Food and Agriculture Organization of the United Nations

ISSN 2026-5611

Nature & Faune

Volume 30, Issue No. 2

SUSTAINABLE MANAGEMENT OF FORESTS AND WILDLIFE IN AFRICA:

Enhancing value, benefits and services

Nature & Faune

Enhancing natural resources management for food security in Africa

Volume 30, Issue 2

Sustainable management of forests and wildlife in Africa: Enhancing value, benefits and services

Editor: Foday Bojang
Deputy Editor: Ada Ndeso-Atanga
FAO Regional Office for Africa

nature-faune@fao.org
http://www.fao.org/africa/resources/nature-faune/en/

Regional Office for Africa
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Accra, 2016

BOARD OF REVIEWERS

ISSN 2026-5611

CONTENTS

CONTENTS

Degraded land, tea plantation, and forested landscape in Uganda.

Photo credit: © FAO/ Foday Bojang

MESSAGE TO READERS

Bukar Tijani[1]

This second edition of the 30th volume of Nature & Faune journal focusses on Sustainable management of forests and wildlife in Africa: Enhancing value, benefits and services. The choice of theme reflects some key recommendations of the 20th session of the African Forestry and Wildlife Commission (AFWC) held in Nairobi, Kenya, on 01-05 February 2016 (http://www.fao.org/forestry/afwc/31908/en/). In this edition, articles cover a broad spectrum of events, programmes, and research that have deepened meaningful discourse on Africa's renewable natural resources and expanded the impact and reach of forestry and wildlife around the continent. Whether it is for commercial scale or local/community level management of forests (natural or planted) and wildlife areas, the articles pay attention to plant as well as wild animal products/resources.

This edition contains 23 succinct articles addressing issues, challenges and opportunities in Africa's diverse ecological zones including, for example, the activities and preliminary results of the Great Green Wall of the Sahara and the Sahel Initiative and those in the rich tropical rainforests and swamps. Each article communicates in its own way and with differing emphasis the many facets of management of forests and wildlife in Africa, and how they can enhance the value, benefits and services they provide. And do not miss the lesson in communication, learned from Central Africa on brand identification of projects and programmes shared by the "Bushmeat Project".

We are delighted to present Somalia as the Country Focus selection this time. It is refreshing to note that in spite of its political and social challenges, Somalia still has preserved quite a number of biodiversity hotspots. Read this article and be inspired by the resilience of Somali biodiversity and its custodian communities!

The spirit of this edition is encapsulated in the editorial, which allows a sneak peek at the realities of going beyond sustainable forest management in Africa towards integrating sustainable tree cover into family farming.

Photo credit: © FAO/ Tony Karumba

[1] *Bukar Tijani, Assistant Director-General/Regional Representative for Africa, Regional Office for Africa, United Nations Food and Agriculture Organization, P. O. Box GP 1628 Accra. Ghana.*
Tel.: (233) 302 675000 ext. 2101/ (233) 302 610 930; Fax: 233 302 668 427 Email: ADG-RAF@fao.org

EDITORIAL

Towards Sustainable Integration of Tree Cover into Family Farming in Africa

Festus K. Akinnifesi[1]

Summary

Sustainable forest management has been promoted as an important way to ensure the forests last from generation-to-generation. Expansion of cropland and permanent agriculture accounts for 60% of forest conversion in Africa, causing tremendous environmental footprint and disequilibrium. At the current rate, the future of human security in Africa —for basic food, fiber and shelter will be severely threatened by unsustainable practices. Yet, Africa must double its food production by 2030, without further expansion of the cropland area—which remains a major challenge. This article presents a win-win two-prong approach to achieving "avoided deforestation" through i) innovatively integrating tree cover in agricultural landscapes (Evergreen Agriculture), and ii) sustainable agriculture intensification of cropland. This integrated approach can lessen the pressure on forestlands, increase food production, meet many other livelihood needs, and enhance climate change adaptation and mitigation.

1. Introduction

Global agricultural production has increased three-fold in the past 50 years, with only 12% agricultural land expansion between 1975 and 2000, but 700% increase in fertilizer use, and 70% increase in irrigated cropland area (Foley at al, 2005). This has helped to save millions of hectares of forests from conversion to farmland through extensive farming, and has saved huge amount of ecosystems services and avoided the release of an estimated 590 billion tons of CO2 into the atmosphere (Burney et al, 2010), but not without considerable environmental footprints. Nonetheless, this global generalization is only partly true for sub-Saharan Africa, which had been by-passed by the Green Revolution.

Despite increase in Africa's total agriculture production (160%) compared to 30 years ago (NEPAD, 2013), food availability per capita in the last two decades has only increased by 12 percent. Only 11 out of 40 countries in sub-Saharan Africa were able to halve the number of hungry people, and 220 million people are still undernourished (FAO, 2015). Improvement in productivity for key production factors—labour and land has been negligible. The yield of cereal has only improved from 1.2 to 1.6 t ha-1 from 1993 to 2013 (FAOSTAT, 2015), and sub-Saharan Africa's yield gap remains the highest in the world. Some increase in total production comes from land expansion into forestlands, marginal lands and by mobilizing more labor force.

The expansion of area of small-scale permanent agriculture in Africa accounts for 60% of forest conversion, mostly for food and fuel production (FAO, 2010). Faced with the challenge of doubling food production, how can Africa achieve sustainable forest management and yet meet the growing livelihood needs of rural dwellers? This article examines the prospects of increasing tree cover on Africa's agricultural landscapes as part of the intensification of sustainable agriculture in order to avoid deforestation and boost food production.

2. Drivers of deforestation in Africa

Globally, the depletion of forest cover by 13 million hectares annually outpaced 5.7 million hectares of annual re/afforestation (FAO, 2014). It is also estimated that 3.4 million hectares was lost annually in Africa during 2000 to 2010 (FAO, 2014). At this rate, Africa and South America together will account for 85 percent of the expansion of cultivated land by 2050 (Fischer, 2009).

The main drivers of deforestation in Africa include: i) Agricultural expansion and timber extraction; ii) Forest ecosystems conversion by large-scale plantation forests; iii) Permanent commercial tree crops (cocoa and oil palm plantations), leading to extensive emission of carbon and contributing to global warming; and iv) Large-scale investment in contract farming in Africa has reached 20 million hectares over the last 10 years (NEPAD, 2013).

[1] *Festus K. Akinnifesi, Deputy Strategic Programme Leader, Sustainable Agriculture Programme*
Food and Agriculture Organization of the United Nations (FAO)
Viale delle Terme di Caracalla, 00153 Rome, ITALY
Tel: +39 06 570 54950 Email: Festus.Akinnifesi@fao.org
Skype: festus.akinnifesi2

Nearly 65% of land—more than 700 million hectares is affected by degradation, leading to 3% annual loss in GDP, and 2.8 million annual forest loss—an area the size of Australia (NEPAD, 2016). This has led to environmental footprint and disequilibrium, including massive land degradation, soil erosion, desertification, biodiversity loss and CO2 emissions. The quest for more land to produce food, coupled with limited opportunities for youth employment in Africa will further pressurize rural dwellers to seek alternative livelihood in the forests. The key challenge is how Africa's forests can be sustainably managed—conserved and protected, and tree cover expanded without encumbering the society's ability to feed itself.

2.1 Turning the lens to sustainable agriculture intensification

Africa's Agriculture faces a critical challenge as it needs to double food production by 2030. This additional food requirement must come from land already under cultivation. Recent evidence suggests that technology change is a major driver of productivity growth. However, unless agricultural technologies are sustainable, the pitfalls of the Green Revolution may be replicated in Africa. In addition, up to 20% of the additional food can come from reduction of food waste, along the value chain, particularly the reduction of post-harvest losses. Unlike in agriculturally advanced economies, characterized by monoculture, tractorization and heavy use of chemicals—fertilizer and pesticides, the main challenge in Africa is the unsustainable farming practices relying on expansion into forests, causing massive environmental footprint rather than sustainable 'farming intensification.' Africa needs to find approaches to sustainably intensify production in a way that promotes environmental health while protecting the future of farming. The trade-offs and negative interactions at the interface of 'agriculture-forest,' is creating a hegemony between the two sectors, instead of synergistic relations. It is time to be more creative.

2.2 Cross-sectoral integration can help avoid deforestation.

A plethora of single-sector "sustainable management" approaches have been promoted in the various agricultural and natural resources management sectors for decades. Although with good intentions, the successes of these approaches do not add up, but have instead developed into sectoral silos, fragmentation and competition for the same resources—land, water, finance and demand for policy attention, hence accentuating trade-offs rather than benefits and synergies. Addressing 'sustainability' at scale at the 'agriculture-forest' interface, is a big challenge that is not amenable to single-sector solutions. Sustainability involves a large, complex and dynamic set of interactions with multiple entry points and trajectories, and should aim at maximizing benefits while minimizing trade-offs. FAO's Common Vision for Sustainable Food and Agriculture (SFA) provides a robust framework for transitioning towards sustainable agricultural sector transformation. It is based on five key principles: i) improving resources use efficiency; ii) conserve, protect and enhance natural resources; iii) protect rural livelihoods and improve equity and social well-being; iv) enhance the resilience of people, communities and ecosystems; and v) innovative, effective and responsible governance. The SFA approach emphasizes cross-sectoral integration, multi-stakeholder dialogues and approaches that creates synergies (FAO 2011). This is at the heart of sustainable transition to sustainable agriculture.

2.3 People-centered approach.

For long, the forest has been viewed with the lens of 'protectionism,' such that the people aspect is underplayed, although there has been some progress towards addressing this weakness in the last two decades, especially with concepts of communal forest management, co-management, managing tree products, and aspects of agroforestry systems. However, sustainable forest management effort must strike a good balance between producing timber, protecting the ecosystem and meeting the society's growing needs by offering decent livelihoods for rural populations. With shrinking land, forests and water resources, and the added pressures of an increasingly vulnerable region, with food deficit and rising population, human security depends on better stewardship of natural resources. Sustainable forest management cannot be achieved unless the interrelations with other sectors affecting forest are strengthened—especially those that can have direct or indirect impact on the forest. It is the rural dwellers—largely family farmers, who are the natural custodians of forestlands and resources. They can be part of an effective solution to sustainable agriculture in the context of sustainably conserving and restoring the forests. There is need to strengthen the link between "forest and people" in sustainable forest management and governance.

3. Prospect for integrating trees in the agricultural landscapes.

There is huge opportunity to put trees back into forest on Africa's agricultural landscapes using integrated approaches. Zomer et al (2014) showed that nearly half of the agricultural land in the world (more than 1 billion hectares) has tree cover of more than 10 percent, indicating the importance of trees outside forests. In the report, the majority of agricultural land in Africa has 12 to 30% of tree cover, compared to global average of 10. The advantage of small-scale agriculture in Africa is that it is possible to integrate trees into agricultural land-use and rural homesteads, while at the same time increasing productivity. It might even be possible to innovatively increase tree cover to 20% in Africa

Akinnifesi et al (2010) reviewed the fertilizer trees systems in the last two decades in East and Southern Africa and found that: (i) fertiliser trees can add more than 60 kg N ha−1 per year through biological nitrogen fixation (BNF); (2) nutrient contributions from fertiliser tree biomass can reduce the requirement for mineral N fertiliser by 75%, translating to huge savings on mineral fertilisers; (3) Financial analyses showed that fertiliser tree systems are profitable and also have higher net returns than the farmers' de facto practice, i.e. continuous maize cropping without fertiliser. As part of this work, (4) a meta-analysis across sub-Saharan Africa has provided conclusive evidence that with good management, sustainable intensification using fertiliser trees systems can double maize yields compared with local farmer practices of maize cultivation

without addition of external fertilisation (Sileshi et al, 2008). The fertilizer trees systems increased yield over unfertilized maize field by extra 1.3 to 1.6 t ha−1 with coppicing woody legumes. Yield may be doubled or even tripled in low and medium potential sites. Garrity et al (2010) reviewed four national cases where "Evergreen Agriculture"—the integration of trees into annual food crop systems, has been demonstrated at scale in Africa (Box 1).

Box 1. Evergreen agriculture cases in Africa.
The following are successful examples of Evergreen agriculture and low input systems involving hundreds of thousands of small-scale farmers integrating trees on farms in Burkina Faso, Malawi, Niger and Zambia: i) In Burkina Faso, over 200,000-300,000 hectares of farmland have been integrated with trees and have boosted production by 80,000 tonnes annually, enough to feed 500,000 people (Bharucha, 2013); ii) Niger, five million hectares of the desert has been rehabilitated and "re-greened" using Faidherbia albida-based agroforestry system and water conservation, benefitting 2.5 million people, and resulting in the production of additional 500,000 tonnes annually (Bharucha, 2013); iii) National scale agroforestry initiatives have been promoted in Malawi in the last decade, where diverse range of trees were introduced into farming systems: including "fertilizer trees" (legumes) for boosting crop yield, fodder trees for livestock, fruit trees, timber and fuelwood, have been integrated with cash crops by over 200,000 smallholder farmers to enhance enterprise diversification and income generation (Akinnifesi et al, 2008 a, b). In this initiative, average of 20 tonnes of tree seeds were used annually, and farmers harvested twice as maize yield compared to farmers practice, and reduced use of fertilizer by half, while maintaining the same field from year-to-year (Akinnifesi et al, 2010); and iv) In Zambia, under initiatives especially spearheaded by NGO and the ministry of agriculture, over 160,000 family farmers have adopted conservation agriculture with integration of Faidherbia albida (Garrity et al, 2010).

Integrating sustainable agriculture production in the non-logging forest areas using adequate agroforestry configurations, e.g. understory cultivation in plantations using shadow tolerant crops and livestock integration, and or other forms of 'forest-compatible' farming could be important. With regards to sustainable production intensification to avoid agricultural land expansion, there is need for productive systems that can improve soil fertility with minimum use of chemical fertilizers, such as agroforestry, fertilizer tree systems, push-pull systems and conservation agriculture. Integrating valuable trees into homegardens could be an important part of urban forestry.

As part of the effort to introduce trees into agriculture and to enable farmers to commercialise the production of tree seed and nurseries, Community Agroforestry Tree Seed Banks were set up. Figure 1 shows Community Agroforestry Tree Seeds Bank (CATS Bank) model involving multi-stakeholder's support to whole-village farmer groups or clubs to produce and market tree seeds, and integrate trees in the agricultural landscapes in Malawi (Akinnifesi, 2008, unpublished). Farmer groups provide "seed loans" to new members using their lands as collateral, and repay in "seed interest" (10% of tree seed harvest) which goes to the CATS Bank's "seed reserve" for expansion of jointly managed orchards, plantation or woodlots initiatives. These farmers were being linked to the markets, and infrastructures for seed storage, testing and quality control was provided by the forestry department, while training was jointly provided by the forest and agricultural extension services.

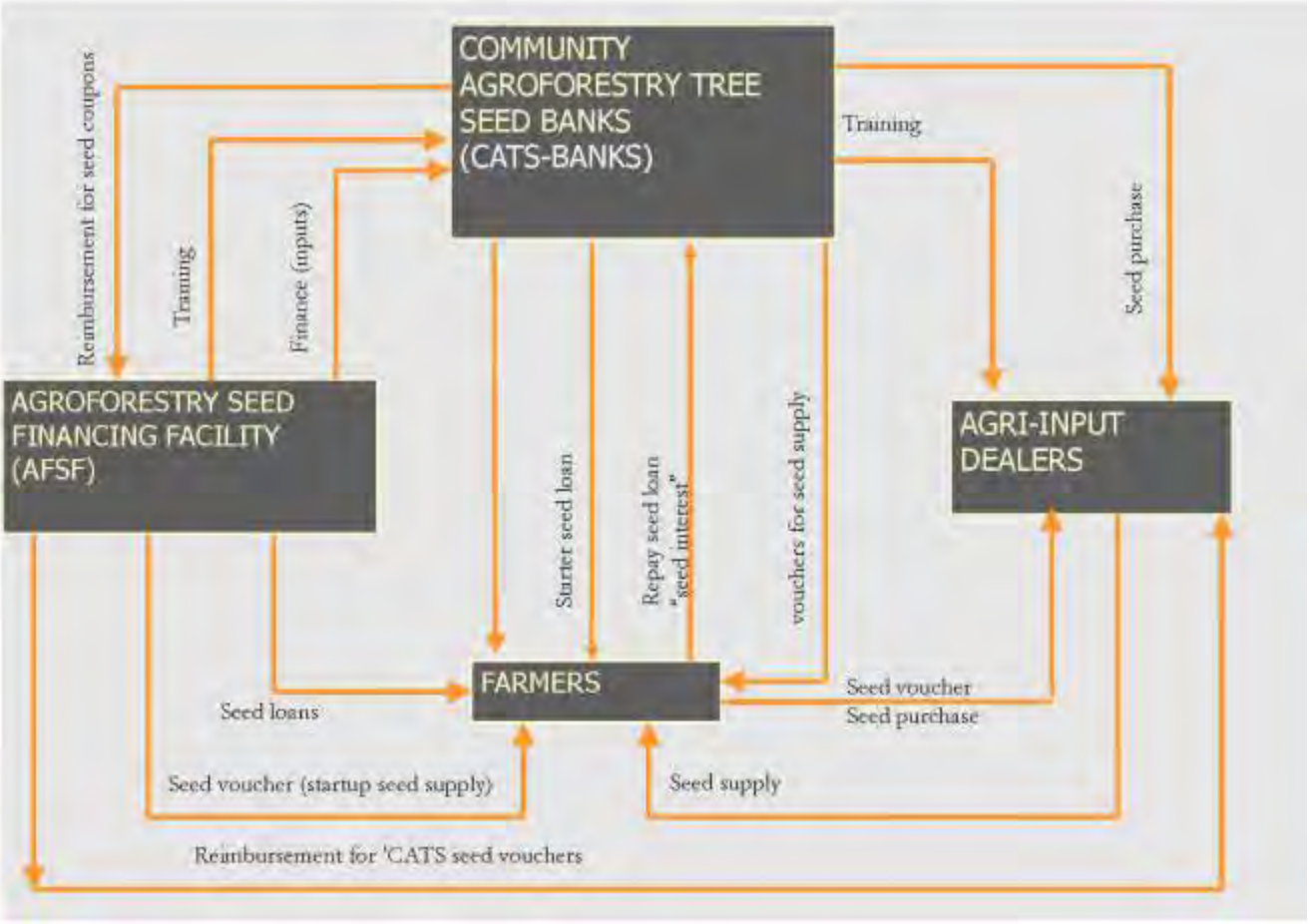


Figure 1: *Conceptual framework of the Community Agroforestry Tree Seeds Bank (CATS Bank) approach (Source: Akinnifesi F.K., unpublished, 2008).*

The domestication of forest food-producing trees, especially fruit trees offers opportunity for diversifying the agricultural production systems, increasing biodiversity on farms and increasing food security, nutrition and income for rural dwellers, especially women (Akinnifesi 2006, 2008). The success of these 'Trees Outside Forest, i.e. Agroforestry or Evergreen Agriculture initiatives depends on knowledge intensive supports, capacity development, training and quality tree seed supply system for smallholder farmers, and the enabling environment, including governance and policies in support of increasing sustainable production. Currently, African leaders are calling for massive tree planting to restore forest landscapes. In the African Forest Landscape Restoration Initiative (Afr100), a large partnership is building up led by NEPAD, including FAO, governments, CSOs, as well as private sectors, financial, investment and technical partners, to restore 100 million hectares of Africa's land by 2030 (NEPAD, 2016; www.newforestsforafrica.org). This also applies to the "Green Wall" initiative in the African Sahel. It will also involve schools, communities and farmers. This is a step in the right direction.

4. Concluding remarks and way forward

Urgent measures need to be taken to avoid further loss of Africa's forests associated with agricultural expansion which cause increased negative environmental and carbon footprints—land degradation, loss of biodiversity and ecosystem services, CO2 emission and contributes to climate change. Innovative, integrated and cross-sectoral sustainable agriculture approaches can help increase tree cover, food security and sustainability. Sustainable agriculture intensification based on low input production systems, has an impeccable prospect of integrating trees in the agricultural landscapes to achieve synergies, eliminate competitions and minimize trade-offs.

Figure 2. *Examples of whole-village agroforestry initiative in Malawi: a) Community nursery in southern Malawi, b) Faidherbia albida trees with maize cropping in Malawi; c) quality tree seed sachets for smallholder farmers, d) Mr Markos Majoni a successful farmer cultivating Gliricidia-maize in the same field for over a decade in Malawi, by coppicing trees and incorporating the leaves and twigs from trees as "green fertilizers."*

References

Akinnifesi, F.K., Ajayi, O.C., et al (2010). Fertilizer trees for sustainable food security in the maize-based production systems of East and Southern Africa region: a review. Agronomy for Sustainable Development 30:615-629.

Akinnifesi F.K., Ajayi O.C., et al (2008 a). Contributions of agroforestry research and development to livelihood of smallholder farmers in Southern Africa: 2. Fruit, medicinal, fuelwood and fodder tree systems. Agricultural Journal 3:76-88.

Akinnifesi, F.K., Leakey, R.R.B., et al (2008). Indigenous Fruit Trees in the Tropics: Domestication, Utilization and Commercialization. World Agroforestry Centre: Nairobi. CAB International Publishing, Wallingford, UK, 438 pp

Akinnifesi, F.K., Kwesiga F., et al (2006). Towards Developing the Miombo Indigenous Fruit Trees as Commercial Tree Crops in Southern Africa. Forests, Trees and Livelihoods 16:103-121

Burney J.A., Davis S.J. and Lobell D.B. (2010). Greenhouse gas mitigation by agricultural intensification. PNAS 107 (no. 26):12052–12057, doi: 10.1073/pnas.0914216107 [http://www.pnas.org/content/107/26/12052.full]

Bharucha Z.P. (2013). Sustainable food production: Facts and figures. www.scidev.net/global/food-security/feature/sustainable-food-production-facts-and-figures.html

FAO (2010). Global Forest Resources Assessment 2010. Main report. FAO. Forestry Paper 163, FAO, Rome.

FAO (2011). Building a common vision for sustainable food and agriculture: principles and approaches. FAO, Rome, 50 pp.

FAO (2015). Regional overview of food insecurity: African food security prospects brighter than ever. FAO, Accra.

FAO (2014). The State of World Forest Genetic Resources. FAO, Rome. (Also see http://www.fao.org/news/story/en/item/40893/icode/)

Fischer G. (2009). World Food and Agriculture to 2030/50: How do climate change and bioenergy alter the long-term outlook for food, agriculture and resource availability? FAO Expert Meeting on How to Feed the World in 2050, 24-26 June 2009

Foley J.A., DeFries R. Asner G.R. et al (2005). Global consequences of land-use. Science 309:570-574

Garrity D.P., F.K. Akinnifesi, et al (2010). Evergreen Agriculture: a robust approach to sustainable food security in Africa. Food Security (2010) 2:197–214.
NEPAD (2013) Agriculture Transformation in Africa—Transformation and outlook
http://www.un.org/en/africa/osaa/pdf/pubs/2013africanagricultures.pdf
NEPAD (2016). Afr100: Africa restoring 100 million hectares of deforested and degraded lands by 2030 [http://afr100.org]

Sileshi G, Akinnifesi F.K., et al (2008). Meta-analysis of maize yield response to woody and herbaceous legumes in sub-Saharan Africa. Plant Soil (2008) 307:1–19
DOI 10.1007/s11104-008-9547-y

Zomer RJ, Trabucco A., et al 2014. Trees on farms: an update and reanalysis of agroforestry's global extent and socio-ecological characteristics. Working Paper 179. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program. DOI: 10.5716/WP14064.

Photo credit: © FAO/Benjamin De Ridder

Community Mangrove reforestation in Ambondrolava, S.W. Madagascar

Private sector ready to scale up commercial reforestation as part of forest landscape restoration

Peter Paap and Paul Hol [1]

Summary

The initiative 'Forests for the Future, New Forests for Africa' completed its first conference on African soil in the Ghanaian capital Accra on March 16 and 17, 2016. One hundred and fifty (150) participants gathered to discuss, share and propose steps to translate the Paris COP21 commitments on restoring 100 million hectares of deforested and degraded land in Africa by the year 2030 (the AFR100 initiative) into concrete actions. It was concluded that the private sector is a major force that will make large-scale reforestation and forest landscape restoration possible. But rather than just as a "do-good" investment for non-profit environmental and social gains, commercial reforestation companies can and should be enabled to do so from a business perspective.

Introduction

By year 2030, up to 250 million people on the African continent will live in areas of high water stress (Global Water Institute, 2013). Population growth and resource scarcity will inevitably exacerbate water shortage: 65 percent of land in Africa is already affected by degradation, and the continent loses 3 percent of agricultural Gross Domestic Product annually due to soil and nutrient loss on farmland (WRI, 2016). Despite these extreme circumstances, Africa is determined to vigorously work to minimize negative effects of climate change. According to analysis from WRI and the International Union for the Conservation of Nature (IUCN), Africa has the largest opportunity for forest landscape restoration in the world: more than 700 million hectares (1.7 billion acres), an area nearly the size of Australia (WRI, 2015a). In fact many African countries are taking action, focusing on reforestation but also on farmer-managed natural regeneration of trees, agroforestry and management of rangeland and presently non-forested ecosystems.

At COP21 in Paris, African leaders committed themselves to an effort to restore the productivity of 100 million hectares of deforested and degraded African landscapes by the year 2030 in the AFR100 initiative. AFR100 countries have already committed themselves to restore more than 31.7 million hectares and partners, including the World Bank, are earmarking more than $1 billion in development finance and $540 million in private sector impact investment to support these activities (WRI, 2015a). "While the priority must remain on preserving our natural forests, the revival of denuded areas through reforestation helps not only Ghana but also the global fight against climate change," says Kofi Annan, who with his Kofi Annan Foundation supports action towards a fairer and safer world. At the climate conference in Paris, he was a strong supporter of the AFR100 agreement.

"The commitments made at the various conferences have so far not been legally binding," notes Mr. Paul Hol, Director of Sustainable Forestry Investments (SFI), which is a Dutch investment company with large scale investments in landscape restoration in Ghana and Tanzania. "The companies have the knowledge, the government can help to designate suitable and appropriate areas and investors can assist with covering the start-up costs," says Hol. Over the past ten years SFI has invested more than 35 million dollars with external support from international investors. In order to increase the number of reforested hectares even further, there is a commitment to have a total of 150 million dollars invested by 2030.

"Reforestation is much more than just planting new trees," says Hol. "Especially the impact on the ecosystem is very important, such as improvement of the soil, micro climate, biodiversity and water management. In addition, employment is a very important aspect of this long-term investment."

---

[1] *Peter Paap is Senior Forestry Consultant at Form International; Paul Hol is CEO of Form International. Form international, Bevrijdingsweg 3, 8051 EN Hattem, The Netherlands, tel : +31 38 444 8990, email: info@forminternational.nl, web: www.forminternational.nl .*

[2] *The 21st Conference of Parties of the United Nations Framework Conference on Climate Change; http://unfccc.int/meetings/paris_nov_2015/meeting/8926.php*

Forest landscape restoration (FLR) from a commercial angle

Forest landscape restoration (FLR) involves increasing the density of trees across landscapes to boost productivity and ecological functionality, and restoration practices go well beyond simply planting trees. For Africa, the most direct benefits would be to improve soil fertility and food security, facilitate access to clean water, increase natural forest cover to provide ecosystem services, combat desertification, create "green jobs", and bolster economic growth and livelihoods, while at the same time making a substantial contribution to climate change mitigation.

An excellent and at the same time simple approach to restore landscapes is to restore degraded land into mosaic landscapes by integrating trees on private farms, communal lands and public space, either interplanted in crops and pastures, such as in agroforestry, or as specific woodlots/belts/plantation for protection of hydrologically or biodiversity important areas and/or production of timber, fuelwood, fodder, food or other products (see figure 1). When well designed and placed, this set of tree-based restoration practices can increase soil nutrients and groundwater retention, thus improving both food and water security.

Figure 1. *Restoring Degraded Land Improves Livelihoods. Source: World Resources Institute, December 2015*

Many African communities are already reaping the benefits of restoration. For example farmers in the Ethiopian region of Tigray have already restored more than one million hectares of degraded land through assisted natural regeneration, agroforestry and improved silvopastoral management. By doing so, they have expanded the possibilities of farming long into the dry season, thus increasing food security and economic opportunities. Farmers in Niger and Mali have greatly increased on-farm tree densities by protecting trees and shrubs growing naturally alongside their crops (WRI, 2015b). These on-farm trees increase and help mobilize soil nutrients, increase rainfall infiltration and retention of water, while providing other benefits and ecosystem services, which help boost crop yields, known as re-greening (WRI, 2012).

Role of private sector commercial reforestation stakeholders acknowledged

"The task of greening 100 million hectares of (degraded) land in Africa by 2030 is a task of mammoth proportion," said Ghana's Minister Nii Osah Mills in his speech when addressing the audience. There is a tendency among international organizations involved in sustainable development, climate change, reforestation and natural resource management to rely on governments alone. This is evidently not sufficient as governments cannot carry out this task alone; opinions are however changing. "I notice that such organizations are now more open to private sector involvement. This will make a difference," stated former UN Secretary-General Kofi Annan, keynote contributor to this conference.

Photo credit: © Form International

Photo 1. *Former UN Secretary-General H.E. Kofi Annan, delivering a speech at the conference*

A large number of reforestation companies and community forestry initiatives have already set up (or are working on developing) sustainable forestry projects based on a long-term approach and multi-stakeholder benefits, often adopting environmental, social and governance requirements of certification schemes such as the Forest Stewardship Council (FSC). These companies involve forestry experts and Research and Development (R&D) institutions, engage with local communities and authorities and have benefit sharing contracts on basis of which part of the revenues of harvests flow back to the local communities. They also regularly set aside areas for conservation and their reforestation efforts take place for the most part on degraded land. These companies build their business on a sound and sustainable basis, and create employment. Through innovation and efficiency, they have the ability to restore vast areas of forest landscape.

The AFR100 Initiative is designed to help expand such efforts across the continent. But the challenge to reach the target which African nations have set themselves – restoring 100 million hectares of degraded forest landscapes by 2030 - is ambitious. To realize this goal, African leaders see the need for sustainable forestry projects based on a long-term approach and ensuring multi-stakeholder benefits. They particularly recognize the benefits of intensifying the cooperation with the private sector which has the resources, innovation and the ability to deliver results.

Conference 'Forests for the Future – New Forests for Africa'

To explore the contribution that private sector could make to realising the AFR100 commitments and to stimulate and drive large scale reforestation in Africa, the initiative 'Forests for the Future – New Forests for Africa' has been established. Recently, as a first step in furthering this initiative, the working conference 'Forests for the Future – New Forests for Africa', was held in Accra on the 16 and 17th of March 2016. The conference was organised by Nyenrode University and Form International in partnership with the Forestry Commission of Ghana, the Dutch Entrepreneurial Development Bank FMO, the Finnish development fund FinnFund and the World Resources Institute.

The aim of this conference was to discuss the need to establish new forests for Africa to meet COP21 agreements regarding forests and climate change mitigation and adaptation. "We want to take the next step and that is why we are bringing the larger commercial reforestation companies, and community forestry organisations of Africa, government officials and international investors together in Accra, "said Paul Hol. The conference audience and speakers consisted of African leaders and representatives of various institutions such as development funds, commercial scale reforestation companies, national forestry commissions, NGO's and representatives of local communities.

In presentations and panel discussions held during the conference, representatives of important stakeholder groups shared information and their views. In plenary sessions and break-out groups on specific themes, the stakeholders explained their business models and called for more flexible investment, incubation financing (covering the gap between pilots and large scale impact investments), and secure land-tenure rights. All parties (re)confirmed their commitment to play a part to realize the AFR100 objective of restoring 100 million ha of degraded forest land in Africa by the year 2030.

[3] *In the current context, "private sector" includes all private sector stakeholders intervening in agroforestry and forestry value chains. This would include smallholder agroforestry and forestry entrepreneurs as well as SMEs and large commercial reforestation companies. Many countries have smallholder producers well organized in landscape restoration activities involving reforestation, and subsequent value chains related to timber production, poles and wood fuel. They process and market their products.*

Photo Credit: Form International

***Photo 2.** "Monitoring training" exercise by Form Ghana*

Box 1: Quotes by organizing partners with regards to the role of commercial scale reforestation in forest landscape restoration.

Box 1
Paul Hol: "After 20 years of growth, part of the trees, the part with the largest value, is ready for felling. The freed space is replanted again as part of the sustainable cycle. The timber is brought into the market. The return on investment of approximately 10-15% a year will only then be released. We are, therefore, looking for long-term investors. The presence of the Dutch Entrepreneurial Development Bank FMO and its Finnish counterpart FinnFund at the conference in Accra is, therefore, encouraging."

Long-term Senior Investment Officer Gerhard Engel (FMO) says the following about investing in reforestation: "Investing in reforestation is a long-term matter. If we want to reforest and finance in a sustainable manner, we must start the work with passion and commitment. The impact of forestry is huge for the reduction of CO2-emissions and for realizing local, especially rural, employment. Forestry will thus give people a future and more opportunities to plan and act."

Initiative firmly established

In order not to lose momentum for the vision shared during the conference, the organizing partners are discussing establishment of the platform 'New Forests for Africa!' (NFfA). NFfA is a multi-stakeholder platform of forest plantation companies, financial institutions, governments, NGO's and local communities who will actively set up projects and initiatives to boost reforestation with a focus on degraded lands. The NFfA conference is seen as a first step in this movement. Participants at the conference in Ghana endorsed the value of the Movement and pledged their commitment to collaborate in order to realize the ambitious task of the AFR100 conference. The enthusiasm for this Movement was shown by Tanzanian Minister of State H.E. January Makamba. He indicated that he was impressed by the design and set-up of the Movement and hence invited all participants to come to Tanzania in a similar setting in November 2016, to show progress, share best practices and plan for the next steps.

Next to the conference report and a video report, a final statement of sorts - the NFfA declaration - was elaborated by the conference organizers in order to consolidate the discussions and presentations at the Conference. In the declaration, the conference organizers and their key partners emphasize that in order to reach AFR100 targets, upscaling of reforestation and forest restoration is needed urgently. They also urge for recognition that the private sector, with strong support of other stakeholders, is a main driver of successful and sustainable reforestation and forest restoration and should be supported and facilitated in upscaling of their activities. Among several urgently needed steps, the organizers outline a significant first step to be taken to implement these steps through development of a (NFfA) Fund, allocating significant funding for greenfield investments that can be used as incubator funds for larger impact investments. The conference report, a conference video report and a declaration by the organizers can be downloaded from the website www.newforestsforafrica.org

Sustainable management of commercial scale reforestation in Africa: Enhancing value, benefits and services

Sustainable Forest and Wildlife Management in Africa will have to go hand in hand with commercial scale reforestation if AFR100 commitments are taken seriously. The demand for timber, poles, charcoal, fuelwood and wood fiber cannot be met by just sustainably managing the remaining tropical forests. With so many degraded forest reserves under government or community control in the region, the concept of commercial scale reforestation, as promoted during the conference in Ghana, can help contribute to counteract forest landscape degradation. It can even provide necessary stepping stones in restoring ecological networks in the region that offer refuge and migratory paths for wildlife and promote adaptation pathways for flora and fauna in the face of climate change.
The restoration of degraded forests and forest lands in Africa will greatly contribute to the earth's health. To ensure that it is done in a sound and sustainable way the following considerations are important:

a. Allocation of the most appropriate lands to commercial scale reforestation concessions: degraded forest reserves have already been allocated to forestry activities – no agricultural land is 'grabbed' for these purposes;

b. The forest landscapes to which the concessions pertain are considered as 'soft' management units, where the concessions are seen as nucleus for development of these wider forest landscapes, from which landscape management is coordinated. This would include looking for options of intercropping with agricultural crops in newly planted forest areas of the concessions, carried out by local communities; and outgrower schemes to enhance commodity production in the surrounding regions. Outgrowers contracts should focus on timber (preferably of locally preferred and/or indigenous species), non-timber forest products (NTFP) or even tree-based commodities, such as cashew or cocoa. Fire management will be done on a landscape level, wherein both concession and community lands are included in protective and remedial measures;

c. Concession holding commercial scale reforestation companies will establish benefit sharing agreements with other stakeholders in the region, stipulating the regulations and conditions under which the companies operate and the support that can be expected from the other stakeholders. This collaborative effort could perhaps tap into funding for Reduction of Emissions from Deforestation and Forest Degradation (REDD+);

d. Those landscapes allocated to forest concessions will be reforested using the FSC principles, which includes the setting-aside of a significant proportion of the area for forest restoration, protection of pockets of indigenous trees and blue corridors (waterbodies such as streams, rivers, marshes, lakes), thorough social and environmental impact assessment, etc.

e. In order to present a positive business case for the commercial scale reforestation programmes, the degraded forest landscapes are initially planted with commercially valuable tree species that do well in plantations and currently have a high market value (often exotic species) – this is a transitional situation. By enrichment planting in and along the corridors and in 'hotspots', a commercially valuable secondary forest can be created that can gradually replace large parts of the original plantations and offer a steady supply of high value timber from local/indigenous species, expulsing the need for plantation of exotic species. In the surrounding areas, the private sector can work more with communities, preferably to plant native rather than imported exotic species;

f. Over time, the commercially valuable secondary forest can be managed using sustainable forest management principles, with a multipurpose perspective: optimization of the overall productivity of the forest, where timber and non-timber forest products and environmental services (water retention, protection of biodiversity, mitigation and adaptation to climate change) are optimized as economic, social and ecological drivers in the broader rural landscapes.

It is clear that asset creation can take place in the areas under commercial scale reforestation, where the standing value of the forests is increased – from a productive point of view and a potential ecosystems viewpoint (carbon credits, payment for water, biodiversity and eco-touristic services). A broad stakeholder community will thus benefit from the management of these newly created or restored forests, through employment generation, possibilities for intercropping and outgrowing, and contributions to socio-economic development through benefit sharing agreements. The regenerating or restored forest landscapes will retake a crucial place also in delivering services such as adaptation to climate change, enhanced sequestration of Green House Gas emissions and reduced emissions from deforestation and forest degradation. There is a future for the forests in Africa.

List of references

Global Water Institute, 2013. "Future Water (In)Security: Facts, Figures, and Predictions"

WRI, 2011. "Restoring Forests: An Opportunity for Africa"

WRI, 2012. "Q&A: Sustainable Land Management Specialist Chris Reij Discusses Re-greening in Africa".

WRI, 2015a. "'RELEASE: African Countries Launch AFR100 to Restore 100 Million Hectares of Land"

WRI, 2015b. "Scaling up Regreening: Six Steps to Success"

WRI, 2016. "Restoring Africa's Degraded Lands by Improving Farmers' Rights".

[4] An asset is an item of economic value that is expected to yield a benefit to the owning entity in future periods.

African Forest Landscape Restoration Initiative (AFR100): Restoring 100 Million Hectares of Degraded and Deforested Land in Africa

Jared Messinger[1] and Bob Winterbottom[2]

The susceptibility of our planet to the effects of climate change has become one of the most pressing global issues of our generation. This is especially true for African countries, which have the least historic responsibility for climate change, but their communities are often the most affected. Deforestation, land degradation, low agricultural yields, chronic food insecurity and rural poverty are all major challenges facing these communities.

Climate change will only worsen conditions, with up to 250 million people on the continent expected to live in areas of high water stress by 2030 and an average of 3 percent agricultural GDP lost annually due to soil and nutrient loss on farmland. The effects of degradation – decreased land productivity, lost soil fertility, lower incomes – are often most felt by rural smallholder farmers and households as their activities are largely dependent on stable weather patterns, healthy soils, tree cover and water availability.

To date, most global efforts to improve land use have focused on conserving remaining natural forests and intensifying agriculture. However, in addition to these practices there is an immense opportunity to address land degradation by mobilizing concerted action to restore deforested and degraded rural landscapes. Forest and landscape restoration (FLR) is the long-term process of regaining ecological functionality and enhancing human well-being across landscapes that have already been degraded. It is about "forests" because it involves increasing the number or health of trees in an area. It is about "landscapes" because it involves entire watersheds, jurisdictions, or even countries in which many land uses interact. It is about "restoration" because it involves bringing back the biological productivity of an area in order to achieve any number of benefits for people and the planet. FLR focuses on multiple benefits, is driven by local needs, and seeks to restore functionality rather than "original" forests. It includes a strong emphasis on livelihoods and generation of increased economic benefits for local communities.

When adding more trees to the landscape, looking through the lens of a landscape approach is critical, which is defined by principles that call for adaptive management, working towards multiple benefits and uses, involving stakeholders and much more. Plantations and intensive agriculture are needed to meet demand for food and other consumer products, but they are unlikely to support all aspects of a sustainable landscape. They must be balanced by holistic, landscape approaches, such as FLR.

Restoration Can Yield Multiple Benefits in Africa

According to analysis from WRI and the International Union for the Conservation of Nature (IUCN), Africa has the largest opportunity for forest landscape restoration in the world – more than 700 million hectares (1.7 billion acres), an area nearly the size of Australia.

While FLR involves increasing the density of trees across landscapes to boost productivity and ecological functionality, its outcomes go beyond the restoration of just tree cover. For Africa, the most direct benefits could be to improve soil fertility and food security, boost access to clean water and wood fuel, increase natural forest cover for ecosystem services, combat desertification, create green jobs, and bolster economic growth and livelihoods, while at the same time making a substantial contribution to climate change mitigation.

Restoration is also a pathway for more equitable distribution of economic benefits for women, the rural poor and other disadvantaged groups. Many restoration practices like Farmer Managed Natural Regeneration (FMNR), which encourages the protection and improved management of trees that grow naturally on farms, can be readily adopted by resource-poor farmers and herders. This restoration can then quickly generate benefits in terms of increased supplies of food, fodder for livestock, firewood and improved access to water. The last two are particularly beneficial for women because they are often tasked with collecting firewood and drawing water.

[1] *Jared Messinger*
Program Coordinator, Global Restoration Initiative
World Resources Institute
Email: jmessinger@wri.org
Telephone: +1 202-729-7632
[2] *Bob Winterbottom*
Senior Fellow, Global Restoration Initiative
World Resources Institute
Email: bwinterbottom@wri.org
Telephone: +1 202-729-7897

Restoration Case Studies: Ethiopia, Niger

Most importantly, some African communities are already reaping the benefits of restoration. Farmers in Ethiopia, Niger, Mali, Senegal, Malawi and other African countries have also dramatically increased on-farm tree densities by protecting trees and shrubs growing naturally alongside their crops. Existing initiatives like the Great Green Wall – focused on combating desertification – support a mosaic of sustainable land use practices, including farmer-managed natural regeneration to increase tree cover on their farms. These on-farm trees increase soil nutrients, lock-in water and provide shade, which has helped boost crop yields.

For example, farmers in the Ethiopian region of Tigray have already restored more than one million hectares of degraded land through agroforestry and silvopasture. By doing so, they've expanded farming well into the dry season, increasing food security and economic opportunities. Over the past twenty years, the area of irrigated farming during the dry season has expanded from 40 to 40,000 hectares (Woldearegay et al. 2015). This was made possible by community mobilization and the commitment of local restoration champions assisted by government agencies and other partners.

Since 1985, farmers in Niger in densely populated rural areas began to protect and manage trees and bushes, which regenerated spontaneously on their farmland. By doing so they created a new agroforestry parkland on at least 5 million hectares. They added about 200 million new trees across rural landscapes without relying on government assistance for seedling production and tree planting. The increase in the number of on-farm trees led to annual additional cereal yield of about 500,000 tons, while also providing fodder for livestock, poles, firewood and edible leaves, fruits and other products for consumption and sale (Reij et al. 2009). The annual additional yield is enough to feed 2.5 million people, and the increase in trees has decreased the amount of time it takes women to collect firewood by up to 2 hours per day (Reij et al. 2009).

The AFR100 Initiative

In December 2015, African governments and partners officially launched the African Forest Landscape Restoration Initiative (AFR100) during the Global Landscapes Forum at COP21 in Paris to bring 100 million hectares of degraded and deforested land in Africa into restoration by 2030 – a target endorsed by the African Union and included with the African Resilient Landscapes Initiative (ARLI).

As of September 2016, 21 African countries have submitted their formal commitments to participate in AFR100 to NEPAD Agency, the secretariat for the Initiative. National restoration targets currently amount to 63.5 million hectares.

[3] *For more information, please contact: Mamadou Diakhite, NEPAD Agency, mamadoud@nepad.org and see http://afr100.org*

Restoration of these landscapes will help lift people out of poverty, stabilize food production, protect biodiversity, help African economies grow and contribute to adapting to and mitigating climate change. AFR100 brings together political leadership with financial and technical resources to support a large-scale restoration movement across Africa. It provides a platform to more effectively work together, build capacity, facilitate financial investments and ultimately scale restoration across the continent.

Now, the partnership organized in support of the AFR100 Initiative is working to translate these ambitious commitments into action. Private sector investors, foundations, development banks, bilateral and multilateral donors and more are committing resources to the work. By leveraging grants, equity investments, loans, risk management guarantees and funds for specific restoration interventions, AFR100 will support restoration champions and mobilize local communities committed to land care through increased support for communications and outreach. Technical and financial support is being mobilized in response to specific requests from participating countries to assess restoration successes that could be scaled up, map restoration opportunities, assist with the analysis of economic benefits, diagnose needed improvements in policies, institutional coordination and other enabling conditions, facilitate financing, and develop scaling up strategies along with systems to monitor and report on progress.

A Strategy to Contribute to the Achievement of Sustainable Development Goals

Restoring 100 million hectares of degraded and deforested land in Africa can help to achieve numerous existing African goals at the national, sub-national, continental and even international scale.

At the international level, AFR100 supports the achievement of global and national targets such as Sustainable Development Goal 15 to "sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss" as well as other related SDGs, the targets of the Paris Agreement of the UNFCCC, the Aichi Targets of the Convention of Biodiversity (CBD) and the UN Convention on Combatting Desertification (UNCCD) program on Land Degradation Neutrality. AFR100 also directly contributes to the Bonn Challenge, a global goal to restore 150 million hectares of land by 2020 and 350 million hectares by 2030. Research shows that restoring these 350 million hectares could generate $170 billion/year globally in net benefits from watershed protection, improved crop yields and forest products.

On the African continent, AFR100 complements the African Union Vision 2063, the Great Green Wall Initiative, TerrAfrica, the African Climate Smart Agriculture (CSA) Alliance, the Malabo Declaration on food security, the Cairo Declaration on Africa's Natural Capital, the African Landscape Action Plan (ALAP) and more.

Goals and targets at a national and sub-national level will vary by country, but AFR100 supports development plans and restoration practices that emphasize land productivity, rural incomes and resilience, sectoral master plans and national REDD+ strategies.

It is important to consider agricultural mechanization and related "green revolution" practices as well, though they have not always led to sustainable increases in crop production in Africa. Strategies to achieve significant progress and overall improvements in the lives of smallholder farmers are being demonstrated across the continent – but they are typically not dependent on mechanization and don't require removal of all tree cover on agricultural land.

Agricultural intensification is still an important component of increasing productivity, but large scale, mechanized farming can be difficult on agroforestry land – and is often not warranted or necessary. Further, the potential benefits of more intensive, specialized and mechanized commercial agricultural practices are undermined unless you first address the depletion of soil fertility. The solution is to promote a mosaic of land uses – such as farmer managed natural regeneration (FMNR), integrated soil fertility management, reduced tillage, conservation agriculture and other types of restoration practices – that can address depleting soil fertility and improve overall productivity.

As demonstrated through many successful cases of forest and landscape restoration across Africa, restoration can both intensify and diversify production systems, while contributing to their increased sustainability (Reij et al, 2015).

A Continental Challenge

Restoring forests and tree cover on 100 million hectares of degraded and deforested land in Africa is a challenge of continental dimensions. It will require broad engagement from countries, communities, civil society, donors, investors and technical assistance providers. Fortunately, millions of hectares across Africa have already been restored. There are a number of innovative and effective restoration practices already occurring that can be scaled up to increase productivity on tens of millions of hectares of degraded land where rural communities are mired in poverty and food insecurity. Considerable experience suggests what needs to be done and shows us how it can be done. Tools like the Restoration Diagnostic have improved our understanding of the "key success factors" for successful restoration through the analysis of dozens of case studies from around the world (Hanson et al, 2015). And the basic steps and framework for comprehensive strategies to successfully scale up restoration practices have been analyzed and documented in Scaling Up Regreening: Six Steps to Success.

Already, many countries in Africa are moving from commitment to implementation. Using tools like the Restoration Diagnostic, the Restoration Opportunities Assessment Methodology (ROAM) and Scaling Up Regreening, governments and landowners are able to better assess their restoration opportunities. And with partnerships like AFR100 helping to identify new opportunities to access finance and technical support for restoration activities, countries are acting on their restoration opportunities as well. National governments, regional institutions, public and private sector partners and international development programs are invited to join the AFR100 initiative to help restore degraded landscapes across Africa to benefit its people and land.

References

Hanson, Craig, Kathleen Buckingham, Sean DeWitt and Lars Laestadius. 2015. The Restoration Diagnostic: A Method for Developing Forest Landscape Restoration Strategies by Rapidly Assessing the status of Key Success Factors. World Resources Institute, Washington, D.C.

Reij, C., G. Tappan, and M. Smale. 2009. "Agro-environmental transformation in the Sahel: another kind of 'Green Revolution'." IFPRI Discussion Paper 00914. Washington, DC: International Food Policy Research Institute.

Reij, Chris and Robert Winterbottom. 2015. Scaling up Regreening: Six Steps to Success. A Practical Approach to Forest and Landscape Restoration. World Resources Institute, Washington, D.C.

Woldearegay, K., and F. Van Steenbergen. 2015. "Shallow Groundwater Irrigation in Tigray, Northern Ethiopia: Practices and Issues." In Engineering Geology for Society and Territory - Volume 3, 505–9. Springer International Publishing.

Recent Advances in Forestry in Africa: May the beacons of hope shine long and strong to guide our way forward

Daniel Pouakouyou[1] and Mette Wilkie[2]

Summary

This article outlines recent progress and direction in the forestry sector in Africa. It provides an overview of some of the most important reforms that took place across the continent in the last 30 years including pioneering efforts in community forestry and the role of women in forest management. . The Africa Forest Law Enforcement and Governance which has now metamorphosed into the strategic Voluntary Partnership Agreements with the European Union, is presented as an important mechanism to fight the growing illegal trade in forest products. The role of women in forest management in Africa is briefly provided and the article posits that women are frequently disadvantaged in term of access and control over forest resources for a number of interrelated reasons, but that this situation stands to change. The prominent role of forests in the global fight against climate change is outlined and the REDD+ initiatives highlighted as an important and promising mechanism to tackle the challenges facing Africa's forests. Land degradation is an important issue for Africa and just as we need to take action to restore agricultural lands and undertake the sustainable management of these lands to maintain their fertility, so do we need to restore and sustainably manage our forests. Forest restoration remains one of the promising solutions to regain the ecological integrity and enhance human well-being in the deforested and degraded forest landscapes of Africa. Fortunately enough, several countries have joined the Bonn Challenge and many pledges have been made to restore degraded lands in Africa.

Photo 1: *Fuelwood – How much and how often? Chopped wood from the lowland Rainforest of Mount Cameroon (Cameroon) – © UNEP/ Pouakouyou*

Photo 2: *How Old and for which destination – A giant unmarked log from South Cameroon, Congo Basin - © UNEP/ Pouakouyou*

Photo 3: *Slash and burn agriculture: bring women in or the forest is out – Subsistence Agriculture around the Ziama Forest Reserve (Rep of Guinea, West Africa) - © UNEP/ Pouakouyou*

Photo 4: *Improving knowledge on Africa forest resources: a key to sustainable management – Tree marking, forest inventory in the lowland forest of the Nimba Mountain (Rep of Guinea, West Africa) - © UNEP/ Pouakouyou*

[1] *Regional Technical Advisor for Africa, Division of Environmental Policy Implementation (DEPI), United Nations Environment Programme (UNEP); P.O. Box 30552 00100, Nairobi, Kenya; Email: Daniel.Pouakouyou@unep.org; Tel. +254 207625631*

[2] *Director, Division of Environmental Policy Implementation (DEPI), United Nations Environment Programme (UNEP), P.O. Box 30552 00100, Nairobi, Kenya; Email: Mette.Wilkie@unep.org; Tel. +254 207624782*

Photo credit: © UNEP/ Musonda

Photo 5: *Ready to go - Sawn timber packed from Cameroon (WIJMA Company, Cameroon)*

Forestry reforms moving slowly, but steadily across Africa

About thirty years ago, national policies on forest management in Africa were woolly, usually subsumed in larger agricultural policies and failed to promote participatory approaches. Even in countries where early attempts were made to improve on the situation, the effectiveness of those early policies was debatable. In recent years and with support from international organizations, important policy work has been developed. In many African countries, all or almost all forests are owned by the Government (White & Alejandra, 2002). However, pioneering efforts on community forestry were initiated in the mid 1990's in countries such as Cameroon, Tanzania, Ethiopia, and the recognition of the importance of customary rights and local-level forest-based entrepreneurship has prompted a move towards reform in several African countries. For example, the Government of the Republic of the Congo recently passed an Indigenous Rights Law recognizing the land rights of indigenous forest peoples, the first in Central Africa.

Contemporary studies have indicated that forests and associated ecosystem services are legitimate contributors to the countries' GDP in Africa and elsewhere. But the global trade in roundwood, paper, furniture and charcoal originating from illegally extracted wood remains a multi-billion dollar industry in Africa. Illegal logging not only leaves an obvious mark of destruction on forests, but it also threatens the economic livelihood of local communities and responsible companies. Timber that is logged without payment of duties and taxes pushes down the market price. The World Bank estimates that the global market loses 10 billion USD annually from illegal logging, with governments losing an additional 5 billion USD in revenues (World Bank, 2006).

To address this issue, the Africa Forest Law Enforcement and Governance (AFLEG) process was established in 2003 to build capacity in forest law enforcement, in particular relating to illegal logging and hunting, associated trade and corruption. The AFLEG process is now part of the New Partnership for Africa's Development (NEPAD - http://www.iisd.ca/crs/sdyao/sdvol60num7e.html).

Slightly over ten years since the FLEGT Action Plan was adopted, a number of countries in Africa have entered into Voluntary Partnership Agreements (VPA) with the EU. Eight countries in West and Central Africa have undertaken the VPA process, with Ghana leading the way in negotiating and signing the first VPA with the EU (FAO, 2014). More recently in 2015, NEPAD launched the African Resilient Landscapes Initiative (ARLI). ARLI provides Africa and its partners with the opportunity to work collectively towards ensuring the sustainable use and management of land that will be implemented through forest and ecosystem restoration, biodiversity conservation, climate smart agriculture and rangeland management.

In terms of forest management, some 165 million ha (26%) are designated as production forest and 101 million ha (16% of all forests in Africa) are located within protected areas (FAO, 2015). A total of 140 million ha of forests now have a management plan representing 22 % of the total forest area (FAO, 2015). So while there is progress, there is still room for improvement.

Enhancement of the role of women in forest management

Women in Africa have traditionally had little decision-making power or control over forest resources and their forest rights are often limited to usage rights over non-timber forest products (ITTO, 2011). The struggle to improve the rights and status of women in forest communities in Africa is a long way from being won. Compared with men, women are frequently disadvantaged for a range of interrelated cultural, social, economic and institutional reasons in their access and control over forest resources, and in the economic opportunities available to them and this seems to be the general pattern across the continent.

In Uganda for example, male user groups carry out commercial activities, including crop and livestock production, timber harvesting, charcoal burning and commercial firewood collection while women on their part tend to use the forest for consumption purposes, mainly subsistence farming and collection of firewood, water and medicinal plants (Mukasa et al., 2012). Giesecke (2012) reached the same conclusion in Zambia where in two joint forest management communities in Luapula and Central Provinces and one open forest community in Eastern Province, women were reliant on non-wood perishable products like wild fruits, tubers, mushrooms, and edible insects that required more labor and had lower market values. In contrast, men's forest derived income was largely from the three highest value products: charcoal, timber and honey. There are other similar examples throughout the continent.

But there are also encouraging indications that this situation stands to change and there are a few examples related to policy reforms that point to this direction. In Cameroon, the new national gender policy states "the systematic elimination of inequality between men and women at all levels" (Takang, 2012a). This kind of policy, if effectively implemented is expected to have positive implications for community forestry activities as well as raises awareness of women's rights and gender more broadly. In Burkina Faso, the General Code of Territorial Collectives decentralizes forest management for local communities' responsibility, and encourages a participatory approach that includes women in the exploitation and management of forest resources on the community level (Takang, 2012b). Like in Cameroon, these well intended policies need to translate into practical action on the ground that effectively empowers women to take up their vital role in sustainable forest management.

Indeed in terms of practical actions on the ground, the December 31st Women's Movement in Ghana is one of those prominent early examples in West Africa. In collaboration with the Ghana Forestry Department, this movement established a project in the nineties in the degraded Worobong South Forest Reserve designed to increase the involvement of women in forestry by directly involving them in the establishment of timber plantations and agricultural inter-crops. This project and its outputs, was hinted to as a possible model for the entire ECOWAS region (ITTO, 2011).

Reducing Emissions from Deforestation and Forest Degradation in developing countries (REDD+)

The total forest area in Africa is estimated at 624 million ha, or about 21% of land area (FAO, 2015). Five countries: DRC, South Sudan, Angola, Zambia and Mozambique account for half this forested area (FAO, 2015). The dryland forest areas in Southern and Eastern Africa and the Sahel constitute the majority of what is termed other wooded lands. While deforestation has slowed down marginally in Africa over the last decade according to the Global Forest Resource Assessment 2015 (FAO, 2015), it still remains a serious concern with an estimated annual net loss of 2.8 Million ha in the last five years, driven by unsustainable land-use policies, agricultural expansion, commercial harvesting and urbanization especially in densely populated humid West African countries and some countries in Eastern and Southern Africa.

Yet, over 70% of Africa's population continue to depend on forests for food, timber, fuel for cooking and heating, medicine, carbon sequestration, biodiversity conservation and watershed protection.

REDD+ initiatives are playing important roles in highlighting these challenges and offering opportunities to help African nations to manage their forest and receive payment for storing carbon as well as other benefits. One such REDD+ initiatives is the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries or UN REDD Programme led by FAO, UNDP and UNEP. Twenty eight countries out of the 64 countries that are currently partner countries of the UN REDD Programme, are African countries; demonstrating the continent's willingness not only to contribute to the global fight against climate change, but also to help improve the livelihoods of its people.

[3] *http://www.iwgia.org/images/stories/sections/regions/africa/documents/0368_congolese_legislation_on_indigenous_peoples.pdf*

Forest restoration efforts

According to FAO's statistics on wood production and consumption for 2010-2014, 90 percent of all the wood cut in Africa is used as woodfuel – primarily for cooking, heating, smoking of fish, and production of salt (FAO, 2012). In addition the business as usual forecast indicates that demand for industrial roundwood in Africa could be two to three times the current level by 2050 (Grieg-Gran et al., 2015). And, as you may know agriculture production needs to increase by 70 % globally to meet the needs of 9 billion people by 2050 (FAO, 2009). Much of this expansion is expected to come from Africa. This would put a severe pressure on the forests of this continent. We therefore need to:

- Enhance our efforts to introduce other sources of renewable energy to the rural and urban poor
- Increase the productivity of agricultural lands
- Restore and sustainably manage the forests

There is good news on several fronts. As one example, over 4 million clean and/or fuel efficient cookstoves were distributed in Ethiopia in 2012-2014 (Global Alliance for Clean Cookstoves, 2015), significantly reducing the need for fuelwood.

However, one issue still has to be addressed: land degradation.

UNEP is currently involved in a Study on Economics of land degradation, which includes a study on soil erosion leading to decline in crop productivity in 42 countries of Africa. According to this study (ELD & UNEP, 2015),

The present value of ***the cost of inaction measured in terms of the value of cereal crops loss due to soil erosion induced nutrient depletion*** *over the next 15 years (2016-30) is about 4.6 trillion USD or an annual costs of about 12.3% of the GDP of the 42 countries considered in this study.*

However, taking action through investment in sustainable land management will only cost about 344 billion USD over the next 15 years with an annual ***cost of action of about*** *1.15% of the GDP of 42 countries in the continent.* ***That's 7.5% of the cost of inaction.***

Just as we need to take action to restore agricultural lands and undertake sustainable management of these lands to maintain their fertility, so do we need to restore and sustainably manage our forests. This means increasing resource efficiency through new technologies, improved handling and storage practices or better organization in the supply chain.

But we also need to pay attention to the large area of degraded natural forests. Forest restoration remains one of the promising solutions to regain the ecological integrity and enhance human well-being in the deforested or degraded forest landscapes of Africa. Fortunately, there is an increasing interest in forest restoration in many countries in Africa.

Recent experience from West Africa sees farmers putting the theory into practice. According to Sizer et al. (2011) account, not that long ago, Niger was in the throes of mass famine, spreading deserts and entrenched poverty; but in the past 20 years, over five million ha of land have been restored to productive farmed woodlands as the value of trees to enhance farm yield and provide income from fuelwood has caught on. Over 200 million new trees were planted, protected and managed as a result, and there is no sign of this movement stopping.

Another inspiring example comes from Rwanda which has committed to a nationwide effort to restore forests as a mean to improve livelihoods, enhance food security, and safeguard water supply and biodiversity. This dramatic move seems likely to be the first of several such efforts across Africa.

Several African countries joined the Bonn Challenge for the restoration of degraded lands at the UN Summit in September 2014 (http://www.bonnchallenge.org/commitments).

The Democratic Republic of Congo pledged to restore 8 million ha, Uganda committed to 2.5 million ha. But the largest commitment in the group came from Ethiopia which pledged to restore forests on 22 million ha or about 22% of its land mass.

So there are many challenges but also many beacons of hope in Africa. May these beacons of hope shine long and strong to guide our way forward!

[4] *The Bonn Challenge is a global aspiration to restore 150 million hectares of the world's deforested and degraded land y 20120 and 350 million hectares by 2030. It is not a new global commitment, but a practical means to achieve other existing international commitments including the CBD Aichi Target 15, the UNFCCC REDD+ goal and the Rio+20 land degradation neutral goal (http://www.bonnchallenge.org/content/challenge).*

Bibliography

Global Alliance for Clean Cookstoves (2015). Results Report 2014. Sharing Progress on the Path to Adoption of Clean and Efficient Cooking Solutions. Available at http:/cleancookstoves.org/resources/414.html

ELD Initiative & UNEP (2015). The Economics of Land Degradation in Africa: Benefits of Action Outweigh the Costs. Available at http://www.eld-initiative.org

FAO (2009). How to Feed the World in 2050. Food and Agriculture Organizations of the United Nations. Rome, Italy.

FAO (2012). Global Forest Product Fact and Figures. Forest Products Statistics. Food and Agriculture Organizations of the United Nations. Rome, Italy.

FAO (2014). The Voluntary Partnership Agreement (VPA) process in Central and West Africa: from Theory to practice. Food and Agriculture Organizations of the United Nations. Rome, Italy.

FAO (2015). Global Forest Resources Assessment 2015. How are the World forests changing? Food and Agriculture Organizations of the United Nations. Rome, Italy.

Grieg-Gran, M.; Bass, S.; Booker, F & Day, M. (2015). The role of forests in a green economy transformation in Africa. United Nations Environment Programme (UNEP), Nairobi, Kenya.

Giesecke, G. (2012). Gender and forest management. USAID Knowledge Services Center (KSC). Bridgetown, Inc. and Library Associated. USA.

ITTO (2011). Twenty-five years of success stories. Illustrating ITTO's 25-year quest to sustain tropical forests. International Tropical Timber Organization (ITTO), Japan.

Mukasa, C.; Tibazalika, A.; Mango, A. and Muloki, H.N (2012). Gender and Forestry in Uganda: Policy Legal and Institutional Frameworks. Working Paper 89. CIFOR, Bogor, Indonesia.

Sizer, N.; Minnemeyer, S. & Lars, L. (2011). Restoring Forests: An opportunity for Africa. World Resource Institute (WRI). Washington, D.C. (http://www.wri.org).

Takang, J.T. (2012a). Women and Forests in Cameroon: Taken Stock of Gender in Natural Resource Management in Cameroon. African Women's Rights to Forests: Gender in Forest Management and Policy in Central and West Africa. Rights and Resources. Washington, DC.

Takang, J.T. (2012b). Women and Forests in Burkina Faso: Gender and Women's Rights in Forest and Land Policy.

White, A. & Alejandra, M. (2002). Who owns the World's Forests? Forest tenure and public forests in transition. Forest Trends. Washington, DC.

World Bank (2006). Strengthening Forests Law Enforcement and Governance. Addressing a Systemic Constrainsts to Sustainable Development. Washington, DC.

Shared areas within forest concessions in Central Africa: An opportunity for mainstreaming joint management in the wildlife component of the management plan

Jean-Claude Nguinguiri,[1] Alain-Noel Ampolo,[2] Abdon Bivigou, Serge Pambou,[3] Frederic Paco Bockandza,[4] and Léna Ilama[5]

Summary

Forest concessions overlap with village lands, creating shared areas that are appropriated by riparian populations and forest concessionaires. Due to their value as heritage, these areas are an opportunity for mainstreaming the joint management approach in the wildlife component of the management plan. This introduction has been explored in two pilot sites in Central Africa. The lessons learned open new possibilities for collaboration between the riparian populations and the forest concessionaires.

Introduction

Integrating wildlife in the management process of a forest concession is a requirement ensuing both from forest legislations and timber markets (ATIBT, 2005). The aim and procedures related to the integration of wildlife in the management process have been described elsewhere (ATIBT, 2005). The investigation conducted by FAO and CIRAD in 2008 (Billand et al., 2010), revealed that controlling poaching is the most efficient measure; however the costs of its implementation are too high for businesses to afford. This type of investment is not immediately productive and is perceived as an external constraint. This approach also carries a negative image of the business to riparian populations who believe they are being stripped of the lands and natural resources on which they rely for their livelihoods. Therefore, it is timely to explore new approaches, as initiated by other authors (Vermeulen et al., 2009). In this article, we propose a complementary approach based on the joint management of shared areas.

1. Shared areas : juxtaposed rights and overlapping uses

Forest concessions are not demarcated on' virgin' lands or without rights but rather cover villages and their lands, thus creating shared areas. In some cases, the shared space corresponds to the entire village land as in Liouesso, Congo, where the village and its land are found within the IFO forest concession. In other cases, only a part of the land is included in the forest concession. In Ovan for example, two-thirds of the village land are shared with Rougier-Gabon. These shared spaces are governed, both by the statute right used by the State and the forest concessionaire, and by local rules governing the appropriation of, and access to natural resources. In this context of coexisting systems of standards, the statute law grants customary user rights to riparian populations. Under some conditions, these populations may access natural resources in the shared spaces. In Liouesso, this space is divided in five zones (FRM et al., 2007):

- The community development series located within a radius varying between 500 m and 1 km around the village and along the road corridor. Populations engage in subsistence farming, fishing, picking and hunting;
- Village hunting areas in which subsistence hunting is authorized provided the regulation is respected;
- The areas where hunting is prohibited and where only subsistence hunting for indigenous populations is allowed;
- The areas around glades with concentrations of wildlife;
- Zones temporarily closed for hunting, due to the intense poaching of flagship and endangered species.

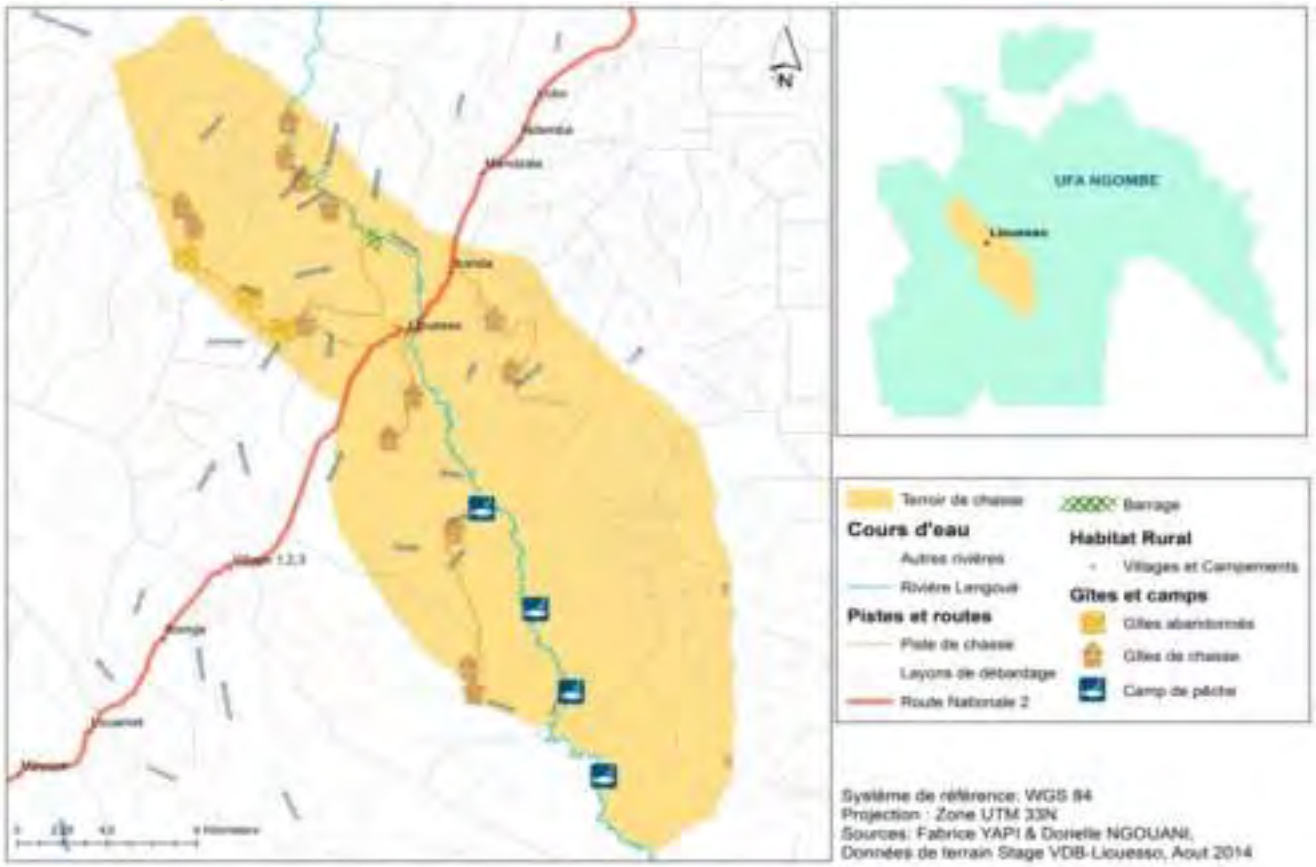
[1]*Forestry Officer, FAO/SFC, Libreville, Gabon. Email : Jeanclaude.nguinguiri@fao.org*
[2]*National Technical Assistant, Project GCP/RAF/455/GFF, Brazzaville, Congo. Email: Alainnoel.ampolo@fao.org*
[3]*Regional Technical Assistant, Project GCP/RAF/455/GFF, Libreville, Gabon. Email: Adbon.bivigou@fao.org*
[4]*National Coordinator, Project GCP/RAF/455/GFF, Libreville, Gabon*
[5]*National Coordinator, Project GCP/RAF/455/GFF, Brazzaville, Congo*
[6]*Junior Forestry Officer, FAO/SFC, Libreville, Gabon. Email: Lena.ilama@fao.org*
[7]*Observations made within the framework of the Regional FAO/GEF Project "Sustainable management of the wildlife and bushmeat sector in Central Africa"*
[8]*Industrie Forestière deOuesso, which operates as a subsidiary of hardwood company Danzer in the Republic of Congo*

These various areas overlap with roundwood production series, research series and conservation series. Thus, in addition to the juxtaposition of rights, there is an overlapping of uses on shared areas.

2. Shared areas: an opportunity for the joint management of wildlife

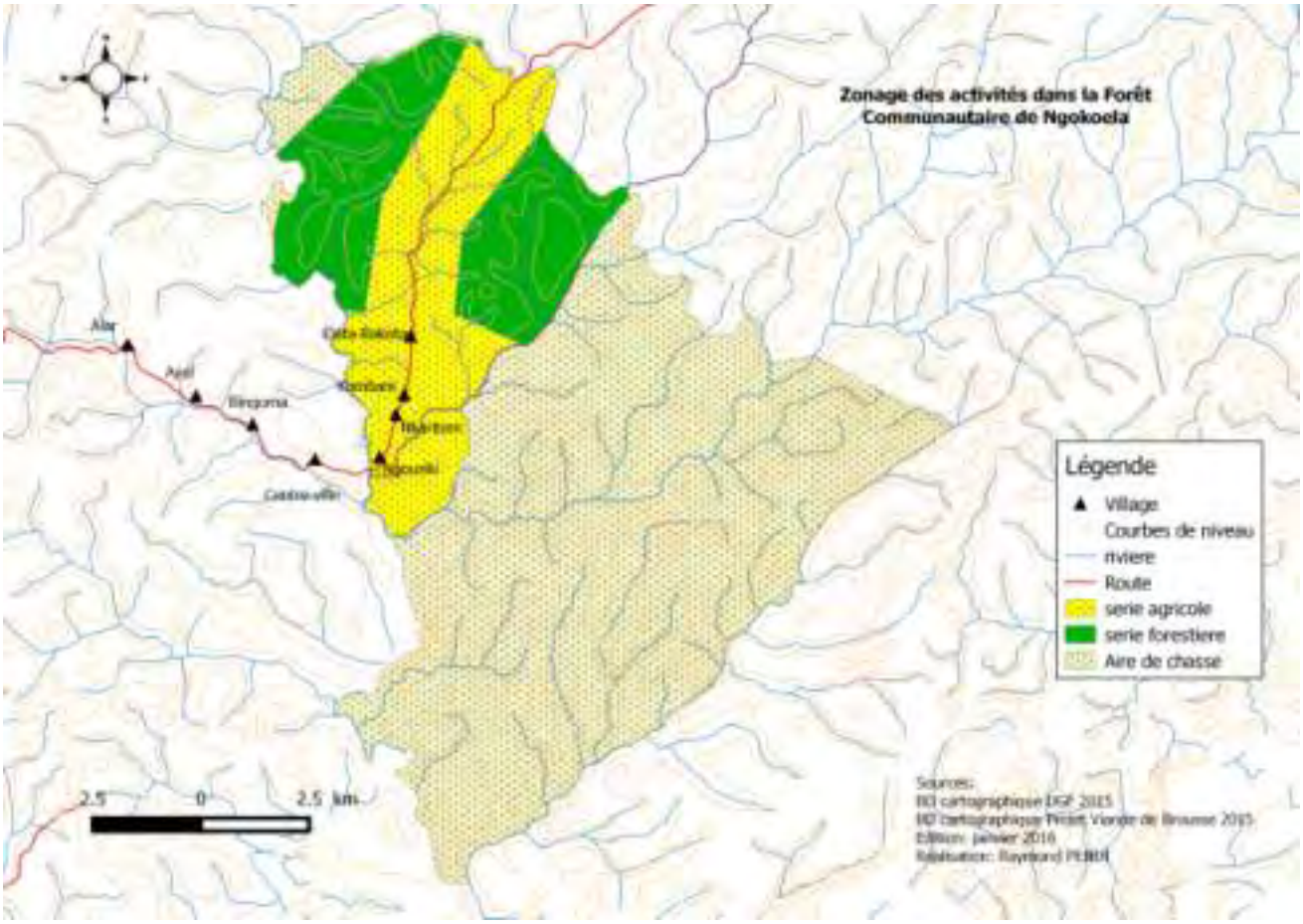
Most often, the forest concessionaire and riparian populations do not trust each other; the first perceives the second as poachers who are likely to affect good forest management. The second believe they are stripped of their lands. Both sides do not have a common long term vision despite the multistakeholders platform instituted within the framework of the management plan. The sustainable management of shared spaces appears to be an interesting input to build a new type of win-win partnership. These spaces have been appropriated both by the first group –based on the applicable legislation– and by the second group, based on 'custom'. By considering a long term management, we ascribe a heritage character to the approach (Weber, 2000). The heritage management is an approach that meets the need to involve local actors in the decision-making process regarding the management of complex objects such as the multifunctionality of the rural space (Stefanini et al., 2001).

The heritage management of shared spaces is tested in Liouesso and Ovan. In the first site, populations in Liouesso and eight other neighboring villages, have mapped their lands (60,000 ha, Yapi, 2014), identified objectives, developed rules, instituted a management structure, etc. Based on an agreement being negotiated with IFO, a hunting plan will be jointly developed and monitored. In the second site, the populations of four villages have committed to manage together their land. A management structure, the "Ngokoela" cooperative, has been established. A section of the land (5,000 ha) has been developed into a community forest. The other section (10,000 ha) is the shared area and is divided into two zones: an ecodevelopment zone (2,300ha) and a community hunting zone (7,700 ha). The use of resources by riparian populations is planned and monitored in agreement with Rougier-Gabon and the populations are in turn responsible for controlling access and poaching.



Map 1. *Liouesso village land included in the Ngombé UFA*

[9] *Mandzala, Bonda, Botonda, Mokania, Mecomé, Attention, Lengoué, Village 1, 2, 3*
[10] *Ngouriki, Kombani, Elata-bakota and Nkaritom*



***Map 2:** Ngokoéla land with its hunting grounds included in the CFAD allocated to Rougier-Gabon*

3. Rethink the wildlife component of the management plan of forest concessions

In the light of lessons learned in Liouesso and Ovan, it is timely to consider aiming the joint management of shared spaces in a direction that is more compliant with the requirements of the management plan. This will involve the following priorities:

- Shift from a top-down approach based on management prescriptions to an approach negotiated in the shared areas. The responsibilities for managing wildlife will be shared among the parties;
- Develop joint hunting plans by using an annual quota system to be adapted based on the monitoring of offtakes;
- Establish a game tracking system to facilitate marketing in the nearest urban centers and allocate a part of the income to controlling the rules of co-management.

This thinking reflects in part the recent proposals for a new type of concession, the 'Concession 2.0', a model based on four features: (i) mapping and recognition of the customary territories within and around the industrial concession, (ii) timber revenue sharing indexed on the extension of the customary territories and contractual management agreements within the communities, (iii) allowance of commercial exploitation of non-timber resources by entitled claimers under the supervision and/or in association with the concessionaire, and (iv) inclusive governance for the management of overlapping rights over the concession area (Karsenty et al. 2016)

Conclusion

The joint management of shared areas has not yet attracted the attention it deserves due mainly to the non inclusion of local standards systems into the traditional development process model. The increasing decline in productivity of forest concessions and intensified land pressure by local populations definitely advocate for a new type of concession adapted to the future challenges of juxtaposed rights and multiple resource use models. In this context, land sharing policies based on a strict specialization of areas should be reviewed in favor or a more balanced approach that will enable to manage overlapping rights and thus move towards "concessions 2.0".

References

ATIBT, 2005. Etude sur le plan pratique d'Aménagement des Forêts naturelles. Volet 3 « Aspects faunistiques ». Paris, ATIBT

Billand A., J. Fournier, L. Rieu et O. Souvannavong, 2010. Prise en compte de la biodiversité dans les concessions forestières d'Afrique centrale. Document de travail sur la biodiversité forestière. Rome, FAO – CIRAD

FRM, RC, IFO, 2007 : Plan d'Aménagement UFA Ngombé - *Résumé public 06 Fév. 09*.
Karsenty A. C. Vermeulen 2016 : Toward "Concessions 2.0": articulating inclusive and exclusive management in production forests in Central Africa. International Forestry Review Vol.18(S1), 2016
Stefanini O. et M. Vidal, 2001. La gestion patrimoniale. Un outil de formation pour une gestion concertée des territoires. Educagri Editions.

Vermeulen C., C. Julve, JL. Doucet et D. Monticelli. 2009. Community hunting in logging concessions: towards a management model for Cameroon's dense forests. *Biodivers. Conserv* DOI 10.1007/s10531-009-9614-6.

Weber J., 2000. Pour une gestion sociale des ressources naturelles. In. Compagnon D. et F. Constantin. Administrer l'environnement en Afrique. Paris, Karthala-IFRA

Yapi A. F., 2014. Cartographie d'un terroir villageois de chasse et suivi indiciel de la faune commune à Liouesso. Montpellier, CIRAD – AgroParisTech - FAO

Brand identification of the "Bushmeat" project in Central Africa: A lesson in corporate communication

Apolline Medzey Me Sima[1], Hyacine Kacou-Amondji,[2] Brigitte Bilonda Mbuyi[3] and Jean-Claude Nguinguiri[4]

Summary

Forestry projects often resort to corporate communication skills to build a strong image and prove their credibility. These communication actions are undertaken during the project implementation. In this article, the authors discuss the right time for a project to build its level of trust and sympathy. They base their argument on the experience of the "Bushmeat" Project to prove that the first contacts are decisive moments in influencing stakeholders' perceptions. The first impression can hardly be changed subsequently, and can thus jeopardize the project.

Introduction

Business or complimentary cards are exchanged at a first encounter between individuals for introduction purposes. Designed in a concise manner, it highlights the image and notoriety of the person. It is a space that would sanction corporate communication (Jeanneret, 2000). In this article, the business or complimentary card is used as a metaphor to analyze the effects of the way a project is presented. This initial contact is decisive in eliciting support for the project. The "Bushmeat" Project offers an interesting case to illustrate this. After amending its "business card", efforts are being consciously made to rebuild the image of the project. The paper concludes with a discussion on the right time to initiate corporate communication actions within a project cycle.

1. The business or complimentary card : first contact, first impression

The sub-regional project "Sustainable management of the wildlife and bushmeat sector in Central Africa" is mostly GEF-funded. It is implemented in Congo, Gabon, Central African Republic and Democratic Republic of Congo by the technical departments of ministries in charge of wildlife, and with the technical support of FAO, CIFOR, IUCN and CIRAD. It aims at demonstrating that participatory wildlife management is a viable option for preserving the function, integrity and biodiversity of the forest ecosystem in the Congo Basin. Developed in 2011, the project was launched in December 2012 and introduced on the international scene and in beneficiary countries between 2011 and 2013.

Its business or complimentary card was formulated during these initial contacts. It is first characterized by its shorter name, i.e. the "Bushmeat Project", a title that emerged during its formulation phase. It is not motivated by a so-called affection as observed in the choice of pet names, or by the need to shorten the project's name. This condensed name was borrowed from the objective of the project, i.e. "bushmeat", just as it is common for the project name to be linked to its implementation site. The project identity (business card) is also characterized by one of the expected outcomes, that is, "the legal sale of bushmeat by community managers". This product or outcome of the project (which is significantly influenced by other 14 products) is the one that stood out in the minds of people. The first contacts generated an image of the project dominated by the legalization of bushmeat hunting and trade; it thus masks, conceals and hides the purpose of the project which is the quest for sustainability.

2. The perceived image: an initiative that swims against the tide

For some stakeholders, namely conservation NGOs, the project does not address the bushmeat crisis in the right sense, that is, controlling poaching and strengthening law enforcement in a context of poor governance. Proceeding otherwise, especially through the legalization of community hunting and game trade to strengthen local wildlife management, is only pure naivety, as written by Hart (2015). The project is charged with being a possible source of mismanagement that will contribute to eroding wildlife conservation efforts, a concern shared by Wieland :

"Bushmeat should remain a commodity for local communities. However, the sector should not be encouraged with laws as this would nullify conservation efforts"

Other reactions were recorded in relation with the Ebola outbreak, namely the reaction of Lion Aid News (2011) which highlights the ambiguous nature of the project which, on the one hand, laments the loss of biodiversity, and on the other hand, promotes its sustainable use, before inviting WHO and FAO to unite in condemning instead of promoting bushmeat trade, in order to facilitate wildlife conservation and bushmeat consumers' health. This image perceived by stakeholders is dominated by bushmeat and its legalization; it obscures the project objectives which point to strengthening of local management capacity of wildlife. This image, for sure, has definitely undermined the level of trust and sympathy for the project.

[1] *Sub regional Coordination Assistant for Project GCP/RAF/455/GFF « Sustainable management of the wildlife and bushmeat sector in Central Africa", FAO, Libreville, Gabon, Email: Apolline.medze@fao.org*

[2] *Communication Officer, FAO Sub-regional Office for Central Africa, Libreville, Gabon, Email: Hyacine.KacouAmondji@fao.org*

[3] *National Technical Assistant in DRC for Projet GCP/RAF/455/GFF, Kinshasa, DRC, Email: Brigitte.Mbuyibilonda@fao.org*

[4] *Forestry Officer, FAO Sub-regional Officer for Central Africa, Libreville, Gabon. Email: Jeanclaude.nguinguiri@fao.org*

[5] *We can mention the case of the TRIDOM and Mayombe Projects implemented by UNOPS and IUCN respectively*

3. A lesson in corporate communication

Corporate communication is not a new tool for forestry projects. It is an essential component of their communication plans. In practice, communication strategies and associated plans are often developed during the first or second year of the project. In the light of the Bushmeat Project's experience, we could wonder if this exercise is conducted at the right time. It appears that the initial contacts made during the formulation and launching of the project, were decisive moments in influencing stakeholders' perception. The perceived image, from the onset can hardly be changed subsequently. Therefore, there would be a need to give the project every chance of success from the initial contact, for, as the saying goes, "you have only one chance to make a good impression". In this respect, the behavior of sales representatives during business development is undoubtedly a source of inspiration for forestry project managers. Sales representatives are almost always trying to make a good impression; in the first 20 seconds the buyer forges an initial idea of the seller and this is why the 4x20 rule is taught to all representatives for a successful first contact (Piron, 2012). The Rule of 4 x 20 is a business practice which is primarily used to trigger a favorable atmosphere between the business agent and the client and to create conditions for active listening. It is based on four basic actions, which should be systematically applied in all sales contacts: (i) the first 20 movements: Exude confidence, and be engaging; (ii) 20 centimeters face: Look at your customer in the eye! Smile! (iii) The first 20 words: Formulate a short sentence to introduce yourself and engage the customer, (iv) the first 20 seconds: Everything happens in a very short time: immediately create a climate of confidence and be attentive to your client.

Conclusion

The experience of the Bushmeat Project has shown the importance of making a good impression at the very beginning of a project. The first image of the project, as it is perceived by stakeholders, has a positive or negative impact on the project. This experience has enabled the authors to challenge the practice of initiating corporate communication activities during the implementation phase of the project. The image of a project should be built from the formulation phase and consolidated gradually, not only through the various technical interventions but also through communication. In the context of the bushmeat project, technical outputs and achievements were emphasized at the expense of communication. In such circumstances, as mentioned by Michel Frois regarding the corporate world (cited by Bordeau, 2013), "if you do not say what your business is, others will say what it is not". It is therefore important to ensure that the image of the project is positive from the beginning of the process, by communicating on the project. Even though the project managers are not equipped in this area, it is however possible to borrow marketing behavioral lessons and to adapt them to the context of forestry projects.

Photo credit: ©FAO/Roberto Faidutti

A forest fire organized by hunters with the aim to force out rodents... Congo basin

[8] *EAGLE (Eco Activists for Governance and Law Enforcement), open letter disseminated in April 2015*
[6] *Michelle Wieland works for WCS in DRC*
[7] *Statement recorded by Mbuyi Bilonda in January 2015 during the Project Steering Committee meeting.*

The bushmeat trade and livelihoods in southern Benin: An exploratory survey

Etotépé A. Sogbohossou[1] and Barthélémy D. Kassa[2]

Summary

Bushmeat is among the multiple and most important products provided by forests to human populations. In this article the authors present the results of an exploratory survey in southern part of Republic of Benin. This exploratory survey aims at assessing the characteristics of the bushmeat trade and evaluate its contribution to local stakeholders' income. The questionnaire survey and observations revealed that four species are more sought by hunters and consumers: francolin, Gambian rat, hare and cane rat. These animals can be found in farms, tree plantations or the Lama forest core area showing the importance of the neighboring protected area to local populations' livelihoods. The bushmeat trade effectively improves the income of stakeholders. However it could not be encouraged because it is illegal and it impacts negatively wildlife and habitat dynamics. It is then critical to apply the laws and regulate this trade. It is also essential to develop activities that provide income to local communities and provide legally wildlife proteins for consumption. Further research on the patterns of this trade and its real impact on the biodiversity is necessary.

Introduction

The importance of forests for human livelihood is unquestionable. Forests provide food, medicine, shelter to humans for millennia. Wildlife, a forest product, has an economic, socio-cultural, dietary and ecological benefits for local communities. The bushmeat sector provides important incomes to many local communities (Fa et al. 2002; Brashares et al. 2004). This trade is detrimental to wildlife species and affects dispersion of forest tree seeds (Fa & Brown 2009; Poulsen et al. 2013; Fa et al. 2015). Several aspects were assessed such as the causes, the volume of the bushmeat trade, its impact on protected areas, particularly in the forest region of West and Central Africa (Fa et al. 2002; Macdonald et al. 2012; Ziegler et al. 2016).

Republic of Benin is a country located in the dry Dahomey Gap within the humid forest belt of West Africa. In the densely populated southern part of the country, wildlife is disappearing mainly by habitat loss and bushmeat exploitation. Few studies have monitored the bushmeat trade in the country (Codjia & Assogbadjo 2004; Aglissi 2013). The current study, which is an exploratory survey, was aimed at assessing the characteristics and contribution of the bushmeat trade to people income in southern Benin in order to make suggestions for a better management of wildlife for both people and wildlife benefits.

Methodology

The study was carried out in Southern Benin. The best preserved protected area in this part of the country is the Lama forest located between 6°55' - 7°00' Northh and 2°04' - 2°12' East. It is composed of a biodiverse core area of 4,785 ha of the natural dense forest surrounded by tree plantations.

We did a questionnaire survey of 150 bushmeat trade stakeholders in the municipality of Tanwe-Hessou, within a distance of 10 km from Lama forest, which hosts in Tegon the most frequented roadside bushmeat market in the region. We expressed the preference for species through the citation frequency which is the ratio of the number of interviewees who cite a species on the total number of interviewees.

Results

Two types of hunting are observed in the area: group hunting and individual hunting. Traditional weapons are used and sometimes hunters are accompanied by dogs. Hunting is more organized during the dry season, most hunters (83.9%) being primarily farmers. Hunting products are mainly sold. They are used for households' consumption only when species killed are too small or are not sold after few days. Three main types of stakeholders are locally involved: hunters, retailers and consumers. The hunters can sell the meat to the retailers or directly to the consumers. Retailers can be locals who sell locally or take the meat to large cities.

Several species can be found in the roadside market with eight which are more common. Figure 1 presents the animals most killed by hunters and the ones consumers prefer to eat. This suggests that hunters killed according to consumers' preference. The preferred species are the francolin Pternistis bicalcaratus, Gambian rat Cricetomys gambianus, hare Lepus crawshayi and grasscutter Thryonomys swinderianus. The other most common species are Pangolin Manis gigantea, bushbuck Tragelaphus scriptus, duikers Cephalophus spp and squirrel Xerus erythropus. According to the hunters, these animals can be found in farms, plantations or the core area of the Lama forest. Half of the species, the largest, can only be found in the forest while the smallest are usually killed in farms.

Bushmeat contributes significantly to the increase of income. The mean income of hunters during the dry season is three times higher than the income from agriculture (366 372 XOF 395 878) while the bushmeat retailers have an income four times higher than from agriculture. The meat is more expensive in the rainy season with an increase of 16 to 69% with hunters and 20 to 86% with retailers.

[1] *Etotépé A. Sogbohossou, Ir, PhD. Faculty of Agricultural Sciences, University of Abomey-Calavi, 01 BP 526 Republic of Benin. Email : etotepe@gmail.com*

[2] *Barthélémy D. Kassa, Ir, PhD. Faculty of Agricultural Sciences, University of Abomey-Calavi, Republic of Benin (République du Bénin) Email: kbarthlmy@yahoo.fr*

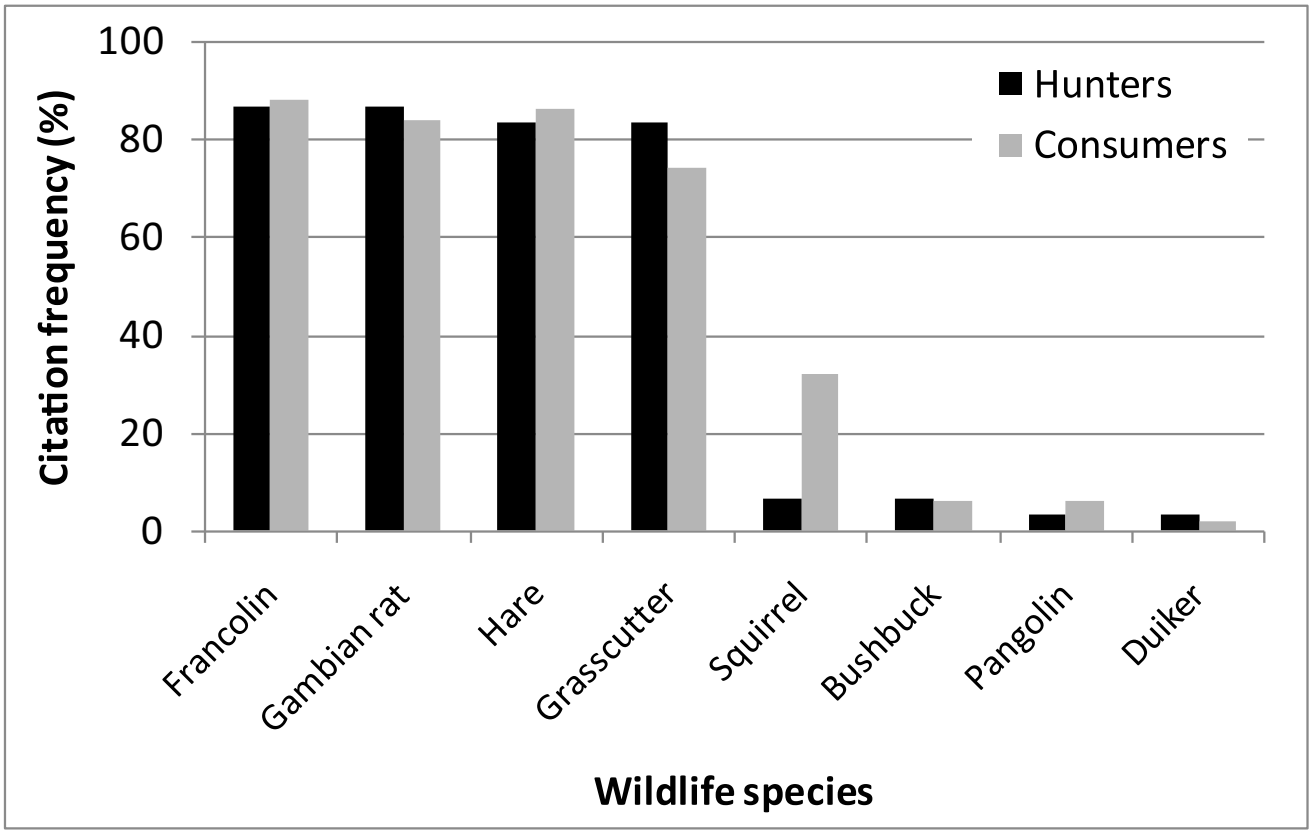


***Figure 1:** Bushmeat species preference of hunters and consumers in Tegon area, southern Benin*

Discussion

The exploratory survey of the bushmeat trade in southern Benin revealed that mainly eight species are targeted by this trade. The absence of taxonomic groups such as primates and reptiles, common in bushmeat markets elsewhere (Brugiere & Magassouba 2009; Fa et al. 2015) does not mean these species are not hunted in the area. In fact, during a previous survey in the same area few years ago (Aglissi 2013) species such as mongooses, bushpig and the red-bellied monkey were found in the roadside market. The difference can be explained by the fact that the current study has been conducted during a period where hunting was limited because of the season and the occurrence of Ebola in the region. Despite the difference in the number of species, the four most preferred species: francolin, Gambian rat, cane rat and hare are the same.

A significant proportion of this bushmeat, especially large species, come from illegal hunting in the Lama Forest. Macdonald et al. (2012) identified national parks as sources of animals traded as bushmeat. The Lama forest management authority reports poaching as being the first threat to wildlife in the forest. The hunting pressure is higher in the dry season as observed in other studies (Brugiere & Magassouba 2009), the period being a rest period from farming. During this season, water is scarce in the forest, compelling the migration of many species outside the forest, into areas occupied by humans. Whether the hunting occurs in the forest or not, it impacts the potential of the forest. Several of the species traded in southern Benin are not endangered but their populations are decreasing. This trade probably contributed significantly to the extinction of species such as the forest buffalo and the red-flanked duiker in the forest. This wildlife extinction can also be detrimental to the trees regeneration as several bushmeat species play an important role in tree regeneration (Poulsen et al. 2013).

The main reasons for bushmeat trade are poverty, unemployment, relatively easy access to resources, lack of other protein sources, a deficient penal system (Lindsey et al. 2011). The wildlife hunting in our study area is commercial rather than for subsistence and the bushmeat trade increase the income by more than 30%. A report on poverty in Benin pointed out that 40% of people in rural areas are poor with farmers being the poorest (INSAE 2012). The bushmeat trade appears then as a short term, unsustainable solution against poverty. Indeed, with a continuous and increasing pressure by hunters, wildlife will decline with as consequence the reduction of its contribution to local communities' livelihoods. On another side, despite hunting being illegal, those who sell bushmeat are not punished except hunters that are caught poaching in the forest. Solutions to the bushmeat trade should then target all or most of these constraints related to human livelihoods.

Conclusion & Recommendations

Bushmeat trade in southern Benin is an important income generating activity fueled by illegal hunting in the neighboring Lama forest and surrounding habitats. The application of laws to control the trade by the National Forest Department will on one hand improve the efficiency of the anti-poaching efforts of the Lama forest headquarters. On the other hand, the domestication and rearing of wildlife as an alternative income and protein sources have shown mixed results (Nyaki et al. 2014). However the development of the farming of wildlife species can increase the success of this alternative since people usually prefer wildlife meat to domestic animals. This will also provide wildlife meat all along the year and not periodically as it is currently observed. Benin has an extended experience with cane rat farming but there is a need to diversify the farmed species based on consumers' preference. These efforts must be backed up with an awareness campaign towards hunters and consumers. All these actions should be supported by further research including a more detailed assessment of the volume of the trade and the evaluation of the trade's impact on wildlife and tree regeneration in neighboring protected areas.

References

Aglissi, J., 2013. Diagnostic du secteur forestier de Koto Lama et évaluation sommaire du commerce de viande de brousse au Sud Benin. Mémoire de Licence, FSA/UAC, Benin.

Brashares, J., Arcese, P., Sam, M., Coppolillo, P.B., Sinclair, A.R., Balmford, A., 2004. Bushmeat hunting, wildlife declines, and fish supply in West Africa. Science 306, 1180–1183.

Brugiere, D, Magassouba, B., 2009. Pattern and sustainability of the bushmeat trade in the Haut Niger National Park, Republic of Guinea. African Journal of Ecology 47, 630-639.

Codjia, J.T.C., Assogbadjo, A.E., 2004. Faune sauvage mammalienne et alimentation des populations holli et fon de la forêt classée de la Lama Sud-Bénin. Cahiers Agricultures 13, 341-347.

Fa, J., Peres, C., Meeuwig, J., 2002. Bushmeat exploitation in tropical forests: an intercontinental comparison. Conservation Biology 16, 232–237.

Fa, J.E., Brown, D., 2009. Impacts of hunting on mammals in African tropical moist forests: a review and synthesis. Mammal review 39, 231–264.

Fa, J. E., Olivero, J., Farfán, M. Á., Márquez, A. L., Duarte, J., Nackoney, J., Hall, A., Dupain, J., Seymour, S., Johnson, P. J., Macdonald, D. W., Real, R., Vargas, J. M., 2015. Correlates of bushmeat in markets and depletion of wildlife. Conservation Biology 29, 805–815.

INSAE, 2012. Enquête modulaire intégrée sur les conditions de vie des ménages. 2eme édition.
Macdonald, D.W., Johnson P.J., Albrechtsen, L., Seymour, S., Dupain, J., Hall, A., Fa, J.E., 2012. Bushmeat trade in the Cross-Sanaga rivers region: Evidence for the importance of protected areas. Biological Conservation 147, 107-114.

Nyaki, A., Gray, S. A., Lepczykyk, C. A., Skibins, J. C., Rentsch, D. 2014. Local-Scale Dynamics and Local Drivers of Bushmeat Trade. Conservation Biology 28, 1403–1414.

Poulsen, J.R., Clark, C.J., Palmer, T.M., 2013. Ecological erosion of an Afrotropical forest and potential consequences for tree recruitment and forest biomass. Biological Conservation 163, 122–130.

Ziegler, S., Fa, J. E., Wohlfart, C., Streit, B., Jacob, S., Wegmann, M., 2016. Mapping Bushmeat Hunting Pressure in Central Africa. Biotropica 48, 405–412.

Gender discrimination in customary land tenure systems and its influence on food security and poverty alleviation: Lessons from Cameroon

Nvenakeng Suzanne Awung[1]

Summary

Cameroon legal framework gives equal land-rights and access to natural resources to both men and women, but the customary tenure system inhibits women from inheriting or owning land. This paper examines how gender and women's marital status affect land acquisition rights and also examines the role of women in food production. Results show that most land is owned by men, while women are the main food producers. Land ownership amongst women correlates with their marital status, with divorcees owning more land; followed by widows, married women and singles. Size of landholding also directly correlates with annual income, with men owning most of the land and consequently making more money than women. Local customary belief has influenced the perception of community land ownership rights resulting into gender inequality; which deprives women of their basic rights to own land despite the fact that they are the main cultivators/producers of food. Educating traditional leaders on women's rights especially land-rights will enable them integrate gender equity solutions in community, and raising community awareness on legal provision through community workshop on rights will empower women to own land and could help unlock their potential to reduce hunger and improve livelihoods.

Introduction

Rugadya (2004) argues that equitable gender allocation of productive resources increase food production by 10-20%. Adequate food production, economic access to available food and nutritional security are essential elements for food security. Though both the UN Charter as well as the Cameroon 1974 Land Tenure Ordinance no. 74-1 (Government of Cameroon, 1974) guarantee the rights to use, own, and dispose of land by all, this is not a practical reality in Cameroon. Most men own land while women worked on it for food provision. The cultural deprivation of women's land rights and usufructs rights makes customary tenure system insecure for women and render them unwilling to invest resource for maximum output. Women constitute 90% of the total workforce in food production providing 80% of food production and 60% of cash production in Sub-Sahara Africa; and even when men and women work in separate farms, women farms are mostly used for food crop cultivation (FAO, 1995). Women play a major role in food provision, children's education and health care of their household; though mostly under-represented in formal sectors. According to Palmer (2009), ownership of land is more than a source for food production, but a mix of socio-economic and political struggle with men subordinating women to inherit and own land. Women are even considered as men's properties and allocation of farmland to women is sometimes consider a privilege, not a right. Most often this is considered acceptable across the society and even law-enforcement. Land ownership therefore shape how the house is run and participation at public sphere. Men often act as the head of family, owning most of the family land, controlling the household finance and often the public speaker of the family unit. In Sub-Sahara Africa, poverty affects rural women more due to their roles in reproduction, production, and socio-economic marginalization. Women constitute 50.6% of the Cameroonian population (Mbarga, 2010) and this gender discriminatory land rights is an economic injustice that does not help to alleviate poverty. In Cameroon, the statutory law gives both men and women equal rights to own land, but traditional beliefs have denied women the rights to own land, rather, it subject them to be main labourers on the family land which is mostly own by men. According to Rugadya (2004), the lack of land ownership also deprived them the rights to access or control the money made from selling agricultural products. Land ownership by women will improve their bargaining power and food security within the socio-economic arena (Palmer (2009), therefore a call to enforce statutory laws that outlaw gender bias has prompt social adjustment.

This paper seeks to identify the role of women in the food production chain in Cameroon, examines why it is important for women to own land even when they have access to their family land, shows that secure tenure influences income and proposes feasible strategies to correct this gender discrimination in the allocation of secure land-rights.

Methodology

Households formed the basic unit for the questionnaire survey. Cluster stratified random sampling was used to collect data within the 41 park villages which are divided into four geographical clusters around Mt. Cameroon National Park (MCNP). Three park villages were randomly chosen within each cluster making a total of 12 villages. Then 264 households were randomly selected for questionnaire administration making sure that at least 15% of the households, 30% of each gender and 10% from each age group in each village served as respondents. Data were imported into SPSS for analysis. Consultations and interview were carried out with proponents working within MCNP projects.

Result

Mann-Whitney U test shows that the size of land holding is significantly related to gender ($p<.001$, $U=5880$, $z=3.5$) with men owning the most land than women (1a). Annual income also significantly relates to landholding (χ^2 (16) $=83.635$, $p<.001$) (1b). The results show that men earn the most land and make more money from it.

[1] *Nvenakeng Suzanne Awung, York Institute for Tropical Ecosystems, Environment Department, University of York, YO10 5DD, UK. Corresponding address: Processiestraat 15, 9200 Dendermonde, Belgium. Email: nvenakeng.s@gmail.com*
Telephone: +32466442860
Also at The Forgotten Green Heroes (TFGH), Buea, SWR, Cameroon.

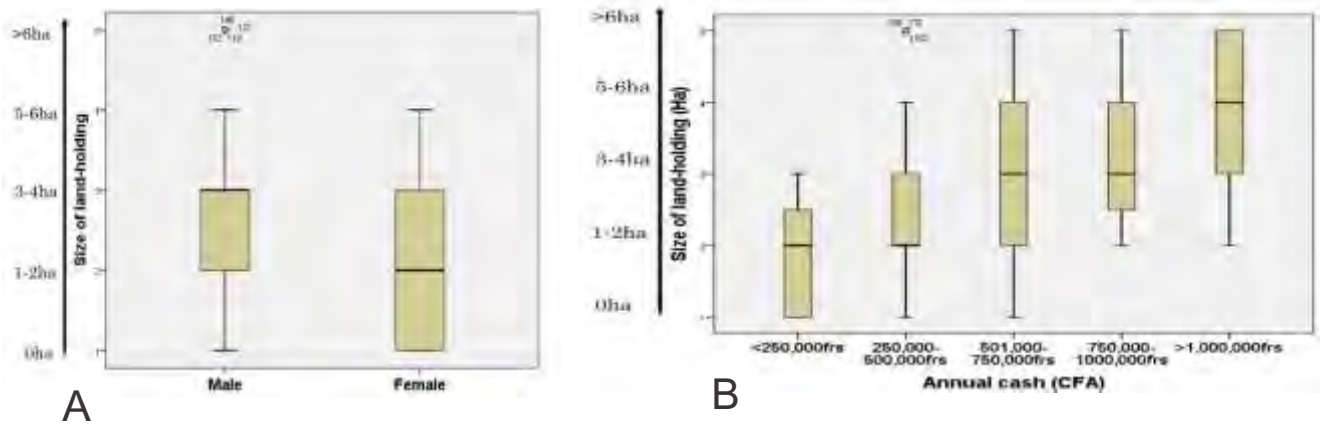


Fig. 1: Showing how the size of landholding relates to gender (a) and income (b)

An independent-Samples Kruskal-Wallis Test shows a significant difference between the size of landholding and women marital status at H(3) =17.334, p =.001, with divorcees owning the most land followed by widows, married women and single women. There was no significant difference in landholding and marital status for men.

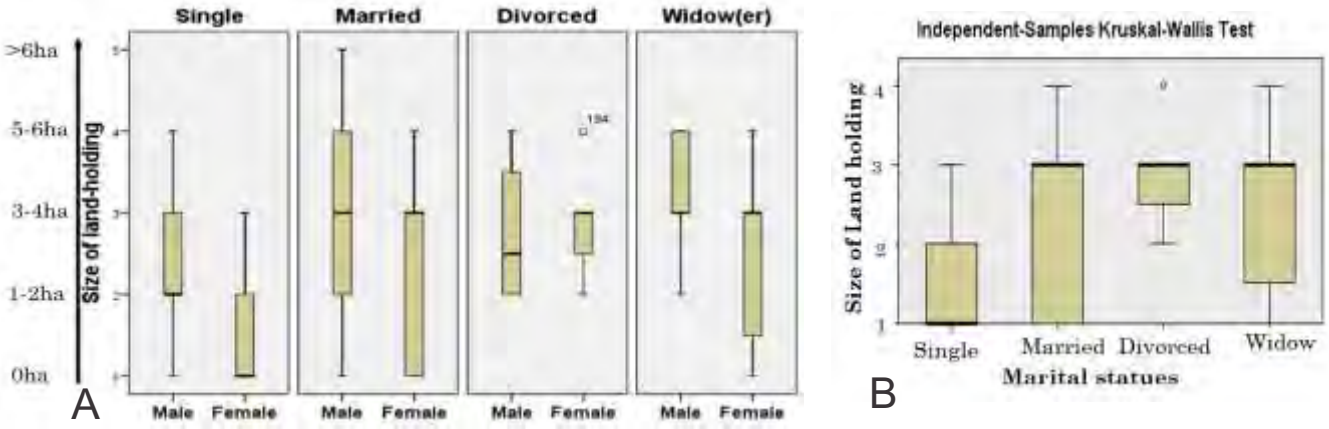


Fig. 2: Showing how size of landholding relates to marital statues (a) especially women (b)

All respondents cultivate food crops and 81% derive their livelihoods from family farming - producing food crops, cash crops and harvesting Non-Timber Forest Products (NTFP). Further analysis shows that women are more involved in food production of all types and that men predominate in the cash crops of rubber and sugar cane cultivation.

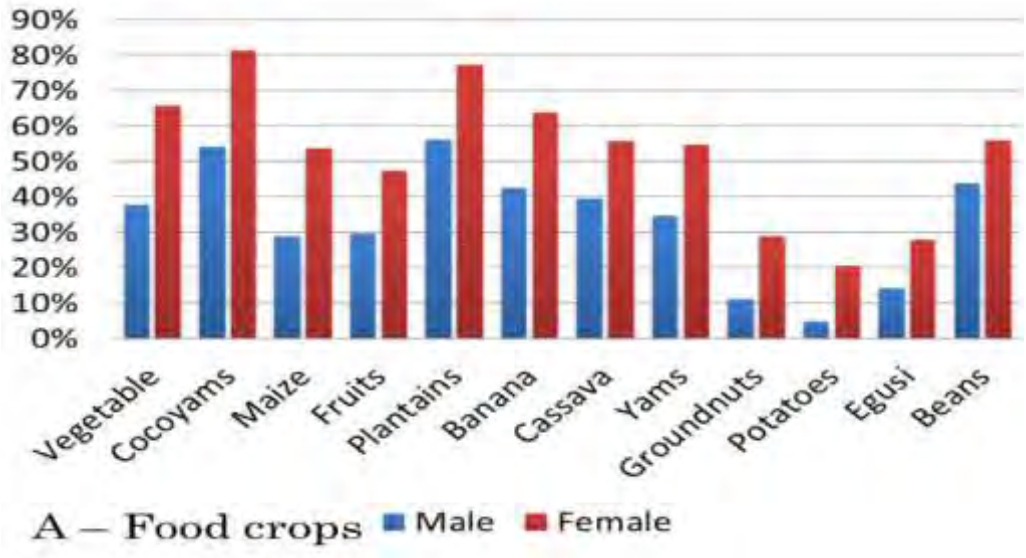


Fig. 3: Percentages of gender involvement in cultivation of food crops (a), cash crops (b) and NTFP (c)

Discussion and conclusion

Land remains a valuable source of economic development, food security, income generation and improve livelihood in rural communities. Women are the backbone of food production in rural households, though their land ownership rights are being denied. Allendorf (2007) found out that, female land-owners often have a say in household decisions (empowerment) and their children are less likely to be underweight (food security) than females without land ownership rights. Therefore, female land ownership is a feasible path to enhance food security, poverty alleviation and empowerment. It also enhance the female voice during discussion, consultation and decision-making processes on resources and income generated from farming as well as other community issues. Though women are the main food producers, they are mostly food insecure mainly due to low-income earning in male headed household and not just inadequate food production (Gladwin et al., 2001) and income directly relates to landholding. Therefore, a holistic approach to institutionalized women's land rights in customary reforms is recommended to improve their income, alleviate poverty, enhance food security, family livelihoods and well-being.

Both policy and technology intervention are needed to ensure food security and economic transformation. Women should be educated on their rights to own land to enable them advocate for the implementation of the law. The government need to set the pace for local authorities to follow by building women's capacity to become equal stakeholders in land tenure reforms, educate and raise awareness within communities and most especially traditional councils on equality in land ownership rights as specify by law. The government should invest in education, capacity building, awareness raising, credits provision, equipment and seeds distribution to female farmers to ensure increased yield, alter cultural perception to land entitlement, ensure equitable tenure security and gendered valuations of work and worth. Income generation, poverty alleviation, food security, improved livelihood and well-being of a woman and her children depend on her direct access to land and productive resources, not just access through her husband or male family head. Depriving women the right to own land is attributed to customary practices that override the legal provision of the 1974 Land Tenure Ordinance no. 74-1. It renders women economically and socially vulnerable and undermines their ability to address food, health and educational needs of their children. Therefore, any effort to improve food security and poverty alleviation should address the importance of women's land rights. Further research should focus on effective approaches in advocating for greater gender equality in land ownership. Gender tenure security is not only for ethics and equity, but also geared towards meeting up with the Sustainable Development Goals.

Reference

Allendorf, K. (2007). Do women's land rights promote empowerment and child health in Nepal?. World development, 35(11), 1975-1988.

FAO, (1995). Women, agriculture and rural development: A synthesis report of the Africa region. FAO. http://www.fao.org/docrep/X0250E/x0250e00.HTM (Accessed 20/04/2016).

Gladwin, C.H., Thomson, A.M., & Anderson, A.S. (2001). Addressing food security in Africa via multiple livelihood strategies of women farmers. Food Policy, 26(2), 177-207.

Government of Cameroon. (1974). Ordinance no. 74-1 of 6 July 1974. http://www.atangana-eteme-emeran.com/spip.php?article22275 (Accessed 21/07/2016)

Mbarga, B. (2010). 3ème RDPH, Rapport de présentation des résultats définitifs. BUCREP (Bureau Central des Recensements et des Etudes de la Population), Yaoundé.

Palmer, R. (2009). Challenges in asserting women's land rights in Southern Africa. In workshop on decentralizing land, dispossessing women (pp. 4-7).

Rugadya, M., Obaikol, E., & Kamusiime, H. (2004). Gender and the land reform process in Uganda. Associates for Development. http://www.aresearchtrust.org/wp-content/uploads/2015/12/Gender-and-the-land-reform-process-in-Uganda1.pdf (Accessed 2/05/2016).

Changing spirituality and natural resources base: implications for common natural resources management in the mid-Zambezi valley.

Mbereko Alexio[1]

Summary

Social capital is a fundamental pillar in Community Based Natural Resources (CBNRM). In the mid-Zambezi valley like other rural African setting, social capital is closely linked to traditional institutions. The traditional institutions used their hegemony to build high levels of social capital, which facilitated effective management of natural resources. The natural resource units were managed using de facto regulations. The mythical fences associated with traditional leadership made them effective in managing natural resources. However, these were replaced with modern institutions. The policies implemented reduced social capital and respect for mythical fences which are necessary for CBNRM. Natural resources depletion resulted from a number of factors associated with modern institutions and liberal government policies. Thus, modern institutions have to find ways of increasing social capital in order to create a conducive environment for CBNRM.

Background

In Zimbabwe, traditional (De facto) and modern (De jure) institutions have always managed natural resources parallel. However, the power and influence of the two in day to day management of the natural resources has been debated in literature. In this paper I will focus on the shifting foci of power and its implications on the micro-management of natural resources in the communities of the mid-Zambezi valley, as it mirrors conditions in other parts of the developing world.

Soon after independence in 1980, people who had been displaced by the colonial government from the Nyamakate areas started trickling back. The ancestral spirits were believed to be the owners of the land and everything on or in it. The role of spiritual and traditional institutions in natural resources management was valued and respected. A legitimisation process of new settlers was perform, and this ensured their commitment to respect the local religious set up and a commitment to the stipulated social order. Admittance of a family meant they had to observe the taboos, rules of land and natural resources use. Traditional institutions had power of either exclusion or inclusion depending on one's loyalty to the local rules and norms. Traditional institutions took advantage of this de facto power and presided over the day to day, on the ground management of natural resources.

From the mid-1980s, institutional changes took place that affected management of the commons in the communal areas within the mid-Zambezi valley. The traditional set up was replaced with modern institutions, this shifted natural resources management to new institutions whose hegemonic legitimacy is questionable. Social capital in most rural sub-Sahara is anchored on the traditional institutions and kinship. Clearly, for Community Based Natural Resources (CBNRM) to be possible social capital is important (Ostrom, 1990). In Zimbabwe, CBNRM was implemented under a programme called the Community Areas Management Program for Indigenous Resources (CAMPFIRE). CAMPFIRE was a conservation and developmental initiative (Matema and Anderson, 2015). Conservation is key in the mid-Zambezi valley because the natural resources are under pressure from both climate change and local communities, which is mediated by questionable institutions. Thus, this paper explores the consequences of changes in the spiritualisation of natural resources and climate on the day to day management of natural resources base.

[1]*Alexio Mbereko (PhD. Dev Studies) Post-Doctoral Fellow, College of Health Sciences, School of Nursing & Public Health. 1st Floor, George Campbell Building, Howard College. University of KwaZulu-Natal, Howard Campus, Durban, 4001. Republic of South Africa.*
Email. ambereko@yahoo.co.uk ; Email: ambereko@gmail.com
Cellular phone: +27 73 443 0607 (South Africa) ;
Cellular phone: +263 783 725 429 (Zimbabwe)

Institutional dynamics

To be a legitimate hegemony, both the traditional and modern institutions have to exercise power over communities (Bryant, 1991). The fundamental difference in their level of cohesion is, in traditional systems' the power is sanctioned by spiritual institutions. In other words a kind of materialistic relationship exists between communities and traditional institutions. The traditional institutions share the lived experiences and the world view (aspirations) of the people. Family and kinship ties strengthen their social capital. It is on the bases of such understandings that traditional leadership becomes legitimate and is able to control other community members through rules and folklore. Traditional systems use 'mythical fences', In this set up the ancestors and founding spirits were the custodians of natural resources and wildlife and their utilization was supposed to be done in accordance with the agreed codes of behaviour that vary from society to society. The traditional system threated magical misfortunes after violation of rules and folklores which would lead to calamities like drought, plague, lions destroying livestock e.t.c. The traditional system is more suited for micro-level management of natural resources. However, modernisation affects social capital hence reduces traditional systems effectiveness such as multiple culturalism, population increase, globalisation, powerful modern formal institutions and external religions.

A paternalistic relationship is expected with formal institutions, since they have to provide for the people to gain favour. The modern formal institutions are external and use a top-down approach. Formal institutions are external to the communities and fail to understand local world views and experiences. External institutions gain legitimacy through cohesion and the judicial system. However, the communities have been documented to use subtle methods to invade the powers of external institutions (Scott, 1985). In the mid-Zambezi river, since the 1990s to date de jure institutions have taken over natural resources management. Formal institutions alienate humans from natural resources through rules and use of enforcement agents that prosecute offenders. This militant approach has limitations in the Zimbabwean context due to the economic crises that haunt the natural resources enforcement agents, limiting their effectiveness (McGregory, 2010). This necessitates looking at the old system and drawing lessons on natural resources which can build personal and community valuation of natural resources and the desire to protect fauna and flora.

The mid-Zambezi

The mid-Zambezi area is endowed with four major resource units, namely; forests, soil, water and wild animals (Table 1). The communities have always derived their livelihoods from these resource units. The uses of natural resources has not changed much with the exception of areas used for spiritual activities. In the past spiritual areas remained pristine, unlike under the modern system they are almost non-existent (Table 1). These pristine areas acted as biodiversity reserves/breeding grounds. Sacred grooves, forests, pools and rivers played an important role in the conservation of wetlands biodiversity and key livelihoods sources (Katerera, 2001). Shrines and sacred grooves were responsible for forest conservation, since the 'axe' was prohibited.

When the traditional institutions were the foci of natural resources management. Communities used to benefit from all the four resource units. This motivated them to observe the traditional rules and at the end natural resources were sustainably managed. For example small game and dry wood could be harvested for domestic use only.

With the increase in population after the government formally resettled people. Human-wildlife conflicts (HWC) increased. The HWC was managed by the Department of National Parks killing problem animals, and the traditional/local leadership distributing the meat amongst community members. Furthermore, communities used to benefit from the professional hunters kills and problem animal control programmes, through meat rations and employment. Traditional rules and national laws were applied in managing natural resources units. However, before the replacement of traditional systems in 1985, de facto rules were more powerful in everyday management of natural resources.

[2] *A sociological/anthropological definition is used here which denotes self-conception as the vessel of the sacred (this conception endowing the moral order with absolute authority and rendering the life-styles rigidly conventionalized) and its quality of being the whole of social and spiritual reality, with functions satisfying all the needs of an individual from birth, through all his life crises and transitions, to death (Robert Redfield, 1897-1958).*

Table 1 Natural resources units and traditional rules

Resource unit	Uses	Traditional governance rules
Water	Domestic uses	Harvest only enough for use avoid excess extraction of water
	Rituals	No metal or anything put on fire to be used to fetch water
	Watering livestock	None
	Watering fields (mainly rain fed)	First fruits were to be provided for a thanks giving ritual
	Watering vegetable gardens	
Soil	Traditional leaders allocated land	Observation of *chisi*(a day of no work in a week)
	Rights to a field and surrounding forest were bestowed to a family	
	Sacred land was not to be cultivated	Grave sites, *rambotemwa*¤ (lands believed to be spirits resting place) and other sacred grounds
Fauna	Could not hunt big game	Sacred animals to the land i.e. elephants, elands etc
	The totem system	One could not eat meat of an animal which is their own totem.
	Killing animals that destroyed crops	The department of National Parks killed problem animals and use the meat to compensate any losses or distribute the meat to community members.
Flora	Dry trees to be cut for fuel	None
	Sacred trees had spiritual functions	*Rambotemwa*¤ (literally, denied to be cut) woodlands believed to provide shade to the spirits when they rest.
	Methods of harvesting trees without threatening their survival e.g. harvesting of branches	

Modern systems and chaos

I argue that the modern era starts at 1990 after the adoption of the liberal policy called the Economic Structural Adjustment Programme (ESAP). Like other resettlement areas kinship was not a consideration and people of different cultures applied through government to be resettled in the area. Such a resettlement system destroys the social capital and indigenous cultures (Barr, 2004). Since, a multi-culture society is created. Yet, social capital and shared culture are the foundation of community based natural resources (Ostrom, 1990). The importance of traditional leadership, respect of nature and mythical fences is reduced and an open access system to the commons is created.

The Hurungwe District Council and the department of National Parks and Wildlife became principal managers of natural resources in the Nyamakate area. They instituted the Zimbabwean version of CBNRM called CAMPFIRE. The district Council has more power over the CAMPFIRE and safari areas. Currently the Council is in running battles of evicting 'illegal settlers' on the buffer zone (Chimhowu 2013). Yet safari operators who are financially beneficial to council invade the space. On the ground CAMPFIRE failed because the community did not realise benefits from the hunters or council (Martin, 1986; Matzke and Nabane, 1996). It was observed that the hunters no longer distribute meat to communities but sell it especially as biltong to well-resourced people and crocodile farms in the Kariba area. Furthermore, population increase and low levels of social capital disturbed the corporation amongst inhabitants on natural resources usufruct rights and methods. In Nyamakate tobacco growers have been said to be the major threat to forests (Mbereko et al., 2015). The new tobacco farmers are prioritising self-enrichment through producing for the commercial market at the expense of forests, whose trees provide energy in the tobacco curing process. A vacuum was created between the resource user and macro-institutions that passed natural resources management laws. The introduction of neo-liberal policies in the country also affected the functions of institutions that managed natural resources in the mid-Zambezi valley. The government reduced direct financial injection to the Rural District Councils and the department of National Parks and Wildlife. The Macro institutions focused on income generation neglecting the local communities. The councils benefited more from the CAMPFIRE fees at the expense of the community (Matzke and Nabane, 1996; Chimhoyu, 2013).

The economic decline that superseded the Economic Structural Adjustment Programme has weakened the macro-institutions ability to effectively police the mid-Zambezi valley. At the same time the reduction in government aid and economic crises have resulted in people exploiting the natural resources in order to cope. This is a fertile environment for the 'tragedy of the commons'. Trees and other resources from sacred places have been depleted significantly. The communities are encroaching into the safari area to at least benefit from the enclosed resources and this creates conflicts with the private hunters who control the area.

Lessons

- Mythical fences are necessary in natural resources management. Declaring and protecting them as heritage sites would benefit biodiversity especially of trees,
- Social capital is a fundamental pillar in community cooperation in natural resources
- Communities conserve natural resources they benefit from

References

Barr, A. 2004. Forging effective new communities: The evolution of civil society in Zimbabwean resettlement villages. World Development, 32: (10), 1753 -1766.

Bryant, R. L. 1991. Putting politics first: the political ecology of sustainable development. Global Ecology and Biogeography Letters, 1: 164-166.

Chimhowu A, O. 2013. Engendering Greater Citizen Rights in CAMPFIRE: A Double Edged Sword? Some Reflections from the Case Study of Hurungwe. http://www.sed.manchester.ac.uk/idpm

Martin, R. B. 1986.Communal Areas Management Programme for Indigenous Resources. Terrestrial Ecology Branch, Department of National Parks & Wildlife, Harare.

Matema, S. and Andersson, J.A., 2015. Why are lions killing us? Human–wildlife conflict and social discontent in Mbire District, northern Zimbabwe. The Journal of Modern African Studies, 53(01), pp.93-120.

Matzke, G.E. and Nabane, N., 1996. Outcomes of a community controlled wildlife utilization program in a Zambezi Valley community. Human Ecology, 24(1), pp.65-85.

Mbereko, A., Scott, D. and Kupika, O. L. 2015. First generation land reform in Zimbabwe: historical and institutional dynamics informing household's vulnerability in the Nyamakate Resettlement community. Journal of Sustainable Development in Africa, 17: (3) 21-38

McGregory,J. 2010. Patrolling Kariba's Waters: State Authority, Fishing and the Border Economy. Journal of Southern African Studies, 34: (4), 861 – 879

Ostrom. E. 1990. Governing the commons: The evolution of institutions for collective action. Cambridge, Cambridge University Press

Monitoring effectiveness of Community Resources Management Areas in western Ghana

Emmanuel Danquah[1]

Summary

The Community Resources Management Area (CREMA) concept in Ghana is a Wildlife Division initiative that devolves sustainable user rights of natural resources to rural communities in an attempt to reconcile the sometimes conflicting goals of conserving biodiversity and enhancing local livelihoods. Perceived advantages of CREMAs have not been tested in Ghana. By using field data from 20 forest fragments; the study compared indices of four forest outcomes (area of forest, biodiversity conservation, carbon storage and livelihood contributions) between CREMAs and non-CREMAs in western Ghana. Results indicated that CREMAs are significantly more effective in their contributions to the forest outcomes. Using self governance (rule-making autonomy) as a distinctive institutional difference the results reflect the importance of decentralization of decision making. They reinforce the urgency to engage relevant mechanisms such as REDD, which provide incentives for community-based forest management, given that most deforestation occurs on community lands due to insecure tenure and weak property rights.

Introduction

Community forests constitute an essential forest group that offer many forest outcomes (benefits), including biodiversity conservation, carbon sequestration and also contribute to increased food production and rural income (Harvey et al., 2008). Institutional arrangements to govern community forests are believed to significantly influence these forest outcomes, especially when they integrate local knowledge, decentralized decision making and rule-making autonomy. In Ghana, the Wildlife Division of the Forestry Commission has implemented the Community Resources Management Area (CREMA) programme, which transfers management and use rights to rural users to use and sustainably manage natural resources to the social and economic development of fringe communities (WD, 2000). Evidence is emerging that such a focus may be instrumental in reconciling numerous forest outcomes, including biodiversity conservation, carbon storage and livelihood contributions from forests in developing countries (Chazdon, 2008). The urgent global need to protect biodiversity while sustaining carbon storage, agricultural productivity, indigenous cultures and rural livelihoods, requires a better understanding on the relationship between institutional arrangements that govern forests and their contributions to forest outcomes (Chhatre and Agrawal. 2008).

Materials and Methods

Study Area: Bia Conservation Area

The Bia Conservation Area in western Ghana forms 306 km2 of moist semi-deciduous vegetation. Bia extends latitudes 6°20' N to 6°40' N and longitudes 3°00' W to 3°10' W, adjacent the Ghana-Cote d'Ivoire border (Figure 1). The off-reserve area includes a network of 4 CREMAs.

[1]*Emmanuel Danquah,*
Department of Wildlife and Range Management,
Faculty of Renewable Natural Resources,
College of Agriculture and Natural Resources,
Kwame Nkrumah University of Science and Technology,
Kumasi, Ghana.
Email: emmanueldanquah@gmail.com
Phone: +233-244 742385

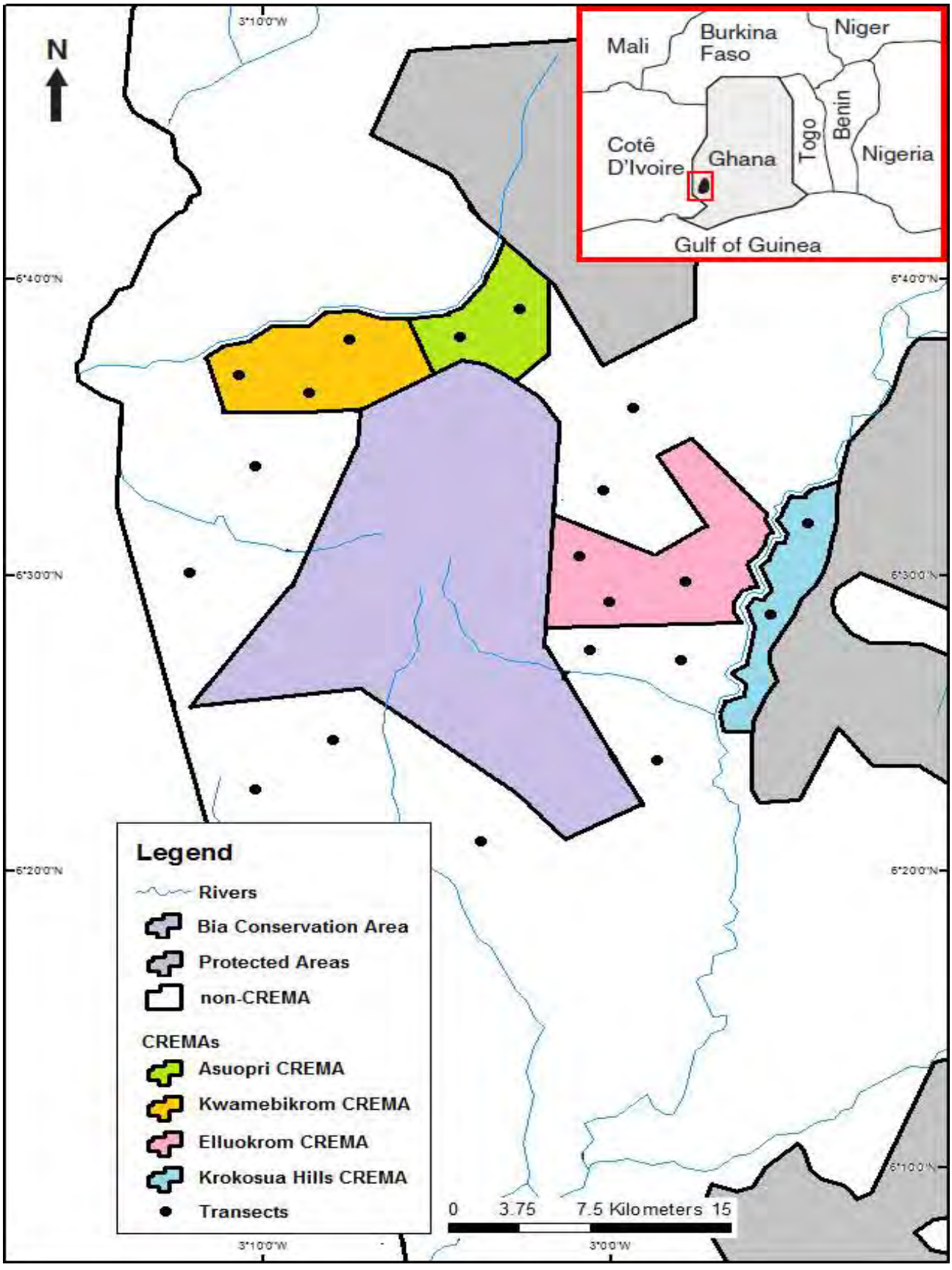


Figure 1: *Map of study area showing the distribution of transects.*

Methods

Twenty forest fragments were selected: ten within four CREMAs (Kwamebikrom, Asuopri and Elluokrom CREMAs) and ten outside CREMAs (non-CREMA) (Figure 1). A one-hectare (20 x 500 m) strip transect was systematically laid across the middle of each forest. Transect surveys were conducted in the wet season months of April–July 2014. Navigation to the starting point of each transect was done with a compass and Global Positioning System (GPS). Transect length was measured with the GPS. Four forest outcomes were constructed from each forest by measuring forest size and indices of biodiversity, carbon storage and livelihood benefits. Forest size was calculated by noting the boundaries of forests and marking their coordinates using a GPS. The coordinates were digitized into a Geographic Information System (ArcView Spatial Analyst, version 9.0) to calculate each area in hectares. An index of biodiversity per hectare was generated for each forest by recording mammal signs (droppings and prints) along strip transects. Tree basal area per hectare was used as a measure of above-ground carbon storage (Chhatre and Agrawal. 2008). Basal area (square meters per hectare), was calculated by measuring all trees >10 cm diameter at breast height in the strip transect. Livelihood contributions was measured by an index extracted through analysis of the proportions of NTFPs per hectare on transects e.g. (i) food (ii) household (iii) medicinal plants and (iv) building materials that each forest provides to local users. One survey team of four persons was maintained throughout the counts to ensure consistency in data collection procedures. Differences in forest outcomes (forest size, biodiversity, carbon storage and livelihood benefits) between the CREMA and non-CREMA were explored using the independent sample t-test in the Statview software (SAS, 1999).

Results

There were significant differences in all forest outcomes between CREMAs and non-CREMAs (Table 1).

Table 1: Summary statistics of forest outcome for CREMAs and non-CREMAs

	CREMA		Non CREMA		t-test		
Variable	Mean	SD	Mean	SD	*t-value*	*df*	*p*
Forest size	7.0	1.1	3.4	0.8	8.58	18	< 0.01*
Biodiversity index	6.2	1.7	1.0	1.2	7.84	18	< 0.01*
Carbon storage	17.1	2.2	6.8	1.7	11.80	18	< 0.01*
Livelihoods index	18.0	4.8	2.4	2.1	9.51	18	< 0.01*

NB: * indicates significance

CREMAs consistently had larger forest sizes ($r^2 = 0.804$, $p < 0.01$) and were associated with high biodiversity ($r^2 = 0.773$, $p < 0.01$), carbon storage ($r^2 = 0.885$, $p < 0.01$) and livelihood benefits ($r^2 = 0.834$, $p < 0.01$). Specifically, large forest fragments were more likely to be found in CREMAs (the group of off-reserve forests providing high biodiversity, carbon storage and livelihood benefits) compared to non-CREMAs.

Discussion

Our findings have two vital implications for decentralization reforms. One, it is possible for governments to improve livelihoods, biodiversity and carbon storage benefits particularly in off-reserve areas by strengthening self governance of forest resources and rule making autonomy at the community level. Two, significant improvements in biodiversity, carbon storage and livelihood benefits can be realized if communities control and govern larger forest fragments (Chhatre and Agrawal. 2008). These findings suggest a perceived overexploitation of natural resources when communities are not in complete control of the land and tenure rights are less secure. This is a case of Hardin's (1968) 'tragedy of the commons', where common pool resources without a governance structure, are irrationally utilized rather than conserved for the benefit of all. Devolution of management rights over natural resources as exists in CREMAs likely supports biodiversity conservation and carbon storage benefits because local communities are motivated to sustainably use natural resources (WD, 2000). The results indicate that such an institutional arrangement that integrates local knowledge and decentralized decision making in enhancing values, benefits and services, is essential for the sustainable management of forests and wildlife in Africa.

The analysis presented in the article has practical implications, especially for local policies that focus on community participation and decentralization of decision making such as the Wildlife Division policy for collaborative community based wildlife management (WD, 2000). This policy aims to enable the devolution of management authority to defined user communities and encourage the participation of other stakeholders, to ensure the conservation and sustainable use of the nation's wildlife for the maintenance of environmental quality and a perpetual flow of optimum benefits to all segments of society. Such local initiatives can be strengthened through international policies such as PES (payments for ecosystem services) and REDD (Reduced Emissions from Deforestation and Forest Degradation) action plans, which provide incentives and compensation to local communities in exchange for reduced use of livelihood benefits from off-reserves areas, particularly CREMAs (Chhatre and Agrawal, 2008). Current REDD action plans under two key global initiatives—United Nations Framework Convention on Climate Change REDD and Forest Carbon Partnership Facility of the World Bank—do not yet identify CREMAs as relevant institutions for managing forests to sequester carbon or derive biodiversity and livelihood benefits from forests (Pagiola and Bosquet, 2009; Chhatre and Agrawal, 2008). They rather focus on national governments, repeating past histories of centralized control over forests. Thus, identification of relevant institutional mechanisms that channel REDD funds to local communities based on practical lessons from decentralized forest management will boost efforts to improve biodiversity and carbon sequestration without negatively affecting local livelihoods (Chhatre and Agrawal, 2008).

References

Chazdon R. (2008). Beyond deforestation: Restoring forests and ecosystem services on degraded lands. Science 320: 1458–1459.

Chhatre, A. and Agrawal, A. (2008). Forest commons and local enforcement. Proceedings of the National Academy of Sciences (PNAS) 105(36): 13186-13191.

Hardin, G. (1968). The tragedy of the commons. Science 162: 1243–1248.

Harvey, C.A., Komar, O., Chazdon, R., Ferguson, B.G., Finegan, B., Griffith, D.M., Mart´Inez-Ramos, M., Morales, H., Nigh, R., Soto-Pinto, L., Van Breugel, M. and Wishnie, M. (2008). Integrating Agricultural Landscapes with Biodiversity Conservation in the Mesoamerican Hotspot. Conservation Biology 22 (1): 8–15.

Pagiola S. and Bosquet, B. (2009). Estimating the Costs of REDD at the Country Level. http://www.forestcarbonpartnership.org/fcp/sites/forestcarbonpartnership.org/files. Accessed January 16, 2016.

SAS (1999). SAS/STAT Users Guide, 4th edn. SAS Institute, Cary, NC.

Wildlife Division (WD), (2000). Wildlife Division Policy for Collaborative Community Based Wildlife Management. Technical Report, Accra Ghana.

Perspectives on tenure rights in local community engagement in REDD+ forest conservation projects on Mount Cameroon

Nvenakeng Suzanne Awung,[1] Rob Marchant,[2] and Ernest L. Molua[3]

Summary

The success of Reduced Emission from Deforestation and land Degradation, forest conservation, sustainable forest management and enhancement of carbon stocks (REDD+), depends on effective participation of local communities because ultimately they are the ones to implement REDD+ on the ground and are the potential beneficiaries of such policy. However, few studies have examined community involvement in the design, implementation and monitoring of REDD+ projects. This field note presents a summary of community's engagement in the Mount Cameroon National Park (MCNP) conservation project at an early stage to provide information that guide management strategies in ensuring effectiveness, efficiency and equitable REDD+ programmes and prevent early failure of the initiative as REDD+ projects get implemented. This report argues that insecure tenure, ineffective communication between park managers and communities, inadequate benefit-sharing mechanism, and top-down management strategies have impeded community's engagement in the REDD+ projects within all clusters. The present level of local engagement in the MCNP conservation project, nonetheless, makes the attainment of these goals difficult. REDD+ should be based on effective participatory bottom-up approaches that empower and allow more decision-making powers to communities to achieve effectiveness and potential co-benefit expectations of REDD+.

1. Introduction

Cameroon is rich ecologically and culturally, with high flora and fauna biodiversity. Most of Cameroon's biodiversity is located in forested areas renowned for high number of endemic plant and animal species. Its significant forest cover makes Cameroon a high potential target country for implementing the REDD+ concept. The Mount Cameroon National Park (MCNP) was established in December 2009, around Mt. Cameroon (an active Haiwan type volcano covering 58,178 ha situated just 2 km from the Atlantic Ocean at its southernmost boundary) to support conservation of biodiversity, reduce deforestation and land degradation, and improve livelihoods of forest dwellers. Three protected areas close to the park are the Mokoko Forest Reserve, the Meme River Forest Reserve and the Forest Management Unit. To the South and South Eastern of the MCNP are four community forests: Woteva (1,865 ha), Etinde (4,976 ha), Bakingili (905 ha) and Bomboko (6000ha). The Western slope of the mountain is the only area in both Central Africa and West Africa with unbroken vegetation gradient from low-land evergreen rainforest at sea level through montane forest to the montane grassland and alpine grassland near its summit, thereby, making it the most biodiverse area. The zone contains more than 2,300 species of plants (800 genera, 210 families) of which more than 49 are strictly endemic and 50 are near endemic species (Cable and Cheek, 1998; Cheek et al., 1996) which may be due to the fact that the mountain is part of an important Pleistocene refugia (Beentje et al., 1994). Mt. Cameroon is host to more than 85 species of mammals, 363 species of birds (including eight threatened species and two strictly endemic species, e.g. Francolinus camerunensis and Speirops melanocephalus), 130 species of butterfly (including three endemic species), 76 species of dragon flies and one third of the reptilian fauna (86 species) in Cameroon (Beentje et al., 1994). Assessments qualify Mount Cameroon National Park as a hot spot for REDD+ activities (Sunderlin et al., 2008). Moreover carbon sequestration is possible through re-growth and forest conservation on 4300 ha of forest area (EcoSecurities, 2002).

There are about 350,000 people living around MCNP. However, due to hunting and deforestation, the population of chimpanzees, drills and elephants have been fast decreasing. The most important source of livelihood is food-crop farming, with agriculture employing about 95% of the population while some carry out timber exploitation, hunting, animal-husbandry and trading; illegal timber and firewood exploitation are rampant in the reserve. The FAO notes that the annualaverage deforestation rate in Cameroon for the 1980–1995 period was 0.6% or a loss of close to 2 million ha, and almost 0.9% for the 1990–2000 period and reached 1% between 2000 and 2005 (FAO 2006). Today, it is estimated that between 1990 and 2010, Cameroon lost 4,400,000 ha (18.1%) of forest cover at an average rate of 220,000 ha (0.90%) annually. These figures suggest that Cameroon has the second highest deforestation rate of Congo Basin countries, after the Democratic Republic of Congo. Cameroon is well placed to better exploit the Reduced Emission from Deforestation and land Degradation (REDD+) mechanism of the United Nation's Framework Convention on Climate Change, aimed at financially supporting developing countries to reduce greenhouse gas emission by taking action to mitigate climate change. REDD+ in its mandate is expected to support forest stewardship activities of local communities providing benefits like strengthening of community resource rights, empowering local institutions and improving income through benefit-sharing. However, there is concern that this might restrict customary rights (land and resource), increase centralisation of forest management, restrict local participation, lack free, prior and informed consent and inequitable benefit-sharing. Effective capacity building of local communities, knowledge and skills to engage in sustainable forestry and Payment for Ecosystem Services are crucial for REDD+ to succeed.

[1] *Nvenakeng Suzanne Awung. York Institute for Tropical Ecosystems, Environment Department, University of York, YO10 5DD, UK. Also: The Forgotten Green Heroes (TFGH), Buea, Cameroon*
Email: nvenakeng.s@gmail.com Tel.: +32466442860
[2] *Rob Marchant. York Institute for Tropical Ecosystems, Environment Department, University of York, YO10 5DD, UK*
[3] *Ernest L. Molua. (Corresponding author). Department of Agricultural Economics and Agribusiness, Faculty of Agriculture & Veterinary Medicine, University of Buea, Cameroon, P.O. Box 63 Buea, Cameroon. Tel: (+237) 699 49 43 93;*
Fax: (+237) 243 32 22 72; Email: emolua@cidrcam.org
Also: Centre for Independent Development Research (CIDR), Buea, South West Region, Cameroon

2. Materials and Methods

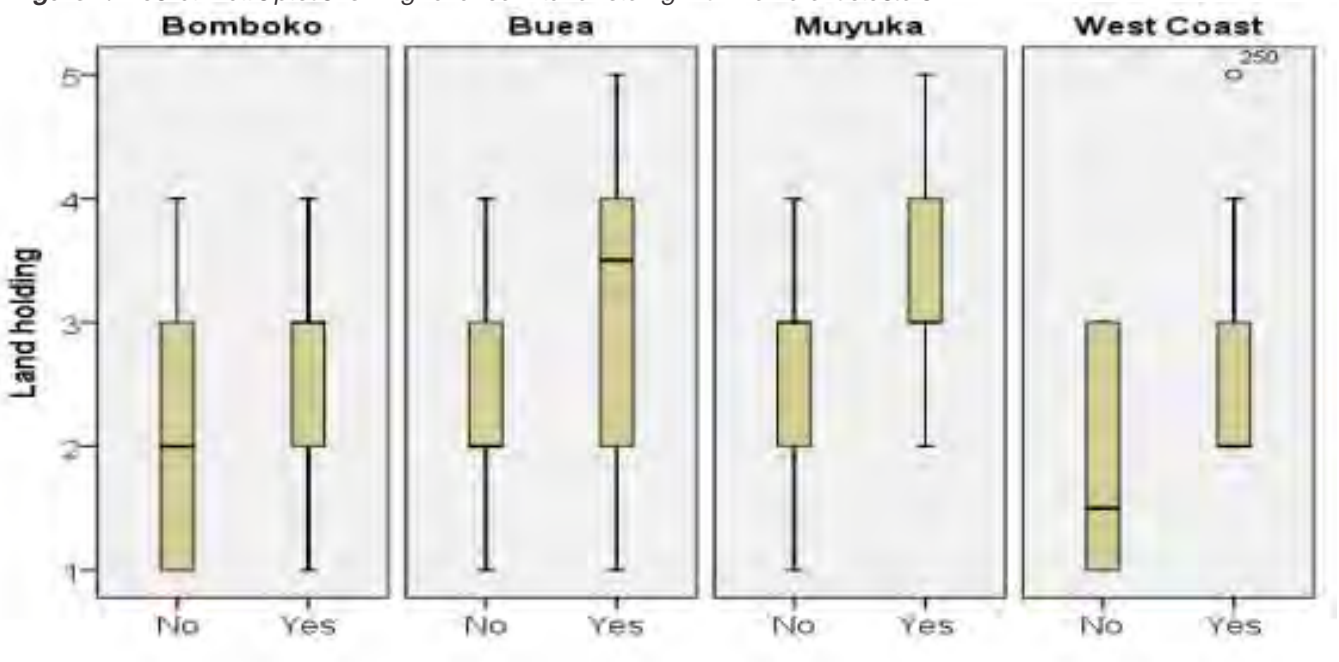
The 41 park villages in the MCNP were divided into four geographical clusters based on natural boundaries, culture and livelihood differences; through cluster multi-stage random sampling four park villages were identified for study. About 240 households were then surveyed, with respondents interviewed and focus group discussions held with key informants. In addition, consultation was undertaken on key governmental and non-governmental organisations to better understand successful strategies and principles for effectiveness, efficiency and equity in REDD+ programmes.

3. Findings and Discussion

The MCNP management involves peripheral villages which are divided into four geographical clusters (Buea, Muyuka, Mbonge/Bomboko and Idenau/West-Coast) based on natural boundaries, culture and livelihood differences to facilitate collaborative management activities. The MCNP co-management approach is managed by the German Technical Cooperation, the State and the park villages and requires full engagement of all stakeholders. Negotiation and signing of the Conservation Development Agreement is carried out by relevant stakeholders on park and three village delegates and signed by a conservator and village chiefs who are seldom educated enough to make sound decision. This agreement defines roles and responsibility and states incentives for collaboration. Only 1.5% of respondents in MCNP communities know the existence of REDD+ as a strategy, though most respondents are aware of the need to reduce the impacts of climate change, stem deforestation, promote tree planting, conservation of forest and biodiversity. REDD+ promoters also promise employment and finance of local projects through a participatory-based approach. According to Evely et al. (2011), high level of participation in conservation projects increases sustainability and adaptability because they build capacity of participants to learn and better manage projects and also stakeholders' participation in developing policy. Implementing them encourages both ownership and responsibility of environmental problems. Communities need to fully participate in REDD+ project implementation to reduce the risk of government and conservation NGO grabbing land and carrying out forest protection approach that marginalise forest dwellers.

Since 2009 members of park villages are deprived from extending farmlands into the park. Tenure rights are insecure at the MCNP REDD+ project site. Members of local communities are restricted to access land, water, food, and firewood for daily livelihood because most of them do not hold legal title to the forestland they occupy, use and derive their basic needs. Tenure is very important to forest dwellers because it is local communities that are going to practically implement REDD+ and the methods of implementation will either benefit or impact them greatly. A Kruskal-wallis test shows a significant difference between landholding in different clusters. Similarly, the t-test in figure 1 shows a significant difference in landholding between non-participants and participants in MCNP activities' groups. Result reveals a significant correlation between participation and number of landholding. A linear regression analysis model (i.e. $P = 0.981 + 0.325L$) to investigate how size of landholdings (L) influences participation (P) shows a direct correlation between landholding and participation in all clusters and also within each cluster. The absence of recognition of traditional rights to own land and restricted access to forest resources have resulted to land scarcity, conflict and decline in production of forest products and these may hinder the effectiveness of MCNP-project. Similarly, the uncertainty in land tenure system poses a problem in determining carbon ownership. Cameroon is yet to define property rights to carbon. Lack of carbon rights makes forest dwellers to question the efficiency of REDD+ in improving livelihood through forest conservation. Insecure tenure has resulted to land claims and contestation within MCNP. Some members of the community who depend heavily on the forest relocate to cities for alternatives. Securing tenure and enhancing local engagement is critical for increasing local communities' resilience or adaptive capacity to climate change. Government's ownership and control over forest have led to tenure insecurity which is significantly influencing participation in MCNP-activities. PES cannot be achieved without effectiveness and equity in customary resource rights because good governance and land tenure rights are key to ensure benefits from natural resources, so tenure needs to be the starting point to REDD+.

Figure 1: *Kruskal-Wallis plot showing variance in landholding within different clusters*



The communities on the MCNP affected by REDD+ projects rely essentially on farming, agro-forestry and harvesting of NTFPs to feed their households and generate income for themselves. Figure 2 shows that the major Non Timber Forest Products harvested mostly from the permanent or managed forest include indigenous commodities such as njansanga, bush pepper, bush mango, eru, cashew and kola-nuts. Results further reveal that communities experience a decrease in 'most important products' (e.g. firewood, timber, food and medicine) due to government restriction on reserve. The production of food-crop is declining within MCNP-clusters since 2009. As noted in Figure 3, the three main actions needed to increase the benefits from food-crops include increase cultivation of products, better access to credit/capital and equipment technology to increase yield and better access to market and reduced price risk in MCNP-clusters as well as in each cluster. In the MCNP incentives are offered to communities, with some community members recruited for boundary demarcation, while others work as security guards trapping down defaulters and reporting illegal forest activities. Community head reports any unlawful entrance or activity in the forest, creating hatred and conflict amongst them. But then, the most disadvantaged members of the community are excluded because they neither get hired nor participate in community projects.

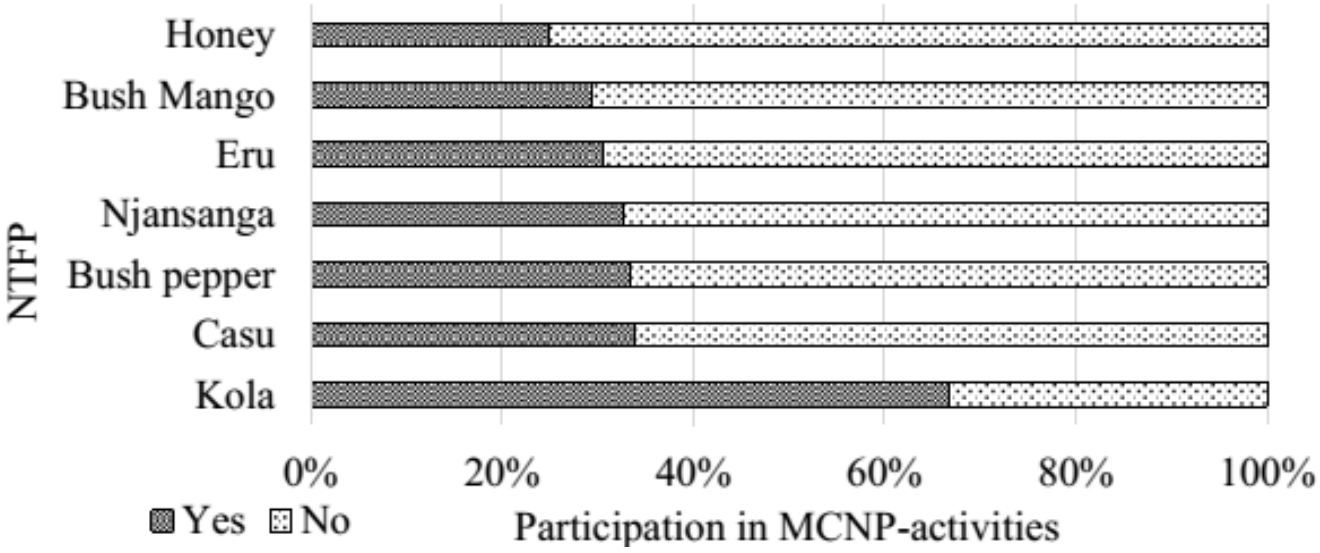


Figure 2: *Main NTFPs harvested within MCNP and how these relate to participation in MCNP-activities*

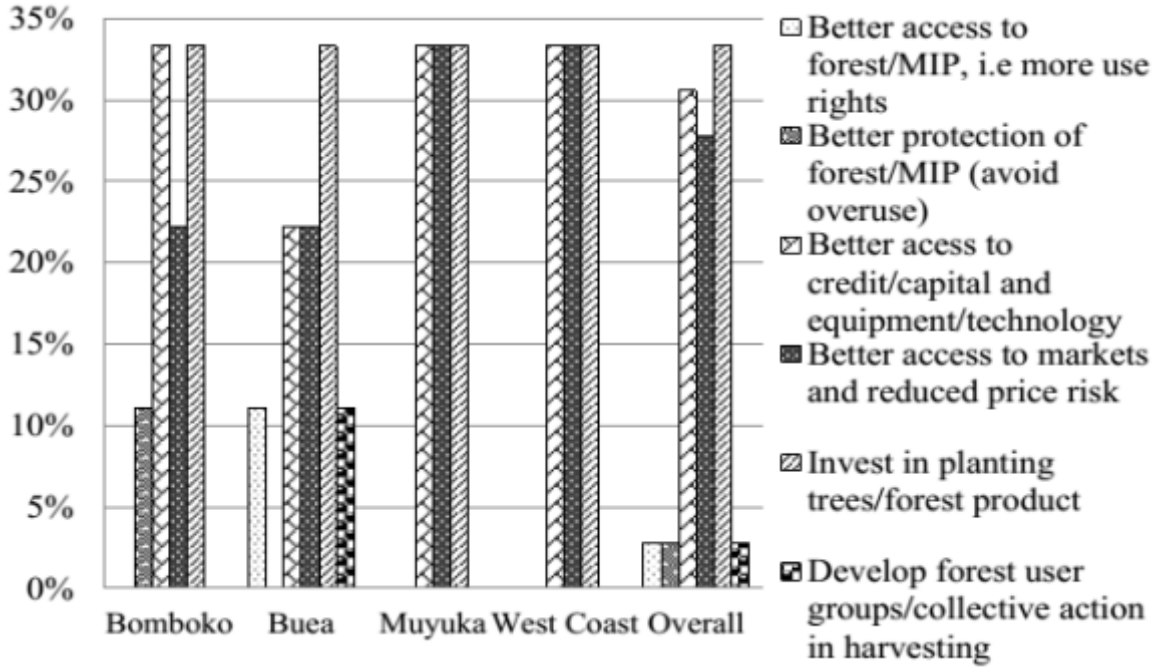


Figure 3: Reported reasons and ways to increase benefits from food within MCNP-clusters.

In addition, poor livelihood, unemployment, bad roads and absence of markets for forest products are the major problems faced by local communities not being targeted by REDD+. It is unlikely if REDD+ will really benefit local communities with associated restrictions, without solving these major issues faced by local communities. Interviewees talked mostly about forest, farm and crops from where three themes were deduced: Cameroon forestry law, community forest activities and farms food-crops. Typical comments provided by different levels of stakeholders include: "The forest is our only source of survival, but now that we have been restricted from using the forest, the people restricting us have to provide us with other means of living or give us jobs." The social and livelihood expectations of REDD+ may be threatened if land tenure reforms which are pre-condition of carbon payment and community engagement are not fulfilled during planning and implementation of REDD+. REDD+ could play a potential role in tenure reforms which need to be consistent with customary systems where local communities' rights and access to use natural resources are respected. In summary, excluding indigenous people from accessing forest resources (food, fruits, medicines, fibres, fishing and hunting) for basic need is an infringement on their livelihood, survival, and above all, their customs and traditions with limited land rights. REDD+ must not result in a situation where local communities and forest are subjected to a form of expropriation. In consequence of decline in forest products due to restriction on reserve, developmental projects and provision of improved agricultural techniques to farmers to meet up with livelihood challenges should be a priority. Local communities are key to forest management and improving tenure security is crucial for carbon sequestration potential of forest. Therefore, community forest management might be a feasible option in enhancing sustainable livelihood and communities' development while safeguarding their rights and values.

4. Conclusions and recommendations

This field research notes inadequate engagement of local communities in MCNP. As the adverse effects of climate change become more evident, the REDD+ implementation challenges such as tenure insecurity, inadequate forest governance, inequitable benefits-sharing, livelihood challenges, ineffective communication and inadequate co-management approach should be addressed to get all stakeholders on-board and uncover social safeguards in conservation and development programmes. Given its top-down implementation REDD+ projects increase marginalisation and poverty among local communities. There is need to empower local communities to better engage in decision-making about issues that concern them, claim ownership of their land through community forestry and participate as major stakeholders in all activities in their environment. REDD+, if carried out effectively, could contribute to poverty alleviation while addressing mitigation and adaptation of climate change, hence, in line with the Sustainable Development Goals. REDD+ donors and managers should support local community quests for secure tenure and national level REDD+ programmes should be linked to adaptation and community development objectives as agreed at COP-18. Cameroon should be capable to keep drivers of deforestation under control and embed customary laws into forest laws in such a way that national REDD+ strategies will fall under a broad national development strategies without marginalising forest dwellers.

References

Blom, B., Sunderland, T., &Murdiyarso, D., (2010). Getting REDD to work locally: Lessons learned from integrated conservation and development projects. Environmental Science & policy 13, 164-172.CIFOR, (2008). Forest day summary report, Forest day CentralAfrica, Shaping the debate on forest and climate change in Central Africa, Pp.7.

Cable, S., & Cheek, M. (Eds.) (1998). The plants of Mt. Cameroon: a conservation checklist. London: Royal Botanic Gardens, Kew.

Cheek, M., Cable, S., Hepper, F.N., Ndam, N., & Watts, J. (1996). Mapping plant
biodiversity on Mount Cameroon. In The Biodiversity of African Plants. 110-120. Springer Netherlands. Carl, H., & Gribble, J. (2011). Population bulletin,

http://www.prb.org/pdf11/world-at-7-billion.pdf (June, 2012).EcoSecurities, (2002). Evaluation of the Potential for Developing a Carbon Programme in the Cameroon Mountains Region (Report for CAMCOF). Oxford.

Evely, A., Pinard, M., Reed, M., &Fazey, I. (2011). High levels of participation in conservation projects enhance learning. Conservation Letters, 4, 116-126.

FAO (UN Food and Agriculture Organization). 2006. Global Forest Resources Assessment 2005: progress towards sustainable forest management. FAO, Rome

Freudenthal, E., Nnah, S., &Kenrick, J. (2011). REDD and Rights in Cameroon: A Review of the Treatment of Indigenous Peoples and Local Communities in Policies and Projects. Forest Peoples Programme.

Skutsch, M., & McCall, M.K., (2012). The role of community forest management in REDD+. Unasylva, 63(239), 51-56.
Sunderlin, W., Hatcher, J., & Liddle, M. (2008). From Exclusion to Ownership? Challenges and Opportunities in Advancing Forest Tenure Reform. Rights and Resources Initiative, Washington, DC.

Communal area landscape

Photo credit: ©FAO/Jon Spaull

Role of formal and informal institutions in the management of threats to wildlife resources in the Middle Zambezi Biosphere Reserve, northern Zimbabwe

Olga Laiza Kupika [1] *and Edson Gandiwa* [2]

Summary

The Middle Zambezi Biosphere Reserve (MZBR), in northern Zimbabwe, is under threat from anthropogenic-induced stressors such as habitat encroachment, land degradation, climate change, deforestation, and illegal harvesting of resources. Stakeholders in the wildlife sector, have a mandate to interpret international policies and adapt them to local conditions, and to inculcate them in local policies and laws. This paper uses evidence from key informant interviews, focus group discussions and documentary analysis to highlight the legal and policy framework for wildlife and forestry management as well as programmes, projects and/or strategies for sustainable utilization of wildlife and forest resources within a semi-arid environment in the MZBR. Results indicate that despite the absence of formal legislation pertaining biodiversity threats and exclusion from wildlife policy; formal and informal institutions play a minimal role addressing threats to forests and wildlife resources in the biosphere reserve. There is need to mainstream biodiversity threats particularly illegal harvesting of wildlife resources and climate change into national wildlife policies. Integrated management of wildlife resources in biosphere reserves is critical to mitigation of threats to wildlife resources.

Introduction

Biosphere reserves provide an international framework for the demonstration and implementation of participatory and integrated management of natural resources (Stoll-Kleemann & Welp (2008). The Biosphere Reserve concept was developed by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1970s to promote interdisciplinary research and capacity building for biodiversity conservation (UNESCO, 2010; Naturajan et al, 2008). UNESCO (2015) noted that climate change is already affecting designated World Heritage Sites and Biosphere Reserves. UNESCO (2011) noted that biosphere reserves play a critical role in its Climate Change Strategy of 2008 and the Climate Change Initiative of 2009. Thus UNESCO (2015:3) calls for member states to respond to "new kinds of conservation challenge posed by climate change, developing innovative policy, tailoring management strategies, and recognizing the value of resilient protected area systems that help safeguard the global environment and human societies from the threats posed by climate change.

In Zimbabwe, the MZBR, is the sole biosphere reserve, particularly, in the Zambezi River Basin (Magadza, 2013). Thus, the biosphere reserve is expected to be the icon of the promotion of conservation of natural resources through collaboration between people and nature. However, wildlife resources within protected areas such as the MZBR are threatened by multiple stressors such as climate change (Magadza, 2013), siltation of rivers (Gandiwa & Zisadza-Gandiwa, 2015) invasive species, illegal harvesting of resources, illegal alluvial gold mining, tourism development activities (UNESCO, 2010) and agriculture intensification (Chivuraise et al, 2016). According to Desanker & Magadza (2001), threats to biodiversity can result in loss of forests with consequent impacts on biodiversity and ecosystem values which are crucial for sustaining livelihoods.

Few studies have focused on the role of formal and informal institutions in managing biodiversity threats in biosphere reserves (Kusova et al, 2008; Ruiz-Mallen et al 2015; Speelman et al, 2014). Formal institutions refers to prescribed organizations based on documented rules and regulations whereas informal institutions are unofficial establishments mainly derived from societal interactions, norms and practices (Scoones,1998). This paper seeks to highlight forest and wildlife related institutions in addressing the threats and challenges of managing wildlife resources in the MZBR.

[1] *Olga Laiza Kupika, (Corresponding author) Lecturer, Department of Wildlife Ecology and Conservation, Chinhoyi University of Technology,*
Private Bag 7724, Chinhoyi, Zimbabwe;
Email: olgal.kupika@gmail.com; okupika@cut.ac.zw;
Mobile: +263 778 099 634

[2] *Edson Gandiwa. Professor and Executive Dean, School of Wildlife Ecology and Conservation, Chinhoyi University of Technology, Private Bag 7724, Chinhoyi, Zimbabwe;*
Email: edson.gandiwa@gmail.com;
Mobile:+263 773 490 202

Methods

Study Area

The MZBR was accorded the Biosphere Reserve status by UNESCO in 2010, covering Mana Pools National Park which was designated as natural World Heritage sites in 1984 (UNEP, 2011). The MZBR lies in the Zambezi Valley, covering an area of approximately 21,616 km2 (Magadza, 2013). Eighty three percent (83%) of the total area comprises the core and buffer zones (Fig. 1; Magadza, 2013).The total human population including the communal areas is approximately 40,600 (UNESCO, 2010). The MZBR comprises riverine, i.e., Lake Kariba and terrestrial ecosystems (Matusadona National Park and Mana Pools National Park). The area is endowned with diverse wildlife species including elephant (Loxodonta africana), black rhino (Diceros bicornis), painted wild dog (Lycaon pictus) and nyala (Tragelaphus angasii). The flora consist of dry savannah deciduous Brachystegia, Faidherbia albida and Colophospermum mopane woodlands (UNESCO, 2010).

Data collection and analysis

Data were collected through field observations within the MZBR ecosystem, key informant interviews and focus group discussions between April and August 2015. Open-ended key informant interview surveys were done with 19 key informants, representing traditional leaders, private landowners, the rural district council, conservation management, local NGOs and government agencies. Respondents were asked questions related to major threats to the biosphere reserve and the adaptive management policies which are in place to address these challenges. A review of published scientific literature on work conducted in the Lower Zambezi valley was also done. Data were qualitatively analysed and presented along major themes following Gandiwa & Zisadza-Gandiwa (2015) related to legal and institutional frameworks for management of wildlife and forest resources.

Results

Legal and institutional framework for sustainable management of wildlife and forest resources

Findings from documentary analysis indicate that the management of natural resources in the MZBR is governed by national and local institutions. Presently the biosphere reserve concept in Zimbabwe is being legislated using a soft law approach. It is not embedded in the Parks and Wildlife Act, therefore there is no national legislative support. However, The Constitution of Zimbabwe (Act No. 20) 2013, states that all citizens must have basic and fundamental rights, including those over natural resources. Thus, all stakeholders in the Biosphere Reserve have a mandate to utilise and manage resources within the framework of national laws. Role of formal and informal institutions in managing threats to wildlife resources in the MZBR are highlighted in Table 1.

Wildlife in Africa.

Photo credit: ©FAO/Giulio Napolitano

Table 1: Threats, policy and institutional role towards management threats to wildlife and forests in the MZBR

Threats/ issues	Guiding national and local and policy and position (in brackets)	Stakeholders participating or implementing project in the MZBR	Current intervention strategy/ projects
Climate change	• Zimbabwe National Climate Change Response Strategy (2013) (national adaptation and mitigation responses to climate change) • National Biodiversity Strategy Action Plan 2013 (Conservation and management of threats to biodiversity)	• Carbon Green Africa, • Rural District Councils (RDC), • Zimbabwe Parks and Wildlife Management Authority (ZPWMA), • Government, • Civic Society, • Local communities	Reducing Emissions from Deforestation and (Forest) Degradation REDD+ , Afforestation
Deforestation due to tobacco farming	• Forest Act (Chapter 19:05) 1949 (amended in 2002(control and management of state forests) • Communal Land Forest Produce Act 1987 (Chapter 19:04) Regulates harvesting and marketing of forest produce • Hurungwe RDC Annual Development Plan 2015 (Problem Animal Control (PAC), resolution of land disputes, , deforestation)	• Environmental Management Agency (EMA), • Forestry Commission, ZPMWA, • Local communities; • Carbon Green Africa	Forest Monitoring; Education and awareness, Afforestation
Human-wildlife conflict	• Hurungwe RDC Annual Development Plan 2015 (Problem Animal Control (PAC) monitoring of natural resources such as wildlife (CAMPFIRE), conduct stray stock auction and awareness campaigns related to nature conservation	• ZPWMA, Rural District Councils, Local communities	Awareness campaigns from problem animal control unit, Communal Area Management Programme For Indigenous Resources (CAMPFIRE) programme
Sand mining prospecting	• Hurungwe RDC Annual Development Plan 2015 (Problem Animal Control (PAC), resolution of land disputes	• ZPWMA, • EMA, • Ministry of Mines	-
Poaching and illegal harvesting of resources	• The Trapping of Animal Control Act (Chapter 20:21) (Prohibits making, possessing or using certain types of traps, and specifies the purposes for which animal trapping is permitted • Traditional Leaders Act (Chapter 29:13) 1988 as amended 2002 (Empowers traditional leaders as custodians natural resources and penalises environmental offenders) • Rural District Councils Act (Chapter 29:13) 1988 Formulates and enforces conservation by laws on threats to natural resources such as forests and wildlife: • Parks and Wildlife Act 1975 (Chapter 20:14) (as amended in 1996 and 2002) Provides guidelines for conservation of wildlife inside and outside protected areas	• ZPWMA, • EMA, • RDCs • Traditional Leadership, • Matusadonha Anti - poaching Unit • Zambezi Society	Law enforcement , Anti-poaching, Education and Awareness; CAMPFIRE; Zambezi Society -Anti poaching programme
Tsetse fly	• Tsetse and *Trypanosomiasis* Control (TTCB)	• ZPWMA, • Ministry of Agriculture • University of Zimbabwe	Research, education and awareness on tsetse control
Uncontrolled veldt fires	• Policy for Wildlife Zimbabwe 1992 (Legal and enforcement measures to prevent the illegal use of wildlife) • Forest Act (Chapter 19:05) 1949 (	• ZPWMA, • EMA, • Forestry Commission, • RDCs,	Fire management, CAMPFIRE

	amended in 2002 particularly the which is of relevance to the establishment of plantations in Zimbabwe as well as control of veldt fires, Pollution	• Local community & Traditional leadership	
Illegal alluvial gold panning	• Environmental Management Act (Chapter 20:27) 2002	• Ministry of Mines, • RDC, • Zambezi Society	Research
Siltation of rivers	• Environmental Management Act (Chapter 20:27) 2002	• RDC, • Wildlife Environment Zimbabwe (WEZ), • Zambezi Society (ZAMSOC) EMA	Local Environment Action Plan Programme (LEAP); Research
Tourism development	• Environmental Management Act (Chapter 20:27) 2002	• ZPWMA, • Tour operators, ZAMSOC, • Rural District Councils	Research, Communication, CAMPFIRE
Impoundment of Zambezi River, i.e., Lake Kariba	• Environmental Management Act (Chapter 20:27) 2002	• Zambezi River Authority, • Zambezi Society, • ZPWMA	Research, Communication
Invasive species and Changing ecology of the floodplain	• Environmental Management Act (Chapter 20:27) 2002; Forest Act (Chapter 19:05) 1949 (amended in 2002) control of invasive exotic species	• ZPWMA, • Research Institutions	Afforestation, Research on invasive species

Source: modified from Magadza (2013) & ZPWMA (2010)

Anthropogenic stressors, threats and opportunities for wildlife conservation

Findings from the key informants, Focus Group Discussions and documentary analysis revealed that key threats and challenges to the management of wildlife resources include population growth, human encroachment into the buffer zone, illegal harvesting, poaching, climate change and variability in the form of persistent droughts and high temperatures. Although there is evidence to indicate role of both formal and informal institutions, respondents noted that financial constraints and lack of government support in the form of an enabling policy environment results in failure to fully implement the biosphere reserve concept.

Discussion and Conclusion

Although formal and informal institutions in the MZBR are involved in the management of threats to wildlife and forests, efforts to address threats are hampered by weak institutional structures, lack of financial resources, too little or in some cases lack of benefits to local communities and other political factors. The key policy which is directly related to biodiversity management (the Parks and Wildlife Act) is old and as such they do not address some of the key threats such as climate change, invasive species, poaching, human wildlife conflict and illegal harvesting. There is need for an enabling policy framework to promote collaborative and holistic management of threats to biodiversity in the biosphere reserve.

Acknowledgements

"This document has been produced with the financial assistance of the European Union under the DREAM Project.

References

Chivuraise, C., Chamboko, T., and Chagwiza, G., (2016)"An assessment of factors influencing forest harvesting in smallholder tobacco production in Hurungwe District, Zimbabwe: An application of binary logistic regression model." Advances in Agriculture: Volume 2016, Article ID 4186089, 5 pages
http://dx.doi.org/10.1155/2016/4186089

Desanker, P., & Magadza, C. (2001). Climate Change 2001 Impacts, Adaptation, and Vulnerability: 494-499

Gandiwa E & Zisadza-gandiwa P (2015) Siltation of major rivers in Gonarezhou National Park, Zimbabwe: a conservation perspective. Nature & Faune 30(1);39-42

Kušová, Drahomíra, and Jan Těšitel. "Social perception of nature protection in protected areas (Czech Republic case)." Silva Gabreta 20.1: 41-54.

Magadza, C.H.D., (2013). Managing Threats to the Middle Zambezi Biosphere Reserve, In AfriMAb Biosphere Reserves in sub-Saharan africa: showcasing sustainable development. (R. Pool-Stanvliet, & M. Clusener- Godt, Eds.) Pretoria: UNESCO: 141-151

Natarajan, I., Persic, A., and Hoang Tri,N., (2008) "Concept and practice: the case of UNESCO biosphere reserves." International Journal of Environment and Sustainable Development 7.2: 118-131.

Ruiz-Mallén, I., Newing, H., Porter-Bolland, L., Pritchard, D.J., García-Frapolli, E., Méndez-López, M.E., Sánchez-Gonzalez, M.C., De La Peña, A. and Reyes-Garcia, V., (2014) "Cognisance, participation and protected areas in the Yucatan Peninsula." Environmental Conservation 41.03 (2014): 265-275.

Scoones, I., (1998). 'Sustainable rural livelihoods: a framework for analysis'. IDS Working Paper 72

Speelman, E. N., et al. "From coping to adaptation to economic and institutional change–trajectories of change in land-use management and social organization in a Biosphere Reserve community, Mexico." Land Use Policy 41 (2014): 31-44.

Stoll-Kleemann, Susanne, and Martin Welp (2008). "Participatory and integrated management of biosphere reserves: Lessons from case studies and a global survey." GAIA-Ecological Perspectives for Science and Society 17.Supplement 1 (2008): 161-168.

UNEP (2011). Mana Pools National Park, Sapi and Chewore Safari Areas Zimbabwe.
http://www.worldheritageoutlook.iucn.org/searchsites (assessed on 26 April, 2016)

UNESCO (2010) UNESCO-MAB Biosphere Reserve Directory, Biosphere Reserve Information, Zimbabwe:http://www.unesco.org/mabdb/br/brdir/directory/biores.asp?mode=all&Code=ZIM+01 (accessed on 26 Apri, 2016)

UNESCO (2015) UNESCO, Climate Change and COP 21, Paris, France

Governance of Dzanga-Sangha Protected Areas in the Central African Republic: From an administrative approach to an inclusive local management approach

Dieudonné Bruno Waneyombo-Brachka[1] *and Marie Marguerite Mbolo Abada*[2]

Summary

Like other countries in the Congo Basin, the Central African Republic is rich in biodiversity. The management of these resources continues to rely on a management system that takes into account the current realities of the various landscapes. Improving local governance of Dzanga-Sangha Protected Areas (APDS) by all stakeholders concerned appears urgent in that part of the Tri-National de la Sangha (TNS) Landscape. An inclusive governance approach integrating indigenous and local populations as well as their game practices was tested in two pilot sites of the Sustainable management of wildlife and bushmeat sector in the Central African project in Central African Republic. This experience is an opportunity for good governance of the APDS.

Introduction

In the Central African Republic (CAR) as in the other Central African countries, wildlife constitutes a major source of proteins and incomes for communities (Steeman & Waneyombo-Brachka, 2013). The Dzanga-Sangha Protected Areas (APDS) and their surroundings have been declared biodiversity "hotspots" of supraregional relevance with overlapping activities where stakeholders (indigenous and local communities) are not involved in making decisions regarding resources management. This managerial approach based on the abuse of power has shown its limitations and has led to a social and ecological dead end (Fargeot, 2011). It also portrayed a poor image of APDS to riparian communities. Therefore, it is important to promote local governance (Nguinguiri, 2003). In this article, we propose an approach based on an inclusive local governance of the Dzanga-Sangha Protected Areas (APDS).

1. The Dzanga-Sangha Protected Areas : a landscape approach

The Dzanga-Sangha Protected Areas are located in the Central African part of the Congo Basin tropical forest and in the central part of the TNS (World Heritage) with a surface area of about 4,590,000 hectares. It was established as a reserve in 1990 due to its very high density in large mammals (forest elephants, forest buffalos, gorillas, etc.) and declared a biodiversity "hotspot" of supra-regional relevance. This mosaic is subdivided in several zones with various uses: the Dzanga-Ndoki National Park where access is totally restricted and the multiple-use Dzanga-Sangha Reserve. These protected areas have a considerable ecological and touristic potential. Their touristic potential is enhanced by the presence of the only lowland gorillas accustomed to humans found in the entire continent.

The current zoning mainly dates back to the creation of the APDS in 1990. The largest portion of lands being allocated to other types of uses, indigenous and local communities, and hunters-gatherers peoples are thus subjected to new rules of access (Wildlife Protection Code, statutes and bylaws, etc.) that are directly in conflict with their survival strategies.

2. Management of Dzanga-Sangha Protected Areas

The administration of APDS has been placed under the umbrella of the Ministère des Eaux, Forêts, Chasse et Pêche and is centered almost exclusively on activities related to the original tasks for the conservation of large-fauna. This situation is explained both by the limited means available and the competencies ensuing from its position in the administrative and institutional context of the country (APDS, 2010). Management activities are:

- Management i.e. administration;
- Conservation (surveillance and ecological monitoring);
- Local socio-economic development and
- Ecotourism

[1] *Dieudonné Bruno Waneyombo-Brachka, National Technical Assistant, Projet GCP/RAF/455/GFF « Sustainable management of wildlife and the bushmeat sector in Central Africa (GEF/FAO)" Bangui – Central African Republic.*
Tél.: +236 75 71 19 05.
Email : Brachka.Waneyombo@fao.org
[2] *Marie Marguerite Mbolo Abada, Chargée de Cours Université de Yaoundé 1 – Faculté des Sciences*
Tél: +237 693 262 083
Email: noagody@yahoo.com

Planning all these activities in this vast landscape is done unilaterally by the APDS administration without involving the others relevant stakeholders. For a time, the State facilitated the development of private rights on some shared resources of that landscape while excluding the communities. Thus, the biodiversity managerial strategy grants priority to emblematic species such as elephants, gorillas and bongos. Scientific and financial resources are hence focused on these species and on both protected areas, while marginalizing commercial hunting (Fargeot, 2011), fishing, etc. (Deubel, 2010).

Biodiversity conservation in the APDS landscape is handicapped by the lack of fully functional institutional bodies to manage the Reserve, and an insufficient long term funding due an unfavorable political context, and the unwillingness of riparian communities because of rampant poverty in the area.

Despite the coercive means used, the efforts have remained fruitless due to the lack of adapted capacity. Without valid and reliable information, the APDS administration could continue to make mistakes (fines that are too high or too low, scientifically baseless quotas, etc.). Unfortunately, the managers do not realize that the other stakeholders concerned are being excluded due to some wrong beliefs.

According to the managers, indigenous and local communities would be incapable of organizing themselves and hence solutions should be imposed on them. However, the reality on the ground tells a different story: stakeholders other than riparian communities – who have been using their resources sustainably for hundreds of years – are inciting the destruction of natural resources.

For the manager, the most obvious expressions of governance with the other local actors are the repayment of part of the park entry fees to the municipality, the setting up of a consultation platform in the form of an APDS Local Arbitration Committee and the participative planning of the agricultural zone (APDS, 2010). In spite of this, indigenous and local communities are complaining about their lack of active involvement and participation in management decision making.

The current landscape management approach has numerous adverse consequences on the living conditions of communities, including the frequent pressure on natural resources and conservation. The process as rolled out is not inclusive.

3. Towards a local governance: an inclusive approach

The current trend is to work with the communities living in that landscape, i.e. within protected areas and their surroundings. For an open cooperation between stakeholders within and around the APDS in terms of governance and management of natural resources, capacity strengthening among the communities remains the major challenge for success in implementing collective interventions.

Before claiming to have sustainably managed resources in that landscape, all relevant stakeholders should be on board (i) for the structuring of communities (rights holders) into efficient, fair and socially accepted and respected local institutions (Munro-Faure and Mathieu, 2013), (ii) the assurance by other stakeholders to respect the commitments made by rights holders, and (iii) the organization of a mutual monitoring of the landscape. This approach is tested on two pilot sites of the FAO/GEF project titled GCP/RAF/455/GFF "Sustainable management of the wildlife and bushmeat sector in Central Africa" in the Central African Republic.

For a good governance of shared natural resources that are part of larger and more complex systems such as the APDS, It is proposed a local inclusive management approach that really integrates the indigenous and local communities, their game practices and their needs (Fargeot, 2011) and in which:

a. The rights-holding individuals or households, as well as the limits of the shared resource, should be clearly defined;
b. The rules restricting the appropriation of resources in terms of time, space, technology and/or quantity, are related to local conditions and commitments in terms of labor, materials and money;
c. Most individuals concerned by the operational rules can participate in their amendment;
d. The overseers report to the rights holders or are rights holders themselves;
e. The rights holders who transgress the rules are subject to sanctions;
f. The rights holders have a fast access to local affordable platforms to resolve conflicts;
g. The rights of rights holders to create their own institutions are not questioned by governmental authorities;
h. For shared resources that are part of larger and more complex systems, the activities related to appropriation, surveillance, enforcement of rules, conflict resolution and governance are organized by multiple corporate overlapping levels.

These principles have guided the corporate approach during the implementation activities related to the four components of project GCP/RAF/455/GFF "Sustainable management of the wildlife and bushmeat sector in Central Africa" in the Central African Republic.

Fargeot et al., (2015) have demonstrated that the existence of rules governing access to wildlife resources contributes to the sustainability of the bushmeat system in CAR. Their conclusion confirms the assertion by Ostrom (2010) that wildlife should be considered as a shared resource that can be managed by local communities.

Conclusion

How to connect landscape management with local governance? Local governance is an imperious necessity for the sustainable management (Combe, 2015) of the entire "Dzanga-Sangha Protected Areas" landscape as it enables to renew reflection on land governance, its modes of management and administration. To ensure the sustainability of local governance, it should not be a prisoner of rapidity, urgency, simplification, centralization and power. There is a need for balance between the vertical and horizontal dimensions of decision-making.

References

Fargeot C., 2015. Evidence of social regulation in access of wildlife in the Village Hunting Territory, the case of the Central African Republic

Munro-Faure P. & Mathie P., 2013. Promotion de la gouvernance responsable dans le cadre de la gestion des ressources naturelles en Afrique

Nguinguiri J.C., 2003. Gouvernance des aires protégées: l'importance des "normes pratiques" de régulation de la gestion locale pour la faisabilité des réformes dans le Bassin du Congo. Bulletin de l'APAD 26 (2003)

Steeman, A. & Waneyombo-Brachka, D. B., 2013. Assurer la durabilité des ressources fauniques en Afrique centrale au moyen de la participation des communautés. Nature & Faune, 27 (2): 71 – 74.

URL de la page en cours :
http://www.melchior.fr/Gouvernance-des-biens-communs.10931.0.html

Photo credit: ©FAO/Riccardo Gangale

A training session for a local community in Central African Republic

Reforestation as a strategy for restoring shallow soils and recharging groundwater in Cabo Verde

Jacques de Pina Tavares[1], José João Teixeira[1], Philippe Amiotte-Suchet[2], Samuel Gomes[1], and Domingos Barros[3]

Summary

In the domain of climate change adaptation, degraded soils restoration and groundwater recharge, Cabo Verde has opted to go green through reforestation. The success of this option largely lies in the pre-treatment of slopes using terraces and check dams prior to planting woody or forest tree species. This form of catchment management has contributed to doubling of soil water retention capacity and to ensuring efficient farming in arid and semi-arid zones. The key species in the success of reforestation is the Prosopis juliflora (approximately 61%) as compared to the others, due to its fast growth and its resistance to droughts and its capacity to adapt to eroded and shallow soils. Currently, about 80% of the water consumed in Cabo Verde comes from groundwater largely recharged by woody plant cover. Moreover it is wood originating from reforestation that supplies energy to the entire local sugar cane industry that processes cane juice into Rum. As a result of reforestation, the atmospheric carbon stored in trees is estimated at 402,103 metric tons. However, some species introduced during reforestation campaigns, such as Prosopis juliflora, Fulcrea gigante, Dichrostachys cinerea and Lantana camara, have started invading some ecosystems, such as water courses, watersheds and pastures.

1. Introduction

One of the greatest environmental challenges of Cabo Verde, a small Sahelian island state on a volcanic archipelago with 4,033 km2 of land area, has been the restoration of mountains, dunes and shallow soils. These island ecosystems have been weakened by the impact of man in his search for wood, farmland and grazing areas. These human activities combined with recurring droughts and torrential rains have caused an unprecedented loss of soil and plant cover and constant erosion to the detriment of terrestrial biodiversity and soil organic matter. This phenomenon which started since the 16th century has claimed the lives of thousands of Cabo-Verdians and has had tremendous impacts on the economy of the country and its ecological fabric. Thus, during the 17th century, under the reign of Don José, the first efforts at reforesting the islands started and the initial official actions took place mid-19th century, specifically in 1851 and 1871 on the Boa Vista Island, and in 1877 on the Brava Island (Teixeira & Barbosa cited by Soares, 1982; Bucarey, 1987). According to Livro Branco (2004), in the semi-humid mountainous region of the big island –Santiago– which is also the largest in terms of human presence, land area and agriculture, the impact of climate change was clearly seen in the volume of rainfall. Between 1941 and 2000, the annual rainfall which used to be 555 mm, dropped to 387 mm between 1970 and 2000 (Livro Branco, 2004). To meet this daunting environmental and socioeconomic challenge, land reforestation is actually spearheading the rehabilitation of degraded land and recharging the groundwater. The objective of this article is to describe, on the one hand, the strategy adopted for pre-treating the ecosystems (catchment basins, plateaus and valleys) before the introduction of forest tree species to ensure their success. The article will go further to review the biophysical and socioeconomic dimensions of these interventions.

[1]*Jacques de Pina Tavares, Rural Development Scientist at the National Institute for Agricultural Research and Development (INIDA). BP 84 Praia, Cabo Verde. Email: jacques.tavares@inida.gov.cv and jacques.tavares@gmail.com*
Tel: +238 271 1127 / + 238 989 2840 /Fax: + 238 271 1133.
- José João Teixeira, Email: Jose.teixeira@mdr.gov.cv and Jose.teixeira@inida.gov.cv. Tel: +238 271 1127/+ 238 995 1224/ Fax: + 238 271 1133.
- Samuel Gomes, Email : Samuel.gomes@inida.gov.cv /Samuel.gomes@mdr.gov.cv/
Te: +238 271 1127/+238 991 1203/Fax: + 238 271 1133
[2]*Philippe Amiotte-Suchet, Assistant Professor, Earth and Environmental Sciences-Biogeosciences UMR CNRS 5561, 6 bd Gabriel, 21000 DIJON, France, University of Dijon. Email : philippe.amiotte-suchet@u-bourgogne.fr.*
Tel: 00 33 3 80 39 3971 / Fax: 00 33 3 80 39 6387
[3]*Domingos Barros, Forestry Engineer at the Directorate of Agriculture and Rural Development (DGADR). BP 84 Praia, Cabo Verde. Email: Domingos.Barros@mdr.gov.cv Tel : +238 260 4180 / Fax: + 238 271 1133*

2. Reforestation Policy

In 1975, the year of independence of Cabo Verde, only 2,974 ha was reforested, including 2,232 ha in the mountainous region and 742 ha in low and arid regions (Bucarey, 1984 and 1987). Two years after the Independence of Cabo Verde, Belgium decided to fund the project titled "Forest development and Reforestation in Cape Verde" to reforest the Santiago and Maio Islands to the tune of 6 million dollars including about 4 millions US dollars provided through FAO. The two main objectives of the project were: Institutional support interventions by the Ministry of Rural Development (MRD), and Reforestation of both islands (Abreu & Soares, 1983). Other countries have also provided financial and technical support to the reforestation campaigns including Germany in the Fogo and Brava Islands, France in São Nicolau, Holland in Santo Antão, Switzerland in Boa Vista and Santiago, and the United States through USAID (Bucarey, 1987). In 1978, the first tree planting interventions started with the aim of protecting lands from desertification and firewood production. The reason being that over 90% of the rural and periurban population mainly used wood for cooking. Due to the severity of hydropedological conditions in the arid and semi-arid biosystems of the country several activities were conducted to ensure the success of the tree planting. Thus, there was a need to conduct in situ adaptability tests on forest tree species, to pre-treat the slopes with various devices in order to benefit as much as possible from the three or four heavy rains of the rainy season which generate heavy runoffs.

There were four main techniques (Benched terracing, contour terraces, contour ditches, and half-moons) that were adopted for treating and preparing slopes for tree planting (see Table 1 and Figure 1). These involve reducing the length and the intensity of the catchments' slopes, thus reducing the speed of runoff and the accumulation of eroded sediments behind these hydraulic structures. The latter are practically able to triple the water retention capacity of soils on slopes, as compared to other non-treated soils (Madoux, 1983). These measures have been decisive in fixating and development of the woody/tree species planted and in reducing soil erosion on catchments. These interventions are relatively easy-to-implement measures and the equipment needed for building them are available locally and are well known by farmers. On the other hand, the techniques used to torrent-correct and protect the banks of catchments, even though highly efficient in reducing the sloping of streams and stabilizing the base of catchments or banks, involve rather exorbitant financial costs that farmers cannot afford.

Table 1: The main pre-treatment techniques of watersheds and streams in Cape Verde

Type **Name in English** (Name in French and/Portuguese in bracket)	Fig. 1	Slopin g (%)	Dimensions (m)			Purpose	Costs of building *		
			Lengt h	Widt h	Heigh t		Unit .	h/j	US$
Bench terraces (Terrasse en gradins /socalco ou terraço)	a	40 - 70	variabl e	0,4	2	Irrigated farming in catchment s	ha	5150	19,00 0
Contour stone wall terraces (Murets/muretes ou arretos)	b	40 - 70	variabl e	0,3	0,5	Rainfed farming in catchment s	ha	5150	9,066
Contour ditch (Banquettes simples /banquetas)	c	30 - 80	variabl e	1,2	0,5	Reforestati on	ha	240	450
Crescent shaped terrace or half-moons (Demi-lunes /caldeira)	d	40 - 70	1,0	0,2	0,4	Reforestati on in watersheds	ha	65	114
Check dams (Digues/ diques)	e	0 - 40	20-30	0,8-2	3-5	Flood control at watercours es	m^3	13	23**

Source: Adapted from Haagsma, 1990.
* 1985-1986 on the Santo Antão Island at the far north of the Archipelago
** The average volume is between 50-100 m3. At that time US$ 1 = 2,300 escudos (local currency).

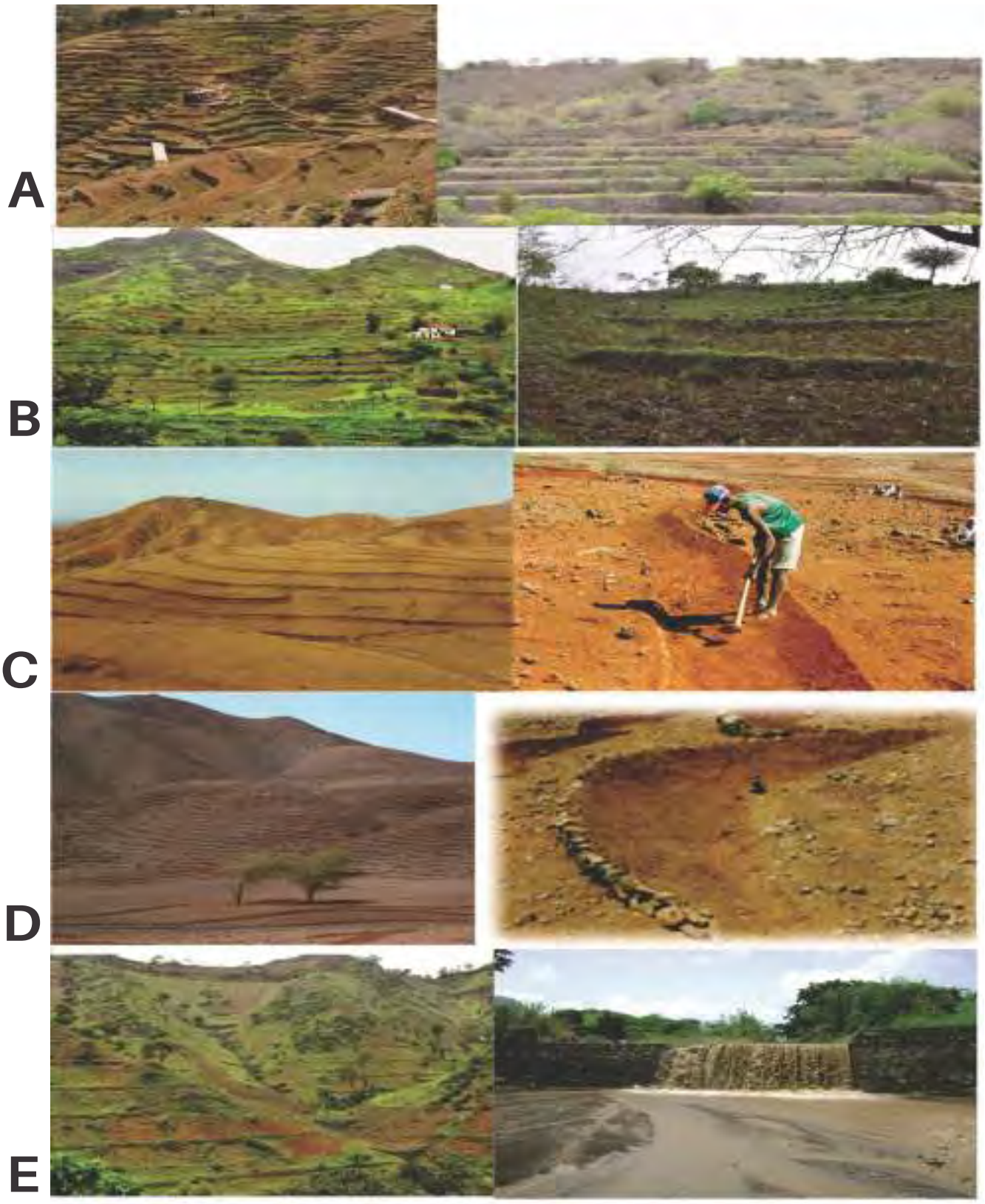


Figure 1. *Main measures adopted to manage catchment basins. (**a**) **Bench terraces** built along the slopes; (**b**) **Contour stone wall terraces** i.e. stone walls with smaller dimensions on stony slopes; (**c**) **Contour ditch** i.e. sandy slopes braided by simple terraces; (**d**) **crescent shaped terrace or half-moons** mainly built on catchments that support rain-fed farming; (**e**) **Check dams** torrent-correction dikes highly efficient in recharging groundwater and capturing eroded sediments along catchments, albeit very expensive.*

2.1. Bench terraces

These are types of walls made of stones along the catchments. This is the main soil and water conservation technique used to develop catchments in the Santa Antão Island which is the second largest island of Cape Verde due to its size, geomorphology and agricultural relevance. Using terracing, this island has brilliantly succeeded in controlling water erosion in catchments and has exploited hundreds of hectares of arable land. Using this technique, farmers perfectly control its implementation without any external support from their land, and are able to treat any type of catchment, regardless of its form and sloping. However, due to risks inherent to its implementation, the availability of stones and the arduous labor involved, building them takes a long time and is fairly expensive (Figure 1 a). Currently, there are 1,096 ha of land treated with terracing and then reforested, i.e. 1.2% of the total land area of the country.

2.2. Contour stone wall terraces (stone walls built along contour lines)

These are stone walls built along contour lines of a highly stony catchment with a 40 to 70% sloping. This technique helps to clear stony surfaces, and to use these stones to make walls as well as facilitate the cultivation of crops on the cleared surfaces. The higher the sloping of the land or catchment, the smaller the interval between contour terraces (Figure 1b). The surfaces treated with contour terraces and then reforested represent 4,310 ha, that is 4.8% of the total land area.

2.3. Contour ditch (sandy slopes braided by simple terraces)

These are types of open trenches or canals constructed along the toposequence of a non-stone catchment and perpendicularly to the slope, at regular intervals on catchments with a 30 to 80% sloping. Before opening the contour ditch, farmers determine the contour lines of the catchment using a locally designed tool called “cavalete” and a level affixed to the device. The canals have a tilt of between 1 to 2% and upstream the soil coming from the canals' opening is accumulated in the form of backfill. The width of the bench terraces can reach 120 cm and a depth of 60 cm. The dimensions vary based on the sloping, the type of soil and the climate of the region where the contour ditch are to be built. They are subdivided in 5 meters sections to minimize the risks of breakage in case of heavy rains. These retention terraces play an important role in harvesting runoff and reducing water erosion (Figure 1.c). In the studies conducted for the Forestry development project FAO GCP/CVI/015/BEL, contour ditch with a 5m-spacing built in semi-arid zones can store over 500 mm of water when the volume of precipitations varies between 250 and 300mm (Silva, 1997). Bench terraces represent the most important form of pretreatment of reforested surfaces with a surface of 23,631 ha, i.e. 21.8% of the total land area of the country.

2.4. Half-moon or crescent shaped terraces

These surface runoff harvesting structures are actually micro catchment-basins built with clay and often strengthened upstream with stones. These half-moons are designed on catchments where the sloping varies between 40 and 70%. They are arranged in staggered lines from the upstream to the downstream, narrow at the level of both extremities and large at the center, since this is the level where the runoff will concentrate and also where the plantation will be established. The height of half-moons can reach 40 cm and their width at the mid-section, 100 cm. the farther one moves from the center, the narrower it becomes (Figure 1 d). Crescent shaped or half-moon terraces are second in terms of pretreated and reforested surfaces with 19,676 ha, i.e. 17.4% of the total land area.

2.5. Check dams (or retention check dam)

These are the most used hydraulic works utilized in Cabo Verde. The main ones are rock dikes, dry-stone dikes and gabion bunds. These structures are built perpendicularly along watercourses from upstream the watershed to their mouth. Their function consists in reducing the runoff speed of floods, forcing the accumulation of water and its silt load. These infrastructures play a notable role in recharging the groundwater and restoring arable lands. They are large scope works that require substantial financial and technical resources (Figure 1e).

3. Current biophysical and socioeconomic effects of reforestation

One of the key elements in reforestation interventions is related to applied research. Thus, 63 varieties of forest tree species were tested including the main species: acacias, eucalyptus, prosopis, casuarinas, cupressus and pinus. Their seeds originate from 14 different regions, namely Australia for the 17 acacia species and the 16 eucalyptus species; India and South America for the 8 prosopis species. The seeds were tested in Cabo Verde to identify those that adapt better to the archipelago's conditions. These species were tested in the various bioclimatic strata of the archipelago based on their water requirements. Acacias and prosopis were essentially tested in arid and semi-arid zones while the eucalyptus were specifically tested in humid and semi-humid areas. Based on the forestry inventory made (MDR, 2013), there are 52 species in the reforested areas among which the prosopis, acacias, eucalyptus, pines and cupressus represent 69.1% of the total land area reforested (Table 2).

Table 2: The main forest tree species and their existing respective varieties in Cape Verde

N°	Specie	Variety	Surface (ha)	Surface (%)
1	Prosopis	5	54,697	60.8
2	Acacia	15	5,634	6.3
3	Eucalyptus	3	1,116	1.2
4	Pinus	5	534	0.6
5	Cupressus	5	127	0.1
Total		----	**62,108**	**69.1**

Tests conducted in the mountainous and humid area among species introduced, have shown that in that environment, an adult cupressus tree can produce up to 200 liters of water daily by capturing moisture from fog. Thus, 2,500 liters of water are captured for a 400 trees/ha density and for annual precipitations of 250 mm (Morais, 2012). On the Brava Island, by planting over 60 Furcraea gigante trees, a farmer was able to harvest 400 to 600 liters of water every night, thus enabling him to meet his household's needs and irrigate his small market garden (Baladon, 1980). A survey conducted among the population on Santo Antão island, has revealed that an over 40-year old acacia can capture more than 200 liters of water from fog every night (Tavares, 2016). All the small industries that process sugar cane (main crop of irrigated farming) into rum in Cabo Verde get all their wood energy supply exclusively from planted trees. The income generated by this trade plays a valuable role in the local economy of rural households. Over 80% of fodder used to feed animals in the Saint Jorge national livestock center in Santiago, come from the forests around the Pico de Antonia mountain range. Prosopis pods which are very rich in protein, play a major role as supplement in feeding small ruminants in all the islands. Even though several tree species and varieties are used in reforesting the archipelago, the prosopis species, and especially the juliflora variety is largely dominant in almost all the reforested islands, except on the Santo Antão and Fogo Islands where acacias are in the majority. In terms of water, 78% of the water currently consumed in Cabo Verde originate from groundwater that were formerly recharged only by 13% of rainwater, while the remaining 87% were lost as runoff and evaporation. Currently, less than 40% of the population still use fuelwood as source of energy for cooking in rural and periurban areas. This considerably helps reduce the human pressure on reforested lands and facilitate the growth of planted trees.

Currently, Prosopis species represent nearly 61% of existing species due to their resistance to drought and the shallowness of soils. In terms of plant cover, the forest ecosystems are habitats for wildlife. The reforested land area has increased from 2,974 ha in 1975, to 89,903 ha in 2015 with positive impacts in terms of forest products, i.e. more firewood, timber, charcoal (essentially produced on the Maio Island), in terms of fodder (prosopis pods) and organic matter (fodder production) among others.

The reforested land area has three main uses, first, wood production on a surface of 44, 975 ha, i.e. 50% of the total reforested land area, and then protection for an area of 44,681 ha, i.e. 49.7%, and lastly is its use associated with research which covers 248 ha, i.e. 0.3% of the total land area reforested. Based on the same data of forest inventory, there is at least one endemic species in 9,371 ha of reforested land, or 10.4% of the total reforested area. In the reforested humid mountainous areas, there are endemic species on a land area covering 2,070 ha (2.1% of the total reforested land) and more than twice in arid zones, that is 5,247 ha (8.2%). According to Mendes et al (2005), 80% of the reforested areas are found in arid and semi-arid zones and the remaining 20% in humid and sub-humid zones. Annual firewood production is estimated at 84,260 m3 (PAFN, 2001 cited by FAO, 2012) with only 28 m3 of timber (FAO, 2012). Nearly 402,000 tons of carbon are stored in the above-ground biomass of forest species (MDR, 2013).

Despite the invasive character of prosopis, Cabo Verde is strongly counting on this species to strengthen the plant cover of watersheds and mountains, especially in arid and semi-arid areas so as to control desertification and soil erosion. Prosopis juliflora is currently the only species that can grow properly and cover the soil in almost all the bioclimatic zones of the archipelago. As a legume, juliflora plays a notable role in strengthening the organic capital of catchment soils by capturing the atmospheric nitrogen and putting back into the soil. Another key element in choosing Prosopis juliflora for reforestation is due to the fact that its palatability level is very low, in other words, since its leaves are bitter, they are shunned by animals, especially goats that feed on everything in sight. However, due to the invasive character of prosopis and their ability to find water in the remotest and unimaginable places, they are often rejected in most villages in Cape Verde, and especially in areas devoted to rainfed and irrigated farming. In the humid mountainous region of the Santiago Island, and more specifically in the Ribeira Seca catchment basin, Lantana camara and Dichrostachys cinerea (espinho cachupa) have largely grown, thus preventing the regeneration of other species under their canopy. Another species, used to fix soils in watersheds threatened by erosion is Fulcrea gigante (carrapato), but it has become invasive, especially in grazing areas. For the moment, no measures have been taken by the relevant authorities to strongly counter the invasive character of prosopis or of the other three invasive species (Lantana camara, Dichrostachys cinerea and Fulcrea gigante).

Conclusion

The watershed management practices that precede planting of forest tree species were decisive for the establishment of forests in Cabo Verde. The configuration and intensity of terracing and their ability to store rainwater have played a key role in reducing runoff and soil erosion. The exotic woody species planted, especially eucalyptus and prosopis (Prosopis juliflora) have adapted well but to the detriment of local species (Livro Branco, 2004). The invasive nature of Prosopis juliflora which occupies nearly 61% of reforested land has not been boldly addressed. However, for the past few years, timid efforts are being made to reintroduce local species in the humid area in Serra Malagueta, on the Santiago Island. The local species reintroduced at experimental level include: Echium hypertropicum (lingua de vaca), Euphorbia tuckeyana (tortolho), and Artemisia gorgonum (losna). Overall, reforestation is proving to be a useful instrument and a long term adaptation strategy to mitigate the adverse effects of drought, desertification and climate change in Cabo Verde.

Bibliography

Abreu, A.T., 1983. Conclusões sobre a temática: Desenvolvimento e Pesquisa no longo prazo em Cabo Verde. Mesa Redonda. Edité par Armando Trigo Abreu et Horácio Soares. Fundação Calouste Gulbenkian. Instituto Gulbenkian de Ciência. CEEA, Oeiras, pp (165-188).

Amaral, I., 2007. Santiago du Cabo Verde. La Terre et les Hommes, n° 48, 2ème Edition-CSU 908 (665-822), pp 444.

Baladon, A. N. A., 1980. Precipitações ocultas e a sua utilização na agricultura. Agrometeorological Applications Associates. Ornex, France. FAO/CTA/Joint Research Center of EE, pp 180.

Barcellos, C.J., 2003. Subsídios para a história de Cabo Verde e Guiné Vol. II parte 3, 2ª Edição, notas e apresentação de Daniel Pereira, IBN.

Bucarey, J. R. E., 1987. Contributo para a história da florestação em Cabo Verde. Projecto de desenvolvimento florestal nas ilhas de Santiago e Maio –FO : GCP/CVI/015/BEL. FAO

Bucarey, J. R. E., 1984Programme de Formation et de Qualification pour le secteur forestier. Praia FAOGCP /CVI/015/BEL.

Cadamosto, L., 1550. Navegocioni di Alvise de Cadamosto, Venice, 1550 (in Chevalier, 1935)
Carreira, A., 1983. Cabo Verde – Formação e extinsão de uma sociedade escravatória (1460-1878) Inst. Nat. Do Livro, Praia, Cabo Verde.

Chevalier, A., 1935. Les ~iles du Cap Vert. Géographie, biogéographie et agriculture – Flore de l'Archipel. Revue de Botanique Appliquée et d'Agriculture Tropicale. Bull. 170-171 Oct-Nov 1935 (733-1090).

FAO, 2012. Quadro programático ao nível do país (QPP) / Country Programming Framework (CPF) 2012 – 2016, pp 53.

Livro Branco, 2004. L'Etat de l'Environnement au Cabo Verde. Ministère de l'Environnement, de l'Agriculture et des Pêches – Direction Générale de l'Environnement, pp, 228.
Leyens, T., Lobin, W., 1996. Primeira Lista Vermelha de Cabo Verde. Courier, Forschungsinstitut Senckenberg. CFS 193. Frankfurt a. M., 24.9.1996

Mannaerts, C., 1993. Assessment of the transferability of laboratory rainfall-runoff and rainfall soil loss relationsheps to field and catchement scales. International Institute for Aerospace Survey and Earth Sciences (ITC) publication – Nº 19, pp. 202.

Maudoux, E., 1983. Reconstitution d'une couverture végétale dans les écosystèmes arides et semi-arides des îles du Cap Vert. In Desenvolvimento e Pesquisa no longo prazo em Cabo Verde. Mesa Redonda. Edité par Armando Trigo Abreu et Horácio Soares. Fundação Calouste Gulbenkian. Instituto Gulbenkian de Ciência. CEEA, Oeiras, pp (165-188).

MDR, 2013. Inventário Florestal Nacional. Ministério de Desenvolvimento Rural (MDR), pp 36.
Mendes, A., Cardoso, J., Evora, R., 2005. Estratégia Nacional para Energias domésticas em Cabo Verde. Programa Regional de Promoção das Energias Domesticas e Alternativas no Sahel (P.R.E.D.A.S). DGIE & CILSS, pp. 50.

Morais, 2012. Réalités et perspectives de la filière forestière au Cabo Verde. Ier Congrès des Ingénieurs Lusophones. Centre Culturel de Bélem-Portugal, pp. 26 (diapositifs).

Haagsma, B., 1990. Erosion and Conservation on Santo Antão. No shortcuts to simple answers. SARDEP-Bilateral Cooperation: Cabo Verde – Holland. Working document nº 2. Ministry of Rural Development-Santo Antão Rural Development Project- Republic of Cabo Verde, pp. 54.

Silva, I, A, 1997. A florestação em Cabo Verde. MAAA-Direcção Geral da Agricultura, pp. 55 pp.
Tavares, J., 2016. Tecnologias Sociais – Produção de água a partir da humidade atmosférica de nevoeiro (In Press). INIDA / Projecto Mudanças Climaticas. Ficha Técnica sobre capatação de água de nevoeiro em Cabo Verde, pp 8.

Restoration programme in practice for Africa's Great Green Wall

Moctar Sacande[1]

Summary

Combining community needs and preferences with dryland plant expertise in order to select suitable native species for large-scale restoration is the approach that has been successfully used in the transboundary project for the Great Green Wall in four cross-border regions of Bankass/Mopti (Mali), Djibo/Soum and Dori/Seno (both Burkina Faso), and Tera/Tillabery (Niger). 120 beneficiary village communities, with a total population of over 50,000 farmers were selected to implement the approach, leading to the selection of 170 native plant species, most of which were mainly used for food, medicine, fodder, and fuel. Of these, 55 most environmentally well-adapted and economically relevant species were planted to initiate restoration by increasing plant diversity and vegetation cover of 2,235 ha of degraded land. On average, 60% of seedlings survived and grew well in the field after three rainy seasons. Such promising results have led to a scaling up of the approach to the whole GGW restoration area in the Sahel.

Introduction

The ambition of the reforestation and restoration efforts within the Great Green Wall for the Sahara and the Sahel Initiative (hereafter GGW) is huge (AUC/PAGGW 2012), as it is estimated about 600 million hectares of potentially restorable land circum Sahara (FAO 2016, unpublished data). After a slow start, the lessons learned from early mistakes, and from past projects are helping make the GGW initiative a success. Today, the initiative is taking shape, with the 'wall' now understood to be not long (and ultimately futile) lines of trees planted to halt the desert's "spread", but rather a metaphor for a mosaic of restoration and rural development activities, and sustainable land use approaches (Berrahmouni & Bojang 2014; FAO 2015). Planting trees is now seen as just one possible restoration strategy, but remains one of the most powerful tools for communication with and mobilisation of rural communities.

This paper describes a restoration approach for the GGW that addresses beneficiary communities' needs and preferences for useful plant species, the mobilization of quality seeds for large-scale restoration and their involvement from the planting set up to the monitoring of increasing biodiversity and land cover in the GGW (Sacande & Berrahmouni 2016). The approach is presented here and with the example of its application carried out in Burkina Faso, Mali and Niger, as part of the GGW restoration programme.

Figure 1: *General ecological extent of Africa's Great Green Wall around the Sahara (redesigned from Olson et at. 2001*

Figure 2: *Four border regions where the GGW restoration approach has been implemented in Burkina Faso, Mali and Niger.*

[1] *Moctar Sacande, Senior Expert, Forest seed & Dryland restoration. Forestry Department, FAO Viale delle Terme di Caracalla 00153 Rome (Italy)*
Telephone: +39 0657052134
Email: Moctar.Sacande@fao.org

Methods and Results

The implementation of the approach was carried out using a cross-border concept between 3 GGW countries, to initiate restoration of plots managed by rural communities for themselves and for their livestock, in four border regions of Bankass/Mopti (Mali), Djibo/Soum and Dori/Seno (both Burkina Faso) and Tera/Tillabery (Niger). A deliberate choice was made to focus on these regions that are historically strategic exchange points, and are also currently areas suffering sporadic inter-community conflicts on limited natural resources. If success can be achieved here, it would go a long way to increase understanding and mutual respect for efforts invested in restoration across international borders. Subsequently, this could – it is hoped- help smooth potential national conflicts, and conflicts between herders and farmers, as efforts and managements are collegial and reflect the essence of solidarity between communities and countries that is the inspiration for the Great Green Wall initiative. The restoration model is conceived as a five-stage approach: (i) societal needs of communities, (ii) ecological appropriateness of plant species and interventions, (iii) technical requirements for specific species selected for propagation and planting, (iv) capacity development of beneficiary communities, and (v) sustainable management, monitoring and maintenance of the restored areas.

The process of Community consultation through participatory diagnostics and their participation efforts in all the interventions, including selection of plant species and identification of both restoration objectives and areas, enables not only the understanding of local needs, priorities and preferences for plant species, but also the combination of uses of those plant species and plant products. The selected beneficiary village communities have a total population of over 50,000 farmers, in the end this process, incorporated 120 villages of the four cross-border regions, increasing markedly through their own requests for intervention, from 21 villages in 2013 to 96 in 2014 and 120 in 2015. They selected on their wish-list 170 multipurpose plant species, which are variously used by formal thematic professions of farmers, herders and traditional healers (women and men) in communities, and are needed for different objectives and reasons for propagating and planting them. The largest proportion (88%) of plant uses listed were for animal feed, medicines and veterinary products, accounting for 150 species (Sacande & Berrahmouni 2016).

All of the prioritised species by rural communities in the intervention areas were subjected to quality seed collections, parts of which were used for seedling production in village nurseries and another part for direct sowing in the field. All seeds of herbaceous fodder and woody species were collected in bulk and from the best known provenances in selected natural stands. These stands are previously identified in the seed zones that are determined by the national forest seed centres and for various species, mainly based on the similarity of ecological conditions. However, the total needs for seeds for such large-scale GGW restoration were far over what forest seed centres could make available per annum. Hence, the approach recommends that seeds be collected with the contributions and involvement of trained and supervised village technicians. Seeds' physiological characteristics and handling were studied according to international standards (ISTA 2010, OECD 2014) to determine their germination response for propagation and their thousand seed weight for quantities needed to be collected. The quality of all the seed material used was reflected in the 60-100% germination levels obtained for most species.

Operations on the ground included soil preparation for planting, which is critical for rain water harvesting and subsequently to the success of tree plantations and land restoration in those zones with long (8-9 months) dry seasons. The selected communities contributed land and labour, and helped with hand-dug planting holes, in half-moon shapes to capture rain water in designated restoration areas. In open degraded land, at least 10 species were planted per hectare, combining woody seedlings and herbaceous seed sowing usually in a ratio of 7:3 or 8:2 per station. On average, 200 to 500 seedlings were planted per hectare to maximise plant diversity, land cover and resilience and to enrich farmer-managed village lands in agroforestry systems.

Monitoring and evaluation of field performance of species showed that 60% survival was obtained, on average, after 3 years across all planted seeds and seedlings. The top five herbaceous fodder species planted (about 5 kg seed/ha) included Alysicarpus ovalifolius, Andropogon gayanus, Cymbopogon giganteus, Panicum laetum (also used as food for people) and Pennisetum pedicellatum. The preferred woody species planted across the four regions, were Acacia nilotica, A. senegal, A. tortilis, Adansonia digitata and Balanites aegyptiaca. The project capitalised on trained village technicians, who participated in collecting data on field performances of species, such as germination and survival rates of planted species in the restoration plots. Training and capacity development reached out to 105 Village Technicians who were consensually designated by villages of intervention areas.

Photo credit: ©FAO/Giulio Napolitano

Figure 3: *GGW planting in the village of Bajirga, Niger through direct sowing in traditional half-moons along with shrub and grass seeds for maximum diversity of plants*

Discussion and Conclusions

In the first three years of the project, the total area planted by the 120 partner villages across the four border regions increased from 300 ha in 2013 to 1,150 ha in 2014 and 2,235 ha in 2015. Already the benefits from year 1 were seen in the harvesting of edible grass seeds and the collecting of fodder from the planted plots for their livestock. Although this programme mainly addresses ecological restoration, it also positively impacts land productivity and agricultural performance in agroforestry systems.

Large-scale restoration of landscapes and plant reintroductions the types of GGW must be underpinned by the effective use of quality seeds of well-adapted native species and genetic considerations. This, in turn requires sufficient biological and technical knowledge of a large number of species to enable the collection, handling and germination of seeds and establishment of seedlings (Sacande & Pritchard 2004; OECD 2014, Thomas et al. 2014). As a way forward, the current six GGW countries with established national forest seed centres (i.e. Burkina, Ethiopia, Kenya, Mali, Niger and Senegal) which can mobilise and supply a total of about 25 tonnes of seeds per annum of 200 species of trees, shrubs and grasses must be strengthened through community-based restoration seed banking (Sacande & Berrahmouni 2016).

Incorporating the needs of local communities and other stakeholders for plants is of vital importance in achieving success in both environmental goals and the promotion of human and livestock wellbeing. With humans continuing to be the major driving force in dryland ecosystems any planning of restoration projects must address the needs and contexts of the people who live in the area to ensure long-term success. It is now planned for the coming years to scale up this current approach across the whole GGW restoration area in other communities, countries and in the Sahel (see www.fao.org/in-action/action-against-desertification/en/). Further research is recommended in areas of value addition and sustainable use of e.g. fodder gums and resins as non-wood forest products (NWFP) so as to address direct benefits and income generation by beneficiary communities.

References and further reading

AUC/PAGGW [African Union Commission / Pan African Agency of the Great Green Wall] (2012) Harmonized regional strategy for the implementation of the Great Green Wall for the Sahara and the Sahel initiative. Document developed with the technical and financial support of FAO, EU and the Global Mechanism of UNCCD. FAO, Rome.

Berrahmouni N., Bojang F. 2014. The Great Green Wall for the Sahara and the Sahel initiative: an opportunity to enhance gender equality in the management of Africa's natural resources. Nature & Faune 29: 50-53
FAO (2015). Global guidelines for the restoration of degraded forests and landscapes in drylands: building resilience and benefiting livelihoods, by Berrahmouni, N., Regato, P. & Parfondry, M. Forestry Paper No. 175. Rome, Food and Agriculture Organization of the United Nations.

OECD [Organisation for Economic Co-operation and Development] (2014) OECD Forest seed and plant Scheme. Rules and Regulations. OECD Publishing, Paris.

ISTA [International Seed Testing Association] (2010) International rules for seed testing. International Seed Testing Association, Bassersdorf.

Sacande M., Pritchard H.W. (2004) Seed research network on African trees for conservation and sustainable use. Forest Genetic Resources 31: 31-35.

Sacande M., Berrahmouni N. (2016) Community participation and ecological criteria for selecting species and restoring natural capital with native species in the Sahel. Restoration Ecology. DOI: 10.1111/rec.12337.

Thomas E., Jalonen R., Loo J., Boshier D., Gallo L., Cavers S., Bordács S., Smith P., Bozzano M. 2014. Genetic considerations in ecosystem restoration using native tree species. Forest Ecology and Management 333: 66–75.

FAO's Websites on GGW restoration: www.fao.org/in-action/action-against-desertification/en/; www.youtube.com/watch?v=XB5hill7ydA&feature=youtu.be;

Animals grazing in the area around Asmara, Eritrea

Photo Credit: ©FAO/Roberto Faidutti

Substitution test of *Nicotiana tabacum* by forest tree species in bio-conservation of maize kernels in southwestern savanna of Democratic Republic of Congo

Kabongo Tshiabukole,[1] Pongi Khonde,[2] Lubanzadio Nsunda,[3] and Bipini Mbula[4]

Summary

A study was carried to determine the efficacy of three plants (Nicotiana tabacum, Eucalyptus citriodora, Tephrosia vogilii) against pests of maize in storage. Leaves powder of these three plants were mixed for 27g at 270g of grain and tested in comparison with a synthetic insecticide (Actellic) during six months in real conditions of storage in Mvuazi (28- 32°C and 65-70% RH). Significant differences (p <0.05) were observed between treatments for the attack rates over time. Actellic recorded 0% of attack rates followed by Nicotiana tabacum with 12%, Eucalyptus citriodora with14% and 16% of Tephrosia vogilii with emergence powers of 80.5%, 71%, 70% and 67% respectively. Control recorded 40.75% of attack rates and 2% of emergence. These results suggest that eucalyptus and tephrosia could represent an alternative to the use of synthetic products which are generally expensive and scarce for tropical Africa.

Introduction

The conservation of food products in general and maize in particular, poses serious problems in tropical environments because insect pests by feeding destroy products and cause enormous damage. Worldwide, about 10% of the products are lost (Fleurat , 1982).These losses can reach 20 to 40% of stocks in the tropics (Foua-Bi K., 1992). Several inexpensive solutions have been proposed to reduce these losses in the respect and protection of the environment (Delobel et Malonga , 1987 ; Golob et Webley , 1980 ; Ivbijaro , 1983 Seck & al., 1996 ; Tamile , 2001). In most cases, tobacco was used to performances against infestations of postharvest insects (Danjumma et al, 2009). However, in the region of Mvuazi, tobacco powder is very popular with the public for its invigorating power. Therefore, use of some non-edible forest species can improve the quality of seed saving, replacing synthetic products and Nicotiana tabacum. The object of this study was to compare the quantitative and qualitative performance of some bio-insecticides from the forest to replace Nicotiana. tabacum and synthetic insecticides in the conservation of maize seed.

Materials and methods

The study was carried at INERA Mvuazi Research Centre (470 m, 14 ° 54'E and 21 ° 5'S) during the period from 13 January to 14 July 2011, this period corresponding to shelf life exit seed of the season A. Young leaves of *Nicotiana tabacum, Eucalyptus citriodora, Tephrosia vogilii* were harvested, dried in the shade to prevent loss of essential oils. After drying they were ground and passed to 0.5mm sieve to obtain a fine powder. Following the protocol of *Kaloma et al.* (2008)27 grams of the leaves powder were mixed with 270 grams of maize kernels (Variety *Samaru* appreciated by the people of Mvuazi) and placed in sealed polyethylene bags and placed in a previously arranged place imitating real conditions of conservation. During six months, two control samples (with and without AtéllicTM : pirimiphos-méthyl à 25%) were compared with bio-insecticides to assess the attack rates during storage; and the outcome of preservation, germination test was done in a randomized design with four replications.The data were submitted to variance analysis and the general linear model was analyzed. Significant differences to 5% have been observed (n = sample size)..

[1] *Kabongo Tshiabukole. National maize selection programme of INERA Mvuazi.*
Email: jpkabon2005@gmail.com,
Tel.: +243815992827
[2] *Pongi Khonde. Agronomist, National maize programme INERA.*
Email: Mvuazigetousfr2002@gmail.com
Tel.: +243815184592
Lubanzadio Nsunda. Technician, National maize programme INERA. Mvuazi
[3] *Tel.: +243815247106*
Bipini Mbula. Infrastructure and maintenance personnel, INERA Mvuazi.
[4] *Email: timothebipini@gmail.com*
Tel.: +243816535199

Results

Analyses of variances have, over time, showed significant differences ($p < 0.05$) between treatments. The attack rates were estimated at over 40% in the control without ActellicTM (Figure 1).

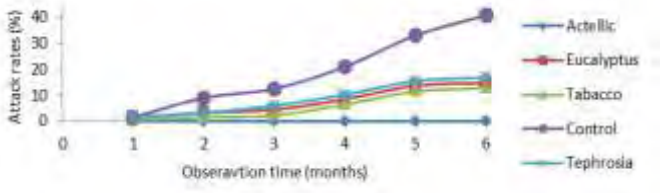


Figure 1. *Evolution of conservation corn grain attack rate*

When insecticides were applied, after 6 month the attack rates were reduced to 16%, 14%, 12% and 0% respectively for tephrosia, eucalyptus, tobacco and Actellic™.

A significant difference ($p < 0.05$) was found between treatments for the emergence rate. At the end of the retention period, kernels treatment germinated at 80.5% with Actellic followed by Nicotiana tabacum with 71%, Eucalyptus citriodora with 70%, Tephrosia vogilii with 67% and control with 2% (Figure 2).

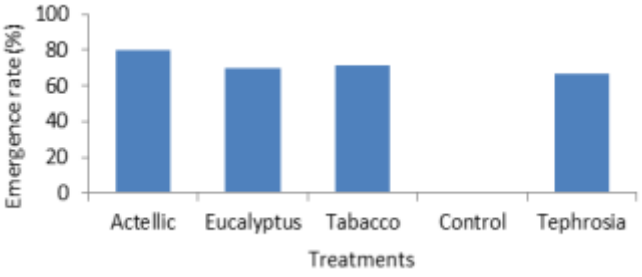


Figure.2. *Comparison of the germination after storage of 6 months*

Discussion and conclusion

It appears from these results that all the grains of the control have been destroyed at 40%. The same plant extractions effects against insects have been reported by Liu (1991) and by Ogendo et al.(2004). Golob & al.(1982) also reported that Nicotiana tabacum powder application provided protection of the grain of maize against maize weevil Sitophilus zeamais and the grain moth Sitotroga cerealella during storage. A similar situation was presented by Gakuru & Buledi (1993) when comparing the effects of tobacco powder and castor oil on weevils of Vigna unguiculata. Indeed, Actellic and Nicotiana tabacum are commonly used in the food crop seed conservation in tropical Africa (Danjumma et al ; 2009 ; Malik et Mujtaba, 1984). The repellency of Tephrosia vogilii against Sitophilus zeamais was reported by Ogendo et al (2004). Regarding Eucalyptus citriodora performance have been reported by Kaloma & al. (2008) and Tamil (2001) in the conservation of common bean and maize. After this study, it appears that maize weevil Sitophilus. zeamais actually colonize the land of Mvuazi causing damage. The insecticide and insect repellent effect of powdered tobacco leaves, eucalyptus and Tephrosia vogilii have been proven on Sitophilus zeamais. The effectiveness of these powders was demonstrated when applied to 10% of the seed weight. At these doses, these plants could validly replace standard products commonly used.

Recommendations and suggestions

Residues of Tephrosia vogilii leaves being harmful in the food and feed (Wilbaux, 1934), these would be indicated for the precious seeds not intended for later consumption. Regarding Eucalyptus citriodora, leaves residues are harmless (Kaloma et al., 2008). An economic analysis of the use of these leaves, taking into account the labor involved and the reduction in the cost of purchased inputs and alternatives is important to give recognition to the potential value of the use of these species to improve livelihoods. Such an assessment should also include the impact on the sustainability of using these forest species.

References

Danjumma B.j, Majeed Q., Manga SB.,Yabaya A., Dike MC. & Bamaiyi L. 2009: Effect of Some Plants Powders in the Control of Sitophilus zeamais Motsch (Coleoptera: Curculionidae) Infestation on Maize Grains, American-Eurasian Journal of Scientific Research 4 (4): pp313-316

Delobel A. & Malonga P., 1987: Insecticidal properties of six plants materials against Caryedon serratus (OL) (Coleoptera: bruchidae). J. Stored Prod. Res., Vol. 23, 3, pp173-176.

Fleurat-Lessard F., 1982 : Les insectes et les acariens. In: Multon J.L. (Coordonnateur): conservation et stockage grains et graines et produits dérivés. Tome 1, Paris, Lavoisier, pp. 394-436.

Foua-Bi K., 1992 : La post-récolte en Afrique. Préambule. Act. du Sém. Int. Abidjan: 29 janv.-1 fév. 1990, Montmagnis; AUPELF-UREF, pp. 4-8.

Gakuru S. & Buledi M.K., 1993 : Effet comparé des poudres de tabac (Nicotiana tabacum L.), de citronnelle (Cympopogon citratus DC Stapf) et de l'huile de ricin (Ricinus communis L.) sur conservation des graines de Vigna unguiculata (L.) Walp. Tropicultura, 13, 2,pp 59-61.

Golob P. & Webley D., 1980: The use of plant and minerals as traditional protecting of stored products. Rep. Prod. Inst. G., 138, Vit. 32 p.

Golob, P., J. Mwanbula, V. Mbhango & F. Ngwube, 1982. The Use of Locally Available Materials as Protectants of Maize Grains against Insects Infestation during Storage in Malawi. J. Stored Products Res., 18: pp67-74.

Ivbijaro M.F., 1983: Toxicity of neem seed, Azadirachta indica to Sitophilus oryzae in stored maize. Protection Ecology, 5, pp353-357.

Kaloma A., Kitambala K., Ndjango N.L., Sinzahara U. & Paluku T, 2008 : Effet des poudres d'Eucalyptus citriodora, de Cupressus lucitanica et de Tagetas minitiflora dans la conservation du maïs (Zea mays) et du haricot (Phaseolus vulgaris) dans les conditions de Rethy (République Démocratique du Congo) ; TROPICULTURA, 2008, 26, 1, pp24-27

Liu. T P. 1991: Tabaco Smoke and Tracheal Mite, American Bee J., 137(7): pp. 439-439.

Malik MM & Mujtaba Naqvi SH, 1984: Screening of some indigenous plants as repellants or antifeedants for stored grain insects. J Stored Prod Res 1984; 20 : pp41-4.

Ogendo, J.O., Deng, AL., Belmain, S.R., Walker, DJ. & Musandu, AAO. 2004. «Effect of Insecticidal Plant Materials, Lantana camara L. and Tephrosia vogelii Hook, on the Quality Parameters of Stored Maize Grains». Journal ofFood Technology in Africa 9, 1: pp29-35.

Seck D., Lognay G., Haubruge E., Marlier M. & Gaspar C., 1996: Alternative protection of cowpeas seeds against Callosobruchus maculatus (F.) (Coleoptera: Bruchidae) using hermetic storage alone or in combination with Boscia senegalensis (Pers.) Lam. Ex Poir. J. Stored Prod. Res., 32, 1, pp39-44.

Tamile A., 2001 : Essai préliminaire de conservation de semence de Phaseolus vulgaris à l'aide des poudres de certaines plantes dans les conditions de Nioka. INERA/Nioka, Inédit, 11 p.

Wilbaux R., 1934 : Composition et Propriétés Toxiques des Graines et des Feuilles de Tephrosia Vogelii Hook. f.Revue de botanique appliquée et d'agriculture coloniale Année 1934 Volume 14 Numéro 160 pp. 1019-1027

Strategy for improving wild mango (Irvingia gabonensis) productivity in Equatorial Guinea

Armand Asseng Zé,[1] *Ousseynou Ndoye,*[2] *and Norberto Lohoso Bela*[3]

Summary

While engaging in their income-generating activities, rural communities in Equatorial Guinea are faced with various challenges including the unwillingness to work in groups, the need to strengthen entrepreneurial capacity, and the difficulty in increasing their productivity using traditional methods. The Project GCP/RAF/479/AFB implemented by FAO, has trained communities in Abiara Esatop (Nsok-Nzomo) and Moka, Equatorial Guinea, in entrepreneurial development and in wild mango (Irvingia gabonensis) domestication techniques. Using a trainer, the project taught participants how to produce two hundred layers of Irvingia gabonensis on the branches of this mature tree. Also, 400 improved Irvingia gabonensis species bought by the project for the beneficiaries have been planted in farmers' fields. Moreover, members of the groups have received hundred and sixty machines worth CFAF 2,560,000 (US$ 4,655). These machines will enable them to easily split the wild mango fruits to extract the kernel, thus avoiding accidents and injuries caused by the use of machetes or knifes.

1. Introduction

Equatorial Guinea is one of the five member countries of the Central African Forests Commission (COMIFAC) involved in Project GCP/RAF/479/AFB "Strengthening the contribution of Non-Wood Forest Products (NWFPs) to food security in Central Africa". This project is implemented by the United Nations Food and Agriculture Organization (FAO) under the supervision of the Central African Forests Commission (COMIFAC). It is funded by the African Development Bank (AfDB) through the Congo Basin Forest Fund (CBFF).

With a view to improving the integration of NWFPs in policies, the authorities of Equatorial Guinea established a National Consultative Committee on NWFPs (CCN-PFNL in French) in June 2014. The CCN-PFNL is the governmental body in charge of coordinating all NWFPs-related interventions. This committee has overseen all the activities of project GCP/RAF/479/AFB at national level, including: i) baseline studies at the Abiara-Esatop (Nsok-Nsomo) and Moka pilot sites; ii) formulation of the strategy and action plan for the development of NWFPs in Equatorial Guinea; iii) study of the policy, legal and institutional framework governing the NWFPs sector in Equatorial Guinea; and iv) suggestion of NWFP-related articles to be amended in the 1997 Forestry Law. These activities are in line with the vision of Equatorial Guinea for 2020. In that vision, an analysis of productive sectors shows tremendous potential, of which crude oil – the bedrock of the economy – represents only a part. Other sectors, including NWFPs, could become the pillars of a diversified Equatoguinean economy in 2020 (Republic of Equatorial Guinea, 2007). These activities are in line with the National Forestry Programme of Action of Equatorial Guinea (PNAF) which addresses NWFPs, more specifically in Sub-chapter 4.1.5. (Recursos forestales no maderables) of Chapter IV on the diagnostic of the status of the forestry sector (PNAF, 2000).

2. Importance of NWFPs in Equatorial Guinea

The surveys conducted at the Abiara-Esatop (Nsok-Nsomo) and Moka pilot sites as well as the Ebebeying, Riaba and Lùba markets have shown the actual diversity of NWFPs. However, about twenty of these products are more frequently used by populations as described in Table 1.

[1]*Armand Asseng Zé, Natural Resources Specialist, Non Wood Forest Products, Project FAO-NWFP GCP/RAF/479/AFB;*
Email: Armand.AssengZe@fao.org and assengze@yahoo.fr;
Tel: 237 677 18 61 83
[2]*Ousseynou Ndoye, Chief Technical Adviser (CTA) Project FAO-NWFP GCP/RAF/479/AFB;*
Email: Ousseynou.Ndoye@fao.org;
Tel: +24101774783
[3]*Norberto Lohoso Bela, National Coordinator of Project FAO-NWFP GCP/RAF/479/AFB in Equatorial Guinea;*
Email: Norberto.lohosobela@fao.org;
Tel: +240 222 25 3043
[4]*The four other countries are: Burundi, Rwanda, Sao Tome and Principe, and Chad.*

Table 1: Main NWFPs used in Equatorial Guinea

N°	Local name	Scientific name	Family	Parts used	Use
1	Andok/Chocolate	*Irvingia gabonensis*	Irvingiaceae	Kernels; fruits; bark of the tree	Food (kernels and fruits); sale; Traditional medicine (barks)
2	Sisa	*Solanum américanum*	Solanaceae	Leaves	Food and sale
3	Medicinal plants (ex Ekouk)	*Alstonia bonei*	Apocynaceae	Bark of the tree	Traditional medicine (barks) and sale
4	Ekang/ Aceite de palma	*Elaies guineensis*	Arecaceae	Fruits	Food and sale
5	Atom	*Dacryodes macropylla*	Burseraceae	Fruits	Food and sale
6	Atanga/Obe	*Dacryodes edulis*	Burseraceae	Fruits	Food and sale
7	Eweume	*Coula edulis*	Olacaceae	Kernels	Food and sale
8	Woé/vue	*Apis mellifera*	Apideae	Honey Wax Propolis	Food and sale; Traditional medicine
9	Amvut	*Trichoscypha macrophylla*	Anacardiaceae	Fruits	Food and sale
10	Abehe/cola	*Cola acuminata*	Sterculiaceae	Kernels and barks	Food (kernels); Sale; Traditional medicine (barks)
11	Oñeñ	*Garcinia kola*	Clusiaceae ou Guttiferae	Kernels and barks	Food (kernels); sale; Traditional medicine (barks)
12	Engong	*Trichoscypha acuminata*	Anacardiaceae	Fruits	Food and sale
13	Nsuiñ	*Raphia* spp.	Arecaceae	Fruits	Food and sale
14	Bushpeper	*Piper guineense*	Piperaceae	Fruits	Food and sale
15	Bitalif	*Vernonia amigdalina*	Asteraceae	Leaves	Food; sale; Traditional medicine
16	vuha	*Alstonia congensis*	Apocynaceae	Barks	Traditional medicine
17	Völolo	*Annickia chlorantha*	Annonaceae	Barks	Traditional medicine
18	Milaba-laba	*Bidens pilosa*	Asteraceae	Leaves	Traditional medicine
19	Bihasa	*Prunus africana*	Rosaceae	Barks and leaves	Traditional medicine
20	Aligueta peper	*Aframomum melegueta*	Zingiberaceae	Fruits	Food; sale; Traditional medicine

Source: Project GCP/RAF/479/AFB

The table shows that 45% of the twenty NWFPs are used for food and as income sources, 30% cumulatively for food, income and healing through traditional medicine, and 25% only for traditional medicine.

The wild mango (Irvingia gabonensis), one of the most important NWFPs identified by Equatoguinean populations is highly valued for food, income generation and its medicinal attributes. Its fruits are mainly collected by women who are among the beneficiaries of the project.

3.1. Identification and analysis of challenges encountered by producers

Table 2: *Challenges faced by wild mango producers*

Challenges	Targeted structures	Comments
	In the short term	
Injuries caused by the use of machetes or knives on farmers' hands and fingers while cutting the fruits to extract the kernel. This hinders the production of large quantities of kernels of this NWFP	Technicians, Ministry in charge of Forestry, development partners, farmers	The machine to split the wild mango designed by technicians is already available. The Ministry in charge of Forestry and development partners are planning to increase their number and distribute them to farmers. The latter could acquire these machines by themselves.
Poor condition of roads and irregular availability of vehicles. The condition of the road network prevents vehicles from reaching production zones. Those that do are not regular.	State	Maintain the roads to ensure they are always in good condition
Harassment by municipal officers who randomly charge amounts varying between CF F 1,000-2,000-3,000 and 5,000 based on the volumes of NWFPs.	State and law enforcement agencies	- Improve the policy, legal and institutional framework of NWFPs; - Enforce the applicable legislation and sanction abuses
	In the medium term	
Insufficient number of productive wild mango trees to meet the demand. The fruits are collected under natural and planted trees. However, the production of these categories of trees does not meet the demands of the population, hence the need to promote domestication	Researchers/ Scientists, Civil Society organizations, farmers	Promote domestication
	In the long term	
Wounds caused by thorns and lianas as well as bites by insect pests	Farmers	Wear protective equipment while harvesting *Irvingia gabonensis* (boots, gloves, hats, appropriate suits)
Irregular production. It has been observed that some trees do not produce fruits for a period of two years or produce less fruits than normal.	Researchers/Scientists	Conduct studies on the causes of irregular production including the effects and impacts of climate changes on *Irvingia gabonensis* production
- Presence of rains. They prevent kernels from drying properly - Poor kernel drying, storage and conservation practices - Attacks of kernels by weevils	Researchers/ Scientists and farmers	Strengthen the capacity of farmers on best drying, storage and conservation techniques for *Irvingia gabonensis* developed by researchers/scientists

3.2. Strengthening farmers' capacity following the challenges encountered

The capacity of the project's beneficiaries was strengthened by organizing farmers into Small and Medium Forest Enterprises (SMFEs), by domesticating the wild mango, by manufacturing and officially handing-over the machines for splitting wild mangoes in order to reduce women's arduous labor and accidents caused by the use of machetes and knives.

3.2.1. Organization of farmers into SMFEs

During the training on entrepreneurial development for SMFEs, farmers were taught concepts of organized, structured, functional and dynamic professional groups and the advantages of working in groups as well as the need to organize group sales of NWFPs. At the end of the training, 11 SMFEs were created/strengthened in Equatorial Guinea. The first group sales organized in Nsok-Nzomo on February 20th 2016, enabled four groups (1.Union de cora zones, 2. Fuerza del Pueblo, 3.Buena Semilla, 4.Compression y Amor) totaling 72 farmers, to get a profit of 517,600 CFA F after deducting expenses in the amount of 105,000 CFA F from the total gross sale of the products worth 622,600 CFA F.

3.2.2. Training on Irvingia gabonensis domestication techniques

The project has trained communities in Abiara Esatop (Nsok-Nzomo) in Irvingia gabonensis domestication techniques. Eighty direct stakeholders of the Irvingia sector, including 50 women and 30 men, participated in this training. At the end of the training, the participants had been taught how to produce two hundred layers of Irvingia gabonensis on the branches of mature trees. Also 400 improved Irvingia gabonensis species procured by the project for the beneficiaries have been planted in farmers' fields.

3.2.3 Machines for splitting wild mango fruits

Hundred and sixty machines for splitting wild mango fruits have been manufactured by the project. This required an investment of 2,560,000 CFA F (US$ 4,655), or 16,000 CFA F per machine. These were handed over to farmers' groups in Abiara Esatop (Nsok-Nzomo) during a ceremony chaired by the Director of Forestry (Chairman of the CCN-PFNL) representing the Minister in charge of these resources. The FAO Representative in Equatorial Guinea and the Government Delegate of Nsok-Nzomo were among the high officials who participated in the ceremony. These machines will help improve women's labor productivity and prevent wounds caused by the use of machetes and knives to split Irvingia gabonensis fruits to extract the kernel.

4. Conclusion

NWFPs in general and the wild mango in particular, are of great importance for communities in Equatorial Guinea. In view of this, the government considers them as a priority and has engaged in a project to diversify sources of growth. It would be advisable, with the support of development partners such as FAO and of CCN, to exploit the full potential of NWFPs and contribute to facilitate the emergence of Equatorial Guinea. In fact, according to Guinea Ecuatorial 2020, at the beginning of the "second decade of oil" this country should meet major challenges among which the diversification of the economy.

In order to reach that objective, the following actions should be conducted: i) further domestication and processing of Irvingia gabonensis in the form of cubes; ii) valorization of 'njanssang' (Ricinodendron heudeulotii); iii) modern processing of medicinal plants, most of which are sold in an archaic manner; iv) development of beekeeping due to the presence of numerous melliferous trees; v) establishment of Prunus africana plantations in Moka due to the favorable climate in that locality, etc.

5. Bibliography

République de la Guinée Equatoriale, (2007). Guinée Equatoriale 2020, Agenda pour une diversification des sources de la croissance. Tome I Diagnostic stratégique. Rapport final 83p.

Ministerio de Planificación y Desarrollo Económico. Plan Estratégico Guinea Ecuatorial horizonte 2020.

Ministerio de Bosques, Pesca y Medio Ambiente, República de Guinea Ecuatorial. Programa Nacional de Acción Forestal (PNAF) Política Forestal de Guinea Ecuatorial, Febrero 2000.

Ministerio de Pesca y Medio Ambiente. Estrategía y Plan de Acción para la conservación de la biodiversidad en Guinea Ecuatorial 2005.

FAO, (2016a). Estudio de base sobre productos forestales no maderables de origen vegetal a la seguridad alimentaria en el consejo de poblado de Abiara-Esatop, distrito de Nsok-Nsomo, Guinea Ecuatorial. 37 p.

FAO, (2016b). Estudio de base en la localidad de Moka, Guinea Ecuatorial. 44 p.

FAO, (2016c). Rapport final des formations sur le développement entrepreneurial des très petites et moyennes entreprises forestières (TPMEF) au Tchad, au Burundi, au Rwanda, en Guinée Equatoriale et à Sao Tomé et Principe. 67 p.

Preliminary studies on *Imbrasia oyemensis,* a valuable non-wood forest product in Cameroon

Paule Pamela Tabi Eckebil,[1] François Verheggen , Denis Jean Sonwa, and Cédric Vermeulen

Summary

The consumption of insects plays a major role in food security among populations in Africa, Asia and Latin America. Imbrasia oyemensis (Saturniidae) is an edible caterpillar belonging to the category of Non-wood forest products (NWFPs). It feeds specifically on Entandrophragma cylindricum, a tree commonly known as "Sapele" tree and categorized among the main timber species exported. The use of this species could therefore prove competitive for the local populations who could find themselves deprived of the caterpillar – a prized resource. This article presents the preliminary findings of an ongoing study that aims at identifying the morphological and physiological features of trees involved in the selection of nesting sites for these moths. The primary findings show that caterpillars are found on co-dominant or dominant individuals that have already reached regular fruiting age. Further in the study, more in-depth analyses of the chemical content of Sapele leaves and trunks will help define the appropriate conditions for developing I. oyemensis larvae. These results will provide useful paths as entry point to studies on the ecology of caterpillars in relation to its host tree.

Introduction

The consumption of insects or « entomophagy » is a secular practice among populations in tropical zones and is highly valued in their culture (Bodenheimer, 1951; Van Huis, 2013). Approximately 1,500 species of edible insects have been identified to date (Malaisse, 2004); the Lepidoptera Order is the most consumed group of insects. Imbrasia oyemensis, a moths from the Saturniidae family, generally fits the definition of Non-wood forest products (NWFP) – products of biological origin other than wood and found in forests or woodlands (FAO, 1999). Local populations in subsaharan africa specifically focus on this species, harvesting it massively at the caterpillar stage "(Balinga et al., 2004; Van Huis, 2003)" and consuming it instead of meat and fish during their proliferation periods "(Akpossan et al., 2009).. This moth species is specific to the Sapele (Entandrophragma cylindricum), a wood species of the Meliaceae family, the distribution area of which spans from Sierra Leone to Uganda (Vivien et Faure, 1985). The competition between logging and harvesting this NWFP makes Sapele a pottentially competitive species (Vermeulen et al., 2009), however numerous factors remain unknown on this moth species (Tabi Eckebil et al., Soumis). Thus, in order to determine the criteria for the selection of moths to ensure the survival of their progeny, we raise the assumption that several morphological features of trees would be used by I. oyemensis in finding ideal nesting sites. To test this assumption, we have quantified the relative abundance of caterpillars per Sapele tree and have compared this abundance with the main morphological features of trees , i.e. the dimensions of the bole and crown.

Materials and Method

The southern part of Cameroon is made up of production forests, i.e. 34% of forest area (Eba'a Atyi et al., 2013). In the context of the sustainable forest ranges management, various licensed logging companies have a department dedicated to sylvicultural studies. To that effect, the experimental systems called "phenological plots" have been installed in the forests where the species are studied. The aim was to improve knowledge about the development cycle of forest species and initiate actions in response to the disturbances they are subjected to (logging, climate change) in order to ensure their sustainability.

This study was conducted within one of the phenological plots installed in the forest range of a forest concession certified by the Forest Sustainable Management "FSC" located in the south-east of Cameroon, renowned for its rich forest species and viewed as an area abounding with Sapele trees (Fig. 1).

[1]*Paule Pamela Tabi Eckebil (1,*), François Verheggen (2), Denis Jean Sonwa (3), Cédric Vermeulen (1)*

*(1) Paule Pamela Tabi Eckebil Laboratoire de Foresterie tropicale, Axe Gestion des Ressources Forestières, Département Biose, TERRA-Fac, Gembloux Agro Bio Tech, Université de Liège. Passage des Déportés, 2. B-5030 Gembloux (Belgique). *E-mail: pamela.tabi@gmail.com/ptabi@doct.ulg.ac.be*

(1) Cédric Vermeulen Laboratoire de Foresterie tropicale, Axe Gestion des Ressources Forestières, Département Biose, TERRA-Fac, Gembloux Agro Bio Tech, Université de Liège. Passage des Déportés, 2. B-5030 Gembloux (Belgique). E-mail: cvermeulen@ulg.ac.be

(2) François Verheggen University of Liège – Gembloux Agro-bio Tech, Functional and evolutive entomology. Passage des Déportés, 2. B-5030 Gembloux (Belgique). E-mail: fverheggen@ulg.ac.be

(3) Denis Jean Sonwa Center for International Forestry Research /International Institute of Tropical Agriculture (CIFOR/IITA). BP. 2008 Messa Yaoundé – Cameroun. E-mail: d.sonwa@cgiar.org

Figure 1. *Study area (Source: Environmental and Social Impact Study of UFA 10038 – GIMERC 2009)*

The phenological plot in which the data is collected is composed of 175 Sapele trees the biological cycle of which has been studied for the past five years. Among these trees, 36 have been identified as having born caterpillars at least once during the past four years (2010-2014) and are analyzed by the current study. These trees are distributed based on their bole-diameter falling in a 20-100 cm range. At the same time, in addition to the diametric measures, measurements were taken on the estimated height of the trees, as well as the dimension of the foliar crown, so that all the morphological parameters of the trees are taken into account in assessing the reasons that explain the relative abundance of caterpillars on some Sapele trees rather than others. These tree measurements are taken using a circumferential tape to measure the diameter; of a decameter to measure the leaf crown; and of a Suunto clinometer to measure the height.

To quantify the caterpillars, a surface equivalent to a projection of the bole on the ground, has been defined around each tree and subsequently cleared from shrubs and weeds to facilitate the counting of caterpillars falling to the ground. The material needed for the collection included tarpaulins, pickets and baskets (Fig. 2).

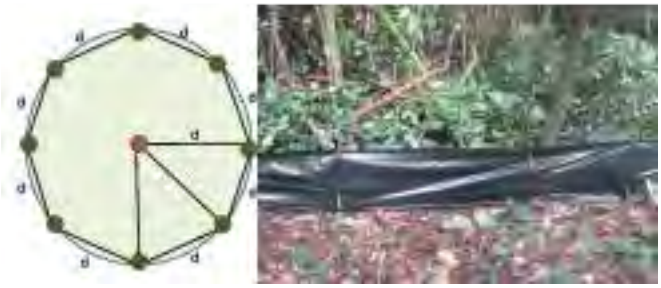


Figure 2. Materializing the crown cover on the ground using tarpaulins and markers

In order to define a perimeter around each Sapele tree, tarpaulins were arranged as hedges supported with wooden pickets to trap caterpillars within the perimeter and thus quantify their abundance better.

In the South-East of Cameroon, and generally speaking, caterpillars typically occur between the months of July and August each year. During this study, the sampling was done during a five-week period and at a sampling frequency equivalent to two observations per week (i.e. a total of ten observations). However, the full season of I. oyemensis caterpillars actually lasts only two weeks during the month of August.

RESULTS AND DISCUSSION

The sampling is made up of 36 Sapele trees that have born caterpillars over four consecutive years of phenological monitoring out of a total of 175 Sapele trees present in the plot studied. Figure 3 below shows a few caterpillars harvested at the base of a tree.

Figure 3. *Imbrasia oyemensis caterpillars*

Figure 4. Entandrophragma cylindricum Sapele Tree in Congo Brazzaville

Photo credit: © en. Wikipedia.org

Below, Table 1 provides the number of caterpillars quantified per Sapele tree, as well as the measurements of each of the trees (specifically, the bole diameter, total height of the tree and the crown surface area).

Table 1: Distribution of the total number of caterpillars and morphological characteristics of the Sapele trees sampled

Number of caterpillars (in categories)		**0**	**1 - 10**	**11 - 20**	**21 - 30**	**31-40**	**41-50**	**51-60**	**61-70**	**>70**	**Total trees**	**Total**
Diameter ranges	20-30	1 [**0**]	0	0	0	0	0	0	0	0	1	1 [**0**]
	31-40	4 [**0**]	0	0	0	0	0	0	0	0	4	4[**0**]
	41-50	6 [**0**]	1 [**9**]	0	0	0	1 [**46**]	0	0	0	8	8[**55**]
	51-60	3 [**0**]	0	1 [**14**]	1 [**22**]	0	0	0	0	0	5	5[**36**]
	61-70	1[**0**]	3 [**13**]	0	0	0	1[**49**]	0	0	1[**30 1**]	6	6[**36 3**]
	71-80	3 [**0**]	0	1 [**11**]	0	0	0	0	1[**65**]	1[**25 4**]	6	6[**33 0**]
	81-90	1 [**0**]	0	0	0	0	0	0	0	0	1	1 [**0**]
	91-100	4 [**0**]	0	0	0	0	0	0	0	0	4	4 [**0**]
	100	1 [**0**]	0	0	0	0	0	0	0	0	1	1 [**0**]
	Total cater-pillars [n]	0	22	25	22	0	95	0	65	555	36	36[**7 84**]
Tree height	15-20	3[**0**]	0	0	0	0	1 [**46**]	0	0	0	4	4[**46**]
	21-25	2[**0**]	0	0	0	0	0	0	0	0	2	2[**0**]
	26-30	5 [**0**]	1 [**4**]	0	0	0	0	0	0	0	6	6[**4**]

Distribution of the total number of caterpillars and morphological characteristics of the Sapele trees sampled Continued

	31-35	7[**0**	2[**0**]	2	1	0	1 [	0	0	1[**30**	14	14[**4**
		]		[**25**]	[**22**]		**49**]			**1**]		**06**]
	36-40	4 [**0**]	5 [**0**]	0	0	0	0	0	1[**65**]	1[**25 4**]	7	7[**32 8**]
	40	3[**0**]	0	0	0	0	0	0	0	0	3	3[**0**]
	Total Cater-pillars [n]	0	22	25	22	0	95	0	65	555	36	36[**7 84**]
Leaf crown surface area	30-100	10 [**0**]	0	0	0	0	1 [**46**]	0	0	0	11	11[**4 6**]
	101-150	2[**0**]	3[**19**]	2 [**25**]	1 [**22**]	0	1[**49**]	0	0	1[**30 1**]	10	10[**4 16**]
	151-200	5 [**0**]	1 [**3**]	0	0	0	0	0	0	0	6	6[**3**]
	201-250	3[**0**]	0	0	0	0	0	0	1[**65**]	0	4	4[**65**]
	251-300	1 [**0**]	0	0	0	0	0	0	0	1[**25 4**]	2	2[**25 4**]
	301-350	1 [**0**]	0	0	0	0	0	0	0	0	1	1 [**0**]
	351-400	1 [**0**]	0	0	0	0	0	0	0	0	1	1 [**0**]
	400	1 [**0**]	0	0	0	0	0	0	0	0	1	1 [**0**]
	Total cater-pillars [n]	0	22	25	22	0	95	0	65	555	36	36[**7 84**]

Figure 4 below shows the linear regression lines establishing a link between the morphological characteristics of trees and the abundance of caterpillars harvested at the base of 36 Sapele trees.

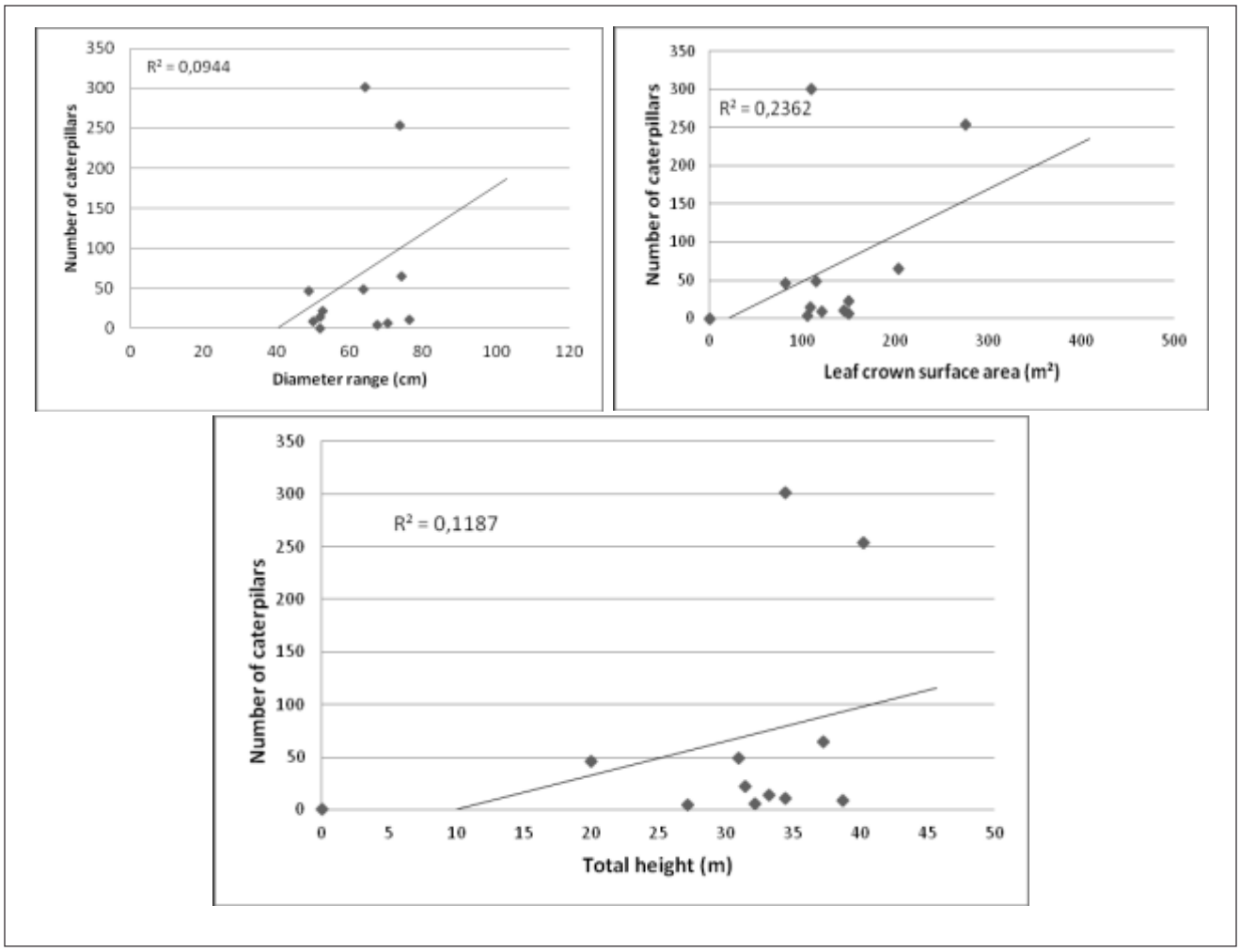


Figure 4. *Linear regression lines between tree characteristics and caterpillars' abundance*

Based on these preliminary findings (Table 1 and Figure 4), I. oyemensis larvae are mostly found on individuals with a 45 – 80 cm diameter (fig 4A) and a crown surface comprised between 100 and 150 m2 (Fig. 4B) and 30 to 40m high (Fig. 4C). According to Dawking indexes, these are individuals with an index of IV and V, i.e. co-dominant or dominant respectively (Jennings et al., 1999) and for the most part have already reached the regular fruiting diameter (de Madron et Daumerie, 2004). In other words, in view of the leaf crown dimensions and even the height of the trees, Sapele trees with the greater number of caterpillars are those still growing, with a foliage exposed to broad daylight and of reproductive age (seed production).

Even though these preliminary results provide initial estimates of the morphological factors that define what attracts insects to Sapele trees, a second harvest of caterpillars on the same sampled individuals, as well as further studies, especially chemical analyses of the leaves and trunk, with more in-depth statistical tests, will enable to be more specific on the morphological and physiological characteristics of the host plants needed for good I. oyemensis larval growth.

CONCLUSION

This article aimed at defining the morphological criteria of trees found at the nesting sites of I. oyemensis. The preliminary results obtained within our study site show that females mostly drop their eggs on co-dominant or dominant Sapele trees that have already reached their regular fruiting diameter. These are individuals in full growth. This result is all the more exciting as, contrary to initial assumptions on the presence of caterpillars on larger-diameter trees (often 100 cm and more) and ripe for logging, we observe that these caterpillars are found on intermediate-diameter trees (50-70 cm). However, to be sure, a second harvesting of caterpillars is needed, together with chemical analyses of leaf organs in nutritive compounds for these caterpillars and the tree trunk. An additional aspect to consider is tracing the development cycle of the caterpillar in relation with its host tree, the Sapele. Moreover, the marketing method and the specialized sectors selling edible caterpillars at regional level, should be studied. The results obtained from these various complementary research, both in the forest (second quantification of caterpillars) and in the villages surrounding forest ranges (socio-economic survey) will help inform the appropriate individuals to be preserved from logging and to ultimately propose management measures agreed on by loggers and populations in order to ensure the sustainable use of both resources.

BIBLIOGRAPHY

AKPOSSAN, R. A., DUÉ, E. A., KOUADIO, J. P. E. N. & KOUAMÉ, L. P. 2009. Valeur nutritionnelle et caractérisation physicochimique de la matière grasse de la chenille (Imbrasia oyemensis) séchée et vendue au marché d'Adjamé (Abidjan, Côte d'Ivoire). Journal of Animal & Plant Sciences, 3, 243-250.

BALINGA, M. P., MAPUNZU, P. M., MOUSSA, J.-B. & N'GASSE, G. 2004. Contribution des insectes de la forêt à la sécurité alimentaire – L'exemple des chenilles d'Afrique Centrale. Rome, Italie.

BODENHEIMER, F. S. 1951. Insects as human food, Springer.

DE MADRON, L. D. & DAUMERIE, A. 2004. Diamètre de fructification de quelques essences en forêt naturelle centrafricaine. Bois For. Trop, 281, 87-95.

EBA'A ATYI, R., LESCUYER, G., NGOUHOUO POUFOUN, J. & MOULENDE FOUDA, Thérèse. 2013. Étude de l'importance économique et sociale du secteur forestier et faunique au Cameroun. CIFOR, Bogor, 268 p.

FAO 1999. Vers une définition harmonisée des produits forestiers non ligneux. Unasylva, 50, 53-94.

JENNINGS, S., BROWN, N. & SHEIL, D. 1999. Assessing forest canopies and understorey illumination: canopy closure, canopy cover and other measures. Forestry, 72, 59-74.

MALAISSE, F. 2004. Ressources alimentaires non conventionnelles. Tropicultura, 30-36.

TABI ECKEBIL, P. P., VERHEGGEN, F., DOUCET, J.-L., MALAISE, F., DAÏNOU, K., CERUTTI, P. O. & VERMEULEN, C. Soumis. Entandrophragma cylindricum (Sprague) Sprague (Meliaceae), une espèce ligneuse concurrentielle en Afrique Centrale : synthèse bibliographique. Biotechnol. Agron. Soc. Environ.

VAN HUIS, A. 2003. Insects as food in sub-Saharan Africa. International Journal of Tropical Insect Science, 23, 163-185.

VAN HUIS, A. 2013. Potential of insects as food and feed in assuring food security. Annual review of entomology, 58, 563-583.

VERMEULEN, C., SCHIPPERS, C., JULVE, C., BRACKE, C. & DOUCET, J.-L. 2009. Enjeux méthodologiques autour des produits forestiers non ligneux dans le cadre de la certification en Afrique centrale. Bois Forêts Trop, 300, 69-78.

VIVIEN, J. & FAURE, J. J. 1985. Arbres des forêts d'Afrique Centrale, Paris, France, Agence de coopération culturelle et technique.

Twenty-two years of agroforestry in Mampu in Western Region of the Democratic Republic of Congo: Lessons learned.

Cécile Diaka Pika[1], Tony Muliele Muku[2], Jean-Pierre Kabongo Tshiabukole[3] and Jean-Claude Muliele Lumbu[4]*

Summary

The sequential agroforestry system involving Acacia auriculiformis fallows associated with annual crops (namely cassava and maize), was implemented in Mampu, in the western region of the Democratic Republic of Congo (DR Congo).

Twenty-two years later, a large Acacia auriculiformis multi-service forest is established in contrast with the natural vegetation made up of an herbaceous savannah. Agroforestry practices improve soil fertility (especially the organic carbon, nitrogen and base cation content) and promote an increase in the production of cassava (20 to 25 MT/ha), of maize (1.7 to 2 MT/ha) and of honey (12 to 30 kg/hive) with net average profit gains amounting to three thousand hundred and fifty dollars, four hundred and fifty dollars, and twenty eight dollars (USD) respectively as compared to traditional practices. Charcoal production (1.5 ha) yields a net gain of two thousand seven hundred USD. An ecological living environment has been created, family farms with economic jobs were generated and a trade center has been set up around Acacia auriculiformis.

Introduction

The Mampu Agroforestry Center is located in the Batéké plateau, in the Kinshasa province region of the DR Congo, situated in the north-eastern part of Kinshasa between 4°19'S and 15°47'E and spreading to the north of the large Kwango plateau.

The climate at the Batéké plateau is of a tropical-humid type with 4 months of dry season (June-September). The vegetation is dominated by a savannah colonized by herbaceous (e.g. Loudetia arundinacea and Hyparrhenia diplandra) and tree species (e.g. Hymenocardia acida and Crossopteryx febrifuga) on the plateaus. The slopes of the valleys and their affluents used to be covered with thick forests which are now degraded by shifting agriculture. The soil (Rubic Ferralic Arenosols according to the Word Reference Base (WRB) classification have developed on ochreous sands of the Kalahari system) is chemically poor (pH≤5.3; cation exchange capacity (CEC): < 10 cmolc/kg soil, base cations status: <0.40 cmolc/kg soil) and has a low water retention capacity. The organic carbon content (Corg) is low or very low (<1%), and uniformly decreases with depth in A horizon. The nitrogen content (0-50 cm) is highly deficient (<0.05%). The mineralogical composition is essentially made up of quartz, kaolinite and some Al and Ti residual oxides (Kasongo et al., 2009). Despite this low potential for farming, the soil at the Batéké Plateau is largely exploited by farmers with limited means to improve soil fertility, especially for cassava, maize and groundnut production.

In order to promote a productive, profitable and sustainable agricultural system in Mampu, the government of the DR Congo (former Zaïre), with help from the European Union and the Hanns Seidel Foundation (German political foundation) and the contribution of the Mbankana Centre for Integrated Development (CADIM, Congolese NGO), has introduced the Acacia auriculiformis-based sequential agroforestry system. In addition to its ability to grow on nutrient-poor soils through the symbiotic fixing of the atmospheric nitrogen with Rhizobium-type bacteria, this legume tree grows very fast, can produce abundant litter and has a thick forest conducive to carbonization.

This article, mainly based on the data obtained from documentation, will address the experience of the Mampu agroforestry system, especially (i) the implementation of agroforestry, (ii) the effect of agroforestry on the physicochemical quality of the soil, (iii) the impact of agroforestry on the productivity and social life of agroforesters, and (iv) on biodiversity.

[1]*Cécile Diaka Pika. Natural Resources Expert, Kasangulu Integrated Programme, World Vision. BP 942, Kinshasa/Gombe, Democratic Republic of Congo. Tel : +243 97 00 10 655 ; Email : ceciledіaka@yahoo.fr.*

[2]**Tony Muliele Muku (Correspondind Author), Pedologist and Natural Resources Manager. National Institute for Agricultural Studies and Research (INERA), B.P. 2037, Kinshasa/Gombe, Democratic Republic of Congo. Tel: +243 85 315 88 22 ; Email : tonymuliele@yahoo.fr.*

[3]*Jean-Pierre Kabongo Tshiabukole, Plant selection Expert, National Institute for Agricultural Studies and Research (INERA), B.P. 2037, Kinshasa/Gombe, Democratic Republic of Congo. Tel: +243 81 599 28 27; Email: jpkabon2005@gmail.com.*

[4]*Jean-Claude Muliele Lumbu, Sustainable Forest Management Expert, Mbankana Centre for Integrated Development (CADIM), Mbankana, Democratic Republic of Congo. Tel : +243 81 839 46 31; Email: jcmuliele@gmail.com*

Conducting agroforestry in Mampu

The first Acacia farms (8,000 ha) planted with 3m x 3m and 4m x 3m spacing (1,111 and 833 seedlings/ha respectively), were established between 1987 and 1993. Originally, Mampu was the pilot phase of a large-scale reforestation project aiming at addressing the shortage of wood-energy in Kinshasa. The density of these farms was recommended to obtain medium diameter seedlings conducive to carbonization. From the 1994s, a deliberate shift towards rural agroforestry was observed. Mampu was further divided into basic 25 ha-plots allocated to farmers. These were supposed to manage their farms with the technical assistance of the Hanns Seidel Foundation following an agroforestry model inspired from the traditional slash-and-burn farming model (Peltier et al., 2010). The implantation of agroforestry farmers aims at both establishing households in a family setting and providing rural employment for economic activities. Each agroforester cultivates a surface area of about two hectares/year, processes the wood into charcoal, burns the residues at the beginning of the rains and establishes a cultural cassava-maize association. It should be noted that Acacia auriculiformis does not reject the shoot, after the cutting. The artificial passage of fire initiates the growth of the Acacia auriculiformis seeds which germinate in great number. When weeding his farm, the agroforester preserves the crops on the planting lines of dead shoots. If needed, he can restock the areas where the seedlings are very sparse or eliminate the excess seedlings (dense areas). During the growing cycle of maize and cassava, Acacia seedlings are not coppiced or cut, and no negative effect of the density of 1111 and 833 Acacia seedlings/ha on crop yield has been reported so far. Four months after the fire, the maize is harvested, the acacias are about 0.5 m high; between 11 and 18 months after the fire, at the harvest of cassava, the acacias are averagely 1.20 m high. These acacias thus obtained through Assisted Natural Regeneration (ANR) can grow without further human intervention, except the thinning (heavily dense areas that would produce numerous plants that are however too thin to be carbonized), of protection against fire and some invasive species. Twelve years later, the agroforesters can come back again to farm on the plot and initiate a new cycle: felling of acacias, carbonization, incineration of residues at the beginning of rains, and establishment of cassava-maize crop association. Agroforesters in Mampu also engage in beekeeping, livestock production (large (cows) and small (goats)) and poultry.

Effect of agroforestry on the physicochemical quality of the soil

The increase in Corg and total nitrogen (Ntot) content and of the sum of base cations (SB) with the fallow duration, indicates an improvement of soil fertility under Acacia as compared to the savannah (natural vegetation) of the Batéké Plateau (Table 1). More acid pH values under older Acacia fallows, would follow the humidification of the organic-litter matter of Acacia (Kasongo et al., 2009). With very acid pH, aluminum becomes highly soluble, which will justify the high content in exchangeable aluminum (AI3+) in the more acid old fallows .

Table 1. *Physicochemical properties of the topsoil (0-25 cm) under growing Acacia auriculformis. Age 0 corresponds to the savannah (natural vegetation of the Batéké plateau).*

Age of fallow (years)	pH_{H2O}	pH_{KCl}	Corg (%)	N_{tot} (%)	C/N	SB (cmol$_c$/kg)	Al^{3+} (cmol$_c$/kg)
0	4.97c	4.30	0.86a	0.045a	19c	0.39	1.03
4	4.72b	4.20	1.16b	0.080b	15b	0.44	1.26
8	4.66ab	4.15	1.87c	0.178c	11a	0.43	1.40
10	4.61ab	4.18	1.94d	0.186c	10a	0.84	1.27
17	4.50a	4.12	2.92e	0.280d	10a	0.93	2.00

Source: Kasongo et al. (2009). Values followed with different letters vary significantly ($P<0.05$).

Impact of agroforestry on the productivity and social life of farmers

Agroforestry practices have enabled to considerably increase cassava (x 3.6), maize (x 2.5) and honey production (x 4.3) as compared to traditional practices (Table 2). As for timber production, a 12-year old farm produced around 120 tons/ha of Acacia auriculiformis dry wood (Bisiaux et al., 2009) and carbonization yield varies between 18 and 23% (Peltier et al., 2010). The net gains for 1.5 ha of Acacia auriculiformis felled and carbonized are estimated at USD 2,700 (Peltier et al., 2010).

The increase in incomes for agroforesters, has enabled them to invest in other sectors, namely livestock production and to improve their living conditions (access to health care and schooling for children) (UNDP, 2012). Formerly an uninhabited savannah, Mampu is currently a multi-services Acacia auriculiformis forest, one of the main centers of agricultural production around the 320 rural job-creating family farms, already established for the past 22 years; a highly attractive trade center for the sellers of agricultural products (cassava and maize), honey and charcoal, the annual needs of which were estimated at 0.6 – 1.2 million tons for the city of Kinshasa alone (Bisiaux et al., 2009). The success of this project has aroused interest for the reproduction of this model on other savannahs in the country, especially at Gungu in the Kwilu province.

Table 2. *Increase in cassava, maize and honey production following the adoption and implementation of new techniques.*

Production indicators	Traditional practices	Net income (USD)	Agroforestry practices	Net income (USD)
Cassava	5.5 T/ha	1.650	20 T/ha	5.000
Maize	0.6 T/ha	300	1,5 T/ha	750
Honey	3.5 kg/hive	8.4	15 kg/hive	36
Fuelwood	N/a	N/a	120 T/ha	N/a
Charcoal	N/a	N/a	24 T/1.5ha	2.700

Source: UNDP (2012). N/a: not available.

Impact of agroforestry on biodiversity

The establishment of Acacia auriculiformis plantations has enabled to reduce the pressure and overexploitation of natural forests, namely for fuelwood. The studies conducted by CADIM (UNDP, 2012) have revealed the reappearance of 45 plant and 16 animal endangered species. Numerous animal and plant species that were formerly found only in forest patches (fungi, caterpillars, yams, rodents, reptiles) are now found in the Acacia auriculiformis forest. The Acacia auriculiformis plantations would also have a positive impact of undergrowth ecosystems and this leads to the harvest of the young shoots of edible undergrowth plants (Peltier, 2010; UNDP, 2012).

Conclusion and recommendations

The sequential agroforestry of Acacia auriculiformis forest-annual crops (maize, cassava) established twenty-two years ago in Mampu, has established households and created rural employment with economic activities. This agroforestry system enables to protect ecosystems and supply the cities with charcoal and food products. It enables to replace the savannah ecosystem with that of the forest, to improve soil fertility (especially organic carbon, nitrogen and base cations content), to diversify harvests, to increase crop yields and net gains, and thus the income of agroforesters. It has also enabled to reduce the pressure and overexploitation of nearby natural forests. The option of an agroforestry system could be promoted in order to increase the productivity of marginal lands and to protect ecosystems.

References

Bisiaux F., Peltier R. et Muliele J.C. 2009. Plantations industrielles et agroforesterie au service des populations des plateaux Batéké, Mampu, en République démocratique du Congo. Bois et Forêts des Tropiques 301 (3): 21-32.

Kasongo R.K, Van Ranst E., Verdoodt A., Kanyankagote P. and Baert G. 2009. Impact of Acacia auriculiformis on the chemical fertility of sandy soils on the Batéké plateau, DR Congo. Soil Use and Management 25: 21–27.

Peltier R., Bisiaux F., Dubiez E., Marien J-N., Muliele J-C., Proces P. et Vermeulen C. 2010. De la culture itinérante sur brûlis aux jachères enrich0ies productrices de charbon de bois, en République démocratique du Congo. Coudel E., Devautour H., Soulard C.T. et Hubert B. (Eds). ISDA 2010, Jun 2010, Montpellier, France. Cirad-Inra-SupAgro, 16 p., 2010. <hal-00512274>.

United Nations Development Programme (UNDP). 2012. Mbankana Centre for Integrated Development (CADIM), Democratic Republic of Congo. Equator Initiative Case Study Series. New York, NY.

Somalia: A glimpse of the resilience of the Somali biodiversity and its custodian communities

Saleem Ullah[1], Hussein Gadain[2], and Richard Trenchard[3]

Summary

Somalia's terrestrial and marine ecosystems exhibit unique potential, despite anthropogenic and natural stresses. The potential of marine ecosystem is rooted in its nutrient replenishing capacity due to upwelling phenomena that attracts substantial in-migration. Compared to the country's vast deep seas, its continental shelf is very narrow and under tremendous stress due to excessive anthropogenic activities. The terrestrial ecosystem, despite its arid nature, has evolved remarkable endemism of biodiversity in general and plants in particular. With the loss of socio-institutional cohesion due to the collapse of central government, the country's fauna and flora are under tremendous stress. These stress drivers are both anthropogenic and natural including deforestation and habitat degradation, spread of invasive species and climate change. As a coping strategy a holistic approach of conservation, sustainable use and equitable distribution of the benefits is recommended that will be demonstrated and mainstreamed through setting up of systems of protected areas (terrestrial and marine) in the biodiversity hotspots of the country. The article presents the resilience of Somali biodiversity and its custodian communities.

Introduction

The terrestrial and marine ecosystems of Somalia have outstanding potential. Somalia has the longest (3,333 Km) coastline in continental Africa with a Large Marine Ecosystem (LME) known as the Somali Current Marine Ecosystem. The abundance of phytoplankton and zooplankton, supported by upwelling phenomena, suggests that Somalia has some of the continent's major fishing stocks. Somalia's inshore waters support a rich and diverse demersal fish stocks, including pelagic fish, sharks, crustaceans and turtles. The continental shelf is very narrow, and the coast with biodiversity potential (such as mangroves, corals, sea grasses, breeding sites of turtles and birds, etc.) is very thin. Due to its narrowness and population pressure, the coastal biodiversity is stressed by the concentration of uncontrolled anthropogenic activities.

Terrestrially the country is centrally located in the Horn of Africa biodiversity hotspot, one of only two entirely arid hotspots (the other being Succulent Karoo in SW Africa). Despite its arid nature, the country has evolved significant endemism. Of the estimated 5,000 vascular plant species, over half of them are endemic. The dominant vegetation type is Acacia – Commiphora bushland, which provided for thousands of years frankincense (from Boswellia sacra and B. frereana in Somalia) and myrrh (from the widespread Commiphora myrrha and C. guidottii) to Africa and Middle Eastern countries. In the entire Horn of Africa biodiversity hotspot, Somalia hosts the Yeheb nut (Cordeauxia edulus, VU), an evergreen shrub with yellow flowers and edible, highly nourishing seeds. Hundreds of new species have been discovered in Somalia alone in the last 20 years, most notable among them the Somali cyclamen (Cyclamen somalense). Known only from a small area in northern Somalia, the plant was a surprising discovery in tropical Africa, as the genus Cyclamen is otherwise found only in the Mediterranean region.

The major purpose of this purpose is to highlight the current status of Somali biodiversity, key challenges, ongoing actions aimed at triggering the conservation of Somali biodiversity and road map to ensure the vision of enhancing Somali biodiversity and sustainably use its products and services. The article will also help the readers to realize the resilience of Somali biodiversity that is rooted in the efforts of the war-torn Somali communities and its nascent Government.

[1] *Saleem Ullah, Consultant for National Biodiversity Strategy and Action Plan (NBSAP), FAO Somalia, Phone:+254708034887,saleemullah65@gmail.com*
[2] *Hussein Gadain, Formerly Chief Technical Advisor, Somalia Water and Land Information Management Project, FAO Somalia, currently Representative FAO Egypt: hussein.gadain@fao.org*
[3] *Richard Trenchard, Representative FAO Somalia; Email: Richard.Trenchard@fao.org; Phone: +254701558506;*

The status and trends of Somalia's biodiversity and biological resources

Arid and semi-arid conditions prevail in Somalia since ages. This "stability" helped biodiversity to evolve in harmony and to adapt to the apparently less-hospitable semi-desert environment. In spite of its harsh climate and xeric vegetation, the country is still home to high levels of endemism rooted in its remarkable location where the two global zones of endemism meet each other (Horn of Africa Biodiversity Hotspot and Coastal Forests of Eastern Africa Hotspot. See Map 1).

Although 1,250 plants species were recorded from the region, the extent of endemism is not known. Lying in the Horn of Africa, the country is notable for endemism of mammals in general and antelopes in particular. The examples are Dibatag (Ammodorcas clarkei, VU) found only in Somalia, Beira (Dorcatragus megalotis, VU), Hirola (Damaliscus hunteri, CR) and Speke's gazelle (Gazella spekei, VU). There are also a number of smaller mammals including four Gerbillus species, one Microdillus species, one white-toothed shrew (Crocidura greenwoodi, VU), and the walo (Ammodillus imbellis, VU), a gerbil known only from Somalia. The Somali warthog (Phacochoerus aethiopicus delamerei, VU) is also near endemic to this ecoregion.

Widely distributed but threatened ungulate species include dorcas gazelle (Gazella dorcas, VU) and Soemmering's gazelle (Gazella soemmeringi, VU). African wild ass (Equus africanus somaliensis, CR) inhabits this region, nevertheless the extent of which is confirmed. The beisa oryx (Oryx gazella beisa) was formerly widespread throughout Somalia, however, excessive hunting had exterminated this antelope over much of its Somalian range by the 1980s but it is still distributed over a wide range in Ethiopia. The gerenuk (Litocranius walleri) also occurs and has a wider distribution, extending further south into Kenya. The greater and lesser kudu (Tragelaphus strepsiceros, Timberbis) once abundant in Somalia, now can be found in areas of Acacia-Commiphora woodland in the Ethiopian section of this ecoregion.

Elephants (Loxodonta africana, EN) and buffalo (Syncerus caffer) were previously widespread in the wetter portions of this ecoregion. Lion (Panthera leo, VU), leopard (Pathera pardus, EN), cheetah (Acinonyx jubatus, VU), and striped and spotted hyaenas (Hyaena hyaena and Crocuta crocuta) are the main large carnivores in this ecoregion, however, the extent of which cannot be confirmed in Somalia. Most of these canivores, including the endangered wild dog (Lycaon pictus) can be found in the Ethiopian section of this ecoregion.

Most of the endemic animal and plant species are associated with dry habitats, but the riverine habitats along the Juba and Wabi Shebele support two strictly endemic birds, the Degodi lark (Mirafra degodiensis, VU) and the Bulo Burti bush-shrike (Laniarius liberatus, CR), qualifying as an Endemic Bird Area. The Abyssinian yellow-rumped seedeater (Serinus xanthopygius), the short-billed crombec (Sylvietta philippae, DD), and Sidamo bushlark (Heteromirafra sidamoensis, VU) are all restricted to this ecoregion as well, while the sombre chat (Cercomela dubia, DD), white-winged collared-dove (Streptopelia reichenowi), Salvadori's weaver (Ploceus dicrocephalus), and the scaly babbler (Turdoides squamulatus) are considered near-endemic.

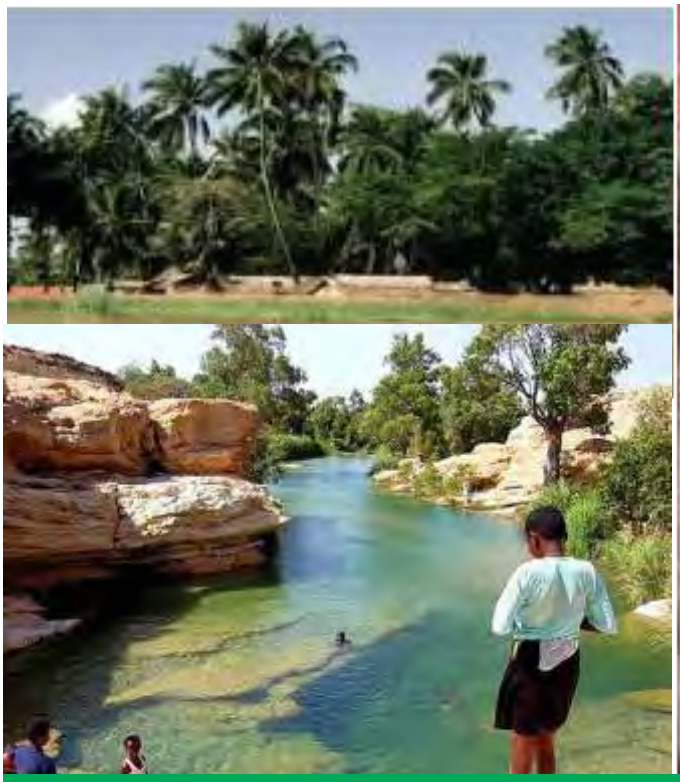
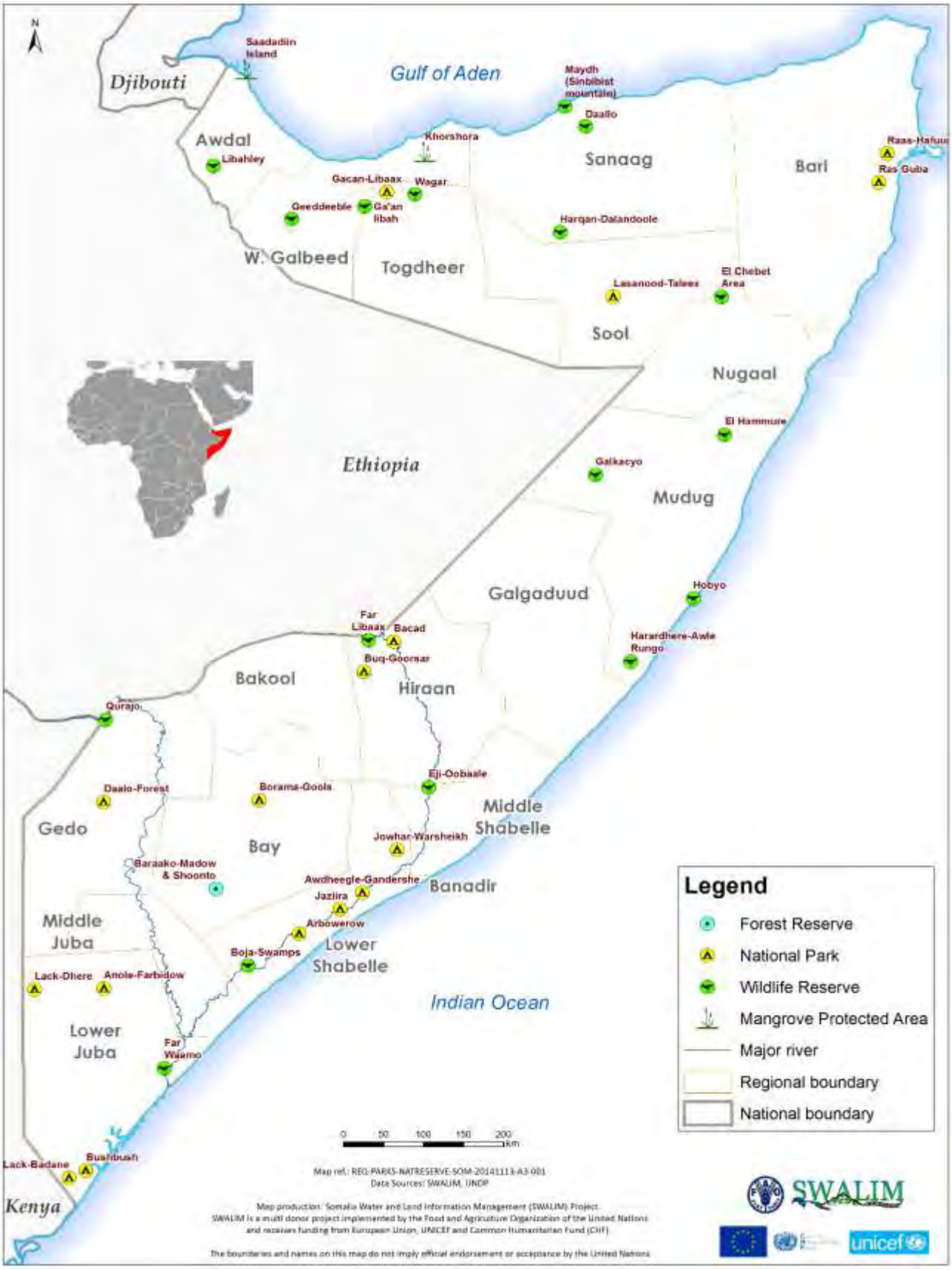


Photo credit: ©www.somaliaonline.com /Mohamed Abdi

Photo credit: ©www.pickandgotravel.com/Somalia-east-Africa

Somalia... one of the most beautiful places in the world; happy Somali kids

Photo credit: www.pickandgotravel.com/Somalia-east-Africa



Map 1: *Current and proposed Nature Reserves and Protected Areas of Somalia*

Map production: Somalia Water and Land Information Management (SWALIM) Project. The boundaries and names on this map do not imply official endorsement or acceptance by the United Nations
Source: Ullah Saleem and Gadain Hussein. FAO 2016. National Biodiversity Strategy and Action Plan, Somalia

Early colonial officials (such as R.E Drake Brockman, 1910) reported on the astonishing abundance and diversity of wildlife. Somalia at the time had a reputation of being one of the best wildlife havens in Africa. Till 1980s the country was reported to host around 3,023 species of higher plants and was thus considered as a center of floral endemism (White, 1983). The current status of biodiversity together with endemism is illustrated in table 1 below:

Table 1: Endemism of Somalia's biodiversity
(http://www.cepf.net/resources/hotspots/africa/Pages/Horn-of-Africa.aspx)

Taxonomic group	Species present in Somalia	Endemic Species	Percentage Endemism
Plants	3165*	800	25
Mammals	220	20	9.1
Birds	697**	24	3.4
Reptiles	285	93	32.6
Amphibians	30	6	20
Freshwater Fishes	100	10	10

* Flora of Somalia, vol. 3
** Birdlife international report the number of bird species as 566 with 9 endemic (http://www.birdlife.org/datazone/country/somalia).

Despite all the challenges, the country's biodiversity in comparison with other East African Countries present a promising status. Table 2 presents a comparative analysis of the biodiversity of East African countries.

Table 2: Biodiversity comparison among East African Countries

		Mammals		Birds		Plants				
Country	Area in Km^2	Endemic	Total	Endemic	Total	Endemic	Total	Percentage (%) of land converted from natural habitat to other land-uses	Percentage (%) of land protected	Actual Area of protected lands (in km2)
Burundi	27830	0	107	0	451	not known	2500	37	5	1391.5
Djibouti	23200	0	61	1	126	6	826	1	1	232
Eritrea	117600	0	112	0	319	not known	not known	19	4	4704
Ethiopia	1104300	31	277	28	626	1000	6603	39	5	55215
Kenya	580370	23	359	9	844	285	6506	13	6	34822.2
Rwanda	26340	0	151	0	513	26	2288	52	8	2107.2
Somalia	637660	12	171	11	422	500	3028	6	6	38259.6
Uganda	241040	6	345	3	830	not known	4900	36	7	16872.8
All countries	2758340	72		52		1797		24	4	110333.6

Source: UNEP, 2006. Africa Environment Outlook 2, revised for Somalia, 2016

[4] *SWALIM (Somalia Water and Land Information Management) project is a multi-donor project implemented by the Food and Agriculture Organization of the United Nations (FAO) and receives funding from European Union, UNICEF and Common Humanitarian Fund (CHF)*

The challenges of Somali biodiversity:

The biodiversity and its habitats are going through substantial stress with the deforestation and degradation as the major stress factors, followed by invasive species and in the backdrop of climate change.

Deforestation and habitat degradation

Despite its reputation in endemism, the country has less than 3% area covered by close canopy forests. This is distributed in the Golis Mountains of the north and the Coastal Forest Mosaic, south off-Kismayu. Close to open canopy Acacia and Commiphora vegetation covers a vast part of the country. In spite of being a forest poor country, deforestation is a reported fact, since 1970s, on rather a localized scale for firewood, timber and charcoal making. The Golis forests provide timber, firewood and Non-wood Forest Products (NWFP) to the local population. The Acacia & Commiphora belt is subject to deforestation particularly for charcoal making. The pressure on the resource increased tremendously when the charcoal became the financial source groups and clans involved in warfare. The favorite wood for charcoal is Acacia bussei and a recent study (by FAO – SWALIM for Puntland) estimates the annual rate of Acacia bussei decline at about 5%. The charcoal output of north-east Somalia in 1996 was estimated to be in the order of 4.8 million sacks, each weighing 25-30 kg. Producing such a volume required cutting approximately 2.1 million Acacia bussei trees. At an average density of 60 trees per hectare, this translates into a deforestation rate of 35 000 hectares of land per year. Extrapolating the above figures for production of the 10 million sacks of charcoal produced in the South Somalia during 2011 (only export), it means felling 4.375 million trees or clearing 72,916 hectares of land. Considering the above mentioned extent of Acacia bussei tree felling in Somalia and no establishment of new plantations, this species was placed on the Red List of threatened species in 2009 by the IUCN.

Invasive species

The major invasive species in Somalia is Prosopis juliflora, together with Prosopis pallida and P. chilensis. These were initially introduced to East Africa for the stabilization of dune systems and for providing fuel wood after prolonged droughts in the 1970's (Von Maydell 1986). In many areas the species have hybridized to an extent that the current varieties have lost most of their valuable woody attributes and aggressively outcompete native shrub and tree vegetation (Pasiecznik 2001). The recent study (unpublished) conducted by FAO-SWALIM, assesses the invasion of Prosopis in Somaliland and confirms that it is encroaching only productive areas under agriculture or forestry. In the desert or semi-desert areas its infestation is rather insignificant. The islands and mountain areas are also infested. The results also confirm that Prosopis is widely spread across Somaliland with a particularly high concentration in the Woqooyi Galbeed region. Also the pattern of invasion confirms that it invades first lowlands next to rivers and Wadis as well as peri-urban areas both inland and along the coast (FAO-SWALIM, Rembold, F. and Leonardi, 2014).

The other leading invasive species is Indian crow (Corvus splendens). The Indian crow is a common bird of the crow family that is of Asian origin but now found in many parts of the world, where they arrived assisted by shipping. It is noteworthy that in Somalia scientists perceive the Indian crow as an invasive pest that particularly affect the avian biodiversity, not only due to competition for food but also the chicks and eggs of various birds form the feed of the Indian crow. The worst factor is its ever increasing number without much control mechanism available for both these leading invasive species. So far the available eradication measures are not cost-effective and in the rather limited financial and institutional capacity of the Government, this can only be attempted in a pilot project mode.

Climate change as a stress factor

Extreme climate events of alternating droughts and floods cause adverse effects on biodiversity. Somalia has increasingly suffered in the recent decades from alternating flash floods and droughts, thus cannot escape the impacts of climate change as direct drivers of biodiversity loss. The drought exacerbates deforestation for charcoal, increases hunting, and accelerates soil erosion due to deforestation, bush fires, wildlife migration and reduction of biodiversity. It also leads to increased number of pests and pathogens. The flooding leads to soil erosion and loss of nutrients, wildlife migration, reduced aquatic reproduction and productivity of habitat and causing local extinctions. The droughts also affect marine biodiversity by reducing the plankton production, increased salinity in coastal ground water due to salt water intrusion and coral reef destruction due to higher Sea Surface Temperature.

Climate change has caused changes in species distributions, population sizes, the timing of reproduction or migration events, and an increase in the frequency of pest and disease outbreaks. The coral reefs of Somalia have undergone major, although often partially reversible, bleaching episodes due to the local sea surface temperatures increase by 0.5–1o Celsius above the average of the hottest months. Harm to biodiversity will grow worldwide with increasing rates of change in climate and increasing absolute amounts of change, however with very low level of preparedness, Somalia will be the worst affected of these changes, despite the fact that its contribution to the global GHG (greenhouse gas) is rather negligible.

Conclusions

The state-led systematic biodiversity conservation interventions faced complete halt with the collapse of the Somali Government in 1991. Both effective legislation and functioning conservation infrastructure remained missing for a prolonged period. Fourteen protected areas (that form less than 1% of the total land area) and 11 wildlife conservancies have been established since 1970s, however with no formal conservation measures available at least since 1991. Most of the pre-collapse areas were of small size, except Lag Badana National Park measuring around 100,000 hectares.

The turn towards reversing the decay was taken by signing the Convention of Biological Diversity in 2009, Somali Government broke the prolonged lull in managing its terrestrial and marine ecosystems. In the succeeding years the government forged partnership with international agencies, including FAO to assist the Somali nation in rehabilitating the degrading ecosystems of the country and adopted the approach of setting up Protected and Marine Protected Areas management system as the key coping strategy to respond to the situation.

The foremost action is the two yearlong National Biodiversity Strategy and Action Plan (NBSAP) process that not only led to the development of a cohesive road map for rehabilitating the biodiversity but also developed a nationwide consensus, in otherwise fragmented country, on conserving and sustainably using its biodiversity. In this regard the key stakeholders came up with a longer term vision backed by series of concrete actions to attain it. To trigger this process of change, a trained cadre comprise of 100 biodiversity managers and outreach experts were developed. They represent federal and regional governments, civil society organizations and community representatives. Recognizing the very important role of cyclic outreach, a clearing house mechanism is designed that will perform as interactive communication hub focusing on biodiversity issues. The NBSAP process also provided the Somali government with a resource mobilization roadmap that emphasize on mobilizing finances from the conventional and non-conventional donors on one hand whereas mainstreaming biodiversity conservation in the overall development agenda of the Government. Led by the Government, an Environment Working Group (EWG) is constituted that has already met three times in the current year. The EWG bring together donors, UN agencies and Government to ensure complementarity, mobilize finances and mainstream biodiversity in the Government and Donors agenda. As a result the Somali Government for the first time has mainstreamed biodiversity in its first ever National Development Plan. The biodiversity issues are also mainstreamed in the climate change and combating desertification agendas. All these efforts are mounting towards conserving the Somali biodiversity and sustainably using its products and services, thus shows a resilient approach on the face of adversities.

In the succeeding years the government forged partnership with international agencies, including FAO to assist the Somali nation in rehabilitating the degrading ecosystems of the country and adopted the approach of setting up Protected and Marine Protected Areas management system as the key coping strategy to respond to the situation. The Government has adopted a two prong approach of starting with representative hotspots with the aim of expanding to the rest of the country. In the first instance the country aims at setting up systems of protected areas as follows:

1. Representing each of the five Somali eco-regions, five functional Protected Areas are in place namely: (a). Golis mountain range, (b). Sool, Karkar, Sanag & Bari areas (wild cat zone), (c). Northern Zanzibar-Inhambane Coastal Forest Mosaic, (d). Acacia – Commiphora zone and (e). Juba-Shebelle Swamps/wetlands. Through the establishment of these Protected and Marine Areas 35% of the forest canopy is expected to be restored and endemic/flagship faunal and floral species are expected to be regenerated/restored, afforested and reforested. These include but not limited to Somali wild ass, wild cats, elephants, Gerenuk, Beira, Acacia species, Angel tree species, etc.

2. With focus on Mangroves, coral reefs and migratory birds' hotspots four functional Marine Protected Areas were established comprising: (a). South of Kismayu, (b). Ras Asyer at the Horn of Africa, (c). Mangroves east of Berbera and (d). Zylec & Saada Din Islands near the border of Djibouti. Through the creation of functioning Marine Protected Areas focusing on the hotspots, at least 40 per cent coastal biodiversity will be conserved and protected through effective management and fair distribution of benefit and obligation sharing. The management approach in these landscapes will be oriented through valuation of ecosystem services allowing for all ecosystem goods and services including carbon sequestration. Sustainable funding of the models based on Payments for ecosystem services (PES) will be elaborated in a business plan including the marketing of these values, particularly watershed conservation, tourism, NWFP and the voluntary carbon market, as well as benefit sharing arrangements.

Somalia faces the challenges of unstable security situation, limited available finances and inadequate human and institutional capacity. These prevailing challenges call for setting up and implementing a coping strategy. Nevertheless the government together with its international development partners are mindful of this situation and are thus striving to boost capacity and financial resources as well as enhance the access to the people and their resources, despite deteriorated security situation in the country.

Recommendations

Although the country has done reasonably well to demonstrate its commitment and resilience in conserving its fragile biodiversity, however Somalia is still missing the due focus of the international community in conserving its biodiversity. Following are concrete recommendations to implementing the coping strategy:

Cooperation and complementarity with ongoing similar programs such as climate change resilience, Programme for sustainable charcoal and alternative livelihoods, national action plan for controlling desertification, etc. should be further enhanced.

Somali biodiversity needs to be looked in the context of ecosystem goods and services, therefore the nexus between larger development and poverty eradication programmes with biodiversity needs genuine appreciation by investing into biodiversity conservation.

A due focus on biodiversity is required in any technical and financial support for the recently launched SGDs in Somalia

Somalia is not eligible for the STAR allocation of GEF Trust Fund, this decision is an unfair standpoint and needs a prompt reversal in the current cycle of GEF.

The global support to rehabilitate the Somali biodiversity is much less, compare to the other contemporary post conflict countries such as Afghanistan, Congo, etc. The comparison needs a genuine realization from the global community.

The private sector in the country is shaped around natural resources, without due contribution to sustainably managing its biodiversity, the private sector thus needs to be duly engaged in contributing through schemes such corporate social responsibility, etc.

List of references

Bolognesi M., Leonardi U., Vrieling A., Rembold F., Gadain H. 2014. Detection of Charcoal Production Sites in Southern Somalia Using Very High Resolution Imagery. Technical Project Report. FAO-SWALIM, Nairobi, Kenya.

CBD, 2003. Inter-linkages between biodiversity and climate change: Advice on the integration of biodiversity considerations into the implementation of UNFCCC and its Coyoto Protocol, CBD Technical Series No. 10.

Conservation International, 2008. Biological diversity in the Horn of Africa
(http://www.eoearth.org/view/article/150644/)

FAO 2005, Global Forest Resources Assessment, Thematic Study On Mangroves Of Somalia (draft)

FAO, UNEP. 1981. Tropical forest resources assessment project. Forest resources of tropical Africa. Part II: Country briefs. FAO, UNEP. 586 pp.
FAO-SWALIM, 2010. Monitoring of Mangroves in Somalia, Technical Report No. L-19, December 2010.

Technical Series, Report Nr. VI, vol. 31 133 pages. Gland, Switzerland; Cambridge, UK; Nairobi, Kenya.

Hughes, R.H., and J.S. Hughes. 1992. A Directory of African Wetlands. IUCN, WCMC, UNEP,

Kingdon, J. 1989. Island Africa: The evolution of Africa's rare animals and plants. Princeton University Press. Princeton, NJ, USA.

Lovett, J.C., and I. Friis. 1996. Patterns of endemism in the woody flora of north-east and east Africa.

Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC.

Pilcher, N.J. & F. Krupp, 2000. Status of coral reefs in Somalia - 2000. PERSGA Technical

Rembold, F. and Leonardi, 2014. Mapping areas invaded by Prosopis juliflora in Somaliland on Landsat 8 imagery.

Schleyer & Baldwin, 1999. Biodiversity assessment of the northern Somali coast, east of Berbera. IUCN East Africa Series Report, Jeddah. 21 pp.

Sommerlatte, M. and Umar,A., 2000. An Ecological Assessment of the Coastal Plains of North-western Somalia (Somaliland).IUCN Eastern African Programme, Nairobi, Kenya.

UN Somalia, 2014. UN Joint Programme for Sustainable Charcoal Production and Alternative Livelihoods

UNDP, 2011. Somalia National Marine Environment Diagnostic Analysis, Agulhas & Somali Current Large Marine Ecosystems (ASCLME) Project.

UNSC, 2014. Report of the Monitoring Group on Somalia and Eritrea pursuant to Security Council resolution

Van den Berg EC., Kotze, I. and Beukes, H. Detection, Quantification and Monitoring of Prosopis in the Northern Cape Province of South Africa using Remote Sensing and GIS, South African Journal of Geometrics, Vol. 2, No. 2, April 2013

WSP, 2001. Rebuilding Somalia: Issues and possibilities for Puntland. WSP Somali Programme.

Human-Wildlife Conflict management Toolbox: Feedback from the field test in Crystal Mountain national park (Gabon)

Elisee Joel Angoran[1]

Summary

In order to mitigate human-wildlife conflicts in Central Africa, a toolbox tailored for the Central African region has been produced by the Food and Agriculture Organization (Ilama, 2015). The toolbox offers a set of 45 practical solutions to help solve the recurring conflicts between humans and wildlife and includes a monitoring system set up through a smartphone application to track the different conflicts occurring in the region and the solutions tested on each site. This toolbox was tested on 11 different sites, among which was Crystal Mountain national park in the northern part of Gabon. This article gives feedback on the effectiveness of the toolbox at that particular site. The solutions offered in the toolbox have to not only be effective but sustainable as well to preserve the integrity of the biome. A few of the solutions presented in the toolbox were already put in place by the local populations, but lacked the desired effectiveness. It's by alternating the solutions that a credible outcome will be achieved. Some other solutions that could have potentially been more effective would have been harder to set up due to a lack of funding. Frequent follow up on the different site has to be done as well to ensure the sustenance of the solutions.

Introduction

For many years, interaction with wildlife has negatively impacted the daily lives of villagers. Encounters can occur and often have devastating consequences. The frequency of the conflicts between wildlife and local populations has endangered food security and the livelihoods of villagers (FAO, 2010). Notably, the conflict between humans and elephants has been a recurrent issue studied in the region and to this day, still affects farmers (Tchamba, 1996).

For the most part, the damage caused consists of the destruction of plantations and agricultural fields. However, it could escalate to loss of life (Woodroffe et al., 2005). Consequently, the toolbox, a set of five handbooks proposing conceptual and practical means of managing various types of conflicts and finding a sustainable cohabitation between people and the various species occupying the same natural habitat in the Central African region has been developed, after very little had been done to mitigate the occurring conflicts (Le Bel et al., 2010). Indeed, government officials have done very little to compensate the villagers for their plantations that were ravaged by animals (Barua et al., 2013). Different solutions were tested based on the problems witnessed and registered in the KoBoCollect application, a data gathering application. The purpose of the application was to monitor the conflicts to have a better understanding of the issues as well as track the proposed solutions' effectiveness (Le Bel et al., 2016). This article gives feedback on what has been done on the Crystal Mountain national park site in Gabon, and provides suggestions on other possibilities to make the toolbox a success.

Methodology and Methods

In the study area, villagers grow crops to feed their families and as a commodity. However, many different wildlife species such as cane rats (Thryonomys xx), roan antelopes (Hippotragus equinus), bush pigs (Potamochoerus xx), and elephants (Loxodonta africana xx), come and destroy their plantations. The objective of the field test was to use the toolbox to find ways to prevent the animals destroying the plantations while taking into account their protected species status, as well as monitor the various conflicts and the efficacy of the solutions through KoBoCollect, the data collecting application that helps survey the conflicts and monitor the different solutions.

[1] *Elisee Joel Angoran, Environmental Scientist, Wageningen University*
Mailing address: Bornsesteeg 1, 19A005; 6708GA Wageningen, Netherland
Email: angoran.joel@gmail.com

[2] *The Toolbox is downloadable at : http://ur-bsef.cirad.fr/content/search?SearchText=BO-CHF*

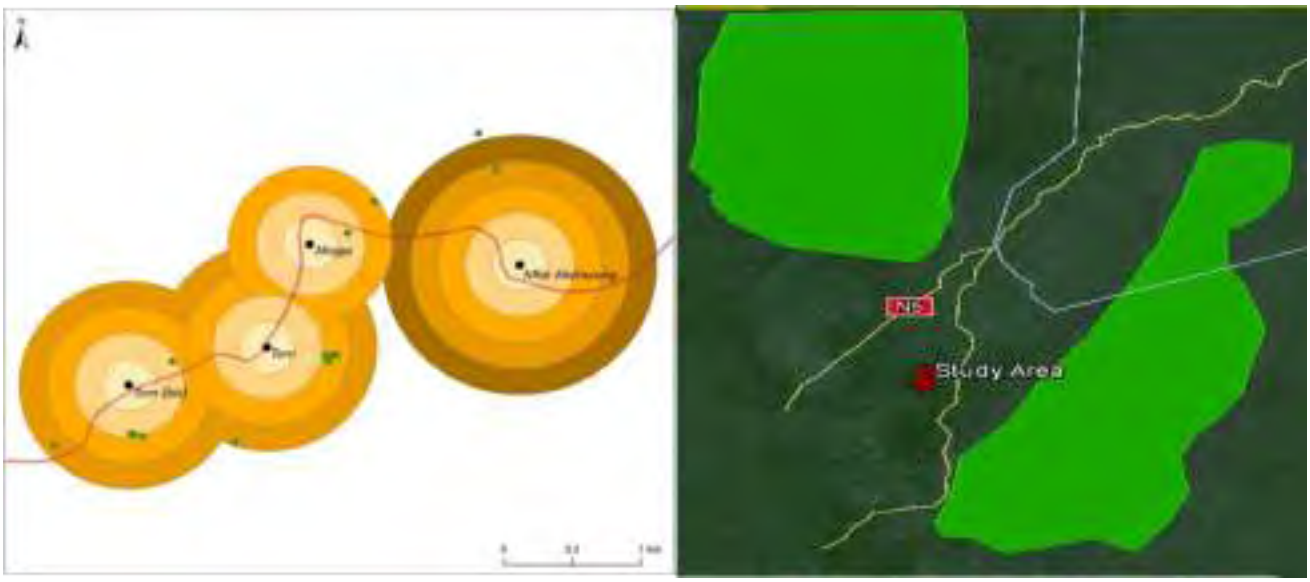


***Figure 1:** Map of the visited plantations with the distances from the different villages and the study area based on the location of the park.*

***Source:** Loic Eyi Akono*

The site on which the toolbox was tested in this article is Crystal Mountain national park located in the northern province of Gabon. The study area had a very low population density, with about 20 individuals in each of the four visited villages. Throughout the mission which lasted from June 11th to August 3rd, a dozen plantations that the owners allowed to be surveyed within a radius of two kilometers of the villages were visited. The majority of plantation owners were forthcoming and willing to discuss the issues they were dealing with. They agreed to take part in the study and gave a tour of their plantations where data were gathered. This included the size of the plantations which was roughly about 3000 m2 for most plantations, the crops grown, as well as an account of the events that lead to the destruction of their crops, and evidence such as the damage done or leftover animal waste was sought to determine which species were involved and what was their method of operation. Pictures, GPS coordinates as well the damages caused by the various species and the solutions that came up at first were all incorporated in the KoboCollect application and were discussed with the villagers.

Results

The different plantations showed many similarities with respect to crops, size and devastation. Across the board, over half of the plantations were destroyed if not all of it, showcasing the extent of the issue. The solutions believed would have the greatest result were fencing the plantations with wooden logs to block the animals from reaching the crops, making a fire or noise to scare the animals away, or have somebody monitoring the plantations during nighttime. These solutions were considered as being the best because they were easy to set up and did not require any financial investment. Given what was available to work with, these solutions represented the best outcome. Some were actually put in place prior to the development of the toolbox, but were neither effective nor efficient, such as making fire to scare away undesired animals.

All the visited plantations had been affected by wildlife. Depending on the species causing the damage and the crops destroyed, different elements could be found. Mandrillus sphinxes, the largest species of monkey commonly known as Mandrill, dig to uproot cassava roots, so do cane rats (Thryonomys xx). However, an entire cassava plant removed is indicative of elephants.

Table 1: Summary of the attempted and proposed solutions in the affected plantations.

Village	Affected Crop	Species	Number of Animals	Attempted Solutions	Toolbox Proposed Solutions
Akoga	Cassava	Antelope	Unknown	Fire/Scare Away	Keep Watch/
Akoga	Corn/Cassava	Antelope	>5	Fire/Scare Away	Keep Watch/Metallic Fence/Cover Crop
Tom	Cassava	Thryonomys	Unknown	Wooden Fence/Fire	Metallic Fence
Akoga	Cassava	Mandrill	>5	Fire/Scare Away	Keep Watch/Regulated Killing
Akoga	Peanut/Corn	Thryonomys	3	Wooden Fence/Fire	Metallic Fence
Tom	Cassava	Elephant	1	Fire/Scare Away	Keep Watch/Trench/Bee Hive Fence/Pepper Production/Regulated Killing/Metallic Fence/Cover Crop
Tom	Peanut	Mandrill	>5	Fire/Scare Away	Keep Watch/
Mbe-Akelayong	Cassava	Thryonomys	>5	Wooden Fence/Fire	Metallic Fence
Tom	Pineapple	Mandrill	Unknown	Fire/Scare Away	Keep Watch/Regulated Killing
Akoga	Cassava	Thryonomys	Unknown	Wooden Fence/Fire	Metallic Fence
Tom	Pineapple	Viper	Unknown	Fire	
Mbe-Akelayong	Cassava	Elephant	>5	Fire/Scare Away	Keep Watch/Trench/Bee Hive Fence/Pepper Production/Regulated Killing/Metallic Fence/Cover Crop
Tom	Atanga tree	Bird	Unknown	Fire	Fire
Akoga	Cassava	Potamochoerus	Unknown	Wooden Fence/Fire/Scare Away	Keep Watch/Regulated Killing

Discussion

A range of solutions from the toolbox could have been used but most would have been more labor intensive, time consuming and would have required funds. A fence made out of bee hives would not only yield honey, which is a commodity that could be sold, but would scare away many animals, amongst which elephants that would fear getting stung (King et al., 2010). Cultivating pepper would be helpful as chili-pepper extracts could be used is projectiles as they have a deterring effect on animals, amongst which elephants, due to their strong scent and taste (Osborn, 2002). With a little bit of start-up money from government wildlife agencies, self-sustaining solutions are viable options to the recurring conflicts that are faced in the remote villages surrounding Crystal Mountain national park. Many causes backed by conservation NGOs require government attention, notably the human-wildlife conflicts. Metallic fences deeply rooted in the ground would prevent many of the disruptive species from reaching the crops such as cane rats (Thryonomys spp), roan antelopes (Hippotragus equinus). However, given the large area that each plantation covered, ranging from 2000 to over 5000 m2, the price of this particular solution might be substantial. Moreover, elephants for instance could potentially break the fence down, or mandrills could climb over it.

A single solution cannot be effective forever, thus the importance to combine various ones (Hoare, 2015). Once faced with a challenge to access the plantations, the animals will devise ways to go around whatever it is that was blocking them. With multiple solutions involved simultaneously, the cost of the solutions would be outweighed by the benefits. Farmers would have the ability to feed their communities and sell their crops, thus benefiting the local economy. Gathering the data is an important step in solving the issues. With the gathered information, there is a better understanding of the actual situation, thus a better action plan can be put in place to mitigate the various conflicts that the local populations have to frequently face (Le Bel et al., 2016).

The observation and testing period lasting only a couple of months, the research lacks insight on the recurrence of the conflicts depending on the season and the long term effect of the proposed solutions. Hence, frequent follow-ups are necessary to ensure that those solutions are properly enforced. A longer timeframe spanning on at least two years could give an accurate survey of the effectiveness of the different solutions attempted. A community action plan that takes these different solutions and devises ways to not only put them in place on a given plantation, but in the entire Central African region with the collaboration of both villagers and organizations attempting to mitigate the human-wildlife conflicts would be the ideal way to ensure the proper use of the toolbox and yield credible results.

Conclusion

The conflict between humans and fauna in Central Africa is a major concern for conservation. The people that are affected by these conflicts need viable and sustainable solutions that will not only help them in the long run, but protect the different species involved in the conflicts. It is through environmental education and counseling that any results will be achieved. The idea behind the toolbox was to offer the villagers solutions in order to prevent wildlife from destroying their farms. Attempts have been made to mitigate the conflicts but the efforts were generally fruitless. For an effective response to the conflicts between humans and wildlife, governments as well as organizations have to make an effort to gather funds in order to tackle the issue. Based on observations, the best solutions such as fencing the plantations with metallic fences or using chili-pepper extracts would require money. The efforts done with the toolbox and KoBoCollect are the first steps in the right direction to solve the ongoing conflicts. The data gathering aspect has been pivotal in the process. Nonetheless, only the solution handbook of the toolbox was of credible assistance. Little has been done on the ground, however with coordinated efforts from the government, conservation organizations and local populations, optimistic goals can be achieved.

References

Barua, M., S. A. Bhagwat, S. Jadhav. 2013. The hidden dimensions of human–wildlife conflict: Health impacts, opportunity and transaction costs. Biology Conservation 157:309-316

FAO. 2010. Human-wildlife conflict in Africa: Causes, consequences and management strategies, FAO Forestry Paper 157

Hoare, R. (2015). "Lessons from 20 years of human-elephant conflict mitigation in Africa." Human Dimensions of Wildlife 20(4): 289-295

Ilama, L. 2015. A toolbox for human-wildlife conflict management in Central Africa. Nature et Faune 29(2):70-73
King, L. E., J. Soltis, I. Douglas-Hamilton, A. Savage, and F. Vollrath. 2010. Bee Threat Elicts Alarm Call in African Elephants. PLoS ONE 5, 9

Le Bel, S., D. Chavernac, F. Stansfield 2016. Promoting a mobile data collection system to improve HWC incident recording: a simple and handy solution for controlling problem animals in southern Africa. Problematic Wildlife A Cross-Disciplinary Approach, Francesco A.M. (Ed.), Springer, 395-411

Le Bel, S., G. Mapuvire, R. Czudek 2010. La boite à outils des conflits humains-faune sauvage : des solutions pratiques pour les agriculteurs et les communautés. Unasylva 236, Vol. 61, 12-13

Osborn, F.V. 2002. Capsicium oleoresin as an elephant repellent: field trials in the communal lands of Zimbabwe. Journal of Wildlife Management 66(3):674–677

Tchamba, M. N. 1996. History and present status of the human/elephant conflict in the Waza-Logone region, Cameroon, West Africa. Biology Conservation 75(1):35-41

Woodroffe, R., S. Thirgood, A. Rabinowitz. 2005. People and Wildlife, Conflict or Coexistence? Conservation Biology 9:13-26

Enhancing sustainability and efficiency of woodfuel production and consumption in Sub-Saharan Africa

Zuzhang Xia[1]

Summary

This article summarizes the significance and impacts of traditional woodfuel sector and the key concerns on production sustainability and consumption efficiency of woodfuels in the context of sub-Saharan Africa. It briefly discusses the means of improving sector performance through enhancement of governance and calls for a systematic approach along the entire value chain to tackle the problems in the sector and to make woodfuel a sustainable and viable energy option. It also highlights the importance of developing wood fuel technologies that must be appropriate to the environment and cultural norms together with a range of other proposals for improvement.

Introduction

Wood is a basic energy resource for billions of people. One-third of households worldwide and two-thirds of those in Africa use wood as their main fuel for cooking, heating and boiling water. Woodfuel provides more than half the national energy supply in 29 countries, of which 22 are in sub-Saharan Africa (SSA). The share of wood energy in total primary energy supply accounts for 27 percent in Africa – 71 percent in Central Africa, 65 percent in East Africa, and 30 percent in West Africa (FAO, 2014).

Wood energy has advantages and disadvantages. It is often the most affordable and locally available source of energy for households and involves a significant number of informal employment that supports local livelihoods, especially among low-income groups in developing countries. Despite its socioeconomic significance, the traditional woodfuel sector is often associated with unsustainable and/or illegal production that leads to deforestation, forest degradation and, in some areas, woodfuel scarcity. It also links to indoor air pollution due to the use of inefficient woodstoves, leading to health problems. Moreover, fuelwood collection can impose a disproportionate work burden on women and children. Figure 1 shows that people in some countries have to go far away to collect fuelwood and carry it back home for household cooking.

Photo credit: ©FAO/A. Thulstrup

Figure 1. *Fuelwood collection in Samburu, Kenya*

[1] *Zuzhang Xia, Forestry Officer (Wood Energy), Forestry Department, Food and Agriculture Organization of the United Nations (FAO), Viale delle Terme di Caracalla, 00153 Rome, Italy*
Email: Zuzhang.Xia@fao.org | Phone: (+39) 0657054056 | Web address: www.fao.org/forestry/energy/

In general, traditional use of woodfuel declines as household incomes rise and people switch to other fuels or electricity. However, the total demand for woodfuel at a national or regional level may not necessarily decline in the short to medium term or may even increase due to population growth and an initial switch in households from fuelwood to charcoal, coupled with growth in the industrial use of woodfuel. In many SSA countries, it is likely unrealistic to replace woodfuel with fossil fuels as the primary source of energy for households in the foreseeable future, nor would this be an optimum solution given the availability, accessibility, affordability and potential sustainability of woodfuel compared with many other energy options. Rather, efforts are needed to address the problems associated with traditional woodfuel production and use through regulatory interventions, improved forest management practices, enhanced woodfuel production through agroforestry and trees outside the forest by smallholders, and technological advances.

Valuing the contribution of the wood energy sector

Woodfuel is often handled by the informal sector and therefore official statistical data are lacking in many countries. Nevertheless, the economic value of wood energy is considerable. For example, FAO has estimated that 195 million people in Africa are employed in the wood energy sector on a full-time or part-time basis – the equivalent of 45 million full-time jobs or roughly 4.6 percent of total employment in the region (FAO, 2014). The annual contribution of the charcoal sector alone to employment, rural livelihoods and the wider economy has been estimated at about US$650 million and US$450 million in Tanzania and Kenya, respectively (World Bank, 2010). These estimates correspond roughly to 2.2 percent and 1.2 percent of the national gross domestic products (GDPs) of those two countries in 2009. Fuelwood and charcoal production and trade by individuals and small enterprises play important roles in subsistence livelihoods and as an important means of income generation, particularly to the low-income groups. It may not be appropriate to simply treat fuelwood and charcoal production as illegal and/or irresponsible practices without differentiation of the contexts and provision of alternative energy options. Harsh restrictions that ignore realities of the existing informal sector, such as banning charcoal production, may block provision of basic energy service and put many players of the wood energy value chain into a more difficult situation.

The international community has identified wood energy as having the potential to contribute to various Sustainable Development Goals (SDGs), particularly SDG7 (energy access), SDG13 (combat climate change), and SDG15 (sustainable forest management). Wood energy is also relevant to SDG3 (health and well-being) and SDG5 (gender equality) because the clean and efficient use of wood energy reduces deadly exposure to indoor air pollution and the time spent collecting wood and cooking, both of which are particularly important for women and children. The wood energy sector contributes to SDG8 (economic growth and employment), and the modernization of the wood energy value chain would have considerable economic impacts and create many jobs, especially in rural areas.

Enhancing the sustainability of woodfuel production

The assessment of woodfuel sustainability involves a complex array of criteria and indicators on environmental and socio-economic dimensions. The criteria and indicators developed for modern bioenergy under the Bioenergy and Food Security project of FAO provide informative references for the sustainability assessment of the wood energy sector (FAO, 2012).

Globally about half of total wood production is used as woodfuel. The share of woodfuel in total wood production varies from 17 percent in high-income countries to 94 percent in low-income countries (FAO, 2015). Such a high percentage of energy use of wood produced in low income countries implies that woodfuel is a major concern to sustainable forest management. The potential connections between forest degradation and the human pressure are reflected in maps set side by side in the SSA region (Figure 2).

A recent study estimated that one-fourth to one-third of the woodfuel harvest worldwide was unsustainable, with geographic variations but concentrated in South Asia and SSA (Bailis, 2015).

[2] *World Bank data indicate that the GDPs of the United Republic of Tanzania and Kenya were US$28.57 billion and US$37.02 billion, respectively, in 2009.*

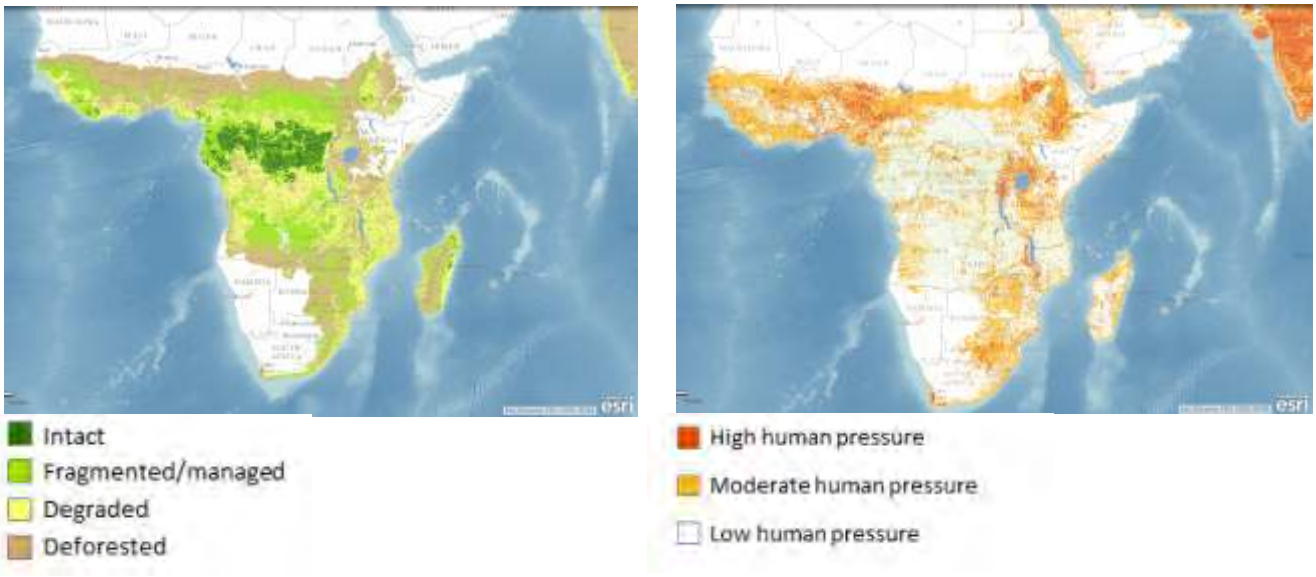


***Figure 2.** Current conditions of forests and human pressure in SSA (Source: WRI, 2015)*

In many African countries, the wood energy sector is characterized by the presence of numerous actors, informal practices, the unequal distribution of benefits, and a lack of incentives to produce woodfuel sustainably. The key issues include a resource deficit due to extraction rates that exceed natural growth; a lack of woodfuel plantations; insecure tenure and access rights; the unequal distribution of benefits to producers; competition for the use of trees and land; a lack of awareness and knowledge of sustainable management practices; the low efficiency of charcoal production; and weak resource governance.

Potential interventions to increase the sustainability of wood energy production include improving forest management; the establishment of dedicated woodlots for energy production; and the efficient use of wood wastes from harvesting and processing industries. Wood production may be increased by incentives to improve the management of degraded forests; the adoption of agroforestry; and the reforestation of fallow or degraded land. Other measures include participatory approaches for resolving conflicts over land tenure, better planning and monitoring, and the improvement of tree harvesting techniques and regulations.

Improving the efficiency of woodfuel conversion and consumption

Charcoal is a primary cooking fuel for urban dwellers in many SSA countries because of its comparative advantages to fuelwood (such as higher energy content, less smoke, and ease of transport and storage). The high demand for charcoal from major urban centers imposes heavy threats to forest resources in proximity to the cities and in areas along the highways far away from the urban centers, leading to landscape level impacts. The charcoal making efficiency is well below its technical potential. For example, the prevailing wood-to-charcoal conversion efficiency is only about 15 percent. Improving conversion efficiency to 25 percent would reduce the volume of wood required to produce the same amount of charcoal by 40 percent. Such efficiency improvement may not require a large upfront investment. Given the increasing demand for charcoal, effective improvement in charcoal production efficiency would have great significance. From technological perspectives, various efforts have been made to improve the efficiency of charcoal production ever since early 1980s. The FAO publication "Simple Technologies for Charcoal Making" (FAO, 1983) provided a comprehensive overview on various issues along the charcoal value chain, covering the logistics of charcoal production, growing the wood raw material, harvesting and transporting fuelwood, comparative performance of carbonization systems and various charcoal kilns, as well as the transport, distribution, storage and using of charcoal.

The inefficient combustion of woodfuel using traditional stoves results in serious indoor air pollution. Although advanced wood-burning stoves can obtain thermal efficiencies of more than 50 percent, three-stone fires with a thermal efficiency of less than 15 percent are still used widely. Previous lessons and experience with cookstove improvement programmes suggested that such programmes must take into account the cooking practices and economic, social and cultural circumstances of target users. No matter how efficient or cheap the stove, uptake by households will be low if the stove is difficult to install and maintain or not easily adaptable to local preferences. On the other hand, households have tended to be most receptive when the dissemination process has taken full account of the capacities and needs of local stove producers and consumers.

Technological progress in the modern industrial use of woodfuel in developed countries may inspire innovations for more efficient conversion and productive uses, but the investment scale of some technologies and the cost of the products may be prohibitively high to be replicated in the contexts of many less-developed countries, even though such stoves are clean and efficient. Thus, low-cost appropriate technologies that match local socioeconomic conditions should be further explored.

Enhancing governance in the woodfuel sector

Wood energy suffers from a lack of recognition in national planning, at least partly because it spans the energy, forestry, agriculture and rural development sectors but is not fully incorporated in any of these, and partly because of the complexity of dealing with a largely informal sector. Wood energy is also relevant to several other sectors, such as environmental protection, gender development, and transportation. There is often poor coordination between institutions in these various sectors affecting wood energy, and agencies tend to see little benefit in expending effort in the sector.

Many developing countries, including SSA countries, lack policies governing woodfuel production, trade and consumption. Even when such policies are in place, they are often vague, inconsistent, contradictory or conflicting. Moreover, the institutional capacity to enforce wood energy policies and regulations (where they exist) is often weak and, as a consequence, illegal logging and trade may be widespread. Institutional weaknesses, coupled with unclear policy and legal frameworks, invite corruption – a major cause of a lack of regulation and enforcement in the wood energy sector, particularly with respect to charcoal production and trade.

Addressing the problems associated with wood energy production and consumption and to improve governance in the sector requires political will. It also requires effective cross-sectoral coordination to balance the needs of stakeholders and to create a harmonized regulatory environment. An important step in building political will is recognition of the important role a sustainable wood energy sector can play in national energy and food security, ecosystem conservation, rural livelihoods, health, gender development and job creation.

Adequate data and information on the wood energy value chain are important in formulating sound policies and regulations for the sector. FAO has been compiling a Yearbook of Forest Products since 1947, covering data on fuelwood and charcoal production and trade provided by Member States. There exists however concerns on data quality for certain countries, partially due to the fact that wood energy data are not included in official statistics. To improve data availability and reliability, regular surveys should be carried out on woodfuel production and supply, trade and transport, end-user consumption and market demand, and how these are changing over time.

In addition to data, tools are also important means in support of policy formulation and sector governance. The Woodfuel Integrated Supply/Demand Overview Mapping (WISDOM) is a spatially-explicit method for highlighting and determining woodfuel priority areas or "woodfuel hot spots", developed by FAO in early 2000s and applied in many countries and regions. WISDOM is oriented to support strategic planning and policy formulation, through the integration and analysis of existing demand and supply related information and indicators. Rather than absolute and quantitative data, it is meant to provide relative/qualitative values such as risk zoning or criticality ranking, highlighting, at the highest possible spatial detail, the areas deserving urgent attention and, if needed, additional data collection. WISDOM may serve as an assessing and strategic planning tool to identify priority places for action (FAO, 2003).

Conclusion

The wood energy sector in SSA faces a range of socioeconomic, technological, market, financial, institutional, policy, regulatory and governance barriers that are deeply rooted and which impose significant constraints. A systematic approach – with interventions along the entire value chain – is required to tackle the problems in the sector, which may involve (among other issues):

- Recognizing the value and importance of the wood energy sector in the provision of energy service
- Conducting assessment of the current status and future trends in wood energy production and consumption
- Developing tools to support policy formulation and decision-making processes, particularly in resource assessment and supply-demand analysis and planning, and strengthening the institutional framework and cross-sectoral coordination to create an enabling environment for investment and innovation in the sector.
- Enhancing technical capacity to improve the sustainability of wood energy production, the effective use of wood waste, the efficiency of charcoal-making, and the cleaner use of wood energy in the household sector.

References

Bailis, R., Drigo,R., Ghilardi, A., Masera O. 2015. The carbon footprint of traditional woodfuels. Nature Climate Change 5, 266–272 (2015).

http://www.nature.com/nclimate/journal/v5/n3/full/nclimate2491.html

FAO. 1947-2014. Yearbook of Forest Products. http://www.fao.org/forestry/statistics/80570/en/

FAO. 1983. Simple technologies for charcoal making. http://www.fao.org/docrep/X5328e/X5328e00.htm

FAO. 2003. Woodfuel Integrated Supply/Demand Overview Mapping (WISDOM). http://www.fao.org/docrep/005/y4719e/y4719e00.htm

FAO. 2014. State of the world's forests: enhancing the socioeconomic benefits from forests. http://www.fao.org/3/a-i3710e.pdf FAO. 2012. A compilation of tools and methodologies to assess the sustainability of modern bioenergy. http://www.fao.org/docrep/015/i2598e/i2598e.pdf

Photo credit: ©FAO/Giulio Napolitano

Farmers transporting firewood by donkey in the sahel

The snail value chain in Sao Tome and Principe: An opportunity for income diversification for rural communities

Ousseynou Ndoye,[1] Da Conceicao Neto De Oliveira Faustino[2] and Armand Asseng Ze[3]

Summary:

Snail is an important Non Wood Forest Products (NWFP) for the livelihood of rural communities living in Sao Tome and Principe. The purpose of the paper is to show the potential snail has in improving the livelihood of collectors, most of whom are women. The paper describes the approach used by the FAO NWFP project in developing the entrepreneurial capacity of communities involved in the collection and sale of snails. The beneficiaries are organized in groups which allow them to generate revenues from sales of snails. The bank account opened are aimed at enabling the groups to better manage the profit from the snail business and to plan for future investment. Domestication activities have been started to reconcile livelihood improvement with sustainable management of snails in Sao Tome and Principe.

Introduction

The flesh of snail called Buzio (Archachatina marginata) in Sao Tome and Principe (STP) is rich in proteins, iron, calcium, and amino acid, which are essential nutrients for human beings. This Non Wood Forest Product (NWFP) has always been consumed by the populations of STP. It plays an important role in strengthening food security and nutrition and provides revenues to local communities. In STP, this NWFP is also used in traditional medicines to cure asthma, heal wound, stop haemorrhage, fight against anaemia, and to cure epilepsy.

The gathering or collection of snails and their consumption with cocoyam (Xantosoma sagittifolium) are e done by poor members of communities, living mainly in the periphery and in remote areas and inside cocoa and coffee plantations. Baseline studies carried out in Plancas 1 and in Novo Destino, the two pilot sites of the project strengthening the contribution of Non Wood Forest Products to food security and nutrition in Central Africa funded by the African Development Bank (AFDB) through the Congo Basin Forest Partnership (CBFP), implemented by FAO under the supervision of COMIFAC, showed that communities that collect snails were not organized in carrying out their activities and were not working in groups to mutualize their efforts and to increase their revenues.

Due to the necessity of having viable enterprises that master the snail value chain in STP, training on the entrepreneurial development of small and medium forest based enterprises (SMFE) was organized and served as a platform for the elaboration of Enterprise Development Plans (EDP) or business plans before starting the group marketing of NWFP. The ultimate goal of the training was to strengthen the cohesion between the members of the communities and to improve their well being. The objective of the paper is to show the potential that snail has to improve the livelihood of collectors. The results show that snail collectors get a monthly income that exceeds the minimum wage that prevails in Sao Tome and Principe. The first section of the paper describes the steps required before organizing a group marketing of NWFP. Included in this section are a brief description of the training on Market Analysis and Development, the structuration of enterprises, and the building of warehouses and the supply of small materials. The second section discusses the group marketing and includes a description of the snail value chain, the number of group marketing organized and the strategy to manage the profit made from the snail enterprise. Section three discusses the domestication of snails to reconcile improvement in livelihood and sustainable management of snails. Section four provides some perspectives.

[1] *Ousseynou Ndoye, Chief Technical Advisor, Non wood forest products project (NWFP), Food and Agriculture Organisation of the United Nations (FAO), Sub regional office for Central Africa (SFC) ; Immeuble Bel Espace Batterie IV 2643 LIBREVILLE, BP 2643. Email: Ousseynou.Ndoye@fao.org. Telephones: +241 01774783; +241 07641164; +241 01741092. Website: www.fao.org/africa/central*

[2] *Da Conceicao Neto De Oliveira Faustino, National project coordinator for Sao Tome and Principe, Email: faconeol@yahoo.com.br, Tel: +239 9905279*

[3] *Armand Asseng Ze, Specialist Natural Resources/Non Wood Forest Products, FAO Cameroon, Email: Armand.AssengZe@fao.org*

Figure 1. Snails in Sao Tome and Principe

1. Steps required before organizing the group marketing of NWFP

1.1 Training on Market Analysis and Development (MA&D)

Two trainings on the entrepreneurial development of SMFE were organized in April 2015 in the two pilot sites of Plancas 1 and Novo Destino. The general objective of these trainings was to provide knowledge on entrepreneurial development and on basic principles of the Market Analysis and Development (MA&D) approach and particularly its phase 3 to representatives of SMFE of NWFP, to representatives of local NGOs, and to staff of public institutions.

The trainings have allowed the identification of the major income generating NWFP and the creation of SFME around these products: Buzio (snail) (Archachatina marginata), Jaca (Artocarpus altilis), Fruta pao or Bread fruit (Artocarpus heterophyllus), Palm wine (sap of Elaies guineensis), Morango (Rubus rosifolius), and Pimpinela (Sechium edule). At the beginning of the project, revenues obtained by households from sales of NWFP were less than 50 percent of revenues from sales of agricultural activities.

1.2 Structuration of SMFE

After the creation of SMFE, their structuration was the next step, each of them elaborating its status and appointing the members of its governing body. This was an important step in order to get the legal recognition of the SMFE by government authorities.

1.3 Building of warehouses and provision of small materials to SMFE

Building warehouses to store NWFP strengthens the competitiveness of SMEF and enables them to improve the quality of their products. Due to the perishability of many NWFP, their conservation remains a priority for the entrepreneurial activities of the project. Two warehouses inaugurated by the Minister of Agriculture and Rural Development of STP were built in the project pilot sites, Plancas 1 and Novo Destino. In each site, the warehouse is under the responsibility of the head of the community. The total cost of the two warehouses is 16000 USD. Several equipments (materials) composed of a generator, one deep freezer, several buckets, gloves, and cool boxes were distributed in each pilot site in order to preserve the quality and sanitary conditions of the NWFP. The generators have not started running in both the two pilot sites. After building the warehouses and distributing the materials, SMFE started to prepare for the group marketing of NWFP.

2. Group marketing of NWFP

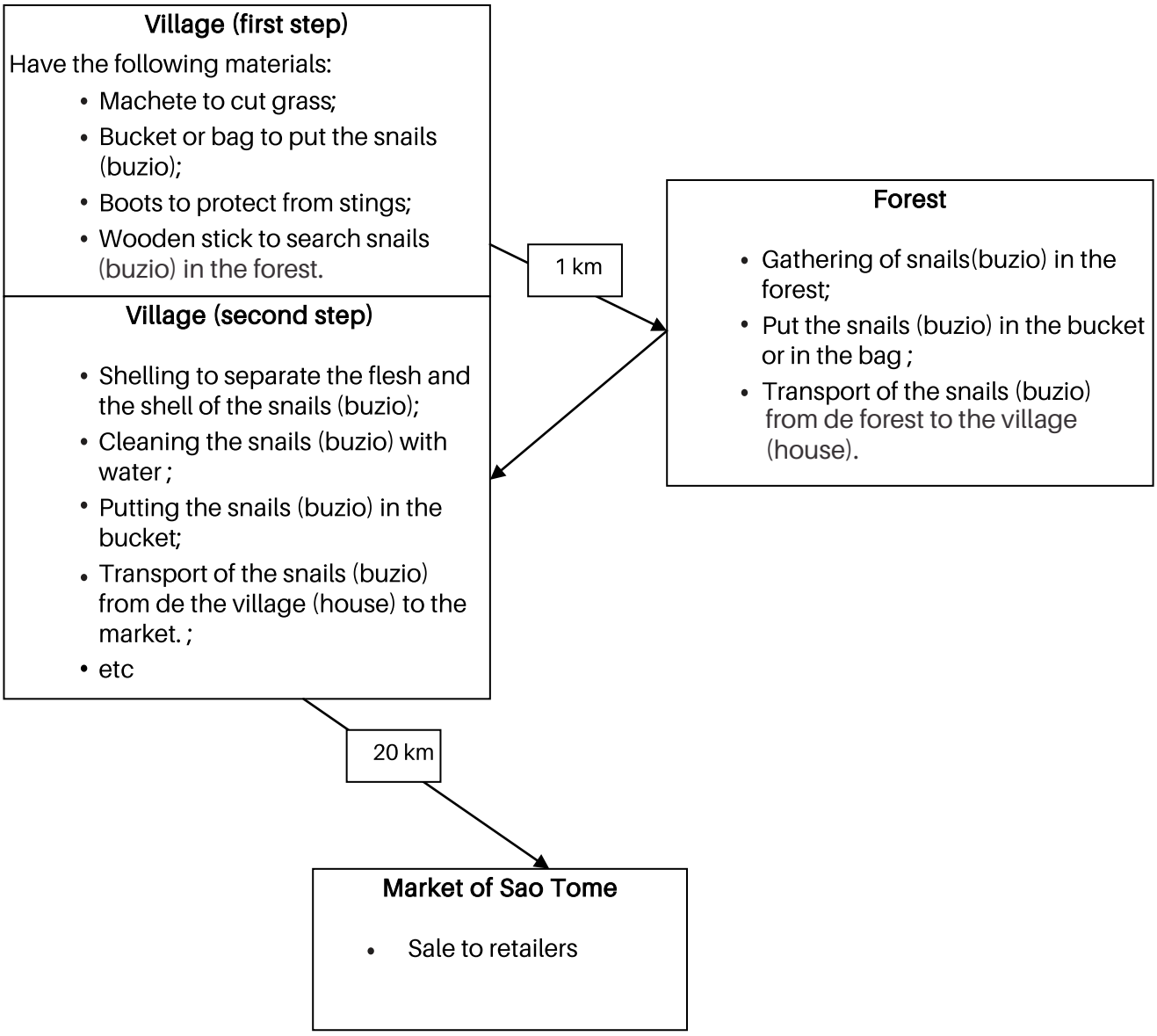
A group marketing of NWFP can be defined as an activity through which during a given date agreed by parties, members of SMFE sell their NWFP to one or several traders who will afterwards sell them in semi-urbans and urban markets thereby facilitating a good matching of supply and demand of NWFP. Group marketing enables traders to collect larger quantities of NWFP at once which will allow them to save time by taking advantage of economies of scale. Furthermore, group marketing of NWFP increase the bargaining power and the incomes of members of SMFE.

2.1 Steps of the value chain which facilitate the group marketing of snails

The following steps are required before the SMFE could organize a group marketing of snails:

- Gathering of snails in the forest by members of the SMFE;
- Transport of snails from the forest to the village and cleaning with water;
- Shelling to separate the flesh and the shell;
- Conditioning and conservation in cool boxes. The snails are sold fresh. Putting them in the cool boxe protects them from the sunny condition in the market which may otherwise affect the quality of the snails and their sale prices;
- Transport of the snails from the village to the central market of Sao Tome for the group marketing which is carried by few members of the SMFE on behalf of the whole group.

Snail value chain in Sao Tome and Principe



2.2 Number of group marketing organized

From 02 November 2015 to 03 March 2016, the SMFE of Novo Destino involved in the gathering of snails organized 13 group marketing of this NWFP. The results are presented in the table below.Before being organized in group, each member was working alone and all the revenues obtained after sale were spent in the market (buying good food, drinking wine etc...) with no account management and no savings. Being in group, allows a better management of the account and savings in the bank. This implies that each member is better off being in group than in individual business.

As it can be seen in the table below, the number of members went from 22 to 16 as few members left for lack of continuous motivation. For each harvest, a small group of women (4-5) is designated to gather snails in the forest. The exercise takes between three to four hours each harvest day. During another harvest day, another small group of women is designated. This implies that the harvest of snails in the forest is done on a rotation basis.

Table: Group marketing of Buzio (Archachatina marginata) and profit made by the SMEF of STP

N°	Date	Number of buckets sold	Number of kg sold	Amount of the profit made (Dobras)	Number of Beneficiaries
1	02 november 2015	6	210	6 025 000	22
2	09 november 2015	6	210	5 665 000	22
3	14 november 2015	6	210	6 355 000	22
4	28 november 2015	6	210	5 105 000	22
5	01 december 2015	6	210	4 515 000	22
6	08 december 2015	3	140	4 060 000	22
7	22 january 2016	1	35	1 980 000	16
8	30 january 2016	1	35	1 200 000	16
9	05 february 2016	2	70	1 245 000	16
10	12 february 2016	2	70	1 520 000	16
11	19 february 2016	1	35	975 000	16
12	26 february 2016	1	35	1 585 000	16
13	03 march 2016	1	35	1 560 000	16
Total: Forty-one millions seven hundred ninety thousand Dobras,				**41790 000 Dobras**	
Equivalent in FCFA				**1 129 200 FCFA**	
Equivalent in USD				**1 882 USD**	

Sources: Data collected by the NWFP's project GCP/RAF/479/AFB (March 2016)

The total quantity of snails sold is 1505 kg giving a total profit (after deducting all costs) of 41.790.000 Dobras, equivalent to 1.129.200 CFA F (USD 1882). The strategy followed by the SMFE before each group sale is to give to each member a quantity of snails equivalent to 200.000 Dobras to satisfy the needs of the household. The total value of the snails allocated to the members of the SMFE represents 48.800.000 Dobras from 02 November 2015 to 03 March 2016. This strategy allows the members of the SMFE to save the total amount of profit reported in the table above. Furthermore, it strengthens the solidarity within the group. The profit that is deposited in the bank (see section 3.3 below) is divided in three parts. The first and most important part will be divided equally among the members of the group to enable them to satisfy the basic needs of their households. The second part will be used for the operational costs of the group. The third part will remain in the bank to serve for the future investment of the group.

The total profit made from the snail business is equivalent to a monthly income of 29.98 USD for each member of the group. In addition, the value of the quantity of snails given to each member before each group sale amounting 39.03 USD per month, this implies that each member potentially gets 69 USD per month from the snail business. This is very encouraging for one value chain. The amount exceeds the minimum wage of 40 USD per month that prevails in Sao Tome and Principe.

Figure 2. Group sale of snails in market of Sao Tome

2.3 Opening a bank account and strategy to manage the profit from the group marketing of snails

During the MA&D trainings, a particular emphasis was made on the importance by the SMFE to open a bank account and on how to manage the profit generated by the SMFE. Furthermore, a representative of Ecobank was invited to attend the sessions where the Enterprise Development Plans elaborated were presented to allow him to grasp the income generation and employment potential of NWFP and to present to participants Ecobank conditions for opening a bank account. Some administrative bottlenecks linked to the renewal of the national identity cards of some members of the governing body of the SMEF have delayed the opening of the bank account which has finally been opened at the beginning of April 2016. Prior to opening the account, the revenue generated by the SMFE through the sale of snails was kept by the accountant.

3. Effort put forth for the domestication of snails in Sao Tome and Principe

In order to reconcile livelihood improvement and the sustainable management of snails, domestication of this valuable resource has been carried out by the project. The objective was to provide the members of the communities with sustainable technics that would allow them to increase the production of snails especially in the dry season. Two domestication sites costing a total of 4300 USD, have been constructed in Novo Destino and Plancas 1 to train members of communities on how to produce snails in order to reduce the pressure on the wild resource that is available in the forest.

4. Perspectives

With the political will of the government of STP aimed at promoting the consumption of local products, NWFP could play an important role and contribute to food and nutrition security, and income generation for the populations. The gathering and commercialization of snails carried out mainly by women, is a good opportunity for the diversification of their revenues thereby increasing their contributions to their households. The results obtained with the domestication of snails are very encouraging and will allow communities to increase production, consumption and marketing of this important NWFP throughout the year. To better match the supply and demand of snail, information on their availability needs to be disseminated to traders, restaurant owners and consumers. The success of this initiative could be facilitated by the availability of mobile phones in rural areas which allows good communication between the areas of supply and those of the demand of snail in STP.

Bibliography

FAO (2015). Rapport final de la formation sur la domestication de Archachatina marginata Sw. à Novo Destino, Coordination Nationale du projet GCP/RAF/479/AFB, Sao Tomé et Principe.

FAO (2016). Entrepreneurial development and group marketing of Buzio (snails) in Sao Tome and Principe Enhancing the Contribution of Non-Wood Forest Products to Food Security in Central Africa, GCP/RAF/479§/AFB Information note N° 7. FAO, Central African Forest Commission (COMIFAC), Congo Basin Forest Fund (CBFF). April 2016.

LINKS

"Forests for the Future – New Forests for Africa" March 2016 Conference Report
http://newforestsforafrica.org/wp-content/uploads/2016/06/20160617-CONFERENCE-REPORT-NFFA-MARCH-2016-final.pdf

The initiative 'Forests for the Future – New Forests for Africa' has been established with the aim to stimulate and drive large scale reforestation in Africa. The target to reach 100 million hectares of new forests, which African nations have set themselves is of an exceptional size. To realize this, African leaders see the need for sustainable forestry projects based on a long-term approach and multi-stakeholder benefit. They particularly see the benefit to intensify the cooperation with the private sector as they have the resources, innovation and the ability to deliver. 'Forests for the Future – New Forests for Africa' is thus a multi-stakeholder movement of forest plantation companies, financial institutions, governments, NGO's and local communities who will actively set up projects and initiatives to boost reforestation with the focus on degraded land. The first landmark that has been set was the working conference (March 16 and 17, 2016 in Accra, Ghana) with key players in reforestation and a keynote of the Honourable Mr. Kofi Annan, former UN Secretary General. Download the conference report from the following link: http://newforestsforafrica.org/wp-content/uploads/2016/06/20160617-CONFERENCE-REPORT-NFFA-MARCH-2016-final.pdf

FoodTank - Using agroforestry to save the planet

Food Tank highlights 16 agroforestry projects that are benefiting farmers, communities, and the environment. http://foodtank.com/news/2016/05/using-agroforestry-to-save-the-planet

Deforestation in Congo basin highest in forest concessions with forest management plans or in those without?
Full article: http://dpfac.cirad.fr/amenagement-et-deforestation

An article in Land Use Policy early 2016 concluded that deforestation in Congo were highest in forest concessions with forest management plans (FMPs) than in those without. The impact assessment analysis which led the researchers to such a result is based on matching randomly selected plots in concessions with and without management plans. These researchers suggest that the network of forest roads more developed in managed concessions is one of the explanatory factors. The other would be local development connected with specifications of FMPs, which would lead to an increase in population in these concessions and increased deforestation. However, a group of twenty researchers, familiar with the problems of forest management in Central Africa, decided to analyze deforestation at concessions level over the same time interval. Results show, this time, that deforestation is lower in concessions with FMPs than in the others. In a comparative analysis of deforestation with production remaining constant, concessions with FMPs are approximately twice as efficient as those without: per cubic metre produced, gross loss of forests cover was lower by half in concessions with FMPs. The researchers do not argue that forest management planning reduces deforestation because they understand that there are other factors which play essential roles. The dynamics of these other factors need to be analyzed so as to avoid systematically attributing to forest management planning a greater role in deforestation trends than deserved. Lastly, any assessment should remember that forest management is a long-term process, with long-term objectives that include sustained timber yields and avoidance of forest conversion.
Download article in English :http://dpfac.cirad.fr/amenagement-et-deforestation

Africa Energy Outlook: A focus on energy prospects in sub-Saharan Africa
https://www.iea.org/publications/freepublications/publication/AEO_ES_English.pdf

In sub-Saharan Africa Bioenergy use – mainly fuelwood and charcoal – outweighs demand for all other forms of energy combined, a picture that changes only gradually even as incomes rise. Four out of five people in sub-Saharan Africa rely on the traditional use of solid biomass, mainly fuelwood, for cooking. A 40% rise in demand for bioenergy to 2040 exacerbates strains on the forestry stock, with efforts to promote more sustainable wood production hindered by the operation of much of the fuelwood and charcoal supply chain outside the formal economy. Scarcity, along with efforts to make alternative fuels like liquefied petroleum gas available, results in some switching away from wood use, especially in towns. Promotion of more efficient biomass cook stoves reduces the health effects of pollution from indoor smoke. Nonetheless, 650 million people – more than one-third of an expanding population – still cook with biomass in an inefficient and hazardous way in 2040
Link to full article: https://www.iea.org/publications/freepublications/publication/AEO_ES_English.pdf

Why we should stop talking about 'desertification'

The write-up, written around a newly published book "The End of Desertification? Disputing Environmental Change in the Drylands". It is an "article" on its own. The worries, argumentation and statements made fit well into many other areas of work other than only "desertification". The article addresses issues of paradigm change, policy and institutional inertia and resistance, why things don not change, embracing uncertainty, and working with variability.
The article was written by Ian Scoones and appeared on Zimbabweland (https://zimbabweland.wordpress.com/)
For full article visit:
https://zimbabweland.wordpress.com/2016/07/25/why-we-should-stop-talking-about-desertification/

News from African Protected Areas (NAPA) newsletter
The 98th edition of the NAPA letter presents the second part of the EU Strategy for Conservation of Biodiversity in Africa. It also provides a few job offers. http://iucn-email.org/2GI3-S9J8-4RLTI8-DWUXK-1/c.aspx

Highlights of the 23rd Committee on Forestry/World Forest Week 5 (18 to 22 July 2016)
FAO Headquarters, Rome, Italy. Theme: Shaping a new agenda for forests

Key quotes from the opening ceremony high-level speakers on the role of forests in sustainable development and the realignment of agriculture and forestry. http://www.fao.org/about/meetings/cofo/highlights/monday/en/

Drylands; woodfuel in emergency situations; funding opportunities for forestry after the Paris Agreement.
http://www.fao.org/about/meetings/cofo/highlights/tuesday/en/

Forest peoples and the Paris Agreement; Forests and wood products - propelling a low-carbon future; scaling up the development of small-scale forest enterprises in Africa.
http://www.fao.org/about/meetings/cofo/highlights/wednesday/en/

Forests, wildlife and food security, urban forests; greening the charcoal chain, and forests and social protection. Including the appointment of the 23rd Committee on Forestry (COFO23) Chair and former President of Guyana as FAO Special Ambassador for Forests and the Environment.
http://www.fao.org/about/meetings/cofo/daily-highlights/thursday-friday/en/

Photo credit: ©FAO/Sia Kambou

FAO Regional Conference for Africa, 29th Session (ARC29)

Democratic Republic of Congo embarks on major low-carbon sustainable development programme

The largest-ever initiative to reduce forest degradation and deforestation in Africa is being rolled out in the Democratic Republic of Congo ((DRC) under a new US$ 200 million investment programme, with Norway providing the main funding. Negotiated between the Central African Forests Initiative (a new multi-partner trust fund created by the United Nations Development Programme, FAO, the World Bank and a coalition of willing donors) and the DRC Government, the signatories will commit to a series of cross-sectoral best practices to incentivize action on low-carbon sustainable development. Read more in the press release summary(http://forestry.fao.msgfocus.com/files/amf_fao/project_59/inFO_news_39_2016/inFO_News_39_CAFIFINAL_05_05.pdf) of the letter of intent between the Central African Forest Initiative and the Ministry of Finance of the Democratic Republic of Congo signed in Geneva, Switzerland, on 22 April 2016. Also visit the websites of UN-REDD (http://www.un-redd.org/), the Congo Basin Forest Partnership (http://pfbc-cbfp.org/home.html), the Congo Basin Forest Fund (http://cbff.moziware.net/projects-and-operations) and EU FLEGT (http://www.fao.org/in-action/eu-fao-flegt-programme/en/) to learn more about FAO Forestry and partners' work in the Democratic Republic of Congo.

African Development Bank Group approves USD 14 million for its first private sector direct investment in restoration of degraded forests through sustainable forest plantations in Ghana

The Board of Directors of the African Development Bank Group (AfDB) on July 13, 2016 approved a USD 14 million senior loan through its private sector window to Form Ghana Ltd for restoration of degraded forest reserves through sustainably managed forest plantations. The Board decision supports the Bank's contribution to inclusive and green growth, and its commitment to providing and leveraging well-placed finance for climate resilience. This will enhance the Banks' existing channels of support to the sector which include indirect interventions through the private sector window such as capital participation in specialized Funds focusing on Forestry.
http://allafrica.com/stories/201607190072.html

FAO-Nobel Peace Laureates Alliance for Food Security and Peace

Peace is impossible without food security, and there will be no food security without peace. Shared message of Nobel laureates: Oscar Arias Sánchez, Tawakkol Karman, Betty Williams and Muhammad Yunus FAO headquarters, Rome, Italy, 11 May 2016. Four Nobel laureates, who are acclaimed for their efforts to stop civil war, promote women's rights, provide microcredit to the poor and halt inter-religious violence, gathered at FAO headquarters in Rome in response to the invitation of the FAO Director-General José Graziano da Silva to establish the FAO-Nobel Peace Laureates Alliance. The Alliance was born out of the need to ensure that hunger will not ignite further conflicts and that, if conflict does occur, the food systems in place will be more resilient and sustainable. "Freeing the world from hunger and want is a fundamental contribution to lasting peace", said the Director-General.
Read more http://www.fao.org/nobel-for-foodsecurity-peace/en/ and in the FAO news release http://www.fao.org/news/story/en/item/414047/icode/ about the FAO-Nobel Peace Laureates Alliance, which was established on 11 May 2016 at FAO headquarters in Rome, Italy.

World leaders meet in New York for historic signing ceremony

On 22 April, the world watched as high-level representatives from around the world gathered at UN Headquarters in New York for the Signature Ceremony for The Paris Agreement.
http://unfccc.int/paris_agreement/items/9485.php The landmark climate agreement, reached in Paris in December 2015 by 196 parties to the UN Framework Convention to Combat Climate Change, commits all signatories ratifying the Agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low-carbon future.
Read more about The Paris Agreement and the New York Signing Ceremony at the following link: http://newsroom.unfccc.int/paris-agreement/ .

Five "thrust" areas to catalyze private sector investment in sustainable forestry

The Sustainable Development Goals and the Paris Agreement have spurred global interest in forestry as a viable sector for private sector investment (PSI), but this has also led to calls for more clarity and information on the potential opportunities and risks. Organized principally to serve this purpose, a recent FAO-partner expert workshop held in Spain identified five "thrust" areas as catalysts for increasing PSI in sustainable forestry.

The five "thrust" areas include:

- addressing fragmentation and building integrated value chains;
- bridging knowledge and communication gaps;
- developing a good pipeline of bankable projects;
- strengthening the enabling environment; and
- establishing a community of practice.

Read more about the five key "thrust" areas in the summary of the "Expert workshop on financial and institutional innovation for reducing the risks of private sector investments in sustainable forestry" held at the Forest Sciences Centre of Catalonia in Solsona, Spain, from 21–22 April 2016.
http://forestry.fao.msgfocus.com/files/amf_fao/project_59/inFO_news_39_2016/inFO_news_39_FINAL05_04_doc.pdf
Also visit the Forest Finance website (http://www.fao.org/forestry/finance/en/) for more information on FAO's work in this area. For further information, please contact Rao Matta, FAO Forestry Department, at rao.matta@fao.org

Regional Round-table on Promoting Investment in Plantation Forestry in Africa on November 15th and 16th, 2016

http://newforestsforafrica.org/wp-content/uploads/2016/06/Conference_Tanzania_2016.pdf

The Institute of African Leadership for Sustainable Development (UONGOZI Institute), in collaboration with the Tanzanian Ministry of Natural Resources and Tourism, and the Finnish Fund for Industrial Cooperation (FINNFUND) are organizing a Regional Round-table on Promoting Investment in Plantation Forestry in Africa on November 15th and 16th, 2016. The two-day conference will be held in Dar es Salaam, Tanzania on November 15th and 16th, 2016. In addition to the conference, a two day excursion to an available investment site located in the Southern Highlands of Tanzania will also be arranged, with limited spaces.

Registration information and requests available on website: http://www.uongozi.or.tz

Contact: UONGOZI Institute (Institute of African Leadership for Sustainable Development) No. 62, Msasani Road, Oysterbay,| P O Box 105753| Dar es Salaam| Tanzania

Tel +255 22 2602917 | Fax: +255 22 2602918

New book on lessons learned on inclusive management of forest in Central Africa

The electronic version of the book prepared by FAO subregional office for central Africa in collaboration with the Center for International Forestry Research (CIFOR) on lessons learned on inclusive management of forest in Central Africa is now available. Download from the following link: http://www.cifor.org/library/6131/la-gestion-inclusive-des-forets-dafrique-centrale-passer-de-la-participation-au-partage-des-pouvoirs/

The preparation of this book was initiated within the framework of the implementation of the RU2010206 "Identification, development, testing and sharing of socially inclusive management approach" (last biennium). A limited quantity of hard copies is also available.

Contact: JeanClaude Nguinguiri, Forestry Officer, FAO/SFC, Libreville, Gabon. Email: Jeanclaude.nguinguiri@fao.org

New book on gender and forestry

Gender and Forestry: Climate Change, Tenure, Value Chains, and Emerging Issues, is the title of a publication edited by Carol J. Pierce Colfer, Bimbika Sijapati Basnett, and Marlène Elias (London, Earthscan/CIFOR, 2016). This collection published in April 2016, pulls together mostly new research on these subjects. The approaches range from cross site comparative studies to case studies to narrative analyses, introduced with a conceptual analysis that builds on Colfer and Minarchek's Gender Box (Colfer, CJP, and Daro Minarchek, R. 2013. Introducing 'the gender box': A framework for analysing gender roles in forest management. International Forestry Review 15 (4):1-16.). Five hundred copies of this book will be distributed free in developing countries later in the year, as authors strive for more effective attention to men and women and their differing roles and desires in forests.

For further information, contact Carol Colfer: bounce-1585671-140987@lists.iisd.ca

A new book titled: "The End of Desertification? Disputing Environmental Change in the Drylands"

[Editors: Behnke, Roy, Mortimore, Michael (Eds.)]. A great new book has just been published called 'The End of Desertification? Disputing Environmental Change in the Drylands', available from Springer. It is edited by two people who know a thing or two about these issues – Roy Behnke and Mike Mortimore – and it has 20 top quality chapters from all over the world, documenting why the term desertification has passed its sell-by date. It is an impressive and timely synthesis. One of the first books in the new Springer-Praxis Earth System Series.

Free Preview at:

http://www.springer.com/us/book/9783642160134

Governments reclaiming role in forest certification

Many governments are reclaiming a role that had been pretty well ceded to ENGOs and other private organizations over the past few decades – state governance of forest certification. According to the authors of the report "From governance to government: The strengthened role of state bureaucracies in forest and agricultural certification", this has become more noticeable following the recent rise of state-driven schemes for certifying timber legality as well as palm oil production in places such as Indonesia. To read more visit: http://www.iufro.org/publications/iufro-spotlights/article/2016/07/19/iufro-spotlight-39-governments-reclaiming-role-in-forest-certification/

The report can be found at:

http://dx.doi.org/10.1016/j.polsoc.2016.02.001

THEME AND DEADLINE FOR NEXT ISSUE

Agricultural transformation in Africa: The role of natural resources

In September 2015 the Member States of the United Nations adopted "Transforming our world: the 2030 Agenda for Sustainable Development" as the new global framework for sustainable development. The new Agenda is universal, inclusive and comprehensive, with perspectives and responsibilities reflecting the priorities and needs of all countries: it includes 17 Sustainable Development Goals (SDGs) and 169 targets, which are to be achieved in the next 15 years. The different goals and targets are strongly inter-dependent, aiming at a balance of different dimensions of sustainability.

It is now widely accepted that agriculture, including crop, livestock, forestry and fisheries, is key to achieving many of the core objectives of the 2030 Agenda for Sustainable Development, and especially in Africa, where agriculture remains the backbone of economic, social and environmental development. From ending poverty and hunger to responding to climate change and sustaining our natural resources, food and agriculture lie at the very heart of the 2030 Agenda. The vision set by the SDGs goes beyond conservation to sustainable management of natural resources – including forests, water and soil.

The upcoming edition of Nature & Faune journal will put focus on agricultural transformation in Africa: The role of natural resources. Central to the transformation agenda is improvement of people's lives and livelihoods. It includes their economic base and way of life; their environment; their socio-cultural and political spaces, including their freedom of choice. The conditions for modernizing Africa's agriculture entail transforming not only production processes but also the products; thus adding value, creating more jobs that are attractive to the youths, and improving the livelihood of the rural people who constitute the bulk of Africa's population. It also requires investment in technology, innovation, skills, infrastructure, as well as a paradigm shift from exporting raw agricultural products to exporting processed products through value addition and value chains development. An important driver of agricultural transformation is strategic leadership - it is about setting priorities, getting the policies right and getting things done.

In line with the above "2030 Agenda for Sustainable Development" are some vibrant emerging political commitments in Africa, such as the XIV World Forestry Congress: Achieving the 2050 Vision for Forest and Forestry; the Africa Solidarity Trust Fund (ASTF) and the African Development Bank Group's (AfDB) private window to support inclusive and green growth; as well as the African Union's 2063 Agenda which enhances the ideals of Pan-Africanism. Africa 2063 Agenda articulates a vision for Africa based on aspirations of African countries and their people, reflecting their determination for Africa to become "integrated, people-centred and prosperous . . . , at peace with itself". Africa will strive to achieve developmental momentum on its journey towards fulfilling the ambitions in its "Africa 2063 Agenda". This will require translation of its principles into concrete programmes on which it should act in the natural resource management sector as in all other domains.

The editorial board is therefore inviting authors to submit short articles that address the role of water, soils, forests, trees, wildlife and natural ecosystems in the transformation of Africa's agriculture.

Deadline for submitting manuscripts for the next issue is 1st November 2016.

---

[1] *The Africa Solidarity Trust Fund (ASTF) is an innovative Africa-led fund to support Africa for African development initiatives. Its main goal is to strengthen food security across the continent by assisting countries and their regional organizations to eradicate hunger and malnutrition, eliminate rural poverty and manage natural resources in a sustainable manner.*

[2] *African Development Bank Group supports inclusive and green growth. It is committed to providing and leveraging well-placed finance for climate resilience. This enhances the Banks' existing channels of support to environmental and natural resources sector which include indirect interventions through the private sector window such as capital participation in specialized Funds focusing on Forestry.*

[3] *Africa 2063 Agenda is "A global strategy to optimize use of Africa's resources for the benefit of all Africans" The Agenda 2063 also enhances the ideals of Pan-Africanism. Visit: http://agenda2063.au.int/*

GUIDELINES FOR AUTHORS, SUBSCRIPTION AND CORRESPONDENCE

For our subscribers, readers and contributors:

- **Guidelines for Authors** - In order to facilitate contributions from potential authors, we have created guidelines for the preparation of manuscripts for Nature & Faune journal. Please visit our website or send us an email to receive a copy of the 'Guidelines for Authors'.

- **Submission of articles** - Send us your articles, news items, announcements and reports. Please know how important and delightful it is to receive your contributions and thank you for the many ways in which you continue to support Nature & Faune journal as we all work to expand the reach and impact of conservation efforts in Africa.

- **Subscribe/unsubscribe** - To subscribe or unsubscribe from future mailings, please send an email.

Contact details:

Nature & Faune journal
FAO Regional Office for Africa
#2 Gamel Abdul Nasser Road
P.O. Box GP 1628 Accra, GHANA

Telephone: (+233) 302 610930 Extension 41605
Cellular Telephone: (+233) 246 889 567
Fax: (+233) 302 668 427
Email : nature-faune@fao.org
Ada.Ndesoatanga@fao.org
Website : http://www.fao.org/africa/resources/nature-faune/en/

Nature & Faune journal is a peer-reviewed open access international bilingual (English and French) publication dedicated to the exchange of information and practical experience in the field of wildlife and protected areas management and conservation of natural resources on the African continent. It has been in wide circulation since 1985. Nature & Faune journal is dependent upon your free and voluntary contribution in the form of articles and announcements that enhance sound management of renewable natural resources for food security in Africa.

Address comments and inquiries to:
Nature & Faune journal
FAO Regional Office for Africa
#2 Gamel Abdul Nasser Road
P.O. Box GP 1628 Accra, GHANA

Telephone: (+233) 302 610930 Extension 41605
Cellular Telephone: (+233) 246 889 567
Fax: (+233) 302 668 427
Email: nature-faune@fao.org
Ada.Ndesoatanga@fao.org
Website: http://www.fao.org/africa/resources/nature-faune/en/

I5992E/1/08.16