African Forest Forum

AFF

Pre-XIV World Forestry Congress Workshop Forests, People and Environment:

Some Perspectives from Africa

4-5 September 2015

Durban, South Africa

Book of Abstracts

WFC2015

XIV World Forestry Congress

FORNESSA

Forest Research Network for Sub-Saharan Africa

NGARA

The Network for Natural Gums and Resins in Africa

CESDEV

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Swiss Agency for Development and Cooperation SDC

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Government of South Africa

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FORESTS, PEOPLE AND ENVIRONMENT:
SOME PERSPECTIVES FROM AFRICA

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BOOK OF ABSTRACTS

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Our sincere gratitude goes out to the session leaders, keynote speakers and members of the African Forest Forum (AFF) not mentioned here by name, but have helped organize a great programme.

Foreword

In Africa, nearly all issues in the forestry debate of today revolve, directly or indirectly, around deforestation and forest degradation. Although current information as reported by FAO indicates a decrease in net forest loss in Africa, deforestation still remains a key challenge in many countries. It is important to understand the broader context in which deforestation, forest and land degradation are taking place, and especially why they are so rapid in Africa as compared to other continents.

Understanding the changing role of forests and forestry requires a broader analysis of the state of society as defined by key features like production, consumption and the state of technology employed. Throughout the history of human civilisation, people have used forests and trees for a variety of purposes – economic, social, environmental, cultural and spiritual. This would imply that what is appropriate at a given point of time may cease to be so as circumstances change. As in the case of other regions, the society – forest relationship (society/forestry nexus) in Africa also remains highly dynamic and there is a whole range of interventions resulting in multifarious outcomes with differing consequences on society and forests. Resource use priorities therefore differ considerably.

Broadly, societies can be grouped into four categories namely: forest dependent communities, agrarian societies, industrial societies and post-industrial societies. The principle uses of forests and the production and consumption characteristics of these societies differ considerably. Every country or region has differing proportions of people in each category. In general forest-dependent and agrarian societies characterise most sub-Sahara African countries, while the proportion of industrial and post-industrial segment is low. This is in sharp contrast to most of the developed countries, where post-industrial and industrial societies dominate. Resource use priorities therefore differ considerably. Often some of the conflicts in resource use stem from application of concepts and approaches to resource-use that are not seen as important from the perception of the dominant groups.

Due to the predominance of the agrarian society in most sub-Sahara African countries, the linkage between agriculture and forestry is rather strong, and what happens to forests is largely determined by what happens to agriculture. And as industrialisation progresses, forests have to cater to another array of needs; for example, to supply wood and non-wood products, as well as other ecosystem goods and services including carbon sequestration, biodiversity conservation, among others. On the other hand, the needs of a post-industrial society are somewhat different, with environmental and cultural aspects becoming more important. Depending on the proportion of societies in the different categories, the pressures and conflicts on the use of forests differ. A change in the proportion of different segments in society and changes in their perception of the use of forests will be most fundamental in determining the future of forests.

This booklet highlights developments in African forestry by these different societies. Also included are mechanisms that can enhance the roles of forests and trees in national economic development and poverty alleviation, improve food security and nutrition, secure environmental stability and protect forest values on the continent. These are presented guided by the following themes: rehabilitation of degraded lands using trees; managing forests in the context of climate change; forest governance, marketing and trade in forest products; and socio-economic issues in forestry.

Godwin Kowero
Executive Secretary, African Forest Forum

1.0 Introduction

The African Forest Forum in partnership with the African Union Commission, the Network for Natural Gums and Resins in Africa, the Centre for Sustainable Development-University of Ibadan, and the Forest Research Network of Sub-Saharan Africa, and with financial support from the Swiss Agency for Development and Cooperation (SDC) and the Swedish International Development Cooperation Agency (Sida), is organizing a Pre-XIV World Forestry Congress workshop on the theme: *Forests, People and Environment: Some Perspectives from Africa* on 4 to 5 September 2015 in Durban, South Africa, just before the XIV World Forestry Congress. The two-day workshop will bring together African forestry stakeholders including: national governments, civil society organizations, academia and research; in addition to important groups like youth and women. They will discuss important issues and trends relevant to the African forestry sector with a view to enhancing the roles of forests and trees in national economic development and poverty alleviation; improving food security and nutrition and; enhancing environmental stability and other forest values. The workshop will comprise of plenary sessions on key themes that are also linked to the XIV World Forestry Congress theme, as well as break-out sessions.

1.1 The workshop context

There are several issues and trends within and outside the African forestry sector that have direct and indirect impacts on the present and future status and use of forests and trees. For the purpose of this concept note only a few issues and trends will be highlighted in order to guide discussions on them. Within the forest sector some of the notable issues and trends include:

1.1.1 Deforestation and forest degradation

Nearly all issues in the forestry sector revolve, directly or indirectly, around deforestation and forest degradation; and these define practically all activities of and interventions to the sector. The activities underlying these processes supply forest products, create employment, support livelihoods, contribute to national incomes and support other sectors; among other benefits. Paradoxically, it is through the same processes, when not managed properly, that forest resources, including land on which forests thrive, are either overexploited or destroyed. This could lead to problems such as impairment of the capacity to support the supply of ecosystem services like climate amelioration and regulation of water supplies; scarcity of forest products that could constrain livelihood support, national incomes and developments in other sectors and economy; and adverse effects on other forest roles such as erosion of aesthetic values like ecotourism, and decline in capacity for soil protection, and as windbreaks.

While the forest resources serve practically all people, animals and plants on the continent, it is mainly people that destroy and degrade these resources, with the main drivers of deforestation and forest degradation in Africa being farmers at both small holder and large scale (intensive) levels, and including livestock husbandry.

1.1.2 Commercial tree production

Commercial tree production is now not exclusively reliant on big plantations in many countries but is increasingly being carried out by smallholder farmers, either individually or as communities, groups or associations of farmers. This trend comes with several challenges, including how to strengthen individual farmers as groups or in associations so that their voice can be heard, especially in soliciting credit for investment, value adding, markets for their produce, and lobbying for favourable policies. Added to this is the problem of quality supply of germplasm, as well as economic harvesting and processing of trees from individual farms where trees are interspersed with agricultural crops, livestock enclosures and dwelling structures.

1.1.3 Managing forests in relation to climate change

On the international policy and development scene, a very strong trend in the last decade has been increasingly and singularly with respect to *forests and their management in relation to climate change,* and the ongoing discussions on this issue**.** This is also of great relevance to Africa. In this regard it is increasingly becoming apparent in many countries that forest-related development and economic undertakings, new policies, research and education programmes, conservation efforts, etc., tend to be conceived with some justification on how they take into account climate change mitigation and adaptation. While this may be positive in that this puts a new focus on forests, and attracts previously unheard of amounts of funds for "forest-climate" initiatives, it also has drawbacks. The most problematic one is that this focus on climate change takes attention away from the enormously important current and potential roles of sustainably managed forests and trees as drivers of economic development and poverty alleviation or, from the much more immediately important needs of conserving forests for biodiversity protection and hydrology enhancement. However, there are many positive signs today that funders of various REDD+, carbon credit and climate mitigation programmes realize that without putting economic and "conventional" conservation effects in the foreground, it will not be realistic to achieve major positive impacts on climate through "forest-climate" programmes. To this end, there is increasing recognition that REDD+ can bring climate benefits not only through adaptation and mitigation activities but also beyond carbon. So, in designing and implementing REDD+ strategies, this dual character of benefits needs to be taken into account so that non-carbon benefits are also incentivized.

1.1.4 Rehabilitation of degraded lands using trees

There are recognized traditional forest management practices and technologies that have the potential to promote rehabilitation and/or restoration of degraded forests and woodlands provided proper policies and institutional frameworks are in place. Some of the approaches used in natural regeneration include complete coppice; coppice with standards and selective cutting; pollarding, pruning and lopping; all found to be the predominant form of restoration in dry forests and woodlands of southern Africa. Farmer Managed Natural Regeneration is also common in some countries like Niger where over 5 million hectares are reported to have been regenerated in the 1990s. Enclosures are prevalent in livestock farming areas where they are used to encourage rehabilitation of grazing land, for example in the Tigray in Ethiopia. Artificial regeneration through woodlots or farm forest is prioritized for out-growers in Uganda, energy production in Rwanda and reforestation

of bare hills in Ethiopia. Opportunities also exist for promoting forest restoration through tree planting for carbon markets in rural communities in the form of community-based REDD+ initiatives for sustainable forest management. Agroforestry is also recognized as an important avenue for rehabilitation of degraded areas, especially to improve soil fertility and soil conservation, and also in enhancing ecosystems services.

Natural regeneration through active involvement of local communities supported by enabling policies such as clear forest, tree and land tenure is the most successful and promising option for restoration of the large areas of degraded land. However, while policies promoting participatory natural resource management are in place in most African countries, implementation of these regeneration activities have mostly taken a pilot project based approach with few strategies for up scaling by the governments. In addition, enabling policies for community based approaches, including clear cut land tenure and equitable benefit sharing, are still very much wanting in some countries.

Some important trends that are outside the forest sector or interphase with the sector include:

1.1.5 Rapid economic development and urbanization

A more positive *trend that is emerging in Africa is rapid economic development in many African countries* – there was an average annual growth rate in GDP of 4.8% in the 2001-2010 decade, and the trend continues – Sub-Saharan Africa is predicted to have a growth of 5.2% in 2014. Following this, is a quick growth in middle income groups (in 2011, 60 million African households earned at least USD 3000) and in urbanization (about 40% of the population lives in urban areas), which have resulted in a very significant rise in demand for wood- and fibre-based products, from charcoal, via construction wood, paper products and standard furniture and interior design features (flooring, doors, window frames, etc.), to more luxury items such as exclusive furniture. A large part of these increased needs are still imported but more and more investors, both local and international, see the potential in the forest sector in Africa. The globalization of trade and markets, Africa's strategic geographical position and its apparent potential for exporting wood-based products (and not only logs as today) further underline this trend. The forestry sector appears not to be well positioned to take advantage of these economic developments.

1.1.6 Competition for land

The above economic trends lead to a more controversial trend affecting the future of forestry in Africa, which is increasing search for available land for expanding food, fibre and fuel production. Africa is a continent which certainly has vast expanses of land with sparse population and extensive current land use - e.g. the Miombo woodlands of Southern Africa and the rain forest regions of Central Africa – also suitable for large scale production of food and energy crops and timber plantations. The "scramble" for such land, both by local and foreign investors, has exploded in the last 10-15 years. It has led to many conflicts and disagreements between investors, governments and local communities, and the characterization of such investments as "land grabbing" is often heard. However, there are an increasing number of very good examples where investors, local communities, and local and national governments have come to very satisfactory arrangements with benefits to all concerned.

It is within this context that the African Forestry Forum in partnership with key partners is organizing this pre-XIV World Forestry Congress workshop to look more closely at, continental level, on the above trends, and more specifically on how they are manifesting and being handled in the continent.

1.2 The need for action

The workshop will examine these and other related issues with a view of enhancing the roles of forests and trees in:

- National economic development and poverty alleviation,
- Improving food security and nutrition, and
- Enhancing environmental stability and forest values.

In doing so the workshop will involve the following key stakeholders:

1.2.1 Rural people/local communities/small holder producers

They are at the core of local governance, provided they have secure tenure, access rights, responsibilities and resources. They are increasingly taking on responsibilities for forest and woodland management through devolved rights and responsibilities. Rural people use tree and timber products for many diverse reasons, and are increasingly entering the market for tree and timber products. Rural people are organizing themselves into, for example, associations and village committees, in order to take on their resources rights and responsibilities.

1.2.2 The private sector

This sector is especially important in harvesting of timber from natural forests as well as in establishment of forest plantations. The sector is also prominent in processing of timber, its marketing and trade. It is also important in the harvesting, processing and marketing of non-timber forest products. These attributes give the private sector a central role to play in the future of sustainable forest management and use in Africa. The private sector has also a key role in the governance and use of these resources and establishing responsible relations with local people and communities. However, in many countries, the sector continues to be characterized by many uncoordinated small players, does not feature in national plans, lacks investment and a champion for its cause.

1.2.3 National governments

National governments handle forestry work through their forestry authorities/departments. These have important roles of oversight, policy and law formulation and implementation, and setting in place an enabling environment for sustainable forest management so that rural people/local communities and the private sector can invest in forests and trees and benefit from their products and services. National governments are also major owners of natural forest resources.

1.2.4 Research and academia

There are many unknowns that come with new and emerging issues in forestry like how to handle climate change in forestry, a better perception of the relationship between forests and water, forestry in green economy, implementing the SDGs in the context of forestry, to mention a few. These are some of the issues research will need to move fast in providing the necessary information for informed policy making as well as for implementing plans and programmes. Academicians are extremely important in moulding the future generation that will handle, in an appropriate manner, the changing landscape and demands on it. Short courses on these and other issues for those practicing forestry are also essential to re-tool them in new ways of thinking and acting so that they can meaningfully accommodate changing circumstances.

1.2.5 Non-governmental organizations (NGOs)

The NGOs are emerging as key players in forestry; they fill some gaps left by national governments in Africa when they move away from doing forestry business to becoming custodians of policy and enforcers of forest laws and regulations. NGOs are also a very crucial link to local communities, who are also increasingly owning and managing these resources. They also feature very prominently in handling new issues in forestry, as can be seen in their visibility in facilitating and undertaking, with local communities, REDD+ activities and community based forest management. Unfortunately their effective coordination within the forestry sector, is in many countries not adequate, in addition to the required support (in terms of capacity and skills building and finances etc.) to deliver on their mandates.

1.3 Organization of the Pre-XIV World Forestry Congress Workshop

1.3.1 Overall objective

The overall objective of the workshop is to promote and sustain discussion of key issues related to the interaction between people, forest and tree resources, and the environment on the continent; with a view of coming up with ways through which forestry can be better profiled, and forests and trees are managed in better ways, and all these combine to improve livelihoods, national incomes and the environment.

The Pre-XIV World Forestry Congress workshop is also expected to enhance meaningful African participation and contribution to the deliberations of the XIV World Forestry Congress.

More specifically the workshop will examine trends, on the continent, on four broad themes:

Theme 1: Rehabilitation of degraded lands using trees
Theme 2: Managing forests in the context of climate change
Theme 3: Forest governance, marketing and trade in forest products
Theme 4: Institutional organization for forestry at sub-regional and regional levels

1.3.2 Expected outputs

Outputs expected from the workshop are:

1. Better awareness of the status of forestry in the continent, and more specifically on important trends and main issues affecting African forest sector development.
2. A statement from the workshop to the XIV World Forestry Congress.
3. Proposals on how to move forward on identified key issues.

1.3.3 Pre-XIV World Forestry Congress Programme

The workshop will take place in 2 days as follows:

4 – 5 September 2015: Plenary session
Presentations to be made on the four themes of the workshop (see 1.3.1)

5 September, afternoon: Break-out session
There will be 3 groups to examine key issues that require action and proposals on how to address them. The workshop will come up with a statement on the observations made during the workshop, and in the context of the main agenda for the XIV World Forestry Congress.

6 September: AFF members meeting
All AFF members present at the workshop will meet and guided by an agenda set for the meeting.

1.3.4 Participants

The workshop will bring together African forest stakeholders from national governments, civil society organizations, academia and research, and representatives of different groups like youth and women. There will be limited opportunities for sponsorship to the event; for this contact AFF through the contact details provided below.

1.3.5 Venue

The workshop will be held at the Durban International Convention Center, Durban, South Africa.

1.4 Workshop programme

PRE- XIV WORLD FORESTRY CONGRESS WORKSHOP FORESTS, PEOPLE AND ENVIRONMENT: SOME PERSPECTIVES FROM AFRICA			
DAY 1:	**Friday, September 4, 2015: Inkosi Albert Luthuli International Convention Centre-Durban**		
08:00 - 09:00	Registration (Room 11CDE)		
09:00 - 09:30	Opening ceremony Welcome address- Chair, AFF Governing Council Opening speech- Guest of Honour		PLENARY 1: Room 11CDE **Chair: Yonas Yemshaw**
09:30 - 10:00	**COFFEE BREAK**		
10:00 - 10:30	Introduction to the main theme of the pre-congress and its context **Godwin Kowero**		PLENARY 2: Room 11CDE **Chair: Pumeza Nkhwashu**
TRACK THEME	Theme 1: Rehabilitation of degraded lands using trees	Theme 3: Forest governance, marketing and trade in forest products	Theme 2: Managing forests in the context of climate change
SESSIONS	Room 11CDE **Session I Chair: Ben Chikamai**	Room 12AB **Session II Chair: Abdelazim Ibrahim**	Room 12CD **Session III Chair: Kokou Kouami**
11:00-11:30	Management and restoration practices in degraded landscapes of the Sahel and dry forests and woodlands of eastern and southern Africa ***Paxie Chirwaambia*** ***Stephen Syampungani***	Implications of corruption on marketing and trade in non -timber forest products value chains: Case of Gnetum species in Cameroon ***Julius Chupezi***	The experiences of African countries in REDD readiness processes ***Wale Adeleke***
11:30-12:00	Improved coppice management as trade-off between woodland recovery and rural livelihood in Z	Forest products use and livelihood strategies for households around a once traditionally preserved Miombo woodland in Zimbabwe ***Lizzie Mujuru***	Carbon accounting for REDD in a transboundary mangrove forest in Kenya ***Mohamed Hussein***
12:00-12:30	Community participation in restoration of degraded natural forest: Case of Taungya agroforestry land use system option in South Western Nigeria ***Victor Adekunle***	Production, value addition, marketing and economic contribution of non-wood forest products from arid and semi-arid lands in Kenya ***Meshack Muga***	Problématique de gestion des feux de forêts dans un contexte de dérèglement climatique et de REDD+. ***Afelu Barerema***

12:30-13:00	Restoring degraded ecosystems in the Afromontane highlands of Ethiopia: comparison of tree plantations and natural regeneration ***Hailu Abiyu***	The socio-economic contributions of non-timber forest products (NTFPs) in Muzarabani district, Zimbabwe ***Victor Mabhare***	Résilience aux perturbations des peuplements ligneux des parcs à *Faidherbia albida (Del) A. chev.* et à *Prosopis africana (Guill., Perrot et Rich.) taub.* dans le contexte du changement climatique au Sahel, Niger. ***Massaoudou Moussa***
13:00-14:00	**LUNCH BREAK**		
14:00-14:30 14:30-15:00	Forests must create jobs: evidence for structural transformation of the African forest economy ***Mariteuw Chimère Diaw*** Forests and people: the South African perspective ***Pumeza Nkhwashu***		PLENARY 3: Room 11CDE **Chair: Bjorn Lundgren**
SESSIONS	Session IV Chair: **Thiombiano Adjima**	Session V Chair: **Jean B. Nduwayezu**	Session VI Chair: **Paxie Chirwa**
15:00-15:30	Constraints and potentials of tree planting and management of indigenous and exotic tree species by the local farmers in the semi-arid area of Botswana. ***Joyce Lepetu***	The EU-FLEGT VPAs -A critical review of status and progress in implementation by African partner countries. ***Cliff Dlamini***	Prospects for REDD+ in African tree plantations ***Willy Makundi***
15:30-16:00	Success of three soil restoration techniques on seedlings survival and growth of three plant species in the Sahel of Burkina Faso ***Philippe Bayen***	Socio-economic factors influencing non-timber forest products' marketing in tropical lowland rainforests of south west Nigeria ***Tajudeen Amusa***	Allometric relations for determination of biomass stock and carbon in *Rhizophora mucronata* L. and *Ceriops tagal* P. mangrove species in Kenya ***Lemmy Nyalle***
16:00-16:30	Mechanical and biological methods for controlling wind erosion at Um Jawaseer in Northern Sudan ***Nuha Mutwali***	The Impact of financing arrangements on the production and marketing of shea (*Vitellaria paradoxa*) butter in Tamale in the Northern region of Ghana ***Olivia Abenyega***	Impacts of human disturbance and climate variability on population structure of *Afzelia africana Sm. ex pers. (Fabaceae–Caesalpinioideae)* in Benin ***Achille E. Assogbadjo***

16:30-16:45	**COFFEE BREAK**		
16:45-17:10	La réhabilitation des terres dégradées du Périmètre de Reboisement de Parakou (PRP) ***Brisso Nassirou***	Yield and quality assessment of oil production from *Hildergadia barteri* (Mast.) Kosterm seeds ***Evelyn Adeniyi***	Climate change in African forestry education: current reality and future needs ***August Temu***
17:10-17:40	Population structures and minimum felling diameter of the *Pterocarpus erinaceus poir* in arid and semi-arid habitats of West Africa ***Adjonou Kossi***	Non timber forest products governance: case of *Prunus africana* in the North West Region of Cameroon ***Avana-Tientcheu***	Incorporating climate change in the curricula of forestry schools: the case in Francophone Africa ***Claude Adandédjan***
DAY 2	**Saturday, September 5, 2015: Inkosi Albert Luthuli International Convention Centre-Durban**		
09:00-09:45	Forests and trees: their roles and opportunities in Africa's economic development, food security and environmental health ***Bjorn Lundgren***		PLENARY 4: **Room 11CDE Chair: Johnson Boanuh**
TRACK THEME	Theme 1: Rehabilitation of degraded lands using trees	Theme 3: Forest governance, marketing and trade in forest products	Theme 4: Socio-economic issues in forestry
LOCATION	Room 11CDE **Session VII Chair: August Temu**	Room 12AB **Session VIII Chair: Marie Louise Avana Tientcheu**	Room 12CD **Session IX Chair: Alice Kaudia**
10:00-10:30	Mangroves in Africa: Lesser known forests providing multiple benefits to people, environment and biodiversity. ***James Kairo***	Demystifying forest certification as an approach to improving governance, marketing and trade in forest products: the case of Uganda ***Ceaser Kimbugwe***	The socio-economic impacts of climate change on forest communities in Idanre Forest Reserve, Ondo State, Nigeria ***Johnson Olusola***
10:30 – 11:00	**COFFEE BREAK**		

11:00-11:30	An assessment of the forest regenerating potential of taungya system of farming in Oyo State, Nigeria ***Ismael Azeez***	Policy and governance in forestry and agriculture – meeting uncertainty in mosaic landscapes ***Anders Malmer***	Assessing socio-economic factors influencing household dependence on forests and its implication for forest based climate change interventions ***Chidiebere Ofoegbu***
11:30-12:00	The facilitation role of sea blight (*Suaeda monoica*) in regeneration of degraded mangroves at Mwache creek, Kenya ***Loureen Awuor***	Assessment of the participatory management of forest plantations establishment: A case study from Wari-Maro Forest Reserve, Benin ***Kisito Gandji***	A synthesis of ecological and socio-economic consequences of land rehabilitation with *Prosopis* species in Kenya ***Gabriel Muturi***
12:00-12:30	Professional forestry associations: potential for sub-regional associations ***Jamleck Ndambiri***		PLENARY 5: **Room 11CDEChair: Macarthy Oyebo**
12:30-13:30	**LUNCH BREAK**		
13:30-14:00	Institutional organization for forestry at sub-regional level		PLENARY 5: **Room 11CDE** **Chair: Macarthy Oyebo**
14:00-15:30	**ECOWAS**- Johnson Boanuh **EAC**- Wivine Ntamubano **ECCAS**- Remy M. Shabantu **COMESA**- Chikakula Miti **SADC**-Moses Chakanga **UNFF**-Manoel Sobral Filho		
15:30 – 16:00	COFFEE BREAK		
16:00-16:50	Summary of reports from rapporteurs| ***Mahamane Larwanou***		
16:50-17:10	Key messages from pre-congress ***Doris Mutta***		
17:10-17:30	Closing ***Godwin Kowero***		
DAY 3	**Sunday, September 6, 2015: Inkosi Albert Luthuli International Convention Centre-Durban**		
09:00 - 11:00	Meeting of all AFF members to the XIV World Forestry Congress		**Room 11CDE**

PRE- XIV WORLD FORESTRY CONGRESS WORKSHOP FORESTS, PEOPLE AND ENVIRONMENT: SOME PERSPECTIVES FROM AFRICA, 4 – 5 SEPTEMBER, 2015 DURBAN, SOUTH AFRICA

2.0 Keynote presentations

2.1 Investing in African forestry: a few trends and issues to watch

Godwin Kowero
Executive Secretary, African Forest Forum, United Nations Avenue, Gigiri, Nairobi, Kenya

The environment in which forestry business has been transacted in the last two decades has changed considerably. A few trends from within and outside the sector have become more pronounced, and several new ideas and initiatives that are specific to the sector or are related to the sector have emerged. As regards the latter Africa continues to report considerable forest loss from deforestation and forest degradation; the African youth population continues to rise and its effects are much more felt; the private sector, local communities and civil society are increasingly becoming key actors in forestry; illegal harvesting and trade in forest products continues to increase and receive more attention. With respect to the former, new ideas and initiatives like REDD+, landscape approaches, and green economy and blue economy are the latest additions to the sector, while the Sustainable Development Goals and the new international arrangement on forests are a close next. The practice has been to add, piecemeal, such ideas and initiatives to the sector. Given these increasing demands and actors in the sector a much more holistic examination of the sector would be appropriate. This will facilitate organising the sector around all these issues, and within the planning macro-economic frameworks and multilateral environmental agreements the global community subscribe to, and in ways that will sustainably meet the increasing demands on the forest resources.

Keywords*: deforestation, African youth, trade, climate change*

2.2 Forests must create jobs: evidence for structural transformation of the African forest economy

Mariteuw Chimère Diaw
African Model Forest Network (AMFN), Yaoundé, Cameroon

The paper's key finding is the 'inverted' nature of the African forest economy. While other regions make about ¾ of their forest value added from high-value processed goods, Africa does the reverse. It makes two third of its forest value from primary forestry activities, such as logging and fuel wood collection. And this low value use of forests is sluggish, representing a tiny 6.5 % of what the world makes from the primary forest subsector. The paper makes the case that the African forest challenge mirrors the broader African structural transformation challenge, except that it is more acute. Africa, the second fastest growing region since the late 1990s, has become a prime destination for Foreign Direct Investments (FDI) and has combined GDP and/or consumer spending equivalent or superior today to those of Brazil, Russia or India. However, though broad-based, sustained and accompanied by productivity improvements, the African growth has very weak structural foundations. It is not really capturing the productivity spillovers from FDI; it is weak in productive capacity, infrastructure, higher education and training, technological readiness, strategic intelligence, innovation, and market size. Partly as a result, big disparities are appearing between countries and clusters of countries, fostering "tales of two [or several] Africas".

The paper argues that because of its inverted structure, the inability of the African forest economy to create productivity-enhancing jobs and generate wealth and prosperity is worse than in other economic sectors. Part of the problem lies with a narrative on forests that remains cast around an old colonial paradigm opposing logging and conservation and effectively turning them into unique strategic poles for the forest sector. Both have value but they cannot underpin the contribution of forests to Africa's economic convergence with the rest of the world. Because of these unique features, the post-2015 priority goals and targets for African forests cannot be the same as those of other regions. They must first meet key African priorities in structural transformation, productivity and diversification and be driven by focused investments in green innovations and productive systems. The 'sustainable use' paradigm that has kept most of non –timber uses of forests at the fringes of poverty must be replaced by a radically different social economy powered by innovative R&D in support of local people and local agro-forest value chains. The paper applies a magnifying class to a sample of African innovations to show the bubbling number of such projects and their considerable potential. Novel ways of financing and managing those investments need to be found, including through better targeting of green climate funds and better use of human capabilities and strategic information. It is obvious that forests can create jobs. But for this to happen in any significant way, the traditional conservative outlook on African forests must change.

2.3 Forests and people: the South African perspective

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The advent of democracy in South Africa brought about the involvement of people to ensure sustainable forest management. This commenced with the development of the White Paper on Sustainable Forest Development, 1996 and the promulgation of National Forest Act, No 84 of 1998 which promotes (i) community forestry in terms greening and management of forests for economic gain; and (ii) consumptive (non-timber forest products) and non-consumptive (recreation, education and spiritual) use of forests. The forestry sector is a major contributor to the South African economy through its well-developed and diversified forest products industry. In addition to its upstream and downstream impact, the sector has a strong potential for job and small business creation. It is one of the sectors that has a potential for economic growth, job creation, rural development and transformation as required by the National Development Plan (NDP). In order to achieve the aspirations of the NDP, the sector needs to address several challenges including competition for land, some aspects of land reforms, limited investment, and timber shortages. The Department of Agriculture, Forestry and Fisheries, as the lead Department for the management of forest resources, in collaboration with the Industry and the Department of Rural Development and Land Reform have developed the Agricultural Policy Action Plan (APAP) to try and resolve these issues and to put forestry as a strategic sector that can contribute to economic growth, job creation and poverty alleviation.

Keywords: *economic growth, job creation, land reform, Agricultural Policy Action Plan, transformation*

2.4 Forests and Trees - their roles and opportunities in Africa's economic development, food security and environmental health

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The purposes of the report are to highlight and promote the great potential roles of forests and trees to contribute to Africa's economic development, food security and environmental health and to indicate what requirements need to be addressed in order to realise these potentials.

Official statistics on forest and tree resources in Africa are unreliable for many reasons. FAO indicates an area of 675 mill ha of closed forests (23% of the land area), 350 mill ha of "other wooded land", and a considerable and growing volume of wood in "trees outside forests", e.g. in agroforestry systems. The plantation area is indicated as c. 15 mill ha, but this includes formations that strictly speaking are not forest plantations. Even more unreliable figures are quoted for uses of wood and NWFPs. First, it must be kept in mind that the estimated use of wood for fire-wood and charcoal accounts for more than 80% (615 mill tons) of wood removals. Wood for industrial purposes is estimated at 72 mill m^3 annually, which is probably an underestimate in view of widespread illegal felling/trade in timber. In addition, there is a substantial informal secondary wood and NWF products sector. As a result of all this, the official contribution of the forest sector to GNP and employment is modest, but should, according to FAO, be three times larger if also informal and illegal activities were captured in statistics.

Today, many macro-trends and issues influence the forest sector and its potential to contribute to Africa's economy, food security and environment. These include: i) a continued high rate of deforestation and forest degradation; ii) a rapid economic development in much of Africa with urbanisation and growing middle classes and a growing demand for wood and NWF products; iii) an increasing competition for land for production of food, fibre and fuel (the 3F-question); iv) a rapid growth of tree planting and forest/woodland management by farmers, communities and rural people; and, v) the increasing focus on the role of forests and trees in climate change mitigation.

The potential roles of forests and trees in Africa are treated under three separate categories. The first deals with contributions to ***economic development*** and ***poverty alleviation***. The largest wood-based economic sector today is related to production, transport and sale of charcoal, which is estimated to be worth billions of USD and employing millions of people. However, since this almost invariably occurs in the informal, and often illegal, sectors of the economy, figures are uncertain. Demand is rapidly increasing and there is an enormous economic potential provided that charcoal production/sale are legalised, based on sustainably managed forest/tree resources, modernised technology and given advice. The same applies for other products for local and regional markets, such as scaffolding, building and transmission poles, and for locally sawn timber and products like furniture. Due to factors such as increased local demand, export markets and land availability there

is also a substantial potential for conventional forest products and commercial level forest and tree management, by private and government enterprises as well as by farmers and communities.

The potential contribution of forests and trees to ***food security*** is also large, but often overlooked. Already today, the supplementary food and income derived from wood and NWFPs is an essential part of livelihoods of rural people. The potential of trees in increasing/maintaining fertility of soils and providing fodder to domestic animals, and thereby food crop and livestock productivity and sustainability, have been given much attention in recent decades. The role of forests in hydrology, and thereby water availability for agriculture, and the roles of trees in creating amenable microclimate, e.g. windbreaks and shade also contribute to improved food security. All these various forms of contributions have considerable potentials for improvement.

The third category relates to ***environment enhancement*** and ***climate change mitigation.*** Today, with an almost singular focus on climate change, it is important to point out that by far the most important role forest and tree management can play is to vastly increase the "working biomass" of wood in sustainably managed forests, plantations and on trees on farm. This is more important than to just focus on halting deforestation. In addition, increased use of wood in "long-term deposits", e.g. construction wood, furniture, flooring, etc., will contribute to CO□ sequestration. To achieve all this, economic incentives are essential. The well-known role of Africa's forests and woodlands as protectors of flora and fauna biodiversity is as important as ever and under continuing threat. Instead of just relying on complete protection, integrated use of forests is the way forward, with economic incentives playing an important role, e.g. through eco-tourism, careful harvesting of wood and NWFPs, regulated hunting, etc. Finally, the role of forests and woodlands in catchment and river basin hydrology remain crucial to the continent's water supply.

In order to realise the above potentials of forests and trees, several requirements need to be addressed, with different importance in different countries and in different agro-ecological, political and market situations. They include:

Policies, legislation and ***regulations*** need to be revised, modernised and applied effectively, guaranteeing both an enabling environment for investments and engagement in the forest sector by farmers, communities and the private sector, and an effective prevention of destructive and illegal practices. Realistic plans for the sector at appropriate geographic and commodity levels must be developed and implemented. Land and tree tenure must be modernised to ensure long-term willingness to invest in forest management and tree planting. Africa must acquire a stronger voice and influence in international policy processes influencing forests and their use.

Strengthening institutions in support of forest development must be given priority. This includes government forest administrations and extension bodies, education/training/research institutions, farmer and community organisations, the private sector, professional associations, and regional organisations with a mandate to handle forest issues.

Technical know-how must be increased through research, training, partnership, enhanced practical experience, etc. Among technical aspects that need to be given priority are genetically improved plant material, better management of forests and trees (particularly by communities and farmers), improved products matching customer demands, effective and continuing inventory and monitoring of forest and tree resources, better understanding of environment-forest interactions, and an improved ability to assess and implement integrated management of land and natural resources (e.g. through "landscape approaches").

Economic issues that require attention are partly related to policy issues. Others include better access to credit and reliable information on markets and prices, that taxes and fees are not prohibitive and discouraging to investments, that value adding and value chains of wood and non-wood products are much better understood, that forest certification can be applied when demanded, and that investments in infrastructure (both roads and IT) are increased.

Apart from forcefully, and as appropriate in different situations, addressing the requirements above, ***the way forward*** for countries, organisations, private sector actors and others who want to see an expanded forest and wood sector in Africa should include the following: i) an overall assessment of the current situation with regard to resources, problems and opportunities in the sector; ii) promoting the inclusion of forests, trees and forestry in the mandates of regional bodies, in view of their growing importance on the continent; iii) exploit the potentials related to the enormous funds made available for forest-climate initiative, but ensure that economic aspects are in the fore-ground; iv) explore opportunities for partnerships with actors outside Africa, for increased investments, access to know-how and expanded markets; and, v) for promotional purposes, point at and explain the significant roles forest and trees can and must play in achieving the UN Sustainable Development Goals (SDGs).

Keywords: *Forests, trees, Africa, economic potential, food security, environment*

3.0 Rehabilitation of degraded lands using trees

3.1 Management and restoration practices in degraded landscapes of the Sahel and dry forests and woodlands of eastern and southern Africa

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The highest deforestation and forest degradation rates in Africa occur in the dry forests and woodlands where pressure on land is increasing, poverty is rampant, livelihood options are few and climate change effects are severe. This study examines factors that cause land and forest degradation in the Sahel and dry forests and woodlands of eastern and southern Africa and identifies some restoration practices, technologies and approaches that can be up-scaled. In the Sahel, enclosures are used to protect young growing trees while in East Africa the same are implemented on degraded land as a mechanism for environmental rehabilitation, and with a clear biophysical impact. The choice of techniques for rehabilitating specific degraded areas depends primarily on the priorities and management objectives of stakeholders and including the costs and benefits associated with available rehabilitation techniques and the economic, social, and environmental values of the land resources in their current and desired future states. In the Sahel, sustainable land management is considered as an imperative for their sustainable development; and the practices include soil and water conservation activities and structures. In all the these two regions, both natural and assisted regeneration to promote the growth of especially indigenous species through coppice regrowth and root suckers rather than seeds has been used for natural forest rehabilitation. Assisted regeneration was especially prevalent in the Sahel where indigenous tree species have been identified to dominate the degraded sites during early stages of secondary forest succession. The success of any rehabilitation activities depends on community-based natural resources management. In addition, the forest policies, laws and regulations have to create an enabling environment in order to address issues of concern including (i) the full participation of communities; (ii) clear land and tree tenure and (iii) equitable benefit sharing.

Keywords: *Restoration, dry forests, woodlands, regeneration, policies*

3.2 Improved coppice management as trade-off between woodland recovery and rural livelihood in Zambia

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The study dealt with influence of stump size, height and species on resprouting ability and shoot vigour of selected Miombo woodland species. The study was carried in Choma District, Zambia. The district lies in the ecological zone that receives less than 1000mm of rainfall annually. Data was collected in areas of known management history (areas of known age since charcoal production ceased in the area). A total of 370 stumps of the 11 selected woody plant species were studied. The study observed significant influence of species, stump diameter class and stump height on resprouting and shoot vigour of the studied Miombo woodland species. For example, the variation on the influence of stump size is observed among the studied species;*Albizia antunesiana*(6.0 ± 1.02), *Brachystegia spiciformis*(6.0 ± 0.80), *Brachystegia boehmii (*6.0 ± 1.07), *Julbernardia paniculata (*5.0 ± 2.83), *Terminalia sericea (*5.0 ± 1.28), *Swartzia madagascariensis (*7.0 ± 1.43), *Combretum molle*(6.0 ± 0.81), *Pseudolachynostilis maprouneifolia*(6.0±0.84),*Parinari curatellifolia* (8.0 ± 1.23), *Terminalia mollis*(7.0 ± 1.02) and *Faurea speciosa*(8.0 ± 1.43). The overall findings of this study are that studied dry Miombo woodland woody species are capable of resprouting once cut. Sprouting therefore is an important characteristic that needs to be considered in the management of Miombo woodlands. With observed variation in species response to harvesting, the findings suggest that management of Miombo woodland species should be species specific rather than holistic when harvesting for charcoal production. Furthermore, the study gives an indication of how the influence of stump diameter class and stump height class may be incorporated in harvesting and management of the Miombo woodland species for fuelwood production in order for the woodland to contribute towards rural livelihood.

Keywords: *Resprouting, shoot vigour, species response*

3.3 Community participation in restoration of degraded natural forest: Case of Taungya agroforestry land use system option in South Western Nigeria

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Rural communities' contributions in restoration of degraded natural forest ecosystem through taungya agroforestry system in south western Nigeria were assessed in this study. Three forest reserves where Taungya is active were purposively selected in Ekiti and Ondo States. Five communities (fringe and enclaves) and 30 household heads were randomly selected in each community for questionnaire administration. Data were collected on local communities' perception towards community forestry programmes, roles of forestry in rural livelihood, anthropogenic activities in forest areas, limitations to tree planting and adoption of Taungya and level of dependent on forest ecosystem for sustainability were recorded. Rules and regulations of Taungya were collected from government documents, files, and annual reports.

Results indicated that the level of participation of local people in forest resources management and forest restoration differed between respondents who are living in or around these conservation areas. People, who depend on the forest for livelihood, do not have too much in common in terms of forest restoration and conservation. A total of about 950 small holders are involved in the practice and between 1 and 4ha of land were allocated to each farmer annually. An average of 3800 hectares of teak stands are raised annually by farmers in the degraded forest reserves of the two states. The Taungya famers had more income, production and better access to wood and wood products than the non-taungya farmers. The system is a traditional and economically viable option for forest and forest land restoration.

Keywords: *Nigeria, Taungya, forest stands, Teak, forest restoration, Forest Reserves.*

3.4 Restoring degraded ecosystems in the Afromontane highlands of Ethiopia: comparison of tree plantations and natural regeneration

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Planting trees, for example in woodlots and plantations, and unassisted natural regeneration are options for ecosystem restoration. Two options for restoration of highly degraded former grazing land were compared. The objective was to evaluate their impact on the recruitment of late successional tree species and soil chemical and physical attributes. Four treatments in RCBD with three replications were set up in the degraded matrix in northwest Ethiopia. The treatments were (1) planting two meter cuttings of *Ficus thonningii*, and clearing previously occurring shrubs; (2) sowing seeds of *Senna didymobotrya* as nurse shrubs, and clearing other shrubs; (3) planting two meter cuttings of *F. thonningii* and sowing *S. didymobotrya*, and clearing other shrubs; and (4) leaving previously occurring shrubs. Data collected include density of newly recruited *Olea europaea subsp. Cuspidata* seedlings, soil samples under the shrubs and in the open spaces between the shrubs, composite leaf samples from shrubs and shrubs architecture. The soil and foliar sample including shrubs architecture were collected from six shrub species each replicated three times. *O. europaea* regeneration occurred only under previously occurring shrubs, but not beneath sown *S. didymobotrya* shrubs and *F. thonningii* cuttings. There were differences in the diversity of shrubs according to study area location. The common native shrubs were *Otostegia integrifolia*, *Vernonia rueppellii*, *Dodonaea angustifolia*, *Croton macrostachyus*, *Rhus glutinosa*, and *Maytenus senegalensis*. Soils N, P, K, Ca, Mg content were better immediately under native nurse shrubs than in between open spaces. The foliar N, P, K, Ca, Mg content of some of the native nurse shrubs was high. The results revealed that not all shrub species have a nursing effect. Therefore, forest restoration by means of nurse shrub effect should identify suitable shrub species. In the presence of suitable shrubs species, facilitation is more important in driving trajectory of secondary succession. In addition to restoration purposes, some NNS species can be used as green biomass to improve soil fertility in the agricultural landscapes.

Keywords: *Ethiopia, ecosystem, nurse shrubs, recruitment, restoration, facilitation, competition*

3.5 Constraints and potentials of tree planting and management of indigenous and exotic tree species by the local farmers in the semi-arid area of Botswana.

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Most rural communities in Botswana derive their livelihoods from the natural forests and woodlands including energy, food and fodder for livestock. The woodlands also provide environmental services such as carbon sequestration and protection of watersheds. However, current developments and continuing population growth exerts enormous pressure on the woodlands in general and some individual species. Human activities such as deforestation, unsustainable agricultural practices, and uncontrolled wildfires have increased environmental degradation. Despite efforts by governments to encourage and support communities in tree planting initiatives, the uptake has been very low. This study was conducted to identify constraints to tree planting and management of both indigenous and exotic trees by local farmers in the semi-arid area of Botswana. Data was collected through structured and semi-structured questionnaires administered to 350 randomly selected respondents who were household heads. About 98% of the respondents indicated that indigenous tree species were the main source of biofuel energy and approximately 73% concurred with fact that trees contribute significantly to their food and financial needs. About 81% of the respondents planted both indigenous and exotic tree species in their yards, for shade, fruits, and aesthetic values. Nevertheless, farmers highlighted some constraints that hindered the adoption of tree planting initiatives; including long period of tree maturity, limited information on indigenous trees, unfavourable conditions for exotic species and termite infestation. Some local conditions favouring the adoption of tree planting and agroforestry included the fact that farmers already grow both indigenous and exotic trees on farms and homesteads. The knowledge on the importance of trees gives hope for future adoption of agroforestry practices as part of climate change adaptation strategies. However, supportive policies and laws are crucial to bringing about major changes in tree planting, management and agroforestry practices in Botswana.

Keywords: *Natural woodlands, constraints, agroforestry, indigenous trees, Botswana.*

3.6 Success of three soil restoration techniques on seedlings survival and growth of three plant species in the Sahel of Burkina Faso

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In the Sahel a large part of the soils are structurally unstable, prone to crusting and hard setting, and have low water holding capacity which is hampering vegetation establishment. An experiment was carried out to study the effect of soil restoration techniques on survival and growth of seedlings of *Acacia nilotica*, *Acacia tortilis* and *Jatropha curcas* transplanted on completely barren and degraded land in a Sahelian ecosystem in Burkina Faso. Planting was undertaken in a randomized complete block design with three replicates combining three soil preparation techniques: half-moon, zaï and standard plantation. A total of 522 seedlings (174 plants of each plant species) were planted. Survival and growth rates were evaluated during a 20 months period. The results showed that both survival and growth rates were found to be significantly higher in the half-moon technique compared to the other two techniques. Survival rates of plant species in half-moon method were 62.5%, 28.57% and 10.71% for *A. nilotica, A. tortilis* and *J. curcas* respectively, but in zaï and standard planting techniques seedling survival was zero. The low survival rate of *J. curcas* in the half-moon technique may indicate that *J. curcas* is unsuitable for barren and degraded land; whereas *A. nilotica* and *A. tortilis* appear to be promising tree species for rehabilitation of degraded land.

Keywords: *bare soil, afforestation, water conservation, soil rehabilitation, species selection*

3.7 Mechanical and biological methods for controlling wind erosion at Um Jawaseer in Northern Sudan

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This study was carried out in Um Jawaseer in Merowe locality in northern Sudan. The main objectives of the study were to develop methods for controlling wind erosion using mechanical and biological means and to measure soil erosion and sand accumulation in the study area. The international wind erosion equations were used to estimate the soil erodability and sand accumulation. Checkerboards and surface lying were used as mechanical protection methods. The species protected by mechanical control were: *Salvadora persica* (Araak), *Moringa pregrenia* (Moringa), *Acacia tortilis* (Seyal) and *Ziziphus spinachristi* (Sidir). Biological control was studied using young and mature indigenous tree species. The young trees tested were *Acacia tortilis* (Seyal), *Acacia oerfota* (laot), *Leptadenia pyrotechnica* (Marikh) and *Zizipus spinachriti* (Sidir). The established shelterbelt which was composed of *Eucalyptus microtheca*, *Prosopis chilensis*, *Ziziphus spinachristi*, *Azadirachta indica*, *Conocarpus lancifolius* and *Acacia ampliceps* represented the biological control method with mature trees. Two methods of establishment, namely, direct seeding and seedlings planting were used in the mechanical and biological control methods. Vertical and horizontal sand traps were employed in measuring sand accumulation at different levels from the ground. The results of the study showed that there was instability in soil erodibility due to differences in soil particle size distribution and the cemented materials. The average erodibility of the soil was 16.8 and 37.2 according to tables of erodability developed by Woodruff and Siddway; and Skidmore and Siddway, respectively.

The results also revealed that there was clear evidence of moderate wind erosion in the study area, where some materials of the soil were removed and some deposited. The highest soil accumulation (76.8 ton ha^{1} day^{1}) was obtained at the 15cm height of vertical trap under mechanical control methods which explains that the sand movement is mainly by surface creep. Tree establishment by seedlings' planting showed better growth of all the species tested compared with direct seeding. *Ziziphus spina Christi* (sidir) gave the highest (26.2 cm) height growth. Mechanical protection using checkerboard resulted in the highest (61.4 %) survival rate, followed by surface lying (57.8%) and control (52.1%). The relationship between the biological and mechanical control of wind erosion depicted lower (100.65 ton ha^{1} day^{1}) accumulation of sand in horizontal traps using biological control as compared with the mechanical control (107.98 ton ha^{1} day^{1}), indicating better protection using biological means. The study recommends that the trees should be established using seedlings' planting for both mechanical and biological control methods. Mechanical protection using checkerboards can be used instead of surface lying for better growth of *Acacia oerfota* (laot) and *Ziziphus spina Christi* (sidir). Up to 70% and 80% of the variability in sand accumulation can be explained by trap height (from 0-45 cm) in the mechanical and biological control methods, respectively. Accordingly, in northern Sudan, biological control methods of wind erosion were found to be better than mechanical control.

Keywords: wind erosion, Sudan, biological control, mechanical control, soil erodibility

3.8 La réhabilitation des terres dégradées du Périmètre de Reboisement de Parakou (PRP)

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La présente étude sur « la réhabilitation des terres dégradées du Périmètre de Reboisement de Parakou (PRP) » est réalisée dans la partie septentrionale de la République du Bénin en Afrique de l'Ouest. Elle a pour objectif d'apprécier la restauration des terres dégradées de ce périmètre qui est une forêt urbaine ayant le statut de forêt classée, grâce au reboisement.

De façon spécifique, il s'agit d'une part de déterminer l'ampleur des dégradations sur les écosystèmes de la forêt, et d'œuvrer pour sa réhabilitation par la mise en place de façon pérenne de pépinière et la mise en terre des plants. La démarche méthodologique adoptée s'est réalisée suivant deux étapes. La première a consisté aux enquêtes auprès des différents usagers de la forêt pour la collecte des données sur les raisons de la dégradation de cette forêt, les actions de sa réhabilitation. La deuxième concerne l'opérationnalisation de la réhabilitation par approche participative des populations riveraines et usagers du domaine dans la mise en terre des plants. Les résultats obtenus porte sur la détermination des facteurs de dégradation de la forêt, les impacts et les défis à relever pour sa conservation durable, la rédaction, l'adoption et la mise en œuvre d'un plan d'aménagement de ce Périmètre de Reboisement de Parakou.

Mots Clés: *Périmètre de reboisement, dégradation des terres, réhabilitation, plan d'aménagement, Parakou*

3.9 Population structures and minimum felling diameter of the Pterocarpus erinaceus poir in arid and semi-arid habitats of West Africa

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The Pterocarpus erinaceus Poir (Fabaceae) is an endemic, highly exploited and threatened plant species in arid and semi-arid zones in West Africa. This study was conducted at the sub-regional level across three countries, namely, Burkina Faso, Niger and Togo, which represent a spatial ecological gradient of the *P. erinaceus* distribution that could facilitate collection of information on the population structure and operating standards that could guide the silviculture of the species, ensure its regeneration and establish the appropriate strategies for its management. Data were collected in the *P. erinaceus* populations by means of forest inventories. Results show that the average tree density is 1.17±0.75 trees/ha (Sahelian zone), 49.20.±63.2 trees/ha (Sudanian zone) and 110.9±1.15 trees/ha (Guinean zone). Trees average diameter values range between 26.63±7.89 (Guinean zone), 29.02±15.44 cm (Sudanian zone) and 49.63±19.44 cm (Sahelian) with a major noticeable variability (CV = 53.6%). For these parameters, a significant difference was noted between the zones (P <0,001). For the average total height, the populations in the Sudanian zone (9.51±2.75 m) are significantly less (P <0.001) than the other two zones (10.18±2.27 m for the Sahelian zone and 14.16±2.88 m for the Guinean zone. The merchantable heights are between 4.08±1.35 m (for Sahelian zone) and 3.63±2.63 m (for Guinean zone). They vary significantly from one zone to another (P <0,001). The distribution of trees in diameter classes is different depending on the climate zone: modal with most classes ranging between 30-65 cm in Sahelian zone versus 15-45 cm in Sudanian area; and an "L" model distribution in Guinean zone (most classes ranging between 10-25 cm). The distribution of height classes shows a modal form for all the three climate zones. Results also allow to determine two Minimum Diameters of Exploitation (MDE): 35 cm for the Guinean and Sudanian zones (P = 316.6% for the Guinean zone and P = 53.4%) and 65 cm for the Sahelian zone (P = 111.9%) for a rotation period estimated at 20 years for all the phytogeographical zones.

Keywords: *West Africa, Pterocarpus erinaceus, ecological gradient, structure, Minimum Diameters of Exploitation*.

3.10 Mangroves in Africa: Lesser known forests providing multiple benefits to people, environment and biodiversity.

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Africa is endowed with a rich mangrove ecosystem, that covers over 3.2 million hectares; representing approximately 19% of global mangrove coverage. Despite their limited area, mangroves provide a wide range of goods and ecosystem services for human livelihood, including fisheries and timber production, coastal protection, pollution abatement and carbon sequestration. However, human-induced stresses ranging from over-exploitation of these resources, diversions of freshwater, poor land-use within and adjacent to mangrove forests, and pollution disrupt the natural equilibrium of mangroves. Mangroves are also predicted to suffer from the impacts of climate change, particularly from sea-level rise. Cumulatively, African mangroves have been affected by deforestation and forest degradation. In West Africa, for instance, mangrove areas have diminished from 2.1 million ha in 1980 to their current 1.6 million ha, while in Central Africa they have been reduced from 0.7million ha in 1980 to 0.4 million ha at present. Estimates of existing mangrove areas in Eastern Africa range from 0.8 – 1.2 million ha and no data appears to be available in respect to their rate of loss. FAO reports that Africa has lost over 500,000 hectares of mangroves during the last 25 years. Losses of mangroves have negative effects on fisheries, shoreline stability and resource sustainability. This paper examines the root causes of mangrove degradation in Africa; and the impacts to the people, environment and biodiversity. Feasibility of pursuing carbon financing in the restoration and management of mangrove forests in Africa has also been evaluated; particularly how governments in Africa could include mangroves in their nationally appropriate mitigation actions on climate change.

Keywords: *Blue carbon, climate change mitigation and adaptation, African mangrove forests*

3.11 An assessment of the forest regenerating potential of taungya system of farming in Oyo State, Nigeria

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The world's forest area has been declining at alarming proportions in the last half of the 20th century with Nigeria accounting for most of the loss in West Africa. One of the most challenging problems facing Nigeria is the production of sufficient food and fibre to meet the needs of her ever-increasing population. This paper reports the performance of the *taungya* system of forest regeneration in Osho forest reserve, Oyo State, Nigeria with the view to harnessing information for informed and effective policy decision on forestry development. Four out of seven *taungya* centres within and around the reserve were purposively selected and 68 household respondents were interviewed. The growth performance and survival of species under *taungya* and direct planting system was also assessed from 10 temporary sampling plots, each measuring 25 m x 25 m. It was evident from the study more than half of the farmers (56%) had knowledge about the *taungya* and silvicultural operations while 82% of them had no other farm outside the *taungya* centres. Significant variation was observed in the circumference at breast height of species under the direct planting and *taungya* system with *Gmelina arborea* having contributed most of the variation and the differences in stand age. The survival percentage of tree species under *taungya* and direct planting system was 52% ha^{-1} and 41% ha^{-1}, respectively. The observed key constraints to *taungya* system were; lack of credit facilities, inadequate funding, limited knowledge on the advantage of tree crops on tropical farmland and inadequate technical support among the dependent people. Overall, the *taungya* system was found effective for forest regeneration albeit taking care of farmers' interest beyond the tree canopy closure.

Keywords: *Forest regeneration, Taungya system, direct planting, survival, growth performance*

3.12 The facilitation role of sea blight (Suaeda monoica) in regeneration of degraded mangroves at Mwache creek, Kenya

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While sea blight (*Suaeda monoica*) is common in the degraded sites of Mwache Creek mangrove forest in Kenya, its role in mangroves regeneration is not known. Given the subsequent degradation and the potential encroachment of mangrove ecosystems, quantification of the role of early colonizing vegetation to early mangrove seedlings regeneration and survival is necessary. This study focused on facilitation by an early colonizing nurse species of mangrove ecosystem and its role in regeneration of mangroves in a degraded area. Using stratified systematic sampling, transects of naturally growing sea blight, natural mangrove stands and bare areas were compared for their sediment conditions, vegetation characteristics, structure and composition. The findings indicated that interstitial water temperature and salinity (at low tide) were lower, while sediment organic matter was higher in the vegetated compared to bare sites. The bare areas were sandier than the vegetated sites. Nutrients concentrations varied amongst the three sites, but did not vary significantly ($p>0.05$) between the natural mangrove stands and naturally growing *S. monoica* sites. All regeneration classes of *Avicennia marina* species exhibited no significant differences in sites of natural mangrove stands and sites of *S. monoica* (p□0.05), while the bare areas recorded no regeneration. Other regenerating species encountered were *Rhizophora mucronata* and *Ceriops tagal*. The primary mechanism proposed for improving seedling success is sediment stabilization and hydrology moderation provided by *S. monoica* root network. These findings support the use of facilitation by pioneer species where natural regeneration has been impeded as a tool for management in conservation and restoration of the functional integrity of degraded mangrove habitats.

Keywords: *Indian Ocean Dipole (IOD), nursing plant, restoration, regeneration, sediment conditions, succession.*

4.0 Managing forests in the context of climate change

4.1 The experiences of African countries in REDD readiness processes

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Africa is endowed with vast resource base including some 635 million hectares of forest cover, which is about 16 per cent of the world's forests. These forests are distributed unevenly in the four geographical sub-regions with the Central African sub-region having the highest closed forest cover. Interestingly, a high percentage of Africans (a little over 70 per cent) depends on forests, as the main source of their economic and social needs including food, medicine, shelter material, energy, and income. Additional benefits that the forests provide comprise watershed protection, wildlife conservation and the most recent climate change amelioration through carbon sequestration and sinks.

However, as much as the benefits from the forests are known so also are the devastating effects of deforestation and forest degradation of Africa's forest resources. The loss of Africa's forest resources are driven mostly by unsustainable agricultural practices. Other factors include commercial logging practices, inadequate land-use policies, and lack of sectoral integration. The loss of forests through deforestation and forest degradation contributes up to one third of greenhouse gas emissions in some of the African countries.

The internationally agreed concept on Reducing Emissions from Deforestation and forest Degradation (REDD+) is expected to play important roles in attracting global attention and resources to bear on the challenges African countries have been experiencing in maintaining as well as assisting in the sustainable management of their forest resources. Such external resources to the forestry sector include receiving payments for storing carbon. Of the 54 African countries, only 19 countries have shown interest in the REDD+ processes and actually requested and obtained financial assistance from either the World Bank's Forest Carbon Partnership Fund (FCPF) or the United Nations UN-REDD Fund for the REDD Readiness processes.

This paper looks at the various countries involved in the REDD Readiness process and provides an analysis of their level of engagement guided by questions such as: i) how are the countries fairing? ii); what are the benefits of REDD+ for African countries? and iii) what are Africa's expectations? The paper concludes with the lessons learnt and experiences to date.

Keywords: *REDD+, REDD Readiness, African forests, climate change*

4.2 Carbon accounting for REDD in a transboundary mangrove forest in Kenya

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Carbon accounting is one of the precursors of carbon-offset projects in forestry. It entails measurement of carbon captured and stored by the system, in this case mangrove forests. In this regard total carbon stocks of a transboundary mangrove forest of Vanga pilot area covering an area of ~3000ha were determined, using the IPCC protocol for coastal wetlands. This was followed by development of localized allometric relations for determination of stand biomass and volume of *Rhizophora mucronata* and *Ceriops tagal* which are the principal mangrove species. A total of 47 sampling plots measuring between 100 and 400m^2 were used. Soil organic carbon (SOC) was determined using loss of ignition (LOI) method. Total carbon stock of mangroves in Vanga were estimated at ~469Mg C/ha, with SOC and above ground biomass accounting for 77% (~361 Mg C/ha) and 23% (~108 Mg C/ha) of the total ecosystem carbon respectively. The total carbon for the whole forest was thus estimated to be approximately 1.4 Teragrams. The significance of this data is in the development of carbon offset project for mangroves of Vanga.

Keywords: *Blue Carbon, PES, carbon accounting, mangroves, Kenya*

4.3 Problématique de gestion des feux de forêts dans un contexte de dérèglement climatique et de REDD+.

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Au Togo, la pratique et la gestion des feux sont soumises à des normes légales. Pour prévenir les feux tardifs catastrophiques, il est institué la pratique des feux précoces. Mais toujours, des feux tardifs dommageables à l'environnement et aux populations sont enregistrés chaque année sur près de 60% du territoire national.

Cette étude vise à améliorer l'état des connaissances sur la dynamique et la gestion des feux de forêt. Spécifiquement l'étude vise à dresser l'état des lieux de la dynamique spatiotemporelle des feux au Togo et d'évaluer les impacts des feux sur les ressources végétales.

Pour se faire, les données fournies par les satellites (MODIS) ont été analysées et confrontées à la méthode de mesure au sol. La cartographie des feux actifs et des superficies brulées est réalisées dans ArcGis. Le dispositif expérimental est constitué de parcelles (20x20m et 30x80m) installées dans les savanes du parc national de la Kéran, de la réserve de faune d'Abdoulaye et de la réserve naturelle de Togodo. La strate végétale étudiée est la biomasse herbacée épigée plus exposée aux feux de surface dans les savanes tropicales.

Les résultats montrent, au niveau national, une tendance cyclique de feux extrêmes d'une périodicité de 2 à 4 ans depuis 1995, mais depuis 2012, la tendance est maintenue à un niveau extrême. La vulnérabilité est effectivement plus élevée au niveau des aires protégées, ces dernières concentrent plus de 60% des feux détectés sur le territoire pour à peine 7% de la superficie nationale. Les données fournies par les satellites sont bien en deçà des réalités de terrain à cause des limites de sensibilité. Les superficies réellement brulées sont 2,9 fois plus élevées que les superficies détectées. La vitesse de propagation des feux est plus élevée en savane soudanienne (12 cm/s) qu'en zone guinéenne (10 cm/s). L'intensité des feux se situe entre 1500 et 3000 kW/m et les feux précoces sont les moins dommageables à l'environnement. Rien que pour la zone d'étude, les feux ont provoqué une perte de biomasse de l'ordre de 16015,04 t/an, équivalent à 8007,52 tonnes de carbone rejeté dans l'atmosphère. Ce rejet représente 0,09% des rejets au niveau national. Par unité de surface, la perte de biomasse herbacée est de 16 à 69g/m². Les espèces pyrorésistantes comme les graminées prédominent sur les sites brulés au détriment des autres familles herbacées.

La connaissance de la dynamique des feux sur les écosystèmes forestiers devient incontournable dans l'élaboration et la mise en œuvre des plans d'aménagement des écosystèmes forestiers. Cette étude a mis en exergue la nécessité d'une approche systémique dans la gestion des feux qui s'intègre dans le développement local. Comme pour la plupart des défis environnementaux, la gestion des feux de forêt devient recommande la collaboration au niveau régionale et internationale pour des échanges entre acteurs et gestionnaires pour un développement durable.

Mots clé: *feux de végétation, biomasse herbacée, appropriation de la réglementation des feux.*

4.4 Résilience aux perturbations des peuplements ligneux des parcs à Faidherbia albida (Del) A. chev. et à Prosopis africana (Guill., Perrot et Rich.) taub. dans le contexte du changement climatique au Sahel, Niger.

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Les parcs agroforestiers au Sahel sont le fruit de la création humaine, partant de l'élimination des espèces gênantes et/ou peu utiles, à la sélection, à l'entretien et à l'exploitation des espèces utiles dans les champs pour différents usages des populations. Malgré les différentes pressions exercées par les populations et les sécheresses répétitives, beaucoup d'espèces ligneuses se maintiennent dans les parcs au Sahel à des degrés d'abondance et de stade de croissance variés. Cette étude s'est déroulée dans deux parcs agroforestiers au centre-sud du Niger. Le parc à *Prosopis africana* appartient au domaine de la savane arbustive et le parc à *Faidherbia albida* du domaine de la steppe arborée. L'objectif global de cette étude est de mener une analyse quantitative de la résilience aux perturbations des peuplements ligneux de ces deux parcs dans le contexte du changement climatique. La méthodologie est basée sur les enquêtes menées auprès des populations à travers des questionnaires individuels, des focus groupes et des assemblées villageoises ainsi que l'inventaire au sol des peuplements ligneux. Les analyses des espèces disparues, leurs usages et leurs modes d'exploitation ainsi que celles des Indices des Valeurs d'Importance (IVI) et de la régénération ont permis d'apprécier le niveau de résilience de chaque espèce inventoriée. Vingt-deux (22) espèces réparties en 21 genres et 16 familles ont disparu dans le parc à *F. albida* contre 34 espèces réparties en 28 genres et 18 familles dans le parc à *P. africana*. Cependant, il a été inventorié dans le premier cas, 21 espèces dont 16 au stade adulte et 5 au stade de régénération et dans le second, 29 espèces ligneuses réparties en 20 espèces au stade adulte et 9 espèces au stade de régénération. Les résultats ont aussi permis de déterminer quatre (4) formes de résilience des espèces ligneuses. Les espèces à IVI et à rejets élevés (*P. reticulatum P. africana, F. albida* et *C. glutinosum)* ; les espèces à IVI faibles et à rejets élevés (*G. senegalensis, Z. mauritiana*, *B. rufescens, M. crassifolia, B. aegyptiaca, A. senegalensis, A. chevalieri, C. glutinosum, H. thebaica*); les espèces à IVI très faibles et sans rejets (*T. indica, X. nilotica*, *A. digitata, B. salicifolia, D. mespiliformis* et *S. setigera)* et les espèces à rejets sans des sujets adultes (*C. pendunculata, E. africana, C. singueana, T. avicennioides, F. apodanthera, C. micranthum, C. africana, F. platyphylla* et *C. procera)*. Ces résultats vont permettre de sélectionner et/ou de réhabiliter les espèces sur lesquelles l'on doit s'appuyer dans les plans d'aménagement forestier villageois pour répondre d'une part au besoin d'usages des populations et d'autre part à l'amélioration du mode de gestion et de conservation de ces espèces.

Mots clés: *parcs agroforestiers, espèces ligneuses, résilience, Sahel, Niger*.

4.5 Prospects for REDD+ in African tree plantations

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This study examined the prospects of greenhouse gas mitigation in African tree plantations, with a focus on the prospects of Reducing Emissions from Deforestation and Degradation (REDD+) in such plantations.

It was shown that plantations constitute one out of every five hectares of world forests and that Africa hosts about 16 million hectares of plantations, which is about 4 percent of African forests, less than the global average of 7 percent. In recent years there has been an accelerated pace of planting in Africa, especially by the private sector. This ecosystem is subject to the same factors that drive deforestation and forest degradation, albeit to a varying degree. This study reports that since 1990, Africa has been losing 51,000 hectares of plantations annually with a carbon stock averaging 30 tonnes per hectare. A further 200,000 hectares are estimated to be in various states of degradation every year. Interventions to reduce and/or eliminate emissions would lead to substantial carbon benefits under the REDD+ program given the high carbon stocking of plantations. Estimates using standard assumptions on carbon stocking in plantations yields about 40 million tonnes of CO_2 creditable to REDD+ annually.

The study further reviewed other mitigation activities possible in African plantations and most of these will fall under the rubric of Nationally Appropriate Mitigation Activities agreed to in Doha in 2012. These actions may include, biomass conservation, utilization efficiency improvements, the use of plantation and wood industry residues for co-generation of heat and power, complimentary possibilities to establish new plantations for the production of biofuels, as long as it does not impinge on food security and exacerbate land conflicts where the resource is scarce. It is also recommended that African countries consider expansion of plantations as a REDD+ program to relieve pressure on natural forests. When applied to plantations, REDD+ has less community conflicts over tenure, ownership and access given the largely public ownership of plantations in Africa.

With the magnitude of the ecosystem, and the significant rates of deforestation and degradation, it is recommended that the plantation ecosystem be opened to all mitigation options available in the forestry sector, especially REDD+. It is thus recommended for African countries to involve plantations in climate change baseline studies and include MRV issues in the regular management plans. To allow for meaningful participation of plantations in GHG mitigation, African countries should foment the policy and institutional changes necessary within the forest management system.

Keywords: *African forest plantations, REDD+, GHG mitigation*

4.6 Allometric relations for determination of biomass stock and carbon in Rhizophora mucronata L. and Ceriops tagal P. mangrove species in Kenya

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The need for localized equations for the determination of standing biomass is becoming more apparent as forest carbon offset projects pick up in many parts of the world. The objective of this study was to develop species specific biomass equations for *Rhizophora mucronata* and *Ceriops tagal* in managed and natural mangrove forests along the Kenya coast. Fifty trees of each of the species with diameter ranging from 2.5 cm to 50 cm were harvested and separated into their component parts, namely; trunks, leaves, branches, and stilt roots. The weight of individual component parts was measured *in situ* and sub-samples of each component carried to the laboratory for wet-dry weight conversion.

Correlations between the total biomass with stem diameter (D_{130}), either alone or in combination with height, were used to develop allometric equations of the form $y = ax^b$ (*where*: y = biomass; $x = D_{130}$; a and b are constants).HH The strength of the equations was assessed by the correlation coefficient of determination (r^2) and standard error. Stem diameter (D_{130}) was found to be the best predictor for aboveground biomass with correlation coefficient (r^2) of 0.924 and 0.986 for *R. mucronata* and *C. tagal* respectively. The aboveground biomass for *R. mucronata* was estimated to range between 4.8 and 162.3 t/ha while that for *C. tagal* ranged between 9.2 and 136.4 t/ha. The developed equations could be used to accurately estimate biomass carbon of the mangrove forests in Kenya. This will in turn improve opportunities for attracting more carbon funds through use of more accurate methodologies in estimating carbon stocks.

Keywords: *Kenya, mangroves, REDD+; Stand biomass; allometric equations*

4.7 Impacts of human disturbance and climate variability on population structure of Afzelia africana Sm. ex pers. (Fabaceae–Caesalpinioideae) in Benin

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The objective of this study is to assess the population structure of the endangered species, *Afzelia africana* across gradients of climate and human disturbances. Three climatic zones namely, the Guinean zone, the Sudano-Guinean zone and the Sudanian zone were considered. In each climatic zone, two levels of disturbance (low disturbance and high disturbance) were selected, according to the type, frequency and intensity of disturbances. Dendrometric variables such as regeneration and tree density, mean diameter, basal area and height and stem diameter distribution were recorded in forest stands at each level of disturbance. A canonical discriminant analysis was applied to describe the species' population structure across climatic zones and disturbance levels. Relationships between the principal components based on structural parameters of *A. africana* stands and climatic variables and disturbance levels were determined using Pearson correlation. Significant differences were found in the structural parameters between the disturbance levels, mostly in the Guinean zone. Structural parameters also differed significantly across the three climatic zones, with the Guinean zone recording the highest values. The effects of disturbance levels on structural parameters depend on the climatic zone, and vice versa. In the Guinean zone, the tallest (mean height = 17.70 m) and biggest trees (mean diameter = 70.88 cm) were found at the low disturbance level. However, along the climatic gradient especially on drier regions, trees were shorter (with a mean height of 8.87 m) and smaller (with a mean diameter of 18.56 cm), irrespective of disturbance level. Further, the tallest and biggest trees were found at lower altitudes. It is suggested that protection actions be enforced in the Sudanian and Sudano-Guinean zones and focused on the regeneration (seedlings and saplings). It is also suggested that seed collection under excellent seed bearers could help to establish seed orchard and to assist natural regeneration. Finally, it is suggested that local communities should be involved in these protection actions.

Keywords: *Afzelia africana, disturbances, climatic gradient, conservation strategies, West Africa.*

4.8 Climate change in African forestry education: current reality and future needs

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While the demand for forestry expertise to address landscape sustainability, climate change and environmental services and products is rising, forestry education in Africa is not adequately developed to address these needs. This study survey shows that, current education still largely follows the traditional curriculum that focuses on thematic areas such as forest management, forest biology, wood processing, forest conservation, forest economics, to mention a few. At universities climate change is partially taught as a topic in some of the subjects such as silviculture and ecology, but at technical training level climate change education is only introduced or bypassed altogether. The situation is somewhat better in countries implementing REDD+ projects.

The learning resources currently in use for climate change are mostly drawn from projects and are not well organized in a pedagogical manner to cover the subject holistically. In short, upon graduation, the graduates are not adequately equipped to fully understand climate change, assess climate change impacts, plan or guide other stakeholders on effective forestry response actions.

These observations emanate from a study sponsored by the African Forest forum (AFF) in 2014, undertaken in 12 universities, 3 colleges and 4 research institutes in 12 Anglophone African countries. Following the results from this study colleges and universities teaching forestry are urged to undertake comprehensive reviews of curricula to strengthen climate change content, assist educators to adequately teach this area and adapt learning resources to the African environment. Regional institutions and networks, especially AFF and ANAFE are urged to support collaboration among teaching institutions and explore opportunities to develop model curricula, learning resources and facilitate knowledge exchange.

The authors recommend that the African Union, national governments, development partners and private sector act together to develop and implement policies that elevate the position of forestry in land use and promote more investments in forestry education as a way of strengthening the forestry sector in addressing climate change and other new and emerging issues and initiatives like the Sustainable Development Goals, improving livelihoods and national economies, and securing environmental stability of the continent.

Keywords: *climate change, forestry education, Africa*

4.9 Incorporating climate change in the curricula of forestry schools: the case in Francophone Africa

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The African Forest Forum commissioned a study in 2013/14 aimed at evaluating how climate change features in academic training in both technical and professional francophone forestry institutions as well as to identify ways to facilitate the institutionalization of climate change in these institutions. Fourteen institutions in eight West and Central African countries were selected for the study. The information gathered by interviews during institutional visits was analyzed using qualitative analysis tools and applying creativity to interrogate logic currently used by the key actors to make choices. The study revealed that most of the schools have shown positive signs for the institutionalization of climate change in the curricula; with 65% already teaching climate change as a separate course. The exact contents of these courses that are taught mainly by staff coming from outside of the institutions were not available but appear to comprise of the general concepts of climate change and including adaptation and mitigation measures. Three institutions such as the AGRHYMET Centre in Niger, the University of Dschang in Cameroon and the University of Kisangani in DRC already run masters' degree programs in climate change. Some positive initiatives to these institutions to take up climate change in their programmes already exist in the different countries, including governmental action plans, financial and technical partnerships that were noted at the level of the ministries in charge of the environment in the countries visited. Documentation, access to internet, availability of laboratories, demonstration plots are the main constrains in terms of resources. All the forestry schools sampled use teaching staff outsourced from other institutions for teaching subjects on climate change; the institutions have bare minimum staff whose capacity in climate change needs strengthening, guided by strategies and actions proposed through this study as a way for institutionalization of climate change in forestry training in francophone Africa.

Keywords: climate change, forestry curricula, West and Central Africa, institutionalization

5.0 Forest governance, marketing and trade in forest products

5.1 Implications of corruption on marketing and trade in non timber forest products value chains: Case of Gnetum species in Cameroon

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The role of non-timber forest products in reducing rural poverty and enhancing food security has been widely acknowledged in many forested countries in Africa. The production, transportation and commercialization of economically important NTFPs are generally subject to regulations and laws that are not readily accessible and known to local actors. Opportunistic demonstration of law enforcement by relevant public officials become very apparent during periodic controls along the value chain of highly commercialised NTFPs. This paper reviews the magnitude of such opportunistic behaviour; specifically looking at activities leading to bribery and other corrupt practices, and taking the case of a *Gnetum spp.* (eru), a wild leafy vegetable that is copiously consumed in Central and West Africa as well as in the diaspora. Data collected over a period of one year in Cameroon showed that while transiting eru from a key basin of production to the port of export more than 18000 financial transactions were made with law enforcement officials, with 83% of them being categorized as bribery and other corrupt activities. The value of the bribes added 34% to the costs incurred by traders; and this has negative implications on the net incomes of producers. To contain this, producers pass on this added cost as higher prices paid by consumers. Further, this very high number of financial transactions on the route to ultimate consumers also precipitates very high losses of the perishable vegetable due to increased transit time. The paper suggests an overhaul and redress of the weaknesses in the existing regulations as one way of creating an enabling business environment for local producers of NTFPs in Cameroon.

Keywords: *NTFPs, trade, corruption, Cameroon, livelihoods, value chains*

5.2 Forest products use and livelihood strategies for households around a once traditionally preserved Miombo woodland in Zimbabwe

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Miombo woodlands make up a significant proportion of total forested land in Zimbabwe and are central to the livelihood systems of both rural and urban populations in supplying energy and non- timber forest products. This study was conducted to assess the forest product utilisation and livelihood strategies for households within or in close proximity to formally traditionally preserved Miombo woodland. The main objective was to assess how access to woodland resource utilisation affects the management, use and condition of the woodland.

All households around the forest depend on the forest for wood energy and other sixteen forest products. A few of the forest products contribute between 40-70% of annual household incomes, the greatest from firewood sales. However, there are no defined marketing arrangements as most of the income generating activities are done illegally. Price of products such as firewood increase with distance from source. For some households, forest resources are alternative livelihood strategies caused by a decrease in disposable incomes from other sources and therefore forcing them into the extensive forest product exploitation and trade. Forest product utilisation is also characterised by gender with women and young boys increasingly becoming more enterprising.

The woodland is however threatened by agricultural activities including land clearing and overexploitation of firewood for tobacco curing. There were more small diameter trees in the woodland than large diameter trees and more dry stumps than fresh stumps implying that there is reduction in tree cutting. The importance of local institutions, traditional values, local beliefs and values and traditional property rights influencing utilization of communal resources in management of woodlands and their protection has been eroded by central governments that have replaced village and clan elders in land allocation and forest management. The local communities need full involvement in the management and use of the woodland resources in order to reduce deforestation of miombo woodlands. Further there is need to develop affordable and accessible alternative energy sources for the rural communities.

Keywords: *Miombo woodlands, NTFP, communities, Zimbabwe, forest governance*

5.3 Production, value addition, marketing and economic contribution of non-wood forest products from arid and semi arid lands in Kenya

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Non-wood forest products (NWFPs) are goods of biological origin other than wood, derived from forests, other wooded lands and trees outside forests. In Kenya, the level of NWFPs utilization varies from one region or community to another, and in line with their endowment in the different national ecological zones. Utilization is more pronounced in the Arid and Semi Arid Lands (ASALs) compared to high rainfall areas where modern agricultural crop production dominates land use decisions and practices. ASALs have enormous economic potential and are the home of vital non wood forest products such as honey, gums, resins, medicines, fruits, dyes, and other important emerging natural products that are made from indigenous plants. At international level, the natural products market from such pure and unpolluted sources has grown substantially with bio-enterprises capable of offering new sources of livelihood to the population of the ASALs areas.

This paper reviews the production, value addition, marketing and the economic contribution of NWFPs in Kenya. Policy and legal frameworks, research and development and constraints to optimal utilization are also addressed. Some of the key constraints on the commercialization of NWFPs identified in the study include: inadequate quality control of the products, un-streamlined supply chain, poor pricing and linkages with markets, lack of clear policy on the development of NWFPs, lack of product standards, inadequate access to capital, poor production practices, inadequate data on some of the products and limited market information systems, among others. The following interventions are recommended in order to enhance the sustainable commercialization of NWFPs in Kenya: inclusion of NWFPs issues in the harmonized laws and policies in order to enhance community participation in their conservation and management; promotion and strengthening NWFPs value chains for sustainable commercial production; research, technology development and transfer and sharing of information on NWFPs; enhancing partnerships, synergies and complementarities including public- private partnerships for resource mobilization and investment on NWFPs

Keywords: *Kenya, Non wood forest products, Arid and Semi Arid-Lands*

5.4 The socio-economic contributions of non-timber forest products (NTFPs) in Muzarabani district, Zimbabwe

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The potential role of Non-Timber Forest Products (NTFPs) in improving nutrition, health and reduction of poverty has been recognized in recent years. Despite their significant contribution to food security, and sustaining livelihoods, NTFPs tend to be overlooked by policy makers and have not been accorded the necessary attention in development planning and livelihood improvement programs.

This study was conducted to assess the socio-economic gains of NTFP to communities in Muzarabani district, Zimbabwe. Information was mainly collected from focus group discussions and key informant interviews. A total of eleven NTFPs were actively used in Muzarabani, of which only three were exploited for economic gains. The other eight NTFPs were mainly for subsistence use. The three commercialized NTFPs were the local economic drivers, changing people's standards of living during peak periods. The three commercialized NTFPs contributed 46% of total annual household income; with *Hyphaene coriaceae* leaves, *Ziziphus mauritiana* fruit and *Adansonia digitata* fruit contributing 20%, 56% and 24% respectively. The annual income obtained from sale of NTFPs ranged from USD412 to USD1075 per household with an average of six members per family. Among the non- commercialized uses, 86% of the communities use firewood where as 80% also require the forest for pasture. About 30% were still hunting in the degraded forests.

A major challenge to the sustainable utilization of NTFP is that the accessibility to NTFPs was open to all with no one controlling their exploitation. The products remain open access goods which were even accessed by those from outside the villages or outside the province. There is need for the government of Zimbabwe and non-governmental organizations working in the district to formalize the exploitation and trade of NTFPs so as to promote sustainability avoid leakages and increase income. Owing to socio economic benefits of NTFP, sustainability can be achieved when local communities are included by the local authorities in management and utilization of their forest products.

Keywords: *Non-Timber Forest Products (NTFPs), livelihoods, Zimbabwe, socio-economic development, rural communities*

5.5 The EU-FLEGT VPAs -A critical review of status and progress in implementation by African partner countries.

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The world's forests provide vital goods and services of social, economic and environmental benefit to life on earth. However, the forest resource is under severe pressure from competing needs, land uses and unsustainable utilization. The state of forest governance is very appalling, especially in the African continent. The role of law and the rule of law are not clearly understood yet. Most of all, there is a threat of tree species survival posed by indiscriminate deforestation and alarming illegal and associated timber trade. The other issue is the absence of an enforceable legally binding international instrument on all types of forests. Currently there is only the Non-legally Binding Instrument on All Types of Forests (NLBI), which appears powerless. This has led to the emergence of a plethora of forest regimes seeking to promote good forest governance, sustainable forest management and forest law enforcement, good governance and trade (FLEGT). Recent reviews of the international regulation of SFM have shown that the EU-FLEGT Scheme is the most equitable legal regime to curb illegal logging. The associated Voluntary Partnership Agreements (VPAs) are perceived as a theory of change in international regulation of sustainable forest management (SFM) and good forest governance (GFG). This study examined five African states that have subscribed to EU-FLEGT VPAs. VPAs are a central plank of the EU-FLEGT Action Plan. These are bilateral trade agreements which have incredibly increased multi-stakeholder participation in issues of forest governance, policy reforms and VPA processes in general. Hence transparency, probity and accountability are beginning to manifest in African forestry. There is improved forest governance and inclusivity in decision-making amongst others. While the rate of VPA implementation remains very slow, successes have been observed in all the five study countries. Though some challenges still remain, particularly regarding lack of political will to support FLEGT.

Keywords: *FLEGT, Legality, Sustainable Forest Management, REDD+, Voluntary Partnership Agreements*

5.6 Socio-economic factors influencing non-timber forest products' marketing in tropical lowland rainforests of south west Nigeria

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A number of factors continue to constraint the non-timber forest products' (NTFP) market and its potential to achieve livelihood development and poverty reduction objectives. To better utilize the NTFPs' potential; however, it is important to have improved understanding of the key factors governing success and failure of NTFP trade. This paper reports on the market constraints and socio-economic factors influencing trade in five top priority NTFPs within the tropical lowland rainforests of south west Nigeria. The NTFPs investigated were: bush mango (*Irvingia gabonensis* (Aubry- Lecomte ex O'Rorke) Baill), African walnut (*Plukenetia Conophora* Mull-Arg), chew-stick (*Massularia acuminata* (G. Don) Bullock), fever bark (*Annickia chlorantha* Setten & P.J.Maas) and bush pepper (*Piper guineense* Schumach. & Thonn.). Field data were collected in ten villages located within and around Omo and Shasha Forest Reserves using household survey questionnaires and focus group discussions. Descriptive and inferential statistics using bivariate correlation analysis were employed in analyzing the data. Results showed that seasonality, poor transportation services, lack of storage facilities, and lack of market information were four major market constraints influencing trade in NTFPs. Other socio-economic factors such as level of education, sex, household's income, ethnicity, distance to market and road access significantly influenced market knowledge and information among households involved in the trade of NTFPs. Identified possible actions for eliminating the constraints include the need to improve on the limited source of NTFPs information, enhancement of skills for product transformation, building innovative storage facilities and developing the process of domestication and integration in traditional land use systems. The respondents' socio-economic variables and influence on NTFPs-related market knowledge are also crucial for forest managers and practitioners in the design of appropriate policy measures and mechanism for NTFPs projects and interventions.

Keywords: *Non-timber forest products, market constraints, tropical lowland rainforests, Nigeria*

5.7 The Impact of financing arrangements on the production and marketing of shea (Vitellaria paradoxa) butter in Tamale in the Northern region of Ghana

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In recent times, shea butter *(Vitellaria paradoxa)* has emerged as an important internationally recognized economic commodity because of its medicinal and restorative properties. This study assessed financing schemes and delivery mechanisms available for the production and marketing of shea butter. It also identified financial structures available to shea butter producers including constraints of the financial delivery mechanisms. The study was conducted in the Tamale in the Northern Region of Ghana. Using a social survey, 83 women engaged in shea butter processing were purposively selected and interviewed. Of these, 86% were full time processors of shea butter while 14% engage in other businesses like petty trading, groundnut and rice processing. Respondents also expressed their perceptions on access to financial arrangements for shea butter production. The study revealed low patronage of financial services as only 18% of the respondents took loans. A high proportion, 82% of respondents were under contract financing with companies that purchased shea butter. There were situations where NGOs and some financial organizations have tried to improve the financial arrangements by providing technical support services to the producers. However, there was the absence of continuous support services in credit management. The current high illiteracy rate (97%) of shea butter producers makes it challenging for them to access and use simple accounting and marketing tools to support their businesses. There is therefore need for targeted and effective collaboration among stakeholders as well as the provision of support services to sustain financing schemes. In the long term, policies will have to be formulated to regulate and standardize activities of the shea industry in order to facilitate poverty reduction and sustainable rural development.

Keywords: *Shea (Vitellaria paradoxa), women, financial services, forest products, Ghana*

5.8 Yield and quality assessment of oil production from Hildergadia barteri (Mast.) Kosterm seeds

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The dependence on forests as a source of livelihood (through the extraction of timbers and non-timber forest products), amidst other underlying causes of deforestation and degradation, has informed the need to researching alternatives that will cause less destructive impact on the forest and at same time provide for human needs sustainably. Therefore, this research focused on extraction of oil from the seeds of *Hildegardia barteri* using two different methods of extraction and analyzing the proximate composition, physicochemical and mineral properties of the oil samples with a view to knowing the quality and potentials that could be derived from it. Mature fruits of *H. barteri* were collected within the University of Ibadan campus and dehulled, dried using both sun and oven drying methods before they were milled. Oil content was extracted using N-hexane. Suitability of the extracted oil samples was determined by analyzing the proximate composition, physicochemical and mineral content using the American Society for Testing and Materials (ASTM) and Association of Official Analytical Chemists (AOAC) standard analytical. Oil yields ranged between 23.15-30.53%. Moisture content, crude protein and ash contents ranged from 1.25-1.98, 1.29-1.53 and 0.05-0.11% respectively The range of physicochemical properties obtained were as follows: specific gravity, acid value, free fatty acid, iodine value and calorific value (0.73-0.91, 0.032-0.034, 0.016-0.017, 57.95-61.85 and 33.21-36.14 respectively) ; while results obtained for mineral content for the following elements C, O, H, N, S, Pb, Cd, Ni, and Co were 72.05-72.12, 18.42-18.57, 9.38-9.57, 0.26-0.27, 0.04-0.07, 0.01-0.007, 0.005-0.007, 0.029-0.034 and 0.014-0.017% respectively. The results obtained in this research indicate that oil from the seeds of *H. barteri* is a potential forest product that will be of economic value if invested on as it could be recommended for both human consumption and industrial application without causing negative impact on humans and the forest.

Keywords: *Hildegardia barteri, proximate composition, physicochemical properties, mineral content and extraction methods.*

5.9 Non timber forest products governance: case of Prunus africana in the North West Region of Cameroon

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Political, institutional and legislative aspects of *Prunus africana* management in the North West Region of Cameroon were examined with the view to assess gaps and stakeholder's perceptions on the adequacy and suitability of regulatory framework of non-timber forests product's management. Policy documents were assessed; and questionnaires and semi structured interviews were administered to government stakeholders, NGO representatives, growers and harvesters of such products, community forest management officers and traders. Results of the study showed that though Cameroon possesses a good number of laws and policies geared towards sustainable NTFP management, these instruments are still insufficient for sustainable management of *Prunus africana* in the NW region of the country. Amongst gaps identified were inconsistent NTFP policies and legal frameworks, gaps at the level of production, market structures and management approaches employed for the species. Field findings also revealed that 78% of the stakeholders interviewed were aware of the existence of regulations, and 82% considered the intervention of regulations to be very important. Despite having positive inclinations and awareness of such regulations, there was no significant compliance to the regulations in the field because a majority of the actors (81%) openly stated that they do not obey and abide by these regulations. However, there was evidence of complementarities between the customary and statutory arrangements where 86.4% of the actors indicated that all governance systems put in place for *Prunus* management complement each other. Therefore, sustainability in *Prunus africana* value chain could only be favoured by combining the existing statutory, customary and voluntary arrangements governing the management of this high value endangered species. The study proposed and discussed a Log frame indicating the effects and possible solutions of the ineffective NTFP law compliance on *Prunus* governance in Cameroon.

Keywords: *NTFP, governance, Prunus africana, Cameroon, policy.*

5.10 Demystifying forest certification as an approach to improving governance, marketing and trade in forest products: the case of Uganda

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Several policies and initiatives have been developed globally to address major forest governance issues such as the progressive loss of forest cover and illegal trade in forest products. In Uganda, illegal timber trade is estimated at 80% of the timber on the market (WWF 2012). This has significant implications on revenues collected by government. Using current timber valuations, domestic timber production is valued at approximately USD 27.5 million per year and if 80% of this business pays no taxes, the country loses about USD 7.2 million in un collected revenues (WWF 2012). Illegal logging also exacerbates deforestation, estimated to be about 92,000ha annually. Whereas response measures such as statutory instruments have registered some level of success, deforestation is still unabated, and this calls for a strategic change in approaches that have been used to contain it. Forest certification is a market-based approach that can promote sustainable forest management through upholding principles of good governance in forestry. It involves an evaluation of management planning and forestry practices by a third- party, and based on an agreed-upon set of standards. The standards address social and economic welfare as well as environmental protection. Forest certification gives a consumer assurance and confidence that a forest product is sourced from a legal and sustainably managed forest. Still in the development stages of its national forest stewardship standards, Uganda's draft standard has put in place a more compelling measurement framework for forest governance and a scale for achieving sustainable forest management. The draft national standard is consistent with appropriate ILO conventions and various subject-based FSC guidelines, including the guidance on the right to Free, Prior and Informed Consent. Lessons learnt during the process of developing the standard have facilitated the pursuit of new initiatives on market development for certified timber, specifically targeting smallholder farmers. Whereas certification presents an opportunity to influence the market with consumers demanding certified products, it remains a voluntary approach and is not well understood by key decision makers especially those outside the forest sector. Also its application among smallholders requires special modifications. The full paper seeks to enhance knowledge and understanding of forest certification in the context of governance, trade, and marketing forest products. It also explores mechanisms for addressing certification weaknesses using Uganda as a case study, and by matching the principles of certification under the FSC certification model to responsible forest management and trade in forest products in Uganda.

Keywords: *Forest certification, governance, deforestation*

5.11 Policy and governance in forestry and agriculture – meeting uncertainty in mosaic landscapes

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It is not clear if needed increases in biological production may be able to sustainably meet demand for food, fiber and fuel in the coming decades, through increases in spatial extension of agricultural land-use. Fears of competition for land are present and broadly debated already today. This paper analyses the strong case for restoration and development of production on existing land already under use with low and/or degraded productivity. These lands are in Sub-Saharan Africa mostly in mosaic landscapes with high densities of mixed land-uses and low income and/or subsistence farmers or pastoralists. The sustainable social and ecological restoration and development of these landscapes needs holistic approaches in research, education and governance, more than delivered by traditional agriculture and forest science alone. The definition of landscapes in a dynamic physical/human frame is shortly analysed. This is also done in relation to definitions of what is agriculture and forestry, and the important multi-functionality of scattered trees and groups of trees in landscapes. The current status on development of mosaic landscapes with sustainable intensification of production and development of resilient livelihoods is analysed. It is concluded that uncertainties for production will remain severe in coming decades. The uncertainties include climate development as well as population development, gender roles and the role of youth in emerging land uses in rural areas. The dynamics of birth rates, urbanization and uncertain releasing pressure on land for family livelihoods may assist to determine the possibilities for structural rationalization of land-based production. Neither will there prove to be one answer on these questions, but they may develop differently in different countries and regions. Resilience will be key even for well developing mosaic landscapes as there will always be some external influences from global development, markets and climate change.

Keywords: *Forest and landscape restoration, sustainable intensification, mosaic landscapes, farmers, pastoralists, livelihood resilience*

5.12 Assessment of the participatory management of forest plantations establishment: A case study from Wari-Maro Forest Reserve, Benin

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The study assessed the current status of plantations established in the Wari-Maro Forest Reserve and the socioeconomic impact of their participatory management under the Forest Management Project *''Projet d'Aménagement des Massifs Forestiers (PAMF)''*. An inventory and a structural characterization of plantations were performed using dendrometric parameters from 37 square plots of 729 m^2 each. A principal components analysis on socioeconomic data from survey of households, organs of joint management and forestry officials helped to analyze the local perceptions of the participatory management of plantations. The results showed that full plantations especially made of non-native species have more success than enriched plantations and they showed the best structural characteristics. Local populations argued that they have not been sufficiently associated to the design phase of plantations establishment, and that their standards of living have decreased since the end of the project. There was no plantations monitoring after the project ended and forestry officials did nothing else than repression. A second phase of project or another project with duration of seven years is suggested with objectives that will correspond to the current potentialities the plantations have.

Keywords: *participatory management, sustainability, Project Wari-Maro, Benin*

6.0 Socio-economic issues in forestry

6.1 The socio-economic impacts of climate change on forest communities in Idanre Forest Reserve, Ondo State, Nigeria

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The reality of climate change and its impacts are already widely being felt across Nigeria. However, the people residing in the forests and on the margins of Idanre Forest Reserve, Ondo State, Nigeria appear to be exempted. This study assessed the socio-economic implications of climate change on the forest communities, farmers' perception of climate change, and adaptation strategies that farmers adopted. Five forest communities were randomly selected and a total of 150 households were sampled in the study area and questionnaires were administered to each household. The full range of economic activities undertaken was covered to understand how changes in climatic conditions affect the livelihoods of the forest communities. The study revealed that most of the forest communities lack basic infrastructure and amenities such as good roads, health care facilities, electricity and piped water that should facilitate their adaptation to climatic change and variability. All respondents (100%) were aware of the changing climate and its effects on land productivity as evidenced from reported abnormal rainfall, extreme temperatures, loss of soil nutrient and the resultant low yields. It was also revealed that some of the motivating factors for the respondents to live in the forests and the forest margins were taungya farming, availability of farmland, attachment to their place of birth, availability of timber contracts and opportunities for trade in forest products. The results also indicate that the forest communities have been practicing various methods of farming at the household as well as community level to mitigate the probable impacts of climate change by changing crop planting and harvesting dates. The study also found that adaptation measures can be made more effective through community level involvement in changing crop planting dates and harvesting dates. The results indicate that the forest communities are highly vulnerable to climate change because they lack the capacity to cope with climate change and variability. Recommendations from this study based on their initial coping measures to mitigate the adverse effects of climate change could contribute to wider policy guidance on climate change response strategies in the study area and similar areas.

Keywords: *Climate change, adaptation strategies, forest communities, Nigeria*

6.2 Assessing socioeconomic factors influencing household dependence on forests and its implication for forest based climate change interventions

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Forest based climate change interventions such as the Nationally Appropriate Mitigation Actions (NAMAs) and National Adaptation Programmes of Action (NAPAs) are currently gaining acceptance in African countries as a result of their relevance to addressing the multiple challenges on socio-economic development and sustainable forest management. However, there are concerns about the implications of strategic and practical steps taken in this context on forest-dependent communities. Reconciling local socio-economic vulnerabilities and forest based climate change intervention initiatives is therefore a necessity. This paper addresses socio-economic factors that influence households' dependence on forest resources and its implication on forest based climate change intervention initiatives. A total of 366 households were selected from forest based rural communities in Vhembe District, South Africa. The study revealed 70 to 97 percent of rural communities subsist on the forest resource because of the associated low cost of using forest resources. The use of forest resources was significantly ($p<0.05$) influenced by households' socio-economic characteristics such as skills on livestock keeping, more years of residency in the community and age of the household members. In order to effectively entrench NAMAs and NAPAs, the effectiveness and sustainability of forest based climate change interventions need to be ensured by paying close attention to enhancement of socio-economic condition of indigenous households' in host communities.

Keywords: *Forest, household livelihood, socio-economic, climate change intervention*

6.3 A synthesis of ecological and socio-economic consequences of land rehabilitation with Prosopis species in Kenya

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The devastating Sahelian droughts of 1970's led to expansive loss of ground vegetation cover and both human and livestock mortality in sub-Sahara Africa. In Kenya, land rehabilitation aimed at increased ground vegetation cover was prioritized in drylands up to late 1980s. Exotic and indigenous species were screened for their land rehabilitation, fuelwood and fodder production potentials. *Prosopis chilensis* and *Prosopis juliflora* (both referred to as *Prosopis* hereafter) emerged as the most promising exotic species and were extensively planted. Later, *Prosopis* species invaded the low lying riverine and wetland ecosystems due to extensive random seed dispersal by water, livestock and wildlife, leading to loss of pasture and farms. Following public agitation for *Prosopis* eradication in 1990's, ecological and socio-economic studies were conducted to ascertain the impacts and to guide policy formulation. This paper highlights major findings from the aforementioned studies. Ecological studies have revealed that *Prosopis* invasion manifests in the establishment of impenetrable thickets where tree density is higher and both herbaceous ground vegetation cover and biodiversity are lower than in the adjacent indigenous *Acacia tortilis* woodlands. Moreover, *Prosopis* allelopathy prevents the natural regeneration of *A. tortilis* leading to a gradual transformation of *A. tortilis* woodlands into *Prosopis* monocultures. *Prosopis* thinning and pruning trials have demonstrated potential optimization of trees and herbaceous species ground vegetation cover at an approximate spacing of 6m by 6m. After continuous capacity building on *Prosopis* management, thinned wood is now commercially utilized as poles and for charcoal production. Use of *Prosopis* pods as raw materials for livestock feeds manufacture and gasification of *Prosopis* biomass for electricity generation are also gaining prominence. This has changed the perception that *Prosopis* thickets are not nuisance but resources, if well managed. The change in perception is consistent with government policy of *Prosopis* invasions management through utilization.

Keywords: *Biodiversity, conservation, charcoal, Prosopis chilensis and Prosopis juliflora*

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