood of about 146,000 m^3 per year, most of which is processed inside the city. This assessment only considers the timber inflows in Kinshasa by day and not by night. It is therefore conservative. Official figures show that industrial sawnwood exports amounted to about 28,645 m^3 in 2008. Although official figures are notoriously incomplete in DRC, collected data in Kinshasa show that the informal timber production for domestic markets is far above the formal one.

Finally, in **CAR**, assessments of timber sales in Bangui indicate a volume of about 67,000 m^3 per year, while CAR officially exported 41,000 m^3 of sawnwood in 2009. On top of that, part of the small scale sawnwood is bought by Chad traders and is thus not sold in urban markets.

Table 4.3: Informal production and export of sawnwood (m^3)

	Cameroon (Yaoundé, Douala, Bertoua)	Gabon (Libreville)	Congo (Pointe-Noire, Brazzaville)	DRC (Kinshasa)	CAR (Bangui)
Annual consumption on domestic market:	860,000	70,000	109,500	146,000[26]	67,000
- industrial scraps or small scale permits	198,000	20,000	10,500		34,000
- informal chainsaw milling	662,000	50,000	99,000		33,000
Annual domestic consumption *per capita*	0.072	0.064	0.047	0.018	0.083
Sawnwood export - formal sector (2009)	343,000	150,000	93,000	29,000	41,000

Source: CIFOR

The ratio of timber consumption per inhabitant (table 4.3) in Gabon (about 1.1 million inhabitants in the Libreville area), Cameroon (about 12 million inhabitants in the southern part of the country), in Bangui (800,000 inhabitants) and Congo (2.3 million inhabitants in Pointe-Noire and Brazzaville) is close. It remains quite low in Kinshasa (about 8 million inhabitants), probably in connection with the average livelihoods level in this city, a yet-to-be-completed survey of all timber routes entering the city, and the absence of monitoring of the timber inflows by night.

[26] This assessment only regards artisanal timber coming into Kinshasa by day, with no consideration for the night inflows.

Photo 4.5: Lengthwise sawing of logs is a regular activity

Overall, chainsaw timber production in the Congo Basin, albeit largely informal, is much more important than suggested in the regulatory frameworks and official data. In all these countries, the reported timber volumes and the social dynamics behind the informal timber sector call for its long-awaited acknowledgement by policy makers and its better integration in current and future forest policies.

Results also show that the informal timber sector provides thousands of jobs in the different countries considered. In Pointe-Noire, Brazzaville and Libreville, approximately 1,000 people derive their income directly from timber sales, while in the cities sampled in Cameroon, about 4,000 people sell timber. These estimates only consider the last, and easiest to quantify, part of the value chain[27]: the selling. But they do not include the thousands of jobs provided in rural areas as harvesters, carriers, and many other. In Cameroon alone, the total number of people employed by chainsaw milling is estimated at about 45,000, about 3 times the number of direct jobs provided by the industrial timber sector. This sector constitutes an important source of revenue for rural people and provides urban consumers with cheap timber commodities. However, its influence on the national economies depends on the long-term availability of the resource: a rough analysis of the ecological impacts of chainsaw milling in Cameroon indicates that this activity must be better regulated to become a persistent source of development at the country level (Lescuyer *et al.,* 2009a).

Socio-economic impacts at the local scale

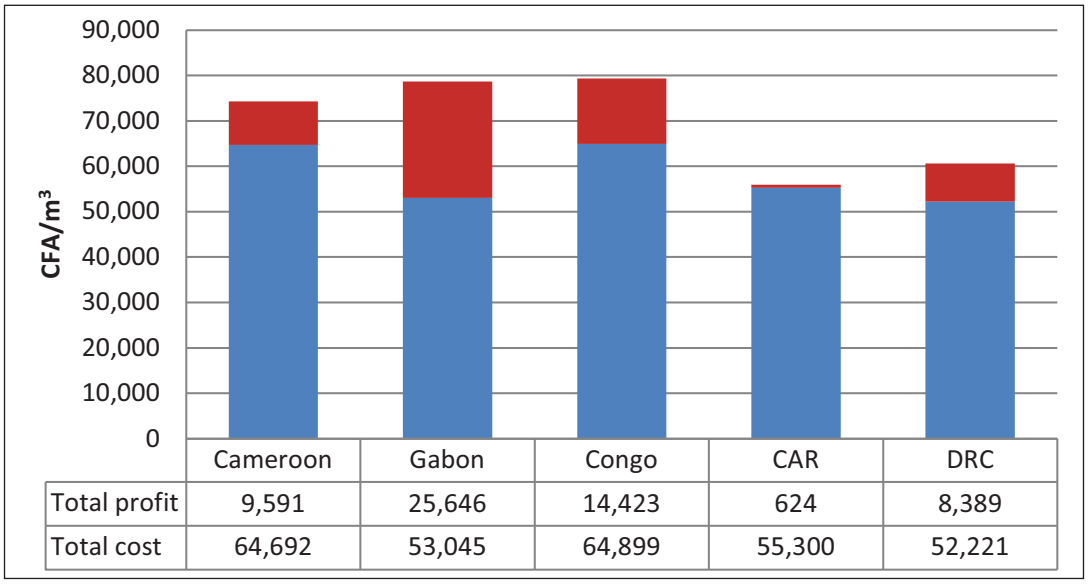
About 800 surveys were conducted in rural Cameroon (Cerutti & Lescuyer, 2011), CAR (Lescuyer *et al.,* 2010), Gabon (Lescuyer *et al.,* 2011a), the Eastern Province of DRC (Lescuyer, 2010a) and Congo (Lescuyer *et al.*, 2011b) to appreciate the dynamics of upstream operations, i.e. regarding all that happens before timber is sold to an urban trader or consumer. Data collected and information from interviews indicate informal logging and wood processing activities to be usually profitable (figure 4.1).

[27]Value chain that goes from harvesting to transport to selling.

Box 4.1: Small scale logging for export

Apart from feeding national consumptions, many small scale loggers are export-oriented. This informal activity is pushed by substantial demands for timber in the neighboring countries or beyond. Most of this timber is not recorded in the national export statistics while it may provide significant revenues to concerned stakeholders. Four main exit points of informal timber have been documented in the Congo Basin countries:

- **From Cameroon to Chad**: 80,000 m^3 of timber reach the northern regions of Cameroon every year, most of it being in transit to the Chad border (Cerutti & Lescuyer, 2011). Around 60 % of the volume comes from informal chainsaw operations. This timber from Cameroon may reach North Africa urban markets;
- **From Cameroon to Nigeria**: the south-west region of Cameroon provides around 12,000 m^3 of sawnwood to Nigeria every year (Cerutti & Lescuyer, 2011). This trade is entirely informal;
- **From CAR to Chad**: At least 6,000 m^3 are exported every year from Bangui to Chad. Most of this sawnwood originates from informal activities;
- **From DRC to Uganda**: while the official export of timber to Uganda amounts to an average of 5,000 m^3 over the recent years (Umunay & Makana, 2009), the actual flows seem to reach between 30,000 and 50,000 m^3 every year (Adebu & Kay, 2010). Part of this DRC timber goes to Kenya and other East African markets.



	Cameroon	Gabon	Congo	CAR	DRC
Total profit	9,591	25,646	14,423	624	8,389
Total cost	64,692	53,045	64,899	55,300	52,221

Figure 4.1: Upstream costs and benefits of chainsaw milling
Sources: Cerutti & Lescuyer, 2011; Lescuyer et al., 2010; Lescuyer et al., 2011a; Lescuyer, 2010a and Lescuyer et al., 2011b

On average in Cameroon, profits for chainsaw loggers are about CFA 10,000 per cubic meter of sawn timber, while operating costs are at about CFA 65,000 per cubic meter. The profit margin is about 13 % in Cameroon and DRC, but rises to 18 % in Congo and even 32 % in Gabon. Surprisingly, the profit is very low in CAR, mainly in reason of the low price of timber on the domestic market and of the high number of administrative seizures (Lescuyer *et al.*, 2010). However, this low profit is partly compensated by the wage of the sawyer who, most of the time, is also the trader of the sawnwood. But, all in all, most sawyers are largely indebted in CAR, which tends to push them to harvest new trees to extinguish their debts.

Photo 4.6: Portable circular saws are increasingly used by local operators

It is useful to distinguish different modes of operation and/or marketing of sawnwood in rural areas. There exists, in fact, a significant difference between on the one hand, semi-professional sawyers producing timber products on the basis of specific market prior requests and, on the other hand, rural loggers in need of cash who cut and then find a customer. Although the difference between these two business models is negligible in Gabon, it is important in Cameroon. Semi-professional millers, with better equipment, financial means and political sponsors, produce a profit of about CFA 15,000 per cubic meter, while the profit of freelance rural sawyers tends to zero. The latter are frequently subjected to external pressures, including the seizure of all their wood, which reduces their average profit margins.

All in all, chainsaw milling provides financial contributions to rural economies which are largely ignored in official statistics and policies. In fact, most expenses paid by sawyers are revenues for the rural people living close to harvesting sites (figure 4.2). In Cameroon for example, almost 50 % of the operating costs are made up of payments to the local workforce while 7 % of the total cost is the remuneration of the customary owner of the felled tree. In Gabon, wages make up 55 % of the total cost, while compensation to the customary owner is lower than in Cameroon. In CAR, the significant cost related to spare parts and oil is due to the poor equipment of the sawyers based around Bangui. In the Eastern Province of DRC, transportation costs are the major expenses due to the focus by the distant urban markets – mainly from Kivu and Uganda – on timber red species. In Congo, mainly around Pointe-Noire, the level of the informal taxes and transportation costs is impressive at about CFA 12,000 per cubic meter produced: it is due to the location of the chainsaw milling that operates near or even within a national park.

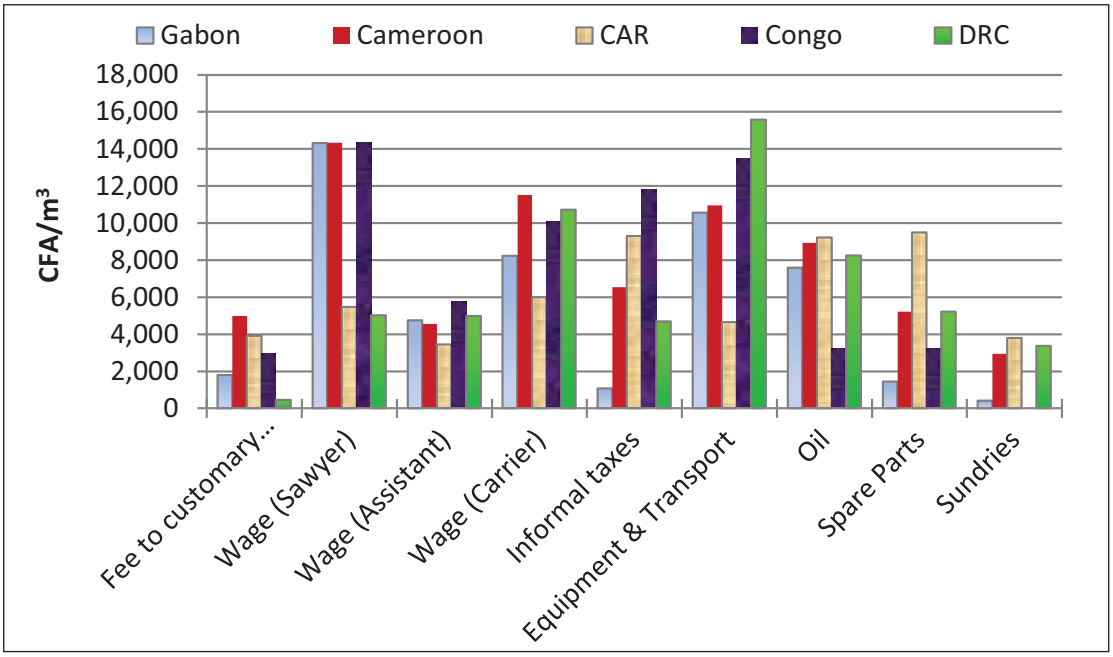


Figure 4.2: Distribution of chainsaw milling costs by production factors
Sources: Cerutti & Lescuyer, 2011; Lescuyer et al., 2010; Lescuyer et al., 2011a; Lescuyer, 2010a and Lescuyer et al., 2011b

Given the total volume of sawnwood sold on the domestic market (see the Timber sales section), the financial gain (aggregating local wages, fees and profits) generated by the informal sector is estimated around CFA 30 billion per year for Cameroon, 6.4 billion for Congo, 2.7 billion for Gabon (around Libreville only) and almost 640 million in CAR (around Bangui only). In all countries, this activity has become a significant source of revenues for the rural economies.

The informal use of timber is a source of income also for actors outside the village economy, such as government officials and local elites, as they require payments for allowing smooth execution of activities by chainsaw millers and timber sellers. These payments are on average about 2-3 % of total operating cost in Gabon, up to 9 % in Cameroon and DRC, and 17-18 % in CAR and Congo (figure 4.2). This may represent a small transaction cost for chainsaw millers, given the overall positive impact of harvesting activities on the village economies. However, informal payments – indicating how much the millers are willing to pay – may also be considered as revenue losses by the State, and if they are extrapolated to the overall volume of informal production, those losses result in about CFA 4.3 billion in Cameroon, 1.1 billion in Congo, 307 million in CAR, and 53 million in Gabon.

Indeed, when asked about the most important problems encountered in carrying out their activities, chainsaw millers and timber sellers list administrative harassment and abuses of power by various authorities on top of their lists (table 4.4).

Photo 4.7: Log sawn into lengthwise planks

Table 4.4: List of problems reported by chainsaw millers and timber sellers (in % of the answers)

	Gabon	Cameroon	Congo	CAR
Administrative hassles	41	71	90	93
Abuse of power (businessmen, clients, workers)	10	41	5	25
Technical (mechanical) problems	17	13	55	68
Difficulty in accessing a legal title	13	10	11	4
Lack of infrastructures	8	11	20	7
Relations with customary owners	5	22	-	14
Lack of capital	3	7	-	7
Rarity of the resource	2	11	3	4

Sources: Cerutti & Lescuyer, 2011; Lescuyer et al., 2010; Lescuyer et al., 2011a; Lescuyer et al., 2011b

Similar concerns have been identified in Cameroon, Gabon, CAR and in Congo, ranging from technical issues to problems related to establishing effective trade networks. Importantly, table 4.4 also shows that only a small fraction of interviewees list the difficulty in accessing a legal title as a problem. Thus, not only the vast majority of chainsaw millers harvest without a legal title, but the lack of the latter is clearly not even a major concern for operators in these four countries. This may indicate that, if one agrees to play by the rules of well established informal networks, illegal timber harvesting is not a very difficult task to be carried out, as can also be gauged from the number of people engaging in this activity over the last decade.

Although concerns are often raised on the ecological sustainability of chainsaw milling, small scale loggers do not perceive their activities as having negative ecological impacts. In fact, according to interviews conducted with operators, the timber resource is not getting scarcer. Nonetheless, such perception needs be mitigated on a per country basis. In Cameroon and Gabon, for instance, the distance between the logs and the road/river is almost always below 2 km, meaning that most of chainsaw milling activities occur in crop areas, fallows or secondary forests. By contrast, in Congo and DRC, this distance is usually above 3 km for two reasons: (i) the exhaustion of various timber species, like okoumé in the southern part of Congo; and (ii) the search for big trees likely to produce large pieces of sawnwood to answer urban demands, like in the Eastern Province of DRC.

At the Congo Basin scale, the informal nature of chainsaw milling does not necessary go with a quick degradation of the forest resources: policies to reduce the environmental impacts of chainsaw milling must be conceived on the basis of the specific socio-economic contexts and dynamics.

Products and prices from chainsaw milling

Selling prices of sawn timber vary by quality, type, origin of product and timber species. In Cameroon, average prices for planks and formworks of ayous (21 % of total sales) can reach respectively up to € 26 and € 24 per cubic meter RWE (table 4.5).

Table 4.5: Selling prices of the most used products of ayous in Cameroon

A. Product	B. Sales on the domestic market (%)	C. Selling price Chainsaw milling (€/m³ RWE)	D. FOB price Formal sector in 2009 (€/m³ RWE)	E. Price on the domestic market compared with the export price (C/D) (%)
Plank	4.7	26	140	18.6
Formwork	16.3	24	140	17.1

Source: Cerutti & Lescuyer, 2011

In Cameroon, the prices of products sold on the domestic market (column C, table 4.5) are on average about 80 % lower for timber sourced from chainsaw milling than the FOB prices – linked to the international market – applied for the industry (columns D and E, table 4.5). Several reasons may justify such differences. First and foremost, the quality of the final product required by the international market is higher, and specifications stricter. Also, domestic timber is not charged with formal taxes - stumpage, sawmill entry, export - and production costs are thus lower than industrial ones. Prices may also be lower because there is much more competition on the domestic market, with thousands of chainsaw millers able to source the market, than on the industrial one, where only a handful of logging companies specialise on few products and species. Also, access to timber is much cheaper for chainsaw millers, as the commercial value of trees is under-estimated by customary owners, makes it possible for chainsaw millers to pay very low prices for valuable tree species.

Conclusion and future prospects

The role of chainsaw lumber production in the forestry sectors of the countries of the Congo Basin has generally been neglected by official policies and is under-researched. Overall, there has been a trend for chainsaw and informal lumbering to develop in parallel with the industrial timber sector, which has been facilitated by the lack of adapted legal frameworks and the widespread vested interests (decentralised civil servants, urban businessmen, military forces ...), among other factors. As a consequence, data about the sector, as well about its impacts on rural and national economies, are often excluded from official statistics. On the other hand, all Congo Basin countries (except the CAR) are today involved in the FLEGT/VPA (see chapter 2) process that requires that all wood commodities – be it for export or for domestic consumption – are legally produced and tracked. This puts a massive pressure on States to recognize, legalize and organize the informal sawnwood sectors.

Results of this chapter show that the domestic timber market has been booming in recent years, with an overall annual production – about 1.25 million m³ of processed products – greater than the industrial one, and with important impacts on local economies, rural livelihoods, and governance.

The challenges ahead, however, in order to professionalize, formalize and improve the sector's contribution to the formal national economies, are many. Results show that public policies and national strategies have not yet been developed to drive the sector through a formal, transparent, and equitable growth. This forces thousands of people to produce and sell illegal timber, because of the lack of a legal framework where to develop their activities, and also because many vested interests challenge the development of a national formal timber market.

Although illegality is not considered as a problem by most chainsaw millers and even constitutes a profitable source of money for corrupt civil servants, the States of Central Africa will find a great economic and financial interest to formalize this activity. Both coercive and incentives measures are to be considered. First and foremost, they should aim at facilitating access to legal authorisations for chainsaw millers, with the development of *ad hoc* legal frameworks more adapted to the needs of local actors than those of the central administrations. In that sense, the adoption and decentralised granting of logging authorisations is a necessary first step. Second, reform should aim at professionalizing chainsaw millers, while concurrently providing workable incentive schemes for civil servants, in order to decrease current corrupt practices. Coupled with incentive schemes, though, an effort is also urgently required by the concerned governments to issue and implement effective sanctions for civil servants that participate in corrupt practices, in order for the overall governance of the sector to be improved.

Photo 4.8: Logs serve as the primary building material for pirogues and locally constructed fishing boats

CHAPTER 5

Contribution of woodfuel to meet the energy needs of the population of Central Africa: prospects for sustainable management of available resources

*Jolien Schure, **Jean-Noël Marien, ***Carlos de Wasseige, ‡Rudi Drigo, ‡‡Fabio Salbitano, ‡‡‡Sophie Dirou, ·Méthode Nkoua

*CIFOR, **CIRAD, ***OFAC, ‡FAO, ‡‡University of Florence, ‡‡‡TEREA, ·CRDPI

Introduction

Fuelwood and charcoal represent 90 % of all wood removal from forests in Africa and a third of the global woodfuel production (FAO, 2011a). Woodfuel serves foremost as cooking energy for households in the absence of accessible and affordable alternative energies. While in the past, issues related to overharvesting of woodfuel have mostly been a concern to Saharan savanna forests, they now need to be assessed for humid areas, such as the Congo Basin forests, especially around urban areas with increasing demand (Marien, 2009).

Woodfuel and the associated sustainability issues have the potential to be perceived from two opposing viewpoints: woodfuel is a cause for deforestation and degradation, or it is a promising renewable energy source. The extent to which production causes negative impacts on the natural resource base depends on the quantities and types of wood that are being harvested, the type of ecosystem, production characteristics and the accessibility of the area (Sizer *et al.*, 2005; Arnold *et al.*, 2006). In Central Africa, the supply of fuelwood and charcoal is often linked to shifting agriculture by a producer or landowner to the point where high demand is attracting producers to cut fresh wood for the sole purpose of woodfuel production. In abundant forest areas, producers seek and select specific species that produce high quality charcoal. Other sources for woodfuel include tree-plantations and wastewood from timber processing companies, which is transformed into charcoal or wood chips. The woodfuel sector is associated with forest resource decrease and increasing prices in areas of high demand. Also, health problems, mainly respiratory diseases, frequently occur with women and children (Smith, 2006; Marien, 2009). On the positive side, the sector provides energy and income generating activities for a large number of people; an estimated 83 % of the population in Sub-Sahara Africa uses woodfuel for cooking (Daurella & Foster, 2009). The access to alternative fuels, the prices of these fuels and household income can be determinant factors affecting the quantities of woodfuel consumed (Chambwera & Folmer, 2007; Ouédraogo, 2007). It is thus imperative to look at the driving forces of woodfuel exploitation and its impacts for households at both producer and consumer sites in order to take appropriate actions that can reconcile environmental and livelihood needs (Schure *et al.*, 2009).

Photo 5.1: Charcoal being transported to market in Kinshasa

This chapter provides an overview of the woodfuel sector in the Congo Basin countries, with a special emphasis on those areas where the exploitation of woodfuel poses threats to the sustainability of the resource base and to the livelihoods of those depending on it. With regard to the fact that little data exist, this chapter draws upon information from recent studies to present an overview of the knowledge base in 2010[28]. It also provides a review of possible or already implemented management options and how these can help to resolve some of the problems associated with woodfuel production and consumption in the Congo Basin.

[28] FAO estimates about national woodfuel production were referred to for those countries with no other available data.
Wood density: 1 m^3 = 0.725 tons (FAO, 2011b).

Status of wood energy in Congo Basin countries

There are large differences between the various Congo Basin countries when it comes to total woodfuel consumption (figure 5.1), from 138,000 tons in Equatorial Guinea to 54.7 million tons in the Democratic Republic of Congo (DRC). In Gabon, woodfuel only represents 24 % of all wood removal, whereas in DRC it accounts for 94 % of total round wood production (figure 5.2). Variations between countries can in part be explained by the number of inhabitants and by the availability of alternative types of energy as shown in figure 5.3 for Cameroon, the Republic of Congo and Gabon.

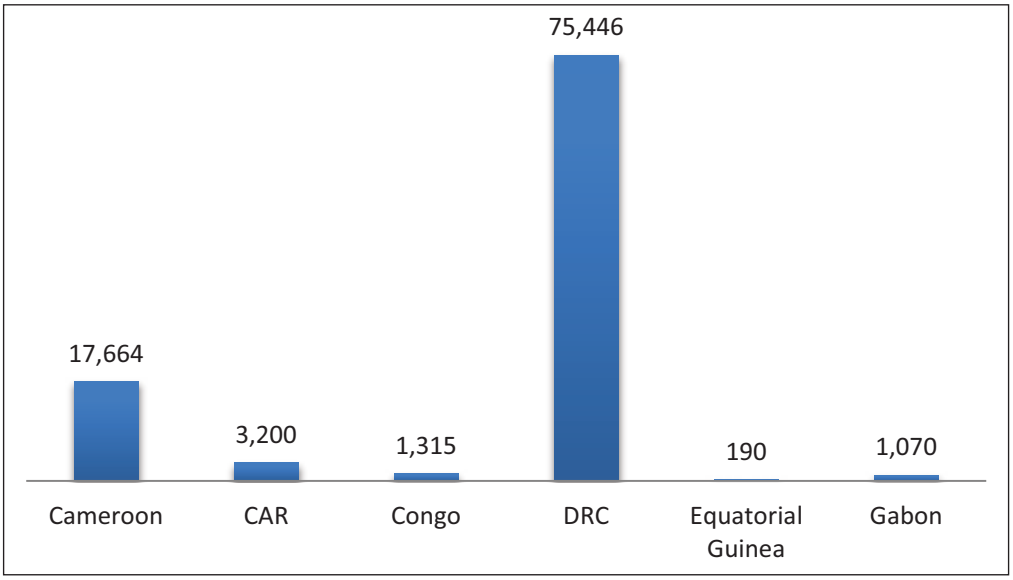


Figure 5.1: Woodfuel production in the Congo Basin countries in 2009 (thousands m^3)
Sources: FAO, 2011b; Yuntenwi, 2008; Drigo, 2009; Ministère de l'Énergie et de l'Eau, 2009-2010

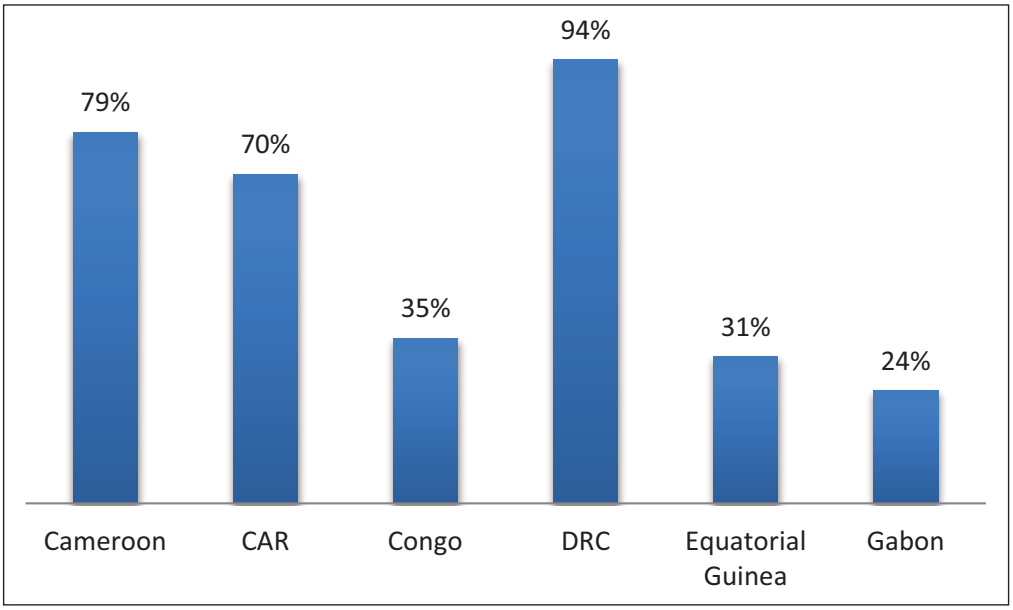


Figure 5.2: Woodfuel production out of total national round wood production in 2009 (%)
Source: FAO, 2011b

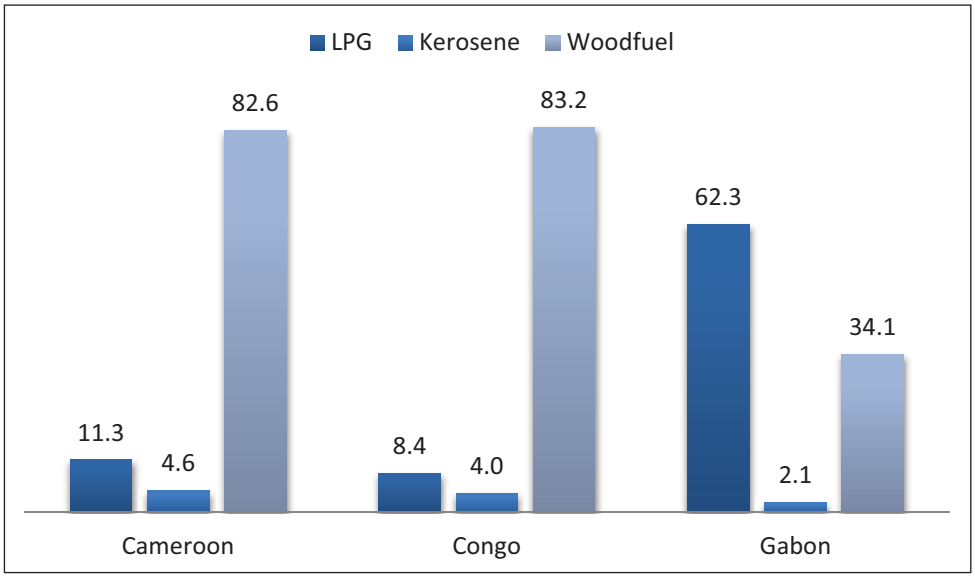


Figure 5.3: Part of the population using LPG, kerosene and woodfuel as their main cooking fuel in Cameroon, Congo and Gabon (%)

Source: Daurella & Foster, 2009

Photo 5.2: Fuelwood collection is often the responsibility of women and children

The following case studies provide further insights on the woodfuel sector, its production and consumption patterns as well as opportunities for management of the sector, in five Congo Basin countries: Central African Republic (CAR), Cameroon, DRC, Gabon and Republic of Congo[29].

Central African Republic

In 2009, national consumption of woodfuel in the CAR totalled about 2.3 million tons of wood (3.2 million m^3)[30]. In Bangui, the capital city where 25 % of the total population of the country lives (i.e., roughly the 50 % of urban population), and its immediate surroundings, the estimated consumption in 2002 was above 430,000 tons per year (Drigo, 2009). It is estimated to have grown to over 520,000 tons (717,000 m^3) by 2010.

The most common supply system in rural CAR is the direct daily or periodic collection of fuelwood by women and children in areas surrounding households, while the commercial fuelwood and charcoal production is limited to Bangui and a few other urban areas and goes largely unrecorded. The Ministry of Waters, Forests, Hunting and Fishing of CAR estimates that in the supply zone of Bangui the wood energy sector employs some 22,650 people (15,000 producers, 3,400 transporters and 4,250 retailers). Fuelwood is by far the most common woodfuel consumed in CAR: 97.2 % of people use woodfuel for cooking, 97 % as fuelwood and 3 % as charcoal. The use of charcoal is slowly increasing in cities, but it is still marginal. In Bangui, for instance, fuelwood represents 91.7 % of the energy used for cooking while charcoal represents 5.5 % (Salbitano, 2009).

There is no evidence of the use of woodfuel in the industrial sector while it is a common source of energy for the commercial sector (food stalls, bakeries and restaurants). The "three stones" system (the traditional stove that consists of three stones or bricks holding a cooking pot) is still highly prevailing in rural areas. In urban areas, charcoal-specific and wood-specific improved stoves are becoming more popular and constitute a commercial niche for the craft sector. The Ministry of Waters, Forests, Hunting and Fishing has started some campaigns to introduce kerosene as alternative energy, but there is not a clear program of subsidies.

Largely informal and uncontrolled, woodfuel harvesting is often associated with land conversion of forest areas to farmland. In the landscape surrounding Bangui, the forest line recedes 0.3 km per year. This is primarily due to the rapid expansion of farmlands, while woodfuel production remains more a by-product of this process as

[29] Equatorial Guinea could not be included as a case study due to a lack of available information about the woodfuel sector in this country. However, in general it was found that although woodfuel is the main source of energy for households, the total amount remains relatively small and woodfuel production is not a driver of deforestation or degradation. The main sources of deforestation are shifting cultivation and logging. No movements of charcoal between Equatorial Guinea and neighboring countries have been recorded.

[30] Estimation for year 2009 based on a consumption rate of 0.54 air-dry tons per person per year (including fuelwood and charcoal). Derived from ESMAP 1992 and several national references (Yandji, 2007).

opposed to a direct cause (Drigo, 2009). According to the Woodfuel Integrated Supply/Demand Overview Mapping (WISDOM) method of analysis (Drigo *et al.*, 2002), CAR has abundant wood resources relative to its internal demand, but the lack of planning combined with farmland expansion creates fronts of unsustainable harvesting, especially around Bangui (Drigo, 2009).

Woodfuel has recently received a more prominent place in CAR's national policy. Where in the past only the industrial and formal timber production was given priority, the new forest law prepared in 2008 gives to woodfuel an important sectoral focus. Moreover, the Strategy on Urban and Peri-urban Forestry, a decision-making participatory document, which was published and accepted by the ministerial board in 2008, includes the woodfuel sector as a key policy objective. A legislative platform was also introduced to enforce policies oriented to optimize the wood energy sector (Salbitano, 2009). Until 2008, there were no dedicated plantations for woodfuel, but the Strategy on Urban and Peri-urban Forestry introduced woodfuel-oriented forestry and agro-forestry practices, and resulted in plantations and agro-forestry initiatives.

A result of the recent analysis of Bangui's wood basin supply (i.e. the necessary sustainable supply zone), found that timber concessions within the wood basin supply now consider woodfuel production for Bangui market a specific management objective (also as a way to prevent uncontrolled harvesting).

NGOs play an active role in promoting best practices in the wood energy chain, including introducing improved stoves as a tool to reduce wood consumption and to lower costs and pollution. In order to ameliorate the commercial sector, formal and informal groups of associated producers, transporters and retailers are incentivized.

Cameroon

Cameroon produced an estimated 11.4 million tons of fuelwood, 214 thousand tons of charcoal and 301 thousand tons of sawdust and wood chips in 2009, representing a market value of over $ 380 million (*Ministère de l'Énergie et de l'Eau*, 2009-2010).

The main consumers of woodfuel are households, of which 82.6 % use wood in the form of fuelwood, charcoal, sawdust or chips, as their primary cooking energy. Other forms of energy for cooking in Cameroon are Liquefied Petroleum Gas (LPG) (11.3 %) and kerosene (4.6 %) (Daurella & Foster, 2009). Various businesses also depend on woodfuel, such as for: grilling and smoking of meat or fish, cooking "*beignets*", ironing cloths, metal and aluminium forgers, and drying of cocoa (Pouna, 1999; Laird *et al.*, 2009).

Case studies from Garoua and Bamenda reveal that in these urban areas, most consumers use traditional stoves and more energy efficient improved stoves remain rare, contributing to overexploitation of the resource in these regions (Yuntenwi, 2008; Ntsama Atangana, 2009). Low energy efficiency is common for charcoal producers who typically use traditional ovens covered with earth for carbonization of the wood (with an efficiency of 10 - 15 %). Some improved charcoal ovens made out of metal or bricks exist at wood processing companies that provide their waste wood for charcoal production.

Photo 5.3: Charcoal production oven, Cameroon

Issues around sustainability have mainly been studied for the northern part of the country with a Sahelian climate, where population growth, woodfuel harvesting and bush fires put pressure on the remaining woodlands. Overexploitation of woodfuel has led to an expanding circle of deforestation around the cities of Maroua and Garoua leading to erosion and decrease of agriculture productivity (Madi *et al.*, 2003; Folefack & Abou, 2009). For the humid forest zone, around places of high demand such as Douala and Yaoundé, woodfuel harvesting leads to forest degradation. Of special concern is the wood collection from valuable mangrove forests for charcoal supply of Douala and export to Chad and Nigeria (Ndenecho, 2007; Feka & Manzano, 2008).

Management of the woodfuel sector is prescribed in the 1994 Cameroonian Forest Law. Non-commercial use of woodfuel falls under users' rights. Commercial production of woodfuel is regulated by the 1995 Decree on forest regime implementation modalities under two types of permits that define the place and quantities authorized: (i) the Permit for exploitation of special products (including charcoal); and (ii) the Permit for exploitation of fuelwood (Cerutti *et al.*, 2009). However, figures over the past years show that less than 1 % of the estimated charcoal production has been allocated under "special forestry product permits": 6 permits representing 1,140 tons of charcoal for 2009 (MINFOF, 2009a and 2009b)

and 6 permits representing 1,800 tons for 2010. There are some examples of woodfuel production output under community forestry arrangements (Minang *et al.*, 2007). Regarding the energy sector, the national Energy Policy recognizes the role of biomass and renewable energy but leaves woodfuel largely out of its national strategy (*Ministère de l'Énergie et de l'Eau*, 2008). Further integration of Cameroon's number one household energy in the country's energy strategy would be a necessary step towards modernizing the woodfuel sector.

Democratic Republic of Congo[31]

DRC produced an estimated 54.7 million tons (75.4 million m^3) of woodfuel in 2009, representing 94 % of its total round wood production (FAO, 2011b).

Use of woodfuel is growing in cities due to population growth, the lack of alternative energy sources, high unemployment, and the weak implementation of forest legislation, and becomes increasingly associated with forest degradation and deforestation. In Kinshasa, the country's capital city with around 8 million inhabitants, it is estimated that the total charcoal consumption in 2010 was around 500 thousand tons of charcoal with a market value of $ 132 million. Woodfuel represents 87 % of households' cooking energy in the capital city. Various businesses, like bakeries, aluminium forgers, breweries, restaurants and brick makers also depend on woodfuel. Urban consumers prefer the use of charcoal over fuelwood (charcoal represents 75 % of cooking energy in Kinshasa and fuelwood 12 %) because charcoal does not produce as much smoke, does not affect the taste of food, and the cooking pot remains cleaner, compared to cooking on fuelwood. Only a small group of urban households (3.2 %) uses energy efficient stoves.

For DRC, unsustainable practices and deforestation are mainly observed in the peri-urban areas where an increasing demand and a lack of management of the woodfuel sector pose threats to the sustainability of the resource base. For the supply of Kinshasa most charcoal comes from within a distance of 200 km from the city, with an average distance of 135 km (figure 5.4). An estimated 42 % comes from the eastern located Batéké Plateau, 34 % from the southern located Bas-Congo province and 24 % enters the province via the Congo River, which includes woodfuel supply from more distant provinces (Bandundu, Equateur and Orientale) up to 1,000 km away. Like in Cameroon, production of woodfuel is artisanal and charcoal producers use traditional ovens, covered with earth (with a low energy efficiency of 10 to 15 %), to carbonize the wood. Over half (52 %) of the woodfuel harvested for the market of Kinshasa comes from agricultural land, 29 % from uncultivated forests and 16 % from other sources such as (village) plantations. Kinshasa's peri-urban forests are rapidly depleting; it is estimated that in the production zones around Kinshasa, 60,000 ha are harvested each year for combined slash and burn agriculture and woodfuel production (Marien, 2009). On the Batéké Plateau (150 km from Kinshasa) a study of satellite images showed that between 1984 and 2010 only 14 % of the dense forest remained intact (Pennec *et al.*, 2010).

Besides the peri-urban zones (such as around Kinshasa, Mbuji Mai and Lubumbashi), the eastern part of DRC, where many refugees aggregate, is sensitive to overexploitation of woodfuel. Biodiversity-rich landscapes, such as Virunga National Park, suffer greatly from illegal charcoal exploitation. WWF has initiated the EcoMakala project (box 5.1) in this area that aims to simultaneously offer alternative sources of woodfuel and increase the use of energy efficient stoves (Bodson *et al.*, 2009).

Photo 5.4: Frontier forest lands near villages and roads are the primary sources for household energy

[31] Most data presented in this case study was provided by the Makala Project, to be published in more detail in a publication about the woodfuel sector of Kinshasa and Kisangani, DRC (Schure et al., 2011). The Makala Project-Sustainable management of woodfuel in DRC - (2009-2013), is coordinated by CIRAD and realized with financial support of the European Union (http://projets.cirad.fr/makala).

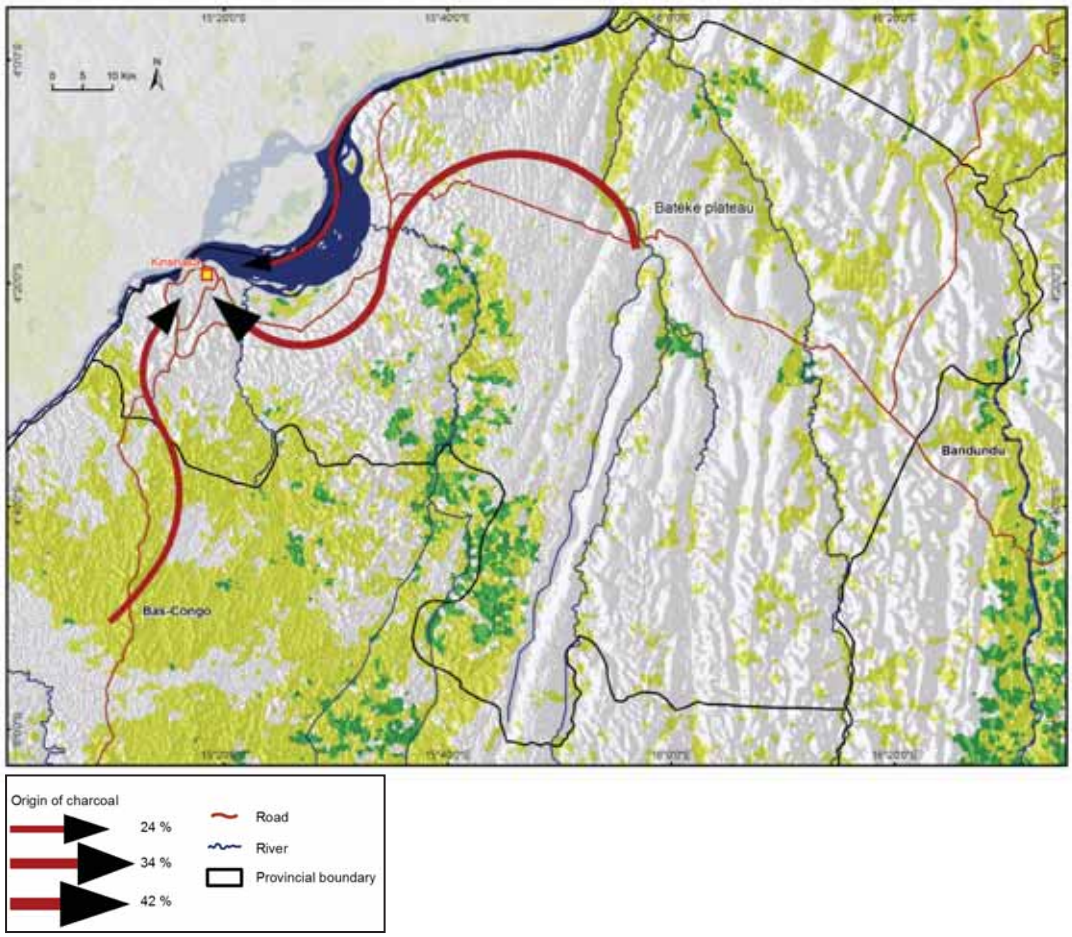


Figure 5.4: Charcoal supply zones of Kinshasa, DRC
Sources: Makala Project; OFAC

Photo 5.5: Fuelwood being readied for transport on the Congo River near Kisangani, DRC

Box 5.1: EcoMakala: Sustainable and alternative rural development to respond to deforestation

Thierry Lusenge and Bruno Hugel
WWF-PEVi

Goma, in the east of the Democratic Republic of Congo (DRC), is the provincial capital of North Kivu. Bordering on Rwanda and close to Virunga National Park (PNVi), it is a town of 800,000 inhabitants. For a long time, this region has had the highest population density in the DRC and timber resources outside PNVi no longer meet the needs of local communities. In 2007, Goma's annual timber consumption was 59,434 tons. 80 % of this came from the illegal and unsustainable logging of the PNVi's natural forests (Balolebwami *et al.*, 2008). The increase in the prices of charcoal in recent years ($ 10-12 in 2006 to $ 15-25 in 2010 depending on the quality) is also a heavy burden for households to bear.

In order to provide Goma with long-term supplies of charcoal, it is estimated that plantations of fast-growing species covering an area of 19,000 to 24,000 ha will be required. Financed mainly by the European Union, the EcoMakala project aims at developing plantations covering 5,500 ha that will primarily be undertaken by small land holders. The project is not seeking to meet the needs of Goma single-handedly but is instead trying to find solutions for the current obstacles to spontaneous reforestation by: (i) developing private forestry, (ii) involving, structuring and building capacity for local communities and associations for reforestation; (iii) developing a stable marketing framework with the help of planter networks; and (iv) carrying out on-site testing of the Kyoto Protocol Clean Development Mechanism as well as the future mechanism on Reducing Emissions from Deforestation and Forest Degradation (REDD+). This project is also linked to a project to provide improved stoves.

The EcoMakala project further seeks to develop an innovative model for long-term community reforestation which would bring rapid reforestation to an area that is facing a significant energy crisis, provide quality control of outcomes, more intensive technical support and the establishment of a capital rotation system that will allow activities to continue when the project finishes.

To achieve this, WWF and local associations responsible for reforestation sign contracts for each planting season (i.e. twice a year). Each association then identifies the potential participants in order to estimate the total area required for the number of plantations. Following validation by WWF, the associations and planters sign contracts. The associations and planters must respect a number of quality standards set out by the project (e.g., alignment, spacing, upkeep) in order to improve reforestation where land is under severe pressure, and ensure maximum profit for planters. Further contracts with associations and planters will depend on the results obtained.

Regulatory frameworks for the woodfuel sector exist in the forestry code and land tenure law. Possible legal options for managing woodfuel production are: (i) public plantations; (ii) private plantations; (iii) reforestation of agricultural parcels; (iv) woodfuel exploitation with a permit for woodfuel cutting and carbonization; and (v) community forestry (Assembe-Mvondo & Lescuyer, 2010).

In practice however, there are not many woodfuel plantations and most wood is sourced from (newly slashed) agricultural land and (degradated) forests. The Mampu project on the Batéké Plateau with production of charcoal from 8,000 ha of acacia trees (*Acacia auriculiformis),* the neighboring reforestation project *Ibi Village* with related charcoal production under the Clean Development Mechanism (CDM), and the EcoMakala project in North Kivu are among the few woodfuel plantations that currently exist. Furthermore, the concept of community forestry (see chapter 11) is still in its infancy and reforestation only takes place on small scale. Despite the higher targets that were set by the National Forest Fund (10,000 ha (500 ha per year) between 1986 and 2006, recently raised to a target of 1,000 ha per year per province), only 4,787 ha have been planted during the period 1986 – 2006 by the Department of Reforestation and Horticulture (DRH, 2009). Individual efforts exist: 21 % of charcoal producers in the supply zone of Kinshasa have planted trees that could be used for woodfuel harvesting. However, most of the producers (79 %) are not involved in any replanting activities. The permit system for woodfuel is officially eligible for rural citizens but figures from the Environmental Department of the Urban Coordination (Kinshasa, Tshiangu), one of the few places that delivers permits, show its lack of implementation; only 19 permits, representing 910 tons of charcoal, were issued in 2009[32].

[32] *Division urbaine de l'Environnement, Coordination de Tshiangu,* April 2010.

Photo 5.6: Baskets of charcoal (makala) for sale at a market in Kisangani, DRC

While recognizing the current weak implementation of legal options for managing the woodfuel sector, it must also be noted that the producers around Kinshasa and Kisangani access their resources mainly under customary rules. Only 3.5 % of the producers are owner of an official forest concession. The common types of access to land are either customary land rights or renting of land or buying trees from the landowner or village chief. This shows the strong role of local authorities in granting access rights to producers, which needs to be taken into account in any woodfuel sector intervention.

Gabon[33]

Gabonese woodfuel production in 2009 was estimated at 776,000 tons or 1.1 million m^3. This represents 24 % of the country's total timber production and is the lowest percentage in terms of woodfuel production in the Congo Basin region (FAO, 2011b). The woodfuel sector in Gabon has two components: industrial and small scale. As this sector has not been widely researched, little precise data exists. Nevertheless, research organizations, forestry and mining companies, as well as other actors involved in environmental protection, are becoming increasingly interested in this sector.

The first component of the small scale woodfuel sector in Gabon relates to two activities: (i) deadwood is used by local populations for their own consumption (this is in total compliance with their right to exercise customary use as described in chapter VI of the Forestry Code); (ii) charcoal and deadwood (used as fuelwood) are produced and sold, mainly to supply the Libreville market. These products are consumed by households with modest incomes that cannot afford to buy gas. They are also used during gas shortages or for braising or smoking food, which is becoming increasingly popular.

The commercial production of woodfuel poses several problems in Gabon. First, it is not regulated apart from the Environmental Code which states that charcoal production should be subject to an environmental impact study[34].

This is not compatible with the small scale aspect and limited extent of this activity. To date, no impact studies for this activity have been submitted to the Environment Directorate-General. From an environmental perspective, this activity is sometimes undertaken in protected areas, notably in the Mondah Classified Forest, near Cap Esterias, and the area around the Akanda National Park, both of which are near Libreville. Furthermore, from a practical viewpoint, this type of activity tends to use small diameters of species that are typical to secondary forests, thereby posing problems for forest regeneration.

The final problem arising from this activity is human-related. People who produce charcoal rarely come from the production zone, or even from Gabon. This causes conflict with local populations and leads to social unrest.

Overall, the sector remains poorly developed, with Gabon's small population almost systematically using gas for household purposes (62.3 % of the population use it as their primary source for cooking notably in the towns (Daurella & Foster, 2009).

Alongside this sub-sector, another sector that is flourishing in Gabon is the industrial woodfuel sector. Whether they are in the forestry or mining sector, more and more operators are interested in this option, seeking an alternative to the coal they import to dry their products. Many forestry enterprises that are equipped with transformation

[33] Data taken from a TEREA (*Terre Environnement Aménagement*) survey of actors working in the Gabonese forestry and environmental domain.

[34] Decree 39/PR-MRSEPN on 10/01/1979, relating to industrial classification and identifying the factors that need to be taken into consideration in pollution assessments.

units currently use sawmill wood chips to aliment their wood dryers. Some manufacturers are also leaning towards woodfuel options that would allow them to produce electricity using cogeneration boilers. However, in light of the large scale investment that would be required, operators are not certain this would be economically viable, and the installation of such units remains delayed despite increases in hydrocarbon costs.

Republic of Congo

Over 80 % of the population in Congo uses fuelwood, charcoal or wood waste for cooking purposes. In 1994, the annual flows of woodfuel to the four main towns (Brazzaville, Pointe-Noire, Dolisie and Nkayi) were estimated to represent 213,880 tons of fuelwood and 25,461 tons of charcoal, which is 426,055 Teq[35] of fuelwood for a carbonization average yield of 12 %. This corresponds to an annual turnover of CFA 9 billion (Lamouroux & Boundzanga, 1994). Urban demand comprises primarily households which, in 1994, consumed 261 kg of fuelwood annually and 60.5 kg of charcoal per household. In 1998, a study carried out in Brazzaville revealed that, for various socio-cultural and economic reasons, substituting gas for woodfuel was highly unlikely (reasons for this include a traditional attachment to using wood, fire risks, and the high cost and inconsistency of gas supplies) (Andzouana, 1999).

In 2004, an assessment of woodfuel and wood derivatives consumption in Brazzaville and Nkayi found that: (i) following studies in 1990 and 1994, the public authorities had made no attempt to find an alternative solution; (ii) there was a growing movement in the energy sector for the substitution of fuelwood by charcoal; and (iii) the ecological situation of peri-urban natural forest spaces was critical (Boundzanga, 2004). In 2006, the country's urban woodfuel consumption was estimated to be 1,029,856 Teq of fuelwood (DFS, 2006). This consumption is unevenly distributed between Brazzaville (57 %), Pointe-Noire (35 %), Dolisie and Nkayi (4 % each). Between 1994 and 2006, consumption increased from 344,425 to 584,728 Teq of fuelwood for Brazzaville (70 % increase), from 244,758 to 364,387 Teq of fuelwood for Pointe-Noire (49 %), from 21,467 to 42,196 Teq of fuelwood for Dolisie (97 %) and from 15,525 to 38,545 Teq of fuelwood for Nkayi (148 %).

The average wholesale price for woodfuel is relatively even across the country's main urban markets and has practically doubled since 1994 - from CFA 20 to 39 per kilogram of fuelwood and from CFA 66 to 109 for charcoal. At the same time, if fuelwood remains the energy source used by poor households, charcoal continues to attract households of all sizes, socio-professional categories, education levels and income because its qualities are very similar to those of gas (e.g., faster cooking, cleaner cooking pots, very few fire risks, nearly always available, cost that can be adapted to all categories of household). The heavy urban demand, which is unlikely to decrease, constitutes an important sector of economic activity and a source of increased revenue for rural and urban populations. This should be weighed against the need to sustainably manage the environmental challenges involved. Finally, given the growing urbanization of the Congolese population, without increases in household revenues and lasting strategies for domestic energy in urban areas, it will be difficult for urban households to open up to alternative energy sources. Nevertheless, the implementation of the new National Afforestation Programme, that aims to promote and develop forestry for energy production, can be considered to represent a lasting alternative that could satisfy urban demand for woodfuel (see box 5.2).

[35]Teq: Equivalent ton

Photo 5.7:Bags of charcoal ready for transport from the Batéké Plateau to urban markets in Kinshasa

Box 5.2: CRDPI: Eucalyptus plantations respond to the urban demand for woodfuel in Pointe-Noire, Republic of Congo

Méthode Nkoua

CRDPI

Pointe-Noire is the economic capital of Congo. It has a population of one million inhabitants and is surrounded by 42,000 ha of industrial clonal eucalyptus plantations that produce logs and paper wood chips for exportation. For two decades, the woodfuel sector has used the remains from eucalyptus exploitation to respond to a growing urban demand for fuelwood and charcoal. For Pointe-Noire, and its woodfuel basin supply, the eucalyptus plantations are facing challenges that are economic, social as well as environmental.

In terms of the economy, eucalyptus plantations represent 47 % of annual flows in woodfuel or 265,000 fuelwood equivalent tons per year in the rainy season (Nkoua *et al.*, 2010). This corresponds to an annual financial flow of CFA 5 billion. The fact that Pointe-Noire markets have a regular availability of eucalyptus fuelwood and charcoal has a regulatory effect on the prevailing prices that are affected seasonally by the availability of timber from natural formations.

From a social perspective, the eucalyptus woodfuel sector generates revenue for townspeople and villagers. In order to ensure woodfuel production, it mobilizes over 300 city operators and about twenty villages organized under an Economic Interest Grouping. Several hundred intermediaries working as transporters, wholesalers, yard managers and retailers depend on this sector to ensure the urban provision of woodfuel. Charcoal from eucalyptus and charcoal from natural forests respectively represent 45 % and 55 % of flows to Pointe-Noire; fuelwood from eucalyptus and fuelwood from natural forests respectively represent 75 % and 25 % (Nkoua *et al.*, 2010). Charcoal and fuelwood are essentially used by urban households; 96 % of these households use charcoal to cook their food (Marien, 2006).

On the environmental front, eucalyptus plantations help to reduce the pressure exerted on peri-urban natural forests by urban and village communities. Without eucalyptus plantations, over 1,000 ha of natural forests would suffer from deforestation each year in order to produce the woodfuel required by Pointe-Noire.

In order to better integrate the eucalyptus sector into the sustainable management of woodfuel basin supply for Pointe-Noire, a study is under way to analyze the effectiveness and territorial balance between natural forest and eucalyptus sectors.

Sustainable management of woodfuel in the Congo Basin

It is clear from the descriptions above that conditions differ between countries, and even within the same country. There is therefore no global or unique, miracle "recipe" for an economy based on the overexploitation of woodfuel to develop into an economy that can introduce and sustainably manage new and renewable resources.

Nevertheless, solutions do exist. Choosing one or rather a combination of several solutions should be based on the most far-reaching and honest appraisal feasible in light of available information and forecasts for medium to long-term trends. It also needs to be recognized that woodfuel in Central Africa is a component of regional development and is usually closely interlinked with agricultural and rural activities. Strategic thinking is necessary to integrate the different components and provide significant incentives for local populations.

Pressure zones

The forest dynamics in the Congo Basin are generally sufficient to respond to the domestic needs of the population and therefore issues related to the sustainability and impacts of this sector have taken a long time to come to attention. Population growth and its concentration in urban areas have considerably changed the situation. Numerous pressure zones have recently appeared that significantly put the sustainability of timber resources into question. The situation is critical, for example, from a geographical perspective in terms of: (i) the accelerated degradation of peri-urban wooded areas around big towns and in protected areas; (ii) the degradation of dry zones (exploitation/logging of wooded savannas); and (iii) the degradation of forest fallows (shortening of cycles and soil impoverishment).

Other critical problems relate to specific aspects of the sector. The lack of organized transport and trade, land tenure, and problems associated with the allocation of the resource and profits represent greater challenges that touch upon governance issues and the role of the State (Arnold *et al.*, 2003; Arnold & Persson, 2003; Sizer *et al.*, 2005). Lastly, the main obstacles to bringing about a lasting improvement are without doubt the lack of research and possibilities for innovation, in addition to the difficulty of successfully and sustainably applying the few results that are available.

Resumed below are the various management options for the woodfuel sector. They are linked to agro-forestry, plantations and improved effectiveness in production and consumption levels.

□ *Promoting agro-forestry*

Recognizing the importance of trees in agricultural systems

Widespread areas, either former forested areas that are currently completely deforested (Bas-Congo in DRC), or savannas (Batéké Plateau in Congo), have been devoted to large scale temporary subsistence farming. The most noticeable aspects of this type of farming are: (i) accelerated depletion of soil nutrients; (ii) increased erosion; and (iii) decrease in productivity. Under these circumstances, the reintroduction of trees is a key element to bring about long-term improvement of the system. Trees provide a wide variety of goods and services, including woodfuel. Reintroducing trees can be undertaken through a classical agro-forestry system, or with the installation of hedgerows (where trees are installed as hedges around the fields and form territorial barriers).

Managing ecosystems of slash and burn agriculture and forest fallow

One of the most widespread anthropogenic landscapes in Central Africa centers on slash-and-burn agriculture and associated forest fallow areas. For a long time, this traditional system has been balanced, alternating one period (2 to 3 years) of crop rotation (cassava, maize, groundnuts, peanuts) with quite a long period (10 to 20 years) of forest fallow. Unfortunately, population growth (both rural and urban) and the resulting increase in the demand for food and wood products, has led to fallow periods being shortened, resulting in land and environmental degradation. In such a situation, using naturally assisted regeneration techniques can promote existing forest species. Seedlings, low forest and sprout forests are various examples of proliferation methods that can be adapted to these rotations. Among these forest species (many of which are specific to this system and not found in forests that are not degraded) some, such as *Pentacletra* spp., are highly regarded for the quality of the charcoal they produce.

Stabilizing frontiers

Human frontiers typically develop along communication routes, often in a disorganized way. Local populations or land holders often only have a very vague idea of the value of vegetation types in these areas. They are encouraged to sell out (often to foreign populations or to intermediaries) in order to gain a relatively low, immediate profit with no thought to long-term considerations. Some of the trees are cut down and transformed, either into planks or into charcoal, but most of the resource is burnt and abandoned onsite to make place for slash and burn agriculture. This is the case for example around Kisangani in DRC, and also on the outskirts of new informal village installations that have developed across the forest environment (notably in concessions or protected areas).

It is difficult to halt population growth along communication routes away from the concessions or the protected zones. However, with targeted information, the villagers and land holders would be able to better appreciate the real value of their heritage so that either they, itinerant loggers or farmers/cultivators could demand a better evaluation.

□ *Plantations*

Plantations in transition zones

Due to the high increase in local demand, the zones surrounding protected areas are often sources of unrestrained coal production. One solution to offset this would be to create a woodfuel source in degraded or deforested zones, for example by planting around villages. This has already been done in the periphery of Virunga National Park in the DRC and Conkouati Douli National Park in Congo. These plantations can be mixed (timber and fruit) which helps to increase their value and hence the effectiveness of their management. This solution furthermore encourages populations to settle in one place and limits encroachment into the central zones of protected area.

Photo 5.8: Burning grasslands facilitates the collection of timber stems

Create an agro-forestry resource for villages and/or agricultural communities

The lack of available timber resources is unfortunately already a reality in many areas of the Congo Basin. There are deforested zones as well as run-down grassy savannas or miombo (dry, dense forests), and wooded savanna areas that have been overexploited by densely-populated rural communities. In such cases, creating resources for villages and agricultural communities is an excellent way to improve living conditions and combat poverty (Marien & Mallet, 2004). Some countries in the sub-region are already implementing this option on a large scale. Creating agro-forestry plantations provides the guarantee for receiving long-term, diversified revenue. Different modalities exist for this: planting pure species, mixed species or a sequence of agricultural and timber products.

Create intensive industrial timber resources

In the Central African region, individuals and private investors alike dispose of significant financial income that they are ready to invest in economically viable opportunities. Industrial plantations designed for timber production offer interesting opportunities. These plantations require a well-defined strategy, long-term land and environment security, as well as significant inputs (both technical and capital). Woodfuel can constitute the principal product or one of the by-products of intensive biomass production, with the development of a sector that has the potential to be controlled by investors. Plans for large scale agro-industrial plantations are being discussed and naturally raise a number of questions. Some of the main criticisms of large scale agro-industry relate to the export of products and profits. The woodfuel sector would not necessarily face the same issues and has the potential to become even more profitable if a carbon finance system is effectively put in place.

□ *Improving the effectiveness of production and consumption*

Use of wood waste

In natural forests, a significant amount of biomass, from non-marketable felled trees, is left on the ground. The exploitation required to make paths, develop means of access and harvest commercial timber leaves a significant amount of biomass (Simo & Siyam Siwe, 2000; Cooper & Laing, 2007). This abandoned biomass often represents an order of 70 % of harvested logs. In addition to biomass that has been left on the forest floor, sawmill residue can be found, notably scraps in the form of flitches (non-marketable short strips of varying sizes). The material yield marketable sawmill/logs is rarely more than 40 % which, in theory, offers considerable potential (Perry & Bediang, 2009). Mobilizing these raw materials poses substantial challenges in terms the mobilizing, conversion and transport costs, as well as the placement of processing units. Nevertheless, some sawmill units in forest concessions are exploiting the potential represented by these residues, using cogeneration system, or transforming waste into woodfuel (coal, sawdust, wood chips) to provide supplies for urban centers.

Developing energy efficiency

Since credible and viable alternatives to woodfuel are not easily available across the Congo Basin, it is absolutely necessary to improve energy efficiency in the near future. The conversion of timber to charcoal can be improved on several levels:

- Selecting species that give high-energy returns;
- Providing efficient technologies for both coal producers and consumers;
- Improving transport, storage and market capacities.

Ideally, the potential and techniques offered by improved stoves in developing countries would allow a more sustainable exploitation and mitigate negative health implications for users. Numerous public and private projects have invested in this area. However, the effective adoption of improved stoves does not depend on financial aspects alone (cost of buying the stove), but also on complex factors such as: capital techniques, available information, starting costs and cultural barriers (Tucker, 1999; Kuteesakwe & Kuteesakwe, 2008). A better understanding of the reasons why consumers in the Congo Basin have or have not adopted the proposed technologies would help to identify more effective solutions.

Conclusion

Woodfuel is an essential source of energy throughout the entire Congo Basin region, although differences in its importance and utilization exist between the countries and sub-regions. In CAR, 97.2 % of all households depend on woodfuel, whereas in Gabon gas provides 62.3 % of households with an alternative cooking energy. In DRC, Congo and Cameroon there is a shift from use of fuelwood to charcoal in urban centers. In addition to households, various businesses also depend on wood energy for their daily operations, including bakeries, breweries, restaurants, brick makers and aluminium forgers. Moreover, large wood-processing and mining companies have shown increased interest in using waste wood for cogeneration or transformation in charcoal or chips for their energy supply. Overharvesting of wood is especially problematic in prevalent in large urban centers, savanna zones and around protected areas. Improved management of the woodfuel sector needs to be implemented without further delay as demand continues to increase and alternative energies will not be available at a level adequate to address demand in the short term. Management alternatives should take into consideration the fact that issues are often location specific and that wood energy production and trade remains primarily an informal sector. Policy and available data remain minimal, and increased collaboration between different sectors (energy, forest, land use planning) is necessary. Establishing sound agro-forestry and improving efficiency at the level of producers and consumers offer important opportunities to guarantee a future energy supply, while simultaneously maintaining the natural resource base.

CHAPTER 6

The role of wildlife for food security in Central Africa: a threat to biodiversity?

*Nathalie van Vliet, **Robert Nasi, ***Katharine Abernethy, ‡Christian Fargeot, ‡‡Noëlle F. Kümpel, ‡‡‡Anne-Marie Ndong Obiang, ˙Stéphane Ringuet

*University of Copenhagen, **CIFOR, ***University of Stirling, ‡CIRAD, ‡‡ZSL, ‡‡‡ANPN, ˙TRAFFIC

Introduction

Meat from wild terrestrial or semi-terrestrial animals, termed "bushmeat", is a significant source of animal protein in Central African countries, and a crucial component of food security and livelihoods in rural areas. Estimates of bushmeat consumption across the Congo Basin range between 1 million tons (Wilkie & Carpenter, 1999) and 5 million tons (Fa *et al.*, 2003), and harvest rates are estimated to range from 23 to 897 kg/km^2/year (Nasi *et al.*, 2008). Starkey (2004) estimated that a total of 161 tons of bushmeat was sold per year in five markets in Gabon. Similarly, Fa *et al.* (1995) suggested that the volume of bushmeat traded annually in Equatorial Guinea's two main markets is of the order of 178 tons. An inventory in 1995-96 of the four main markets in the Cameroon capital, Yaoundé, estimated sales between 840 and 1,080 tons of bushmeat per year (Bahuchet & Ioveva, 1999). In Yaoundé, Edderai & Dame (2006) identified 15 markets and 145 restaurants and cafeterias selling bushmeat and providing jobs for 249 people. Fargeot & Dieval (2000) estimate consumption in Bangui, the Central African Republic (CAR) capital, to be of the order of 9,500 tons per year. van Vliet *et al.* (in press) report annual sales equivalent to 271 tons in Kisangani, Democratic Republic of Congo (DRC).

Many sustainability assessments focusing on tropical forest wildlife in the region have warned about the increasing unsustainability of hunting and associated ecological impacts (Bennett & Robinson, 2000). Although humans have been hunting in the forests of Central Africa for millennia, there are several reasons why hunting is not sustainable in every place and for all species: (i) increasing consumer demand, from growing human populations and a lack of acceptable alternative sources of protein, (ii) greater efficiency of hunting and trade, due to easier access to wildlife source areas and markets and more efficient gear types and (iii) increasing hunter supply, resulting from rural poverty and a lack of alternative rural livelihoods (Kümpel, 2006). In addition, civil conflict or insecurity, poor governance, lack of respect for government law and order, and inadequate law enforcement are all contributing factors. The growth of extractive industries such as logging and mining, particularly where operating without proper management or impact mitigation plans, has multiple impacts on wildlife hunting and trade. In the course of unregulated activities, companies directly destroy critical habitat, disturb movement patterns and alter behavior of wildlife, and indirectly facilitate hunting in remote areas, often not governed by village traditions, by building roads and camps, thus providing or facilitating transportation for hunters and market trade as well as increasing local demand (Thibault & Blaney, 2003; Poulsen *et al.*, 2009). The loss of both traditional hunting territories and methods (e.g., hunting zone rotations) allows open access to the resource and concentration of hunting, with negative implications for hunting sustainability (Kümpel *et al.*, 2010a).

Photo 6.1: A red river hog (Potamochoerus porcus) taken by surprise while feeding

Overhunting for bushmeat in tropical forests is an issue of concern for three main reasons:

- **Food security and livelihoods:** the depletion of wildlife is intimately linked to the food and livelihood security of numerous inhabitants of the Congo Basin, as many forest-dwelling or forest-dependent people have few alternative sources of protein and income. These dependent people would be affected if the resource comes to total depletion as well as suffer from a total ban in hunting or trade, if no alternatives are provided.
- **Ecological impacts:** there is strong evidence illustrating that the scale of hunting poses a real threat to many Central African forest species. Local extirpations of hunted species are widespread, with West and Central Africa being particularly hard hit. The loss of keystone species through hunting reduces the resilience of the forest as a whole by disrupting ecological and evolutionary processes.
- **Health and infectious diseases:** bushmeat is a known reservoir of infectious pathogens, including HIV (which originated from SIV or Simian Immunodeficiency Virus), Ebola and monkey pox virus, but we still understand relatively little about the transfer dynamics of such infections. Parasitic and bacterial infection risks from wild meat consumption are also likely to be significant due to the inappropriate sanitary conditions under which transportation and storage occurs.

Despite the increasing international attention to the bushmeat issue, the available information on bushmeat harvest and trade is still fragmented and understanding of the complex interactions between the ecological, socio-economic and cultural dimensions is limited. Field studies are usually site or country-specific without follow-up or coordination among sites and disseminated either in unpublished reports or peer-reviewed articles that are not easily accessible to certain audiences. As a result, governments and other stakeholders do not have objective data generated at national and regional levels to support their management decisions. A number of international and regional framework agreements and policy forums now call for action. Since the 11th Conference of the Parties (COP-11) from the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) in 2000, three Central African countries have developed or drafted National CITES Bushmeat Action Plans, namely Cameroon, Gabon and the Republic of Congo. From 2001 to 2005, FAO (Food and Agriculture Organization), supported the development of national bushmeat strategies. The Decision IX/5 at COP-9 from the CBD (Convention on Biological Diversity) in 2008 on Forest Biodiversity, urged Parties to address as a matter of priority major human-induced threats to forest biodiversity, including unregulated and unsustainable use of wildlife. Since 2008, the Observatory for the Forests of Central Africa (OFAC), with technical

Photo 6.2: The Douengui camp serves as the technical center for the Compagnie des Bois du Gabon logging concession and as an anti-poaching barrier

support from TRAFFIC[36], is working to include wildlife and bushmeat issues more explicitly in their database through the development of a Central African Bushmeat Monitoring System (*Système de suivi de la filière Viande de Brousse en Afrique centrale* (SYVBAC) – box 6.1). The current edition of the State of the Forest is the first to include a chapter specifically on bushmeat. As an introduction to the bushmeat issue, this chapter aims at synthesizing the most relevant information available for the Congo Basin since the early 1980s. We will start by describing the species commonly hunted and traded as bushmeat. Second, we will focus on the role of bushmeat for food and income. Third, we will analyze the reasons behind bushmeat hunting, trade and consumption, especially in urban areas where other sources of protein are available. Finally, we will describe the impacts of hunting on wildlife populations and the broader forest ecosystem.

Photo 6.3: African rivers often abound with fish

Box 6.1: The development of a Bushmeat Monitoring System for Central Africa (SYVBAC): a multi-stakeholder participatory process coordinated by TRAFFIC

Nathalie van Vliet, Stéphane Ringuet
University of Copenhagen, TRAFFIC

Since 2008, TRAFFIC has been supporting a participatory process with key stakeholders for the development of a Central African Bushmeat Monitoring System (SYVBAC - *Système de suivi de la filière Viande de Brousse en Afrique centrale*). This system will provide a regular overview of the trends in bushmeat harvest and trade at the regional level through indirect indicators. To ensure the sustainability of SYVBAC over the long term, the monitoring system will function under OFAC, with the technical support from TRAFFIC for the development phase. TRAFFIC organized two technical workshops in Douala (Cameroon), in December 2008 and February 2010. In addition, a three day technical expert workshop was held in Libreville (Gabon) in June 2010 to facilitate the involvement of the private sector in the development and functioning of SYVBAC. Stakeholders involved in the development of SYVBAC represent the working expertise from six Central African countries in the region (Cameroon, Central African Republic, Congo, Democratic Republic of Congo, Equatorial Guinea and Gabon). The general objective of SYVBAC is to generate the information needed to support the development of policies and strategies that aim to bring the bushmeat trade down to sustainable levels. The specific objectives are to monitor: (i) the levels and the evolution of bushmeat use and trade in the region; (ii) the factors that influence bushmeat use and trade; (iii) the impacts of bushmeat trade on endemic/rare/protected species; (iv) the importance of bushmeat trade in national economies, poverty alleviation, nutrition and health of human populations. For indicators collected at the national level, SYVBAC will build partnerships with national bushmeat focal points. At the site level (villages, towns, community hunting zones, sports hunting areas, logging/mining concessions, protected areas and buffer zones), SYVBAC will build partnerships with NGOs, the private sector, local wildlife committees and universities or other scientific and technical institutes.

[36]TRAFFIC: The wildlife trade monitoring network (http://www.traffic.org).

Species commonly hunted and traded

In Gabon alone, 114 recognized species have been recorded in hunter catches, household consumption and markets. This figure is very high compared to West African markets, where wildlife is already dramatically impacted. Mammals make up the majority of the harvest (about 90 % of species recorded) in comparison to birds (3 %) and reptiles (6 %).

Different mammal species are not hunted equally frequently. Rodents and ungulates usually represent more than two thirds of the carcasses sold in urban markets or recorded from hunter catches in Central Africa (table 6.1). The most frequently hunted species are those between 2 and 22 kg, with brush-tailed porcupine (*Atherurus africanus*), blue duiker (*Cephalophus monticola*) and red duikers (other *Cephalophus* spp.) forming the majority of the catch in most forest areas. Blue duiker alone can account for about a third of the catch (Kümpel, 2006; van Vliet, 2008). The presence of other species depends on local circumstances as well as hunting techniques.

Table 6.1: Percentage of carcasses from ungulates, primates, rodents and other species in different hunting sites of Central Africa

Country	Site	Source	Ungulates (%)	Primates (%)	Rodents (%)	Other species (%)
DRC	Ituri forest	Hart, 2000	60 - 95	5 - 40	1	1
Gabon	Makokou	Lahm, 1994	58	19	14	9
	Dibouka, Baniati	Starkey, 2004	51.3	10.6	31	
	Dibouka, Kouagna	Coad, 2007	27	8.3	48.7	
	Ntsiete	van Vliet, 2008	65	23.5	9	
Congo	Diba	Delvingt *et al.*, 2001	70	17	9	4
	Oleme	Gally & Jeanmart, 1996	62	38		
	Ndoki and Ngatongo	Auzel & Wilkie, 2000	81 - 87	11 - 16	2 - 3	
CAR	Dzanga-Sangha	Noss, 1995	77 - 86	0	11 - 12	2 - 12
Equatorial Guinea	Bioko and Rio Muni	Fa *et al.*, 1995	36 - 43	23 - 25	31 - 37	2 - 4
	Sendje	Fa & Yuste, 2001	30	18	32	
	Sendje	Kümpel, 2006	35	16	43	
Cameroon	Dja	Dethier, 1995	88	3	5	4
	Ekim	Delvingt *et al.*, 2001	85	4	6	5
	Ekom	Ngnegueu & Fotso, 1996	87	1	6	6

Most mammal species (70 %) hunted for bushmeat in the Congo Basin are not listed as threatened on the IUCN Red List of Threatened Species (see box 3.2). Average extraction rates calculated for African forest mammals within each Red List category indicate that unthreatened species have the highest extraction rates. In Gabon, 23 of the partially protected species and 24 of the totally protected species were found to be used as bushmeat. However, rare and vulnerable species (e.g., great apes, elephants, okapis) usually represent a small proportion (often less than 5 %) of the total catch (Abernethy & Ndong Obiang, 2010; van Vliet *et al.*, 2010).

The nature of the offtake also varies depending on hunting technique, distance from the village and vegetation type. In north-east Gabon, secondary forests provide the greatest diversity of species (15 regularly hunted species, mainly blue duiker, rodents and small monkeys) compared to other vegetation types (van Vliet & Nasi, 2008). Rivers and riverine forests provide prey like reptiles and ungulates (mainly water chevrotain (*Hyemoschus aquaticus*) and sitatunga (*Tragelaphus spekei*). Mature forests provide mainly medium sized ungulates such as red duikers and red river hogs, as well as small monkeys. Rodents and small ungulates (mainly blue duiker) predominate in agricultural areas and small carnivores and birds around roads. Differing hunting methods target different species, with guns being used for larger animals and arboreal species (Kümpel, 2006; Coad, 2007; van Vliet, 2008), and snares for relatively smaller and terrestrial prey, often used to protect farming plots. Strong positive relationships have been found between the distance from a village and both prey species body size (Coad, 2007; van Vliet, 2008) and catch per hunting effort (Kümpel *et al.*, 2010a), suggesting impacts of hunting on wildlife around settlements.

The role of bushmeat in the diet and incomes of people in the Congo Basin

In many rural areas of Central Africa, bushmeat is the main source of animal protein available (although fish is usually also available), and is cheaper than any source of domesticated meat. Even where it is more expensive than alternatives, bushmeat is essentially a "free" source of protein as it can be captured rather than purchased (Kümpel, 2006). As such, bushmeat plays an essential role in people's diet. In rural communities, wildlife provides significant calories, as well as essential protein and fat. Even where bushmeat is used to satisfy basic subsistence requirements, many families also use hunting to supplement short term cash needs (table 6.2). For hunters, the distinction between subsistence and commercial use is often blurred given that meat from the forest supplements both diet and incomes (Kümpel *et al.*, 2010b).

Table 6.2: Bushmeat use in various communities

Country	Locally consumed (%)	Sold (%)	Source
DRC	10	90	de Merode *et al.*, 2003
CAR	27	73	Noss, 1995
	65	35	Delvingt *et al.*, 2001
Equatorial Guinea	57	34	Fa & Yuste, 2001
	10	90	Kümpel, 2006
Gabon	41	59	Starkey, 2004
	60	40	van Vliet, 2008
	56	44	Carpaneto *et al.*, 2007
Cameroon	36	64	Wright & Priston, 2010
	44	56	Solly, 2004
	34	40	Delvingt *et al.*, 2001
	63	15	Takforyan, 2001
	59	28	Takforyan, 2001
	68	14	Dounias, 1999
Congo	28	68	Delvingt *et al.*, 2001
	42	54	Delvingt *et al.*, 2001
	45	35	Delvingt *et al.*, 2001

Note: Total can be less than 100 % as there is a percentage of "loss" and "undetermined" use. Moreover, data come from different villages resulting in disparity between local consumption and sale in the same country and for the same source of data.

Photo 6.4: A moustached guenon (Cercopithecus cephus) hunted in CAR

Photo 6.5: A hunter returns from the forest

It is important to understand to what extent rural people depend on bushmeat, rather than simply use it, and would therefore suffer if the resource diminished (box 6.2). Many people depend on wildlife resources as a buffer to see them through times of hardship (e.g., unemployment, illness of relatives, crop failure), or to gain additional income for special needs (e.g., school fees, festivals, funerals) (Fa & Brown, 2009), and this "safety net" is often more important for the more vulnerable members of a community (Allebone-Webb, 2008; de Merode *et al.*, 2004). Barriers to access to hunting tools (guns, wires, ammunition) mean that in some cases it is the wealthier households in a community that benefit most from hunting (it is the case in DRC for example (de Merode *et al.*, 2004)). However, how bushmeat income is spent is important in judging its potential for poverty alleviation. Studies in Gabon, Equatorial Guinea and Cameroon have found that hunting incomes tend not to be reinvested back into the household but spent on non-necessities (Coad *et al.*, 2010; Kümpel *et al.*, 2010b; Solly, 2004).

By choosing a specific hunting technique and a specific hunting area, hunters target particular species with a view to whether they will be consumed or sold (Coad *et al.*, 2010; van Vliet & Nasi, 2008). They often choose to sell larger species (Abernethy & Ndong Obiang, 2010; Coad, 2007; Okouyi, 2006; Fa & Brown, 2009) or those preferred for their taste (van Vliet, 2008), and consume those carcasses that have little commercial value, including those which are rotten or taboo (Kümpel, 2006), leading to potentially significant biases in the characteristics of the market compared to local offtakes. Fishing, where possible, is also an important source of protein and income. Fishing often has higher investment costs than hunting, where nets or a boat may be required, but can replace hunting as a primary activity in coastal or riverine areas (Blaney, 2008; Abernethy & Ndong Obiang, 2010).

Box 6.2: The role of bushmeat in the livelihoods and food security of rural people in Equatorial Guinea

Noelle F. Kümpel

ZSL

Bushmeat is an important resource for rural people in the Congo Basin, as either a regular source of protein or income, or a safety net in times of hardship. However, it is important to understand the extent to which rural communities depend on bushmeat, and would therefore suffer with its demise. An evaluation of wildlife use and dependence within the context of other available livelihoods and foods was carried out in continental Equatorial Guinea, a country currently undergoing a dramatic economic boom. Household surveys and hunter interviews over 12 months in three villages with differing combinations of market and forest access enabled comparisons between communities, households and individuals.

At community-level, bushmeat was an important source of income (with nearly 90 % of men hunting), while wild plants were more important for consumption, particularly where limited market access increased prices of imported alternatives. Within a village, the poorest and most vulnerable households gained a significantly greater proportion of income and production from bushmeat, largely because of a lack of other livelihoods, and this increased in the lean season. Poorer households were least food secure (having higher "food insecurity" scores) and least livelihood secure (having fewer sources of income). At individual-level, hunting income benefited men more, and was less likely to flow back to the household. Median monthly income from hunting was however less than half that of preferred paid employment.

Bushmeat contributed significant value and income to all communities studied, suggesting it is an important component of the rural economy across the country. Forest and particularly market access were important factors in determining livelihood strategies. Critically, bushmeat was important for the poorest households, particularly as a safety net at vulnerable times. To ensure the sustainability of bushmeat hunting, policy needs to account for the true value of forests to the livelihoods of forest people, control commercial trade, manage forest access and offtakes, and also promote alternative livelihoods for potential commercial hunters.

Hunting for the commercial trade is probably the primary driver of the increasing levels of bushmeat offtake in Central Africa (Davies, 2002). In some of the highly urbanised nations such as Gabon, aggregate urban bushmeat consumption can be higher than aggregate rural consumption due to the higher population density of urban areas (Starkey, 2004), although *per capita* rural consumption across the region is on average 2 to 13 times greater than that of urban individuals (Wilkie *et al.*, 2005). A precise evaluation of the quantity of wild meat consumed *per capita* is not easy to compare between sites from the published information for various practical and methodological reasons. It is clear, however, that consumption depends on the type, wealth and residence of consumers, with hunter-gatherers eating 50 to 216 g of meat daily, while general rural (e.g., farmers or logging company employees) and urban populations consume 40 to 260 g, and 3 to 120 g, respectively (table 6.3).

Table 6.3: Average daily bushmeat consumption in various communities (g/day)

Country	Site	Hunter-gatherers	Rural populations	Urban populations	Source
DRC	Ituri	160			Bailey & Peacock, 1988
	Ituri		120		Aunger, 1992
	Kiliwa		40		de Merode *et al.*, 2004
CAR	Mossapoula	50			Noss, 1995
	Ngotto		90		Delvingt *et al.*, 2001
	Bangui			39	Fargeot & Diéval, 2000
Cameroon	Campo	216	185		Bahuchet & Ioveva, 1999
	Campo	201	18 - 164		Koppert *et al.*, 1996
	Dja		75 - 164		Delvingt *et al.*, 2001
	Dja		171		Bahuchet & Ioveva, 1999
	Mbanjock			5	Bahuchet & Ioveva, 1999
Congo	Odzala		116 - 164		Delvingt *et al.*,2001
Gabon	Libreville			3	Thibault & Blaney, 2003
	Libreville		50 - 260	20 - 120	Wilkie *et al.*, 2005
	Port-Gentil			8	Thibault & Blaney, 2003
	Oyem			24	Thibault & Blaney, 2003
	Makokou			39	Thibault & Blaney, 2003
	Gamba			94	Thibault & Blaney, 2003

Source: Modified from Nasi et al., 2008

Photo 6.6: An African python coiled on a log in Loango National Park, Gabon

Bushmeat consumption in urban areas

Urban consumers usually have the choice of several sources of protein but opt for bushmeat for a variety of reasons (e.g., cost or taste) that vary between regions. In Kisangani (DRC) and Bangui (CAR – box 6.3), consumers typically buy bushmeat as it is the cheapest or most available form of meat although not necessarily the most preferred (van Vliet *et al.*, 2010; Fargeot, 2010). In CAR, the poorest urban families often buy smoked bushmeat as the most available and cheapest source of protein, often from the less expensive species, and consume it in very small quantities per day (Fargeot, 2010). In other Central African towns, bushmeat is among the most expensive sources of protein. For the wealthiest families in Libreville or Yaoundé, the incentives for bushmeat consumption do not only depend on availability and prices. In urban Gabonese towns, the wealthiest households consume less bushmeat per person per day than poorer households, but are less sensitive to prices and often choose fresh wild meat (rather than smoked) and the more expensive species (porcupine, red river hog (*Potamochoerus porcus*) or python) (Knights, 2008). Schenk *et al.* (2006) analyzed taste choices in Gabon, reporting that consumers differentiate amongst bushmeat species and that wildlife cannot be treated as a generic food source. In urban Equatorial Guinea, the most preferred foods are all fresh fish or bushmeat species, red snapper (*Lutjanus campechanus*), porcupine and blue duiker, whereas the top three most consumed foods are frozen mackerel, frozen chicken and frozen pork due to their lower cost (Kümpel, 2006). The price of bushmeat in comparison to other sources of protein affects bushmeat consumption. Wilkie *et al.* (2005) showed that changes in the price of fish affect bushmeat consumption where fish and bushmeat are substitutes.

Box 6.3: Analysis of bushmeat consumption in Bangui

Christian Fargeot
CIRAD

A study of the determining factors for bushmeat consumption in Central African urban areas and the economic importance of this sector was carried out in March 2008. Findings were based on a survey of 1,000 households in Bangui, the capital of the Central African Republic (CAR).

An analysis of households' purchases of protein revealed the importance of beef (40 % of purchases), followed by fish (24 %) and then bushmeat (22 %); smoked meat (17 %) being much more consumed than fresh bushmeat (5 %).

From a religious perspective, only Muslims, for whom it is strictly forbidden (and, to a lesser degree, Jehovah's Witnesses), do not eat bushmeat. From an ethnic perspective, the Foulbés, who are largely Islamist, also do not eat bushmeat. All other religious and/or ethnic groups in CAR are large consumers of bushmeat.

The purchasing power of households determines consumption. The rich buy more bushmeat than the poor. However, relatively, bushmeat is a higher percentage of the protein purchases of the poor for whom bushmeat, especially when smoked, forms an essential part of the food rations. This can be explained by the relative cost of various proteins, expressed in terms of fresh biomass weight: smoked products (caterpillars, fish and bushmeat) are much cheaper than fresh products.

Based on data from this survey the annual total consumption of bushmeat in Bangui is estimated at 8,000 tons of fresh biomass, with an average of 10 kg of biomass consumed per person per year. The total value of bushmeat consumed per year in Bangui is estimated at CFA 8.3 billion ($ 16 million), which amounts to 1.2 % of the GDP of CAR.

Besides the economic factors that drive demand for bushmeat, cultural factors also explain bushmeat consumption patterns. East *et al.* (2005) used a study of consumption and preferences in Bata, Equatorial Guinea, to indicate that besides income, ethnicity and nationality are key determinants of bushmeat consumption. In Bata (Equatorial Guinea) and in Bangui (CAR), purchasers of fresh domestic meat are more likely to be Muslims originating from neighboring countries whereas bushmeat consumers are most likely to be from local ethnic groups (East *et al.*, 2005; Fargeot, 2010). The Equatoguinean consumers preferred fresh meat or fish (not just bushmeat) over frozen meat and fish types, often citing health reasons. Some authors have also shown that a cultural preference for bushmeat encourages consumers to pay high prices for bushmeat (Bahuchet & Ioveva, 1999; Trefon & de Maret, 1999). For example, King (1994) suggests that in urban areas of western Cameroon the rate of consumption seems predominantly dictated by preference or taste rather than a lack of alternatives. Chicken, beef, pork and fish are commonly available in urban restaurants and from street corner "chop stalls" at cheaper prices than bushmeat. In Gabon, familiarity with the taste of bushmeat due to childhood experience is clearly a major factor in determining preference (Starkey, 2004). In Gabon again, bushmeat is associated with the village, with rituals and with ceremonies, such as men's circumcision ceremonies (Angoué *et al.*, 2000; van Vliet & Nasi, 2008). The traditional role of bushmeat has also been shown in Equatorial Guinea, where some species are considered to have magical or medicinal properties that increase their value and others are taboo (Kümpel, 2006). Taboos on certain foods are widespread in parts of Central Africa (Okouyi, 2006; van Vliet & Mbazza, 2011). Taboos can be specific to a tribe, clan, family or individual, and can relate to hunting as well as consumption. Taboos do not necessarily reduce the level of hunting of a species (especially when non-specific hunting methods are used) but do reduce their trade value. For example, yellow-backed duikers (*Cephalophus sylvicultor*) can be accidentally hunted in villages near Makokou, but the meat is never consumed by the young people in the village and never sold in the bushmeat market of Makokou (Okouyi, 2006; van Vliet, 2008). However, local taboos can break down where trade to other regions or to other tribes is possible (e.g., the trade in apes in Equatorial Guinea (Kümpel, 2006)).

Photo 6.7: Hunters often spend several days in basic shelters in the heart of the forest

Long term ecological impacts of hunting

Impacts on wildlife populations

Data from African sites indicate significant drops in mammal densities between unhunted and hunted sites: 13 to 42 % reduction in DRC (Hart, 2000), 44 % in CAR (Noss, 2000) and 43 to 100 % in Gabon (Lahm, 1994; van Vliet, 2008). As hunting pressure becomes heavier, primate numbers may drop almost tenfold (Oates *et al.*, 2000) and carnivores are significantly affected (Henschel *et al.*, 2009). Hunting is also a major cause of a reported 50 % decline in apes in Gabon within two decades (Walsh *et al.*, 2003). Interpretation of these data is however difficult since information on the influence of habitat type and past hunting pressures is not often available. Thus, major drops in mammal densities are more likely to occur in previously unhunted areas than in areas that have gone through a long history of hunting pressure. The rapid decline of fauna after intensive periods of hunting has also been suggested by market studies in Bioko, Equatorial Guinea (Fa *et al.*, 2005). Overall numbers of carcasses decreased by 23 % between 1991 and 2005, while revenue increased by 35 % and the proportion of carcasses of smaller species, such as rodents and the blue duiker, also increased (Fa *et al.*, 2005). This suggests a dramatic reduction in presence of the larger species: Ogilby's duiker (*Cephalophus ogilbyi*) and diurnal primates.

Species are impacted by hunting pressure to different extents. Indeed, some appear very vulnerable while others appear relatively unaffected. Larger-bodied, longer-lived species with low intrinsic rates of population increase, such as large primates, large carnivores, elephant (*Loxodonta africana*) and yellow-backed duiker are less resilient to hunting than species with high intrinsic rates of population increase such as rodents and small to medium-sized duikers. The black colobus (*Colobus satanas*) was found to be more vulnerable to over-hunting in Equatorial Guinea (Kümpel *et al.*, 2008), perhaps because it is an easy target owing to its relative inactivity and large body size (Brugiere, 1998). In areas where larger species have been significantly depressed, abundance of small and medium-sized species can remain unaffected or even increase. For example, the small-sized blue duiker is significantly less abundant in remote forests inside the Ivindo National Park than in hunted areas close to Makokou with similar vegetation cover, while the larger red duikers such as Peter's duiker (*Cephalophus callipygus*) and bay duiker (*Cephalophus dorsalis*) are less abundant or even depleted in those same hunted areas (van Vliet, 2008; van Vliet *et al.*, 2007). The explanation may be that abundance of resilient species may rise if their competitors are harvested, known as "density compensation" (or under-compensation) (Peres & Dolman, 2000). Suggestions of density compensation have been made in Korup forest monkey communities, in Cameroon, with relation to increases in putty-nosed guenons (*Cercopithecus nictitans*) in heavily hunted sites (Linder, 2008).

Population age structures and demographics of hunted *vs* non-hunted sites are rarely available but studies in Gabon in the late 1980s (Dubost,1980) concluded that hunting and trapping most severely affect young adult chevrotains and duikers, the age class with the greatest reproductive potential. Hart (2000) found that duiker dispersal rates in DRC were higher in a hunted than unhunted area, and concluded that dispersal was potentially important in maintaining small ungulate populations under exploitation; as expected under "source-sink" theory, the dispersal capacity of species may also explain the high and localised hunting offtakes over the long term observed in a rotational hunting system in Equatorial Guinea (Kümpel *et al.*, 2010a). Recent results from the Republic of Congo, however, showed that animals' dispersal rates do not appear to be greatly increased by hunting pressure (Mockrin, 2009). Building a fuller understanding of animal population demography under hunting, including dispersal, is essential for management efforts.

Photo 6.8: Great blue touracos (Corythaeola cristata) are actively hunted for meat and feathers

Long term impacts of hunting on ecosystems

The loss of animals from forest ecosystems results in the disruption of ecological and evolutionary processes, as a result of changes in species composition and probable reduction in biological diversity (Emmons, 1989; Redford, 1992). Most of the evidence for this comes from case studies in the Neotropics[37], with a paucity of relevant studies conducted in the Congo Basin. Predicting the long-term influences of hunting on the ecosystem remains a tremendous challenge, but the Neotropical studies already show that reduced mammal densities can result in severe ecosystem changes and cascading effects on the entire food web. Although every organism contributes to ecosystem processes, the nature and magnitude of individual species' contribution varies considerably. Most ecosystem processes are driven by the combined activities of many species. Plant regeneration (affected by the loss of pollinators, seed dispersers and seed predators), food webs (affected by the loss of top predators or of their prey), and plant diversity (affected by a change in herbivores patterns or an increase in pests) are amongst the various processes dependent upon the presence of fauna. Therefore activities such as hunting have the potential to impact not only targeted species but the ecosystem more broadly.

"Keystone species", "ecosystem engineers", or organisms with high community importance value are species or groups whose loss is expected to have a disproportionate impact on the ecosystem compared to the loss of other species. As hunters preferentially select large animals, which are often keystone species, the local extinction of these animals results in dramatic changes to ecosystems. Top predators (e.g., large cats, raptors, crocodiles) impact biodiversity by facilitating the access to resources that would otherwise be scarcely available to other species (e.g., carrion, safe breeding sites) or by initiating a trophic cascade (Terborgh & Estes, 2010). Local extinction of these predators can trigger large changes in prey populations, which in turn dramatically alters browsing or grazing to the point where large regime shifts or ecosystem collapse happen. Elephants and other mega-herbivores can play a major role in modifying vegetation structure and composition through their feeding habits (including differential herbivorous behavior and seed dispersal) and movements in the forest (killing a large number of small trees). Their impact has in some cases appeared to be positive (Goheen *et al.*, 2004), in others negative (Guldemond & Van Aarde, 2008), but they do have a strong impact on vegetation dynamics. Ungulates such as wild pigs and duikers are among the most active seed dispersers or predators; thus a significant change in their population densities will have a major effect on seedling survival and forest regeneration.

Human extractive activities in tropical forests (including but not restricted to hunting) are therefore disruptive processes and can trigger numerous effects, not yet fully understood, which will in turn alter, in a more or less significant way, the overall function, structure and composition of the ecosystem. As forest resilience is dependent upon all these processes and functions, it is very likely to be impacted by the loss of biodiversity linked to the direct and indirect impacts of defaunation (Thomson *et al.*, 2009).

[37]Neotropics (or Neotropical zone) include South and Central America, the Mexican lowlands, the Caribbean islands, and southern Florida.

Photo 6.9: African rivers are a source for freshwater shellfish

Conclusions

Increased hunting pressure has tangible effects on wildlife and is likely to have long term impacts on forest ecosystems. As it is expected in hunted areas, the abundance and composition of mammal assemblages differ from unhunted areas. However, the abundance of several hunted species can decline without necessarily indicating unsustainability. The most resilient species are often able to adapt to hunting pressure, either by modifying their biological parameters and their ecology or by taking the niche left empty by the most vulnerable species. Despite long and continuous sustained heavy harvesting, some bushmeat species continue to thrive in natural and modified habitats. Multiple studies suggest that the brush-tailed porcupine and the blue duiker are highly resilient to hunting. Thus, high harvesting pressure should not always be equated with local extinction. On the other hand, many vulnerable species such as elephants and great apes, although not representing high percentages in the hunter's catch, have declined or become locally depleted due to hunting. In addition, very little is still known for the majority of other Central African hunted species that are partially or totally protected. The effects of hunting on those species need further investigation, with a particular focus on the impacts of hunting at varying spatial and temporal scales and under different hunting techniques, to provide objective information for sustainable wildlife management.

Photo 6.10: Fishermen on the edge of Lake Maï Ndombe in the DRC

Bushmeat plays a crucial role in the diets and livelihoods of rural and urban people in Central Africa. Bushmeat serves multiple roles at the hunter level and remains a major source of protein and income in most rural areas. The distinction between subsistence and commercial hunting is blurred, particularly where rural areas are well integrated in the cash economy, but also because often bushmeat is the most valuable tradable commodity for remote communities. However, there remains a lack of detailed empirical evidence concerning the role of bushmeat within the rural household economy, and in maintaining the food and livelihood security of different forest-dependent communities. Such an understanding is needed to formulate an appropriate policy response to the bushmeat issue for the benefit of both local livelihoods and forest ecosystems.

The increasing trade from rural to urban areas is the main driver of unsustainable levels of bushmeat hunting in Central Africa. Even where urban consumers have access to domesticated sources of meat, bushmeat remains an important item of their diet. Indeed, bushmeat serves multiple functions over and above the purely consumptive. There are cultural, spiritual and taste preferences that override predictions and patterns of behavior captured in economic models. Moreover, in some urban towns, bushmeat remains the cheapest source of protein. As such, with Central African nations becoming increasingly urbanised, there is no guarantee that demand for bushmeat will decline. However, preferences are relatively elastic, and there is generally no particular demand for protected and vulnerable species, with the more common species (such

as brush-tailed porcupine or giant pouched rat) often being the most highly valued for their taste or their cultural value. There is thus hope for the sustainability of the trade if it can be restricted to the more resilient species, supplemented by the production and marketing of acceptable alternatives (such as fresh meat and fish) at an appropriate scale.

The reasons behind bushmeat consumption are complex and integrate factors that should not be disregarded in efforts to promote the sustainable levels of bushmeat hunting. More particularly, a clear understanding of consumer preferences for both wildlife and alternatives is needed before any efforts to develop alternative protein sources are started. As demand from the increasing urban population in Central Africa increases, the target for awareness-raising campaigns should shift from rural to urban settings with innovative messages and approaches that take into account Central African perceptions of wildlife. The Convention on Biological Diversity (CBD) and the report of its Liaison Group on Bushmeat recognizes that existing policies and legal frameworks related to hunting are unpractical or unfeasible, provide unrealistic approaches for enforcement, and ignore the economic and nutritional value of bushmeat (Nasi *et al.*, 2008). As such, multidisciplinary approaches are needed to combine a better knowledge of the use and trade of bushmeat, the strengthening of legal frameworks, the provision of food and livelihood alternatives and the sustainable use of wildlife. None of these alone appear to be able to solve the so-called "bushmeat crisis", but combined and incorporated into solid national and regional bushmeat strategies, there is potential to achieve a more sustainable use of wildlife for food in Central Africa.

CHAPTER 7

Non-timber forest products: contribution to national economy and strategies for sustainable management

**Verina Ingram, **Ousseynou Ndoye, ***Donald Midoko Iponga, **Julius Chupezi Tieguhong, *Robert Nasi*
**CIFOR, **FAO, ***IRET*

Introduction

"Non-Timber Forest Products" (NTFPs) refers to a wide range of goods, which are common sights in households and markets across the Congo Basin. The paradox of these products, as in other tropical forests worldwide, is that despite their importance and everyday use, comprehensive knowledge on their ecology and socio-economic value is largely lacking, hindering the ability to monitor, regulate and manage them. The value chains of these products (see box 7.1) are mainly informal and remain uncaptured in statistics and policy across all Central African states. Their contribution to livelihoods and national economies is thus difficult to evaluate. Policies for sustainable economic development based on their trade and consumption are consequently largely absent. However, data from across the region has been gathered which demonstrates the multi-faceted value of NTFPs. By clearly defining, and then prioritizing the most important NTFPs for both trade and own use, approximate valuation is possible. Whilst the potential market value is difficult to gauge, given the lack of resource inventories, improved and more sustainable management is possible given revisions and harmonization of regulation, increased domestication and monitoring.

Photo 7.1: Kola nuts (Cola acuminata) for sale in a market in Kisangani, DRC

Box 7.1: Forest products value chains

The term "value chain" is useful to understand the activities involved in bringing a product from the forest, through processing and production, to delivery to final consumers and ultimately disposal (Kaplinsky & Morris, 2000). Value chain analysis is a conceptual framework for mapping and categorizing the economic, social and environmental processes. It helps to understand how and where enterprises and institutions are positioned in chains, and to identify opportunities and possible leverage points for upgrading. This analysis encompasses the organization, coordination, equity, power relationships, linkages and governance between organizations and actors.

Defining NTFPs: different interpretations across the Congo Basin

As there is no agreed definition on what an NTFP is across the region, one is given in box 7.2. In Equatorial Guinea, the 1997 Forest Law contains a definition and lists 24 priority NTFPs. The Cameroon 1994 Forest Law uses the term "Special Products" or "Secondary forest products" which includes both timber and non-timber species, but does not define these. The Central African Republic (CAR) Forest Law defines NTFP as "similar products of forest areas or ecosystems other than timber". The 2000 Forest Law of the Republic of Congo refers to "accessory forest products". In the Democratic Republic of Congo (DRC), the 2002 Forest Code defines NTFPs as "all other forest products such as rattans, barks, roots, leaves, fruits, seeds, resins, gums latex and medicinal plants". Finally, in Gabon, both "forest products other than timber" and "NTFP" are used in the 1993 Forest Code, which lists 15 product groups and individual species.

Box 7.2: What are Non-Timber Forest Products?

"Non-Timber Forest Products" (NTFPs), are defined as spontaneous forest products of biological origin (vegetable: including plants and fungi, and animals: including meat, insects and forest fish), other than timber, derived from forests, other wooded land and trees outside forests. Excluded are exotic forest products now farmed and found in the wild in the Congo Basin, such as rubber (*Hevea brasiliensis*) and quinine (*Cinchona* spp.). Fuelwood and its derivatives are classified as NTFPs in the legal framework in Gabon, CAR and Cameroon. NTFPs are often classified by their use: for food, forage, tools, construction, medicines, aromatic products, dyes and colorants, objects of ornament, art and cultural value. All parts can be used and classified as NTFPs. For plants, these parts are the fruits, seeds, leaves, stems, bark, resins, roots, flowers and wood; and for animals, these are meat, hides, hair, horns, hooves, feathers and other parts.

This lack of convergence or common understanding remains despite regional and national studies on NTFPs. In the 1990s, research on types and uses of non-timber forest resources, their harvest and trade (Sunderland *et al.*, 1998), and exports to Europe (Tabuna, 1999) was supported by the development of data collection and monitoring frameworks (Medicinal Plants Specialist Group, 2007; Baker, 2000; Wong, 2003). The need to go beyond national borders has been increasingly recognized, resulting in regional policy initiatives to harmonize the regulatory, monitoring, tax and institutional frameworks on a national and the Congo Basin levels (Walter & Mbala, 2006; Ebamane, 2008; FAO *et al.*, 2008; Betti, 2007).

The importance of indigenous knowledge and local rights has also been recognized (Tchatat & Ndoye, 2006; Eyong, 2007), given the predominance of local communities in harvesting NTFPs. Recent research has focussed on filling knowledge gaps, investigating the social and economic importance of NTFPs for rural and urban livelihoods, their contribution to food security, health, income generation, employment, national and regional economies (Tieguhong & Zwolinski, 2009; Tieguhong *et al.*, 2008; Noubissie *et al.*, 2008; Ingram *et al.*, 2010). Strategies for improving the sector, through small forest based enterprises (Tieguhong *et al.*, 2010a) and certification (Vermeulen *et al.*, 2009) are also being explored.

Photo 7.2: Smoked caterpillars are an important source of proteins

NTFPs for trade and own use

The proportion of NTFPs consumed and sold varies widely by area, ethnic group and the type of product. For example, for 9 plant-based NTFPs in Cameroon and the DRC, on average 67 % of the harvest is traded, whilst for bushmeat between 17 and 53 % is traded (Abugiche, 2008; Ayeni *et al.*, 2001; Nasi *et al.*, 2008; Wright & Priston, 2010; Njiforti, 1996). Such trade provides both cash and acts as a safety net, especially in times of crisis, and serving as a seasonal gap filler. It is the poorest who generally have a subsistence forest-based income, while additional cash income is generated for the relatively richer actors involved in the chains, with profits generally increasing as the product moves along the value chain to wholesaler, retailers and exporters (Vedeld *et al.*, 2007; Tieguhong *et al.*, 2009; Paumgarten, 2007). Gender is often a decisive factor determining who does what in value chains. Cultural, religious, social and family responsibilities have a strong influence on male or female involvement at different stages in an NTFP chain, as well as the product characteristics. Women, often accompanied by children, are largely involved in the collection of easy to gather NTFPs, such fuelwood, *Gnetum* and safou. Men tend to concentrate on harvesting products which require long distances and overnight stays in the forest, such as hunting, collecting *Gnetum* spp. in eastern region of DRC, or collecting bush mango (*Irvingia* spp.) which is a family activity in some areas of Cameroon, or where the harvest is physically demanding - such as collecting *Carpolobia* spp. (cattle sticks), bamboo, rattan and honey. Women tend to dominate retailing, often as this is easily combined with family responsibilities. Wholesalers, intermediaries, transporters and exporters are more likely to be male. Reasons given in Cameroon and DRC for men's involvement in these professions are that it is easier for men to travel, spend time from home and have access to capital to finance these activities. The income gained from NTFPs varies considerably depending on the market, the product and seasonality: accounting from very little to around 80 % of annual average household income, with figures of between 25 to 40 % emerging as regional averages (Angelsen & Babigumira, 2010; Ingram, 2009). How the trade in NTFPs is organized and governed also differs widely per product and country, and has a major impact on the volume harvested and traded, the distribution and equity of incomes between actors such as harvesters and intermediaries; the access to and control of resources and profits. Risks (and losses) born by the actors in value chains of traded NTFPs tend to be greatest for intermediaries, who also tend to have higher levels of dependency on individual NTFPs in which they trade, and less diverse means of income and subsistence generation (Ingram, 2011). Dependency upon a product arises from a combination of factors, including the organization, access and distance to markets and information, local culture and ethnic ties and the nature of the product itself.

Photo 7.3: Honey harvesting in a logging concession

Photo 7.4: Market stall displaying various NTFPs in the Bamenda market in western Cameroon

There are wide variances in the sustainability of harvesting NTFPs and ultimately the livelihoods of those dependent on them. Examples of unsustainable practices are observed with *Prunus africana* harvesting in Cameroon, Equatorial Guinea, and DRC, for which international trade was suspended in 2007 due to fears of over-harvest. Another example is the bushmeat trade which is believed to be increasingly threatened by over-exploitation (Fa & Brown, 2009). For valuable products, such as *Gnetum* spp. (see box 7.3), the high volume trade combined with low levels of domestication results in unsustainable harvests (Nde-Shiembo, 1999; Clark & Sunderland, 2004), whereas for *Dacryodes edulis*, *Cola* spp. and *Raphia* spp. species, high levels of domestication and integration into agro-forestry and farm bush systems have helped ensure the centuries long and Africa-wide trade is sustained.

Box 7.3: Contribution of Gnetum spp. to income diversification and food security in Central Africa

Across Central Africa, leaves from *Gnetum africanum* and *Gnetum buchholzianum*, two understory lianas, are important articles for trade and consumption. These leaves are valued for multiple reasons including their medicinal value to treat nausea, act as a disinfectant and as an antidote to certain types of poison. The leaves also have very high nutritional value as their cellulose can extend digestion periods and reduce cholesterol levels (Toirambe, 2002), and they are rich in protein and other minerals (Isong *et al.*, 1999).

Gnetum spp. exist in a wide range of habitats and are harvested in both fallow farm areas and closed canopy forests. These species contribute to food security, for harvesters who consume them directly and for households that buy leaves in the markets, and income diversification.

Annual harvest of *Gnetum* spp. from Mbandaka, Equateur and Bandundu provinces in the DRC is estimated at 200 tons. In the southwest, coastal and central areas of Cameroon, the annual harvest is estimated at 4,180 tons. The *Gnetum* spp. sector directly involves at least 1,885 and 1,744 people in Cameroon and the DRC respectively. It represents a valuable trade that is estimated at $ 3.8 million per year in southwest Cameroon and at $ 1.2 million per year in Kinshasa.

In late 90's, annual exports to Europe amounted to between 50 and 2,000 tons, representing $ 12 million (Tabuna, 1999).

Studies show that in Kinshasa over 80 % of the population consume *Gnetum* spp. at least once a week. The reasons given for this level of consumption are taste (57.8 %) and nutritional value (19.3 %). In Cameroon, 89 % of *Gnetum* spp. harvesters are women, 60 % are unmarried and they are on average 25 years old. These harvesters can earn $ 98 to 110 per month, which is higher than the guaranteed minimum wage. In the DRC, *Gnetum* spp. traders can earn on average $ 270 per month (Awono *et al.*, 2009). In Republic of Congo, for each trip to Brazzaville, wholesalers are able to make a gross margin of $ 429. In the Central African Republic, *Gnetum* spp. retailers in the Bangui markets can earn on average $ 132 per month, which is also higher than the guaranteed minimum wage.

Incomes from sales of *Gnetum* spp. allow families to pay for food, healthcare and children's education. However, the growing importance of *Gnetum* spp. both for the purposes of nutrition and for earning income increases the pressure placed on the resource. Improved harvesting and domestication techniques are therefore required to ensure the sustainability of this non-timber forest product.

Determining the priorities for managing NTFPs

The very diversity of NTFPs requires tailored strategies for sustainable management, starting with a definition of NTFPs, and a prioritization of which ones need to be managed, where, why and how.

Species used as NTFPs

The first step in managing NTFPs sustainably is to know which species are used per country. Two bibliographies on NTFPs and their uses in the region (Dounias *et al.*, 2000; Maille, 2001) provide a good overview of management issues but omit fuelwood and animal-based products. However, these two classes of NTFPs stand out as among the most important NTFPs, both for own consumption and due to their large scale trade. They are therefore discussed in more detail in chapter 5 and chapter 6. Reviews and market assessments of NTFPs in Cameroon, Congo, DRC, Equatorial Guinea, CAR and Gabon in 2010 by the Forestry Research Network for ACP countries (ACP-FORENET) indicate that over 500 plant species and at least 85 animal species are currently used as NTFPs. For example, in Cameroon nearly 500 plants and 82 animals are used as NTFPs, the majority (67 %) of which have multiple uses, with food and oils predominating (67 %), followed by medicinal products (60 %). These uses are echoed in other countries: in CAR, at least 57 plant and animal species have been recorded with food and medical uses (N´gasse, 2010), with an estimated 70 % of the rural population depending on plants for their health. In Republic of Congo, at least 166 plant species are used for food and 176 have medicinal values used in 289 treatments (Profizi *et al.*, 1993). In the DRC, over 169 plant species have been recorded for food and 166 for medicinal use (Toirambe, 2006). In Gabon, 58 botanic families containing food species, 29 medicinal uses, and 15 construction uses have been identified (Walter, 2001). The differing numbers per country reflect an inadequate capture of indigenous knowledge by science, rather than dramatically different use levels across countries.

The species used as NTFPs, their abundance and density all change with ecosystem type, and with local variations in climate and altitude, making the selection of priority NTFPs highly location specific. For example, the mountains of Cameroon and Equatorial Guinea comprise only 2.5 % of Congo Basin forests, but contain at least 10,320 flora and fauna species, of which 25 % and 10 % respectively are endemic (Bergl *et al.*, 2007) and approximately 23 % are used as NTFPs. An equivalent number of species are used in the swamp forests in Congo, DRC and Gabon, which cover 2.9 % of the basin's landmass (WWF, 2006), and the forest-savanna mosaics covering 31 % of the area (Dounias, 1996; Zapfack & Nkongo, 1999). Unsurprisingly, the majority of species are found in the lowland dense moist forest which comprises nearly 50 % of total forest cover in the region. Anthropogenic disturbances also change natural distribution patterns, for example when useful plants are unknowingly domesticated, such as groves of *Irvingia gabonensis* found along major footpaths within villages in the Takamanda area of Cameroon (Sunderland *et al.*, 2009) and the spread of *Cola* spp. across Central and West Africa (Tachie-Obeng & Brown, 2001).

Photo 7.5: Fumbwa (Gnetum africanum) for sale in a local market in Kisangani, DRC

Prioritizing NTFPs

This vast number of species across countries and the region means that priorities have to be made about which species and products need to be managed and where: at the source or along the value chain. A way to do this is to define what a "priority NTFP" is, using a broad classification of value. The classification criteria are shown in box 7.4. These criteria were developed from both national and regional perspectives[38], permitting a common understanding and harmonization across the Congo Basin. Based on these criteria and values, a list of priority NTFPs per country was established (see Annex 1). Combining these national priority NTFPs results in a list of the 24 most common products used across the Congo Basin (table 7.1). These comprise at least 37 species, with potentially many more species included if all those species used as fuel and bushmeat were known.

Box 7.4: A definition of "priority NTFP"

"Priority" or "key" NTFPs have been defined (Clark & Sunderland, 2004; Wilkie, 1999) as those:

- Products which have a high economic trade value or are important for auto-consumption (i.e., value for livelihoods);
- Products whose demand exceeds supply i.e. unsustainable exploitation (this is a function of *in situ* conser vation priority status and domestication).

Adding to this list, other important criteria are:

- Species which have multiple uses (including conflicting);
- Species from which multiple parts are used;
- Species which are classified as vulnerable or protected (for example, on the IUCN Red List (see box 3.2), CITES listed and/or protected by national laws).

These criteria together address holistically the economic, social and environmental aspects of "value".

Photo 7.6: Njangsa seeds (Ricinodendron heudelotii)

[38] Results of a FORENET Sub-Regional Workshop on Harmonisation of National Reviews on "Non-Timber Forest Products (NTFPs) in Central Africa", 17-18 May 2010, Douala, Cameroon.

Table 7.1: Priority NTFPs across the Congo Basin (see also Annex 1)

Priority NTFPs (trade &/or consumption)	Regional priority (number of countries)	Country					
		Equatorial Guinea	Congo	DRC	Cameroon	CAR	Gabon
Bushmeat (multiple species of mammals & reptiles)	6 countries	√	√	√	√	√	√
Fuelwood (multiple species)		-	-	√	√	√	√
Cola acuminata & *C. nítida*		√	√	√	√	√	√
Gnetum spp.	5 countries	√	√	√	√	√	
Rattans *(Eremospatha* spp., *Laccosperma* spp.*)*		√	√	√	√	√	
Dacryodes edulis		√	√	√	√		√
Elaeis guineensis		√	√	√	√	√	
Raphia spp.			√	√	√	√	√
Snails, larvae & insects		√	√	√	√	√	
Piper guineensis	4 countries	√	√	√	√		
Aframomum spp.			√	√	√		√
Garcinia kola		√	√	√	√		
Irvingia spp.		√			√	√	√
Prunus africana	3 countries	√		√	√		
Marantaceae (Marantochloa sp., *Megaphrynium* sp.*)*		√	√				√
Rauwolfia vomitoria			√	√	√		
Baillonella toxisperma		√			√		√
Coula edulis		√			√		√
Mushrooms				√	√		√
Honey		√	√	√			
Alstonia boonei		√			√	√	
Ricinodendron heudelotii	2 countries	√			√		
Garcinia lucida					√	√	
Dioscorea liebrechtsiana			√			√	

Source: FORENET, 2010

The major uses of these priority NTFPs are for food, fuel and medicine, with many having multiple uses. Included are species such as *Elaeis guineensis*, the oil palm, which is now extensively domesticated in large and small scale plantations, but which is still found in the wild.

The criterion of vulnerability and protection specifically focuses on ensuring sustainable management. For this, NTFPs commonly classed together, such as bushmeat, need to be distinguished at a species level. An example is provided by data from Cameroon, which indicate that about 42 % of the animals recorded as most hunted (Fa *et al.*, 2006; Abugiche, 2008; Tieguhong & Zwolinski, 2009; Willcox & Nambu, 2007; Wilkie & Carpenter, 1999; Ayeni *et al.*, 2001; van Dijk, 1999; Njiforti, 1996), are either protected species under the Forestry Law or are Red Listed as vulnerable. The significant negative impacts of bushmeat trade upon biodiversity across the region indicate that the current classification system for species protection is outdated, inappropriate and ineffective from a conservation perspective (Wilkie & Carpenter, 1999; Cowlishaw *et al.*, 2004; Robinson & Bennett, 2004; Fa *et al.*, 2005; Cowlishaw *et al.*, 2005; Abugiche, 2008; Nasi *et al.*, 2008). For plants, only a minority of the priority species are actually nationally regulated as protected or vulnerable, despite studies indicating that unsustainable harvesting (where exploitation exceeds the rate of regeneration) has been signalled for fuelwood (Marien, 2009; Assembe Mvondo *et al.*, 2009), *Gnetum* spp. (Sunderland *et al.*, 1998; Shiembo, 1998; Ingram, 2010), rattans (Dione *et al.*, 2000; Sunderland *et al.*, 1998), *Prunus africana* (Ingram *et al.*, 2009; Clemente Muñoz *et al.*, 2006; Sunderland & Tako, 1999; Cunningham, 2006) and *Baillonella toxisperma* (Jochem,1995;

Clark & Sunderland, 2004; Louppe & Mallet, 2009; Romain, 2009). As the rate of sustainable harvesting per product is highly geographically specific, and given the lack of resource inventories across the region, only a "red flag" warning of potentially unsustainable extraction rates on a national or regional level is currently possible. The vulnerability of some major traded species is exacerbated by the lack of knowledge about sustainable harvest techniques. For example, in DRC and Cameroon 40 % of *Gnetum* spp. and 70 % of all *Prunus africana* are harvested using unsustainable techniques (Ndumbe *et al.*, 2009; Nkeng, 2009) despite available guidelines.

Valuing NTFPs

The criterion concerning economic trade value reflects the adage "You can't manage what you don't measure": unless an NTFP and its chain are measured, its value and performance cannot be known or governed. The term "value", from the Latin "*valere*", means "to be of worth" or "to be strong". The term "value", however, has multiple dimensions and is perceived differently by harvesters, traders, consumers, policy makers and decision makers. Valuation methods usually focus on one aspect, economic value, namely the market value, profit or turnover. However, these indicators capture only the financial aspect and not the social value when an NTFP is consumed for subsistence, bartered or given as gifts, nor their importance for communities and households i.e. during certain seasons or when goods can only be purchased with cash or not locally. In Cameroon for example, for the Baka'a pygmies in the Centre and East regions and Anyang and Becheve groups in the Southwest region, exchange, gifts and non-cash trade account for an average between 11 to 30 % of the total quantity of fruits harvested (Ingram, 2009). Many rural, remote communities dependent upon NTFPs are also only loosely integrated into the cash economy (Campbell & Luckert, 2002). Thus, quantities and the financial value for own (household) use and local, national and international trade are important indicators of value, as well as highlighting possible sustainability tensions if demand and trade increases (Wilkie & Carpenter, 1999; Ndoye *et al.*, 1998). Financial values, however, largely ignore the environmental and ecosystem importance of a species (Ingram & Bongers, 2009; Jensen, 2009). Another problem is that current and long term economic data both on a national and regional level is largely non-existent, albeit with some exceptions, such as in Cameroon for some 26 products (Ingram & Schure, 2010) (see table 7.2 and figure 7.1). For medicinal plants, where literature has focussed on the efficacy and use of species - rather than on values and volumes - this lack of data has a distorting effect on the selection of "priority" products.

Photo 7.7: Technique used to collect NTFPs from palm trees

Table 7.2: Market value of priority NTFPs in Cameroon

Species	Value score (*)	Annual value ($)	Forest type
Fish (Catfish & other species)	4	613,600,000	All types of forests
Fuelwood (wood, charcoal & sawdust)	4	378,641,309	All types of forests
Gnetum africanum, G. buchholzianum	4	12,197,503	Lowland dense moist forest
Irvingia gabonensis, Irvingia wombulu	4	8,089,580	Lowland dense moist forest
Prunus africana	4	2,874,928	Montane forest
Dacryodes edulis	4	989,504	Lowland dense moist forest
Pausinystalia johimbe	4	847,182	Lowland dense moist forest
Ricinodendron heudelotii	4	730,325	Lowland dense moist forest
Voacanga africana	4	585,586	Lowland dense moist forest
Cola nitida	4	430,639	Lowland dense moist forest
Rattans *(Laccosperma secundiflorum, L. robustum, Eremospatha macrocarpa)*	4	284,013	Lowland dense moist forest
Cola acuminata	4	269,083	Lowland dense moist forest
Garcinia kola	4	249,938	Lowland dense moist forest
Garcinia lucida	4	171,175	Lowland dense moist forest
Baillonella toxisperma	4	11,868	Lowland dense moist forest
Piper guineensis	4	78.9	Lowland dense moist forest
Xylopia aethiopica	4	no data	Lowland dense moist forest
Acacia senegal, Acacia polyacantha	3	4,040,000	Savanna
Bushmeat (small mammals, ungulates, reptiles, rodents)	3	2,799,330	Moist forest, savanna & montane forest
Raphia spp.	3	1,574,661	Moist forest, savanna & montane forest
Apiculture: beeswax / honey	3	244,420 / 61,105	Savanna, montane forest
Tetrapleura tetraptera	3	124,489	Lowland dense moist forest
Rauvolfia vomitoria	3	94,803	Lowland dense moist forest
Cinchona spp.	3	31,500	Lowland dense moist forest
Kigelia africana	3	18,000	Moist forest and montane forest
Carpolobia lutea, Carpolobia albea	3	5,911	Humid & montane zones
Aframomum spp.*(melegueta, daniellii, citratum)*	3	no data	Lowland dense moist forest
Alstonia boonei	3	no data	Lowland dense moist forest
Coula edulis	3	no data	Lowland dense moist forest
Garcinia mannii	3	no data	Lowland dense moist forest
Guibourtia tessmannii	3	no data	Lowland dense moist forest
Harungana madagascariensis	3	no data	Lowland dense moist forest
Khaya ivorensis	3	no data	Lowland dense moist forest
Lophira alata	3	no data	Lowland dense moist forest
Lovoa trichilioides	3	no data	Lowland dense moist forest
Megaphrynium macrostachyum	3	no data	Lowland dense moist forest
Milicia excelsa	3	no data	Lowland dense moist forest
Monodora myristica	3	no data	Lowland dense moist forest
Morinda lucida	3	no data	Lowland dense moist forest
Nauclea diderrichii	3	no data	Lowland dense moist forest
Poga oleosa	3	no data	Lowland dense moist forest
Scorodophloeus zenkeri	3	no data	Lowland dense moist forest
Terminalia superba	3	no data	Lowland dense moist forest
Trichoscypha arborea	3	no data	Lowland dense moist forest
Vitellaria paradoxa	3	no data	Savanna

(*) See table 7.3 for the meaning of score value.

Source: Ingram & Schure, 2010

Table 7.3: Value scoring system used in Cameroon

Score	Use
1	Minor consumption (for cultural, medicinal, alimentation, tools, construction use)
2	Multiple use species (consumption) Limited trade (local trade or barter/exchange)
2.5	Multiple use and local and regional trade
3	Wide scale trade (important revenue source for livelihoods, regional to national and international trade)
	Multiple use species (consumption and trade) Major consumption (important cultural, medicinal, alimentation, tools, construction use) Species classified as protected or vulnerable
4	Major consumption and wide scale trade nationally and/or internationally and/or protected

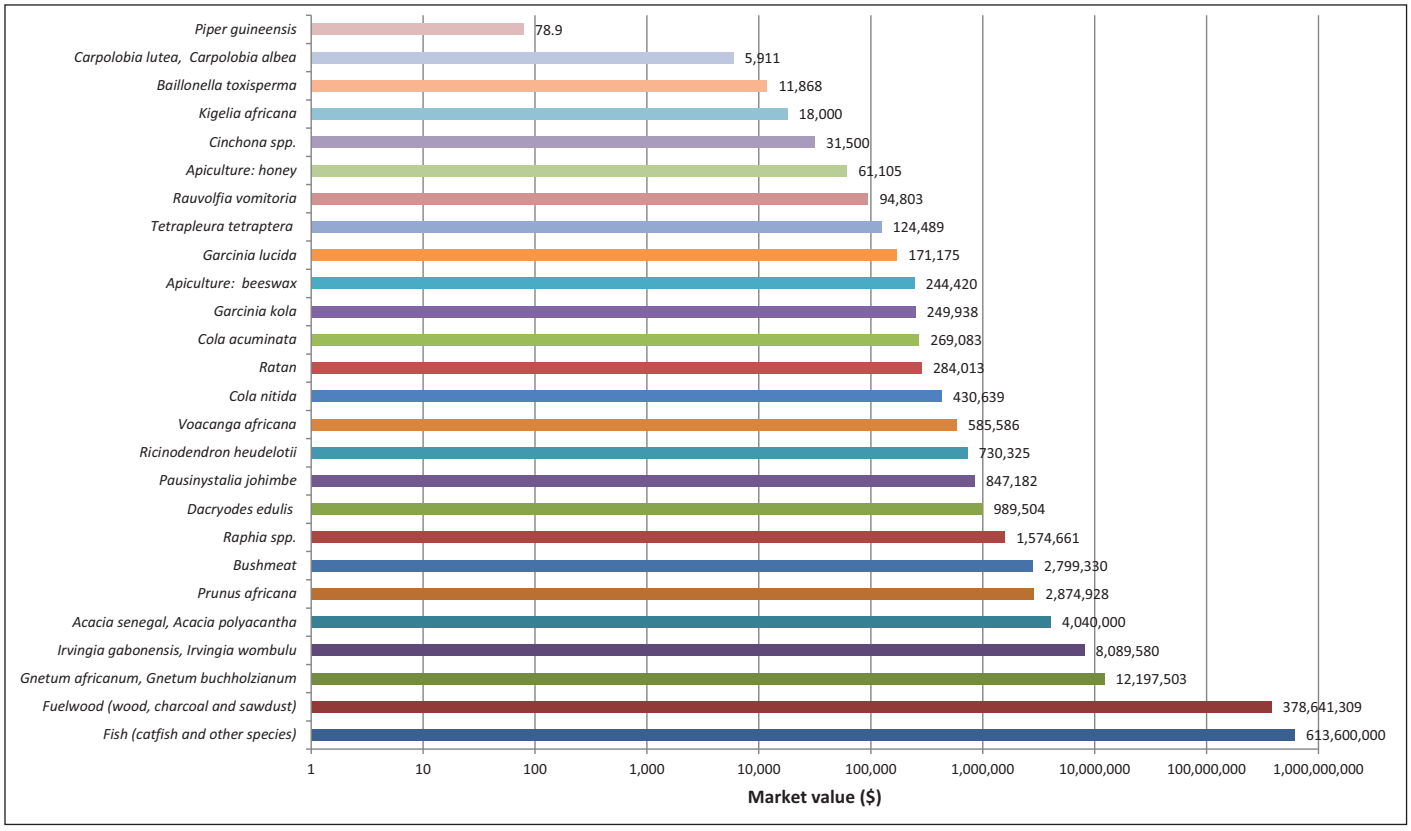


Figure 7.1: Market value of priority NTFPs in Cameroon
Note: market value is represented in logarithmic form
Source : Ingram & Schure, 2010

To compensate the fact that valuing usually focuses only on economic aspects, a multi-faceted but simple scoring system of value that incorporates own use, consumption, barter and non-cash trade is used (table 7.3). This elaborates on the values and importance rankings used in other studies (Zapfack & Ngobo, 2001; Termote *et al.*, 2010). Where data was not provided on the importance, and species had only one use, a "minor consumption" score was given. Species with multiple uses, and from which multiple parts are used, were scored having a higher intrinsic value. Market observations highlight the discrepancy between, on one hand data which focuses on the high value, wide scale often long distance trade in NTFPs such as *Gnetum* spp., *Irvingia* spp. and *Dacryodes edulis*, and on the other hand the 100 or so NTFPs, which are commonly traded and consumed in Central Africa, but for which little data on volumes and values used and traded exists. An explanation for this paradox is that as many of these species have multiple products and uses, the full trade, economic and social value of multiple uses is not captured by market surveys or market information systems, as these tend to focus on food use. *Raphia* species, with over 30 different products, derived from 6 parts, are an excellent illustration of this. Table 7.4 shows the outcome of the valuation exercise for the region.

Photo 7.8: Bush mango (Irvingia spp.) kernels

Table 7.4: Valuing of priority NTFPs in the Congo Basin

Priority NTFPs (trade &/ or consumption)	Trade / consumption (*)		Unsustainable exploitation	Multiple uses	Conflicting uses	Multiple parts used	Vulnerable or protected species	Total score
Prunus africana	L I	C	**	**	**	**	**	13
Baillonella toxisperma	L I	C	**	**	**	**	**	13
Bushmeat (multiple species of mammals & reptiles)	L N I	C	**	**		**	* (some species)	11
Fuelwood (multiple species)	L	C	*	**	**	**	* (some species)	10
Irvingia spp.	L N	C		**	**	**		9
Rauwolfia vomitoria	L I	C		**	**	**		9
Gnetum spp.	L N I	C	**	**				8
Apiculture (honey, beeswax)	L N I	C		**		**		8
Garcinia kola	L	C		**		**	**	8
Alstonia boonei	L	C		**	**	**		8
Rattans (e.g., *Eremospatha* spp., *Laccosperma* spp.)	L N	C	* (some species)	**			* (some species)	7
Dacryodes edulis	L N	C		**		**		7
Elaeis guineensis	L N	C		**		**		7
Raphia spp.	L N	C		**		**		7
Piper guineensis	L N	C		**		**		7
Coula edulis	L I	C		**		**		7
Garcinia lucida	L	C	*	**		**		7
Aframomum spp.	L	C		**		**		6
Cola acuminata & *C. nitida*	L N I	C						4
Snails, larvae & insects	L	C					**	4
Marantaceae (Marantochloa sp., *Megaphrynium* sp.)	L	C		**				4
Ricinodendron heudelotii	L N	C						3
Mushrooms	L	C						2
Dioscorea liebrechtsiana	L	C						2

(*) L = local, N = national, I = international, C = subsistence consumption

Source: Ingram & Schure, 2010

Regulatory and policy framework

A robust regulatory and policy framework can, alongside customary practices, aid sustainable management and increase the contribution of NTFPs to national economies.

Introduction

COMIFAC members have recognized the role of NTFPs in reducing poverty, realizing economic development and conserving biodiversity (Lescuyer, 2010b; FORENET, 2010; Tieguhong *et al.*, 2010a; Chupezi *et al.*, 2009; Ndoye & Tieguhong, 2004). However, the NTFP sector is negatively affected by inconsistent legal and institutional policies that do not favour effective management and commercialization of the resources (Ndoye & Awono, 2009; Tieguhong *et al.*, 2010). In recognition of this, COMIFAC reiterated the need to improve the legal and institutional frameworks governing the NTFP sector in its Convergence Plan, which recently formed a strategic intervention by means of four pan-regional research and development projects and activities in the region (FORENET, 2010; FAO *et al.*, 2008; COMIFAC, 2008). The COMIFAC Directives however focus on vegetal products, whilst the prioritization indicates that fauna products - both bushmeat and forest fish - are equally important.

Photo 7.9: Aiélé (Canarium schweinfurthii) fruit

Legal issues governing NTFP sector

The legal aspect in exploiting NTFPs has become clearer as concepts such as access and user rights, governance, decentralization, corruption, illegality and transparency have evolved. Current legal frameworks however are not wholly effective in sustainably managing NTFPs, instead causing administrative bottlenecks to obtain exploitation and trade permits, a multiplicity of controls and payment of bribes with resulting high administrative and transaction costs for producers and traders in NTFP value chains. As an example, in Cameroon, for the transportation and commercialization of *Gnetum* spp. from production area to export zones over one year, some thirteen groups of actors extorted CFA 114,219,600 ($ 228,439), equivalent to 33.5 % of transaction costs in the majority (82 %) of 18,368 transactions registered (Tieguhong *et al.*, 2010). Of 302 journeys made by these traders in 2008, on average 60 controls were made during the 600 km journey and at each post, between five minutes and up to five hours was spent, with an average 74 tons classed as substandard and 26 tons perishing over this period. The time wasted and loss of products raises prices for traders and consumers, reduces profit margins for traders, and increases volumes harvested to meet demand, as well as resulting in overloading of vehicles (resulting in higher risks of road accidents) and lower prices paid to local producers (Tieguhong *et al.*, 2010; Ndoye & Awono, 2009).

Photo 7.10: Collections of "cattle sticks" near Takamanda National Park, Cameroon

In most Central African countries, access to permits for NTFPs is as complicated and comparable to trading in timber. The main difference tends to be the scale of capital outlay, which is much larger for timber, with long and cumbersome administrative procedures for small and medium scale business (Tieguhong *et al.*, 2010; Ndoye & Awono, 2009; FAO, 2009). In Cameroon, for example, "Special forestry products" are regulated by the forestry administration through a system of quotas set annually. Although the committee deciding the products annually is drawn from different ministries, the quotas set and allocated are not based on any resource inventories but are demand led. In some cases, social ties to members of the quota allocation committee and the influence of higher ranking officials play critical roles in the process. The consequence is that quotas are allocated to individuals not actively participating in the NTFP value chain beyond the stage of quota allocation (Ndoye & Awono, 2009). These individuals resell quotas to traders in the form of waybills at higher prices, up to 800 % in some years, per unit of product traded than the government tax rate. These loopholes mean that small traders find it difficult to obtain permits, paying more to do business or, as the majority of small scale operations do, operating informally and illegally without permits. This is possible given the low level of enforcement of permits and high levels of corruption, plus the low level of knowledge about permitting by officials in the field. Government revenues from taxes in the NTFP sector are therefore not optimized, not showcasing the real economic or social impact of the NTFP sector to policy makers.

Improving regulation

Collective action and small initiatives, often micro-enterprises, based on NTFP value chains can be viable options to reduce poverty and combat food insecurity in Central Africa (Molnar *et al.*, 2010; Awono *et al.*, 2010). However, the weaknesses in current legal and institutional policies do not favor NTFP based business growth and expansion. Conflicting and overlapping customary and formal regulations make management difficult and recognition of positive customary regulations could aid sustainable management (Laird *et al.*, 2010). Good governance (defined as a product of good laws and their appropriate implementation) provides a yardstick for sustainable forest management including NTFP production and commercialization. The identification of weaknesses in current forest codes and legislation across Central African countries have culminated in a participative multi-stakeholder process to produce sub-regional guidelines on sustainable management of NTFP of plant origin in Central Africa, adopted by COMIFAC in 2008 (FAO *et al.*, 2008). These guidelines aim to aid the revision of existing national laws, taking more account of the realities in the NTFP sector. The national forest policies should be redrafted, drawing extensively on these sub-regional guidelines using a participatory approach involving relevant stakeholders. Cameroon has used these guidelines to revise its 1994 Forest Law. Gabon, Congo, and the CAR have already started the process of adapting the sub-regional guidelines to their national contexts, while the DRC will begin in 2011. A second step will be to elaborate decrees of application and the terms and conditions.

A strategic national action plan to promote the development and sustainable management of NTFPs has already been developed in Congo and similar plans are being carried out in Gabon and CAR.

Monitoring

Monitoring permits an awareness of the state of NTFPs and enables a response to changes occurring over time, for example, due to harvesting. It is an important tool to provide information on the effectiveness and efficiency of resource management and further identifying priority species for support or protection. Monitoring is based, for example, on regulations and the efficacy of control systems, level of domestication, exploitation techniques, processing and storage technologies. Currently few NTFPs are monitored for resource availability, use and trade. Only a handful of the most threatened NTFPs in Central Africa are monitored under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES): elephant ivory (*Loxodonta africana*), leopard skins (*Panthera pardus*) and pygeum bark (*Prunus africana*). Whilst many countries in the region record annual permits and exports for particular NTFPs, these do not reflect actual use or trade - due to problems faced in implementing permit systems, the informal nature of most trade and the higher priority given to tracking timber for export. Given the wide range of NTFPs exploited, a key issue in monitoring is deciding which products to monitor, how and what to measure. A proposal for how to define these priorities is made in box 7.4., and table 7.5 illustrates the data required for a regional monitoring of NTFPs.

Table 7.5: Themes and indicators for NTFPs monitoring

Type of data	Monitoring indicators
Knowledge of the resource (potential of priority NTFPs in forest)	Habitat Inventory
Production	Main collection areas Collection method Stakeholders Gender Employment generated Production period Volumes Availability Domestication Constraints
Commercialization	Stakeholders Markets Origin of products Destination of products Volumes Costs Profits Constraints
Processing, packaging and storage	Processing tools Level of processing Derived products Constraints
Consumption	Local scale International scale Energy supply

A regional approach is recommended to harmonize both forestry directives as well as economic and food security, as it is clear that NTFP use and trade crosses national borders. COMIFAC, aware of the legal, institutional, and fiscal needs for convergence and harmonization, have allocated the role of NTFPs monitoring to the Observatory for the Forests of Central Africa (OFAC), to provide both COMIFAC and CBFP members with a powerful steering and data sharing tool to promote better and more coordinated research, governance and sustainable management of forest ecosystems.

The availability of NTFPs on both a national and regional level is currently largely unknown. Inventories are therefore essential for priority NTFPs on a national scale, supported by long term studies (at least five years) to determine their density, actual yields, and their qualitative and quantitative economic, social and ecological value. Collecting such data is only possible when harvesters are recognized more formally and the value chains of these products are understood.

Photo 7.11: Products from palm trees are used for multiple purposes

The methods used to classify and monitor NTFP based commerce need to be harmonized on a national level to allow inter-country comparison, supported by multidisciplinary databases (ethnobotany, socio-economic, ethnozoology and ethnomycology). Principal monitoring activities include: (i) the selection of representative regional study sites (for moist forests, savannas, coastal areas, swamps and mountains), (ii) the selection of the types of information required (i.e. qualitative, quantitative, spatial, legal and institutional) (Betti, 2007), and (iii) agreeing on monitoring indicators to be used to indicate the state of the resource and current management. This should include (a) economic and social indicators (such as the contribution to national product, number of people employed, markets, fiscal and tax revenues, and gender and minority ethnic group implications); (b) a regulatory and institutional framework (existence of regulations, compatibility with customary rights and practices, national strategies, specialized administrative services); (c) resource availability (such as multiple resource inventories and maps of production areas); and (d) a good definition of the sampling strategy and methodology used for inventories.

Further research is needed on high value NTFPs. These are currently scientifically poorly understood. It is important to obtain herbarium specimens, and study the reproduction, propagation and domestication techniques and harvest trials to enable introduction into agro-forestry and farming system, counteracting the risk of over-harvesting in the wild. This is particularly important for vulnerable species.

Strategies for sustainable management

Challenges

Given the current status of NTFPs in the region, the barriers to have a local, let alone national and regional sustainable management of NTFPs are as vast as the Congo Basin forest itself. Challenges include how to ensure sustainability by moving products out of the forest and onto the farm, where issues of tenure, ownership, access and management are often less contentious. Tenure, both of forested land and individual trees, has been shown to be extremely important to ensure sustainable resource use (Guariguata *et al.*, 2011; Laird *et al.*, 2010; Molnar *et al.*, 2010). Domestication techniques do exist and are widely applied for several of the most common NTFPs such as oil palm, raphia, safou and cola. But for many with a large trade and which are difficult to cultivate (such as *Gnetum*) the challenge is to ensure they are more widely known. A major hurdle is to overcome the threat of unsustainable and insecure supply in the face of increasing rural and urban demand, coupled with a lack of checks and balances due to the current inconsistent policies, agencies and regulation, poor governance and a lack of domestication policies. The informality of the NTFP sector, combined with its "hidden" and largely institutionally unsupported nature, also means that the value chains are often inefficient due to ineffective or non-existent market information systems, access to finance and technical support. The majority of NTFPs are inefficiently marketed, resulting in losses of up to 8 % of harvest for *Irvingia* spp., *Gnetum* spp. and *Dacryodes edulis* in Cameroon and DRC, particularly at the earlier stages of the chain. Very low levels of processing and transformation often result in only minimal value and profit being added. This together with undeveloped or unapplied processing technologies, associated with lack of chain-wide knowledge and coordination, lead to improper coordination of consumer preferences and demands with supply. Corruption creates an unfavorable business climate, so that whilst NTFPs provide an income for many, how that income is distributed amongst those concerned in the trade is often highly inequitable, causing revenues for the state, individuals and small enterprises to be highly unpredictable.

Opportunities

Potential to improve the sector and its contribution to national economies and livelihoods are apparent. On a national level, stakeholders in DRC and Cameroon have shown that they are open and willing to participate in formulating policy options and proposing revisions to the national framework to rationalize, simplify, and harmonize some of the contradictory policy and regulatory extremes and inappropriate legal framework. In Gabon and CAR, discussions are underway with stakeholders to put in place national strategies on NTFP to improve the sector. Secure tenure appears critical to sustainable exploitation and domestication. Tenure rights are one of the thorny issues deeply embedded in the conflict between customary and administrative systems in Central Africa and appear less likely to be changed in the short term. Domestication however is ongoing on a small scale and continues to be a key aspect in ensuring a sustainable supply. Promising results have been shown from *Dacryodes edulis* and *Gnetum* spp. agro-forestry projects in Cameroon. However, the up-scaling of pilot projects and demonstration, coupled with extension services are essential to integrate NTFPs into everyday farming systems and take pressure off wild harvesting. Products such as *Gnetum* spp. illustrate that while they are still "freely" available in the wild, and can be harvested without too much effort, and tricky domestication techniques are unknown, uptake is modest but can be greatly improved with training and support (Wirsiy *et al.*, 2010). However, when products are of sufficient value and scarcity, such as *Prunus africana*, and domestication techniques are well disseminated, such as for *Cola* and safou, adoption is more successful (Pye-Smith, 2010). Opportunities to increase employment and profitability by developing national, cross ministerial policies to secure and professionalize the sector instead of criminalizing it, have also positive response in parts of the region. These have provided business, infrastructure, and technical support and enabled market information system trials and value chain platforms, facilitating the operating environment for individuals, small enterprises and value chains,

particularly in cross border cooperation. A focus on processing, storage and value adding techniques/technologies has also been demonstrated for products such as bush mango. They could offer enormous potential to increase profit margins but may also have negative effects on sustainability (if demand is stimulated without securing supply) unless it is well managed. Equally, sustainable harvest techniques exist for several priority species such as *Cola nitida*, *Ricinodendron heudelotii*, *Gnetum africanum* and *Irvingia* spp. (Facheux *et al.*, 2006), rattan (Tshimala-Tshibangu *et al.*, 1996; Sunderland, 2001), bamboo (Ingram *et al.*, 2010), *Garcinia lucida* and *Garcinia kola* (Guedje & Fankap, 2001), *Prunus africana* (Republic of Cameroon, 2009; Tsobeng *et al.*, 2008; MOCAP-CIG, 2007), *Gnetum* spp. (Shiembo *et al.*, 1996; Blackmore & Nkefor, 1998; CENDEP, 2010), and apiculture (Bees for Development, 2008; Anembom Consulting, 2008), but need much wider dissemination.

Future needs include reinforcing the links so that researchers can inform policymakers and NTFP value chain actors on study findings; and a debate to develop consensus among actors in the value chains (harvesters, traders, regulators, consumers) on the criteria for "priority" NTFPs, using a "holistic" approach nationally and regionally. This could be coupled with the current revision of national forestry laws and enforcement mechanisms to ensure a harmonized regional approach. Management implies measuring, and so a realistic, common methodology for data collection and monitoring, is essential.

Photo 7.12: Honey is a common and very appreciated NTFP throughout Central Africa

PART 3

CURRENT CHALLENGES FACING FOREST MANAGEMENT IN CENTRAL AFRICA

CHAPTER 8

International negotiations on the future climate regime beyond 2012: achievements from Copenhagen to Cancún and benefits to the forests of the Congo Basin

**Martin Tadoum, **Vincent Kasulu Seya Makonga, ***Georges Claver Boundzanga, ‡Olivier Bouyer, ##Olivier Hamel, ###Gary Ken Creighton*

**COMIFAC, **MECNT, ***CNIAF, ‡ONFI, ##CIRAD, ###WWF*

Preamble

Reference is made to chapter 11 of the 2008 report on the State of the Forests, "Congo Basin Countries and the Reduced Emissions from Deforestation and Degradation (REDD) Process", which explains how the Central African Forests Commission (COMIFAC) prepared its position for the international negotiations following the 1997 Kyoto Protocol (KP) up until the conclusion of the 14th Conference of the Parties (COP-14) in Poznań in December 2008, which preceded the Copenhagen COP-15. The following chapter continues to document this process, starting with Copenhagen and including the Cancún COP-16 (Mexico), one year before the Durban COP-17 (South Africa).

Photo 8.1: "***Forest giants***" ***are occasionally still found in forest concessions (Wijma concession in Cameroon)***

Brief reminder on the negotiations since Rio in 1992 on the eve of the Copenhagen COP-15

Almost two decades ago, countries worldwide met in Rio de Janeiro (Brazil), and adopted an important international treaty entitled: the United Nations Framework Convention on Climate Change (UNFCCC). Article 2 of the Convention describes its ultimate objective, which is "to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The Convention was geared principally towards mobilizing the northern industrialized countries (Annex 1 of the Convention)[39] to take "mitigating" measures with regard to their GHG emissions and to assist southern countries (non Annex 1 countries)[40] to "adapt" to the adverse effects of climate change brought about by the historical emissions of the northern countries, thereby compensating for the loss of opportunities that they had to suffer.

The Convention, which entered into force on 21 March 1994, recognizes four major principles which are: (i) the precautionary principle, (ii) the principle of equity, taking into account the "common but differentiated responsibilities and respective capabilities of each of the Parties", (iii) the principle of pollutants which states that the industrialized countries of the Convention should take responsibility for southern countries' mitigation and adaptation costs, and (iv) the principle of the right to (sustainable) development of all countries. As the Convention did not specify the reduction and stabilization levels for greenhouse gases, the Parties to the Convention decided in

[39]Annex 1 of the Convention includes the industrialized countries and countries with economies in transition.

[40]Developing Countries (DC) and emerging countries are grouped under the label "non Annex 1 countries".

1997 to adopt binding commitments to reduce emissions by adopting the Kyoto Protocol (KP). The Protocol, which is an amendment to the United Nations Framework Convention on Climate Change (UNFCCC), entered into force on 16 February 2005. Without imposing reduction constraints on southern countries, the KP in its first commitment period (2008-2012), contains legally binding measures whereby, in accordance with Annex B of the Protocol[41], industrialized countries have to reduce their collective emissions by 5.2 % from 1990 levels.

To allow the northern countries to meet the commitments they agreed to in Annex B, the Protocol authorizes them to use three so-called "flexible" mechanisms: (i) one of these mechanisms allows Annex I countries to exchange quotas ("Emissions Trading Mechanism"), (ii) another allows industrial entities in these same countries to exchange pollution rights ("Joint Implementation Mechanism"), and (iii) the last one provides for exchanges between the northern countries and entities in the South (non Annex 1 of the Convention), and is entitled the "Clean Development Mechanism" (CDM).

At the 11th Conference of the Parties (COP-11), held in Montreal (Canada) in 2005, Papua New Guinea and Costa Rica, as part of their preparation for the post-Kyoto 2012 negotiations, requested the international community to take into account emission reductions in the forest sector, underlining the impact of deforestation on global GHG emissions. Supported by other countries with tropical forests, including those in the Congo Basin, the new issue of Reducing Emissions from Deforestation (RED) in Developing Countries became one of the major negotiating items among the Parties. Consequently, since 2006, countries and sub-regional or regional entities have shown great interest in this subject. In 2007, the COP-13, held in Bali, was an important step in the process of recognizing REDD as a contributory mechanism for climate change mitigation.

With regard to the Bali Action Plan that centered on shared vision, mitigation, adaptation, financing, transfer of technology and capacity-building, the Central African countries in the COMIFAC group have remained steadfast in their positions (de Wasseige *et al.*, 2009 - Chapter 11 and submissions by Central African countries). In particular, Congo Basin countries initiated the process of extending RED to REDD, thereby incorporating an important new element, which is taking forest degradation in developing countries (DC) into consideration (see box 8.1).

In Bali, the Parties agreed to extend the negotiations for two years with a view to finalizing them in 2009 at the 15th COP session in Copenhagen. These negotiations were to allow for the adoption in Copenhagen of a legally binding agreement on climate change for the post-Kyoto 2012 period; its legal form remains open for debate.

Photo 8.2: Oil exploitation also occurs in the heart of the Congo Basin forests

[41]Annex B of the Kyoto Protocol attributes emission reduction commitments for each Annex 1 country.

Results of the Copenhagen Conference

The 15th Conference of the Parties (COP-15) for the climate Convention was held from 7 to 19 December 2009 in Copenhagen, Denmark. There was unprecedented attendance with approximately 45,000 participants, including 130 Heads of State and Government. However, deep-rooted disagreement persisted between the major industrial nations, emerging nations and DC. These related to: (i) the northern countries' objectives/targets for reducing GHG; (ii) the constraints that could be tolerated by the emerging nations, (iii) the financial amounts for adaptation and mitigation and, (iv) the transfer of technology. These divergences prevented the adoption of a new global and binding protocol.

Nevertheless, a minimum agreement, expressed as a Declaration entitled the "Copenhagen Accord"[42], was adopted on 18 December 2009 by the Heads of State of 28 industrialized and emerging nations[43]. It represented 80 % of the world's global emissions while the Kyoto Protocol only represented 30 % of emitters. Despite being supported by a large majority of countries, the Accord was not adopted unanimously by the Parties and, therefore, could not be considered legally binding for the United Nations. Consequently, COP-15 could only "take note" of its existence, incorporating it into the regular negotiating process of the United Nations.

The Accord confirms the need to limit global warming to 2°C compared to pre-industrial temperature levels. The signatories, consisting of developed and emerging countries, specified in an annex (made official on 31 January 2010) their respective "commitments" to reduce their emissions. Although these goals/intentions are not binding at this stage, it is nevertheless mentioned that international verification, based on respect for the commitments, is allowed "with respect being given to national sovereignty". Although it still remains extremely vague, this formulation led to an agreement between the USA-EU and BASIC countries.

Photo 8.3: Eucalyptus tree nursery, EFC company (Eucalyptus et Fibres du Congo), near Pointe-Noire, Republic of Congo

At the same time, the Accord includes financial commitments by the industrialized nations, based on $ 30 billion under a "Fast Start"process for a three-year period (2010-2012) for adaptation and mitigation. These same countries "also have as their objective to jointly mobilize $ 100 billion per year from now until 2020 to respond to the needs of the developing countries in the framework of significant mitigating actions". All means are envisaged, "including recourse to markets" so that these financial resources can be mobilized.

A large portion of new and supplementary resources will need to go through the "Green Climate Fund", which was established in Copenhagen. The Fund was set up as an operating entity with responsibility for the Accord's financial mechanism. At the same time, a so-called "technology transfer" mechanism was established in order to speed up the development and transfer of technology that would facilitate adjustment to climate change and mitigate emissions from voluntary southern countries. It is furthermore specified that a governance mechanism, incorporating equal representation from developed and developing countries, would be established, in particular for the purposes of adapting to climate change.

[42] http://unfccc.int/files/meetings/cop_15/application/pdf/cop15_cph_auv.pdf

[43] Including USA, EU and so-called BASIC countries (Brazil, South Africa, India and China).

More specifically, in the context of mitigation measures in the forest sector, article 6 of the Accord recognizes the importance of forest degradation and the effects of emissions from deforestation. It further acknowledges the need for immediate positive incentives for the benefit of DC in order to reinforce the absorption of GHG emissions by the forests through a REDD+ mechanism[44]. Over the period 2010-2012, 20 % of the global sum could be devoted to setting up this REDD+ mechanism, i.e. $ 6 billion.

In view of the urgent need to combat climate change effectively, the outcome of COP-15 in Copenhagen was considered to be disappointing. Although the Copenhagen Accord is positive, it underlines the remaining work that still needs to be accomplished at the Cancún (2010) and Durban (2011) COPs in order to reach a satisfactory, binding agreement before the Kyoto Protocol expires. A number of Parties feel that the Accord has left them with a bitter taste since most of the developed countries accepted that the UN multilateral process could be diluted, which means that Copenhagen was as much a failure as it was an inadmissible opportunity to dispense with United Nations arbitration and any binding climate change agreement. From this point of view, Copenhagen was disappointing but without any agreement at all, it would have been a total failure.

[44]Integrating reduction goals for emissions resulting from deforestation and forest degradation in developing countries, as well as conservation and forest sustainable management and strengthening of forest carbon stocks.

Box 8.1: Position of COMIFAC countries

Since the Montreal Conference of the Parties (COP-11), held in 2005, COMIFAC countries have chosen to work together to develop concerted and common positions and make their presence felt in climate negotiations. This strategy has attracted close international attention.

Strengths of the various positions of COMIFAC countries in climate negotiations:

From 2005 to 2009, COMIFAC countries presented 5 submissions of views (one submission per year) to the Subsidiary Body for Scientific and Technological Advice (SBSTA) of the United Nations Framework Convention on Climate Change (UNFCCC). These submissions related to the following key topics:

- Funding sources;
- Methodological and technical questions;
- Field of application;
- Reference scenario;
- Scale.

The 2007 and 2008 submissions of views underlined the relevance and consistency in the position of the COMIFAC countries as it was presented at Copenhagen in December 2009. In submission No 4 of 25 March 2008 to the 28th session of SBSTA (FCCC/SBSTA/2008/MISC.4), COMIFAC countries requested the explicit inclusion of (i) conservation and sustainable forest management in the REDD, and (ii) the improvement of forest carbon stocks (e.g. forest plantations, agro-forestry). It is these new elements which helped to establish REDD+ in Copenhagen. COMIFAC countries reiterated their wish to have adjusted reference scenarios and highlighted the importance of having two scale levels in the Congo Basin. They underscored their requirements to strengthen their technical capacity for monitoring the forest cover and carbon stocks. In this submission No 4, they reaffirmed their wish for:

- A carbon market, which is one of the instruments that can provide sustainable financial resources for the REDD;
- The establishment of a stabilization fund to remunerate the environmental services of standing forests;
- Answers to methodological and technical questions under debate;
- The explicit inclusion of sustainable forest management which, instead of being a factor of degradation, is presented by the Congo Basin countries as a form of preservation. Due consideration should be given to sustainable management providing possibilities for offsetting emissions and increased carbon stocks in growing forests;
- An adjusted reference scenario dependent upon national circumstances. Countries will have to state their choice of factors to be taken into account in an adjustment of their reference scenarios;
- Sub-national approaches which would allow countries to acquire the necessary experience to progressively evolve towards a national approach.

Post-Copenhagen negotiations: what was achieved?

Following the limited progress achieved in Copenhagen, the Parties really wanted to intensify negotiations so as to reach real agreement in Cancún. In addition to the formal negotiations, carried out under the auspices of the United Nations, some countries set up parallel and informal mechanisms to expedite the discussions on certain aspects. One such example of this was the informal negotiations to set up the interim REDD+ partnership that was supported and backed by France and Norway.

During the formal negotiation process, meetings were held in Bonn and Tianjin (China) in June, August and September-October 2010, during the last stretch before Cancún.

Photo 8.4: Human activities continue to push back the forest

Setting up the Interim REDD+ Partnership

In an attempt to encourage discussions and consolidate what the Copenhagen Accord had achieved on REDD+, France and Norway announced that they were ready to work together to implement article 6 of the Accord. Two international conferences were therefore held on 11 March and 27 May 2010 in Paris and Oslo on climate and forests respectively.

With regard to the financial component of REDD+, commitment had already been made to devote 20 % of the overall amount of the "Fast Start" to the 2010-2012 period, in addition to promises of $ 3.5 billion that had already been made in Copenhagen. The Paris and Oslo conferences brought the total amount of money committed for the period to $ 4 billion. These conferences also contributed towards establishing an informal structure called the "Interim REDD+ Partnership", which is responsible for coordinating early financing for REDD+. The "REDD+ Partnership" has as its objective to serve as a "voluntary, legally non-binding, temporary framework" so that partners can intensify REDD+ activities and funding and to this end take immediate measures to improve the effectiveness, transparency and coordination of initiatives and financial instruments.

To ensure governance, the initiative has devised a system of co-chairing by one country from the North and one from the South. The mandate for the co-chairmanship is for six months. In an effort to achieve economies of scale and encourage collaboration, the FCPF[45] secretariat and the UN-REDD secretariat agreed to share responsibility for secretariat services.

Despite its informal status, the REDD+ Partnership raised considerable hope on the part of the COMIFAC member States, all of which joined the initiative. Countries in the sub-region are expecting this partnership to mobilize new and additional financial resources that will allow them to carry out their respective REDD+ related strategies. These countries announced at the Oslo Conference that they needed $ 200 million for the period 2010 - 2012 in order to be able to undertake their activities during the preparatory phase (readiness). The countries in question arrived at this calculation through their respective R-PP[46] and national REDD strategies.

The REDD+ Partnership succeeded in recording all funding[47] proposed by partners, acknowledging that not all promised funds were additional and new resources. Partners from the North recorded their various forms of support by integrating all their ongoing commitments, whether in the context of the REDD process or that of global forest management, and whether they were bilateral or multilateral initiatives.

As a result of this partnership, achievements have been recorded in mobilization and coordination of early funds for REDD+. Nevertheless, countries' needs, especially those of the Congo Basin countries, are still substantial. Increased pressure should therefore be put on northern partners so that they provide developing countries with the additional resources that will enable them to effectively develop their national strategies.

[45] "Forest Carbon Partnership Facility", an initiative of the World Bank.

[46] R-PP:Readiness Preparation Proposal.

[47] The Partnership's website (http://reddpluspartnership.org/en/) provides detailed information on REDD+ financing.

Box 8.2: Declaration of Central African Forest and Environment Ministers post-Copenhagen

(Adopted in Brazzaville on 21 April 2010)

Following the Copenhagen Accord on Climate Change of 18 December 2009, Central African Ministers maintained that:

- The coordination of "Fast Start" funds should take into account the specifics of lightly degraded forests in the Congo Basin so that they are treated in the same way as other tropical forests in large basins;
- The coordination should include criteria for ensuring the equitable distribution of "Fast Start" funds that are not only based on the level of deforestation and the will of donors, but also on the needs expressed by the countries. Access and payment procedures should be harmonized and simplified so as to ensure that COMIFAC countries benefit from an equitable distribution of the funds;
- Coordination and transparency mechanisms are instrumental in the success of the REDD+ Partnership. To achieve this, it is important that a system be established to coordinate the sources and early REDD+ funding initiatives;
- The international community is providing for an urgent allocation of $ 200 million as early financing for countries in the Congo Basin to support their activities during the readiness phase. The Congo Basin Forest Fund (CBFF), the Forest Carbon Partnership Facility (FCPF) and UN-REDD are the main implementing partners;
- The international community endorses funding phase 2 of the REDD+ process for ECCAS-COMIFAC member countries to implement national REDD+ strategies that were developed during phase 1. The main partners are the Forest Investment Program (FIP), the CBFF, the FCPF, UN-REDD, the Central African States Development Bank (BDEAC), etc.;
- A small secretariat should be established to monitor and make suggestions for an improved allocation of "Fast Start" funds and initiatives, and representation of Central African countries in accordance with the principle of two countries per region. For this purpose, the Central African Republic (CAR) and the Democratic Republic of Congo (DRC) should be the designated representatives;
- Development partners of ECCAS-COMIFAC countries should harmonize and coordinate their interventions in the context of their national R-PPs;
- The 2nd International Forum on Central Africa Indigenous Peoples (FIPAC 2), to be organized in the Republic of Congo on the "Indigenous peoples' rights and biodiversity preservation processes in the Congo Basin", should incorporate concerns related to climate change.

And call for:

- Developed countries to provide increased assistance and amounts of early REDD+ funding to support adaptation activities;
- The international community to pursue negotiations in order to reach a legally-binding post-Kyoto agreement on climate change;
- The establishment of a sub-regional REDD+ Coordination body, under the auspices of COMIFAC, which will be responsible for establishing policies, strategies, norms and action plans on REDD+ in Central Africa in collaboration with all stakeholders, including development partners, civil society and indigenous populations. The Republic of Congo has been designated to act as the coordinator. The specific terms of reference for such a sub-regional coordination body should be drawn up by the COMIFAC Executive Secretary in collaboration with the authorities of the Republic of Congo;
- Other ECCAS-COMIFAC member States to adhere to the UN-REDD programme, in addition to the DRC and the Republic of Congo.

Tianjin negotiations: final hurdle before Cancún

The last session of the Climate Convention negotiations prior to the Cancún Conference were held from 2 to 9 October 2010 in Tianjin. Although this was the final hurdle before Cancún, where the preparatory negotiations for the post-2012 UN climate regime were supposed to be finalized, this session only assembled 2,300 people, which is twenty times less than in Copenhagen.

Fundamental differences persisted between the Parties on the various key issues being negotiated in the *Ad Hoc* Working Group on the Kyoto Protocol (AWG-KP) and the *Ad Hoc* Working Group on Long-term Cooperative Action (AWG-LCA). These were on: shared vision, mitigation, adaptation, financing and transfer of technology.

On shared vision, the Parties continued to have divergent views on the kind of international climate treaty that would replace the Kyoto Protocol. DC continued to call for a legally binding treaty that would reinforce the KP and include all countries, while some developed countries preferred a strengthened Copenhagen Accord with commitments of intention rather than results.

On mitigation in developed countries, aspects that could be integrated into equitable Cancún Agreements were listed as: procedures to ensure transparency in the follow-up process and reporting on targets for emission reductions.

Discussions on mitigation in the DC and in the BASIC countries relate to the voluntary mitigation measures that could be put in place at the national level, funding from northern countries or self-funding in the framework of the NAMAs[48]. Issues under discussion generally relate to monitoring operations (measurement, reporting and verification - MRV) and to financial monitoring of voluntary activities that, when verified at the international level, can be considered to be a violation of national sovereignty. Is it necessary to financially and technically monitor voluntary operations?

With regard to REDD+, while the majority of the Parties agreed on achievements recorded in this area, Bolivia blocked consensus fearing that access to REDD+ credit on the carbon market would lead to a loss of recognition of the multifunctional role of forests, which represent a living environment for rural communities and indigenous populations.

On adaptation, proposals were made for Cancún to create a global committee that would facilitate resource mobilization and the establishment of a global insurance against losses and damages due to climate change.

On funding, consensus was reached to set up a "Green Climate Fund". However, the modalities and operating procedures for such a fund were not specified.

On transfer of technology, discussions related to whether or not to create an executive committee on technology and a network of climate technology centers. The relationship between these two entities, their composition, roles and working methods, were not specified.

Apart from the controversy surrounding the "figures", progress was made in the LULUCF[49] negotiations. A draft decision was prepared for the Cancún Conference. However, there were still divergences on fixing the reference level that would serve as the basis for recording forest carbon sinks in developed countries. This is also relevant to the methodologies that will be applied to REDD+ linked operations to determine the reference levels for each DC, i.e. fixed either on the basis of historic or forecasted levels.

In conclusion, after six days of negotiations in Tianjin, it can be said that hopes had waned. It became increasingly clear that Cancún would not be able to adopt a global agreement on climate change. However, decisions on REDD+, adaptation, finance, and transfer of technology could be adopted in Cancún.

Photo 8.5: The umbrella tree (Musanga cecropioides) is used as building material

Photo 8.6: Agro-forestry helps to maintain trees around villages

[48] NAMAs: Nationally Appropriate Mitigation Actions.

[49] LULUCF: Land Use, Land Use Change and Forestry.

Cancún Conference: results and prospects

The 16th Conference of the Parties (COP-16) for the Climate Convention was held from 29 November to 11 December 2010 in Cancún, Mexico, and assembled approximately 12,000 participants. Bearing in mind the issues that had been left pending in Copenhagen, and despite the uncertainties and divergences that still existed in Tianjin, many continued to hope that Cancún would achieve significant results on key issues. These included mitigation (including REDD+), adaptation, financing, and technology. With regard to mitigation and REDD+, technical and political difficulties stem from follow-up and monitoring because of the need for measuring, reporting and verifying (MRV) the outcomes of operations with the International Consultation and Analysis (ICA). Negotiations on these issues took place throughout the two-week meeting, with the Parties also meeting extensively in plenary sessions, contact groups, informal consultations and bilateral meetings. During the second week, Ministers from developed and developing countries were "paired" in an attempt to facilitate negotiation on key issues. The negotiations continued all week with regular "stocktaking" plenary sessions, which were held to maintain a degree of transparency and to keep all participants regularly informed on progress made in the negotiations.

As a result of the resolve of the Parties and especially the commitment of the Mexican presidency, the "Cancún Agreements" were adopted on 11 December 2010. The Cancún Agreements include decisions under both the Convention and Protocol negotiating tracks, and contain provisions on adaptation, REDD+, transfer of technology, mitigation and financing. While the substantive outcome was viewed by many as far from perfect, most participants were satisfied with the outcome and indicated that it had restored their confidence in the UNFCCC process. However, in spite of the sense of relief felt by many at securing a result, most participants acknowledged that it represented a relatively small step in combating climate change (see the summary of the principal achievements of Cancún in Annex 2).

The negotiation process on climate change was strengthened after Cancún. 139 of 192 countries, representing 88 % of global emissions, agreed to reduce their emissions. The final outcome mentions two main reduction objectives: (i) not exceeding a rise in temperature of 2°C (notably, the EU position); and (ii) remaining under a rise of 1.5°C (position of the African Group and AOSIS countries[50]).

The "Green Climate Fund" was established to provide funding for mitigation activities and adaptation to climate change. It seeks to attract $ 100 billion a year by 2020. Although the "Fast Start" funding procedure was developing very slowly, the REDD+ Partnership managed to assemble approximately sixty countries in December 2010 and was officially given $ 4 billion for the 2010-2012 period.

With specific regard to REDD+, Cancún adopted decisions[51] that officially recognized this mechanism and prepared for its integration into the post 2012 Protocol/Treaty. Sub-chapter C (paragraphs 68 to 79) of Chapter 3 of the decisions and Annex I deal specifically with REDD+.

Paragraph 70 outlines all the areas covered by REDD+, including the sustainable management of forests, conservation of carbon stocks, and reinforcement of stocks (i.e. tree-planting).

Paragraph 71 confirms the adoption of a national approach, while offering the possibility of working at a sub-national level, provided that it leads to national consolidation. Reference levels as well as monitoring and reporting systems must also conform to this approach. This paragraph is therefore important as it shows the necessity for close coherence and compatibility in sub-national approaches in order to achieve national consolidation. In other words, methods and measures at the level of sub-national territories need to be harmonized. A possible consequence of this is that the base units likely to be eligible for REDD+ will comprise the territorial collectivities that are responsible for land-use planning so as to be able to manage the full involvement of populations and avoid possible leakages.

[50] Alliance of Small Island States.

[51] http://unfccc.int/documentation/decisions/items/3597.php?such=j&volltext=/CP.16#beg

Paragraph 74 states that countries should be responsible for their starting phases in relation to their own specific national or sub-national circumstances. However, the methodology to be used to calculate the reference level is not addressed directly. Reference to IPCC[52] methodologies is too vague to be conclusive. The "historic reference" or the "historic reference with adjustment" remains an important issue for the Congo Basin.

Paragraphs 76 and 77 deal with funding, redirecting issues where decision has not been reached for discussion in the AWG-LCA working group.

Paragraph j in Annex I states that payments will be conditional upon results. This somewhat ambiguous statement probably refers to carbon budgets for operations that have been undertaken. It does not apply to sustainable management or conservation estimates which tend to result in balanced budgets. In short, having stocks or forests that provide environmental services is not remunerated. These will probably be priority issues for COMIFAC countries in future negotiations.

Photo 8.7: Although forests are fairly resistant to fires, their periphery remains vulnerable

After Cancún: prospects and questions

In Cancún, the Parties committed themselves to implementing the REDD+ methodology on a global scale and, to this end, a framework was created whereby the modalities for its implementation could be negotiated. This began in April 2011 and should take two years. It started with the Meeting of the Parties in Bangkok which will be followed by discussions to be held under the auspices of the SBSTA[53].

The Cancún Agreements clearly and explicitly recognize the various REDD+ targets. This opens up a wide range of country-specific opportunities and allows for wider participation by concerned stakeholders in Congo Basin countries to strengthen and develop their historic forest heritage and to combat poverty in rural areas.

The Parties have created a mechanism to encourage DC to contribute to mitigation measures in the forest sector through REDD+ activities; however, this mechanism relies on the financial resources (adapted and predicted) that developed countries are willing to provide. A major issue that needs to be dealt with in Durban end 2011 (mandate of the AWG-LCA) is the adoption beyond 2020 of a mechanism linked to restricted market. Congo Basin countries have always said they would prefer a restricted market in order to lift voluntary constraints over the long term.

Decisions on REDD+ identify a progressive approach, starting with:

(i) drawing up strategies and national action plans to be put forward as policies and measures, followed by:

(ii) implementing policies and national measures that require capacity-building, transfer of technology and results-based demonstration activities,

And finishing by:

(iii) evaluating such activities which must be measured, reported and verified (MRV).

In selecting the policies and modalities required to implement REDD+ programs, significant guarantees were given to ensure that environmental, social, socio-economic and legal concerns, including the protection of the rights of indigenous populations, were taken into consideration.

Identifying a national approach, taking sub-national considerations into account, while ensuring national consolidation at the same time that would integrate various monitoring mechanisms adapted to the different scales, requires great stringency to ensure compatibility between sub-national approaches and national "carbon accounting". The precise modalities for doing this are still to be drawn up and agreed upon but it represents one of the main difficulties in the years to come.

Photo 8.8: Dialogue and consultation are essential for the preservation of forest lands

[52]Intergovernmental Panel on Climate Change.

[53]Scientific and technological subsidiary body of the UNFCCC.

Photo 8.9: Slash and burn subsistence agriculture benefits from the richness of formerly forested soils

There is also the difficulty of ensuring supranational coherence at the COMIFAC level so that leakages from one country to another can be monitored and potentially disloyal competition can be avoided.

Two intrinsically important factors are essential in order to ensure coherence at the national and supranational levels: one relates to an accounting basis to establish financial estimates for activities related to conservation and sustainable management, in conjunction with maintaining forest carbon stocks (i.e. the methods employed to fix the reference level) and the other relates to the definition of the "forest" in the context of REDD+.

Common specifications for all countries in the Congo Basin should be used in methodologies to establish each country's reference level. The specifications should be drawn up under COMIFAC guidance so as to avoid any potentially pernicious effects or inconsistencies at the sub-regional level. This does not necessarily mean that the methods for establishing reference levels need to be identical. It would be up to each country to adjust the specifications to suit its own national level by adapting them to the country's specific characteristics. One important question, which also applies to northern countries, is the "historic reference" or "historic reference with specific adjustment to the country". Congo Basin countries have always advocated using a historic reference with adjustment factors due to the low rate of deforestation in Central Africa. This is not the position of many southern countries (notably, Brazil). Coherence at the sub-regional level is the only realistic way to resolve this kind of difficulty.

At the same time, "forest" definition is a real problem. On the one hand, it is perfectly desirable that there should be compatibility with the definition of "forest" as used by the Clean Development Mechanism (CDM), especially since REDD+ integrates activities relating to forest carbon stocks increase; on the other hand, as the REDD+ mechanism, which is applicable to Congo Basin or COMIFAC countries, is equally geared towards all other forests, analysis should not be limited to dense moist forests. All forested areas, and notably savannas in drier zones, are affected by REDD+. Current OFAC evaluations only exist for dense moist forests and cover only 40 % of the surface area of the Congo Basin. Therefore, the problem of "forest" definition has a real impact on calculating the deforestation threshold and, consequently, forest degradation.

All these problems have an impact on monitoring activities at different scales and different latitudes, and important questions are still pending:

- Are assessment techniques using remote sensing compatible with "forest" definitions in ecosystems and climate zones and with what is being monitored (deforestation or degradation)? (see box 8.3)
- Are sub-national or national forest inventories suitable and reliable enough to provide the assessments that are required in order to be able to produce equitable financial estimates?
- Over and above a mere interest in establishing carbon accounting at the national level, in accordance with IPCC methodology, could investments and running costs required to measure and announce performance levels become a more permanent feature? This would be in addition to all other benefits for sustainable development and combating poverty in these countries.
- Are there other indirect technical strategies that could be used to indicate performance evaluations?
- How can conservation and sustainable forest management be realistically and positively encouraged when cost calculations are fixed on the "carbon balance" while activities tend towards zero rather than being geared towards positive balances?
- Are Congo Basin countries abandoning the concept of remuneration for maintaining forests for the role they play in stabilizing climate change? This brings us back to the question of payment for environmental services.

Box 8.3: Measuring forest biomass in DRC

**Aurélie C. Shapiro, **Johannes Kirchgatter, **Dr Sassan Saatchi*

**WWF, **NASA Jet Propulsion Laboratory (JPL)*

The International Climate Initiative of the German Federal Ministry in charge of the Environment, Nature Protection and Nuclear Safety with support from the German Development Bank (KfW) will develop a program with WWF-Germany to map forest biomass in the Democratic Republic of Congo (DRC), develop carbon payment models to finance conservation, and reduce deforestation and degradation.

This project will pilot new technology for estimating forest carbon stocks, while strengthening local capacity in forestry, remote sensing and REDD related activities. Innovative, spatially explicit methods developed by NASA-JPL will integrate field, aerial LiDAR (Light Detection and Ranging) and hyperspectral cameras with multiple satellite (optical and radar) data to map forest biomass at a national scale in DRC, as well as assessing areas of deforestation and degradation (figure 8.1). This project will demonstrate new approaches for mapping forest carbon in multiple forest types with various types of imagery, assessing the errors and uncertainties for future improvements, estimating baseline greenhouse gas emissions from deforestation and degradation for REDD projects and carbon payment initiatives. Additionally, the work aims to evaluate the accuracy and costs associated with this type of national-level above ground biomass inventory.

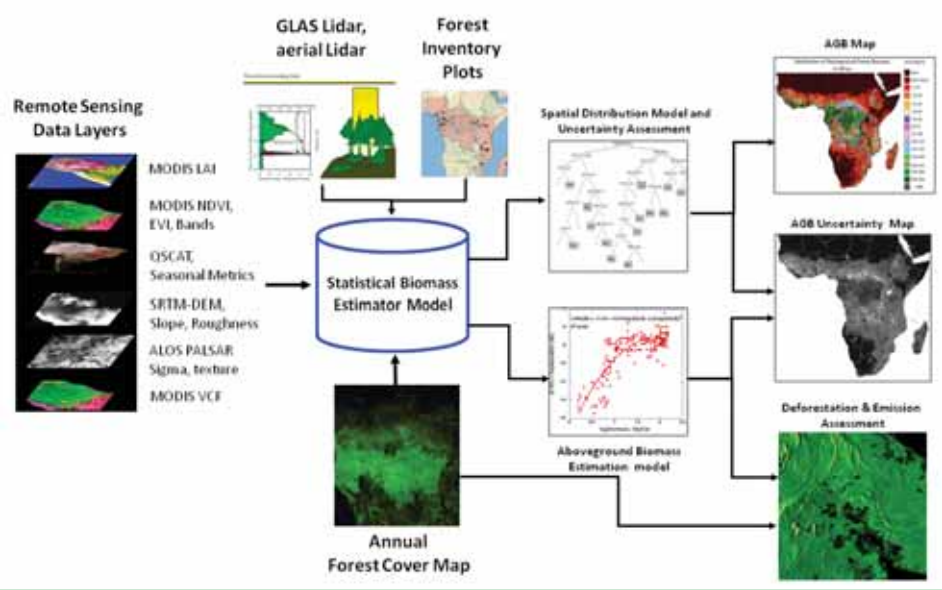


Figure 8.1: Schematic of the approach of the integrated suite of optical and radar satellite data, ground inventories, and airborne, spaceborne LiDAR data

The WWF initiative is supporting DRC government agencies within the Ministry of the Environment (MECNT) and OSFAC (*Observatoire satellital des Forêts d'Afrique centrale*) to build local capacity to integrate field and aerial data, interpret satellite data, and store and disseminate associated information. In addition, the project aims to strengthen ongoing efforts for a national comprehensive forest inventory and monitoring, which is needed to calibrate a national carbon map. The national biomass map will be made available publicly, and for policy decisions through user-friendly, online tool accessible and integrated into government planning and assessment through collaboration with UNEP-WCMC (United Nations Environment Programme – World Conservation Monitoring Centre).

Finally, forestry, remote sensing and REDD-related fellowships for higher education degrees will be offered to DRC citizens through the WWF-US Russel E. Train Environment for Nature program (EFN), increasing local leadership in forest carbon issues. This national forest carbon stock mapping is the largest national effort of its kind, providing the DRC with the necessary components and capacity to develop an accurate map of forest biomass. This map could be used for estimating deforestation and degradation related greenhouse gas emissions, climate conscientious planning and assessment, infrastructure development, scenario building and more.

Photo 8.10: The development of erosion zones is linked to the loss of forest cover

Conclusion

All eyes are now on Durban in South Africa where the 17th Conference of the Parties (COP-17) of the UN Framework Convention will be held. It is hoped that the Parties will be able to finalize and adopt a treaty or a legally-binding protocol on climate change.

Congo Basin countries are totally committed, particularly to REDD+, and are extremely vigilant with regard to the modalities that will be adopted on forest degradation, forest conservation and sustainable forest management. They are also keeping a close eye on other relevant issues (adaptation, financing, transfer of technology and capacity-building).

Until the adoption of all pending decisions, countries in the sub-region are actively pursuing their preparations to join REDD+. Since 2008, the six forested countries, members of the COMIFAC, have received FCPF funds to develop their R-PPs. Some countries, such as the DRC and Congo, are also recipients of UN-REDD funds. These countries are currently at advanced stages in developing their R-PPs which aim to make it possible for countries to secure the services of the REDD national Strategy and Action Plans (box 8.4).

Under COMIFAC's guidance, countries in the sub-region are determined to do everything possible to benefit fully from the opportunities offered by REDD+ mechanisms to strengthen their respective capacities. Initiatives and projects are therefore being implemented at both the national and sub-regional levels. Examples of sub-regional initiatives are:

- Sub-regional project to strengthen institutional REDD capacities in the Congo Basin, funded by the Global Environment Facility (GEF), executed by the World Bank and expected to last for five years (2011-2016);
- Sub-regional MRV project, developed by the FAO in collaboration with INPE[54], to be submitted for CBFF[55] funding.

COMIFAC countries should find these projects helpful in their search for solutions to the methodological and technical problems related to REDD+. Nevertheless, there are as many problems as there are expectations and other ways need to be found to deal with these problems.

[54]National Institute for Space Research (Brazil).

[55]Congo Basin Forest Fund.

Box 8.4: REDD process in the DRC: State of play and outlook

Léon Kanu Mbizi, Bruno Guay

REDD National Coordination

Context

Since January 2009, the DRC has been engaged in the preparatory process of the international mechanism for the Reduction of Emissions from Deforestation and Forest Degradation (REDD+). This process is under the responsibility of the Ministry of the Environment, Nature Conservation, and Tourism (MECNT), in partnership with the United Nations REDD Programme (UN-REDD) and the World Bank (FCPF program).

To date, the following steps have been taken:

In May 2009, establishment of the REDD National Coordination.

In August 2009, the process was officially launched during a workshop in Kinshasa facilitated by the Minister of the Environment.

In November 2009, a Decree from the Prime Minister was issued establishing the governance structure for the REDD process in the DRC, which is:

- The National Committee is the decision-making body and steering committee for the process;
- The Inter-Ministerial Committee is the body responsible for implementing the REDD strategy;
- The National Coordination is responsible for the day-to-day management of the process.

In March 2010, the DRC became the first African country to obtain approval for its national Preparation Proposal for REDD (R-PP) from the UN-REDD Policy Board and the FCPF Participants Committee. This gave the DRC a solid internationally-recognized road-map and substantial funding with which to start program implementation.

The REDD+ preparatory program in DRC comprises four components:

1. Coordination and overall guidance;
2. Development of the REDD strategy;
3. Experimentation program or pilot projects;
4. Early programs.

Component 1: Coordination and overall guidance

Officially established in August 2010, the National REDD Committee and the Inter-Ministerial Committee are actively engaged in the:

- Consideration of national REDD+ financing mechanisms in the DRC;
- Consideration of distribution of REDD+ funds at the local level;
- Establishment of registration procedures, support for and approval of REDD+ projects in the DRC.

REDD National Coordination:

A coordination mechanism was established for the implementation of the R-PP "Information, education, communication and consultations":

The implementation of the information, education, communication and consultations plan is carried out by:

- Producing communication tools (e.g., films, plays);
- A large scale country-wide information and consultation campaign;
- The establishment of a national radio network on REDD.

Component 2: REDD strategy

The national REDD strategy is built on two pillars: studies and tests. Several studies are under way on the causes of deforestation, test results, implementation framework and strategic socio-environmental impact studies.

Priority will be given in the coming months to designing the configuration of the REDD financial mechanism in the DRC.

Thematic Coordination Groups, involving all concerned stakeholders, will further enhance the REDD national strategy.

The DRC is developing a global vision for its MRV system. Major challenges in this area relate to the coordination of support by the multiple partners involved (FAO, Brazil, Japan, USA, France).

Component 3: Experimentation program (Pilot projects)

In addition to studies, the DRC believes REDD+ pilot projects that would assist in the trial scheme required to develop a complete operational national strategy should be undertaken. At present, there are three different types of pilot initiatives in the DRC:

(i) The National Coordination has launched 8 geographically-integrated pilot projects in order to test a range of programs in a geographically-defined area;

(ii) The technical direction of the Ministry of the Environment has launched 2 sectoral projects to explore the potential of agro-forestry and community forestry;

(iii) Projects for voluntary carbon markets.

In order to boost REDD+ projects for voluntary carbon markets in the DRC, the government is currently working on the creation of a transparent mechanism to negotiate and validate partnership contracts.

A register of all REDD+ projects and initiatives in the DRC is also being established to promote transparency and find synergies in the implementation of REDD+. A test version has been presented in Cancún and is available on-line since February 2011. This register will be an important tool for the government administration to monitor incoming funds on a day-to-day basis and evaluate their impact.

Component 4: Early programs

The principle of early programs is to allow activities which, based on feasibility and carbon yield criteria, are identified as urgent to be organized quickly and on a large scale, without waiting for a strategy to be defined. Seven potential programs are envisaged:

- Sectoral Program 1: Peri-urban reforestation;
- Sectoral Program 2: Agricultural intensification in forest zones;
- Sectoral Program 3: Delivery of improved stoves to all urban centers;
- Sectoral Program 4: Combating illegal logging;
- Enabling Program 1: Zoning and land use planning;
- Enabling Program 2: Harmonization and land security;
- Integrated district-wide program.

Financing

Funds committed for the preparatory phase for REDD+ in the DRC are substantial: $ 22.6 million for components 1 and 2 (UN-REDD, FCPF, other donors); $ 39 million for the experimentation program, component 3 (CBFF); and $ 65 million expected from the World Bank/FIP for the implementation of early programs. Hundreds of millions of additional dollars will be necessary for the implementation of these programs.

CHAPTER 9

2008-2009 Economic crisis and its impact on the forestry sector in Central Africa

Alain Karsenty

CIRAD

With the contribution of Nicolas Bayol

FRM

Introduction: an unprecedented crisis

The profitability of the timber export industry in Central Africa varies in accordance with market conditions for international tropical timber, monetary parity, fuel prices and taxation. Tropical timber is not prone to the big price fluctuations that affect such raw materials as petrol or minerals. This is because there is the possibility for substitution between species, with temperate wood and with other building materials. The sector has undergone crises in the past because of economic slowdown in consumer countries, but the 2008-2009 crisis was particularly severe and has left traces that will take time to heal. The crisis will undoubtedly have accelerated a movement for change in the forestry sector. It is still too early to judge whether it will stop or simply delay the slow but sure move towards improving management practices that has been seen in Central Africa over the last decade.

Impact of the crisis on Central Africa

Sharp decline in demand and fall in exports

Such a sharp decline in demand has not happened for a very long time. Since the last quarter of 2008, market players who held out hope until September 2008, realized the scale of the crisis and stopped buying. The market practically ran dry and prices then fell. The fall in prices did not however fully reflect the reality of the market.

The crisis probably caused global trade in tropical timber to decline by about a third.

This figure is just an average estimation, and some segments were more affected than others.

Photo 9.1: Meliaceae logs waiting to be shipped down the river

Photo 9.2: Aerial view of the Mokabi S.A. logging company in the Republic of Congo

Chinese purchases, which appeared to be able to sustain the market until mid-2008, also receded due to slow growth in China and a decrease in re-exportations of processed timber from imported logs and sawnwood. EU countries registered a fall in tropical timber imports of over 40 % in one year (2008-2009) and log entries were five times less. China, the most important global buyer of tropical timber, saw imports fall by a relatively low 16 % in the first half-year of 2009, preventing an even worse decline in the global market. Collapse in European demand, led by Great Britain and Spain, affected all producing countries, but particularly Africa, where many operating sites and processing plants closed down, at least temporarily, resulting in millions of people being made redundant.

Impact on prices

Prices were first difficult to fix and then fell sharply, with 15-30 % decreases over the course of a few weeks in the second half of 2008. The price for African logs fell in December of the same year. There was a smaller decline in the price of sawnwood, although sapelli from Central Africa lost between 25-30 % of its value. The crisis did not affect all species and all markets in the same way: the price of timber used for hydraulic purposes in the Netherlands, such as azobé and tali, was more resistant, and white timber (such as ayous, limba and okoumé) was not as affected as red wood (i.e. *Meliaceae*). The collapse in the housing market in the south of Europe and in Great Britain and the significant decline in the number of new building projects in France explain the differences: fewer doors, windows, interior decoration for flats means less need for red-colored timber.

Prices continued to fall in 2009 although less than in 2008, when stocks had to be sold. Drops of between 5-15 % were registered depending upon the type of species and products. Reduced demand meant that loggers curbed their activities and trees remained intact. Offer and demand were consequently fairly balanced, but at very low prices. The prices of African sawnwood and plywood fell noticeably.

Okoumé logs, which are mostly exported by Gabon, are an exception to the generalities presented above. With no decline in demand from China, India and Vietnam, prices remained constant.

The reaction of companies and the impact on employment

Forest companies very quickly curbed their activities and some had to close down their operating sites and processing plants. Other companies, that had very little stock at the beginning of the crisis, continued their logging activities for a while to take advantage of the dry season. In Cameroon, up to 3,500 employees, which is a quarter of the staff in the timber sector (including transport), were laid off. In Central African Republic (CAR), of the six companies with concessions, 428 employees were made redundant and 1,335 were temporarily laid off. In the Democratic Republic of Congo (DRC), the largest companies, which usually have several concessions, decided to concentrate on their most profitable sites and close the others. In the Republic of Congo, large companies affiliated to international groups with FSC certification, such as CIB (*Congolaise industrielle des Bois*) and IFO (*Industrie forestière de Ouesso*), made hundreds of employees redundant or dismissed them temporarily. According to the January 2010 edition

of "*Les Dépêches de Brazzaville*", 665 of a total of 1,500 CIB staff were dismissed at the end of 2009 of whom 50 % were expatriates. In DRC, of the 9,365 employees working for the 15 companies belonging to the Industrial Professional Association 2,377 employees were dismissed. In addition, 1,300 employees were laid off temporarily. In 2010, PARCAFRIQUE, which was in a judicially parlous state before the crisis, closed its doors leaving 720 staff unemployed and bringing the total number of jobs terminated during the crisis to approximately 3,000.

Without a detailed study, there is no precise information on the number of people who were dismissed or laid off in the sub-region as a result of the 2008-2009 crisis (which continued till mid-2010). The rough estimation that exists holds the crisis directly responsible for the permanent or temporary loss of 25 to 30,000 jobs including dismissals of staff working in the transport sector, which was affected by reductions in timber transportation.

However, from mid-2010, orders started to come in again and some companies began to re-engage staff who had been dismissed. This was more pronounced in Cameroon which withstood the crisis better as it had a number of more stable commercial slots such as azobé (*Lophira alata*) and okan (*Cylicodiscus gabonensis*) timber that can be used for hydraulic purposes. Countries such as Congo and CAR, which depend more heavily on exporting sapelli, and DRC, whose log exports were halved between 2008 and 2009, suffered more (see table 2.6 and figure 2.4). Gabon also had the means to recover rapidly from the crisis, thanks to its okoumé exports, which were mostly destined for emerging nations' markets, notably China. However, the total ban of log exports, announced on 1 January 2009 and effective from 15 May 2010, upset the sector slightly and curbed possibilities for re-employment.

Photo 9.3: A forest technician posing in front of a tali (Erythrophleum suaveolens)

Potential effects on wildlife

Although exact studies are not available on this subject, it can be presumed that this crisis had an indirect impact on pressure exerted on wildlife in forest areas. Temporary unemployment measures or dismissals in the concessions inevitably lead workers who have been laid off and deprived of all or part of their incomes, to seek other means of subsistence or exchange. Hunting, therefore, probably increased around concessions that had to resort to unemployment measures or dismiss their staff.

Government response

In several countries, governments had to agree to provisional tax cuts in the timber industry. This was the case in Cameroon, Republic of Congo and CAR (box 9.1). In many African countries, most of the companies were unable to pay amounts owed and they became indebted to the fiscal administrations.

In **Cameroon**, the government decided to lower annual forestry levies (RFA) by 50 %. These levies are determined by auction and on average amount to € 4-4.5 per hectare per year. This measure, that was adopted in 2009 and tacitly extended in 2010, was taken after the government realized that most companies were unable to pay the RFA. It had important consequences for the municipalities of the forest zones that legally have the right to receive 40 % of RFA revenues, and for local communities that benefit, in principle, from the equivalent of 10 % of these same revenues. The other important measure taken was the relaxation of the restrictive arrangements for log exports: higher quotas were accorded for ayous (*Triplochyton scleroxylon*) and authorization was given to export the so-called "traditional" species (i.e. sapelli, padouk...). Combined with the measure taken in Gabon at the beginning of 2009 to ban log exports, this led Cameroon to considerably increase its round wood exports. Between the first quarters of 2008 and 2009, there was a 20 % increase while over the same period the total amount of lumber exports dropped by 50 %. Tali (*Erythrophleum suaveolens*) and okan (*Cylicodiscus gabonensis*) constituted about half of the amount of round wood exported and 80 % of this amount was sent to Asia.

Photo 9.4: The first processing of logs (sawing) occurs either in close proximity to logging sites or near ports

In **Gabon**, the government lowered the FOB[56] price by 30 %. This price served as a basis to calculate the export tax and the tax of tree felling. The government also took a series of measures to accelerate VAT reimbursements for exporters. In addition, the government decided on a number of fiscal measures, notably with regard to reducing the area charge, but these measures were presented as compensation measures for the ban on log exports. On 4 March 2010, the Head of State announced the establishment of a "Support Fund of CFA 20 billion to Accelerate the Industrialization of the Timber Industry".

In **DRC**, after lowering the area tax by $ 0.1 per hectare per year (from $ 0.5 to $ 0.4 per ha), the government decided to postpone the payment of area taxes for 2009. For 2010, companies could make payments in installments for 50 % of the annual tax amounts. These relief measures followed the increased tax on exports that had been decided in 2008 (from 6 % to 10 % for the tax on log exports, and from 0 % to 5 % for sawnwood).

In February 2009, the government of **the Republic of Congo** adopted a series of measures, one of which was to authorize companies to pay a reduced VAT tax (about 5 %) on fuel imported from Cameroon by companies operating in the north of the country. The other decision was to raise the ceiling from 15 % to 30 % for logs each company could export (although it had never been possible to impose this ceiling at the national level). Other measures were to provide payment facilities for tax backlogs. In 2011, these measures were extended and supplemented by new ones:

- The decision to replace FOB price by FOT (Free On Truck) price (i.e. FOB price marked down to an average transport cost to be borne by the different companies to transport their timber);
- Payment of the area tax only for the exploitable area[57] - to be determined for all concessions before the end of 2010.

[56]FOB: Free On Board. The FOB price does not include transport costs, taxes and other costs.

[57]This measure originates from a request made several years ago, well before the crisis.

Box 9.1: Measures taken in the Central African Republic to offset the impact of the international economic crisis

Gaston Nakoé

Ministère des Eaux, Forêts, Chasse et Pêche - CDF (CAR)

The Central African Republic has not been spared from the economic crisis which has affected countries all over the world. In the forestry sector, the crisis has caused a slow-down in the activities of forestry companies, which has led to some staff being temporarily laid off or losing their jobs altogether.

In order to prevent the crisis from having long-term effects, including the social consequences, the government has taken a certain number of measures to reduce the burden on forestry companies. These include:

- the signing of a joint inter-ministerial Decree to reduce the market value for certain species by 20-40 %, leading to taxes reduction;
- implementing a nine-month timeline to pay the rent tax (tax on the area covered by a permit), instead of requiring payment at the beginning of the year;
- providing increased flexibility with regards to technical unemployment, a solution that has been formulated jointly with the Ministry of Labor and Employment.

These measures should allow forestry companies to gradually resume their activities, take back staff who have been temporarily laid off or dismissed, and pay municipal and treasury taxes. With these measures, log exports increased to 34 % between 2009 and 2010, following a drop of 28 % between 2008 and 2009. In addition, the 37 % drop in production between 2008 and 2009 was reduced to 7 % between 2009 and 2010.

Impact of the crisis on exports

Preliminary note: some data on processed products collected by the author differ from those presented in the Annexes and given by the countries.

Gabon: The measure to ban log exports that came into effect on 15 May 2010 (only logs felled in 2009 and subsequently stocked could be exported until 15 May 2010) led to a spectacular fall in the production of industrial timber: maybe around 2 million m^3 in 2010 against an average production of 3 to 3.3 million m^3 in years prior to 2009 (the record figure of 3.9 million m^3 in 2009 shows that operators rushed to export as many logs as possible before the ban. See chapter 2 and figure 9.1).

Final figures for 2010 were not available when this article was written but it is estimated that about 1.8 million m^3 of round wood was taken to factory. This is an appreciable increase over previous years where estimates amounted to about 1.2 million m^3. However, it was not enough to compensate for the fact that many medium-sized specialist log exporting operators stopped their activities, neither did it solve the problem of finding comparable market shares by switching to another product. This will need to be looked at again in two or three years when returns from investments will have produced the desired results. This confirms the extent of the intrinsic link that is sometimes mentioned when referring to the expected outcomes of the measure to ban log exports.

As regards fiscal revenues, it can be presumed that they plummeted along with the decline in revenues from taxes on logs exported, which constituted the bulk of the sector's fiscal revenues. Preliminary indications given by the Ministry of Finance show a fall in 2010 of 30 % in revenues from the tree felling tax, which has never been properly recovered.

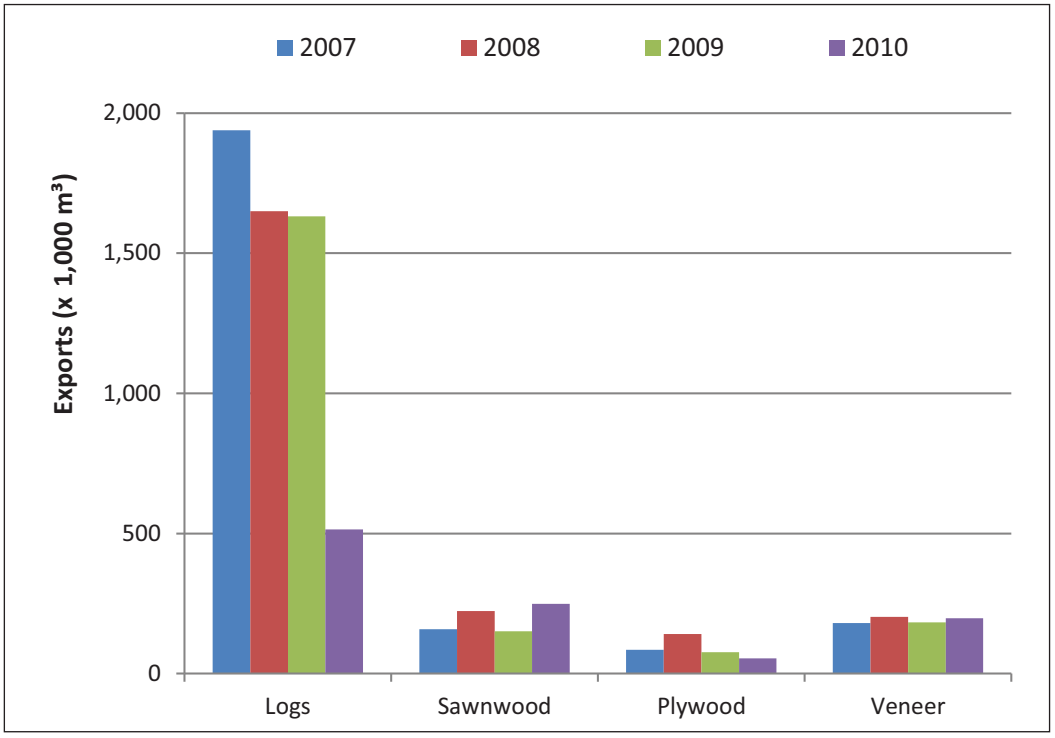


Figure 9.1: Exports of natural and processed timber from Gabon before and during the crisis

Cameroon: Cameroon softened the effects of the crisis by relaxing its restrictive log export policies. In 2010, this situation benefited from the entry into force in Gabon of the ban on log exports. But, sawnwood exports fell in 2009 and, despite a recovery in 2010, Cameroon did not re-establish its pre-crisis export levels (figure 9.2). In 2011, the decision to return to stricter restrictive measures (i.e. quotas) for log exports in traditional species and to restore timber sales, should again benefit sawnwood exports.

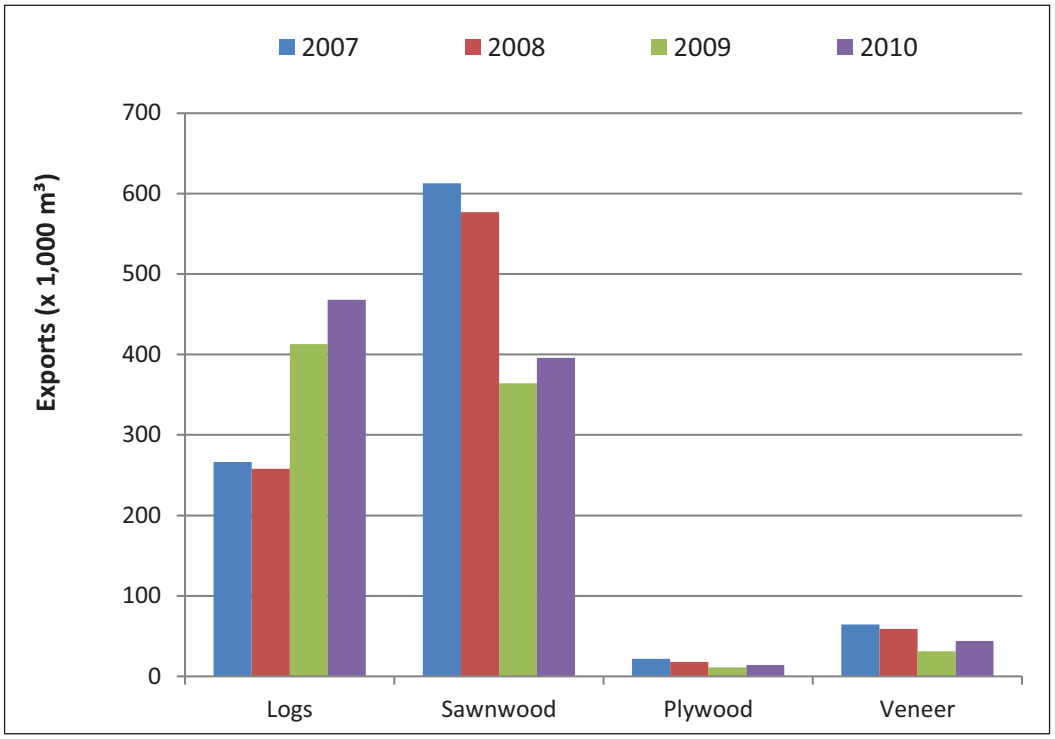


Figure 9.2: Exports of natural and processed timber from Cameroon before and during the crisis

The Republic of Congo: Congo adopted a policy that was somewhat similar to that of Cameroon, by relaxing restrictive measures on log exports. In 2010, production and exports should have returned to levels that were comparable to pre-crisis levels.

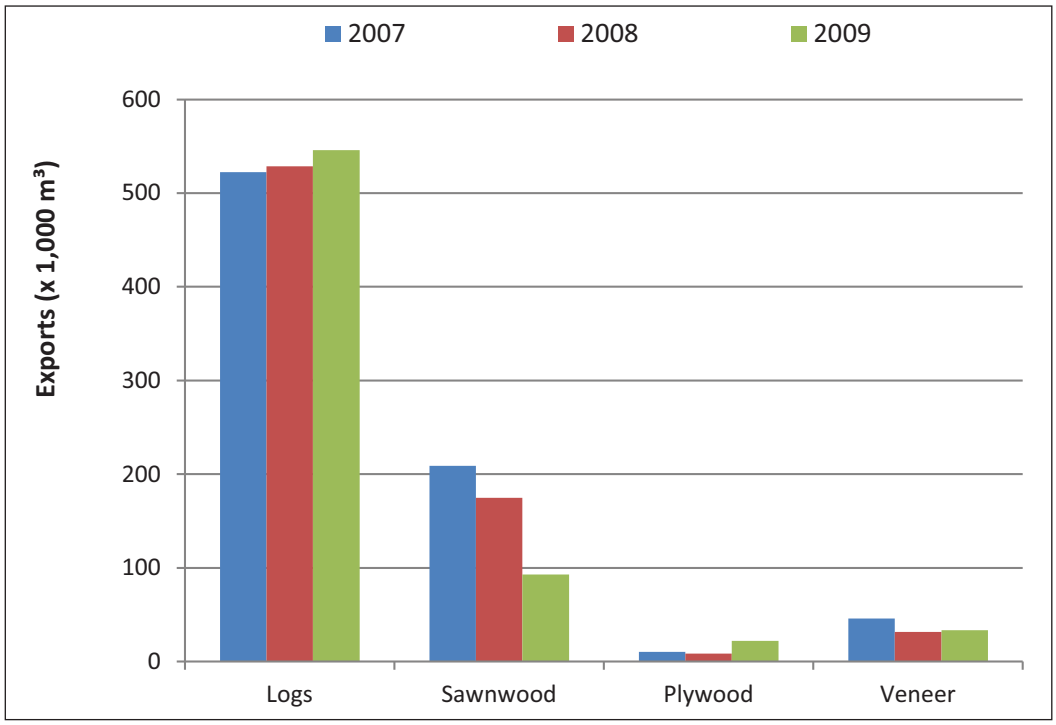


Figure 9.3: Exports of natural and processed timber from Congo before and during the crisis

Equatorial Guinea: Since 2007, log exports have officially been banned in Equatorial Guinea, but statistics show how ineffective this ban has been. It seems that log exports, principally okoumé logs, benefited from the Gabonese export ban. Logging is still largely dominated by Shimmer International which left the country only to return in 2009 at the height of the crisis, perhaps in anticipation of the application of the Gabonese ban.

Long-term effects on the sector and perspectives

With the return of some European buyers at the end of 2009, it was noticeable that some market confidence had been restored. Log-exporting countries hoped to benefit from Gabon's withdrawal from the market. In 2010, most processing plants had resumed their activities and some companies expected that they would make a speedy come-back and even that they would exceed their pre-crisis production levels. Such was the case for companies in DRC and Congo that belonged to the German group, Danzer, which probably benefited from strong German growth from the end of 2009 until early 2010.

Even so, could this be called a return to "business as usual"? Probably not. One reason is because companies suffered significant financial losses during the period. Such was the case for the Danish group DLH which controlled CIB (*Congolaise industrielle des Bois*) in the Republic of Congo and the companies GIB-CIB and CFA (*Compagnie forestière des Abeilles*) in Gabon. DLH announced in 2010 that it was selling majority shares in its companies to concentrate on international trade, which was its main activity. At the end of 2010, Olam International bought these majority shares. Olam, which has its headquarters in Singapore, and is a conglomerate of Indian origin (it also invests in agro-industrial crops), already has a footing in Gabon. Olam announced that it would continue to pursue CIB's policies related to environmental and social issues, which had resulted in FSC certification.

The Swiss group, Precious Wood[58], which manages a total of nearly 5 million hectares (CEB, SODEFOR, SOFORMA), suffered significant losses: $ 15.5 million in 2008 and $ 28.1 million in 2009. Although no such statement has been made to this effect, it can be presumed that the group is studying the profitability of logging in Africa and that it will draw its own conclusions with regard to its extended losses.

CEB and CIB are both FSC-certified companies that are emblematic of the progress that has been made by the timber industry in the region over the last ten years in forest and social management.

With the unstable financial situation of many companies, overcoming the crisis meant resorting to amalgamations of timber companies which will undoubtedly change the face of the industry. There will be fewer companies exporting to the European markets and these are the markets that drive the demand for certified timber.

During the crisis, Asian companies continued to buy European companies: Leroy-Gabon, a company funded by Portuguese capital, was bought by a Chinese company and *Gabon Export Bois* (GEB), a company funded by French capital, which holds over 100,000 ha of concessions, was bought by another Chinese company (Shengyang). Olam International was entrusted with building a new industrial zone not far from Libreville for about fifty processing plants in Gabon and was granted two concessions with a total area of one million hectares to supply the factories to be built in the zone. In the Republic of Congo, the Chinese group Foma signed a joint venture agreement with the Christelle company, which since 2009 has had a 230,000 ha concession in the center of the country.

[58]The Precious Wood group owns CEB in Gabon (*Compagnie Équatoriale des Bois*, 616,700 ha, formerly owned by the French family group, Thanry) and has invested over $ 7 million in the Nordsüdtimber Company (a holding based in Liechtenstein) which has majority shares in several timber companies in DRC (notably, SODEFOR and SOFORMA).

The purchase of certified companies by companies in the emerging nations, notably China and India, that until now have not sought to obtain certified timber – even if this could change in the future – raises questions about the future of certification in the Congo Basin. This is particularly the case since several big environmental NGOs seem to be increasingly reticent to support FSC certification for industrial companies in Central Africa in the hope that the REDD mechanism will provide funding for new protected areas. In addition, in many developing countries, the concentration of companies working in the timber sector does not signify that less logging will take place or that there will be fewer operators. Instead, it means a transfer of activities from the formal to the informal sector. Governments have become aware of the disadvantages of an industry that is very "extraverted", exporting most of its production and hence becoming very open to crises that are inherent in the market, while the domestic market continues to be supplied by small scale sawmills. In Cameroon, production by small scale sawmills exceeds industrial production (see chapter 4). Implementation of Voluntary Partnership Agreements, in the framework of the FLEGT, includes monitoring the legality of the timber, not only for export purposes, but also for the domestic market (see chapter 2). However, it is unlikely that this will have any tangible effects for several years to come.

The 2008-2009 crisis did not mark the end of industrial logging in Central Africa but it did perhaps represent an important moment in the redistribution of economic power in the timber industry. But, it is difficult today to anticipate the effects this will have on forest management in the future.

Photo 9.5: Artisanal loggers increasingly use mechanized tools to process timber

Box 9.2: Prospective analysis of the Congo Basin Forest Ecosystems (outlook for 2040): What does the future hold?

Jean-Noël Marien, Nathalie Bassaler

CIRAD, Futuribles

Recent developments in the Congo Basin forests, particularly those in the COMIFAC zone, have been impressive. The factors that have had a progressive and lasting effect on regional forests over the past decades are, notably, conservation, management, certification, land competition, anthropogenic pressure, timber markets, and the REDD process.

While it is easy to take note of and quantify past developments, it is more difficult to predict a possible future, or more precisely, possibilities for the future. Two tools are generally used for this:

- "Predictions" take past data into account and include them in future plans, e.g. by using modeling techniques;
- "Prospective analysis" also uses these tools, but further analyses qualitative factors in trying to pinpoint disruptive factors based on expert opinion that have not been identified by the predictions. The methodology chosen for this study includes regional specifics such as distancing. It has been endorsed and consists of several phases that are outlined in figure 9.4 below.

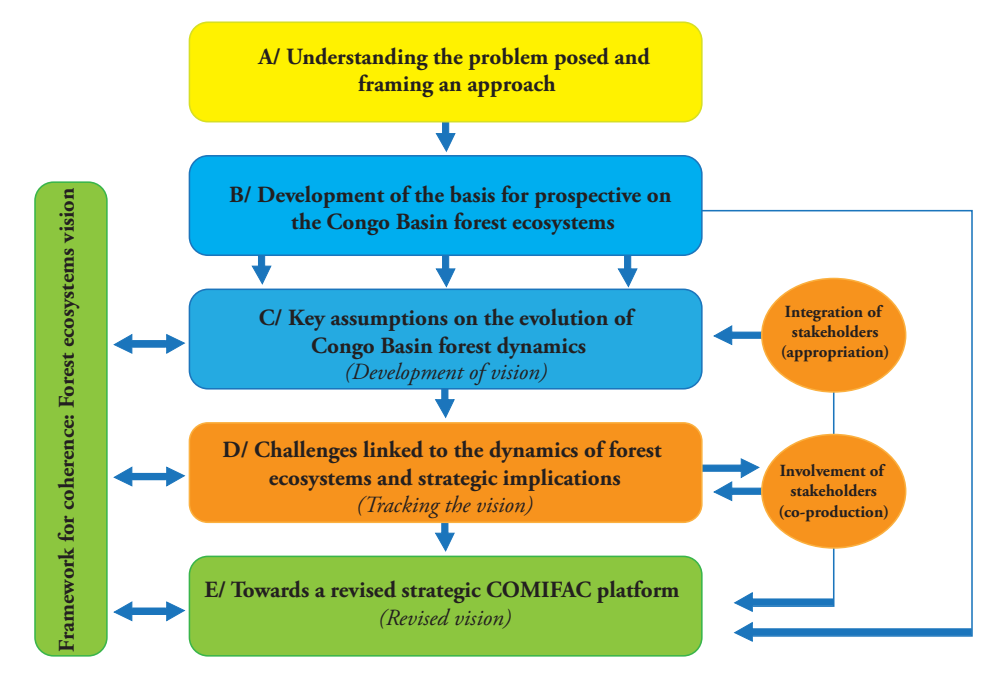


Figure 9.4: Synthesis of the methodology used for the 2040 Forest Ecosystems analysis
Source: Marien & Bassaler, 2010 and 2011

Under COMIFAC leadership, co-financed by France, USA and Germany, and with the technical support provided by Futuribles, CIRAD is currently undertaking a prospective analysis at the regional level to identify, by the end of 2040, future possibilities for the forest ecosystems. The study aims to enlighten policy-makers on the potential consequences of their choices, or lack thereof, with regard to forest ecosystems – in the broad sense of the term. That is to say as a component of a multi-faceted regional territory with a wide variety of resources that faces multiple challenges and their associated risks. The proposed time period for this study is equivalent to the time for a classical rotation on managed and production forest plots. Naturally, this analysis includes, but is not limited to, the most important current issues such as the problematic of climate change and its associated processes, for example the REDD.

Following the training of regional and international experts in the prospective methodology, the first phase of the analysis consisted of identifying a preliminary list of factors, based on expert opinion, which could have significant impact on forest ecosystems development. This list, which is still quite general and consists of over 100 elements, has been classified according to key potential factors which have been determined in accordance with their degree of relevance to the forest ecosystems (figure 9.5):

- Processes and dynamics that directly affect forest ecosystems;
- The intermediary context;
- The global environment.

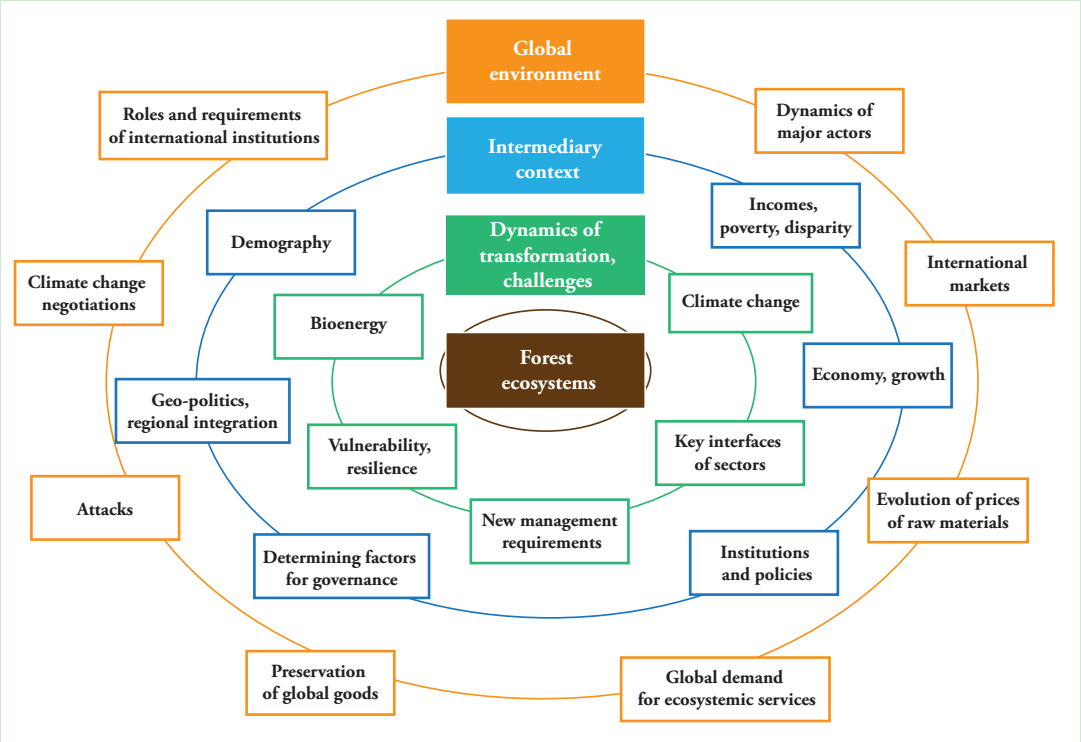


Figure 9.5: First set of factors potentially involved in the future development of the Congo Basin forest ecosystems

As a general rule, the greater the distance from the "driving force", the more difficult it is to directly influence the factors.

The next step of the analysis will be to carry out a regional and international evaluation to document, study in greater depth and prioritize the contents of these key provisional factors. These will then be examined by a wide variety of actors, and in particular, regional experts. Work will also be undertaken with national organizations to allow them maximum involvement in the methodology and in the results. Finally, a consolidated report will be proposed and endorsed at the regional level.

PART 4

LANDSCAPE MANAGEMENT

CHAPTER 10

Protected area management in CBFP landscapes: taking stock

**Kenneth Angu, **Cyril Pélissier, ***Nicodème Tchamou*

**IUCN, **WWF, ***USAID/CARPE*

Introduction and context

In Africa, protected areas (PAs) provide an important land use option that can deliver conservation results and support sustainable development and poverty alleviation. Establishing effective systems of PAs across the Congo Basin is a key component of COMIFAC's Convergence Plan. As the value of ecosystem services is increasingly recognized and monetized, the role of PAs in providing ecosystem services has important implications for regional and national development. Assuring that these services are provided through PA systems that take forest communities into account will help to guarantee that conservation systems are also developed in a fashion that contributes to poverty reduction and local development. PAs in the region do not exist in isolation, but are part of a complex mosaic of resource and land use elements.

Photo 10.1: Aerial view of the Dzanga Bai in CAR

"Protected area" is a generic term for various kinds of officially designated conservation areas (Harmon, 2003). IUCN's definition of "Protected areas" highlights the difficulty to institute a sole "magical" management tool or strategy for PAs. Myriad approaches have been tested or used to manage PAs in Central Africa. This is demonstrated by the variety of PA categories with different management objectives and perspectives, multiple stakeholders with conflicting socio-economic and cultural dynamics, different policies and legislation as well as varied institutional arrangements for PA management and, of course, the tremendous diversity of biological assets found in PAs. This is even more complex when two or more countries are managing transboundary PAs because of different management philosophies, policies and regulatory framework as well as national priorities. PA managers are often expected to adapt their management strategies and policies to the local setting and environment. This can be painstaking because PA managers are in a learning process. They try to rescue biodiversity, frequently fail, and start again after changing their strategies, philosophy, methods, etc., often moving from a conservationist/preservationist approach where they were protecting nature from humans, to a participatory approach in which they try to integrate humankind into nature (Mauvais, 2010). Successful managers must be sensitive to local customs and traditions (e.g., to respect sacred forests) while incorporating sound scientific principles for biodiversity conservation into their management plans (Kamanda *et al.*, 2003).

For decades, PA management approaches have focused primarily on PA territory within delineated boundaries, but management approaches are increasingly moving towards including buffer zones, the latter serving as sponge to absorb outside threats. Most threats to Central African PAs lie outside their boundaries, e.g., human pressure on PA resources as a result of road development, settlements, agricultural activities, informal resource extraction, etc. It is increasingly recognized that the socio-economic well-being of local communities must be accounted for while establishing PA management objectives.

In order to balance the conservation objectives of protected areas with the well-being of local communities and with national development priorities, CBFP (Congo Basin Forest Partnership) and COMIFAC partners have recognized PAs as a core element of broader conservation (often transboundary) landscapes composed of different land use units with different management strategies.

Therefore designing a new paradigm for PA management is inevitable if PAs are to be sustained in Central Africa. Could the landscape conservation approach, now tested by the CBFP, be that paradigm? Landscapes in this instance are defined as priority areas for conservation based on their relative taxonomic importance, and the overall integrity and resilience of their ecological processes.

This chapter (i) provides an overview of threats to PAs in Central Africa, (ii) describes the role of the Congo Basin's protected area network as part of a broader COMIFAC framework for conservation that includes a series of priority conservation landscapes, and (iii) reviews current constraints to establishing effective, sustainable PA management in Central Africa. It complements the overview of national protected area systems presented in previous State of the Forest (SOF) reports (see table 3.1 «The protected areas of Central Africa» in the 2006 SOF and table 1.13 in the 2008 SOF for a review of PAs by country and different IUCN categories). It is founded on the experiences and lessons from a series of complementary programs to support PAs in priority conservation landscapes and concludes with a series of considerations to inform future support for establishing PAs that can deliver both conservation and development results for the benefit of the people of the Congo Basin.

Main threats to the values of protected area systems in the Congo Basin

Threats to PAs and PA systems, in the Congo Basin have been extensively documented in the previous editions of the SOF and in chapter 3 of this report.

For example, among threats with the widest geographical scope and highest severity, poaching for ivory and/or bushmeat trade occurs in most of the PAs of the Congo Basin. The increasing price of ivory on the black market due to the increasing global demand, often coupled with the precarious economic situation in the local surroundings of many PAs, has resulted in a sharp revival in ivory poaching in the region as a whole (see box 10.1). Ivory poaching, often referred as "*grand braconnage*", is capable of seriously depleting elephant populations in PAs and even bringing some of them to local extinction (as seen in DRC). This "*grand braconnage*" is often linked with armed rebel or military groups.

Also often linked with military groups is the establishment of illegal, small permanent or semi-permanent mines along streams within the protected areas. The environmental degradation caused by mining operations can be severe and includes the direct destruction of fragile ecosystems, such as erosion and sedimentation (siltation) in stream beds, and indirect effects such as mining related poaching.

Box 10.1: Central Africa and elephant ivory: lots of illegal trade, little law enforcement

Tom Milliken

WWF

Over the last three decades, Central Africa has lost more African elephants (*Loxodonta africana*) to illegal trade in ivory than any other sub-region. In Cameroon, Central African Republic (CAR), Chad, Congo, Democratic Republic of Congo (DRC), Equatorial Guinea and Gabon, forest and savanna areas once harbored hundreds of thousands of elephants but, at last count in 2007, the IUCN/SSC's African Elephant Database (AED) projected only 10,383 definite, 48,936 probable and 43,098 possible elephants. It was also speculated that another 34,129 animals might also be in these countries but have never been surveyed. Sadly, these numbers are certainly optimistic as the ivory hemorrhaging continues unabated in Central Africa.

The Elephant Trade Information System (ETIS), the TRAFFIC-managed monitoring system to track illegal trade in ivory under CITES, holds the world's largest collection of ivory seizure records since 1989. ETIS repeatedly implicates Central Africa as the most problematic sub-region for elephants in Africa. The last comparative analysis, undertaken in February 2010, was based upon 15,416 records from around the world, but only 96 seizures had been made by Central African countries. At the same time, these same countries were implicated in 936 other ivory seizures that were made outside of the region. In other words, ivory seizures appear to be very infrequent events in Central Africa, but substantial movements of ivory out of the sub-region regularly occur. Indeed, the ETIS seizure records that relate to Central Africa represent nearly 50 tons of ivory, with the largest illicit flows emanating from Cameroon, DRC and Gabon.

Things appear to be getting progressively worse. Over two-thirds of this ivory trade by weight (71 %) has occurred over the last ten years, which is the highest value for any of the African sub-regions. Another hugely worrying development is that 59 % of the ivory relating to Central Africa was seized in the context of large scale ivory shipments involving one ton of ivory or more at a single time. These massive illicit movements are a potent indicator of the presence of organised crime in the trade. It is believed that Asian-run, Africa-based wildlife trade crime syndicates are operative in Cameroon, DRC and Gabon.

But the region's law enforcement capabilities are grossly inadequate to address the challenge at hand. Only one in ten seizures of Central Africa's ivory trade is actually taking place within the region, a development that is the second-worst ratio of the four African sub-regions that have wild elephants. This very poor law enforcement performance is further exacerbated by serious governance shortfalls. Transparency International's Corruption Perception Index collectively gives Central Africa a mean score of only 2.0 (on a scale of 1 to 10), the worst of all of the African sub-regions.

Photo 10.2: Ivory artifacts for sale at a local market in Kinshasa

In addition to large scale movements of ivory outside of the region, Central Africa also harbors a number of thriving domestic ivory markets and had over 300 active ivory carvers as recently as 2001. TRAFFIC's monitoring of these markets indicates that they are comparatively larger, more active and less regulated than anything found in the other African sub-regions. In particular, the DRC's capital city of Kinshasa is believed to offer one of the largest unregulated ivory markets in Africa. The one bright spot is that some recent evidence suggests that Cameroon, Republic of Congo and, perhaps, the CAR have all begun to take steps to suppress their domestic ivory markets.

In sum, comparatively speaking, Central Africa exhibits a set of traits most conducive to illegal trade in ivory. In 2004, the CITES Parties adopted an "action plan for the control of trade in African elephant ivory" which calls for all African elephant range States:

- to prohibit unregulated domestic sale of ivory, whether raw, semi-worked, or worked;
- to instruct all law enforcement and border control agencies to enforce such laws;
- to engage in public awareness campaigns to publicise these prohibitions.

Countries which fail to address unregulated domestic ivory markets within a reasonable period of time face possible sanctions, including the suspension of all wildlife trade options under CITES. Regrettably, some Central African countries are likely to become future targets for punitive action.

Other existing threats to PAs in the region include over-fishing, unsustainable harvest of non-timber forest products (NTFP), agricultural encroachment and illegal logging. While the sustainability of the harvest of NTFP remains difficult to assess, agricultural encroachment and illegal logging affect a few PAs and have highly localized impacts. The tracking of the latter is becoming more regular with overall monitoring of forests and logging activities in the Congo Basin. Illegal grazing is also a major threat for PA located in the savanna fringe of the forest block. Future threats include the potential effects of climate change such as changes in rainfall distribution, habitat and species ranges and increasing dominance of invasive species. Demographic changes in countries such as DRC will also increase pressure on PA resources over time.

Photo 10.3 : Transporting artisanal products out of the forest can be challenging and arduous

Brief overview of the evolution of the Protected Area concept in the Congo Basin

PAs in Central Africa were first established in a colonial context where there was a strong interest in the extraction of large mammals, primarily in the savanna regions, and in reaction to the perceived impacts of this extraction. In the 1960s, when the countries of Central Africa were achieving their independence, over 50 hunting reserves existed on paper in the Congo Basin (most were created between 1930 and 1960). Most of these reserves were later abandoned for financial or management reasons. At the same time numerous forest reserves were created in countries (e.g., 181 in the "Belgian Congo" at the time) for the management of timber resources and to promote research in forestry. Many of these reserves were also later abandoned or converted to other land uses.

Between the 1960s and the 1980s, new national parks (NP) and other types of protected areas were established at various rates across different countries in the Congo Basin, but there was little investment in the PAs or the national institutions responsible for their management. The majority of the little dedicated support available came from international conservation NGOs and bilateral or multilateral projects. With the creation of the CBFP in support of COMIFAC, there has been a growing and significant consideration of PA systems that has been encouraged by the regional nature of many programs to support PA management (e.g., ECOFAC, CARPE, CAWHFI, etc.). At the regional level, RAPAC was formally recognized by COMIFAC as the regional body responsible for monitoring the implementation of the PA component of the Convergence Plan (see box 7.4 in the SOF 2006). At the national level, concerted efforts have been undertaken to review, strengthen and expand PA systems in countries like Gabon (see box 6.1 in the SOF 2006), Cameroon and DRC. Significant efforts have also been put into the creation of agencies for PA system management in some countries where they did not previously exist (e.g., the National Parks Agency (ANPN) in Gabon).

Photo 10.4: Coastal forest landscape in Gabon

Box 10.2: Overview of sub-regional organizations ten years after the Yaoundé Declaration

Jean-Marie Noiraud
JMN Consultant

The institutional landscape in the Central African sub-region has changed considerably in the last ten years. New organizations have appeared on the scene, while others have disappeared or become dormant. Immediately after the signature of the Yaoundé Declaration, COMIFAC was established. In March 2005, Heads of State signed the COMIFAC Treaty, transforming the organization from the "Conference of Ministers in charge of Forests in Central Africa" to the "Central African Forests Commission". At the ECCAS Summit in October 2007, COMIFAC became a specialized agency for dealing with forests. It now represents Central Africa in all international and continental debates related to forestry issues, including the Rio international conventions and other discussions on resource management and sustainability. COMIFAC has as its mandate to coordinate the implementation of the COMIFAC Convergence Plan, its reference tool for policy guidance and forest management activities, both at the sub-regional level and within member States. In order to successfully fulfil their mandates, other pre-existing sub-regional organizations have needed to be reformed so that they align with this new regional framework.

CEFDHAC (Conference on Central African Moist Forest Ecosystems) was the first to be reformed. Its by-laws were officially adopted by the Council of Ministers of COMIFAC in September 2008. Since then, a steering committee has been responsible for guiding the process that will make CEFDHAC a multi-actor platform for stakeholders in Central Africa to oversee agreements and dialogue relating to forests in national and sub-regional forums.

The African Timber Organization (ATO), the International Agency for the Development of Environmental Information (ADIE), and the Organization for Wildlife Conservation in Central Africa (OCFSA), are three older sub-regional organizations that have been underfunded for a significant period and, at this point, have nearly or completely ceased their activities. To be effective, they would need to be completely reformed. A process launched by COMIFAC in 2010 should, by 2011 or 2012, result in the implementation of proposals aimed at assisting these organizations undertake the roles attributed to them by the Treaty.

The Central Africa Protected Areas Network (RAPAC) is a new organization that was created from a proposal to integrate protected areas across the sub-region. RAPAC became an association and is recognized by COMIFAC as the body responsible for coordinating policies and activities related to protected areas.

The Observatory for the Forests of Central Africa (OFAC) was conceived from a European Union (EU) program, but became institutionalized to provide COMIFAC with a permanent means of undertaking monitoring and observation of forests. In 2011, a coordination unit was set up in Yaoundé in the office of the COMIFAC Executive Secretariat with a technical unit based in Kinshasa.

The Network of Forestry and Environmental Training Institutions in Central Africa (RIFFEAC) is recognized as the COMIFAC body responsible for coordinating the work, including the elaboration of training curricula, of academic and training institutions on forestry and environmental issues.

Additional networks also exist, notably REPALEAC, REJEFAC, REDIFAC, REFADD and REPAR. They are all informal dialogue mechanisms that transcend regional barriers and cross borders to develop working relationships to tackle the numerous aspects of sustainable forest management in Central Africa.

In recent years, landscape-scale conservation has become the center piece of natural resource management in the Congo Basin. The landscape approach recognizes that it is important to consider the management of resources in areas around PAs to meet the needs for development and the sustainability of protected areas in the long term. A landscape approach highlights the PAs as core areas for biodiversity conservation within a broader complex of land uses, emphasizing their critical role for maintaining large scale functioning ecological systems. Detailed descriptions of the 12 CBFP priority landscapes can be found in previous versions of the SOF.

Interest in PA conservation has gradually increased over the years thanks in part to timely financial and technical support through CBFP efforts. Central African governments have expanded the number and/or surface area of PAs since the CBFP was launched in 2002 (table 10.1), and they have concomitantly begun processes to renovate PA management structures and increased allocation of conservation funds and human resources. For example, concurrent with the 2002 Johannesburg Summit for Sustainable Development, the Gabonese government announced a network of 13 National Parks and worked to create a National Parks Agency (ANPN) to manage the network. In Cameroon, thanks in part to the international interest generated for conservation by the Summit, CBFP partners including the World Wide Fund for Nature (WWF), the Cameroonian government and others, worked towards the creation of the Boumba-Bek and Nki national parks.

Table 10.1: New protected areas created since the launching of the CBFP landscapes

Landscape	Segment	Protected area included within the landscape	Date of creation (or publication)
Monte Alén-Monts de Cristal	Monts de Cristal (Equatorial Guinea)	• Monts de Cristal National Park • Monts de Cristal Military Reserve	2002 Proposed
Gamba-Mayumba-Conkouati	Gamba-Mayumba (Gabon)	• Loango National Park • Moukalaba-Doudou National Park • Mayumba National Park	2002 2002 2002
Lopé-Chaillu-Louesse	Lopé (Gabon)	• Waka National Park • Birougou National Park	2002 2002
Dja-Odzala-Minkébé (Tridom)	Minkébé (Gabon)	• Mwagne National Park • Ivindo National Park • Minkébé National Park	2002 2002 2002
	Dja (Cameroon)	• Boumba-Bek National Park • Nki National Park	2005 2005
Léconi-Batéké-Léfini	Léfini (Republic of Congo)	• Proposed Ogooue-Leketi National Park	Proposed
	Léconi-Batéké (Gabon)	• Batéké Plateau National Park	2002
Lake Télé-Lake Tumba	Lake Tumba (DRC)	• Tumba-Lediima Reserve • Ngiri Biosphere Reserve	2006 2011
Maringa-Lopori-Wamba (MLW)	Maringa-Lopori-Wamba (DRC)	• Lomako-Yokokala PA • Lyondji Community Bonobo Reserve • Congo-Lopori PA	2006 Proposed Proposed
Maiko-Tayna-Kahuzi-Biega (MTKB)	Maiko-Tayna-Kahuzi-Biega (DRC)	• Tayna Nature Reserve • Kisimba-Ikobo Nature Reserve	2002 Proposed

New paradigm

The backbone of the landscape conservation approach is that PAs (with or without buffer zones) cannot be managed as isolated entities. The fundamental truth is that PAs occur within the broader context of larger functioning ecological systems. Thus management approaches can be designed around specific land or resource units, herein termed "macro-zones", as a cohesive part of the overall ecosystem (see chapter 11). In accordance with principles of integrated conservation initiatives and broad-scale land management, each landscape can be subdivided into different categories of management areas or macro-zones, including: (i) Protected Areas (PA), which are core areas for biodiversity conservation, (ii) Community Based Natural Resource Management (CBNRM) zones, which are core areas for linking conservation with sustainable livelihoods options, and (iii) Extractive Resource Zones (ERZ), which are core areas for sustainable economic development.

Planning is the process in which stakeholders (e.g., community members, scientists, government representatives, private businesses) come together to debate and discuss how to manage lands for the benefit of current and future generations and to ensure ecological sustainability of lands and resources. This approach is supported by technical specialists from United States Forest Service (USFS) and CBFP partners who have developed a series of four guides to work through the planning process. Guides have been prepared for landscape level planning as a whole, and for each of the three categories of macro-zones listed above (PA, CBNRM and ERZ)[59].

[59] http://carpe.umd.edu/carpedocs/index.php

The landscape guide provides practical guidance on developing "integrated landscape land use plans" for the entire landscape. The landscape guide further explains the purpose of planning and outlines key concepts central to the landscape planning process. It describes the process for writing an integrated landscape land use plan and provides a framework of landscape land use plan components. It suggests section headings to use, and provides explanations regarding concepts to consider and items to include when developing each section of a landscape land use plan.

The PAs and CBNRMs guides describe the same issues with the similar emphasis, on sections and terms as the landscape guide, but at the scale of PAs and CBNRM zones respectively.

The ERZ guide provides practical guidance for the field implementing partners to engage in developing and implementing land use management plans for extractive resource zones (ERZ) in coherence with landscape plan objectives. ERZs in Central Africa include forest concessions, large scale private plantations, mining, oil and gas, and safari hunting zones. The ERZ guide highlights how field implementing partners should strive toward sustainable and socially and ecologically responsible operations.

The ERZ guide describes how resources can be extracted on a sustainable basis that does not compromise the long-term productivity or ecological values of the land. It takes into consideration the title holders' aspirations and other stakeholders' concerns, as well as the pertinent legal and regulatory framework, for a given area over a stated period of time. ERZ management plans describe desired conditions for land and resources, their function and use, and their sustainability for future generations.

Photo 10.5: Local transport on the vast river network of the DRC

Protected area management in the new paradigm and within landscapes

PA management planning is a participatory process which first identifies and then elaborates a formal consultation process amongst all actors and stakeholders, including indigenous and local populations, decentralized local and central government officials, international NGOs, etc. This initial identification and consultation process is vital because it promotes buy-ins from all stakeholders, promotes synergy and reduces conflicts. Planning helps to blend management and governance strategies with scientific understanding of natural habitats and socio-cultural systems, patterns, mores and values. This process fosters decision-making that is understood, accepted, feasible and more easily implemented by all actors.

PAs are managed by a management plan, a tool which describes the various activities that are needed to ensure that PAs achieve the purpose and vision for which they were created. The PA planning process seeks to highlight how stakeholders have: (i) assessed and analyzed activities, resources, uses and trends in the PA; (ii) elaborated desired conditions and objectives for the PA; (iii) consulted, collaborated and integrated other stakeholders in plan development; and (iv) focused management activities to achieve desired conditions and priority objectives with the appropriate stakeholders (USFS, 2010).

Photo 10.6: Logs of niové (Staudtia kamerunensis), a lesser known species with interesting prospects in terms of commercial development

Management objectives of protected areas in the landscape concept

Management objectives are specific to a given zone and have to address the whole set of threats that the area is facing and will be facing in the future.

Biodiversity conservation

PAs are the cornerstone of biodiversity conservation in the Central African landscapes. These PAs harbor some of the world's richest biodiversity which, if not conserved now, may well become extinct in the near future. Some of these PAs are globally unique, harboring endemic species like the bonobo and the okapi in DRC.

In order to successfully conserve biodiversity in the Congo Basin, PAs must succeed at maintaining natural processes and viable populations, while mitigating or excluding threats.

Photo 10.7: Forest elephant (Loxodonta cyclotis)

Ecotourism development and recreation

Ecotourism provides an added economic opportunity for some PAs in the Congo Basin. Although the natural wealth of the Congo Basin forested region has not been exploited for tourism systematically due to legitimate logistical and market constraints, few select PAs (such as Volcanoes, Virunga and Dzanga-Ndoki national parks respectively in Rwanda, DRC and Central African Republic (CAR)) regularly receive international tourists. The governments and local populations living adjacent to these parks are benefiting from this source of revenue, which provides a financial incentive for local communities to participate in the sustainable management of PAs.

Research (applied and basic such as inventory and monitoring)

An important achievement is the wealth of research results that are available in the COMIFAC library. The conservation of biodiversity in the various protected areas has facilitated research work by a multitude of stakeholders (e.g., doctoral research studies, government research to facilitate decision-making). These research activities not only contribute to scientific knowledge, but also make available critical knowledge needed to conserve these natural resources for our benefit and that of future generations.

Over the last ten years forest inventories and biodiversity surveying techniques have become more standardized, improving the state of knowledge for many timber species and some key mammal species (see specifically "State of biodiversity in the Congo Basin" in chapter 1 and part 3 of the 2008 SOF). Despite this growing understanding of the status of certain species, more information is necessary to understand the management of many lesser known species and assure the current PA systems are representative of the region's biodiversity.

Photo 10.8: Surveys play an important role in monitoring the status of species

Climate change mitigation

Encompassing vast areas of tropical moist forest, PAs in the Congo Basin also have an important role in terms of ecosystem services. At the same time, these forests have a high potential for carbon storage, and therefore, they can effectively contribute to mitigating the adverse effects of climate change. Integrating PAs into larger scale landscape planning provides opportunities to enhance the resilience of ecosystems to climate change, offering a mechanism to help safeguard provisioning and regulating ecosystem services.

Other ecosystem services

According to the Millennium Ecosystem Assessment (2005), the services provided by ecosystems include: (i) provisioning services (food, fresh water, timber, fiber, genetic resources and bio-chemicals); (ii) regulatory services (climate, water and disease regulation, and water purification); (iii) cultural services (spiritual, aesthetic, recreation and ecotourism, education); and (iv) supporting services (primary production, bio-geophysical systems of soil formation and nutrient cycling). Many of these services are indirectly and/or directly of critical importance to the well-being of people in the Congo Basin: PAs represent an important land use option for preserving these services.

Performance, outcome and results of protected area management in CBFP landscapes

This section seeks to outline some of the major results that CBFP PA managers have achieved since its launching in 2002. As will be seen, some of the achievements are intangible while others are material.

Generation of resource-based knowledge

The last two editions of the SOF reports of 2006 and 2008 describe one of the initial priorities in the management of CBFP PAs: the generation of resource-based knowledge of key biological diversity assets in the Congo Basin to facilitate conservation. This explains why, unlike other macro-zones, substantial financial and technical resources were invested in the management of CBFP PAs. Strong working relationships between government agencies and CBFP partners have generated innovative ideas and concrete results concerning the development and management of PAs in the respective countries. Data that were jointly generated by PA managers and government officials facilitated decision making, notably in both the creation of new PAs and/or the management of existing ones.

An analysis of recent ecological surveys from the Congo Basin reported in the 2008 SOF, demonstrated the importance of PAs for the conservation of some key mammal species. For example, the analysis reported that sites where elephant signs were abundant are located in protected areas. The same analysis concluded that overall the status of some species is cause for concern, and in areas such as the DRC where the syndrome of the "empty forest" has become widespread, a broader and more concerted effort is needed to reverse the biodiversity loss incurred. These results suggest that formal management systems, such as those established through PAs, have a critical role to play in conserving key species. There is an immediate need to establish effective PA management to have any chance of maintaining the Congo Basin's biodiversity. New biologically rich areas have been found[60], gazetted and are now in the process of being vetted as PAs.

Photo 10.9: African forests harbor tree specimens of truly spectacular dimensions

Elaboration of national policies and laws on protected area management

CARPE (Central Africa Regional Program for the Environment) partners, working alongside other CBFP members, notably within the framework of Country Teams, are using concrete field results to develop and validate appropriate policies and laws to facilitate work on the ground. For example, the Gabonese National Parks Agency (ANPN), which is responsible for managing 13 national parks, was created shortly after the inception of CBFP by the government of Gabon as its contribution to the partnership.

While the promulgation of several national parks laws was a hard earned success by CBFP members, establishment of functioning national parks authority has been an additional challenge. In DRC, Country Team members are currently discussing ways and means to improve their PA management structures. In Republic of Congo a draft decree to create a National Wildlife and PA Agency is currently being discussed by Country Team members. In Equatorial Guinea, a presidential decree has been signed that prohibits the hunting of large primates in the country which has demonstrably reduced poaching in PAs. Rwanda and Cameroon are currently discussing revisions to their forestry code and CARPE Country Team members are deeply involved in all the discussions. A National Poaching Control Strategy for Cameroon was adopted in 2008 through the support of CBFP partners like WWF, IUCN, etc.

[60]For example, a new gorilla population discovery in the Sangha Tri-National (TNS) and the Lake Télé landscapes in Republic of Congo almost doubled the western lowland gorilla population estimates from 175,000 to 225,000.

Regionally, CBFP PA managers facilitated the signing of the Lake Télé-Lake Tumba transboundary collaboration Agreement by Ministers in charge of forestry and the environment for the Republic of Congo and DRC in 2010. The Sangha Tri-National Foundation (FTNS), created with assistance from CBFP PA managers, has demonstrated positive impacts in Cameroon, Congo and CAR (box 10.3). The rationale for establishing transboundary landscapes is to address the complex nature of the threats from illegal logging and poaching in PAs and to create a single voice in international discussions.

Box 10.3: The Sangha Tri-National Foundation (FTNS): a mechanism for sustainable financing and transboundary agreements

Brigitte Carr-Dirick, Thimotée Fomete
FTNS

In December 2000, the governments of Cameroon, Central African Republic (CAR) and the Republic of Congo took a decisive step in fulfilling the commitment they made within the framework of the Yaoundé Declaration by signing a Cooperation Agreement to set up and manage the transboundary forest complex called "Sangha Tri-National" (TNS). The TNS covers a total surface area of about 44,000 km^2 and comprises three neighboring national parks, Lobéké (Cameroon), Dzanga-Ndoki (CAR) and Nouabale-Ndoki (Republic of Congo), as well as their buffer zones. The TNS is not only host to forests that are extremely rich in biodiversity; it also provides a wide range of environmental services for local and indigenous communities as well as for the global community through carbon sequestration. The three countries are implementing a management system in partnership and significant progress has been made, in particular, through the establishment of a tri-national anti-poaching brigade, an agreement on the free movement of staff and the adoption of a land use plan. They have also jointly proposed that the TNS become a World Heritage Site.

The "Sangha Tri-National Foundation" (FTNS) was established in 2007 as a private charitable entity under English law, with headquarters in Cameroon, in order to provide for the long-term financing for TNS activities. The FTNS has a legal and governance structure capable of mobilizing investments from all sectors. It is managed by a Board of Directors comprising eleven members that include representatives from the three governments, the KfW, AFD, WCS, WWF, the *Regenwald Stiftung* as well as three representatives from civil society organizations in the countries concerned. The first two capital injections – € 5 million from KfW and € 3 million from AFD – have been invested on international money markets by an investment manager of international stature. The investment is geared towards generating a flow of long-term stable revenue that will finance targeted activities. Income from initial capital will complete that provided by *Regenwald Stiftung*, which has already mobilized nearly € 4 million through the "*Krombacher Regenwald Kampagne*" publicity campaigns organized jointly with WWF in Germany. Other capital contributions are being prepared in order to reach the objective of € 35 million. While waiting for a return on investments, the FTNS operates through grants it receives from KfW, the European Union via UNESCO and the Congo Basin Forest Fund (CBFF). Since 2009, FTNS has been able to use these grants to finance field work. Procedures used ensure a transparent and equitable allocation of revenues.

The FTNS is the result of a true public-private partnership and a forerunner as a tri-national environmental fiduciary fund. It acts as a model for similar initiatives and seeks to establish innovative and sustainable financing mechanisms in support of the COMIFAC Convergence Plan.

Involvement of local and indigenous populations

One of the pillars of the CBFP Protected Area management strategy is participatory management which acknowledges the traditional rights of indigenous and local populations around and within the PAs. Managers have learned from experience that PA management is "a science of compromise… because no one group has enough power to impose rules that other stakeholders do not understand or share" (Usongo & Nzooh Dongmo, 2010). Incorporating communities in the planning and operations of PAs and their peripheral areas, and assuring sharing mechanisms for any potential tangible benefits, provides an important opportunity to develop community endorsement and build local recognition for the role of PAs. This is also an opportunity to provide a mechanism for communities to gain official recognition of their rights in a region where tenure and resource rights remain poorly defined. But before even advancing to this stage, managers were assured that the entire conception and implementation of the PA land use planning was a win-win process wherein local peoples' rights and responsibilities would be fully respected. This was testified as a lesson learned by government officials and some partners during the early phase of CBFP PA management.

For example, empirical evidence from Lobéké National Park in Cameroon has shown how powerful a "seemingly weak" indigenous group could become when they felt that their rights and obligations had been tampered with by some unruly actors. The ministry officials finally recognized their errors and bowed down to persistent pressure from local and indigenous populations, especially on aspects related to delimitation of national parks and harvesting rights. Government forest departments are now abandoning top-down, "command and control" traditions and evolving towards a more adaptive, pluralistic vision of their own role (Sayer & Maginnis, 2005). Stakeholders also found similar problems in the management of the Okapi Faunal Reserve in the Ituri-Epulu-Aru Landscape of DRC when they discovered that "indigenous groups perceived forest in PAs to be an abundant resource for them, and one of the goals of the zoning system was to empower these groups to understand the value and limited nature of their land and resources, and to manage them accordingly" (Brown, 2010). Multi-stakeholders dialogue has been very important in obtaining support from local and indigenous populations who are currently contributing, amidst some minor problems, to the management of the Reserve.

Photo 10.10: Consultation with local communities is an essential and much appreciated part of any participatory process

Small grants and civil society organization in protected areas

One of the strategies to fully engage civil society organization to sustainably manage CBFP PAs was through the Small Grants Program. The Small Grants Program has contributed to strengthening the capacity of civil society organizations to be fully engaged in conservation activities. This strategy has fostered strong partnerships between landscape management consortia, PA managers, local NGOs and government officials in the field. With this seed money, civil society organizations became assets to conservation efforts in PAs because their actions filled some gaps in the PA management plan. For instance, REFADD[61] used small grant money to translate the Forestry Code into a local language (Lingala) and to disseminate it around the protected areas in the Equateur province (DRC). This action yielded unprecedented results whereby local communities reported to the police eight instances of poachers trading endangered species' skins.

Publication of lessons learned in protected areas

The CARPE Lessons Learned publication[62] provided a feedback mechanism from a variety of stakeholders, and has helped participants to benefit from one another's experiences and thereby improve their own interventions. This publication contains 27 case studies of applied conservation as well as 7 overview articles synthesizing the results of case studies, covering different thematic areas. The generation of the Lessons Learned forced CBFP partners themselves to engage in an analytical reflection of their own activities and thus encouraged a process of learning and adaptation during the implementation of future PA program (Yanggen *et al.*, 2010). Key findings in this publication concern thematic areas such as (i) land use planning at the landscape, PA, concession and community scales, (ii) the role of alternative livelihoods, (iii) the promotion of national policies, (iv) the use of small grants to strengthen natural resource governance, and (v) the monitoring of natural resources.

[61]REFADD: African Women's Network for Sustainable Development.

[62]http://www.iucn.org/dbtw-wpd/edocs/2010-037.pdf

Photo 10.11: The small city of Bayanga (in the Sangha Tri-National Landscape - TNS) is an entry point for elephant and great ape wildlife tourism

Coordination of efforts and funds

Some observers are of the opinion that before the CBFP was launched in 2002, conservation funds were not properly used in many of these PAs because management strategies were not well tailored toward robust objectives, efforts were not well coordinated and there were serious issues of environmental political jingoism among partners. With the launch and implementation of the CBFP, donor governments like France, Germany, Canada, the Congo Basin countries themselves, NGOs and international organizations like IUCN, WWF, WRI, WCS, CI, CIFOR and all CBFP members agreed to form a Type II[63] non-binding partnership to facilitate coordination, synergy, joint planning and monitoring of activities in CBFP PAs. This Type II process not only facilitated the identification and recognition of these PAs by all CBFP parties, but also yielded unprecedented results because confidence was restored as coordination of partners' activities and funds became a priority.

A recent analysis provides rough estimates on available funding for PAs in the Congo Basin (GEF, 2010). The PA-related expenditure in 6 Central Africa countries (Cameroon, CAR, Equatorial Guinea, Gabon, Congo, DRC) for the year 2009 surpassed $ 50 million and represents a significant increase compared with previous figures assessed at the launching of the CBFP. In the early 2000s, between $ 10 and 20 million was estimated to be allocated to PA management. However, during the same period, the area under protection increased significantly with the expansion of PA systems and current estimates remain significantly below the annual recurring costs for PA system management. The study stressed significant variations among Congo Basin countries based on estimates of actual spending per hectare.

Capacity building of protected area managers and actors

Capacity building of PA managers and stakeholders in CBFP landscapes has been a top priority of the CBFP and this is increasingly having a positive impact on sustainable PA management. The range of themes covered by trainings provided to PA staff has been continuously expanded since the launching of the CBFP. Initially focusing on specific core PA activities (e.g., wildlife survey and law-enforcement techniques), training sessions were later developed to build staff capacities on broader PA management topics (e.g., management planning, monitoring of management effectiveness) and other related aspects (e.g., leadership). The audience targeted by trainings has been extended beyond the strict PA management team to other stakeholders as well. Government officials, community and civil society organization members have been increasingly included in training initiatives. For example, government officials have been trained on how to develop and use interactive forest atlases to monitor illegal forest and mining activities in PAs and forest concessions. This has to some extent dissuaded concessionaires (logging or mining) from encroaching into PAs.

[63] The principles of this partnership are: (i) the complementarity with intergovernmental agreements (Type I) (mechanism of delivery of concrete and precise results), (ii) the voluntary adoption (mutual respect and shared responsibility), (iii) participatory approach (all participants are considered equal), (iv) the provision of added value, (v) the integration of partners efforts (economic, environmental and social), (vi) the international dimension initiatives (global impacts) and (vii) the need to report the results (transparency, shared accountability).

Box 10.4: Institutional reform: the case of ICCN

Marc Languy
AGRECO G.E.I.E.

At the end of the war in the DRC, protected areas were in an alarming state in terms of conservation but they still showed potential for recovery. An institutional review carried out in 2006 showed that, in addition to a need for increased support for the sites, there was an urgent need to reform the organization in charge of protected area management in the DRC, the Congolese Institute for Conservation of Nature (ICCN).

This reform started in mid-2009 and, although it has not yet finished, it has already highlighted two essential elements required for successful implementation: (i) the need for a favorable political and legal context, and (ii) that the reform should focus on ICCN's greatest asset, its human capital.

The political context relates to the political will to reform all State institutions. This has resulted in ICCN and its supervisory Ministry becoming pilot institutions at the national level and being given a new statutory framework. ICCN therefore moved from being an enterprise to becoming a public body which gave it greater management autonomy. Consequently, in April 2010, ICCN was given its own unique statutes and, at the end of 2010, it started working on revising the statutes for its staff.

ICCN's human capital, comprising over 2,000 employees, is by far its greatest asset. At the same time, it is its greatest management challenge. Reform has focused essentially on gaining a better understanding of the workforce, with a physical and biometric census being undertaken for the entire country. At the same time, by transferring staff between sites, an improved overall distribution of staff was achieved. About 500 additional staff joined staff already working on conservation *in situ*. The new staff came from the former Congolese Institute of Zoological and Botanical Gardens which had been dissolved and merged with ICCN. This merger will provide for economies of scale and exchanges of expertise in complementary areas that are focused on biodiversity conservation in the DRC.

The increased capacity of ICCN also highlights two important areas of reform: (i) staff rejuvenation, through early retirement programs and the recruitment of young staff, and (ii) developing training programs. This latter can only be developed at the end of the reform process once post requirements have been studied and staff evaluations have been carried out.

A huge task awaits ICCN in 2012 to ensure that the benefits achieved by its reform can be assured over the long term. This task is the development of a modern remuneration policy which will keep the best staff on board. This policy will be based on a realistic but extensive study of ICCN's "renovated" resources. Part of these resources will come from an increased State contribution. The revival of tourism, which has significantly increased since June 2009, has provided ICCN with additional resources so that it also will be able to increase its contribution. The support of international partners will however be necessary to guarantee that indispensable additional resources are provided. The establishment of new structures and principles of transparency allowing accounts to be audited in accordance with international criteria will make it possible for contributions to be provided through direct subsidies and also by means of a fiduciary fund for protected areas.

Barriers to the effective management of protected areas systems in the Congo Basin

Financial capacity

Despite an increase in resources dedicated to PAs, inadequate funding remains a major constraint to establishing effective management. National budget allocations and enhanced funding mechanisms are insufficient if PA financial sustainability is to be achieved. There is a need to find more sustainable solutions to mobilize and manage funds. While international cooperation remains critical for PA management in the Congo Basin, other categories of self-generated revenues exist to various degrees, including: tourism and hunting charges, environmental funds (e.g., trust funds - see box 10.3 on FTNS), debt-for-nature swaps (e.g., C2D[64] in Cameroon), corporate sponsorship, biodiversity offsets, etc. Payment for environmental services, including REDD and watershed payments, have a potential to play a more significant role in the future.

Management planning

A 2009 assessment of the status of management planning of 152 PAs in the Congo Basin (DRC, Congo, CAR, Equatorial Guinea, Gabon, Cameroon, São Tomé & Príncipe, Chad), found that 13 PAs (about 8 %) possessed a validated management plan while 23 others (about 15 %) were in the process of elaborating management plans (RAPAC, 2009). While this is a small percentage of the total PAs, this represents a significant effort knowing that management planning has not historically been considered a top priority relative to the establishment of new PAs and addressing immediate threats.

There has also been a growing recognition of the context of PAs within a broader landscape and mosaïc of land use types. In accordance with this principle, the planning process has been expanded to better engage diverse stakeholders (i.e., local communities, other government bodies, private sector) and to take into consideration social aspects of resource management. At the same time, management plans and the planning process have become more complex.

PA management planning in the region has progressively and more systematically included a business plan section. This increases the accountability and transparency of the management activities.

Photo 10.12: The region is characterized by the close interaction of forest and water systems

[64]Debt reduction and Development Contract.

While there is a growing awareness of the value and importance of monitoring management effectiveness, there is a need to more systematically implement such processes. This lack of systematic implementation hinders the establishment of a more pro-active and responsive management style, which is critical to adjust and respond to threats and conditions as is required in the context of the Congo Basin.

Also, there is a risk of considering the management plan as a goal in itself (e.g., for financial attraction) and not implementing the activities and strategies outlined in the plan, nor monitoring the effect of these activities.

Management considerations

Because of the immediate and high level threats to the resources in PAs, effective law-enforcement in and around PAs remains, with few exceptions, a prerequisite for PAs to fulfill their role as core biodiversity conservation areas. Planning, implementation and monitoring of law-enforcement strategies have been generally improved through the use of more robust standards and increasing effort. However, many PAs are still facing major difficulties in ensuring effective law-enforcement, resulting in a serious incapacity to slow down the rapid decline in populations of some wildlife species. This has occurred despite increasing investment and effort in conservation over the last decade and reiterates the needs for more monitoring of management effectiveness and a system for adaptive management.

While recognizing the need to address immediate threats to the protected areas, working at a broader scale has emphasized the tenuous economic situation for communities in and around PAs.

The real poverty issues that concern most communities in the Congo Basin cannot be ignored and establishing sustainable PA systems will also depend on the ability of governments and development organizations to address poverty and development concerns. Partners engaged in PA management do not have the capacity or skill to significantly address these issues.

Competing land pressures

The ecological integrity of PAs is under increasing threat from the expansion of agriculture (to meet human food requirements and in response to demand for agrofuels), mining and logging activities, infrastructure projects, and other development. As land is divided, species' movements, natural cycles, and ecological functions can be disturbed. Participatory and collaborative planning and decision making will be important for different stakeholders within and around PAs and their connective corridors to try and maintain the long term ecological integrity of PAs. In many areas of the Congo Basin, sectors of the national economy are planned and managed by separate agencies. The limited focus of agencies and the lack of clear frameworks for collaboration can make it challenging to incorporate PAs into integrated conservation or development plans.

Photo 10.13: Slash and burn agricultural practices result in the conversion of forests and changes land cover

Opportunities and considerations for effective protected area management

Mitigating threats

- Support and political will to address poaching and wildlife trafficking in and outside of the Congo Basin will need to be strengthened if there is any hope of conserving certain species. Making the link between anti-poaching and trafficking is an important means of tracking management effectiveness. Building capacity and support for judicial follow is critical to assure that deterrence mechanisms can be established.
- PA conservation efforts will never succeed if all concerned government officials are not fully associated with the process. This is normal and expected in most settings, but institutional weakness of Central African administrations could result in the *de facto* management responsibilities falling to NGOs.
- Building off of transboundary initiatives supported through the CBFP, national and regional bodies, regional planning and the harmonization of conservation objectives across boundaries will continue to be important to strengthen individual PA systems.

Box 10.5: The management of protected areas in a post-conflict environment

Dr Jean-Pierre d'Huart

Conservation Consultancy Services SPRL

The impact of conflict on protected areas (PAs) does not disappear when that conflict officially ends. Experience shows that, while a State expects its services to make a special effort in the reconstruction process so that the country can function again normally, a number of obstacles can impede this effort. In most cases, the administration in charge of PAs is among those given lowest priority from a national perspective. The State tends to allocate its limited financial resources to more visible social and economic sectors such as infrastructure, health, education, water/electricity, housing and/or employment. The PA administration often finds itself unable to get its protected areas network up and running quickly. Without its own financial resources, it becomes dependent upon donor support and the assistance of international NGOs. Furthermore, as the instability caused by the conflict has affected its structure and functioning, it may have to deal with complex problems affecting its staff. The administration's management capacity is often ill-equipped to cope with the chaotic situation it faces, and therefore, some donor support is allocated specifically to restructuring and institutional reform.

In the field, staff in a post-conflict environment often rely more on the assistance of NGOs (themselves largely dependent upon donor support) than on that of the central administration and there may be a consideration to outsource the management of some PAs to the private sector. In some cases, relations between the administration and its partners are affected, causing dissension that can only be alleviated through open and professional discussions with staff. Relations with other administrations and the political sphere rarely fare any better. Encouraged by the potential contribution they can make to the country's economic recovery, some Ministries disregard the law and sign important contracts – for roads, petrol or mines – that undermine the integrity of PAs. Apart from the sometimes disastrous environmental impact of these contracts, the conflict of interest they represent can constitute an enormous challenge in terms of the impact on the relative importance a government attaches to its PAs.

In any post-conflict situation, on-site managers are faced with a long list of challenges. The administration has to re-establish security in the country while armed groups are still operating in the interior. As it cannot expose its eco-guards to this situation, it has to work with the armed forces which are often responsible for looting resources. Parks have to deal with the delicate and costly evacuation of the illegal occupants who moved in during the conflict. The administration's relative weakness means it has difficulty re-establishing control: rather than dealing with their principal objectives, conservationists need to devote most of their attention to the problems caused by soldiers, poachers, rebel groups, neighboring communities and local politicians. The large scale projects supporting post-conflict efforts allow basic managerial functions to progressively work again but require extremely skilled managers. The human implications of a post-conflict situation are much more difficult for managers to handle than the reconstruction and surveillance of the park, the reorganization of environmental work and tourism, or the development of an appropriate form of participatory management.

Photo 10.14: A majestic tree appears in the morning mist

Recognizing the value of protected areas in an increasingly competitive land use context

- The natural goods and services maintained by PAs are often provided in the region at no or very low costs. There has been very little progress in introducing the principle of payment for environmental or ecological services. As competition for land increases with development opportunities, it will be important to demonstrate and consider the full economic value of PAs. Building off of the lessons learned through the landscape approach, implementing participatory planning between sectors and recognizing the direct and indirect benefits of PAs will help to address issues associated with increasing competition for land and resources.
- Assuring that Environmental Impact Assessments correctly assess the potential damage and imposed on PAs, and identify mitigation measures that achieve the necessary environmental and social protections will be increasingly important as development of extractive industries and infrastructure grows.
- To establish sustainable funding mechanisms for PAs, support is needed to build management capacity to generate revenue, manage funds in accordance with management and business plans and to promote an enabling institutional and policy environment. At the international level, PAs may qualify for REDD+ financial incentives.

Co-management of protected areas

- Across the Congo Basin, there are individual examples of co-management models with communities at various stages of development for PAs and buffer zones. There is a need to review these examples to further identify effective, sustainable and replicable models of community based PA governance and management models.
- In many countries, the legal frameworks (i.e., land tenure and resource rights) for co-management are not yet fully developed to support the establishment of formal co-management schemes. Moreover, weak systemic and institutional capacities currently prevent national organizations from efficiently integrating local communities into PA management. The establishment of co-management systems will require an increase in investment to support these processes and capacity building, for both national management agencies and local communities.
- The viability of community based management or co-management systems will likely be dependent on economic considerations. Strategies to promote sustainable financing mechanisms for local committees are needed and pilot programs that promote benefit sharing and compensation mechanisms should be promoted.

Capacity building

It is very important to remember that a key underlying requisite for successful PA management in the Congo Basin is capacity building of all relevant stakeholders. Current conservation efforts will certainly be unsustainable if donors do not seek to "normalize" the processes by building the capacities of Central African conservation institutions and actors (see box 10.6).

Policies and laws

It is vital to make sure that relevant policies, laws and regulatory frameworks are regularly updated to meet the challenges of changing and dynamic field conditions. Threats, and therefore conservation dynamics, often change and conservationists must be alert to these dynamics and adapt as quickly as possible.

Box 10.6: ERAIFT's contribution to sustainable development in tropical Africa: capacity building

Samy Mankoto, Baudouin Michel and Noëline Raondry

UNESCO / ERAIFT

On 10 April 1999, the Regional Post-graduate Training School on Integrated Management of Tropical Forests and Lands (ERAIFT) opened its doors on the campus of the University of Kinshasa (UNIKIN). Under the auspices of UNESCO's Man and the Biosphere Programme (MAB), it is supported by several associated African countries and numerous donors (i.e., UNDP, Belgium, European Union, World Bank Trust Fund/EU, and more recently, Wallonie-Bruxelles International and ECCAS-ADF through PACEBCo's regional program).

ERAIFT is developing an original approch in Sub-Saharan Africa, using a systemic approach as a conceptual basis and as a mode of pedagogical training. The school provides post-graduate training in the third cycle (DESS or Master II) for students who have finished 4 to 5 years of university studies and who have at least 3 years of professional experience. The students are from Central African countries (i.e., Angola, Burundi, Cameroon, Congo, Gabon, CAR, DRC, Rwanda, Chad), from West Africa (i.e., Burkina Faso, Benin, Côte d'Ivoire, Guinea, Niger, Senegal, Togo) and from the Indian Ocean region (Madagascar).

In December 2001, at its 20th symposium, held in Abidjan (Côte d'Ivoire), the African and Malagasy Council for Higher Education (CAMES) recognized the ERAIFT DESS diploma, making ERAIFT a very interesting prospect for young African researchers. From 2012, instruction which is currently given only in French will be bi-lingual (i.e., French and English).

ERAIFT has signed agreements with doctoral schools or equivalent bodies from partner institutions (i.e., UNIKIN, UNIKIS, Gembloux Agro-Biotech, Laval University in Quebec, Canada) and provides *in situ* facilities for researchers from the aforementioned countries to allow them to prepare their theses.

ERAIFT also gives further education to ministries and national administrations staff in charge of the environment, nature conservation, land use planning and rural development in tropical African countries and provides advisory services in its areas of competence and research.

In the next three years, ERAIFT is likely to become a category 1 Institute of UNESCO. The systemic approach ERAIFT uses in its teaching and research gives it its defining and original character. As former pupils say, it is "a school unlike any other". An impact study, carried out in 2007 looking at the last four classes, showed the relevance of the teaching provided, the specific pedagogical approach developed by the school, as well as the significant contribution ERAIFT makes to building indispensable capacity, especially in the Congo Basin. Undertaken as an endeavor with a process of participatory evaluation, the lessons learned from the experience of ERAIFT will serve to further improve the school's effectiveness, consolidate its institutional sustainability and allow it to be replicated in other African countries.

Launched under the MAB Programme, the development of a South-South partnership with university and research institutes in Brazil (basin of Amazonia) and in Indonesia (basin of south-east Asia), and the establishment of a tripartite North-South-South cooperation network, are among ERAIFT's current priorities. These priorities are fully compatible with issues that are high on the international community's agenda, in particular those relating to climate change, REDD+, and the "Declaration of the Heads of State and Governments on the Three Tropical Forest Basins in the World" (Brazzaville, 3 June 2011).

Another priority for the school is the establishment of a distance learning method which is likely to significantly increase ERAIFT's impact in providing capacity building for the leaders and decision-makers of the Congo Basin member States and Sub-Saharan Africa.

Conclusion

A new paradigm recognizes that protected areas do not exist in isolation but are core components of landscape scale ecosystems. Therefore, successful PA management should fit into a landscape scale management strategy which addresses surrounding land use practices and provides for the socio-economic well-being of local communities. Although PA management in CBFP landscapes has been very challenging, it has yielded some concrete results over the years, in part because of a people-oriented approach to conservation.

Empirical evidence is now demonstrating the performance of PAs within landscapes in terms of biodiversity protection.

A type II partnership approach to PA management in landscapes through the CBFP has proven effective in orienting funding towards a common goal. Many stakeholders are now collaborating because the strategy has fostered an intrinsic link between conservation and sustainable livelihoods. Results show that conservation is not just biophysical but also socio-cultural; that PA conservation benefits and values are not just economic but also intangible.

Discussions around the world are increasingly tilting towards climate change, notably REDD and payment for environmental services. PAs in CBFP landscapes are invaluable assets for carbon storage and capture. It will therefore be very advantageous for State parties in the Congo Basin to include the natural tropical forests contained in protected areas as part of REDD related negotiations. However, in order to benefit from these assets, there is urgent need to continue with the collaborative management of these PAs by all stakeholders, especially among local populations, governments and PA managers. This is just part of the future priorities for PA managers in the CBFP landscapes.

Photo 10.15: Water and forest dynamics are intimately linked to each other throughout Central African landscapes

CHAPTER 11

Forest zoning experience in Central Africa

**John G. Sidle, **Jef Dupain, *James Beck, ***Janet Nackoney, ‡Carlos de Wasseige, ‡‡Jean Daniel Mendomo Biang, ‡‡‡Robert Leprohon, ‡‡‡Sébastien Malele*

**USFS, **AWF, ***UMD, ‡OFAC, ‡‡MINFOF, ‡‡‡MECNT*

Introduction to forest zoning and land use planning

Photo 11.1: Forest clearings and fallows in the periphery of Kisangani, DRC

During the last two decades, Central African countries and partners have zoned forests as a part of national and sub-national land use planning. The goal of these efforts is to orient forest development and conservation endeavors to support local, national and international objectives. Land use planning provides the process for informed decisions that balance different, competing and incompatible sectoral interests (e.g., mining, community development, protected areas (PAs), agro-industrial plantations, logging concessions). Such a process requires data gathering and synthesis, significant and ongoing stakeholder consultation at all levels, analyses and projections of development trajectories, informed decisions on trade-offs and conflict resolution, and ultimately political will and local acceptance for lasting success.

In this chapter, we first review the concepts of zoning and land use planning as developed and used in Central Africa. Then we provide an update on the status of zoning and land use planning at the national level. Two case studies of national level experiences highlight earlier work in Cameroon and nascent efforts in Democratic Republic of Congo (DRC). Next we provide an update on zoning and planning at the sub-national level through an examination of Congo Basin Forest Partnership (CBFP) landscapes especially the Maringa-Lopori-Wamba Landscape in the DRC. Finally, we conclude with parting observations and perspectives on zoning.

The purpose of forest zoning and land use planning

Zoning in one form or another has been a major component of land use planning throughout the world. Zoning refers to the designation of permitted or conversely unpermitted uses of land based on mapped zones which separate one set of land uses from another. In principle, zoning consists of identifying the most judicious uses of land given the land's characteristics and the environment. Increasing demands for the earth's resources have compelled nations into even further public policies of land use planning to regulate the use of land and its resources for the well-being of people and their physical, economic and social environment.

Forest zoning constitutes an important stage in the management of Congo Basin forest resources. Indeed, 46 % of the 1.6 million km² of the dense humid African forest has already been allocated for timber concessions or designated as protected areas (PA) and given the current pace of zoning it is likely that most forests in the Congo Basin will be zoned within 20 years (World Resources Institute, 2010; Yanggen *et al.*, 2010). In the past, timber concessions and PAs were zoned with little or no public input, however, modern laws in the Congo Basin require extensive public participation. Moreover, there must be a serious examination of all resources and sector/development needs (e.g., mines, roads, agriculture) in order to form a consensus about land use that is consistent with local, national and international obligations (Beck, 2010). Such an exercise can lead to sound forest zoning and form the basis of land management plans at various levels.

The designation of national parks, national forests, reserves and other large areas (e.g., forest concessions) year after year by national governments, has usually been the product of opportunities and needs rather than the product of a national land use planning process. The concept of a "community forest" or "Community Based Natural Resource Management" area (CBNRM) is recent, although few have performed well in Central Africa or elsewhere in the world. Furthermore, managing CBNRMs and funding communities under established procedures appears problematic at present (Agrawal, 2001; Armitage, 2005; Barrett *et al.*, 2005; Cerutti *et al.*, 2010; Ministry of Forestry and Wildlife, 2009; Minang *et al.*, 2007; Ngniado *et al.*, 2010). In addition, experience from Brazil, Cameroon and Indonesia indicates that zoning CBNRMs does not receive the same attention by governments as zoning for timber concessions and PAs (Hoare, 2006; Topa *et al.*, 2009).

Adding to the complexity of zoning in Central African forests, land tenure (resource rights, access, land titles, etc.) represents a critical element of any land use planning process. Central African traditions and law create a challenging environment with respect to the duality and at times inherent conflict of the modern *vs* customary recognition of land tenure (see box 11.1). Land tenure clarity and security is undeniably a fundamental challenge and ultimate output of a worthwhile land use planning process.

Increasingly, REDD national strategies across the region are highlighting land use planning and land tenure to underpin the region's contributions to global climate change mitigation (Coordination nationale REDD, 2010a & 2010b). Such developments can have lasting positive impacts on society and the natural environment we are dependent on - across many ecosystem services beyond carbon sequestration (see box 11.2).

Photo 11.2: Major villages can rapidly evolve into small cities (Lake Edward, eastern DRC)

Box 11.1: Diagnosis of land management systems

**Alain Karsenty, **Samuel Assembe*

**CIRAD, **CIFOR*

The land tenure situation in Central Africa is characterized by legal duality.

The concept of a **"modern" property regime** is organized around a dual axis:

- Registration, a powerful but very cumbersome device to establish individual private property;
- A fairly general assumption of a "domanial" regime for the remaining land, but with the possibility for individuals to be granted land concessions subject to "enhancement" (of that land).

Assuming a "domanial" regime for forests is the general rule; **classification** (such as in Cameroon, Gabon, CAR, Congo) is the procedure for the legal establishment of the **private domain** (of the State or local public collectivities). In DRC, classification is associated with conservation designation and the private domain is assumed for the remaining forests (with no explicit procedure for its legal incorporation). The **national domain** constitutes a category that is specific to some African countries: it is a category that exists "by default" pending the establishment of alternative land status (individual ownership, private domain…). The national domain is linked to the concept of "collective heritage" rather than ownership: the State is the "keeper" (Cameroon law) and not the owner. However, the inappropriate practices of administration officials sometimes cause confusion between national domain and State ownership.

Although **customary land tenure systems** are extremely diverse, they share common principle: they combine in varying proportions the "individual" and "collective" appropriation, which are usually closely linked; resource extraction is carried out on an individual basis (in fact, on a family basis) while the use of space is completely codified at the collective level. It is important to determine village "finage" or "terroirs" (area used by the village community, whatever the appropriation mode) which can be defined as areas with blurred limits governed by customary rights (irrespective of the means by which they were allocated and the legal status of the land). They are characterized by a definition of village land in reference to places rather than limits, sometimes discontinuous, with variable dimensions, defined by the specific patterns for using resources. The boundaries of these collective spaces are not always known for all areas of the forest and, in sparsely populated areas, some land rights are often largely virtual. Land rights combine with other and different specific rights on resources (e.g., trees, non-timber forest products).

Legal duality (superimposing modern and customary tenures) negatively impacts on maintaining wooded cover. Deforestation is not determined by one particular kind of land tenure: private domain of the State is not synonymous with effective protection by powerless administrations; customary tenures are based on "the law of the axe" (i.e. deforestation) for the recognition of exclusive land rights; experience has shown that communities do not always choose to conserve forests -which they consider belonging to them- if more interesting economic opportunities become available. On the other hand, the lack of clarity and recognition of the different rights being applied and their legitimate users (a direct outcome of legal duality) encourages deforestation. The frequent lack of adjustment between land legislation (favoring land reclamation) and forest legislation generates "security strategies" that are at odds with forest cover. Access to legal forms of land security (such as land concessions for agriculture) is dependent upon enhancement/development, i.e. deforestation. Assuming a "domanial" regime and not recognizing customary patterns of using land and resources opens up the possibility of wooded land being allocated for conversion to other purposes.

Uses of forest lands by indigenous, semi-nomadic forest populations are the less "visible" from a land development perspective: these groups need to maintain **access to resources regardless of the land tenure status**. Concerning the REDD, the development of large scale payment for environmental services would require prior identification of the effective users (with capacity to manage and exclude) of the "finages/terroirs" and the recognition of their real rights to use those spaces and resources.

Clear political vision and orientation are required to allow the land situation in Central Africa to evolve. There is need to strengthen the concept of "property creation from the bottom", which is based on a growing sense of ownership by populations linked to institutional changes (relative democratization process, decentralized taxation, community forests, negotiations to classify forests, preemptive rights ...). Such a policy would seek to recognize the **practical rights** of the different actors. Legislation will need to evolve so that these practical rights are recognized through *ad hoc* juridical instruments which do not necessarily need to stretch to absolute property rights. Essentially, what is required is the recognition of the right to manage and exclude outsiders for families, clans and communities.

It would not be appropriate to seek to establish property rights on "environmental services" and especially over carbon. Environmental services are by their very nature collective (or public) goods. They consist of activities (such as the upkeep of the countryside, water quality maintenance, and the reduction of deforestation) that are undertaken by humans for other humans, about the environment. **The real question is one of the ownership of "carbon credits"** which could be offered in exchange for an active contribution to the sequestration of atmospheric CO_2 (by planting) or for maintaining carbon levels on a given land (by avoiding deforestation). In other words, those agents who effectively provide the environmental service have the rights to receive carbon credits (or financial reward) rather than the "owners".

The study conducted by the authors in 2010 and relating to land management in Central Africa makes six proposals:

1. **Revise the concept of "improvement/development/enhancement"** in land tenure laws/codes to one of "active contribution to sustainable development and environmental conservation";

2. Seek to **achieve greater coherence and continuity in land use and forest laws** by lifting the various legal and regulatory barriers that prevent communities from obtaining land concessions in wooded areas, and ownership of natural or planted forests contained in those areas, if they do not convert them for agricultural purposes;

3. **In each country, identify and map out the customary territories** (rural zones/limits - terroirs or finages) **and then identify and register the multiple rights** exercised over those spaces **by the various stakeholder groups/actors** that are using them. Tools such as participatory land mapping for the zones/limits (terroirs/finages) could be used in order to achieve this. The information found could be used in zoning plans and, in the context of sustainable forest management, to share the benefits of exploitation. This work could be undertaken by administrations, delegated to local authorities or civil society using a set of specifications detailing the methods to be employed and the categories to be used (which could be prepared by COMIFAC);

4. **Each country should organize its community forestry around two spaces:**
   - An exclusive space set up as a collective forest or land concession, as part of a wider non-exclusive area;
   - A non-exclusive space, defined by maps drawn up with the communities and their neighbors. This space could have accurate limits (where streams, ridge lines ... exist) or vague limits (grey areas, especially when some resources are shared with neighboring communities).

   Policy, legislative and regulatory documents should explicitly recognize these superimposed rights and the need to manage them jointly in a coordinated way;

5. In order to establish rule of law, countries that currently do so, should **abandon the practice of assuming private forest domaniality.** This does not mean that the State cannot become a forest owner, but that the constitution of the private domain of the State should be carried out in accordance with the proper legal principles and appropriate procedures. This may be called "registration", "classification", or given other designations;

6. It would appear essential that the COMIFAC countries that have not yet done so, should introduce the **concept of a "permanent forest estate"** in their respective forest and land codes. The identification of a permanent forest estate seeking to ensure the long-term maintenance of land under forest cover should be **the primary goal of zoning plans.** Proposals for land allocation that are too detailed and likely to generate conflict should be excluded. Establishing a legal distinction between "permanent forests" (or permanent forest estates) and "non-permanent forests" will set the limits for the respective use of enforceable regulation (logic "command and control") and of economic instruments that could be developed under the REDD.

Box 11.2: Reducing Emissions from Deforestation and Forest Degradation (REDD)

REDD is a climate change mitigation strategy that offers developing countries incentives to reduce their forest carbon emissions. REDD+ goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks. REDD+ brings a new dimension to forest management and forest zoning (Kasulu Seya Makongai *et al.*, 2009). DRC is developing several proposals to build the structural conditions of a large scale and operational deployment of REDD+ (Coordination nationale REDD, 2010a-f). Vast tracts of forest could be zoned as "classified forests" for REDD+ reserves, but it is likely that REDD+ will intervene largely at the forest management level through sustainable forestry practices that better manage carbon: narrower roads, reduced impact logging and other improved standards for forest exploitation (Ndikumagenge, 2010). There may be forest concessions for the production of environmental services (Brummett *et al.*, 2009; Lescuyer *et al.*, 2009b). DRC estimates that $ 500 million are required for the first two years of REDD+ and over $ 5 billion for the following 5-15 years, amounts seen in recent REDD+ agreements in Indonesia. There are also dramatic lessons of corruption and mismanagement in Indonesia (Clement *et al.*, 2010) that are likely to occur in DRC.

Forest zoning must be integrated into the vast national land use planning process envisioned by REDD+ in DRC (MECNT, 2009b; Coordination nationale REDD, 2010b). Because forest zoning is already underway by the CNPZF, DRC policies, CARPE landscapes, USFS assistance and a World Bank funded forest zoning consultant, forest zoning can greatly assist REDD+ in DRC.

Overview of concepts and working definitions

Previously, there has been significant confusion and arguably misunderstanding of some basic terms and concepts pertinent to land use planning and zoning. Therefore, a common definition of terms and concepts is critical to effective and efficient communication in land use planning and zoning. The following terms are defined here to clarify the authors' working perspective (USFS, 2010a):

- **Land use Plan**: a plan that determines the stratification of land uses within a landscape, and provides basic guidance for each land use zone and the integration of these zones;
- **Planning**: process in which stakeholders (e.g., community members, scientists, government representatives, private businesses, traditional authorities) come together to discuss and determine how to manage resources in a particular geographic area for the benefit of current and future generations;
- **Zoning**: process of identifying (or delineating) geographic areas separated by differing land uses (and associated guidelines) as a part of a broader land use planning process;
- **Macro-zone**: a large geographic area such as a national park or forest concession;
- **Micro-zone**: spatially explicit area within a macro-zone where land management differs from adjoining micro-zones.

Existing macro-zones are often micro-zoned into different land uses during the development of management plans. For example, Lobéké National Park in Cameroon has been micro-zoned into areas specially devoted to fishing or local non-timber forest product gathering (Usongo & Nzooh Dongmo, 2010), and the Okapi Faunal Reserve in DRC has been divided into micro-zones devoted to agriculture, hunting and conservation (Brown, 2010). Moreover, timber concessions in Republic of Congo and most countries in the sub-region contain numerous micro-zones for multiple-use objectives such as timber production, conservation, or other micro-zones (Elkan *et al.*, 2006; Poulsen *et al.*, 2010).

Public participation at the local level – Macro-zoning and micro-zoning

Central to forest zoning is the participation of local people who have inhabited the forests for hundreds of years and who depend upon the forests for their livelihoods. In the recent past (and ongoing in some cases), central governments often have entered into agreements with timber companies, mining companies, as well as designated protected areas without the input from local communities. As a result, many people were expelled from their forests. Today, however, for the most part, extensive engagement by local people is required by law and various socio-economic and ecological studies must be undertaken. For example, DRC law requires public involvement, a detailed description and justification for a proposed protected area, and precise mapping of boundaries[65]. Future forests of permanent production, timber concessions, PA, CBNRMs, or other uses that fundamentally change the land cover (mining and agriculture) must be built upon a strong foundation of public involvement.

Macro-zoning requires the involvement of several national-level government ministries (including governmental representatives of agriculture, forest, mining and land use) and well-recognized representatives of minorities, civil society, and the private sector, to name a few. Micro-zoning, however, requires the active participation of representatives of the local communities who depend on the land for their livelihoods as well as the participation of other stakeholders such as the private sector (including logging or mining companies).

The debate continues across the region about the ideal, appropriate, and/or feasible level of public participation during different levels of land use planning and forest zoning. For example, the Ministry of the Environment, Conservation of Nature, and Tourism (MECNT) in DRC is promoting a forest zoning approach that first focuses on macro-zoning in which biophysical, social and economic data are gathered, and community representatives are consulted to develop indicative "proposed" macro-zoning maps. Generally speaking, when actual "decisions" are to be made during the classification processes, more detailed and finer scale participatory mapping will be critical for overall macro-zone borders and micro-zoning. Some contend that micro-zoning should occur before any national/provincial macro-zoning occurs because macro-zoning can result in a *"fait accompli"* by the time the process arrives at the classification stage.

Photo 11.3: Dialogue and consultation efforts between local populations and a logging company

[65]Decree n° 08/08 (8 April 2008), establishing the procedure to classify and unclassify forests. Standards for Forest Zoning: an operational guide. Ministry of the Environment, Conservation of Nature, and Tourism (MECNT). Forest Inventory and Management Division, Kinshasa, DRC.

There are many examples of public participatory processes in Central Africa[66]. In general, these approaches take community needs and desires into account to facilitate land use planning activities. The mechanisms for equitably bringing the interests of all stakeholders into the zoning process for the establishment of PA, community development areas, timber concessions and other extractive resource zones (ERZ) is critical to the success of zoning. Developing mechanisms to give key stakeholder representatives a voice in the zoning process is essential. As noted above, villages may end up with "default zoning" whereby various interests identify and establish PA and timber concessions first, leaving villages with the use of remaining forests. Mining permits, timber concessions, and PA may overlap village lands if the latter are not sufficiently taken into account during, for example, participatory mapping with villagers.

Ideally, extensive on-the-ground work is necessary for adequate community participation given the growing rate of land use change associated with population growth, immigration and informal sector expansion (e.g. agriculture, mining), even in the most remote forests. For example, Hart (2010) found that in eastern DRC forests, participation is not only being in villages and talking about a forest over a map but actually travelling through the forest with local people. The time spent with a community engaging in participatory mapping (usually one year or more) garners the most important input for sound zoning proposals, in this case, a proposed 30,000 km^2 classified forest between the Tshuapa, Lomami and Lualaba rivers (Hart, 2010). Ideally, multi-year participatory mapping and local engagement should occur. However, land use planning resources are often insufficient and national, regional, and international drivers push for quick zoning of palm oil plantations, timber and mining concessions. A less than ideal, though wise and practical choice, may be a high level macro-zoning followed by targeted micro-zoning.

Photo 11.4: The understanding and the marking of limits is central to the success of zoning efforts

Across Central Africa, most villagers have little geographic knowledge outside their community limits and integrating such knowledge into an institutional context is challenging. However, local input and standard indices of human activities and biodiversity can calibrate statements about the forest and its use with similar measurements throughout a landscape of diverse people whose opinions vary as to authority over natural resources and the status of wildlife, fisheries, and other natural resources. Claims for land and resources at the territorial, sector, group and other levels often need to be verified. Hence, zoning proposals must be carried out in a dynamic manner.

[66]See, for example: http://carpe.umd.edu
www.satyadi.com

Status at the national level

COMIFAC member countries have different requirements and visions pertaining to land use planning and zoning because they have different experiences and levels of development in this domain. Table 11.1 synthesizes the pertinent information on that status of national level land use planning processes and forest zoning processes across the COMIFAC member countries (COMIFAC, 2011). The following sections discuss case studies in Cameroon and DRC.

Case study: Cameroon

In Cameroon, planning for the use of forested land which has been funded by the Canadian International Development Agency has been the subject of multiple studies over the last decade. The Forest Zoning Plan of Cameroon (PZF) or, indicative land use map, is an allocation of forest space in Cameroon for specific purposes (e.g., production, protection, recreation, learning, research). The PZF aims to determine which areas are allocated to the "Permanent forest domain" and which to the "Non-permanent forest domain", and to attribute shares within these allocations for national, municipal, and community forests, research areas, mine extraction, etc. (COMIFAC, 2011).

Photo 11.5: Dabema's characteristic crown (Piptadeniastrum africanum)

□ *Process*

In the 1990s, a first exercise worked to elaborate a land use plan for southern Cameroon. The plan covered the first four stages of the national forest inventory. The concerned area was mostly forested, with the exception of the capital Yaoundé and its surroundings. A forest inventory for the area had been drawn up and the map coverage was on a scale of 1/200,000. The method used consisted of:

- Defining forest boundaries;
- Mapping all existing PAs;
- Mapping all valid logging titles in the forest domain;
- Mapping plantations and agro-industrial areas;
- Identifying public land on both sides of access roads and inhabited zones for the purposes of rural development (e.g., agriculture, domestic purposes, community forests). Forecasts for land required for rural development were made for a 25-year period. This was carried out using the most recent national population data available at the time. Forests contained on this public land were included in the "non-permanent forest domain", thus allowing it to be used for a variety of different purposes.

The plan that resulted from this first exercise was the subject of Prime Ministerial Decree No. 95-678-PM of 18 December 1995, indicating appropriate land use in the southern forested area. It was designed to be used as a tool for natural resource planning, orientation and exploitation within the area.

The second exercise was carried out as part of Phase V of the reconnaissance inventory. It targeted relatively populated and developed areas, where most of the land was passably managed. The approach taken included wider consultation of stakeholders, and provided for the participation of administrations concerned with land use, representatives of local communities, donors and civil society. The work consisted of:

- Setting up a multidisciplinary, inter-ministerial team composed of representatives from 10 ministries: (i) environment and forests; (ii) agriculture; (iii) livestock, fisheries and animal industries; (iv) public investment and territorial management; (v) public works; (vi) territorial administration; (vii) tourism; (viii) urban development and housing; (ix) mines, water and energy; (x) scientific and technical research. This team was responsible for providing the forest ministry with sectoral information and for participating in the overall thought process;
- Identifying all the boundaries of classified forests and forest titles;
- Preparing a preliminary land tenure map to be circulated to various actors (i.e. public administrations, donors and civil society) for their comments;
- Review of comments by the Directorate of Forests;
- Preparing a tentative zoning plan;
- Organizing consultation meetings in each provincial capital, with meetings to be chaired by the Prefect, and in each department in the Southwest Region. These meetings brought together concerned local administrations, mayors, deputies, local NGOs and traditional chiefs;

Table 11.1: Status of the land use planning and forest zoning at the national level in the COMIFAC member countries

Country	Status of national process		Notes
	Land use planning	Forest zoning	
Burundi	Initiated	None	Forest Code indicates broad forest use categories. National director scheme for land use management development in progress (current stage: provincial director scheme of land use management). In the meanwhile, *de facto* zoning of PAs, forest reserves/remnants, agricultural lands, and mining permits.
Cameroon	Initiated	Completed (southern zone)	See section "Case study: Cameroon" for further description and analysis.
Central African Republic	None	None	Forest Code indicates broad forest use categories. National scheme for land use does not yet exist and its absence is causing sectoral conflicts on competing uses (e.g., logging, conservation, and mining). *De facto* zoning of PAs, logging concessions, and prospection mining permits.
Chad	No information		
DRC	Initiated (early reflections in context of REDD)	Initiated	See section "Case study: Democratic Republic of Congo" for further description and analysis.
Equatorial Guinea	None	None	Forest Code indicates broad forest use categories. National scheme for land use does not yet exist and its absence is causing sectoral conflicts on competing uses (e.g., logging, conservation, and mining). The law provides for a commission for classification and land use but it's not yet operational. *De facto* zoning of PAs, logging concessions, and mining permits.
Gabon	None (perhaps being studied)	None	Forest Code indicates broad forest use categories. National scheme for land use does not yet exist and its absence is causing sectoral conflicts on competing uses (e.g., logging, conservation, and mining). *De facto* zoning of classified forests, logging concessions, and mining permits.
Republic of Congo	Initiated	None	Forest Code indicates broad forest use categories. National scheme for land use does not yet exist and its absence is causing sectoral conflicts on competing uses (e.g., logging, conservation, and mining). Decree No 2009-304 of 31 August 2009 establishing an Interministerial Committee for dialogue in case of overlapping uses in natural ecosystems. *De facto* zoning of PAs, logging concessions, and mining permits.
Rwanda	Initiated/Completed?	None	Forest Code indicates broad forest use categories. Management and land use plan (Land use master plan): adopted by the Government in 2010.
São Tomé and Príncipe	No information		

- Amending the zoning plan to take into account the comments and recommendations made during consultations;
- Presenting the zoning plan for adoption by the multidisciplinary inter-ministerial team;
- Ensuring the reproduction and distribution of the land use or zoning plan.

□ *Consolidating the Forest Zoning Plan*

The tentative land allocation map, which is under the responsibility of the Ministry of Forests, needs to be consolidated. This consolidation involves using a participatory process that integrates all actors in rural areas. This is the "classification" process (see box 11.1). Classifying a forest creates an opportunity to establish a land title at the level of the State. Prior to classifying any plots of land in the "permanent forest domain", the Ministry of Forestry and Wildlife in Cameroon (MINFOF) issues a public announcement that indicates the Government's intention to incorporate the said forest land into the State's private domain. Any objections or claims with regard to the proposed classification can be submitted in accordance with specific procedures and deadlines. All actors involved in the rural sector are invited to meetings of the departmental Commission on classification. The classification procedure is presided over by the Prefect of the local community where the plot to be classified is situated. Finalized maps of the plots of land are drawn up and validated by the person in charge of the local land register.

Photo 11.6: Participative zoning exercises often begin with simple drawings on bare ground

□ *Management problems*

Contrary to the provisions contained in the 1994 Forestry Law, natural resource management, as practiced today, suffers from a lack of safeguards for forest land. In the case of permanent forests, neither the State nor communities have land titles although each classification decree incorporates the plots of land into their respective private domains. In Cameroon, there is no single benchmark that represents a guiding principle on which to base land titles. Sectoral ministries do not have a concerted approach when handling matters concerning the land. This is causing increasingly frequent inter-sectoral and local conflict in the field. Relevant information is available via a geodatabase that can be found in the Central Unit of Forestry Cartography (UCECAF) at the MINFOF. This information is up-dated as often as possible and in response to changes in limits, and is made available in versions of the "Interactive Forest Atlas of Cameroon" (see box 11.3).

Forest zoning was carried out by MINFOF, within the framework of forestry policy, and only reflected this sector's objectives. In 2009, MINFOF suspended this procedure until the Ministry of Economy, Planning and Regional Development (MINEPAT), which had been given a leadership role in this area, took over. In forest areas, the mining and agro-industrial sectors are expanding rapidly and conflicts have arisen with regard to overlapping land allocations. Without an agreed and adopted land use plan, there is the risk that these conflicts will increase and jeopardize development efforts and sustainable land management.

Box 11.3: Practical applications for the forest Atlases

Lyna Bélanger
WRI

Among other products forest Atlases contain:

- A user-friendly mapping application (GIS) which provides visual details of country-specific thematic areas related to the forest. Data is collected in a single geo-referenced database and presented as vector mapping data, descriptive data and associated metadata;
- A summary document, describing the thematic areas in detail and the resulting practical applications that can be useful for decision-makers;
- A poster showing the allocation of the State forests.

In addition to zoning, the forest Atlases are geomatic tools that can be used for forest management in general, particularly for applications such as:

- Assistance in evaluating and monitoring the allocation of new forest concessions, classified forests, community forests and support in deciding the precise demarcation of these zones;
- Support for decision-making through the analysis of different land uses, their dynamics and possible impacts on protection zones;
- Support for conflict resolution through improved identification of problems related to overlapping of territorial limits, improved planning of on-site monitoring missions, identification of additional zones for the parties involved;
- Support for law enforcement of road construction in or near protected areas by drawing attention to irregularities to provide improved guidance for land monitoring;
- Support for development planning by identifying vital routes for isolated local communities and reducing to a minimum the environmental impacts and costs caused by the construction of new routes by taking full advantage of existing ones;
- Assistance in the preparation of forest management plans;
- Assistance in analyzing levels of forest logging (in relation to spatial distribution and available road infrastructure) and support for forest planning, for instance by: (i) showing that a significant part of total timber production comes from unmanaged zones; (ii) analyzing chronological data for production planning purposes and timber processing; (iii) highlighting the ecological and social consequences of forest logging on a particular zone;
- Monitoring tax revenues in conjunction with a forest statistics and traceability system;
- Support for the Control and Internal Verification Direction in prioritization of control and monitoring missions to determine operators who respect legal regulations, such as deadlines, land areas, production…

Interactive forest Atlases are available on the WRI website (www.wri.org) and on websites of concerned ministries, wherever feasible.

□ *Outlook*

Territorial management in Cameroon falls within the scope of MINEPAT, which should take an active stance on:

- Establishing a participatory process for land use planning;
- Coordinating and managing land allocation at the national level;
- Developing legislation with regard to territorial management.

In this regard, some projects are already under way:

- Revision of forest and mining codes with the support of the Network of Parliament members in Central Africa (REPAR) and MINFOF partners;
- Establishment of a geodetic network under the auspices of the Ministry of State Property and Land Tenure (MINDAF) and in line with the African Geodetic Reference Frame (AFREF);
- Elaboration of a topographic map of Cameroon (MINEPAT/INC);
- Elaboration of a global zoning plan for Cameroon (MINEPAT).

Case study: Democratic Republic of Congo

□ *Overview*

There are about 145 million hectares of forest in DRC, representing about 60 % of the national territory (see table 1.1; Vancutsem *et al.*, 2006; Vancutsem *et al.*, 2009; de Wasseige *et al.*, 2009). About 12.2 million hectares (administrative surface area) of forest have been zoned as commercial timber concessions (about 8 % of the national territory) and 16 million hectares (more or less 11 %) of forest are zoned as "classified forest" (national parks, wildlife reserves, etc.) (MECNT, 2009a; MECNT, 2011a; Toham *et al.*, In Press; USFS, 2009 & 2010b – see figure 11.1).

The 2002 Forest Code envisions the zoning of DRC's forest estate into "permanent production forests", "protected forests" and "classified forests" (figure 11.2). Non-zoned forests remain protected forests. Permanent production forests include current timber concessions as well as tracts of forest for future allocation as timber concessions. In effect, forests designated as permanent production could remain in reserve for commercial timber operations carried out by private companies or local villages. The Code allows a local community to apply for a timber concession.

Photo 11.7: After what may have started as a drawing on the ground, zoning exercises are recorded on more permanent materials

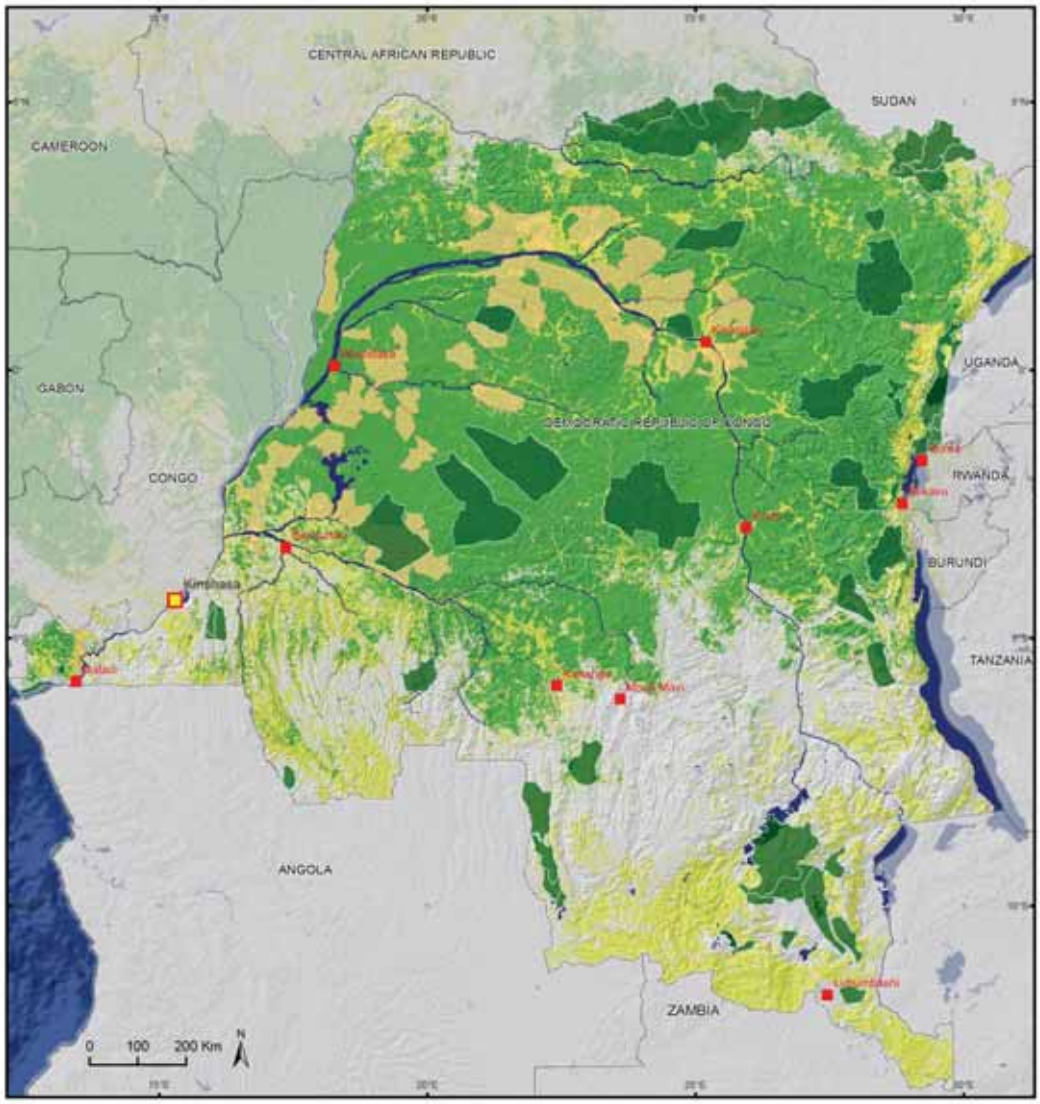


Figure 11.1: Distribution of protected areas and logging concessions already delineated in DRC
Sources : OFAC, WRI

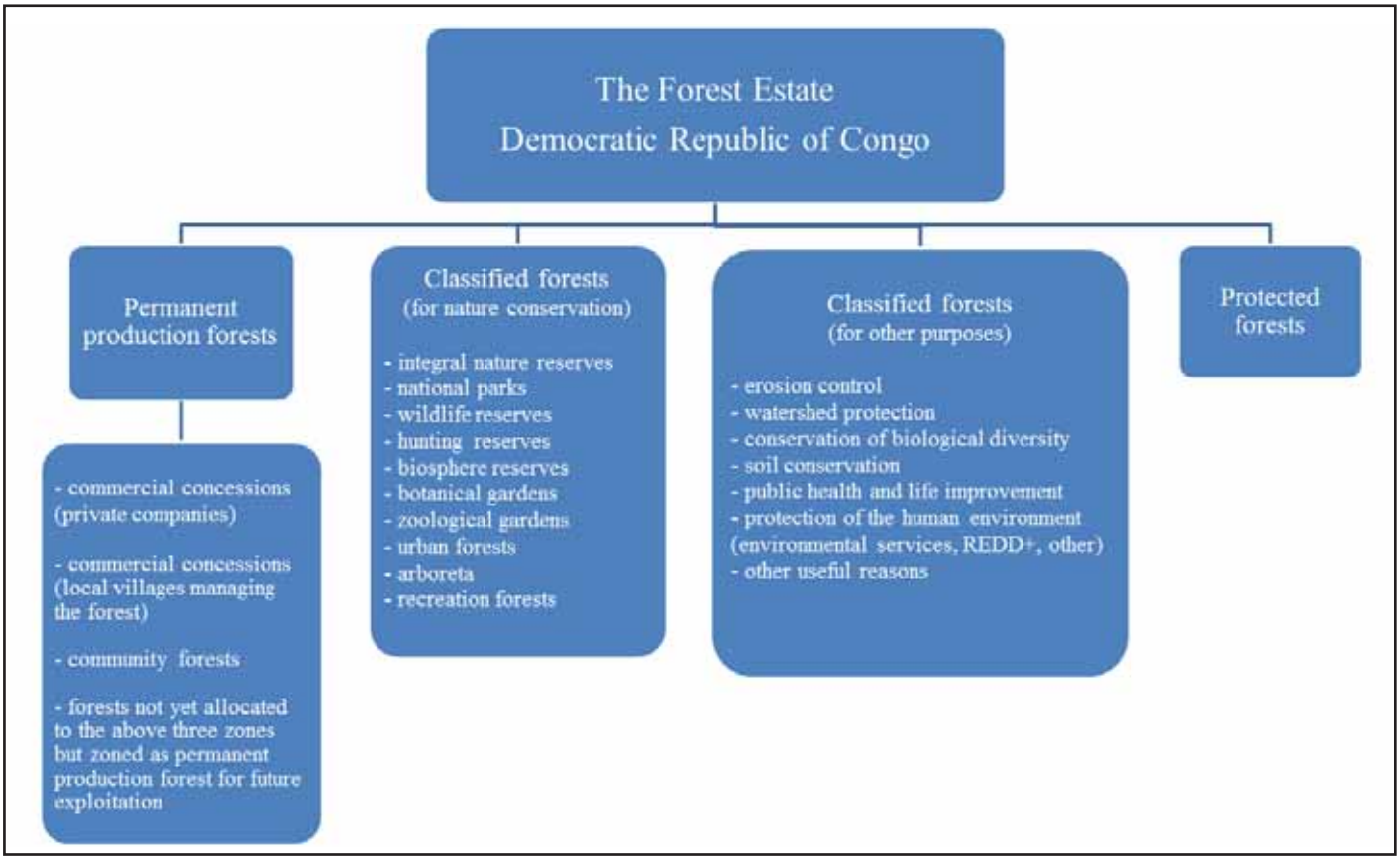


Figure 11.2: Legal forest classification in DRC according to the Forest Code of 2002. "Protected forests" are defined as forests that have not been allocated to permanent production forests, timber concessions or protected areas (classified forests). "Protected forests" could also be converted into palm plantations, mines, roads and other uses depending on the recommendations of the National Steering Committee for Forest Zoning (Comité national de Pilotage du Zonage forestier - CNPZF).

The Forest Code, the policy of the DRC Government (*Institut congolais pour la Conservation de la Nature*, 1973) and draft DRC legislation[67] also requires the placement of millions of additional hectares of forest into protected areas for nature conservation. In 2007, MECNT and partners identified 41 priority areas and 13 corridors from which PA could be established (Toham *et al.*, In Press).

The Forest Code gives a broad rationale for protected areas (called "classified forests"). Classified forest is not just about the zoning of national parks and the protection of wildlife, but also allows the establishment of classified forest for the protection of soils and watersheds, enhancement of the human environment and for any other reason judged useful by DRC (Article 13 of the Forest Code). In general, classified forest could be established to provide a myriad of environmental services to local people and the nation of DRC. As forest zoning proceeds in DRC it is critical that the public and government officials realize that the Forest Code is quite flexible and that there are many justifications for classified forest.

Lastly, the 2002 Forest Code (Article 22) hints at the possibility of another macro-zone, the "community forests", often called CBNRM (Community Based Natural Resource Management) where local communities essentially manage forests (Yanggen *et al.*, 2010; USFS, 2008). Vast areas of DRC have been proposed as CBNRM although no ministerial declarations have formally established any CBNRM (Dupain *et al.*, 2010a; Mehlman, 2010). The DRC Government is currently developing definitions and other criteria for CBNRM. In anticipation of such guidelines and procedures in DRC, various communication structures among local communities have been established in many areas to discuss the management of forests and other natural resources and to draw tentative CBNRM boundaries (see below). It is likely that DRC will first identify forests of permanent production and classified forests, and make adjustments for CBNRMs where communities desire such areas.

[67]Draft Nature Conservation Law, Ministry of the Environment, Conservation of Nature, and Tourism (MECNT), DRC, 2009.

Under the DRC Constitution, the forest domain, zoned or not zoned, is part of the State. In essence, DRC forests are national forests that are slowly being zoned into various uses. Forests that are not zoned into the above categories are called "protected forests". However, people have extensive rights in protected forests (Forest Code, 2002). Indeed, protected forest can be converted into agricultural plots of maximum 2 ha, although provincial authorities must regulate or zone the extent of such agriculture/rural development (figure 11.3). On top of this are other sector interests such as mining and commercial agriculture that may demand forest areas for their purposes.

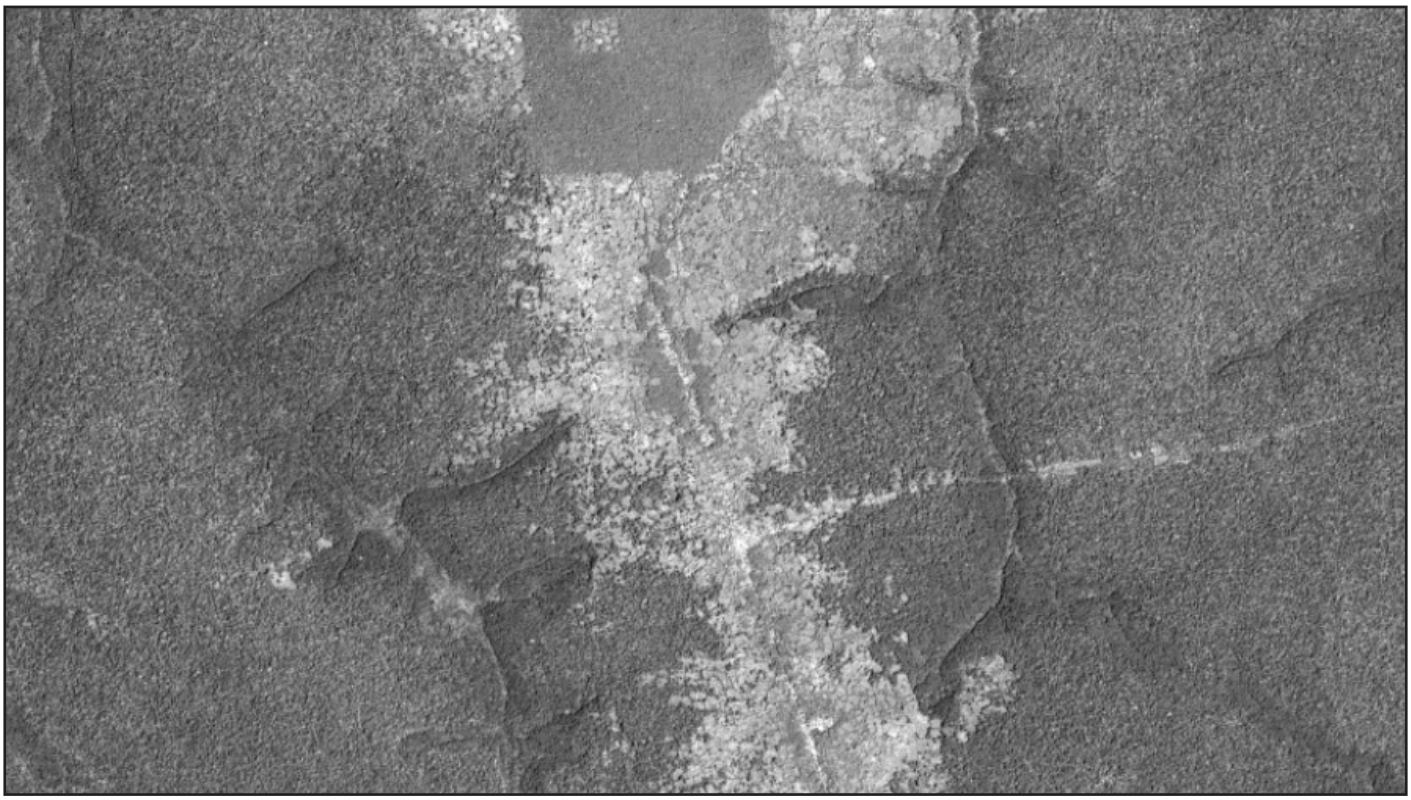


Figure 11.3: Villages and agricultural complexes located along a road in the protected forest of the Maringa-Lopori-Wamba Landscape, Equateur Province, DRC. Forest zoning must take into account human population expansion and required expansion of agriculture into protected forest. Central to zoning will be the accurate mapping of the extent of protected forest used by villages. By understanding the needs of the people, the National Steering Committee for Forest Zoning (CNPZF) can make informed decisions about classified forests and forests of permanent production

Source: US National Geospatial-Intelligence Agency

□ *Role of the DRC Government in forest zoning*

Forest zoning is not simply a matter of listening to local communities and doing exactly what they say. DRC has national and international issues and commitments at stake in the management of its forests including economic development, human rights, carbon emissions, climate, and conservation of biological diversity, to name a few. An institutional process and oversight of zoning will facilitate and allow zoning to occur at a local level and permit the incorporation of national and international obligations.

Since 2009, important milestones have been reached by the DRC Government in order to launch forest zoning in a participatory fashion. New guidelines ensure adequate forest zoning in light of international principles of social and environmental safeguards (MECNT, 2011b). The guidelines are intended to apply the 2002 Forest Code mainly with regard to (i) transparency in the allocation of forest concessions and forests of permanent production, (ii) the participation of the local communities and indigenous people in the forest zoning process, and (iii) the zoning of at least 15 % of the national territory into classified forest.

□ *Macro and micro-zoning process*

Macro-zoning is a national, provincial, or at least landscape level process that identifies existing or new/possible logging concessions, permanent production forests, PAs, and other major land use zones identified in DRC law. Micro-zoning is a process for further identifying spatially distinct areas within a macro-zone where management actions and guidelines differ.

In 2009, a National Steering Committee for Forest Zoning (*Comité national de Pilotage du Zonage forestier* - CNPZF) was established to oversee the zoning of forests in DRC[68]. Forest zoning is now officially recognized. Recommendations about macro-zoning including new permanent production forests, classified forests, and CBNRM will be made by the CNPZF after consultation with a forest planning/zoning team, and local forest zoning committees at the territorial level (figure 11.4).

[68] Ministerial Order No. 107/CAB/MIN/ECN-T/15/JEB/009 of 20 August 2009, pertaining to the creation, composition, organization and functioning of the National Steering Committee for Forest Zoning;

Ministerial Order No. 018 of 28 April 2010, pertaining to the nomination of members of the National Steering Committee for Forest Zoning in DRC.

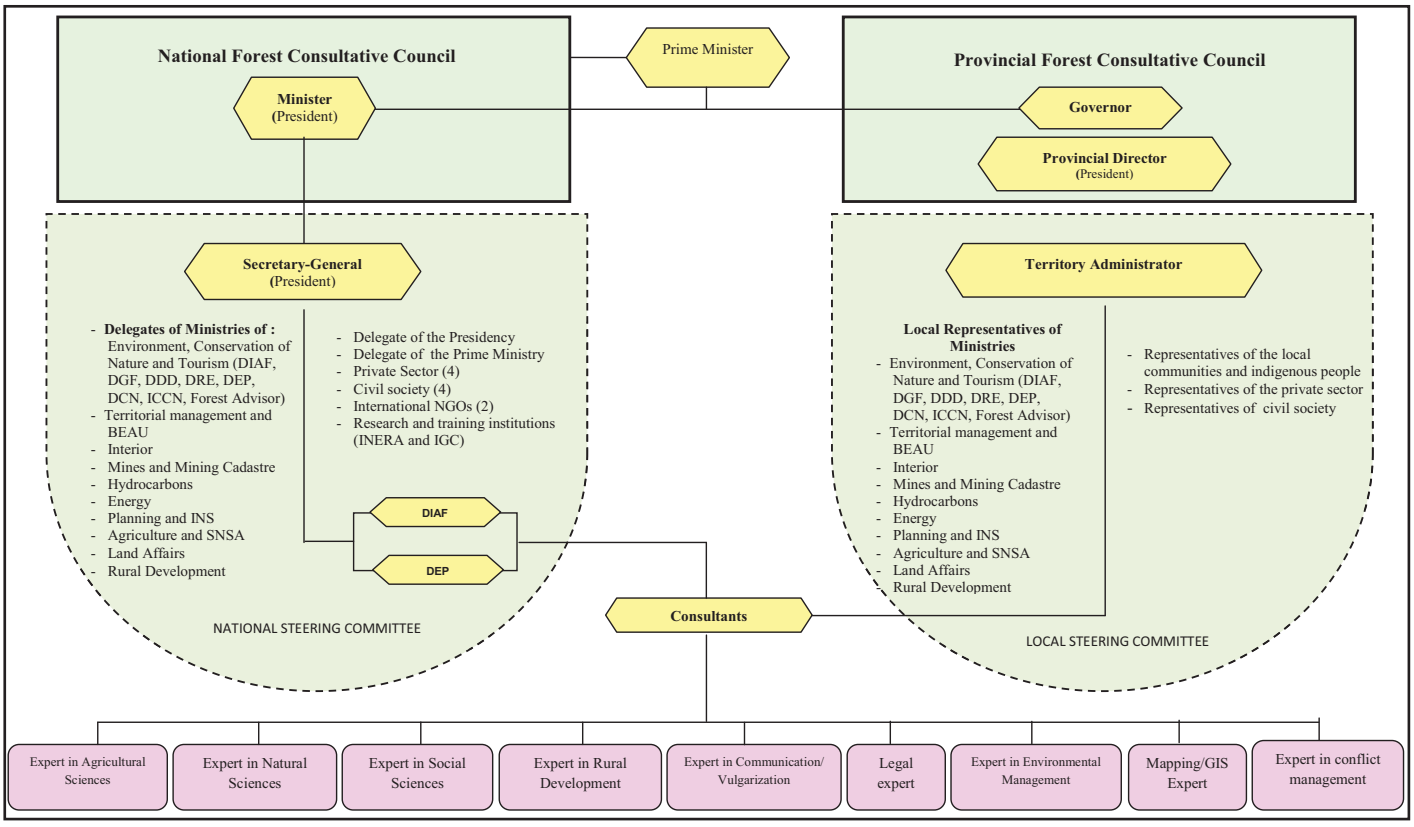


Figure 11.4 : Supervision of forest zoning in DRC; DIAF (Direction des Inventaires et Aménagements forestiers); DGF (Direction de Gestion forestière); DDD (Direction du Développement durable); DRE (Direction des Ressources en Eau); DEP (Direction des Études et de la Planification); DCN (Direction de la Conservation de la Nature); ICCN (Institut congolais pour la Conservation de la Nature); BEAU (Bureau d'Études d'Aménagement et d'Urbanisme); IGC (Institut géographique du Congo); INERA (Institut national d'Études et Recherches agronomiques); INS (Institut national des Statistiques); SNSA (Service national des Statistiques agricoles)

Source: Standards for Forest Macro-zoning: operational guide, Ministry of the Environment, Conservation of Nature, and Tourism (MECNT)

The CNPZF is not a day-to-day working body but rather a board of oversight and approval, meeting periodically to make major decisions about zoning. Given the extent of forest in DRC and available means, the CNPZF is focusing at first on key sectors (e.g., forest production, conservation, agriculture, rural development, mines, energy, transport) in order to:

- understand the current status of forests;
- analyze the various sectors and the potentials for and constraints on development;
- measure the national sector goals in the short, middle and long term;
- prepare the choices and possible arbitrations necessary.

The CNPZF will ensure that various ministries (managers of the resources and space) and others stakeholders are cooperating in the tasks of forest zoning. There will likely be many conflicts as the CNPZF begins its work and the nature of forest zoning is revealed. The laws and regulations governing other governmental sectors may affect forest zoning. Some areas of forest may be zoned for mining, agriculture, roads and other uses. Indeed, various agricultural and forest zoning efforts are already underway in Bandundu and elsewhere (Coordination nationale REDD, 2010c; Impreza-Servisi-Coordinati, 2010a-c).

Subsequent activities after macro-zoning center on moving from the "vision", the forest zoning plan, to "action", the classification of forests and the public inquiry required prior to the granting of concessions. It is during this stage that populations will be most consulted and solicited. These activities are clearly identified in the following regulatory texts:

- "Decree No. 08/08 of 8 April 2008 laying down the classification and declassification procedure for forests". This text specifies the process for forest classification;
- "Ministerial Order No. 024 of 7 August 2008 establishing the public inquiry procedure prior to the granting of forest concessions".

In addition, the Directorate of Inventories and Forest Management has an operational guideline entitled: "Normes d'affectation des terres" (Standards for Land Allocation). This document provides the methodology to use to determine land allocation within forest concessions. The procedure consists of subdividing the concession into three types of series, which represent priority allocations: (i) conservation, (ii) protection, and (iii) timber production.

It is at this stage that the notion of micro-zoning comes into play. Participatory mapping can be a useful tool in contexts where it is important to understand the zones of influence of local populations.

Photo 11.8: Natural forests, farming and plantations will come into increasing contact with each other in the future

Box 11.4: A model of an equitable social clause agreement for the participatory management of natural resources in the DRC

François Makoloh, Bruno Pérodeau

WWF

One of the main innovations in the Democratic Republic of Congo's 2002 Forest Code is the concept of "social specifications", as detailed in Article 89[69]. However, the means for applying this new forest regulation still needed to be defined.

After a series of intense deliberations to elaborate a text to apply this Article of the Code, a first Decree was adopted in 2008. The Decree[70] made it obligatory to consult local communities on the rights and obligations of the parties as well as on the involvement of the decentralized forest administrations; however, the modalities for applying the law remained too vague for the principal stakeholders involved. In particular, the concept of "local community and/or local indigenous peoples", the direct beneficiaries of this clause, and the amount these beneficiaries would receive in return for the loss of certain benefits provided by the forest remained undefined.

In early 2009, under WWF coordination, a small group of actors drew up a draft model "Agreement" to facilitate the negotiation of social specifications between local communities (including indigenous populations) and forest concessionaires. The contract outline was designed to address sensitive issues that may remain unresolved, as well as potential stumbling blocks that may arise in the implementation of agreements. Who would do what? For whom? Where? How best to ensure that adopted agreements would be recognized and respected and would benefit the communities concerned?

Most actors involved in this process strove to assure real involvement of the local communities to ensure true participatory management of natural resources. The modalities for applying the social clause follow the basic principles of participatory management by clearly defining the parties, their rights, responsibilities and the modalities for managing profits and potential conflict, as well as by ensuring the representativeness and legitimacy of the parties.

A crucial aspect of the process was defining "local neighboring communities". This issue was resolved by directly linking customary laws to the social clause through socio-economic studies and preliminary participatory zoning to clearly map out customary laws. The maps annexed to contracts, and recognized by the parties, define the beneficiary communities and the forests where forest operators have commitments.

A second main concern related to the pecuniary value of this clause and the management of generated funds. In the context of the DRC, where communities often ask for unrealistic support (e.g., airports, helicopters, universities), this question needed to be clarified. On the basis of open discussions with the private sector, and with specific reference to the sub-region and certified forest concessions, it was decided community support should be provided at a rate of $ 2 to 5/m^3 of timber removed by the forest company. This support is to be paid into a "Local Development Fund". The fund is to be managed by a Local Management Committee (LMC) consisting of the forest operator and representatives elected by the community. This set up has also partly addressed concerns about legitimacy, representativeness, transparency and the participation of local and indigenous communities.

Once completed, the Agreement established by a Ministerial Decree[71] is accessible to the public as an Annex to the forest concession's contract and its set of specifications. Currently, several forest operators, the DRC forest administration as well as local, national and international NGOs are active participants in this process. This mobilization and the involvement of a wide variety of actors is a promising sign.

For a country that has suffered for nearly four decades from an endemic socio-economic crisis and widespread poverty, this model agreement has the potential to be a key tool in poverty reduction and ensuring the effective participation of local communities in natural resource management. With the official establishment of the REDD+ process in Cancún, this model agreement can likely be further developed and applied in the context of the national strategy for the reduction of emissions caused by deforestation and the degradation of forests in the DRC.

[69]Law No. 011/2002 of 29 August 2002, to enact the Forest Code of the DRC.

[70]Ministerial Decree No. 28/CAB/MIN/ECN-T/15/JEB/08 of 7 August 2008 establishing model contracts and corresponding specifications for exploitation concessions for forestry products.

[71]Ministerial Decree No. 23/CAB/MIN/ECN-T/28/JEB/10 establishing the model Agreement constituting the social clause in the specifications of the forest concession's contract and its annex.

Status at the CBFP landscapes level

Since the creation of the CBFP in 2002, there has been significant investment and progress in supporting land use planning and management at the large landscape scale; in some cases crossing national borders, and in others at the sub-national level. Many innovative land use planning and zoning activities and processes are underway across these CBFP landscapes (see Yanggen *et al.*, 2010).

Previous State of the Forest reports (2006 and 2008) presented detailed CBFP landscape narrative of context, threats, activities, as well as data on various management and process indicators. Here is a summary of the management status across the CBFP landscapes by way of introducing the overarching CBFP macro-zoning approach.

Total area in 2010:

- Total area for all landscapes in 2010: 76,686,829 hectares;
- Total area under improved management for all landscapes in 2010: 44,532,826 hectares.

Table 11.2 provides more disaggregated data on the surface area of the various common macro-zones under improved management across the Congo Basin within priority landscapes (data of 2008).

Table 11.2: The extent of macro-zones in CBFP landscapes in 2008

Macro-zone type	Number of macro-zone	Area (ha)
Classified forest	37	17,883,079
Community Based Natural Resource Management (CBNRM)	69	21,040,366
Extractive Resource Zone (ERZ)	41	14,986,727
Total	**147**	**53,910,172**

Source: CARPE

The next section presents a case study on macro and micro-zoning within the Maringa-Lopori-Wamba (MLW) Landscape, in DRC.

Case study: The Maringa-Lopori-Wamba Landscape

□ *Overview*

The Maringa-Lopori-Wamba (MLW) Landscape, located in Equateur Province, DRC, covers 73,000 km^2. The MLW project (USAID/CARPE) was initiated by the African Wildlife Foundation (AWF) who has led its activities since 2003. Subsequently, AWF and a consortium of partners have worked toward meeting the USAID/CARPE Strategic Objectives to "decrease the destruction of habitat and the loss of biodiversity through better local, national and regional governance of natural resources aiming at reduction of poverty" (Dupain *et al.*, 2010a).

Land use planning has been the overall approach to achieve the above Strategic Objectives in the MLW Landscape. The project considers land use planning and zoning as central components of developing the means for continued sustainable natural resource management throughout the landscape. The land use planning process takes into account the needs of local communities while conserving forest in key areas for biodiversity as defined by the results of field surveys and landscape-wide patterns of agricultural land use and forest change detected by remote sensing and spatial analyses. The following desired outcomes (conditions) were identified by the MLW Consortium:

- Creation of an inter-connected network of PAs that assures continued species viability;
- Assurance of enough forest land for conversion to satisfy the agricultural livelihood needs of local communities;

- Assurance of enough forested land to satisfy both the need for maintaining biodiversity habitat and sustaining community dependence on the collection of non-timber forest products (NTFP) for local livelihoods and social well-being.

Realization of these conditions requires macro-zoning and a subsequent map of spatially defined major use zones (delineation of space for rural development, development of a network of PAs, and delimitation of community forests, for example). Using this map, priorities and opportunities for micro-zoning can be located.

The identification of these priorities depends on the focus of the program. The formal establishment of macro-zones requires the development of management plans for timber concessions[72], PAs or community forests[73]. These management plans require the delineation of micro-zones supporting a variety of land use activities and specific management strategies. In the MLW Landscape, the identification of priority areas for micro-zoning was based on the identification of "hotspots" recognizing areas where there is simultaneously high biodiversity importance and increased pressure from rural expansion and deforestation. These areas were identified using a variety of maps and spatial analyses of the geographic distribution of land use types and patterns of land use change throughout the landscape. The MLW partners focused on micro-zoning the unprotected "protected forests", areas that are more vulnerable to unsustainable land use change and deforestation, especially in areas of high population density.

In the MLW Landscape, it is estimated that more than 50 % of the forest will remain "protected forest". As part of MLW's micro-zoning objectives, the MLW Consortium is developing a formal strategy to distinguish within this forest class the "non-permanent protected forests" (also called the "Rural Development Zone" or RDZ, designated for the sustainable expansion of agricultural activities under a management plan) and the "permanent protected forests" (designated as protected forests for Community Based Natural Resource Management or CBNRM).

Both indicative macro-zoning and micro-zoning require public participation and formal recognition. Depending on the scale of the zoning (macro *vs* micro), the mechanisms to achieve full stakeholder participation and formal recognition are different, as stakeholders vary between the two scales (see above). Formal recognition processes might also require stronger outreach to different levels of political administration, depending on the scale of the zoning. The work in MLW illustrates these distinctions and highlights the differences between macro and micro-zoning for land use planning.

Photo 11.9: Forest concessions are one of the most widespread examples of the ERZ concept (Extractive Resource Zones) in Central Africa

[72]Forest Code of 2002 and Ministerial Order No. 034/CAB/MIN/ECN-EF of 5 October 2006 establishing the procedures for setting up, approving and implementing the management plan for timber production forest concessions.

[73]Ministerial Order No. 038/CAB/MIN/ECN-T/15/JEB/2008 of 22 August 2008 establishing the modalities for developing, approving and implementing the management plan for a classified forest.

□ *Macro-zoning*

Data collection and spatial mapping

In the MLW Landscape, several extensive macro-zones already exist such as the Lomako Yokokala Faunal Reserve (established from a 2004-2006 macro-zoning exercise culminating from a longstanding effort to create a PA for the conservation of bonobos) and a number of timber concessions (MECNT, 2011a) established during a nationwide review of DRC timber concessions in 2009. Using preliminary data collection comprised of biodiversity surveys complemented by input from various stakeholders in the MLW Landscape, the MLW Consortium produced a map of tentative macro-zones for the landscape (figure 11.5). The zones include existing timber concessions, existing and proposed PAs, the RDZ located along the road network (designated as the "non-permanent protected forest" zone as described above), and potential CBNRM (designated as the "permanent protected forest" zone also described above). Data gap analysis and participatory data collection, followed by spatial mapping and modeling informed the process of defining the macro-zones.

Spatial mapping and modeling have been paramount to achieving an understanding of the geographic priorities for conservation and rural development for land use planning in the MLW Landscape. The University of Maryland, as part of the MLW Consortium, has generated a suite of spatially-explicit conservation planning models for the landscape to identify:

- Areas of highest and lowest human influence (defined by human accessibility and forest degradation as threats to terrestrial biodiversity) and potential human-wildlife conflict;
- Wildlife corridors connecting areas of lowest human influence and existing PAs (classified forest);
- Areas of greatest conservation priority;
- Areas most suitable for future agricultural expansion given the spatial distribution of human populations and locations of conservation priority areas.

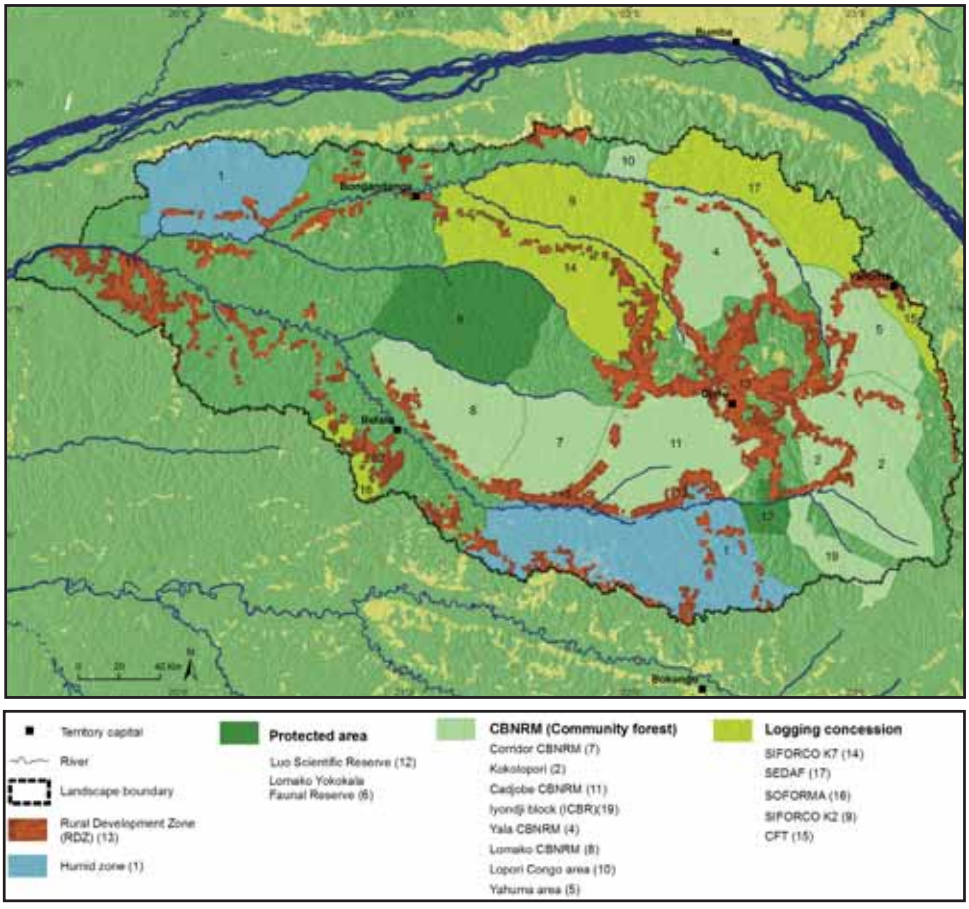


Figure 11.5: Tentative macro-zones for the Maringa-Lopori-Wamba Landscape
Source : MLW Consortium

A threat-based model was built in a Geographic Information System (GIS) to identify locations of forest blocks having lowest human influence and where forest conservation efforts could be prioritized. Wildlife corridors connecting these forest blocks were then modeled[74]. In addition, an optimization model was generated to identify the most suitable areas for the establishment of the RDZ at minor "cost" for conservation. Given locations of important forest blocks and the wildlife corridors connecting them, the model determined areas where agricultural expansion might be encouraged using an identified target of land needed to be converted for human livelihoods by 2015. The resulting map (figure 11.6) displays the most optimal areas for future agricultural expansion based upon current distributions of human settlement, agricultural land use, projected human population expansion, and locations of high conservation priority (including classified forests, remote forests and wildlife corridors). The results of these models, built at the broad landscape scale, are meant to be indicative and interpreted somewhat loosely from a large scale perspective. Still, they have been valuable tools for creating a clearer understanding of geographic processes and priorities across the MLW Landscape. Replicating these types of models will become more important throughout DRC in the future as the CNPZF pursues macro-zoning at a national scale.

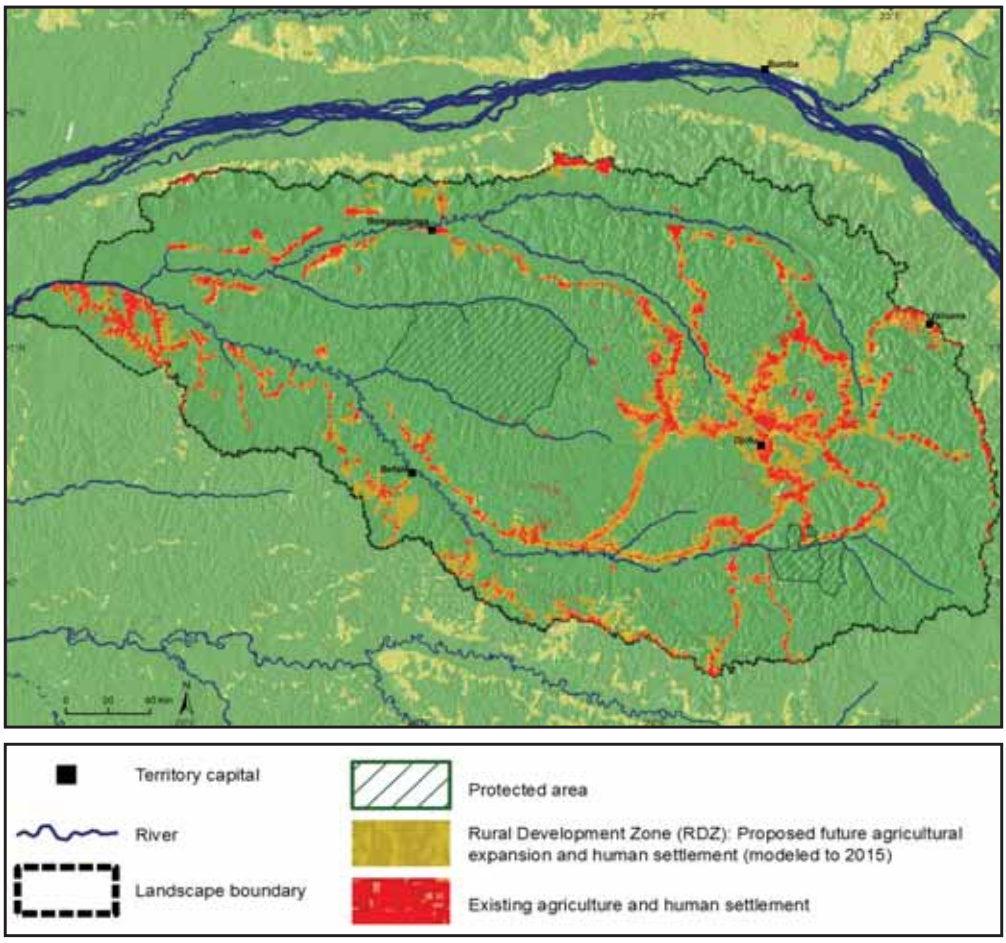


Figure 11.6: Location of the most optimal areas for future agricultural expansion
Source : MLW Consortium

[74] Using the Corridor Designer tool of ArcGIS (http://corridordesign.org/).

Public participation

At the MLW Landscape level, a Local and National Partner Committee (LNPC) is composed of the Consultation Frameworks (Cadres de Concertation - CdCs) for each of the four administrative territories in the MLW Landscape. The CdCs are comprised of representatives from civil society and local authorities of varying notability and gender, as well as representatives from the private sector and local representatives of the government. In effect, the CdC fulfills the CNPZF's territorial representation. Two representatives of the LNPC are members of the MLW Landscape Land Use Planning Committee as part of the MLW Consortium. The primary objectives of the CdC are to:

- Participate in the design of the MLW land use plan and increase the understanding of its rationale, development and execution;
- Create a platform for the expression of concerns and conflicts brought about by the land use planning process;
- Inform landscape stakeholders about the activities of the MLW Landscape project;
- Coordinate and monitor activities of the project;
- Advise the LNPC on the progress of the MLW land use planning program.

Public participation at the macro-zone level centers on the formation of a Local Management Committee (LMC) for each macro-zone. The LMC interacts with the MLW Consortium on the land use planning process and is the major entity directly involved in coordinating public participation activities at the macro-zone level. Because macro-zones often geographically span multiple administrative and political units (such as the administrative territories, for example), the LMC is composed of representatives from multiple administrative levels and units.

Formal recognition

The MLW Consortium has created a MLW land use planning Steering Committee consisting of MECNT, provincial authorities, and national and international NGOs. This Steering Committee approves the work plans of the MLW program and assures, as such, that the program responds to the priority agenda of the DRC for national land use planning activities.

Since creation of this Steering Committee, the CNPZF has been established and the process for macro-zoning has been made official. Formal recognition of the participative macro-zones as created in the MLW land use plan will now be presented to the CNPZF for approval by a ministerial declaration. In 2009, the MLW Consortium entered into an agreement[75] with MECNT to carry out the zoning and land use planning in the MLW Landscape with subsequent formal recognition of the zoning at the DRC national level.

□ *Micro-zoning*

Data collection and spatial mapping

The MLW Consortium prioritizes micro-zoning based on identification of areas achieving the aforementioned desired outcomes. Initial participative surveys in the landscape indicate that local communities consider the agricultural sector their top priority for income generation. Access to NTFPs (bushmeat, fruits, and medicinal plants, for example) is also an important asset for social well-being and livelihood security. The forests which provide NTFPs to local communities also provide important habitat to a range of species that underpin biodiversity in MLW. As such, the MLW Consortium has identified three criteria for the development of micro-zones via a participatory process:

- Set aside enough protected forest for conversion into non-permanent forest needed to sustain agricultural livelihoods;
- Identify enough protected forest for conversion into permanent community forests for sustained dependence on NTFPs;
- Assure wildlife habitat connectivity between the classified forests for continued species viability.

The spatial modeling exercises outlined in the previous section assisted in the preliminary identification of the above protected forest at a coarse scale by allowing for the identification of the forests most important for connectivity between the protected areas but simultaneously identified as being under the biggest threat for land conversion through slash and burn agriculture. At the local scale, the spatial models are complimented by fine-scale participatory mapping and data collection with local communities to achieve distinction between the permanent forest (CBNRM) and the non-permanent forest (RDZ).

A pilot project is in place in eastern MLW to engage in participatory micro-zoning of a 2,000 km^2 area located between two classified forests. This area, located just west of the town of Djolu, contains a large center of slowly expanding agricultural production in addition to a

[75] Ministerial Order No. 106/ CAB/MIN/ECN-T/15/ JEB/09 of 20 August 2009 defining provisions for implementing the project of participatory zoning in the Maringa-Lopori-Wamba Landscape.

large wildlife corridor important for connectivity between the two classified forests. The MLW program is engaging in participative micro-zoning and livelihood improvement for local communities living in 27 villages identified through a voluntary process.

Through participative mapping complemented by the use of 30 m resolution Landsat satellite imagery and GPS data collection, the limits of the villages' historical agricultural and forest boundaries are identified and mapped in a Geographic Information System (GIS). Figure 11.7 shows an example of a map that was generated by this process for one village in the study area. The map displays a Landsat satellite image in the background. A yellow polygon delineates the outer boundary of the village's forested areas that the local community has traditionally relied on for the collection of NTFPs. As seen on the map, this boundary extends 14 km^2 northward and 7 km^2 southward from the road. This forested area can consist of a combination of secondary forest (abandoned agricultural fields), primary forest, and swamp forest. The agricultural boundary, which extends not as far outward from the road, is shown in the map as a smaller polygon (black with diagonal dotted lines) in the center of the village.

In the formal micro-zoning process, the forest and agricultural polygons shown on the map are considered two separate micro-zones. The larger forest boundary delineated by the yellow polygon is considered the permanent forest micro-zone, or CBNRM area, while the agricultural boundary delineated by the smaller black polygon is considered the non-permanent forest micro-zone, or Rural Development Zone (RDZ).

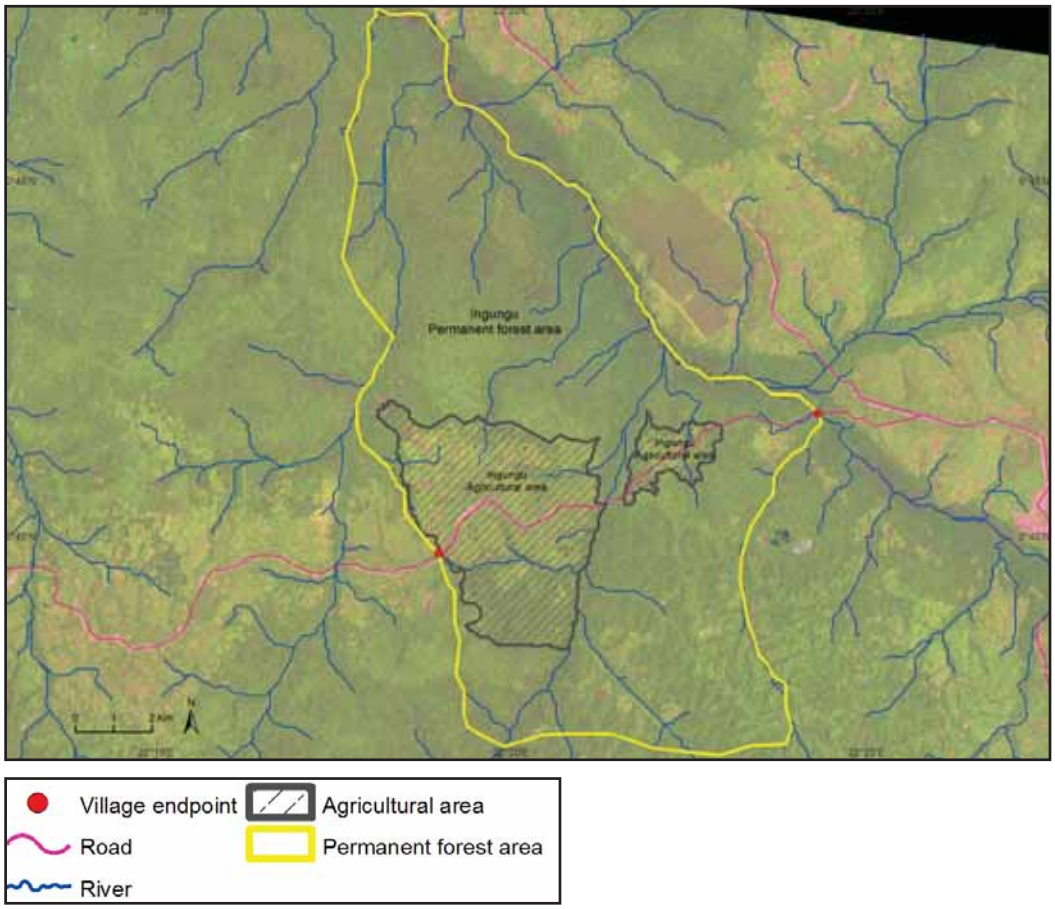


Figure 11.7: Result of a participative mapping process conducted in the Maringa-Lopori-Wamba Landscape
Source : MLW Consortium

Representatives of each village have signed an agreement with the MLW Consortium to respect the defined permanent and non-permanent forest boundaries in exchange for agricultural livelihood improvement within the non-permanent forest micro-zone. The community agrees not to expand their agricultural activities outside of the RDZ, therefore restricting conversion of forests in the permanent forest zone and protecting it for NTFP activities and forest habitat. In exchange, MLW Consortium partners provide technical and financial support to increase the productivity and diversity of agricultural production in the RDZ. With increased agricultural productivity inside this non-permanent forest zone, it is speculated that the amount of agricultural land needed to support the average household will either stay the same or decrease, even after taking population growth into account. Through a series of discussions and negotiations among the villages and the MLW Consortium, the limits and rules for further agricultural expansion can be negotiated.

Photo 11.10: Local communities learning about micro-zoning principles

Public Participation and Formal Recognition

Participative mapping and public participation provide the basis for MLW's micro-zoning activities. It is key that all levels of local society are represented both in the development of the agreements and in any decision-making processes related to the delimitation of the RDZ in the protected forest.

Local authorities at the district, territorial and sector level, as well as traditional authorities (representing the group authority level, for example), are involved in discussing the content of the agreements. Following traditional models, open negotiations are organized with the local communities with a focus on the participation of women. Based on these discussions, a draft protocol is then developed locally in French and Lingala with all members involved. It is the village chief who represents the village at signature of the agreement.

After discussion and negotiation with the local communities, the draft agreement is discussed and approved by the MLW Landscape Steering Committee in Kinshasa and validated subsequently by the group authorities as well as representatives of the localities of the different groups. Final agreements are signed in the presence of district and territorial authorities. The formal recognition of the results of the micro-zoning process requires equal involvement of authorities across local, provincial and national levels. It is the interactive participation at each level from local to national that assures the best outcome for the micro-zoning agreements and will eventually lead to the signature of an inter-ministerial declaration by MECNT and the Ministry of Agriculture.

To date, 27 villages have participated and agreed to this process. 21 villages have defined the limits of their RDZ and 4 of those villages have also defined the limits of their permanent CBNRM forest zone. In the coming months, the MLW mapping team will be working with the remaining villages to define the boundaries of the remaining permanent CBNRM forest zones.

Conclusion

At a time when large scale land use decisions are being heavily influenced by economic considerations and global demand for resources (e.g., large scale plantations, mining, forest management, infrastructure development, changing demographics), the importance of transparent and coordinated land use planning and forest zoning that incorporates participatory planning at the field level are paramount. Effective planning to respond to international, national, and local objectives and interests is an inherently complex and critical process for sustainable development.

Some may argue that new protected areas, timber concessions, mining permits, palm oil plantations, and community forests can be established in an *ad hoc* manner without any organized planning or zoning effort. However, forest management, biodiversity conservation, economic development, social equity and good governance are highly interdependent goals that must be approached simultaneously. Many of the problems encountered in the past with mining and timber concessions as well as protected areas can be avoided with a professional approach to planning rather than the sometimes haphazard and opportunistic approach of the past.

Increasingly, REDD national strategies across the region are highlighting land use planning to underpin the region's contributions to the mitigation of global climate change. This clearly is a positive development and if conducted properly can have ripple effects that transcend the climate challenge and result in lasting and sorely needed improvements in land management and economic development across the Congo Basin.

Photo 11.11: Flooded forest

Bibliography

Abernethy K. & Ndong Obiang A.M., 2010. Bushmeat in Gabon/ La viande de Brousse au Gabon. Technical report to the Directeur Général des Eaux et Forêts, Président du Comité interministériel de la Stratégie nationale de Gestion de la Viande de Brousse. Technical Report, Ministère des Eaux et Forêts, Gabon.

Abugiche S. A., 2008. Impact of Hunting and Bushmeat Trade on Biodiversity Loss in Cameroon: A Case Study of the Banyang-Mbo Wildlife Sanctuary. Doctor of Philosophy (Ph.D) in Environmental and Resource Management. Faculty of Environmental Sciences and Process Engineering, Brandenburg University of Technology Cottbus. Germany

Adebu C., Kay F., 2010. Exploitation artisanale de bois d'œuvre dans le Territoire de Mambasa et Irumu. An Ocean report for UICN-NL and the Rainforest Foundation, Kisangani, RDC.

Agrawal A., 2001. Common property institutions and sustainable governance of resources. *World Development* 29:1649–1672.

Allebone-Webb S. M., 2008. Evaluating dependence on wild foods in continental Equatorial Guinea. PhD thesis, Imperial College London and Institute of Zoology, Zoological Society of London. Web site: www.zsl.org/equatorialguinea.

Ampolo A.N., 2005. La transformation artisanale des bois tropicaux : cas des scieries artisanales au Congo Brazzaville. MSc thesis, ENGREF, Montpellier, France.

ANDEGE, 2010. Estudio del impacto de la explotación forestal por las motosierras clandestinas para redactar un decreto presidencial de atenuación en Guinea Ecuatorial. CARPE-ANDEGE-UICN report, Bata, Guinea Ecuatorial.

Andzouana L.R., 1999. Enquête sur la substitution des combustibles ligneux dans les ménages de Brazzaville. Mémoire IDR. Brazzaville: 59.

Anembom Consulting, 2008. Value chain analysis for honey and bee products in the Kilum Ijim Montane forest region, North West Province Cameroon, edited by SNV. Bamenda: SNV.

Angelsen A., and Babigumira R., 2010. Quantifying the role of forests in poverty alleviation: Preliminary results from the PEN dataset. Seoul, Korea: IUFRO.

Angoué C., Assoko Ndong A., Binot A., Carette S., de Maret P., Trefon T., 2000. Gabon. In: Bahuchet S., de Maret P. (Eds). Les peuples des forêts tropicales aujourd'hui: Volume III, Région Afrique Centrale : Programme Avenir des Peuples des Forêts Tropicales (APFT), Université Libre de Bruxelles, Bruxelles, Belgique.

Armitage D., 2005. Adaptive Capacity and Community Based Natural Resource Management. *Environmental Management* 35:703–715.

Arnold J.E.M. and Persson R., 2003. Reassessing the fuelwood situation in developing countries. *International Forestry Review*, 5(4): 379-383.

Arnold J.E.M., Kohlin G., Persson R. and Shepherd G., 2003. Fuelwood revisited: what has changed in the last decade? CIFOR, Occasional Paper No 39. Bogor, Indonesia. Web site: www.cifor.org/publications/pdf_files/OccPapers/OP-39.pdf

Arnold J.E.M., Kohlin G. and Persson R., 2006. Woodfuels, livelihoods, and policy interventions: Changing perspectives. *World Development*, 34(3): 596-611.

Assembe Mvondo S., Awono A., Ingram V., Lescuyer G., Schure J., Sonwa D., and Somorin O., 2009. L'État de l'Art de Bois d'Énergie en RDC: Analyse institutionnelle et socio-économique de la filière bois d'énergie: rapport préliminaire (Version 1, Août 2009). Yaoundé: CIFOR/ Projet Makala.

Assembe-Mvondo S., Lescuyer G., 2010. Revue des conditions légales et institutionnelles. In: Schure J. *et al.* (Eds), 2010. L'état de l'art du bois énergie en RDC: Analyse institutionnelle et socio-économique de la filière bois énergie. Yaoundé, CIFOR, Projet Makala: 9-31.

Association des Lépidoptéristes de France. Site web : http://www.lepido-france.fr/liens/categorie/region-afrotropicale/

Aunger R., 1992. An ethnography of variation: food avoidance among horticulturalists and foragers in the Ituri forest, Zaire. PhD, University of California, Los Angeles.

Auzel P., Wilkie D.S., 2000. Wildlife Use in Northern Congo: Hunting in a Commercial Logging Concession. In: Robinson J.G. and Bennett E.L. (Eds). Hunting for Sustainability in Tropical Forests, pp. 413- 426. New York: Columbia University Press.

Awono A., Manirakiza D. and Ingram V., 2009. Étude de base de la filière *Gnetum* spp. (*Fumbwa*) dans les Provinces de L'Équateur et de Kinshasa, RDC. FAO-CIFOR-SNV-World Agro-forestry Center-COMIFAC, February 2009 [cited May 2009]. Web site: http://www.fao.org/forestry/enterprises/45716/en/.

Awono A., Ingram V., Mala W., and Schure J., 2010. Petites et moyennes entreprises du secteur des PFNL : un instrument de promotion de la croissance et de l'emploi en RDC.

Ayeni J. S. O., Tah E. A., and Mdaihli M., 2001. A Survey of Wildlife Utilization in Boki and Anyang Tribes. Edited by M. Cameroonian (MINEF)-GERMAN (GTZ) Project for the Protection of Forests Around Akwaya (PROFA). Mamfe: PROFA.

Bahuchet S., Ioveva K., 1999. De la forêt au marché : le commerce de gibier au sud Cameroun. In: Bahuchet S., Bley D., Pagezy H., Vernazza-Licht N. (Eds). L'homme et la forêt tropicale. Travaux Société Écologie Humaine, Paris. pp. 533-558.

Bailey R.C., and Peacock N.R., 1988. Efe pygmies of northeast Zaire: subsistence strategies in the Ituri forest. In: de Garine I. and Harrison G.A. (Eds). Uncertainty in the Food Supply, pp. 88-117. Cambridge University Press, Cambridge.

Baker N., 2000. Report on the Workshop Developing needs-based inventory methods for non-timber forest products. Paper read at Application and development of current research to identify practical solutions for developing countries, 4 – 5 MAY 2000, at Rome, Italy.

Balolebwami J.C., Balolebwami E., 2008. Enquête sur le charbon de bois. Africa Conservation Fund (UK), ACF(UK) P 17.

Barrett C.B., Lee D.R., McPea K.J.G., 2005. Institutional arrangements for rural poverty reduction and resource conservation. *World Development* 33:193–197.

Beck J.P., 2010. Land-use planning at the landscape scale: Central African Regional Program for the Environment (CARPE). In: Yanggen D., Angu K. and Tchamou N. (Eds), 2010. Landscape-Scale Conservation in the Congo Basin. Lessons Learned from the Central African Regional Program for the Environment (CARPE). Gland, Switzerland: IUCN. Xiv + 262p, pp 3-9.

Bees for Development, 2008. Best hive type for Africa. Bees for Development Journal, Web site: http://www.beesfordevelopment.org/portal/article.php?id=1214.

Bennett E.L., Robinson J.G., 2000. Hunting of Wildlife in Tropical Forests. Implications for Biodiversity and Forest Peoples. *Biodiversity Series*, Impact Studies, Paper No 76, The World Bank Environment Department, Washington D.C.

Bergl R.A., Oates J.F., and Fotso R., 2007. Distribution and protected area coverage of endemic taxa in West Africa's Biafran forests and highlands. *Biological Conservation*, 134:195-208.

Betti J. L., 2007. Stratégie/Plan d'action pour une meilleure collecte des données statistiques sur les Produits Forestiers Non Ligneux au Cameroun et recommandations pour les pays de la COMIFAC. Yaoundé: Ministère Fédéral d'Allemagne pour l'Alimentation, l'Agriculture et la Protection des Consommateurs, COMIFAC, FAO.

Billand A., 2005. Étude sur le plan pratique d'Aménagement des Forêts Naturelles de Production Tropicales Africaines. Application au cas de l'Afrique Centrale. Volet 3 « Aspects Faunistiques », ATIBT, Paris, France, 100p.

Billand A., Fournier J., Rieu L., Souvannavong O., 2010. Prise en compte de la biodiversité dans les concessions forestières d'Afrique centrale. CIRAD, FAO, Document de travail sur la biodiversité forestière, No. 1, FAO, Rome, Italie, 102p.

Blackmore P., and Nkefor J.T., 1998. The Transfer of the Eru (*Gnetum africanum, G. buchholzianum*) Domestication Model to Village-Based Farmers on and around Mount Cameroon, edited by Limbe Botanic Garden. Limbe.

Blaney S., 2008. Contribution des ressources naturelles à la sécurité alimentaire et à l'état nutritionnel d'une population rurale d'une aire protégée du Gabon. PhD thesis. Université de Laval, Quebec.

Boahene K., 1998. The Challenge of Deforestation in Tropical Africa: Reflections on its Principal Causes, Consequences and Solutions. *Land Degradation and Development*, 9, 247-258.

Bodson T., Buhendwa R., Languy M., de Marcken P., 2009. Virunga Landscape. In: de Wasseige C., Devers D., de Marcken P., Eba'a Atyi R., Nasi R. and Mayaux P. (Eds), 2009. The Forests of the Congo Basin - State of the Forest 2008, Luxembourg: Publications Office of the European Union, 411 p, ISBN 978-92-79-13210-0, doi: 10.2788/32259, pp 361-369.

Boevinger S., 2008. Étude de marché et potentiel de développement de l'exploitation artisanale du bois dans le contexte de la mise en place des forêts communautaires pilotes dans le Nord-Est du Gabon. MSc thesis, Faculté Universitaire des Sciences Agronomiques de Gembloux, Belgique.

Boulvert Y., 1986. République Centrafricaine, Carte phyto-géographique à 1:1.000.000. Éditions de l'ORSTOM, Collection explicative n°104, Paris.

Boundzanga G.C., 2004. Évaluation de la consommation en bois énergie et divers du bois dans les villes de Brazzaville et Nkayi. Programme (CPO): 2004 - 2007, Composante du programme environnement. FAO - République du Congo - PNUD: 50.

BRAHMS, Botanical Research and Herbarium Management System. Web Site: http://dps.plants.ox.ac.uk/bol/

Breteler F.J., 1988. Gabon's evergreen forest, the present status and future. Department of Plant Taxonomy, Agricultural. Wageningen, Pays Bas.

Brown E.L., 2010. Okapi Faunal Reserve, Ituri-Epulu-Aru Landscape, Democratic Republic of Congo. In: Yanggen D., Angu K. and Tchamou N. (Eds), 2010. Landscape-Scale Conservation in the Congo Basin. Lessons Learned from the Central African Regional Program for the Environment (CARPE). Gland, Switzerland: IUCN. Xiv + 262p, pp 48-52.

Brugiere D., 1998. Population size of the black colobus monkey *Colobus satanas* and the impact of logging in the Lopé Reserve, Central Gabon. *Biological Conservation*, 96 (1), 15-20.

Brummett R., Tanania C., Pandi A., Ladel J., Munzimi Y., Russell A., Stiassny M., Thieme M., White S., Davies D., 2009. Water Resources, Forests and Ecosystem Goods and Services. In: de Wasseige C., Devers D., de Marcken P., Eba'a Atyi R., Nasi R., and Mayaux P. (Eds), 2009. The Forests of the Congo Basin - State of the Forest 2008, Luxembourg: Publications Office of the European Union, 411 p, ISBN 978-92-79-13210-0, doi: 10.2788/32259, pp 141-157.

Butynski T.M., 2001. Africa's great apes. In: Beck B.B. *et al*. (Eds). Great Apes and Humans: The Ethics of Coexistence. Smithsonian Institution Press, pp. 3-56.

Bwangoy J.B., Hansen M.C., Roy D.P., De Grandi G. and Justice C.O., 2010. Wetland mapping in the Congo Basin using optical and radar remotely sensed data and derived topographical indices. *Remote Sensing of Environment*, 114: 73-86.

Campbell B., and Luckert M.K. (Eds), 2002. Uncovering the hidden harvest: Valuation methods for woodland and forest resources, People and Plants Conservation Manuals. London: Earthscan.

Carpaneto G.M., Fusari A., Okongo H., 2007. Subsistence hunting and exploitation of mammals in the Haut-Ogooud province, south-eastern Gabon. *Journal of anthropological sciences*, 85: 183-193.

CENDEP, 2010. Training of Real or Potential Smallholder Farmers in the Cultivation of *Gnetum* in three Communities of Yokadouma, East Region, Cameroon. Limbe: CIFOR.

Centre d'Echange d'Informations de la RDC. Site web : http://bch-cbd.naturalsciences.be/congodr/cdr-fra/Default1.htm

Cerutti P.O. and Tacconi L., 2006. Forests, illegality and livelihoods in Cameroon. Working paper n°35. Center for International Forestry Research (CIFOR), Bogor, Indonesia. 28p.

Cerutti P.O., Ingram V., and Sonwa D., 2009. The Forests of Cameroon in 2008. In: de Wasseige C., Devers D., de Marcken P., Eba'a Atyi R., Nasi R., and Mayaux P. (Eds), 2009. The Forests of the Congo Basin - State of the Forest 2008, Luxembourg: Publications Office of the European Union, 411 p, ISBN 978-92-79-13210-0, doi: 10.2788/32259, pp 43-56.

Cerutti P.O., Lescuyer G., Assembe-Mvondo S., and Tacconi L., 2010. The challenges of redistributing forest-related monetary benefits to local governments: a decade of logging area fees in Cameroon. *International Forestry Review* 12:130-138.

Cerutti P.O., Lescuyer G., 2011. Le marché domestique du sciage artisanal au Cameroun: état des lieux, opportunités et défis. CIFOR, Occasional Paper 59, Bogor, Indonesia.
Web site: www.cifor.org/publications/pdf_files/OccPapers/OP-59.pdf

Chambwera M. and Folmer H., 2007. Fuel switching in Harare: An almost ideal demand system approach. Energy Policy, 35(4): 2538-2548.

Chevillotte H., Doumenge C., Valton C., Fauvet N., Onana J.M., Beina D., Kami E., Guillaumet J.L., 2010. Phyto-Afri: un site web pour un atlas interactif des forêts denses humides d'Afrique (http://phyto-afri.ird.fr/carte_accueil/flash/). In: Jeannoda V.H., Razafimandimbison S.G., De Block P. (Eds). 19th AETFAT Congress, 25-30 April 2010, Antananarivo, Madagascar. Abstracts. Scripta Botanica Belgica 46: 116.

Christy P., Jaffré R., Ntougou O. and Wilks C., 2003. La forêt et la filière bois au Gabon. Multipress, Libreville, Gabon, 389 p.

Chupezi T.J., Ingram V., and Schure J., 2009. Impacts of artisanal gold and diamond mining on livelihoods and the environment in the Sangha Tri-National Park (TNS) landscape, Congo Basin. Bogor, Indonesia: CIFOR and IUCN.

CITES, 2011. Annexes I, II et III de la CITES. CITES & UNEP, 42 p. Site web: http://www.cites.org/fra/app/F-Apr27.pdf

Clark L. E., and Sunderland T. C., 2004. The Key Non-Timber Forest Products of Central Africa: State of the Knowledge. In: Clark L.E., and Sunderland T. C. (Eds). SD Publication Series Technical Paper No. 122: U.S. Agency for International Development, Office of Sustainable Development, Bureau for Africa.

Clark C.J., Poulsen J.R., Malonga R., Elkan P.W.J.R., 2009. Logging Concessions Can Extend the Conservation Estate for Central African Tropical Forests. *Conservation Biology*, Volume 23, No. 5, 1281–1293.

Clement G.R., Sayer J., Boedhihartono A.K., Venter O., Lovejoy T., Pin Koh L., and Laurance W.F., 2010. Cautious optimism over Norway-Indonesia REDD pact. *Conservation Biology* 24: 1437-1438.

Clemente Muñoz M.A., Navarro-Cerrillo R.M., Kasimis N., Hernández Bermejo J.E., Padrón Cedrés E., Martín-Consuegra Fernández E., Hernández Clemente R., and García-Ferrer Porras A., 2006. Evaluation of the harvest of "*Prunus Africana*" bark on Bioko (Equatorial Guinea): Guidelines for a management plan. Córdoba, Spain: Universidad de Córdoba.

Coad L., 2007. Bushmeat hunting in Gabon: Socio-economics and hunter behaviour, Ph.D. thesis, University of Cambridge.

Coad L., Abernethy K., Balmford A., Manica A., Airey L. and Milner-Gulland E. J., 2010. Bushmeat, wealth and gender: the distribution and use of bushmeat incomes in a rural village, Central Gabon. *Conservation Biology*, 24 (6), 1510-8. doi: 10.1111/j.1523-1739.2010.01525.x.

Coforchange. Consortium interdisciplinaire dirigé par le CIRAD (France), financement ANR (France) et NERC (RU). Site web : http://www.coforchange.eu/fr/projet

Colyn M. *et al*., 1987. Données sur l'exploitation du "petit et moyen gibier" des forêts ombrophiles du Zaïre. In: Clers B. de (Eds). Wildlife management in Sub-Saharan Africa, Paris, Fondation internationale pour la sauvegarde du gibier, pp 110-145

Colyn M. and Deleporte P., 2002. Biogeographic analysis of central African forest guenons. In: Glenn M.E. & Cords M. (Eds). The guenons: Diversity and Adaptation in African Monkeys. Kluwer Academic / Plenum Publishers, New-York, pp 61-78.

COMIFAC, 2008. Sub-regional guidelines on the sustainable management of NWFPs of plant origin in Central Africa. Yaoundé, Cameroon.

COMIFAC, 2010. Monitoring Forest Carbon Stocks and Fluxes in the Congo Basin. Conference Report, 2-4 February 2010. Brazzaville, Republic of Congo. Web site: http://www.observatoire-comifac.net

COMIFAC, 2011. Atelier de Présentation des Guides sur la Planification de l'Aménagement Intégrée et de la Gestion des Paysages COMIFAC et Échanges d'Expériences sur le Zonage. Hôtel Résidence La Falaise, 19-22 Avril 2011, Douala, Cameroun.

Cooper C.J. and Laing C.A., 2007. A macro analysis of crop residue and animal wastes as a potential energy source in Africa. *Journal of Energy in Southern Africa*, 18(1): 11.

Coordination nationale REDD, 2010a. Programme REDD+ : Modernisation et sécurisation foncière. Document d'orientation. Ministère des Affaires Foncières et Ministère de l'Environnement, Conservation de la Nature et Tourisme, République démocratique du Congo, 24 p.

Coordination nationale REDD, 2010b. Programme REDD+ : Appui à la mise en place d'une politique nationale d'aménagement du territoire. Document d'orientation. Ministère de la Décentralisation et de l'Aménagement du Territoire et Ministère de l'Environnement, Conservation de la Nature et Tourisme, République démocratique du Congo, 28 p.

Coordination nationale REDD, 2010c. Programme intégré REDD+ à l'échelle du District de Maï Ndombe. Document d'orientation. Ministère de l'Environnement, Conservation de la Nature et Tourisme, République démocratique du Congo, 32 p.

Coordination nationale REDD, 2010d. Programme REDD+ : Afforestation/Reforestation dans les bassins d'approvisionnement des grandes villes. Document d'orientation. Ministère de l'Environnement, Conservation de la Nature et Tourisme, République démocratique du Congo, 28 p.

Coordination nationale REDD, 2010e. Programme REDD+ : Réduction de l'impact de l'agriculture de subsistance sur la forêt. Document d'orientation. Ministère de l'Agriculture, Ministère du Développement rural, Ministère de l'Environnement, Conservation de la Nature et Tourisme, République démocratique du Congo, 28p.

Coordination nationale REDD, 2010f. Programme REDD+ : Amélioration de l'efficacité énergétique par la diffusion des foyers améliorés. Document d'orientation. Ministère de l'Environnement, Conservation de la Nature et Tourisme, Ministère de l'Énergie, République démocratique du Congo, 28p.

Cowlishaw G., Mendelson S., and Rowcliffe J.M., 2004. The Bushmeat Commodity Chain: patterns of trade and sustainability in a mature urban market in West Africa. ODI- Wildlife Policy Briefing 7:4.

Cowlishaw G., Mendelson S., and Rowcliffe J. M., 2005. Evidence for post-depletion sustainability in a mature bushmeat market. *Journal of Applied Ecology* 42 (3):460-468.

Cunningham A.B., 2006. *Prunus africana* CITES Significant Trade Review of *Prunus africana*. Paper read at CITES 6th meeting of the Plants Committee, 3-8 July 2006, at Lima, Peru.

Daurella D.C. and Foster V., 2009. What can we learn from household surveys on inequalities in cooking fuels in sub-Saharan Africa?

Davies G., 2002. Bushmeat and international development. *Conservation Biology*, 16, 587-589.

de Merode E., Homewood K. and Cowlishaw G., 2003. Wild resources and livelihoods of poor households in Democratic Republic of Congo. Overseas Development Institute Wildlife Policy Briefing series, no. 1.

de Merode E., Homewood K., Cowlishaw G., 2004. The value of bushmeat and other wild foods to rural households living in extreme poverty in Democratic Republic of Congo. *Biological Conservation*, 118, pp 573-581.

de Wasseige C., Devers D., de Marcken P., Eba'a Atyi R., Nasi R., and Mayaux P. (Eds), 2009. The Forests of the Congo Basin – State of the Forest 2008. Luxembourg: Publications Office of the European Union, ISBN 978-92-79-13210-0, doi: 10.2788/32259, 411 p.

Defourny P., Bicheron P., Brockmann C., Bontemps S., Van Bogaert E., Vancutsem C., Huc M., Leroy M., Ranera F., Achard F., Di Gregorio A., Herold M. and Arino O., 2009. The first 300-m Global Land Cover Map for 2005 using ENVISAT MERIS time series: a Product of the GlobCover System. Proceedings of the 33rd International Symposium on Remote Sensing of Environment (ISRSE), May 2009, Stresa, Italy.

Delvingt W., Dethier M., Auzel P., Jeanmart P., 2001. La chasse villageoise Badjoué, gestion coutumière durable ou pillage de la ressource gibier ? In: Delvingt W. (Ed.) La forêt des hommes : Terroirs villageois en forêt tropicale africaine. Les Presses Agronomiques de Gembloux, Gembloux, Belgique. pp. 65-92.

Dethier M., 1995. Étude Chasse. Projet Ecofac - Composante Cameroun. Dja Reserve, Cameroun.

Devers D., Vande weghe J.P. (Eds), 2007. The Forests of the Congo Basin - State of the Forest 2006. CBFP, ISBN 978-90-788-2701-6, 256 p.

DFS, 2006. Étude de faisabilité pour la mise en place des plantations forestières privées en République du Congo, Deutsche Forest Service GmbH: 50.

Dione A.M., Tamnjong I., Ndam N., and Blackamore P., 2000. Socio-Economic Case Study of the Production-To-Consumption System of the Rattan Sector in Cameroon: INBAR.

Djiré A., 2003. Le secteur informel du bois d'œuvre. Rapport d'appui à la revue du secteur forestier en RDC - Rapport technique. Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Montpellier, France.

Dounias E., 1996. Ecotone forêt-savane et système agraire des Tikar du Haut Mbam (Cameroun central). Paper read at Symposium international: Dynamique à long terme des écosystèmes forestiers intertropicaux, 20-22 Mars 1996, Paris, France.

Dounias E., 1999. Le câble pris au piège de la conservation. Technologie du piégeage et production cynégétique chez les Mvae du Sud Cameroun forestier. In: Bahuchet S., Bley D., Pagezy H., Vernazza-Licht N. (Eds). L'homme et la forêt tropicale, Travaux Société Écologie Humaine, Paris, France, pp 281-300.

Dounias E., Rodrigues W., and Petit C., 2000. Review of Ethnobotanical Literature for Central and West Africa. *African Ethnobotany Network* 2:5-117.

DRH, 2009. Direction du Reboisement et de l'Horticulture du Ministère de l'Environnement. Communication personnelle, août 2009, Kinshasa, RDC.

Drigo R., 2009. WISDOM pour les villes - Plateforme WISDOM pour Bangui. Diagnostic et cartographie du territoire et de la société pour le bois Énergie. TCP/CAF/3103, F.P. http://www.fao.org/docrep/012/k5586f/k5586f00.htm

Drigo R., Masera O.R. and Trossero M.A., 2002. Woodfuel Integrated Supply/Demand Overview Mapping - WISDOM: a geographical representation of woodfuel priority areas. Unasylva (English ed.) 53(211): 36-40.

Dubost G., 1980. L'écologie et la vie sociale du céphalophe bleu (*Cephalophus monticola thunberg*), petit ruminant forestier africain. Z. Tierpsychol. 54, 205–266.

Dupain J., Degrande A., de Marcken P., Elliot J., and Nackoney J., 2010a. Lessons learned from the Maringa-Lopori-Wamba landscape. In: Yanggen D., Angu K. and Tchamou N. (Eds), 2010. Landscape-Scale Conservation in the Congo Basin: Lessons Learned from the Central African Regional Program for the Environment (CARPE). Gland, Switzerland: IUCN. Xiv + 262p, pp 30-39.

Duveiller G., Defourny P., Desclée B., and Mayaux P., 2008. Deforestation in Central Africa: Estimates at regional, national and landscape levels by advanced processing of systematically distributed Landsat extracts. *Remote Sensing of Environment*, 112: 1969-1981.

East T., Kümpel N.F., Milner-Gulland E.G., and Rowcliffe J.M., 2005. Determinants of urban bushmeat consumption in Rio Muni, Equatorial Guinea. *Biological Conservation*, 126, pp 206-215.

Eba'a Atyi R., Devers D., de Wasseige C., and Maisels F., 2009. State of the Forests of Central Africa: Regional Synthesis. In: de Wasseige C., Devers D., de Marcken P., Eba'a Atyi R., Nasi R., and Mayaux P. (Eds.), 2009. The Forests of the Congo Basin - State of the Forest 2008, Luxembourg: Publications Office of the European Union, 411 p, ISBN 978-92-79-13210-0, doi: 10.2788/32259, pp 15 – 41.

Ebamane S., 2008. Synthèse des rapports d'études réalisées dans le cadre du Projet GCP/RAF/398/GER. FAO, Yaoundé, Cameroun.

Edderai D. and Dame M., 2006. A census of the commercial bushmeat market in Yaoundé, Cameroon. *Oryx*, Vol 40, No 4, pp 472-475.

Elkan P.W., Elkan S.W., Moukassa A., Malonga R., Ngangoue M., and Smith J.L.D., 2006. Managing threats from bushmeat hunting in a timber concession in the Republic of Congo. In: Laurance W.F., and Peres C.A. (Eds.). Emerging threats to tropical forests. University of Chicago Press, Chicago, Illinois, pp 393-415.

Emmons L.H., 1989. Tropical rain forests: Why they have so many species and how we may lose this biodiversity without cutting a single tree. *Orion Nature Quarterly*, 8: 8-14.

Enviro-Protect, 1997. Illegal logging and timber trade in Cameroon: background and consequences. Enviro-Protect, Yaoundé, Cameroon.

Ernst C., Verhegghen A., Bodart C., Mayaux P., de Wasseige C., Bararwandika A., Begoto G., Esono Mba F., Ibara M., Kondjo Shoko A., Koy Kondjo H., Makak J.S., Menomo Biang J.D., Musampa C., Ncogo Motogo R., Neba Shu G., Nkoumakali B., Ouissika C.B. and Defourny P., 2010. Congo Basin forest cover change estimate for 1990, 2000 and 2005 by Landsat interpretation using an automated object-based processing chain. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, XXXVIII-4/C7.

Eyong C. T., 2007. Indigenous Knowledge and Sustainable Development in Africa: Case Study on Central Africa. In: Boon E. K. and Hens E. Luc. Sustainable Development: Relevance for Africa. Indigenous Knowledge Systems and Tribes and Tribals. Kamla-Raj Enterprises.

Fa J.E., Juste J., Perez del Val J., Castroviejo J., 1995. Impact of market hunting on Mammalian species of Equatorial Guinea. *Conservation Biology*, 9, 1107-1115.

Fa J.E. and Yuste Garcia J.E., 2001. Commercial bushmeat hunting in the Monte Mitra forest, Equatorial Guinea: extent and impact. *Animal Biodiversity and Conservation* 24(1): 31-52.

Fa J., Currie D. and Meeuwig J., 2003. Bushmeat and food security in the Congo Basin: linkages between wildlife and people's future. *Environmental Conservation*, 30(1), 71-78.

Fa J. E., Ryan S. F., and Bell D. J., 2005. Hunting vulnerability, ecological characteristics and harvest rates of bushmeat species in afrotropical forests. *Biological Conservation,* 121 (2):167-176.

Fa J.E., Seymour S., Dupain J., Amin R., Albrechtsen L., and Macdonald D., 2006. Getting to grips with the magnitude of exploitation: Bushmeat in the Cross-Sanaga rivers region, Nigeria and Cameroon. *Biological Conservation*, 129 (4):497-510.

Fa J.E. and Brown D., 2009. Impacts of hunting on mammals in African tropical moist forests: a review and synthesis, *Mammal Review*, 2009, Volume 39, No. 4, 231–264.

Facheux C., Tchoundjeu Z., Foundjem D., and Mbosso C., 2006. From Research to Farmer Enterprise Development in Cameroon: Case Study of Kola Nuts. Acta Hort. 699.

FAO, 2005. Global Forest Resources Assessment 2005 – Main report. *FAO Forestry Paper* 147, Italy.

FAO, 2009. Cadre légal et réglementaire régissant l'exploitation et la commercialisation des Produits Forestiers Non Ligneux (PFNL) au Cameroun, edited by FAO. Yaoundé: FAO-CIFOR-SNV-World Agro-forestry Center-COMIFAC.

FAO, 2010. Global Forest Resources Assessment 2010 – Main report. *FAO Forestry Paper* 163, Italy.

FAO, 2011a. State of World's Forest 2011. Food and Agriculture Organization of the United Nations: 264. Rome, Italy.

FAO, 2011b. ForesSTAT. FAOSTAT. Rome. Retrieved 10-05-2011. Web site: http://faostat.fao.org.

FAO, GTZ et COMIFAC, 2008. Directives sous-régionales relatives à la gestion durable des Produits Forestiers Non Ligneux d'origine végétale en Afrique Centrale. FAO, GTZ, COMIFAC. Yaoundé, Cameroun.

Fargeot C., 2010. Bushmeat consumption in Central African Republic. XXIII IUFRO Congress, 23rd -28th of August 2010, Seoul, South Korea.

Fargeot C., Dieval S., 2000. La consommation de gibier à Bangui, quelques données économiques et biologiques. *Canopée*, 18, 5-7.

Feka N.Z. and Manzano M.G., 2008. The implications of wood exploitation for fish smoking on mangrove ecosystem conservation in the South West Province, Cameroon. *Tropical Conservation Science*, 1: 222-241.

Fiche d'information Bushmeat Crisis Task Force (BCTF), avril 2006. Économie de la viande de brousse. 2 p. Site web: http://www.bushmeat.org/sites/default/files/FSeconomics.pdf

Figueiredo E., 1994b. Diversity and endemism of angiosperms in the Gulf of Guinea islands. In: Fa J.E. and Juste B.J., Biodiversity conservation in the Gulf of Guinea Islands. Special Issue of Biodiversity and Conservation 3, 9: 785–793, Springer.

Figueiredo E., 1998. Pteridophytes of São Tomé and Príncipe (Gulf of Guinea). Bulletin of the Natural History Museum 28, 1: 41–66.

Figueiredo E., Paiva J., Stévart T., Oliveira F. and Smith G.F., 2011. Annotated catalogue of the flowering plants of São Tomé and Príncipe. Bothalia 41, 1: 41–82.

Flore du Cameroun, 1965 à 1978. Tomes 1 à 20. Museum National d'Histoire Naturelle, Paris, France.

Flore du Cameroun, tomes 21 à 37, Herbier national du Cameroun.

Flore du Gabon, 1964 à 2004. Tomes 1 à 37. Museum National d'Histoire Naturelle, Paris, France.

Flore du Gabon, 2009 et 2010. Tomes 38 à 41. Herbier National des Pays-Bas, Herbier National du Gabon, M.N.H.N.

Flore Numérique d'Afrique Centrale. Jardin botanique national de Belgique, Flore sur Internet. Site web: http://www.br.fgov.be/RESEARCH/DATABASES/FOCA/

Folefack D.P. et Abou S., 2009. Commercialisation du bois de chauffe en zone sahélienne du Cameroun. Sécheresse, 20(3): 312-8.

FORENET, 2010. Sub-regional Workshop on Harmonisation of National Reviews on "Non-Timber Forest Products (NTFPs) in Central Africa". Paper read at atelier sous-régional sur «L'harmonisation des revues nationales sur les produits forestiers non ligneux (PFNL) en Afrique centrale», 17-18 May 2010, Douala, Cameroon.

FRM, 2001. Document de base. Première conférence sur la transformation plus poussée des bois en Afrique. Libreville, Gabon., sept 2001. OAB/OIBT.

Gally M., Jeanmart P., 1996. Étude de la chasse villageoise en forêt dense humide d'Afrique Centrale. Mémoire de fin d'étude. Faculté Universitaire des Sciences Agronomiques de Gembloux, Gembloux, Belgique.

GBIF, Global Biodiversity Information Facility. Web site: http://www.gbif.org/

GEF, 2010. Partnership for Biodiversity Conservation: Sustainable financing of protected areas systems in the Congo Basin. Project document GEF/UNDP PIMS 3447, p 101.

Goheen J.R., Keesing F., Allan B.F., *et al.*, 2004. Net effects of large mammals on Acacia seedling survival in an African savanna. *Ecology*, 85(6): 555-1561.

Grossmann F., Hart J.A., Vosper A., Ilambu O., 2008. Range occupation and population estimates of Bonobos in the Salonga National Park: Application to large-scale surveys of Bonobos in the Democratic Republic of Congo. In: Furuichi T. and Thompson J.M. (Eds). The Bonobos: Behavior, Ecology and Conservation. Springer, 327 p, pp189-217.

Grubb P., 2001. Endemism in African rain forest mammals. In: Weber W., White L.J.T., Vedder A. and Naughton-Treves L. (Eds). African Rain Forest Ecology and Conservation: An Interdisciplinary Perspective. Yale University Press, New Haven, CT., pp. 88-100.

Guariguata M.R., García-Fernández C., Nasi R., Sheil D., Herrero-Jáuregui C., Cronkleton P., Ndoye O., and Ingram V., 2011. Timber and non-timber forest product extraction and management in the tropics: towards compatibility? In: Non-timber Forest Products in the Global Context, edited by S. Shackleton, D. Mitchell, C. Shackleton, B. Campbell and P. Shanley. Netherlands: Springer.

Guedje N.M., and Fankap R., 2001. Utilisations traditionnelles de *Garcinia lucida* et *Garcinia kola* (*Clusiaceae*) au Cameroun. *Systematics and Geography of Plants* 71 (2):747-758.

Guldemond R., Van Aarde R., 2008. A meta-analysis of the impact of African elephants on savanna vegetation. *Journal of wildlife management*. 72(4): 892-899.

Hansen M.C., De Fries R.S., Townshend J.R.G., Carroll M., Dimiceli C. and Sohlberg R.A., 2003. Global Percent Tree Cover at a Spatial Resolution of 500 Meters: First Results of the MODIS Vegetation Continuous Fields Algorithm. *Earth Interactions*, 7-010.

Hansen M.C., Roy D.P., Lindquist E., Adusei B., Justice C.O., Altstatt A., 2008. A method for integrating MODIS and Landsat data for systematic monitoring of forest cover and change in the Congo Basin. *Remote Sensing of Environment*, 112(5), 2495- 2513.

Harmon D., 2003. The Source and Significance of Values in Protected Areas. In: The Full Value of Parks: From Economics to the Intangible, Rowman and Littlefield Publishers, Inc, Oxford, United Kingdom, pp 13-25.

Hart J.A., 2000. Impact and Sustainability of indigenous hunting in the Ituri forest, Congo-Zaïre: A comparison of unhunted and hunted duiker populations. In: Robinson J.G., Bennet E.L. (Eds). Hunting for sustainability in tropical forests. New York: Columbia University Press, pp 106-153.

Hart T., 2010. Integration of sector and provincial level initiatives in support of participatory delimitation of a future national park and community conservation zone in the Province of Maniema. Unpublished report. Tshuapa-Lomami-Lualaba Project, Lukuru Foundation, Kinshasa, Democratic Republic of Congo.

Hecketsweiler P., 1990. La conservation des écosystèmes forestiers du Congo. IUCN, Tropical Forest Programme, 187 p.

Henschel P., Hayward M.W., Somers M.J., 2009. The status and conservation of leopards and other large carnivores in the Congo Basin, and the potential role of reintroduction. Reintroduction of top-order predators. *Conservation Science and Practice* 5: 206-237.

Hoare A.L., 2006. Divided forests: towards fairer zoning of forest lands. The Rainforest Foundation, London, UK.

Hooper D.U., Chapin F.S.I., Ewel J.J., Hector A., Inchausti P., Lavorel S., Lawton J.H., Lodge D.M., Loreau M., Naeem S., Schmid B., Setälä H., Symstad A.J., Vandermeer J. and Wardle D.A., 2005. Effects of biodiversity on ecosystem functioning: a consensus of current knowledge and needs for future research. Ecological Monographs 75:3-35.

Impreza-Servisi-Coordinati, 2010a. Conseil agricole et rural de gestion (CARG) du Territoire de Kwamouth: plan de développement agricole et rural du territoire. Impreza-Servisi-Coordinati, Projet de Développement Agricole du Bandundu. Ministère de l'Agriculture, Pêche et Élevage, République Démocratique du Congo. Financement Union Européenne, Food 172 355.

Impreza-Servisi-Coordinati, 2010b. Conseil agricole et rural de gestion (CARG) du Territoire de Kutu: plan de développement agricole et rural du territoire. Impreza-

Servisi-Coordinati, Projet de Développement Agricole du Bandundu. Ministère de l'Agriculture, Pêche et Élevage, République Démocratique du Congo. Financement Union Européenne, Food 172 355.

Impreza-Servisi-Coordinati, 2010c. Conseil agricole et rural de gestion (CARG) du Territoire d'Inongo: plan de développement agricole et rural du territoire. Impreza-Servisi-Coordinati, Projet de Développement Agricole du Bandundu. Ministère de l'Agriculture, Pêche et Élevage, République Démocratique du Congo. Financement Union Européenne, Food 172 355.

Ingram V., 2009. The hidden costs and values of NTFP exploitation in the Congo Basin. FAO, Buenos Aires, Argentina.

Ingram V., 2010. From fossils to food: Trade in *Gnetum* species in the Congo Basin. Paper read at SWC2010 International Conference: People, forests and the environment: coexisting in harmony. 25-27 May, 2010, Casablanca, Morocco.

Ingram V., 2011. Governing Forest Commons in the Congo Basin: The case of Non-Timber Forest Product Value Chains. Paper read at 13th Biennial Conference of the International Association for the Study of the Commons (IASC), November 2010, at Hyderabad, India.

Ingram V., Awono A., Schure J., and Ndam N., 2009. National *Prunus africana* Management Plan Cameroon, edited by CIFOR. Yaoundé, Cameroon: FAO-CIFOR-SNV-World Agro-forestry Center-COMIFAC-GTZ.

Ingram V., and Bongers G., 2009. Valuation of Non-Timber Forest Product Chains in the Congo Basin: A methodology for valuation. Yaoundé, Cameroon: FAO-CIFOR-SNV-World Agro-forestry Center-COMIFAC.

Ingram V., and Schure J., 2010. Review of Non Timber Forest Products (NTFPs) in Central Africa: Cameroon, edited by FORENET. Yaoundé: CIFOR.

Ingram V., Tieguhong J. C., Nkamgnia E. M., Eyebe J. P., and Ngawel M., 2010. Bamboo Production to Consumption System, Cameroon. Edited by CIFOR. Yaoundé, Cameroon: CIFOR/INBAR.

Institut Congolais pour la Conservation de la Nature, 1973. Revue Léopard No 1, 1973.

Institute of Applied Ecology (IEA), 1998. African Mammals Databank - A Databank for the Conservation and Management of the African Mammals, Vol 1 and 2. Brussels European Commission Directorate. Web site: http://www.gisbau.uniroma1.it/amd/

Isong E.U., Adewusi S.A.R., Nkanga E.U., Unoh E.E., and Offiong E.E., 1999. Nutritional and phytogeriatological studies of three variaties of *Gnetum africanum* ('afang'). *Alimentation Chemistry* 64:489-493.

Jensen A., 2009. Valuation of non-timber forest products value chains. *Forest Policy and Economics*, 11:34-41.

Jochem S., 1995. Exploitation of Moabi in the dense humid forests of Cameroon, Harmonization and improvement of two conflicting ways of exploitation of the same forest resource. Bois Newsletter, July 1995, 20-32.

Kamanda B., Angu K., and Nguinguiri J.C., 2003. The Social Value of the Nyangkpe Sacred Forests of South West Province of Cameroon. In: The Full Value of Parks: From Economics to the Intangible, Rowman and Littlefield Publishers, Inc, Oxford, United Kingdom. pp 77-89.

Kaplinsky R. and Morris M., 2000. A handbook for value chain research. Prepared for the IDRC.

Kasulu Seya Makongai V., Armathé Amougouii J., and Hamel O., 2009. Congo Basin Countries and the Reduced Emissions from Deforestation and Degradation (REDD) Process. In: de Wasseige C., Devers D., de Marcken P., Eba'a Atyi R., Nasi R., and Mayaux P. (Eds) 2009. The Forests of the Congo Basin - State of the Forest 2008, Luxembourg: Publications Office of the European Union, ISBN 978-92-79-13210-0, doi: 10.2788 /32259, pp 173-190.

King S., 1994. Utilisation of wildlife in Bakossiland, West Cameroon. TRAFFIC Bulletin, 14, pp 63-73.

Knights K., 2008. Who ate all the crocodiles? An investigation of trends and patterns in trade and consumption of bushmeat in Gabon, MSc Conservation Science, Imperial College London, UK.

Koppert G., Dounias E., Froment A., Pasquet P., 1996. Consommation alimentaire dans trois populations forestières de la région côtière du Cameroun : Yassa, Mvae et Bakola. In: Hladik C.M., Hladik A., Pagezy H., Linares O. F., Koppert G.J.A., Froment A. (Eds). L'alimentation en forêt tropicale, interactions bio-culturelles et perspectives de développement. Volume I, Les ressources alimentaires: production et consommation. UNESCO, Paris. Pp 477-496.

Kümpel N., 2006. Incentives for sustainable hunting of bushmeat in Rio Muni, Equatorial Guinea, PhD thesis, Institute of Zoology/Imperial College London, UK.

Kümpel N. F., Milner-Gulland E. J., Rowcliffe J. M. and Cowlishaw G., 2008. Impact of gun-hunting on diurnal primates in continental Equatorial Guinea. *International Journal of Primatology*, 29:1065–1082.

Kümpel N. F., Milner-Gulland E. J., Cowlishaw G. and Rowcliffe J.M., 2010a. Assessing sustainability at multiple scales in a rotational bushmeat hunting system. *Conservation Biology*, 24:861-871.

Kümpel N.F., Milner-Gulland E.J., Cowlishaw G. and Rowcliffe J.M., 2010b. Incentives for hunting: the role of bushmeat in the household economy in rural Equatorial Guinea. *Human Ecology*, 38(2), 251-264.

Kuteesakwe J. and Kuteesakwe J.K., 2008. Viable Strategy for Scaling up the Dissemination of Improved Stoves among the Poor in Africa. SESAM/ARTES/DAAD AFRICAN ALUMNI: 58.

Lahm S.A., 1994. Ecology and economics of human/wildlife interaction in Northeastern Gabon. New York: New York University.

Laird D.A., Brown R.C., Amonette J.E. and Lehmann J., 2009. Review of the pyrolysis platform for coproducing bio-oil and biochar. Biofuels Bioproducts & Biorefining-Biofpr, 3(5): 547-562.

Laird S., Ingram V., Awono A., Ndoye O., Sunderland T., Lisinge E., and Nkuinkeu R., 2010. Integrating customary and

statutory systems: The struggle to develop a legal and policy framework for NTFPs in Cameroon. In: Laird S.A., McLain R., and Wynberg R.P., 2010. Wild Product Governance: Finding Policies that Work for Non-Timber Forest Products, London: Earthscan.

Lamouroux M., Boundzanga G.C., 1994. La filière bois énergie dans les quatre principales villes du Congo, PNAE - Congo: 144.

Lebrun J.P., 1976. Richesse spécifique de la flore vasculaire de divers pays ou régions d'Afrique. Candollea, 31: p 11-15.

Lemmens R.H.M.J. and Sosef M.S.M., 1998. The flora of the Congo Basin. In: Besselink C. and Sips P. (Eds). The Congo Basin: Human and Natural Resources. Netherlands Committee for IUCN, Amsterdam, the Netherlands, p. 25-30.

Lescuyer G., 2010a. Analyse économique de l'exploitation forestière artisanale dans la Province Orientale de la République Démocratique du Congo: Diagnostic succinct. Forests Monitor report, London.

Lescuyer G., 2010b. Importance économique des produits forestiers non ligneux dans quelques villages du Sud-Cameroun. *Bois et Forêts des Tropiques*, 304 (2):15 -24.

Lescuyer G., Eba'a Atyi R., Cerutti P.O., 2009a. Consommations nationales de bois d'œuvre en Afrique centrale : un enjeu majeur pour la gestion forestière durable. Article presented at the World Forestry Congress, October 18-23, Buenos Aires, Argentina.

Lescuyer G., Karsenty A., and Eba'a Atyi R., 2009b. A New Tool for Sustainable Forest Management in Central Africa: Payments for Environmental Services. In: de Wasseige C., Devers D., de Marcken P., Eba'a Atyi R., Nasi R., and Mayaux P. (Eds), 2009. The Forests of the Congo Basin - State of the Forest 2008, Luxembourg: Publications Office of the European Union, 411 p, ISBN 978-92-79-13210-0, doi: 10.2788 /32259, pp 127-139.

Lescuyer G., Laporte J., Essiane Mendoula E., 2010. Étude de la filière du sciage artisanal à Bangui. PARPAF, Bangui, République Centrafricaine.

Lescuyer G., Cerutti P.O., Ndotit Manguiengha S., Bilogo bi Ndong L., 2011a. The domestic market for small-scale chainsaw milling in Gabon. Present situation, opportunities and challenges. CIFOR, Occasional Paper 65, Bogor, Indonésie. Web site: www.cifor.org/publications/pdf_files/OccPapers/OP-65.pdf

Lescuyer G., Yembe Yembe R.I., Cerutti P.O., 2011b. Le marché domestique du sciage artisanal en République du Congo. Etat des lieux, opportunités et défis. CIFOR, Document Occasionnel 71, Bogor, Indonésie, 44 p. Web site: www.cifor.org/publications/pdf_files/OccPapers/OP-71.pdf

Letouzey R., 1985. Notice de la carte phytogéographique du Cameroun au 1 : 500 000. Domaines sahélien et soudanien. Région agro-montagnarde et étagée sub-montagnarde. Domaine de la forêt dense humide semi caducifoliée. Domaine de la forêt dense humide toujours verte. Toulouse (FRA) : Institut de la Carte Internationale de la Végétation, 1985, 5 vol., 240 p.

Letouzey R., 1986. Manuel de botanique forestière. Centre Technique Forestier Tropical, 3 vol., Nogent-sur-Marne, France.

Linder J., 2008. Differential vulnerability of primates to hunting in Korup National Park, Cameroon: implications for primate conservation. PhD Thesis. Hunter College, City University of New York, NY, USA.

Lokasola A., 2008. First field study of the salongo monkey (*Cercopithecus dryas*), Kokolopori bonobo reserve, DRC. Vie Sauvage, Kokolopori, Equateur, DRC, IPS 2008 Congress, Edinburgh, 3-8 Aug 2008.

Louppe D., and Mallet B., 2009. Dossier spécial: Les produits forestiers non ligneux. *Le Flamboyant*, 65:40.

Mabiala N., 2004. Missions de recensement dans les communes de Libreville, d'Owendo et de N'toum des PME & PMI exerçant dans la 2e et la 3e transformation du bois (Menuiseries / Ebénisteries). Ministry of Forest Economy, Libreville, Gabon.

Madi A., Huub P. and Sali B., 2003. La demande urbaine en bois énergie et nécessité d'une gestion rationnelle des ressources naturelles : le cas de la ville de Maroua à l'Extrême Nord du Cameroun. In: Jamin J.Y., Seiny Boukar L., Floret C. (Eds), 2003. Savanes africaines : des espaces en mutation, des acteurs face à de nouveaux défis. Actes du colloque, mai 2002, Garoua, Cameroun. PRASAC, 9 p.

Maille P., 2001. Bibliography NTFPs Central Africa. US Forest Service. Web site: www.fs.fed.us/global/globe/africa/reports/nftp_bibliography.pdf

Marien B., 2006. La filière bois énergie de Pointe-Noire : compte rendu des enquêtes ménages. UR2PI/CIRAD, 34p.

Marien J. N., 2009. Peri-Urban Forests and Wood Energy: What are the Perspectives for Central Africa? In: de Wasseige C., Devers D., de Marcken P., Eba'a Atyi R., Nasi R., and Mayaux P. (Eds) 2009. The Forests of the Congo Basin - State of the Forest 2008, Luxembourg: Publications Office of the European Union, ISBN 978-92-79-13210-0, doi: 10.2788 /32259, pp 209-221.

Marien J.N., Mallet B., 2004. Nouvelles perspectives pour les plantations forestières en Afrique centrale. *Bois et Forêts des Tropiques*, 282(4): 67-79.

Marien J.N., Bassaler N., 2010. Les perspectives d'évolutions futures des écosystèmes forestiers: Quels enjeux pour les négociations sur les changements climatiques ? Note de prospective, décembre 2010, 6 pp.

Marien J.N., Bassaler N., 2011. Analyse prospective sur les écosystèmes forestiers du Bassin du Congo. Rapport d'étape décembre 2011, 90 pp.

Mauvais G., 2010. Land-Use Planning in Central African Protected Areas: Examples and Lessons Learned. In: Yanggen D., Angu K. and Tchamou N. (Eds), 2010. Landscape-Scale Conservation in the Congo Basin. Lessons Learned from the Central African Regional Program for the Environment (CARPE). Gland, Switzerland: IUCN. Xiv + 262 p, pp 41-47.

Mayaux P., Janodet E., Blair-Myers C. and Legeay-Janvier P., 1997. Vegetation map of Central Africa at 1:5 000 000. *TREES*

Publications Series D1, EUR 17322 (European Commission, Luxembourg), 32 pp.

Mayaux P., Achard F. and Malingreau J.P., 1998. Global tropical forest area measurements derived from coarse resolution satellite imagery: a comparison with other approaches. *Environmental Conservation*, 25, 37-52.

Mayaux P., Bartholomé E., Massart M., Vancutsem C., Cabral A., Nonguierma A., Diallo O., Pretorius C., Thompson M., Cherlet M., Pekel J.F., Defourny P., Vasconcelos M., Di Gregorio A., Fritz S., De Grandi G., Elvidge C., Vogt P. and Belward A., 2003. A Land Cover Map of Africa – Carte de l'occupation du Sol de l'Afrique, EUR 20665, EN (European Commission, Luxembourg), 20 pp.

Mayaux P., Bartholomé E., Fritz S. and Belward A., 2004. A new land cover map of Africa for the year 2000. *Journal of Biogeography*, 31(6), 861-877.

MECNT, 2009a. Processus de conversion des titres forestiers en contrats de concession forestière (carte). Décret No. 05/116 du 24 Octobre 2005. Ministère de l'Environnement, Conservation de la Nature et Tourisme, République Démocratique du Congo.

MECNT, 2009b. Potentiel REDD+ de la RDC. Ministère de l'Environnement, Conservation de la Nature et Tourisme, République Démocratique du Congo.

MECNT, 2011a. Point de Presse du 29 janvier 2011 sur la Clôture du Processus de Conversion des Anciens Titres Forestiers et Perspectives dans le Secteur de l'Exploitation Forestière en RDC. Ministère de l'Environnement, Conservation de la Nature et Tourisme, République Démocratique du Congo.

MECNT, 2011b. Normes de macro-zonage forestier : guide opérationnel. Direction des Inventaires et Aménagement Forestiers, Ministère de l'Environnement, Conservation de la Nature et Tourisme, République Démocratique du Congo.

Medicinal Plants Specialist Group, 2007. International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP). Edited by IUCN. Bonn, Gland, Frankfurt, and Cambridge (BfN-Skripten 195): Bundesamt für Naturschutz (BfN), MPSG/SSC/IUCN, WWF Germany and TRAFFIC.

Mehlman P., 2010. Lessons learned from the Maïko Tayna Kahuzi-Biega landscape. In: Yanggen D., Angu K. and Tchamou N. (Eds), 2010. Landscape-Scale Conservation in the Congo Basin: Lessons Learned from the Central African Regional Program for the Environment (CARPE). Gland, Switzerland: IUCN. Xiv + 262p, pp 10-20.

Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC.

Minang P.A., McCall M.K. and Bressers H.T.A., 2007. Community capacity for implementing Clean Development Mechanism projects within community forests in Cameroon. *Environmental Management*, 39(5): 615-630.

MINFOF, 2009a. Décision No 0020/D/MINFOF/SG/DF/SDAFF/SAG du 06 Jan 2009 Portant octroi des quotas d'exploitation des produits forestiers spéciaux, République du Cameroun: Ministère des Forêts et de la Faune: 3.

MINFOF, 2009b. Décision No 1148/D/MINFOF/SG/DF/SDAFF/SAG du 31 Déc 2009 Portant octroi des quotas d'exploitation des produits forestiers spéciaux, République du Cameroun: Ministère des Forêts et de la Faune: 3.

Ministère de l'Énergie et de l'Eau, 2008. Élaboration du Diagnostic du Secteur Eau et Énergie, Document 3 : Diagnostic du sous-secteur des énergies renouvelables. Division des Études, de la Prospective et de la Coopération (DEPC): 33, Yaoundé, Cameroun.

Ministère de l'Énergie et de l'Eau, 2009. Système d'information énergétique du Cameroun Rapport 2009. Yaoundé, SIE, Cameroun: 150.

Ministère de l'Énergie et de l'Eau, 2010. Système d'information énergétique du Cameroun. Rapport 2010. Yaoundé, SIE, Cameroun.

Ministry of Forestry and Wildlife, 2009. Manual of procedures for the attribution and norms for the management of community forests. Ministry of Forestry and Wildlife, Cameroon.

MOCAP-CIG, 2007. Training of Trainers on Modern Harvesting techniques and marketing of *Prunus africana* for Forest Management Institutions of the Association of Kom Forest Management Institution (ASSOKOFOMI) and the Association of Oku Forest Management Institution (ASSOFOMI), edited by FGF. Manchok, Oku: Mount Cameroon *prunus* management common initiative group.

Mockrin M., 2009. Duiker demography and dispersal under hunting in Northern Congo. *African Journal of Ecology*. 48(1): 239-247.

Molnar A., Mbile P., Bandiaky S., Kozak R., Canby K., and France M., 2010. Small Scale, Large Impacts. Transforming Central and West African Forest Industry and Trade to Improve Sustainable Development, Growth and Governance. Washington DC: Rights and Resources Initiative.

N´gasse G., 2010. Revue nationale sur les Produits Forestiers Non Ligneux: PFNL. Cas de la République Centrafricaine: RCA, edited by FORENET. Brazzaville.

Nasi R., Nguinguiri J.C., Ezzine de Blas D., 2006. Exploitation et gestion durable des forêts en Afrique Centrale. Paris, L'Harmattan, pp 403.

Nasi R., Brown D., Wilkie D., Bennett E., Tutin C., van Tol G., Christophersen T., 2008. Conservation and use of wildlife-based resources: the bushmeat crisis. Secretariat of the Convention on Biological Diversity, Montreal, and Center for International Forestry Research (CIFOR), Bogor. *Technical Series* no. 33, 50 p.

Ndenecho E.N., 2007. Economic value and management of mangrove forests in Cameroon. *International Journal of Sustainable Development & World Ecology*, 14(6): 618-625.

Nde-Shiembo P. (Ed.), 1999. The Sustainability of Eru (*Gnetum africanum* and *Gnetum buchholzianum*): Over-Exploited Non-Wood Forest Product from the Forests of Central Africa. In: Sunderland T. C. H., Clark L. E. and Vantomme P. Non-wood forest products of Central Africa: current research issues and prospects for conservation and development. Based on the outcome of the International

Expert Meeting on Non-Wood Forest Products in Central Africa, The Limbe Botanic Garden, Cameroon 10-15 May 1998: FAO.

Ndikumagenge C., 2010. Forest concession land-use planning: lessons learned. In: Yanggen D., Angu K. and Tchamou N. (Eds), 2010. Landscape-Scale Conservation in the Congo Basin. Lessons Learned from the Central African Regional Program for the Environment (CARPE). Gland, Switzerland: IUCN. Xiv + 262p, pp 77-82.

Ndoye, Ousseynou, Manuel Ruiz Pérez, and Antoine Eyebe. 1998. The Markets of Non-timber Forest Products in the Humid Forest Zone of Cameroon. Rural Development Forestry Network. *Network Paper*, 22c:25.

Ndoye O., and Tieguhong J.C., 2004. Forest Resources and Rural Livelihoods: The Conflict between Timber and Non-timber Forest Products in the Congo Basin. *Scandinavian Journal of Forest Research* 19 (4 supp 4):36-44.

Ndoye O., and Awono A., 2009. Regulatory policies and *Gnetum* spp. trade in Cameroon: Overcoming Constraints that Reduce Benefits and Discourage Sustainability. In: Wild Product Governance: Finding Policies that Work for Non-Timber Forest Products, edited by S.A. Laird, R. McLain and R.P. Wynberg. London: EarthScan.

Ndumbe L., Ingram V., and Awono A., 2009. Baseline study on *Gnetum* spp. in the South West and Littoral Regions of Cameroon, edited by CIFOR. Yaoundé, Cameroon: FAO-CIFOR-SNV-World Agro-forestry Center- COMIFAC.

Ngnegueu P., Fotso R., 1996. Chasse villageoise et conséquences pour la conservation de la biodiversité dans la réserve de biosphère du Dja. COFAC: Yaoundé, Cameroun.

Ngniado A., Defo L., Chendjou C., and Nzooh Dongmo Z., 2010. The process of allocating and managing community forests in Cameroon: case studies from the Sangha tri-national and the Dja-Odzala-Minkébé tri-national landscapes. In: Yanggen D., Angu K. and Tchamou N. (Eds), 2010. Landscape-Scale Conservation in the Congo Basin. Lessons Learned from the Central African Regional Program for the Environment (CARPE). Gland, Switzerland: IUCN. Xiv + 262p, pp 113-118.

Njiforti H. L., 1996. Preferences and present demand for bushmeat in north Cameroon: some implications for wildlife conservation. *Environmental Conservation* 23 (02):149-155.

Nkeng P.F., 2009. Sustainable management of *Prunus africana* (Hook.f.) Kalk. in Cameroon: An assessment of exploitation methods in South-West, North-West and Adamaoua Vicinities. Msc Ingénieur des eaux et forêts et chasses, faculty of agronomy and agricultural sciences, University of Dschang, Dschang.

Nkoua M. *et al.*, 2010. Approvisionnement en bois énergie de la ville de Pointe-Noire : rapport d'enquête sur le trafic du 14 au 28 février 2010. Rapport CRDPI. 13p.

Noss A. J., 1995. Duikers, cables and nets: The cultural ecology of hunting in a Central African Forest. Ph.D. Dissertation, University of Florida, Gainesville.

Noss A.J., 2000. Cable Snares and Nets in the Central African Republic. In: Robinson J.G. and Bennett E.L. (Eds). Hunting for Sustainability in Tropical Forests. New York: Columbia University Press. Pp. 282-304.

Noubissie E., Chupezi T. J., and Ndoye O., 2008. Analyse des aspects socio-économiques des produits forestiers non-ligneux (PFNL) en Afrique Centrale. Synthèse des Rapports d'études réalisées dans le cadre du Projet GCP/RAF/398/GER. Yaoundé, Cameroun: FAO. Renforcement de la sécurité alimentaire en Afrique Centrale à travers la gestion et l'utilisation durable des produits forestiers non ligneux.

Ntsama Atangana J., 2009. Contribution à l'évaluation environnementale liée à la problématique du bois de feu dans la ville de Garoua (Nord Cameroun). Faculté d'Agronomie et des Sciences Agricoles. Yaoundé, Université de Dschang, CRESA. Master II Professionnel: 134.

OAB, 2004. Promotion de la transformation plus poussée des bois tropicaux en Afrique. Plan d'action proposé par la Conférence Ministérielle de l'OAB. Organisation Africaine du Bois. Libreville. Gabon. 51 p.

Oates J.F., Abedi-Lartey M., McGraw W.S., Struhsaker T.T. and Whitesides G.H., 2000. Extinction of a West African red colobus monkey. *Conservation Biology*, 14, pp 1526–1532.

Obiang Mbomio D., 2010. El Sector Forestal en Guinea Ecuatorial: políticas, Economía y causas de la Deforestación local. Seminario de Capacitación REDD+. 6-10 septembre 2010. Bata, Guinea Ecuatorial.

Okouyi J., 2006. Savoirs locaux et outils modernes cynégétiques: développement de la filière commerciale de viande de brousse à Makokou (Gabon). PhD thesis, Université d'Orléans.

Onana J.M., Cheek M., 2011. Red Data Book of the Flowering Plants of Cameroon: IUCN Global Assessments. Royal Botanic Gardens, 578 p.

Orchidacea of Central Africa. Web site: http://www.orchid-africa.net

OSFAC, 2010. Forêts d'Afrique centrale évaluées par télédétection FACET. Étendue et perte du couvert forestier en République démocratique du Congo de 2000 à 2010. Publié par l'Université d'État du Dakota du Sud, Brookings, Dakota du Sud, États-Unis d'Amérique. ISBN: 978-0-9797182-5-0. Site web: http://osfac.net.

Ouédraogo B., 2007. Filière bois d'énergie burkinabé: structuration des prix et analyse de la répartition des bénéfices. *Bois et forêts des tropiques*, 294(4): 75-88.

Paumgarten F., 2007. The Significance of the Safety-Net Role of NTFPs in Rural Livelihoods, South Africa, Environmental Sciences, Rhodes University, Grahamstown, South Africa.

Pennec A., Gond V., Gourlet-Fleury S., 2010. Cartographie de la végétation des plateaux Batéké à partir de l'imagerie satellitaire - présentation Projet Makala, CIRAD, Projet Makala: 50.

Peres C.A. and Dolman P., 2000. Density compensation in neo-tropical primate communities: evidence from 56 hunted and non-hunted Amazonian forests of varying productivity, *Oecologia*, 122, 175-189.

Perry E., Bediang K.A., 2009. Étude de la filière bois au Cameroun: Identification des interventions porteuses d'emplois,

Ministère de l'emploi et de la formation professionnelle, Organisation Internationale du Travail: 40.

PROTA - Plant Resources of Tropical Africa, 2006 à 2010. Tomes 1-14 et bases de données sur Internet PROTA4U. Sites web : http://www.prota4u.org/searchresults.asp et http://www.prota.co.ke/fr/accueil

Plants of Gabon. Web site: http://dps.plants.ox.ac.uk/bol/Gabon/Home/Index

Plouvier D., Eba'a Atyi R., Fouda T., Oyono R. et Djeukam R., 2002. Étude du sous-secteur du sciage artisanal au Cameroun. Ministry of Environment and Forests, Yaoundé, Cameroon.

Poilecot P., 2010. Le braconnage et la population d'éléphants du Parc national de Zakouma (Tchad). *Bois et Forêts des Tropiques*, n°303, Montpellier, France, pp 93-82.

Poulsen J.R., Clark C.J., Mavah G. and Elkan P.W., 2009. Bushmeat Supply and Consumption in a Tropical Logging Concession in Northern Congo. *Conservation Biology*, 23:1597-1608.

Poulsen J.R., Clark C.J., and Curran B.K., 2010. A multi-organizational model of land-use planning to conserve wildlife and forest resources in forestry concessions. In: Yanggen D., Angu K. and Tchamou N. (Eds), 2010. Landscape-Scale Conservation in the Congo Basin. Lessons Learned from the Central African Regional Program for the Environment (CARPE). Gland, Switzerland: IUCN. Xiv + 262p, pp 96-101.

Pouna E., 1999. La situation du bois-énergie au Cameroun depuis 1990. Collecte et analyse de données pour l'aménagement durable des forêts - joindre les efforts nationaux et internationaux. Programme de partenariat CE-FAO: 9, Yaoundé, Cameroun.

Profizi J., Makita-Madzou J., Milandou J., Karanda C., Motom M., and Bitsindou I., 1993. Ressources végétales non ligneuses des forêts du Congo. Université Marien Ngouabi (Faculté des Sciences), Brazzaville, République du Congo.

Projet Sud Expert Plantes, 2010. Site web: www.sud-expert-plantes.ird.fr

Pye-Smith C., 2010. The Fruits of Success: A programme to domesticate West and Central Africa's wild fruit trees is raising incomes, improving health and stimulating the rural economy. Edited by ICRAF, Trees for Change No. 4. Nairobi: World Agro-forestry Centre.

RAPAC, 2009. Séminaire-atelier sous régional sur le développement des outils et modes de gestion des aires protégées en Afrique centrale. Rapport général. Brazzaville, 10-13 février 2009, République du Congo, p 60.

Redford K.H., 1992. The empty forest. *BioScience*, 42, 412–422.

Red List IUCN. Web site: http://www.iucnredlist.org/

Reed E. and Miranda M., 2007. Assessment of the Mining Sector and Infrastructure Development in the Congo Basin Region. WWF Macroeconomics for Sustainable Development Program Office, United States of America. (http://www.panda.org/mpo).

Reitsma J.M., 1988. Végétation forestière du Gabon / Forest vegetation of Gabon. *Tropenbos Technical Series* 1. The Tropenbos Foundation, Ede, The Netherlands.

Réjou-Méchain M., Fayolle A., Nasi R., Gourlet-Fleury S., Doucet J.L., Gally M., Hubert D., Pasquier A., Billand A., 2010. Detecting large-scale diversity patterns in tropical trees: Can we trust commercial forest inventories? *Forest Ecology and Management*, Volume 261, Issue 2, 15 January 2011, pp 187-194.

Republic of Cameroon, 2009. Guidance for a National *Prunus africana* Management Plan, Cameroon, edited by G.S. Ministry of Forestry and Wildlife, Department of Forestry, Yaoundé, Cameroon.

REBAC. Web site: http://www.rebac-botanists.com

Robinson J.G., and Bennett E.L., 2004. Having your wildlife and eating it too: an analysis of hunting sustainability across tropical ecosystems. *Animal Conservation* 7:397-408.

Romain N.J., 2009. Le Moabi (*Baillonella toxisperma*) Un arbre multi-ressources des forêts denses humides du Cameroun. *Le Flamboyant*, 65:2-5.

Salbitano F., 2009. Stratégie de développement et plan d'action pour la promotion de la foresterie urbaine et périurbaine de la Ville de Bangui. Urban and Peri-Urban Forestry Working Paper, no. 3. Rome, FAO, Forestry Dept. Web site: ftp://ftp.fao.org/docrep/fao/012/i0926f/i0926f00.pdf.

Sayer J., and Maginnis S., 2005. New Challenges for Forest Management. In: Forests in Landscapes: Ecosystem Approaches to Sustainability, Earthscan. Cambridge: pp 1-16.

Schenck M., Nsame Effa E., Starkey M., Wilkie D., Abernethy K., Telfer P., Godoy R. and Treves A., 2006. Why people eat bushmeat: results for two-choice taste tests in Gabon Central Africa. *Human Ecology*, 34(3), 433-445.

Schure J., Ingram V., Awono A. and Binzangi K., 2009. From Tree to Tea to CO_2 in the Democratic Republic of Congo: a framework for analyzing the market chain of fuelwood around Kinshasa and Kisangani. World Forestry Conference XIII. 18-23 October, Buenos Aires, Argentina.

Schure J., Ingram V. and Akalakou-Mayimba C., 2011. Bois énergie en RDC: Analyse de la filière des villes de Kinshasa et Kisangani (version préliminaire). Yaoundé, CIFOR, Projet Makala (http://projets.cirad.fr/makala): 67

Shiembo P.N., 1998. The sustainability of Eru (*Gnetum africanum* and *Gnetum buchholzianum*): Over-exploited Non-wood Forest Product from the forests of Central Africa. In: Sunderland T.C.H., Clark L.E. and Vantomme P. (Eds). Non-wood Forest Products of Central Africa: Current research issues and prospects for conservation and development. International Expert Meeting on Non-wood Forest Products in Central Africa, FAO, Limbe, Cameroon, 10-15 May 1998.

Shiembo P., Newton A., and Leaky R., 1996. Vegetative propagation of *Gnetum africanum welw*., a leafy vegetable from West Africa. *Journal of Horticultural Science* 71 (1):149-155.

Simo A. and Siyam Siwe S., 2000. Availability and conversion to energy potentials of wood-based industry residues in Cameroon. Renewable energy, 19(1-2): 213-218.

Sizer N., Bass S., Mayers J., Arnold M., Auckland L., Belcher B., Bird N., Campbell B.M. *et al.*, 2005. Wood, Fuelwood,

and Non-wood Forest Products. In: Millennium Ecosystem Assessment (Ed.), *Ecosystems and Human Well-being: Policy Responses*. Washington, DC: Island Press. pp. 257-293.

Smith K.R., 2006. Health impacts of household fuelwood use in developing countries. Unasylva, 57(224): 41-44.

Solly H., 2004. Bushmeat hunters and secondary traders: making the distinction for livelihood improvement. Wildlife Policy Briefing 7. Overseas Development Institute, London.

Sonke B., Lachenaud O., Simo M., Taedoumg H., Droissart V., Lemaire B., Stévart T., Dessein S., 2010. Botanical survey in Central Africa: taxonomical novelties and new records for the flora of Cameroon. 19th AETFAT Congress, 25-30/04/2010. Antananarivo, Madagascar.

Sosef M.S.M., Wieringa J.J., Jongkind C.C.H., Achoundong G., Azizet Issembé Y., Bedigian D., van den Berg R.G., Breteler F.J., Cheek M., Degreef J., Faden R., Gereau R.E., Goldblatt P., van der Maesen L.J.G., Ngok Banak L., Niangadouma R., Nzabi T., Nziengui B., Rogers Z.S., Stévart T., Taylor C.M., van Valkenburg J.L.C.H., Walters G. and de Wilde J.J.F.E., 2006. Check-list des plantes vasculaires du Gabon/ Checklist of Gabonese vascular plants. Scripta Botanica Belgica, 35, 438p.

Starkey M., 2004. Commerce and subsistence: the hunting, sale and consumption of bushmeat in Gabon, PhD thesis Fitzwilliam College, University of Cambridge-UK.

Stiassny M.L.J., Teugels G.G. and Hopkins C.D., 2007. Poissons d'eaux douces et saumâtres de Basse Guinée, ouest de l'Afrique centrale (The Fresh and Brackish Water Fishes of Lower Guinea, West-Central Africa). Volumes 1 et 2. Paris: Institut de Recherche pour le Développement (IRD), Musée Royal de l'Afrique Centrale (MRAC).

Stuart S.N., Adams R.J., Jenkins M., 1990. Biodiversity in sub-Saharan Africa and its islands: Conservation, management, and sustainable use. IUCN, Occasional Paper, Volume 6, Gland, Switzerland, 242 p.

Sunderland T.C.H., 2001. The Taxonomy, Ecology and Utilisation of African Rattans (*Palmae: Calamoideae*) University College, London, UK.

Sunderland T.C., Clark L.E., Vantomme P., 1998. Non-Wood Forest Products in Central Africa; Current research issues and prospects for conservation development. Paper read at International Expert Meeting on Non-Wood Forest Products in Central Africa, 1999, at Limbe, Cameroon.

Sunderland T.C., and Tako C., 1999. The exploitation of *Prunus africana* on the island of Bioko, Equatorial Guinea, edited by P. a. P. Initiative. Bonn: *Prunus africana* Working Group.

Sunderland T., Asaha S., Balinga M., and Isoni O., 2009. Regulatory Issues for Bush Mango (*Irvingia* spp.) Trade in South-West Cameroon and South-East Nigeria. In: Wild Product Governance: Finding Policies that Work for Non-Timber Forest Products, edited by S.A. Laird, R. McLain and R.P. Wynberg. London: EarthScan.

Tabuna H., 1999. Le marché des produits forestiers non ligneux de l'Afrique Centrale en France et en Belgique: produits, acteurs, circuits de distribution et débouchés actuels. CIFOR, Bogor, Indonesia.

Tachie-Obeng E., and Brown N., 2001. *Cola nitida* & *Cola acuminata*, edited by CARPE. Oxford: Central African Regional Program for the Environment.

Takforyan A., 2001. Chasse villageoise et gestion locale de la faune sauvage en Afrique. Une étude de cas dans une forêt de l'Est-Cameroun. EHESS. Paris, France.

Tchatat M., Ndoye O., 2006. Étude des produits forestiers non ligneux d'Afrique centrale : réalités et perspectives. *Bois et Forêts des Tropiques* 288 (2):27-39.

Tela-botanica. Le réseau de la botanique francophone. Site web: http://www.tela-botanica.org

Terborgh J., Estes J.A., 2010. Trophic cascades: predators, prey, and the changing dynamics of nature. Island Press, Washington.

Termote C., Damme P.V., and Djailo B.D.A., 2010. Eating from the Wild: Turumbu Indigenous Knowledge on Non cultivated Edible Plants, Tshopo District, DRC. *Food and Nutrition*, 49 (3):173–207.

Teugels G.G. and Thieme M.L., 2005. Freshwater Fish Biodiversity in the Congo Basin. In: Thieme M.L., Abell R., Stiassny M.L.J., Skelton P., Lehner B., Teugels G.G., Dinerstein E., Kamdem Toham A., Burgess N. and Olson D., 2005. Freshwater Ecoregions of Africa and Madagascar. Island Press, Washington, Covelo and London, pp 51-53.

The Ants of (sub-Saharan) Africa. Web site: http://antbase.org/ants/africa/

Thibault M., Blaney S., 2003. The oil industry as underlying factor in the bushmeat crisis in Central Africa. *Conservation Biology*, 17(6):1807-1813.

Thieme M.L., Abell R., Stiassny M.L.J., Skelton P., Lehner B., Teugels G.G., Dinerstein E., Kamdem Toham A., Burgess N. and Olson D., 2005. Freshwater Ecoregions of Africa and Madagascar. Island Press, Washington, Covelo and London.

Thomson J.R., Moilanen A.J., Vesk P.A., *et al*., 2009. Where and when to revegetate: a quantitative method for scheduling landscape reconstruction. *Ecological applications*. 19(4): 817-828.

Tieguhong J. C., Ndoye O., and Ekati J. E., 2008. Community-based NTFP production and trade for rural poverty alleviation and resource conservation: Case of *Prunus africana* on Mount Cameroon, Cameroon.

Tieguhong J. C., and Zwolinski J., 2009. Supplies of bushmeat for livelihoods in logging towns in the Congo Basin. *Journal of Horticulture and Forestry* 1 (5).

Tieguhong J.C., Ndoye O., Vantomme P., Zwolinski J., and Masuch J., 2009. Coping with crisis in Central Africa: enhanced role for non-wood forest products. Unasylva 233 (60):49-54.

Tieguhong J. C., Ndoye O., Grouwels S., Asseng Ze A., Masuch J., Fokou Sakam I., and Mala W., 2010. Transparency and governance in non-wood forest product commodity chains, an example from Cameroon: A need to include NWFP in the FLEGT mechanism. FAO, Rome, Italy.

Tieguhong J. C., Ndoye O., Grouwels S., Marcel U.K., and Ze A.A., 2010a. Small scale forestry and non-wood forest product enterprise development for poverty alleviation

in Central Africa. Paper read at Small scale forestry in a changing world: opportunities and challenges and the role of extension and technology transfer, 06-12 June 2010, at Bled, Slovenia.

Toham A.K., Shapiro A.C., Thieme M.L., Blom A., Carroll R., de Marcken P., Lumbuenamo R., Quist N., Sindorf N., Springer J. and Vande weghe J. P., *In Press*. Democratic Republic of Congo: Strategic Biodiversity Assessment, A blueprint for Future Protected Areas. Ministère de l'Environnement, Conservation de la Nature et Tourisme, Institut Congolais pour la Conservation de la Nature, World Wildlife Fund, Observatoire Satellital des Forêts d'Afrique Centrale. Kinshasa, Democratic Republic of Congo.

Toirambe B., 2002. Utilisation des feuilles de *Gnetum* spp. dans la lutte contre la pauvreté et l'insécurité alimentaire dans le Bassin du Congo, cas de la RDC. Kinshasa, FAO: 32.

Toirambe B., 2006. Analyse de l'état des lieux du secteur Produits forestiers non ligneux et leur évaluation à la contribution de la sécurité alimentaire en République Démocratique du Congo. FAO, Yaoundé, Cameroun.

Topa G., Karsenty A., Megevand C., and Debroux L., 2009. The rainforests of Cameroon: experience and evidence from a decade of reform. The World Bank, Washington, DC.

Topa G., Karsenty A., Megevand C., Debroux L., 2010. Forêts tropicales humides du Cameroun: Une décennie de réformes. Banque Mondiale. Direction du Développement. Washington DC. 232p.

Trefon T., de Maret P., 1999. Snack nature dans les villes d'Afrique Centrale [Snack nature in Central African towns]. In: Bahuchet S., Bley D., Pagezy H., Vernazza-Licht N., (Eds.). L'homme et la forêt tropicale. Travaux Société Écologie Humaine. Éditions de Bergier. Paris, France, pp. 559–573.

Tshimala-Tshibangu, Ngeh C., and Bene D., 1996. The economic evaluation of rattan in Yaoundé, Cameroon. In: Domestication and commercialization of non-timber forest products in agro-forestry systems, edited by FAO. Rome: Food and Agriculture Organization of the United Nations.

Tsobeng A., Degrande A., Avana Tientcheu M.L., Tchoundjeu Z., and Tabuna H., 2008. Cultivation and Sustainable Bark Collection of *Prunus africana*, edited by ICRAF, Yaoundé, Cameroon.

Tucker M., 1999. Can solar cooking save the forests? *Ecological Economics*, 31(1): 77-89.

Umunay P., Makana J.R. 2009. Étude sur le Commerce Transfrontalier de Bois dans le nord-est de la République démocratique du Congo. UICN report, Kinshasa, RDC.

USFS, 2008. Community-based natural resource management planning in central Africa: a United States Forest Service Guide. Version 2.0, 39 p.

USFS, 2009. Les aires protégées et les dispositions du Code forestier portant sur les forêts classées : conséquences pour le zonage forestier en République démocratique du Congo. United States Forest Service, 25p.

USFS, 2010. Protected Area Management Planning in Central Africa. A United States Forest Service Guide. Version 2.0, Washington DC, USA.

USFS, 2010a. Integrated Landscape Land Use Planning in Central Africa: A United States Forest Service Guide. Version 3.0, 34 p.

USFS, 2010b. Mission to support forest zoning, Ministry of the Environment, Conservation of Nature, and Tourism, Democratic Republic of Congo. 1 July-31 december, 2009. http://carpe.umd.edu/Documents/2009/USFS_Sidle_Report_DRC_July_Dec_2009_final.pdf

Usongo L. and Nzooh Dongmo Z., 2010. Lessons Learned in the Lobéké National Park, South-East Cameroon. In: Yanggen D., Angu K. and Tchamou N. (Eds), 2010. Landscape-Scale Conservation in the Congo Basin. Lessons Learned from the Central African Regional Program for the Environment (CARPE). Gland, Switzerland: IUCN. Xiv + 262 p, pp 53-60.

van Dijk J.F.W., 1999. Non-timber forest products in the Bipindi-Akom II Region, Cameroon: A socio-economic and ecological assessment Kribi: Tropenbos-Cameron Programme.

van Vliet N., 2008. Spatial and temporal variability within the "hunter-animal-village territory" system - towards a geographical approach to hunting sustainability in Central Africa- case study on duikers in north-east Gabon. PhD thesis, Université Toulouse le Mirail: Faculté de Géographie, France.

van Vliet N., Nasi R., Emmons L., Feer F., Mbazza P. and Bourgarel M., 2007. Evidence for the local depletion of bay duiker *Cephalophus dorsalis*, within the Ipassa Man and Biosphere Reserve, north-east Gabon. *African Journal of Ecology* 45: 440-443.

van Vliet N. and Nasi R., 2008. Hunting for Livelihood in Northeast Gabon: Patterns, Evolution, and Sustainability. *Ecology and Society*, 13(2), 33.

van Vliet N., Nebesse C. and Nasi R., 2010. Dynamics of Bushmeat trade in the market of Kisangani, DRC. XXIII IUFRO Congress, 23rd -28th of August 2010, Seoul, South Korea.

van Vliet N. and Mbazza P., 2011. Recognizing the multiple reasons for Bushmeat consumption in urban areas: a necessary step towards the sustainable use of wildlife for food in Central Africa. Human Dimensions of Wildlife, 16 (1), 45.

van Vliet N., Nebesse C., Gambalemoke S., Akaibe D., Nasi R., *in press*. The Bushmeat market in Kisangani, Democratic Republic of Congo: Implications for Conservation and Food security. *Oryx*.

Vancutsem C., Pekel J.F., Evrard C., Malaisse F., and Defourny P., 2006. Carte de l'occupation du sol de la République Démocratique du Congo, Notice explicative. Unité de recherche en Environnemétrie et Géomatique, Faculté d'ingénierie biologique, agronomique et environnementale, Université catholique de Louvain, Belgique.

Vancutsem C., Pekel J.F., Evrard C., Malaisse F., and Defourny P., 2009. Mapping and characterizing the vegetation types of the Democratic Republic of Congo using SPOT VEGETATION time series. *International Journal of Applied Earth Observation and Geoinformation* 11:62-76.

Vande weghe J.P., 2004. Forêts d'Afrique centrale: La Nature et L'Homme. Lanoo, Tielt, Belgique, 367p.

Vedeld P., Angelsen A., Bojö J., Sjaastad E., and Kobugabe Berg G., 2007. Forest environmental incomes and the rural poor. *Forest Policy and Economics*, 9 (7):869-879.

Verhegghen A., Defourny P., 2010. A new 300 m vegetation map for Central Africa based on multi-sensor times series. In: Sobrino J.A. (Ed.), Third Recent Advance in Quantitative Remote Sensing. Publicaciones de la Universitat de Valencia,Valencia, Spain.

Vermeulen C., Schippers C., Julve C., Ntoune F.D.M., Bracke C., Doucet J.-L., 2009. Enjeux méthodologiques autour des produits forestiers non ligneux dans le cadre de la certification en Afrique centrale. *Bois et Forêts des Tropiques*, 300 (2):69-78.

Vivien J., Faure J.J., 1995. Arbres des forêts denses d'Afrique centrale. Espèces du Cameroun. Ministère des Relations Extérieures, Coopération et Développement, ACCT, Paris, 565 p.

Walsh P.D., Abernethy K.A., Bermejo M., Beyers R., DeWachter, P., Ella Akou, M., Hujibrechts B., Mambounga Idiata D., Kamden Toham A., Kilbourn A.M., Lahm S., Latour S., Maisels F., Mbina C., Mihindou Y., Obiang Ndong S., Ntsame Effa E., Starkey M., Telfer P.T., Thibault M., Tutin C.E.G., White L.J.T. and Wilkie D.S., 2003. Catastrophic decline in ape populations in western equatorial Africa. *Nature* 422: 611-614.

Walter S., 2001. Non-Wood Forest Products in Africa: A Regional and National Overview / Les Produits Forestiers Non Ligneux en Afrique: Un Aperçu Régional et National: European Commission (EC) and Food and Agricultural Organisation of the United Nations (FAO) Partnership Programme.

Walter S., Mbala S. M., 2006. État des lieux du secteur « Produits Forestiers Non Ligneux » en Afrique Centrale et analyse des priorités politiques. Malabo, Guinée Équatoriale : European Commission (EC). Food and Agricultural Organisation of the United Nations (FAO), COMIFAC.

White F., 1983. Vegetation of Africa: a descriptive memoir to accompany the UNESCO/AETFAT/UNSO vegetation map of Africa. UNESCO, Natural Resource Research, 20: 1-356, UNESCO, Paris, 356 p.

Wilkie D., 1999. CARPE and non-wood forest products. In: Sunderland T.C., Clark L.E., and Vantomme P. (Eds). Non-Wood Forest Products in Central Africa: Current research issues and prospects for conservation and development. FAO, Limbe, Cameroon.

Wilkie D. S., and Carpenter J. F., 1999. Bushmeat hunting in the Congo Basin: an assessment of impacts and options for mitigation. *Journal of Biodiversity and Conservation* 8, 927-955.

Wilkie D., Starkey M., Abernethy K., Nstame Effa E.N., Telfer P. and Godoy R., 2005. Role of prices and wealth in consumer demand for bushmeat in Gabon, Central Africa. *Conservation Biology*, 19(1), 268-274.

Wilks C., 1990. La conservation des écosystèmes forestiers du Gabon. IUCN, Tropical Forest Programme, 215 p.

Willcox A.S., and Nambu D.M., 2007. Wildlife hunting practices and bushmeat dynamics of the Banyangi and Mbo people of Southwestern Cameroon. *Biological Conservation*, 134: 251 –261.

Wirsiy E.F., Tanda G.A., Ngah P., Tamoh A.N., and Youndjie K.G., 2010. Documenting the Eru management project in Cameroon: Cultivation and Sustainable Management of Eru (*Gnetum* spp.) in the Buffer Zone of the Korup National Park, SW Region Cameroon, edited by LEISA.

Wong J., 2003. Recommendations for the inclusion of nationally important NTFPs in standard forest inventories (EI & ISSMI). LTS Report to the EDF/Uganda Forest Department: Forest Resources Management and Conservation Programme.

World Bank, 2010. World development report 2010 – Development and climate change. Washington D.C.

WCMC - World Conservation Monitoring Centre, 1992. Global Biodiversity: Status of the Earths Living Resources. Chapman and Hall, London.

World Resources Institute, 2010. Lessons learned on forest concession monitoring in central Africa. In: Yanggen D., Angu K. and Tchamou N. (Eds), 2010. Landscape-Scale Conservation in the Congo Basin: Lessons Learned from the Central African Regional Program for the Environment (CARPE).Gland, Switzerland: IUCN. Xiv + 262p, pp 228-236.

WRI, 2007. Mertens B., Minnemeyer S., Ayenica Nsoyuni L., Neba Shu G., Steil M. (Eds). Atlas forestier interactif du Cameroun. Version 2.0. Document de synthèse. WRI, MINFOF. Washington D.C. 48p.

WRI, 2009. Atlas forestier interactif du Gabon. Version pilote. Document de synthèse. WRI, MEFEPA. Washington D.C. 70p.

WRI, 2009. Mertens B., Minnemeyer S., Ayenica Nsoyuni, L., Steil M. (Eds). Atlas forestier interactif du Congo. Version 1.0. Document de synthèse. WRI, MEF, CNIAF. Washington D.C. 39p.

WRI, 2010. Atlas forestier interactif de la République démocratique du Congo. Version 1.0 – Données 2009. Document de synthèse. WRI, MECNT. Washington D.C. 68p.

Wright J.H., and Priston N.E.C., 2010. Hunting and trapping in Lebialem Division, Cameroon: Bushmeat harvesting practices and human reliance. *Endangered Species Research* 11(1):1-12. Web site: www.int-res.com.

WWF, 2006. Inventaire Participatif PFNL-CBNRM de Bobangi. WWF, Kinshasa, RDC.

Yandji E., 2007. Rapport 3ème phase. Consultant National spécialiste en foyer amélioré et filière bois énergie Projet TCP/CAF/3003 (A) Appui à la formulation d'une stratégie nationale et d'un programme de foresterie urbaine et périurbaine à Bangui. FAO

Yanggen D., Angu K. and Tchamou N. (Eds), 2010. Landscape-Scale Conservation in the Congo Basin: Lessons Learned from the Central African Regional Program for the Environment (CARPE). Gland, Switzerland: IUCN. Xiv + 262 p.

Yuntenwi E.A.T., 2008. Improved biomass cookstoves: a strategy towards mitigating indoor air pollution and deforestation; a case study of the North West Province of Cameroon, Brandenburg University of Technology in Cottbus Allemagne. PhD in Environmental and Resource Management.

Zapfack L., and Nkongo M.N., 1999. A Participatory Survey and Inventory of Timber and Non Timber Forest Products of the Tikar Plain. Yaoundé, Cameroon: University of Yaoundé and IITA Cameroon.

Zapfack L., and Ngobo M.N., 2001. Inventaire Participatif des Produits Forestiers Non Ligneux et Ligneux de la région de Djoum: Sud du Cameroun. Yaoundé: CARPE.

Further readings

Bicheron P., Defourny P., Brockmann C., Schouten L., Vancutsem C., Huc M., Bontemps S., Leroy M., Achard F., Herold M., Ranera F., Arino O., 2008. Globcover 2005 - Products and validation report, version 2.1. Web site: http://www.esa.int/esaEO/SEMGSY2IU7E_index_1.html

Ball I.R., Possingham H.P., and Watts M., 2009. Marxan and relatives: Software for spatial conservation prioritization. In: Moilanen A., Wilson K.A., and Possingham H.P. (Eds). Spatial conservation prioritization: quantitative methods and computational tools. Oxford University Press, Oxford, United Kingdom, pp 185-195.

Bayol N., Demarquez B., Pelissier C., 2007. Etude sur le plan pratique d'aménagement des forêts naturelles de production tropicales africaines. Application au cas de l'Afrique centrale. Volet 1 « Production forestière ». Association Technique Internationale des Bois Tropicaux (ATIBT), Paris, 136 p.

Cassagne B., Nasi R., 2007. Aménagement durable des forêts de production de la RDC : progrès et perspectives. In : Quel avenir pour les forêts de la République démocratique du Congo ? : Instruments et mécanismes innovants pour une gestion durable des forêts. Reflection and discussion paper. 2007/01. Coopération Technique Belge (CTB), Bruxelles, pp 35-39.

Chen J., Cannon C.H. and Hu H., 2009. Tropical botanical gardens: at the *in situ* ecosystem management frontier. Trends Plant Sci. 2009 Nov 14, (11): 584-9. Epub 2009 Sep 24.

Dudley J.P., Ginsberg J.R., Plumptre A.J., Hart J.A. and Campos L.C., 2002. Effects of war and civil strife on wildlife and wildlife habitats. *Conservation Biology*. Vol 16, n°2, pp 319-329.

Dudley N. (Ed.), 2008. Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. x + 86 pp.

Dupain J., Botamba F., Bwebwe F., Nackoney J., Way T., and Williams D., 2009. Updated participative landscape land use plan design, Maringa-Lopori-Wamba landscape, Democratic Republic of Congo. African Wildlife Foundation.

Dupain J., Bwebwe F., Elliott J., Sebunya K., Williams D., and Nackoney J., 2010b. The role of "alternative livelihoods" in achieving a people-centered approach to conservation. In: Yanggen D., Angu K. and Tchamou N. (Eds). Landscape-scale conservation in the Congo Basin: lessons learned from the Central African Regional Program for the Environment (CARPE). Gland, Switzerland: IUCN. Xiv+ 262 p, pp 144-159.

FAO, JRC, SDSU and UCL, 2009. The Global Forest Resources Assessment Remote Sensing Survey: an outline of the objectives, data, methods and approach. Forest Resources Assessment Working Paper 155. Published by FAO with FRA RSS partners, Italy.

Gilmour D., 2005. Applying an Adaptive Management approach in FLR. In: Forests in Landscapes: Ecosystem Approaches to Sustainability, Earthscan, Cambridge, pp 1-16.

Kalpers J., 2005. Biodiversité et urgence en Afrique subsaharienne : la conservation des aires protégées en situation de conflit armé. Dissertation présentée en vue de l'obtention du grade de Docteur en Sciences, Université de Liège, Belgique, 246 p.

Karsenty A., Bayol N., Cerutti P., Ezzine de Blas D., Forni E., 2010. The 2008-2009 timber sector crisis in Africa and some lessons for the forest taxation regime. *International Forestry Review*, 12 (2, sp), pp 172-176.

Lanata F., 2007. The challenges of rehabilitating a Central African garden in a country in search of stability and good governance. Proceedings of the 3rd Global Botanic Gardens Congress - Wuhan 2007.

Lewis C. (Ed.), 1996. Managing conflicts in Protected Areas. IUCN, Gland, Switzerland, and Cambridge, UK. xii + 100 p.

Marien J.N., 2008. Quel avenir pour les écosystèmes forestiers du bassin du Congo ? Projet d'analyse prospective. Présentation CCR, PFBC, Bangui, 18 mars 2008.

Olson D.M., Dinerstein E., Wikramanayake E.D., Burgess N.D., Powell G.V.N., Underwood E.C., D'amico J.A., Itoua I., Strand H.E., Morrison J.C., Loucks C.J., Allnutt T.F., Ricketts T.H., Kura Y., Lamoreux J.F., Wettengel W.W., Hedao P. and Kassem K.R., 2001. Terrestrial Ecoregions of the World: A New Map of Life on Earth. *BioScience*, 51:933-938.

Pousse F., Samyn J.M., 2011. Evaluation ex post. Secteur forestier dans les pays du Bassin du Congo : 20 ans d'intervention de l'AFD. Agence Française de Développement. 188p.

Shambaugh J., Oglethorpe J., Ham R. (Eds), 2001. L'herbe foulée: Atténuer l'impact des conflits armés sur l'environnement. *Biodiversity Support Program*. Washington, D.C., 122 p.

UNEP, 2007. Sudan post-conflict environmental Assessment. United Nations Environment Programme, Nairobi. 352 p.

Vancutsem C., Pekel J.F., Evrard C., Malaisse F., Defourny P., 2009. Mapping and characterizing the vegetation types of the Democratic Republic of Congo using SPOT VEGETATION time series. *International Journal of Applied Earth Observation and Geoinformation*, 11, (1), pp 62-76.

WWF. Endangered species/great apes/web page for bonobos: http://wwf.panda.org/what_we_do/endangered_species/great_apes/bonobo/

Annexes

Annex 1 : PFNL priorities by countries

Country	Scientific name	Local name	Use
Republic of Congo (Plants)	*Gnetum africanum, bucchholzianum*	Koko, mfumbu	Food
	Rattans *(Eremospatha* spp.*,Laccosperma* spp.*)*	Rotin, ngosi	Construction, tools
	Dacryodes edulis	Safou	Food
	Marantaceae spp.	Ngongo, makassa	Construction, tools
	Aframomum spp.	Tondolo	Construction, tools, food
	Grewia coriacea	Tsui-téké	Food
	Elaeis guineensis	Noix de palme, palmier à huile, mbila	Food
	Cola *(Cola* spp.*, Garcinia* spp.*)*	Ngadiadia, lari, petit cola, nkouloukou, cola, mobelou	Food, socio-cultural
Republic of Congo (Animals)	*Manis gigantea*	Lukaka, pangolin géant	Food, socio-cultural
	Manis tricrispis	Lukaka, pangolin à écailles transpides	Food
	Cephalophus dorsalis	Kissiba, céphalophe à bande dorsale noire	Food
	Python sebae	Mboma, boa	Food, traditional medicine
	Tragelaphus scriphus	Nkabi, guib harnaché	Food
	Varanus flavescens	Mbamb, iguane, varan	Food
	Atherurus africanus	Ngoumba, porc-épic	Food
	Thryonomys swinde	Sibissi (Aulacode)	Food
	Cercopithecus cephus	Nsengui, Dondo, kamba, sundi, singe	Food
	Cephalophus grimmia	Nsessi, gazelle, céphalophe gris	Food
	Cricetomys gambianus	Nkoubi, rat de Gambie	Food
	Caterpillar	Mihouka	Food
	Eidolon helvum	Nguembo, vampire	Food
Gabon (Plants)	*Aframomum* spp.	Tondo	Food, medicine
	Afrostyrax lepidophyllus	Oignon sauvage	Medicine
	Antrocaryon klaineana	Ozabilii	Food
	Baillonella toxisperma	Moabi	Food
	Cola acuminata	Noix de cola	Food
	Cola nitida	Noix de cola	Food
	Coula edulis	Noisettes	Food
	Dacryodes buettneri	Ozigo	Food
	Dacryodes edulis	Atanga / safou	Food
	Dacryodes macrophylla	Aton	Food
	Elaeis guineensis	Palmier à huile	Food
	Garcinia lucida	Tokà	Food
	Garcinia kola	Bois amer	Food
	Gambeya lacourtiana		Food
	Gnetum africanum	Nkumu	Food
	Hua gaboni	Ail africain	Food
	Irvingia gabonensis	Andok	Food
	Panda oleosa	Afane	Food, medicine
	Piper guineense	Poivre de brousse	Food
	Pseudospondias longifolia	Raisin sauvage	Food
	Poga Oleosa	Afo	Food, medicine, wood

Country	Scientific name	Local name	Use
Gabon (Plants)	*Raphia hookeri*	Palmier raphia	Food
	Ricinodendron heudelotii	Essesseng	Food
	Trichoscypha abut	Raisin sauvage	Food
Gabon (Animals)	*Atherurus africanus*	Porc-épic	Food
	Cephalophus callipygus	Céphalophe rouge	Food
	Cephalophus dorsalis	Céphalophe	Food
	Cephalophus monticola	Céphalophe bleu	Food
	Cercopithecus nictitans	Singe	Food
	Cephalophus nigrifrons	Céphalophe à front noir	Food
	Cephalophus sylvicultor	Céphalophe à dos jaune	Food
	Genetta servalina	Genette	Food
	Hyemoschus aquaticus	Chevrotin aquatique	Food
	Manis tricuspis	Pangolin	Food
	Potamochoerus porcus	Potamochère	Food
	Uromanis tetradactyle	Pangolin à longue queue	Food
	Nandinia binotata	Civette	Food
	Osteolaemus tetraspis	Crocodile noir à museau court	Food
	Tragelaphus scriptus	Sitatunga, kéwel	Food
	Civettictus civetta	Civette	Food
	Tragelaphus spekii	Sitatunga	Food
	Thryonomys swinderianus	Aulacode	Food
Central African Republic (Plants)	*Gnetum africanum*	Gbakoko	Food
	Gnetum buchholzianum	Koko	Food
	Dorstenia psilurus	Ngbein	Food
	Irvingia gabonensis, I. excelsa		Food
	Raphia spp.	Péké	Food, construction, tools
	Elaeis guineensis	Mbourou	Food
	Rotang	Vovro	Construction, tools
	Afrostyrax lepidophyllus	Yembé	Food
	Xylopia aethiopica	Mazindi	Food
	Megaphrynium macrostachyum	Kougbé	Wrapping, construction
Central African Republic (Animals)	*Cephalophus* spp.	Dengbé, (dos bleu, dos jaune, sylvi)	Food
	Cercopithecus cephus	Makako	Food
	Civettictis civetta	Lougou	Food
	Artherurus afrcicanus	Ngeze	Food
	Tryonomys swinderianus	Djodjo	Food
	Tragelaphus enryceros	Lékpa	Food
	Syncerus caffer	Ngbah	Food
	Potamocherus porcus	Vongba	Food
	Caterpillar	Chenille	Food
	Imbrasia oyennesis	Mboyo	Food
	Imbrasia epimethea	Sounga	Food
	Anaphe venata	Ndossi	Food
	Cymothe caenus	Mokongo	Food
	Cymothe aranus	Konadou	Food
	Achatima chetima	Ngolo	Food

Country	Scientific name	Local name	Use
Democratic Republic of Congo (Plants)	*Cola acuminata*	Kanzu, Bobelu	Food
	Dacryodes edulis	Safou	Food
	Dioscorea spp.	Igname	Food
	Garcinia kola	Gadiadia	Food
	Gnetum africanum	Mfumbwa	Food
	Ipomoea involucrata	Matembele, Muhululu	Food
	Piper guineense	Ketchu, Bunjululu	Food
	Psophocarpus scandens	Kikalakasa	Food
	Pteridium aquilinum	Misili, fougère	Food
	Satyrium buchananii	Kikanda	Food
	Rattans *(Laccosperma secundiflora, syn Ancistrophyllum secundiflorum, Calamus deerratus, Eremospatha haullevileana, ...)*	Makawu	Construction, tools
	Megaphrynium macrostachyum	Ndjombe	Wrapping, construction
Democratic Republic of Congo (Animals)	*Anomalurops* sp.	Anomalure	Food
	Atherurus africanus	Athérure	Food
	Cephalophus dorsalis	Céphalophe à dos noir	Food
	C.leucogaster	Céphalophe à ventre blanc	Food
	C. monticola	Céphalophe bleu	Food
	C. nigrifrons	Céphalophe à front noir	Food
	Cercocebus albigena	Singe, cercocèbe à joues grises	Food
	C. galeritus	Cercocèbe agile	Food
	Cercopithecus cephus	Singe moustache	Food
	Colobus guereza	Colobe guereza	Food
	Crossarcuhus obscurus	Mangouste brune	Food
	Dendrolyrax arboreus	Daman des arbres	Food
	Hylochoerus meinertzhagebi	Hylochère	Food
	Manis giganthea	Pangolin géant	Food
Equatorial Guinea (Plants)	*Irvingia gabonensis*	Andok	Food
	Prunus africana	Biasa	Medicine
	Dacryodes edulis	Safoutier, asas, osonga	Food
	Piper guineense	Poivre noir, ondondo ndjig	Food
	Garcinia kola	Bitacola ou Oñein	Food
	Enantia chlorantha	Moambe jaune ou Nfoo	Medicine, tools
	Rattans: *Laccosperma secundiflorum* & *Eremospatha macrocarpa*	Ebolo, ongam	Construction, tools
	Elaeis guineensis	Palmera ou Alen	Food
	Cola acuminata	Cola, Abehe	Food
	Megaphrynium macrostachyum	Akieñ	Wrapping
	Ricinodendron heudelotii	Esesang	Food
	Coula edulis	Noisetier, castaño, coula, ewom, eweme	Food

Country	Scientific name	Local name	Use
Equatorial Guinea (Animals)	*Cephalophus montícola*	Duiquero azul o fritambo, Opkwong	Food
	Atherurus africanus	Porte pic, puerco espín, Ngom	Food
	Ostealaemus tetrapis	Crocodile, cocodrilo frente ancha, Ncom-ngan	Food
	Kinixys erosa	Tortuga del bosque, etugu mechini	Food
	Snails: *Achatina fulica* & *Archachatina marginata*	Caracoles, kuein	Food
	Barbus spp.	Silures, barbos, ngoho	Food
Cameroon (Plants)	*Baillonella toxisperma*	Moabi	Food, wood
	Cola acuminata	Cola nut	Food
	Cola nitida	Cola nut, chewing stick	Food
	Dacryodes edulis	Safou	Food
	Elaeis guineensis	Oil palm	Food
	Garcinia kola	Kola nut, onie/onye bark	Food, medicine
	Gnetum africanum, Gnetum buchholzianum	Eru, okok, koko	Food, medicine
	Irvingia gabonensis, Irvingia wombulu	Bush mango, mangue sauvage	Food, medicine
	Piper guineensis	Bush pepper	Food, medicine
	Prunus africana	Pygeum	Medicine
	Ricinodendron heudelotii	Njangsang	Food
	Voacanga africana	Voacanga	Medicine
	Acacia senegal, Acacia polyacantha	Gum Arabic	Medicine, cosmetic
	Aframomum spp. *(Aframomum melegueta, Aframomum daniellii, Aframomum citratum)*	Wrapping leaves, gorilla Alimentation, spice	Wrapping
Cameroon (Animals)	Fish (Catfish)	Fish, poisson	Food
	Apiculture (beeswax / honey)	Honey, miel	Food, cosmetic, tools, medicine
	Tragelaphus euryceros	Cutting grass, cane rat, alucode	Food
	Felis aurata	Golden cat, tiger cat	Food
	Potamochoerus porcus	Red river hog	Food
	Cephalophus spp.	Duiker	Food
	Crocodylus niloticus	Crocodile	Food
	Atherurus africanus	African brush-tailed porcupine, Chugger-chugger, Hedgehog, porky pig	Food, cultural
	Syncerus caffer nanus	Forest buffalo	Food
	Phataginus tricuspis	Tree pangolin	Food
	Cercopithecus spp.	Guenons monkey	Food
	Thryonomys swinderianus	Greater cane rat	Food
	Tragelaphus spekei	Antelope	Food
	Termites	Termites	Food
	Tragelaphus spekei	Sitatunga	Food

Annex 2: Summary of the main achievements in Cancún

Challenge	Main achievements	Pending questions
Shared vision	• Stabilize temperature increase at 2 degrees Celsius over pre-industrial levels • Review the consideration of the possible adoption of a 1.5 degree Celsius goal	Collective long-term goal for 2050 will be considered by the COP-17
Adaptation	Establishment of the Cancún Adaptation Framework with the following objectives: • Planning and implementing actions, including those identified in the programs of action of the Least Developed Countries (LDCs) • Impact assessment and evaluation of adaptation options • Strengthening institutional capacities • Strengthening socio-economic and ecological systems • Strengthening risk reduction strategies • Implementing coordination and cooperation measures with regard to migration • Research and development • Improving climate-related systematic observation	The SBI[1] to prepare procedures and modalities for adoption by the COP-17
	Establishment of a support process for the LDCs to formulate and implement adaptation plans	The SBI to prepare the procedures and modalities for adoption by the COP-17

	Institutional arrangements:
	• Strengthening the capacities of existing institutions
	• Establishing an adaptation committee with the following objectives:
	  • Technical support to facilitate the implementation of adaptation actions
	  • Fostering information exchange
	  • Promoting synergy
	  • Providing recommendations to the COP on incentives for implementing actions
		The Parties are invited to submit their views on the procedures and modalities for the Adaptation Committee by 21 February 2011 so that the AWG-LCA can consider them in their preparations

	Establishment of a work program to consider approaches to address loss and damages associated with climate change impacts in developing countries that are particularly vulnerable	The SBI will determine the activities to be organized in the context of this work program. The Parties were invited to submit their inputs on elements for the work program by 21 February 2011
	• Establishment of regional centers and networks encouraged • Possible establishment of an international center to enhance adaptation research and coordination	

[1]Subsidiary Body for Implementation.

Annex 3: Data for Cameroon

OFAC principal correspondent: Samuel Ebia Ndongo, email : ebia_ndongo@yahoo.fr

Contribution of the forestry sector to the national economy

Economic data	2006	2007	2008	2009	2010
Contribution to GDP (%)					
Contribution to tax revenues (CFA)			18,992,911,840	11,615,491,647	
Direct employments (Nbr)	13,000				
Indirect employments (Nbr)	150,000				

Log production

Year	Volume (m^3)
2006	2,296,254
2007	2,894,221
2008	2,166,364
2009	1,875,460
2010	

Main timber species harvested in the formal sector (volume harvested in m^3)

Species	2005	2006	2007	2008	2009	2010
Azobé (Bongossi)	97,020	117,265	112,771	107,359	113,343	
Dabéma					64,855	
Ilomba	40,552					
Iroko (Kambala)	84,669	89,658	89,324	79,632	80,741	
Kosipo	41,315	45,367	43,751	46,151	35,267	
Limba (Fraké)	77,653	86,449	70,682	75,732	65,067	
Movingui	37,961	50,870	37,662			
Obeché (Obachi/ Ayous/ Samba/ Wawa)	656,655	799,820	684,560	756,311	480,360	
Okan	40,618	87,762	61,683	67,859	118,819	
African padauk		45,252	31,136	38,248	48,963	
Sapelli	378,756	377,142	395,469	408,068	264,771	
Sipo				30,901		
Tali (Missanda)	153,375	159,788	144,989	189,580	181,531	
Total other species		436,635	417,391	366,523	421,743	
Total	**1,608,574**	**2,296,008**	**2,089,418**	**2,166,364**	**1,875,460**	

Production by type of logging title (m^3)

Type	2005	2006	2007	2008	2009	2010
Timber recovery permit (timber salvage authorization and timber removal authorization)	141,743	154,830	215,919	189,942	257,437	
Timber concession	1,683,045	1,866,228	1,757,056	1,559,092	1,397,174	
Provisional concession				374,188	171,830	
Sales of standing volume	157,336	275,195	116,447	43,141	49,019	
Total	**1,982,124**	**2,296,253**	**2,089,422**	**2,166,363**	**1,875,460**	

Production of the 10 most important companies (m³)

Company	2005	2006	2007	2008	2009	2010
ALPICAM	75,183		78,444	86,259	62,945	
CAMBOIS	102,119		98,697	48,832	110,268	
CFC	71,744	91,767	73,827	93,220		
CIBC		66,757				
CUF		85,436			66,297	
Filière Bois			59,293			
FIPCAM				68,218	67,670	
GRUMCAM		105,893	91,737	135,144		
GWZ	90,774	71,857			68,478	
Ingénierie Forestière	81,057					
PALLISCO	67,742	97,943	90,416	140,702	94,354	
PANAGIOTIS MARELIS			57,540			
PLACAM	61,172					
SEFAC	99,918	84,972	94,723	91,918	94,163	
SFID	79,634	65,194		211,195	81,042	
SIBAF	64,535	65,848				
STBK		93,386	116,726	134,311	61,405	
TRC			81,106	65,916	86,227	
Total	**793,878**	**829,053**	**842,509**	**1,075,715**	**792,849**	

Processed products (m³)

Products	2005	2006	2007	2008	2009	2010
Sawnwood	660,000	601,000			912,462	
Peeled veneer	63,000	57,000			62,000	
Sliced veneer	4,980	4,290			1,826	
Plywood	23,000	18,000			22,700	
Total	**750,980**	**680,290**			**998,988**	

Exports by type of products (m³)

Products	2005	2006	2007	2008	2009	2010
Logs	146,000	316,000		257,578	413,000	
Sawnwood	660,000	601,000		524,632	343,118	
Planed sawnwood				52,887	21,867	
Peeled veneer	63,000	57,000		59,408	31,220	
Sliced veneer	4,980	4,290		2,843	1,000	
Plywood	23,000	18,000		17,983	11,350	
Total	**896,980**	**996,290**		**915,331**	**821,555**	

Export destinations (m³)

Region	2006	2007	2008	2009	2010
COMIFAC countries	1,904		3,771	4,095	
Africa (excluding COMIFAC countries)	43,384		50,726	30,210	
North America	19,435		16,369	9,574	
Asia	277,956		289,857	435,686	
European Union	632,020		550,841	340,520	
Other destinations	19,530		3,431	1,087	
Total	**994,229**		**914,995**	**821,172**	

Management of forest concessions

Management status	2007		2008		2009		2010	
	Nbr	Area (ha)	Nbr	Area (ha)	Nbr	Area (ha)	Nbr	Area (ha)
Annual cutting range (AAC)	91	247,758			78	199,940		
Forest already classified					52	3,533,008		
Process not initiated					13	1,396,884		
Under definitive agreement (management plan approved)			65	4,207,862	75	5,341,895		
Under provisional agreement (management plan in preparation)			38	1,866,171	21	1,039,789		
Total	**91**	**247,758**	**103**	**6,074,033**	**239**	**11,511,516**		

Processing units

Type of unit	2007		2008		2009		2010	
	Nbr	Capacity (m³)	Nbr	Capacity (m³)	Nbr	Capacity (m³)	Nbr	Capacity (m³)
Industrial sawmill	51	519,941						
Peeling plant	5	64,286						
Slicing plant	4							
Total	**60**	**584,227**						

Protected areas in 2009

Protected area type	Number	IUCN category	Total area (ha)
Community forest			413,622
Botanical garden	1	Ia	44
Zoological garden	3		8
National park	17	II	2,808,184
Forest plantations			17,133
Wildlife reserve	6	II	702,995
Forestry reserve	83	Ia	952,072
Wildlife sanctuary	3	III	95,667
Flora sanctuary	1	Ia	1,000
FMU		VI	5,958,776
ZIC	46	VI	4,680,193
ZICGC	22	VI	1,396,382
Total	**182**		**17,026,076**

Annex 4: Data for Gabon

OFAC principal correspondent: Raymond Ndomba Ngoye, email : ndombangoye@yahoo.fr

Contribution of the forestry sector to the national economy

Economic data	2007	2008	2009	2010
Contribution to GDP (%)	4.3	3.02	4.5	
Contribution to tax revenues (CFA)	12,345,981,885	9,252,059,023	11,271,115,064	
Direct employments (Nbr)	12,868	12,420	14,121	
Indirect employments (Nbr)			5,000	

Log production

Year	Volume (m^3)
2005	2,769,902
2006	3,220,957
2007	3,350,678
2008	2,057,537
2009	3,947,231
2010	

Main timber species harvested in the formal sector (volume harvested in m^3)

Species	2005	2006	2007	2008	2009	2010
Okoumé	1,772,737	2,061,412	2,144,434	1,130,535		
Total other species	997,165	1,159,544	1,206,244	1,818,900		
Total	**2,769,902**	**3,220,956**	**3,350,678**	**2,949,435**		

Production by type of logging title (m^3)

Type	2007	2008	2009	2010
Forest concession under sustainable management	527,478		1,885,648	
Lots railway development zone permit	9,157			
Associated forestry permit	566,275		798,973	
Industrial permit	508,056		668,739	
Temporary logging permit	1,128,147		258,026	
Other	611,565			
Total	**3,350,678**		**3,611,386**	

Production of the 10 most important companies (m³)

Company	2007	2008	2009	2010
Bois et sciages de l'Ogooue	119,794			
Bonus Harvest			266,424	
Compagnie des bois du Gabon	118,930			
Compagnie Équatoriale des Bois	323,975		259,689	
Compagnie forestière des abeilles	132,023		291,020	
Cora wood	78,896		263,674	
Exploitation gabonaise des grumes	82,681			
GEB	87,308			
HTG	195,506			
RFM			266,302	
Rougier Gabon	390,778		322,670	
SBL			265,251	
SEEF			384,719	
SFIK			264,127	
TBNI			306,242	
Toujours vert	107,747			
Other	1,713,040		903,308	
Total	**3,350,678**		**3,793,426**	

Processed products (m³)

Products	2005	2006	2007	2008	2009	2010
Sawnwood	200,151	200,239	296,406	280,379	196,423	
Planed sawnwood				1,269	3,299	
Peeled veneer	237,501	180,717	180,516	202,282	183,124	
Sliced veneer	2,856		1,285			
Plywood	819,122	32,900	84,795	140,931	76,724	
Total	**1,259,630**	**413,856**	**563,002**	**624,861**	**459,570**	

Exports by type of products (m³)

Products	2005	2006	2007	2008	2009	2010
Logs	1,586,228	1,768,080	1,938,079	1,649,309	1,631,374	
Sawnwood	152,724	158,250	157,856	222,739	150,591	
Planed sawnwood					1,139	
Peeled veneer	171,899	188,213	144,135		130,902	
Sliced veneer	2,256		1,889			
Plywood	87,177	29,906	28,384		80,299	
Total	**2,000,284**	**2,144,449**	**2,270,343**	**1,872,048**	**1,994,305**	

Export destinations (m³)

Region	2005	2006	2007	2008	2009	2010
COMIFAC countries					125	
Africa (excluding COMIFAC countries)	73,628	86,594	140,635		77,588	
North America					2,944	
Asia	1,033,117	1,290	1,377,571		3,017	
European Union	479,398	391,392	419,872		245,266	
Other destinations					33,992	
Total	**1,586,143**	**479,276**	**1,938,078**		**362,931**	

Management of forest concessions

Management status	2007		2008		2009		2010	
	Nbr	Area(ha)	Nbr	Area(ha)	Nbr	Area(ha)	Nbr	Area(ha)
Annual cutting range (AAC)	12	74,392			13	100,383		
Forest already classified	1				14	3,012,375		
Under definitive agreement (management plan approved)	10	3,025,173			12	3,419,475		
Under provisional agreement (management plan in preparation)	33	6,018,597			22	6,473,759		
Total	**56**	**9,118,162**			**61**	**13,005,992**		

Processing units

Type of unit	2007		2008		2009		2010	
	Nbr	Capacity (m³)	Nbr	Capacity (m³)	Nbr	Capacity (m³)	Nbr	Capacity (m³)
Planed sawnwood (parquets, moldings)					1	2,952		
Industrial sawmill	60	1,013,487			72	1,033,750		
Plywood plant	4	236,000			5	122,000		
Peeling plant	12	673,600			10	466,824		
Slicing plant	1	10,000						
Total	**77**	**1,933,087**			**88**	**1,625,526**		

Protected areas in 2009

Protected area type	Number	IUCN category	Total area (ha)
Sibang arboretum	1	III	
Hunting zone	1	IV	
Mondah classified forest	1	II	493
Wildlife reserve	1	IV	
National park	13	II	3,013,842
Presidential reserve (Wonga-Wongue)	1	IV	480,000
Total	**18**		**3,494,335**

Annex 5: Data for Equatorial Guinea

OFAC principal correspondent: José Raphaël Edjang, email : peperaf@yahoo.es

Contribution of the forestry sector to the national economy

Economic data	2006	2007	2008	2009	2010
Contribution to GDP (%)		0.22			
Contribution to tax revenues (CFA)					
Direct employments (Nbr)	2,000			490	
Indirect employments (Nbr)					

Log production

Year	Volume (m^3)
2007	524,799
2008	88,097
2009	13,760
2010	

Main timber species harvested in the formal sector (volume harvested in m^3)

Species	2006	2007	2008	2009	2010
African mahogany			2,093	701	
Azobé (Bongossi)	9,528	28,387	10,431	1,322	
Dabema	1,663	57,541			
Dibétou	6,525				
Doussié	3,598				
Eyong		5,693	2,972		
Ilomba	7,652	31,313	28,683	2,081	
Iroko (Kambala)	9,856		2,127	629	
Kosipo		8,189			
Limba (Fraké)			2,329		
Movingui			1,446		
Okan		33,020			
Okoumé	242,560	247,133	13,482	1,886	
Onzabili	2,153				
Ozigo				567	
African padauk		17,878	7,307	760	
Sapelli		15,005		930	
Sipo				417	
Tali (Missanda)	114,377	22,212	5,972	846	
Wengé	1,632				
Total other species	6,438	48,055	11,256	3,622	
Total	**405,983**	**514,424**	**88,097**	**13,760**	

Production by type of logging title (m³)

Type	2007	2008	2009	2010
Community forest	84,262			
Rental contract for logging	420,074	88,097	13,760	
Timber concession	20,463			
Total	**524,799**	**88,097**	**13,760**	

Production of the 10 most important companies (m³)

Company	2006	2007	2008	2009	2010
ATO	3,089	1,816			
Chilbo	15,755	23,457	8,980		
Comali	20,357	31,838	18,400	3,048	
Matroguisa	1,782	1,123	630		
Rio Muni Timberland	7,856	32,036			
SAFI	187				
Shimmer International	286,702	309,369			
SIJIFO	2,913	9,991	24,053	2,028	
SINOSA	4,153	12,541			
SOFMAL	63,188	102,628	36,034	8,685	
Total	**405,983**	**524,799**	**88,097**	**13,760**	

Processed products (m³)

Products	2006	2007	2008	2009	2010
Peeled veneer		293	17,503	11,214	
Sliced veneer	25,989	27,644			
Sawnwood	1,432	784	1,385	5,576	
Total	**27,421**	**28,721**	**18,888**	**16,790**	

Exports by type of products (m³)

Products	2006	2007	2008	2009	2010
Logs	450,061	547,299		23,385	
Peeled veneer				8,388	
Sliced veneer	31,819	31,101			
Sawnwood	403	600		3,375	
Total	**482,283**	**579,000**		**35,149**	

Export destinations (m³)

Region	2006	2007	2008	2009	2010
Africa (excluding COMIFAC countries)	12,515	10,680		1,565	
North America				35	
Asia	373,942	492,705		16,472	
European Union	92,276	77,240		17,046	
Other destinations				31	
Total	**478,733**	**580,625**		**35,149**	

Management of forest concessions

Management status	2008		2009		2010	
	Nbr	Area(ha)	Nbr	Area(ha)	Nbr	Area(ha)
Under provisional agreement (management plan in preparation)	1	50,000				
Total	**1**	**50,000**				

Processing units

Type of unit	2006		2007		2008		2009		2010	
	Nbr	Capacity (m^3)	Nbr	Capacity (m^3)	Nbr	Capacity (m^3)	Nbr	Capacity (m^3)	Nbr	Capacity (m^3)
Industrial sawmill			1				2			
Plywood plant			2				2			
Peeling plant			5				4			
Slicing plant	4	27,471								
Total	**4**	**27,471**	**8**				**8**			

Protected areas in 2009

Protected area type	Number	IUCN category	Total area (ha)
Natural monument	2	III	39,000
National park	3	II	303,000
Scientific reserve	2	Ib	51,500
Natural reserve	6	IV	192,500
Total	**13**		**586,000**

Annex 6: Data for Central African Republic

OFAC principal correspondent: Gaston-Prosper Nakoé, email: n2gprosper@yahoo.fr

Contribution of the forestry sector to the national economy

Economic data	2008	2009	2010
Contribution to GDP (%)	5	13	
Contribution to tax revenues (CFA)	3,349,000,000	964,805,678	
Direct employments (Nbr)		4,000	
Indirect employments (Nbr)			

Log production

Year	Volume (m^3)
2008	555,143
2009	348,926
2010	

Main timber species harvested in the formal sector (volume harvested in m^3)

Species	2005	2006	2007	2008	2009	2010
African mahogany	8,075	4,841	1,926	2,024		
Azobé				603		
Bété		1,033	840	819		
Bossé	4,263	5,177	5,122	3,544		
Dibétou	1,270	9,419	8,390	14,066	10,482	
Doussier		4,051	3,059	1,791		
Fraké				2,093		
Iroko	32,062	18,620	22,458	20,398	11,228	
Kosipo	6,786	37,174	24,033	30,921	12,548	
Longhi (Aniégré)	46,228	29,327	34,506	26,059	18,717	
Obeché (Obachi/ Ayous/ Samba/ Wawa)	108,577	93,557	81,279	111,020	67,952	
African padauk		2,019	6,195	9,314		
Pao rosa		17,538	1,107	830		
Sapelli	215,220	335,604	295,954	271,283	188,206	
Sipo	21,896	28,909	21,098	28,329	17,359	
Teck				456	1,616	
Tiama	3,095	14,399	14,561	16,493	5,176	
Total other species	6,931	23,194	17,470	14,602	15,642	
Total	**450,403**	**624,862**	**537,998**	**554,645**	**348,926**	

Production by type of logging title (m^3)

Type	2005	2006	2007	2008	2009	2010
Logging and management permit	454,402	617,578	526,122	545,613	347,559	
Exceptional permit					1,366	
Harvesting special permit		7,283				
Harvesting special permit (SEBOCA)			11,875	9,529		
Total	**454,402**	**624,861**	**537,997**	**555,142**	**348,925**	

Production of the 10 most important companies (m³)

Company	2005	2006	2007	2008	2009	2010
IFB	67,429	87,489	85,415	77,930	60,087	
SCAD	56,003	69,746	47,637	55,896	21,947	
SCAF	36,339	44,153	72,552	23,654	10,372	
SCD				7,223	10,246	
SEBOCA		7,283	11,875	9,529	502	
SEFACA	4,229					
SEFCA	131,493	222,351	177,377	223,656	151,032	
SESAM	8,688					
SETEC					865	
SOFOKAD	56,635	40,888		12,391	7,624	
Thanry	16,665	32,411	54,547	44,373		
VICA	76,922	120,540	88,595	100,491	86,252	
Total	**454,403**	**624,861**	**537,998**	**555,143**	**348,927**	

Processed products (m³)

Products	2005	2006	2007	2008	2009	2010
Sawnwood	454,402	624,861		73,675	61,849	
Peeled veneer						
Plywood	1,434	805		194	863	
Total	**460,523**	**709,970**		**73,869**	**62,712**	

Exports by type of products (m³)

Products	2005	2006	2007	2008	2009	2010
Logs	145,912	192,259	193,213	155,301	111,464	
Sawnwood	52,940	70,779	76,042	62,233	40,477	
Peeled veneer	4,686	6,270	4,300			
Plywood	5	475	513	72		
Total	**203,543**	**269,783**	**274,068**	**217,606**	**151,941**	

Export destinations (m³)

Region	2005	2006	2007	2008	2009	2010
Asia	22,106	64,420		58,541	45,011	
COMIFAC countries	4,896	15,166			1,474	
European Union	113,491	111,499		92,475	64,568	
Other destinations	5,418	1,174			412	
Total	**145,911**	**192,259**		**151,016**	**111,465**	

Management of forest concessions

Management status	2008		2009		2010	
	Nbr	Area(ha)	Nbr	Area(ha)	Nbr	Area(ha)
Total annual cutting range (AAC)	14	106,271	17	129,463		
Forest already classified	1	27,956	1	27,956		
Process not initiated	3	674,561	3	674,561		
Under definitive agreement (management plan approved)	7	2,454,000	7	2,454,000		
Under provisional agreement (management plan in preparation)	3	582,789	3	582,789		
Total	**28**	**3,845,577**	**31**	**3,868,769**		

Processing units

Type of unit	2008		2009		2010	
	Nbr	Capacity (m^3)	Nbr	Capacity (m^3)	Nbr	Capacity (m^3)
Industrial sawmill	8		7	500,000		
Plywood plant	1	15,000	1	864		
Peeling plant	1		1	700		
Total	**10**	**15,000**	**9**	**501,564**		

Protected areas in 2009

Protected area type	Number	IUCN category	Total area (ha)
National park	5	II	3,188,700
Integral reserve	1	Ia	86,000
Biosphere reserve	2	IV	14,600
Wildlife reserve	5	IV	2,440,000
Special reserve	2	IV	316,815
Safari hunting zone	26	VI	5,506,900
Village hunting zone (ZCV)	7	VI	953,800
Total	**48**		**12,506,815**

Annex 7: Data for Republic of Congo

OFAC principal correspondent: Massimba Claude-Etienne, email : massimba.claude@yahoo.fr

Contribution of the forestry sector to the national economy

Economic data	2006	2007	2008	2009	2010
Contribution to GDP (%)	5.6				
Contribution to tax revenues (%)					
Direct employments (Nbr)		7,424			
Indirect employments (Nbr)		14,848			

Log production

Year	Volume (m^3)
2005	
2006	1,330,980
2007	
2008	
2009	
2010	

Main timber species harvested in the formal sector (volume harvested in m^3)

Species	2005	2006	2007	2008	2009	2010
African mahogany	14,840	11,874	24,633			
Aniégré	331	5,545	2,199			
Bossé	59,229	41,214	45,146			
Iroko (Kambala)	42,014	30,601	16,983			
Kosipo	4,320	12,177	29,641			
Moabi	5,417	4,266	5,167			
Okoumé	343,632	316,098	295,221			
Sapelli	496,547	539,264	575,591			
Sipo	72,906	75,971	80,076			
Wengé	16,604	16,594	25,862			
Total other species	313,371	276,355	211,386			
Total	**1,369,211**	**1,329,959**	**1,311,905**			

Production by type of logging title (m^3)

Type	2005	2006	2007	2008	2009	2010
Management and processing convention	1,300,209	1,264,267	915,624			
Industrial processing convention	36,617	58,055	50,776			
Total	**1,336,826**	**1,322,322**	**966,400**			

Production of the 10 most important companies (m³)

Company	2005	2006	2007	2008	2009	2010
Bois et Placages de Lopola (BPL)	45,574	48,636	54,403			
Congolaise Industrielle des Bois du Niari (CIBN)	170,330	154,522	188,459			
Congolaise Industrielles des Bois (CIB)	341,681	359,546	374,510			
FORALAC	57,086	41,139	32,337			
Industrie de Transformation des Bois de la Likouala (ITBL)	37,045	35,386	19,892			
Industrie Forestière de Ouesso (IFO)	175,648	162,804	163,639			
Likouala Timber (LT)	165,728	67,124	94,618			
Mokabi S.A.	74,043	98,848	126,099			
Société Thanry Congo (STC)	20,319	42,247	57,231			
Taman Industrie	78,239	167,703	53,715			
Total	**1,165,693**	**1,177,955**	**1,164,903**			

Processed products (m³)

Products	2005	2006	2007	2008	2009	2010
Sawnwood	219,932	258,679	212,719			
Peeled veneer	14,376	2,224	44,826			
Molding products		9,953	11,300			
Small logs		163,183	248,648			
Plywood	6,390	7,456	8,665			
Total	**240,698**	**441,495**	**526,158**			

Exports by type of products (m³)

Products	2005	2006	2007	2008	2009	2010
Logs	709,710	632,665	522,497	528,688	546,005	
Sawnwood	163,075	181,365	209,122	174,937	93,015	
Peeled veneer	13,040	3,968	15,307	21,775	19,153	
Plywood	1,974	2,980	1,755	660	113	
Other	17,731	135,282	250,746	341,924	354,171	
Total	**905,530**	**956,260**	**999,427**	**1,067,984**	**1,012,457**	

Export destinations (m³)

Region	2006	2007	2008	2009	2010
Africa (excluding COMIFAC countries)	26,785	11,962	103,137	6,825	
North America	11,226	22,773	13,710	7,366	
Asia	444,311	400,491	459,774	514,437	
COMIFAC countries	3,289	1,450	3,559	2,500	
European Union	319,210	295,679	333,025	460,484	
Other destinations	151,439	267,071	154,775	20,845	
Total	**956,260**	**999,426**	**1,067,980**	**1,012,457**	

Management of forest concessions

Management status	2007		2008		2009		2010	
	Nbr	Area(ha)	Nbr	Area(ha)	Nbr	Area(ha)	Nbr	Area(ha)
Under definitive agreement (management plan approved)	3	1,907,843						
Under provisional agreement (management plan in preparation)			22	6,371,718				
Total	**3**	**1,907,843**	**22**	**6,371,718**				

Processing units

Type of unit	2007		2008		2009		2010	
	Nbr	Capacity (m^3)	Nbr	Capacity (m^3)	Nbr	Capacity (m^3)	Nbr	Capacity (m^3)
Industrial sawmill	25	1,000,000						
Plywood plant	4	30,000						
Peeling plant	6	210,000						
Total	**35**	**1,240,000**						

Protected areas in 2008

Protected area type	Number	IUCN category	Total area (ha)
National park	3	II	2,189,161
Hunting zone	2	VI	346,301
Community reserve	1	VI	461,815
Wildlife reserve	4	V	87,855
Biosphere reserve	1	VI	148,006
Sanctuary	3	IV	280,300
Total	**14**		**3,513,438**

Annex 8: Data for the Democratic Republic of Congo

OFAC principal correspondent: Godefroid Ndaukila, email: godendaukila@yahoo.fr

Contribution of the forestry sector to the national economy

Economic data	2007	2008	2009	2010
Contribution to GDP (%)				0.2
Contribution to tax revenues ($)		9,946,261		11,977,015
Direct employments (Nbr)	15,000			
Indirect employments (Nbr)				

Log production

Year	Volume (m^3)
2005	71,129
2006	
2007	310,000
2008	353,247
2009	
2010	173,127

Main timber species harvested in the formal sector (volume harvested in m^3)

Species	2005	2006	2007	2008	2009	2010
African mahogany		6,798	13,576	19,101		
Afrormosia	14,691	18,344	31,138	29,009		7,789
Bomanga (Evène)		7,201	13,370			
Bossé	1,638	5,542		10,319		6,725
Iroko (Kambala)	5,353	26,566	24,036	29,818		25,594
Khaya	1,489					
Kosipo	1,949			8,303		
Sapelli	21,131	52,376	60,914	56,542		65,466
Sipo	9,072	28,886	26,952	30,537		12,551
Tali (Missanda)						2,748
Tchitola			9,385			5,947
Tiama	4,368	6,068	10,986	15,716		6,791
Tola		23,493	24,134	25,701		6,389
Wengé	4,251	29,392	51,971	55,722		17,844
Total other species	6,349	9,747	43,514	69,474		13,283
Total	**70,291**	**214,413**	**309,976**	**350,242**		**171,127**

Production by type of logging title (m³)

Type	2006	2007	2008	2009	2010
Artisanal cutting permit	60,813	24,966	96,122		
Industrial cutting permit			708,326		
Ordinary cutting permit/ACIBO	620,951	309,976			
Total	**681,764**	**334,942**	**804,448**		

Production of the 10 most important companies (m³)

Company	2005	2006	2007	2008	2009	2010
Bimpe Agro			13,794	10,149		
CFT	5,112	2,114				
FOLAC				14,570		
FORABOLA (Société forestière et agricole de la Mbola)	2,756	11,700	17,184	26,251		20,935
ITB (Industrie de transformation du bois)			36,259	19,310		18,372
SAFO	1,485	12,013				
SAFO-K		2,684				
SEDAF (Société d'entreprise et de développement africain)		24,358	18,794	22,815		7,321
SIFORCO (Société industrielle et forestière du Congo)	33,817	69,005	65,740	94,735		82,254
SODEFOR (Société de développement forestier)			48,699	64,693		
SOFORMA (Société forestière du Mayombe)	816	7,004	14,417	25,277		15,262
TM-BOIS (Trans M bois)	3,713	17,816	48,442	35,085		5,724
RIBA CONGO	5,885	1,924				7,371
SOEXFORCO (Société exploitation forestière du Congo)		4,313				4,179
SAFBOIS (Société africaine de bois)	15,811		14,643	12,410		2,361
XUNBANG						1,752
SICOBOIS (Société industrielle congolaise de bois)			8,063			
Total other companies				32,067		7,597
Total	**69,395**	**152,931**	**286,035**	**357,362**		**173,128**

Processed products (m³)

Products	2008	2009	2010
Sawnwood	28,645		
Planed sawnwood	4,300		
Peeled veneer	3,330		
Sliced veneer	840		
Total	**37,115**		

Exports by type of products (m³)

Products	2005	2006	2007	2008	2009	2010
Logs	111,243	150,883	208,087	189,086		124,038
Sawnwood	25,704	26,192	30,382	28,645		25,838
Planed sawnwood	5,134	891	1,152	970		225
Peeled veneer						
Sliced veneer	1,171	2,549	1,392	840		
Plywood		5,525	6,762	3,330		
Other	784,857	890,748	1,152			98
Total	**928,109**	**1,076,788**	**248,927**	**222,871**		**150,199**

Export destinations (m³)

Region	2005	2006	2007	2008	2009	2010
Africa (excluding COMIFAC countries)	16,058	15,695	11,876	42,540		12,835
COMIFAC countries						
North America	4,524	5,099	5,146	55,221		1,749
Asia	9,780	16,751	35,021	50,128		46,207
European Union	136,404	173,187	221,251	137,292		184,680
Other destinations	3,622	1,488	6,431			
Total	**170,388**	**212,220**	**279,725**	**285,181**		**245,471**

Management of forest concessions

Management status	2007		2008		2009		2010	
	Nbr	Area (ha)	Nbr	Area(ha)	Nbr	Area (ha)	Nbr	Area (ha)
Forest already classified	28	22,653,178						
Process not initiated								
Under definitive agreement (management plan approved)								
Under provisional agreement (management plan in preparation)			46	6,590,628				
Total	**28**	**22,653,178**	**46**	**6,590,628**				

Protected areas in 2009

Protected area type	Number	IUCN category	Total area (ha)
National park	7	II	8,250,000
Natural reserve	11	IV	6,440,250
Hunting zone	54	VI	11,104,750
Biosphere reserve	3		33,000
Scientific reserve	1		
Zoological and botanical garden	5		
Total			**25,828,000**

European Commission

EUR 25161 — The Forests of the Congo Basin — State of the Forest 2010

Luxembourg: Publications Office of the European Union

2012 — 274 pp. — 21,5 x 28 cm

ISSN Collection: 1018-5593
ISBN: 978-92-79-22716-5
doi:10.2788/47210

HOW TO OBTAIN EU PUBLICATIONS

Free publications:

- via EU Bookshop (http://bookshop.europa.eu);
- at the European Union's representations or delegations. You can obtain their contact details on the Internet (http://ec.europa.eu) or by sending a fax to +352 2929-42758.

Priced publications:

- via EU Bookshop (http://bookshop.europa.eu).

Priced subscriptions (e.g. annual series of the *Official Journal of the European Union* and reports of cases before the Court of Justice of the European Union):

- via one of the sales agents of the Publications Office of the European Union (http://publications.europa.eu/others/agents/index_en.htm).

LB-NA-25161-EN-C

The 2010 State of the Forest report (SOF) benefited from financial support from the European Union, the United States, Germany, France and UNESCO. It represents the collaborative effort of over 100 individuals from a diversity of institutions and the forestry administrations of the Central African countries.

The SOF process began with the selection and definition of indicators relevant to monitoring the state of forests in Central Africa. The indicators are structured around three thematic areas: (i) forest cover; (ii) management of production forests; and (iii) conservation and biodiversity. They are presented in a hierarchical structure at the regional, national and management unit (i.e. logging concessions and protected areas) levels. The indicators were vetted by a representative panel of stakeholders of forest management in Central Africa.

The indicators are used to guide an annual data collection process carried out between April and August by national groups of four to ten individuals working within the forestry administrations. The data reported on in the 2010 SOF were primarily collected in 2009 and 2010. Results were validated in national workshops attended by government officials as well as representatives of environmental NGOs, the private sector and development projects. The data provided an important basis for the authors of the 11 chapters of the 2010 SOF, which were under the coordination of a scientific committee of international renown. A final workshop was held 29-30 March, 2011 in Douala to review a draft report. Following amendments based on comments from a wide audience of experts the final layout was completed.

European Commission
USAID
FROM THE AMERICAN PEOPLE
Federal Ministry
for Economic Cooperation
and Development
UNESCO
United Nations Educational, Scientific and Cultural Organization
World Heritage Convention
MaB
Man and the Biosphere Programme
France cooperation

doi:10.2788/47210
ISBN 978-92-79-22716-5
9 789279 227165