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Enhancing natural resources management
for food security in Africa

Biodiversity:
Its central role
in the sustainable
development of Africa



Cover photo: Malamawa village, Zinder Region, Niger: A girl climbs a baobab tree while looking for baobab leaves to be cooked as a meal.

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Volume 33, Issue 1

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Biodiversity: Its central role in the sustainable development of Africa

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Message to R

Foreword

By Abebe Haile-Gabriel
FAO Assistant Director-General and
Regional Representative for Africa

A photograph of a bird, possibly a hornbill, in flight against a clear blue sky. The bird is positioned in the upper right quadrant, with its wings spread wide, showing dark feathers on the outer edges and lighter feathers on the inner parts. Its long, curved beak is pointed downwards. To the left of the bird, there are several bare, brown tree branches extending from the left edge of the frame. The overall composition is simple and focuses on the bird's movement.

Readers



Africa boasts of a rich diversity with its living organisms comprising around a quarter of the global total. If this diversity is not properly conserved and sustainably used, its loss would have rippling effects on the goods and ecosystem services on which we all depend on, severely threatening our food and health security.

Human activities exert pressure on biodiversity. Due to the global food production system, and its reliance on intensification, 75 percent of the food produced globally is generated from only 12 plants and 5 animal species, and in the last century, more than 90 percent of crop varieties disappeared from farmers' fields. Habitat conversion due to agricultural activity is also leading to loss of forests, wetlands, grasslands, and ecosystem services. It is a future challenge for the region to provide sufficient nutritious and healthy food to a fast-growing population while protecting and restoring biodiversity.

As we enter 2020 and the last decade of the Sustainable Development Goals (SDGs), we are bringing biodiversity as one of the cogs in the wheel towards the achievement of these ambitious, collective goals.

The importance of biodiversity is not overlooked by our strategic development partners. There are two UN Decades spearheaded by the Food and Agriculture Organization of the United Nations (FAO) in collaboration with other UN agencies: the UN Decade for Family Farming 2019–2028 with IFAD and the UN Decade on Ecosystem Restoration 2021–2030 with UNEP. These two decades are interlocked in many aspects in terms of timeline and collaboration.

By putting family farming and all family-based production models at the focus of interventions, the UN Decade for Family Farming will contribute to a world free of hunger and poverty, where natural resources are managed sustainably, and where each and every single individual in the world has access to safe and nutritious food. We believe this model has the potential to make a big impact, as family farms occupy around 70 to 80 percent of farmland worldwide and indigenous people and local communities manage 33 percent of forests globally.

According to FAO Africa's recent publication *Regional Synthesis for the State of the World's Biodiversity for Food and Agriculture*, in African smallholder agricultural landscapes, home



From the cover, Photo: ©FAO/Luis Tato

gardens constitute a particularly important source of biodiversity for food and agriculture. Additionally, their contribution to the richness and diversity of plant species is increasingly gaining interest among researchers and practitioners.

The UN Decade on Ecosystem Restoration also positions the restoration of ecosystems as a major nature-based solution towards meeting a wide range of global sustainable development goals and national priorities. We all depend on biodiversity, which is the key for resilient and healthy ecosystems for food and energy, water, climate change adaptation and mitigation and human survival.

We cannot highlight enough that the loss of biodiversity can have critical implications, from the collapse of food and health systems to the disruption of entire supply chains. The current rate of extinction is tens to hundreds of times higher than the average over the past 10 million years – and it is accelerating. The continued degradation contributes to climate change and enhances the risk of severe ecological disasters. Widespread loss of function in both terrestrial and aquatic ecosystems will be catastrophic for our planet and a huge setback on progress made towards achieving the SDGs.

As we welcome the two timely UN Decades, the FAO Regional Office for Africa is glad to present the newly-revamped version of *Nature and Faune*, kick-starting with the theme on biodiversity. Through inspirational stories on biodiversity conservation and sustainable use in different African countries, we hope to mainstream biodiversity into agricultural policies and practices, address biodiversity-related issues with multidisciplinary approach, protect nature capital with all its diversity, forests, grasslands and agroforestry, and agroecosystems. All of these to achieve transformative change in food production without hampering our ecosystem and future generations.

We hope that the stories in this edition of *Nature and Faune* will showcase Africa's biodiversity conservation efforts to national, regional, and global audiences and contribute to Africa's diversity for shared security and prosperity.

It is my pleasure to coincide the launch of this edition with the Twenty-Second Session of the African Forestry and Wildlife Commission and the Sixth African Forestry and Wildlife week to be hosted in Skukuza, Mpumalanga, in the heart of South Africa's iconic biodiversity jewels: the Kruger National Park.

Editorial

Rebuilding our
biodiversity and humanity
hand-in-hand, across generations

By Nora Berrahmouni
FAO Senior Forestry Officer for Africa





Rebuilding our biodiversity and humanity *hand-in-hand, across generations*

By Nora Berrahmouni



Africa's response to the Sustainable Development Goals cannot be effective without the conservation and the sustainable use of its biodiversity. This response should come not only from the ministries and institutions in charge of the environment, but from everyone in society, and more importantly those sectors benefiting from natural resources while exercising pressure to meet our development demands.

African women and men have been using and managing plants and animals and other natural resources for millennia with care, accumulating knowledge and experience, and giving the necessary time and space to biodiversity to regenerate and flourish. Africa has been an inspiring source of nature-based solutions. For millennia, nature was everywhere, the core of humankind's existence.

Africa's current population of 1.25 billion is likely to double by 2050 and will put accrued pressure on the continent's biodiversity. Multiple investors attracted by the region's resources are encroaching on its biodiversity in a rate that had never been seen before, destroying its forests, grasslands and wetland habitats and species,

leading to land degradation and desertification and further vulnerabilities and disparities. Cities were built, precious wood and materials and mineral resources were extracted, lands were deforested and cleared for agriculture and for development, all at the expense of Africa's invaluable wealth: its biodiversity.

The Food and Agriculture Organization of the United Nations' (FAO) *State of the World's Biodiversity for Food and Agriculture* and the *Global Assessment Report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)*, have called for urgent action to stop degradation trends and restore our relationship with nature, conserving and sustainably using and restoring our biodiversity, if not for anything, for our own food security. The post-2020 Global Biodiversity Framework of the Convention on Biological Diversity (CBD), which is under development, creates the opportunity for the world and especially for Africa to come together, to review its Aichi targets, revamp its ambition for the new decade and sharpen its focus and action in addressing drivers of biodiversity loss.



Photo: ©FAO/Luis Tato

In this edition, *Nature and Faune* gives the voice for Africa's stories to be heard and shared, saying loud and clear that reversing the trend of biodiversity degradation and loss is still possible but we need to act now. Successful conservation and sustainable practices exist but we need to learn from them, and scale them up and address the challenges still laying ahead of us. To do so, partnerships are needed among sectors, communities, organizations and countries. Promising nature-based solutions need to be mainstreamed in every policy, every practice, every sector, at local, national, regional and global levels.

Indeed, the article by Mansell-Moulin *et al.* showcases an ongoing ambitious partnership programme on sustainable wildlife management to address the unsustainable hunting for wild meat, operational in ten countries in Africa. This partnership explores a combination of context-specific solutions such as hunting management, which will reduce the demand for wild meat while promoting alternative sources of food and income, improving hunting laws and land tenure systems, and protecting the rights of communities.

The article by Kalunda *et al.* illustrates how by conserving and sustainably using native plants, such as the ones in Uganda, we can address local and global challenges targeting poverty and climate change. Communities winning the right to land and carbon credits can contribute to their own development, and benefit the world environment.

A selection of articles from Benin, Botswana, Senegal and Zimbabwe show successes, challenges and lessons learnt from the implementation of another nature-based solution, ecotourism. Ecotourism supported communities to conserve biodiversity, increase their livelihoods and food security. Communities become custodians of biodiversity, taking advantage of biodiversity management approaches such as protected areas. Related to the same subject, the case study from Namibia and Tanzania, in particular, draws our attention to the negative impacts that ecotourism has in protected areas, on soil, habitats and wildlife through game drive. The narrative discusses the challenges and recommends management options to mitigate such impacts and prevent land degradation and biodiversity loss.



While Africa's wildlife is at the centre of the world's conservation efforts and tourists' safari dreams, communities on the ground are facing challenging and conflicting situations, including competing land uses leading to damaged crops, poaching and settlements, putting at risk the life, food security and livelihoods of people while hampering wildlife conservation efforts. An article from Tsakem *et al.* discusses the Human-Wildlife conflict (HWC) in the "Case of Cameroon", showcasing how the gorillas in Cameroon, because of the reduction of their habitats, are posing a big challenge to communities and damaging their crops. Recommendations to address the conflict include review of the protected management and zoning, education and awareness-raising programmes, and compensation schemes.

Going further in-depth and broadening the scale, the article by Rodina *et al.* provides us with a regional overview of the current

state of affairs on HWC and showcases FAO's efforts in supporting its member countries in effective management of this conflict.

Africa, in particular its drylands, is extremely vulnerable to the impacts of climate change, with biodiversity as a salvation. If well managed, conserved and restored, biodiversity can fully play its role of building resilience of landscapes and communities' livelihoods. The article by Getahun A. and Dejen E. highlights the rich diversity of fish in the freshwater of Ethiopia's drylands, but its potential for fish production for food security and livelihoods is being compromised by overfishing, catchment degradation, introduction of exotic fish species and invasion by aquatic weeds and pollution. The authors highlight that these issues can be addressed only if coordination of stakeholders is improved for the management of freshwater biodiversity



Photo: ©FAO/Luis Tato

fisheries and the watershed management, capacities of communities are developed and legal regulations are improved and enforced.

The article of Sacande *et al.* gives us hope. Using the rich plant diversity, adapted to the extreme conditions and communities' needs, provides multiple benefits including food security, biodiversity conservation, combating desertification and erosion, and building resilient landscapes and production systems. An approach that is being replicated elsewhere and has great potential to be upscaled massively across Africa's drylands, growing Africa's green wall for the present and the future generations.

The World Charter of Nature as showcased in the article by Westing A. emphasizes the need to use education for younger generations, the decision-makers of tomorrow, to create positive change, disseminate ecological behaviour and mainstreaming nature conservation in Africa's development path and people's day-to-day life.

Unless appropriate policies, investments and strategies are adopted and effectively implemented and mainstreamed in all sectors, the ability of nature to satisfactorily contribute to people's survival will greatly diminish. To make it happen, we need to address two elements. The first is to recognize the role of multistakeholder dialogues to gear collaborative action across sectors, bringing about a holistic and integrated approach to address environmental and development challenges. The second is to embrace and revive the diversity of our cultures and heritage and continue to support youth-driven initiatives in conserving Mother Nature.

Africa's Regional Multistakeholder Dialogue on mainstreaming biodiversity in agriculture sectors, the first of its kind in the region, organized in Rwanda at the end of 2019, prepared a fertile ground to facilitate a multigenerational movement and renewed collective actions.



The Sustainable

Wildlife

Management Programme:
conserving wildlife and
improving food security

David Mansell-Moullin,¹ Michela Baratelli,¹
Caroline Abid,² Anne Hebert³ and Jeremy van Loon⁴

Photo: Public Stock

¹ Forestry Department, Food and Agriculture Organization of the United Nations (FAO)

² Wildlife Conservation Society

³ French Agricultural Research Centre for International Development (CIRAD)

⁴ Centre for International Forestry Research (CIFOR)





Plate 1. Wild meat on sale at the Moutuka Nunene market in Lukolela, Democratic Republic of the Congo.
Photo: ©CIFOR/Olivier Girard



Plate 2. SWM Programme team members from the four partner organizations (FAO, CIRAD, CIFOR, WCS) and the donor (EU DEVCO) together with local community representatives at the KaZa Zambia project site. Photo: ©FAO/David Mansell-Moullin

The European Union-funded Sustainable Wildlife Management (SWM) Programme is one of the most comprehensive global initiatives to tackle unsustainable levels of hunting for wild meat. Since August 2018, the SWM Programme has been implementing innovative projects in 12 African, Caribbean and Pacific (ACP) countries.

Wild Meat Challenge

Millions of people depend on wild meat for food and income. Wild meat is an essential source of protein, fat and micronutrients, particularly for indigenous peoples and rural communities in tropical and subtropical regions. It has been estimated for example that, in the Congo Basin some 4.9 million tonnes of wild meat are hunted and consumed annually (Fa *et al.*, 2002).

Expanding human populations, habitat loss, improved hunting practices and commercial trade in wild meat (see Plate 1) are all significant threats to wildlife (Benítez-López *et al.*, 2017). Wildlife populations will decline and rural communities may suffer rising levels of food insecurity if hunting for wild meat is not kept at sustainable

levels. The situation is becoming more critical as the demand for wild meat grows, particularly in urban areas where it is consumed as a luxury or tradition (Wilkie *et al.*, 2016). Consequently, recent studies estimate that 285 mammal species are already threatened with extinction due to hunting for wild meat (Ripple *et al.*, 2016).

The Sustainable Wildlife Management Programme: Facts and Figures

SEVEN-YEAR African, Caribbean and Pacific countries initiative implemented in **12 PILOT COUNTRIES**

Implementation of activities began in **AUGUST 2018**, after a one-year inception phase

ONE of the largest European Union-funded biodiversity programmes

EIGHT sustainable approaches being developed

SIX common results are guiding activities in each country

“THERE IS AN URGENT NEED TO
IMPLEMENT SOLUTIONS THAT ACHIEVE
BOTH HUMAN DEVELOPMENT GOALS
AND WILDLIFE CONSERVATION”

Partnership Approach

There is an urgent need to implement solutions that achieve both human development goals and wildlife conservation. Depending on the local circumstances, these may include managing hunting of more resilient species at sustainable levels, reducing demand for wild meat and developing alternative sources of food and income for rural communities. In many countries, there is also a need to revise and improve hunting laws and land tenure systems.

The Sustainable Wildlife Management (SWM) Programme is developing sustainable solutions to tackle these challenges. The SWM Programme is an initiative of the Africa, Caribbean and Pacific (ACP) Group of States funded by the European Union through the 11th European Development Fund. The SWM Programme mobilises an international group of partner organisations with experience and expertise in wildlife conservation, food security and policy development. A consortium of partners, which includes FAO, the Centre for International Forestry



Photo: ©WCS by Mark Gately

Research (CIFOR), the Wildlife Conservation Society (WCS) and the French Agricultural Research Centre for International Development (CIRAD), is implementing the programme. In each pilot ACP country, these partners are working closely with national authorities, local communities and technical institutions (see Plate 2).

Innovative models

The SWM Programme is developing innovative and scalable new models that tackle wildlife conservation and food security issues hand-in-hand.

The rights of communities are at the centre of each approach. All the projects are guided by the

SWM Community Rights-Based Approach, which requires the Free, Prior and Informed Consent (FPIC) of indigenous and rural communities. Pilot projects are currently being implemented in the following countries:

- **Democratic Republic of the Congo** (Ituri Landscape): Supporting two approaches to natural resources management, one within a national protected area (Okapi Faunal Reserve) and the other a community-based approach in local community forest concessions;
- **Gabon** (Mulundu Department): Focusing on the sustainable management of village hunting and the local wild meat trade;
- **Guyana** (Rupununi Savannahs): Developing new models for sustainable wildlife and fisheries management in savannah and forest landscapes;
- **Madagascar** (Makira Landscape): Promoting consumption and improving access to more resilient or domestic species through the development of backyard poultry and fish farming;
- **Papua New Guinea** (Bismarck Forest Corridor): Working on sustainable wildlife consumption, for both cultural materials and food, at the village level;
- **Congo** (Ouessou Basin): Focusing on community management of hunting and fishing within logging concessions and reduction of wild meat consumption in logging towns and secondary cities;
- **Sahelian Wetlands Site** (RESSOURCE Project): Working on the sustainable management of migratory waterbirds in wetlands in Chad, Mali, Senegal and Sudan; and
- **Zambia and Zimbabwe** (KaZa Transfrontier Conservation Area): Promoting local development through the sustainable use of natural resources, including wildlife and fisheries, in the Simalaha Conservancy (Zambia) and Mucheni Conservancy (Zimbabwe).



Photo: ©FAO/Luis Tato

Each pilot project is working towards the following desired and interconnected outcomes:

**1:
The institutional and legal framework for the sustainable use of meat from wild species resilient to hunting or fishing has been improved.**

The aim is to improve, strengthen and further enable the implementation of policy and legal frameworks to support the production and consumption of meat (including fishes) at sustainable levels. In addition, it will seek the protection of protected and/or endangered species in order to reconcile food security and wildlife conservation.

**2:
Management of fish and terrestrial wildlife resilient to hunting or fishing is improved**

The aim is to ensure that wildlife and fish populations are managed in a sustainable manner. Innovative models for

the sustainable utilisation, as well as the protection of protected and endangered species, will be developed and implemented, primarily at the village level in close collaboration with communities.

**3:
Supply of alternative protein is improved**

The aim is to generate a sustainable supply of domestic animal-source meat and eggs, which are culturally acceptable, affordable, and regularly available to consumers to create alternatives to the meat of wild caught species.

**4:
Consumption of wild meat becomes sustainable**

The aim is to understand the volume of wild meat and fish consumed within rural and indigenous communities and urban centres in each site, and determine

the nutritional dependence on these food sources and the drivers for their consumption. This will help determine ways in which wild meat and fish consumption can be reduced, particularly in towns and cities.

In addition, the SWM Programme emphasises the importance of monitoring, evaluation and learning, and the sharing of knowledge to scale up and increase the impact of the initiative.

► Further information

Additional information on the SWM Programme is available in the first issue of the quarterly SWM newsletter (<http://www.fao.org/3/ca3952en/ca3952en.pdf>) or on request by contacting the SWM Programme Management Unit: swm-programme@fao.org

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Trees

for Global Benefits:
eradicating poverty
one tonne (of carbon)
at a time

Pauline Nantongo Kalunda,¹ Jonah Butsatsa,¹
Lilian Kiguli¹ and Adrine Kirabo¹

Photo: Public Stock

¹ Environmental Conservation Trust of Uganda





SUMMARY

The nexus between poverty and environment has been a preoccupation of many conservationists for decades. Reducing poverty among rural households and protecting ecosystems on which these households depend for their basic needs of subsistence agriculture, safe drinking water and forest products is one of the challenges faced by most countries in sub-Saharan Africa.

There have been numerous efforts to address this by introducing integrated conservation and development initiatives. A central obstacle to these efforts, however, is the long-term gestation period of sustainable land use initiatives, yet most of them rely on short-term donor grants to fund activities.

In this article, we share lessons from Trees for Global Benefit, a cooperative carbon offsetting scheme that for the last 16 years has been consistently mobilizing and delivering a sustained flow of financing to smallholder-led landscape restoration initiatives that

alleviate poverty, while enhancing the flow of environmental services, including biodiversity conservation in Uganda.

Introduction

Reducing poverty among rural households and protecting ecosystems and biodiversity on which these households depend for their basic needs of subsistence agriculture, safe drinking water and forest products is one of the challenges faced by most countries in sub-Saharan Africa. Banadda (2010) cites poverty as probably the main obstacle in addressing land degradation, since resources are required for investing in good land management practices. He further asserts that the side effects of degradation affect 88 percent of Uganda's rural population that subsist on less than two hectares per family and constituting over three million small-scale holdings. The combined challenge of poverty and land degradation among smallholders in developing countries is further exacerbated with the unpredictable weather patterns as well as extreme weather events associated with climate change.



Photo: ©FAO/Luís Tato

“EFFECTIVE MANAGEMENT OF ECOSYSTEMS... REQUIRES EFFORTS THAT ADDRESS POVERTY, CLIMATE CHANGE AND DEGRADATION AS A COMBINED CHALLENGE”

Effective management of ecosystems on which smallholders depend, therefore, requires efforts that address poverty, climate change and degradation as a combined challenge.

There have been numerous efforts to address the combined challenge of poverty, climate change and degradation by introducing integrated conservation and development initiatives. A central obstacle to these efforts however is the long gestation period of sustainable land-use initiatives, yet most of these initiatives rely on short to medium term donor grants. To overcome this, smallholders in developing countries have begun to take advantage of carbon finance to support climate-smart agriculture within the context of the global voluntary carbon markets (Shames *et al.*, 2016). Trees for Global Benefit (TGB) implemented by ECOTRUST in Uganda is an example of one of the few innovative carbon schemes that have successfully managed to support communities to address the combined challenge of poverty, ecosystem degradation, loss of biodiversity and climate change.

TGB for 16 years has been at the forefront of mobilizing foreign direct investment in smallholder-led agroforestry and forest management. The scheme, pioneered in 2003 by ECOTRUST, has grown into one of the biggest smallholder agroforestry carbon projects in Africa under the Plan Vivo standard of certification. TGB is currently contributing to the restoration of over 6 000 ha with indigenous tree species in some of the most ecologically vital landscapes of Uganda. The introduction of trees in the land use system seeks to build the resilience of the system to climate-induced risks, while providing an opportunity for farmers to diversify income streams.

The TGB model won the 2013 SEED Award particularly for its innovation and entrepreneurship and promising efforts to promote economic growth, social development and environmental protection in Uganda, and the potential of its partnerships to inspire others. The project in 2017 achieved a significant milestone of sequestering one million tonnes

of CO₂.² The aim of TGB is to produce long-term, verifiable voluntary emission reductions by combining carbon sequestration with livelihood improvements through small-scale, farmer-led, forestry/agroforestry projects while at the same time, reducing pressure on natural resources in national parks and forest reserves. The fundamental challenge affecting poverty eradication in such PES (Payment for Environmental Services) schemes is finding effective ways of involving the broader community and the sociocultural institutions governing them (FAO, 2003; World Bank, 2012). The PES model under TGB has not only focused on promoting effective participation of relevant stakeholder groups but also establishing efficient financing models that remove risks from the sustainable land-use investments to continue incentivizing greater stakeholder participation. In this article, we highlight how effective participation has been built and how the financing model functions to de-risk investments.

² <http://www.planvivo.org/project-network/trees-for-global-benefits-uganda/>.



Photo: ©FAO/Luis Tato

Building Capacity for Effective Participation

In establishing effective participation, TGB has mainly focused on approaches that bring together local farming community, local technicians and country-based experts to identify and prioritize local problems and solutions. There are numerous types of local community participation in development programmes globally ranging from self-mobilization, interactive participation and functional participation among others as described by Pretty (1995). Trees for Global Benefit has adopted the effective participation approach, which as recommended by FAO (2003), aims at ensuring greater involvement with and

empowerment of diverse groups of people to achieve success and sustainability of the programmes. TGB achieves this by employing an all-inclusive ‘pro-poor’ approach where the whole community is facilitated to develop a common vision and every household supported to develop a plan that meets the household’s individual needs but also contributes to the community vision. Participating farmers receive training and attend workshops to identify forestry activities that are suitable to their needs at community level and at household level. The workshops are complemented with home visits to support the translation of those activities into a land use map, which also doubles as a business plan for that household.

Although farmers are trained as a group, and are given an opportunity to participate in the identification and making of decisions on priority local community level problems and solutions, each household is given an opportunity to implement the plan as and when they are ready. TGB is designed as a cooperative carbon-offsetting scheme, in which each participant retains the rights to land, trees, carbon credits and all the income from the sale of the products and environmental services belong to the smallholder. This way the project is able to harness the benefits of a collective vision, while safeguarding each individual rights to decision-making as well as the tenure rights of land, trees and carbon credits.

“EVERY TONNE OF CARBON EMISSIONS OFFSET THROUGH SMALLHOLDER-LED SCHEMES SUCH AS TREES FOR GLOBAL BENEFIT BRINGS A FAMILY CLOSER TO ERADICATION OF POVERTY AND AT THE SAME TIME IMPROVES BIODIVERSITY AND ECOSYSTEM QUALITY”

The combination of a common vision and the household's right to decision-making in project adoption through self-selection has resulted into significant ancillary benefits beyond sustainable land management. Social capital has been built within participating communities by creating a sense of project ownership, driven by a general vision of achieving a better future, not just for individual households but also for the general community. Community Visioning sessions have resulted into the formation of community-owned institutions such as Savings and Credit Cooperatives (SACCOS), farmer marketing groups, artisans, tour guides, among others. These groups have been instrumental in addressing societal challenges and bring about socio-economic change. An example of this is 'The Bushenyi Women in Development,' an association of active female tree growers within Bitereko sub-county, Mitooma district, in the Albertine Rift region of Uganda, that has become instrumental in garnering women participation

in tree growing. Through this association, women are able to apply for grants from development partners, able to access markets for their produce and support each other in times of need.

De-risking smallholder-led agroforestry investments

Sustainable land-use investments including agroforestry are normally characterized by a long-term planning period of 20 to 50 years. The long-term planning horizons coupled with the lack of financing create a barrier that prevents many smallholders from adopting these high capital and labour-demanding sustainable land use investments (Banadda 2010). The PES model in TGB is designed to incentivize the transformation of smallholder investment horizons from the short-term hand-to-mouth seasonal plans to long-term sustainable land use/business plans. TGB's PES incentives revolve around making the adoption of

agroforestry-based sustainable land use a viable livelihood option by ensuring availability of a sustainable flow of financing at the different stages of the land-use enterprise. This is achieved through the creation of opportunities for smallholders to tap into multiple funding sources, for agroforestry as a means of generating income and improving land management while contributing biodiversity conservation and global climate benefits.

TGB works as a cooperative carbon-offsetting scheme, through which credits from across multiple landholdings are aggregated to achieve marketable scale enabling smallholder rural poor farmers in Uganda to access the voluntary carbon market. Farmers receive ex-ante payments in installments based on farm performance over a ten-year period. The income from the sale of the environmental services provides the much-needed capital in form of foreign direct investment to kick-start the agroforestry enterprise.

“THE PES MODEL IN TGB IS DESIGNED TO INCENTIVIZE THE TRANSFORMATION OF SMALLHOLDER INVESTMENT HORIZONS FROM THE SHORT-TERM HAND-TO-MOUTH SEASONAL PLANS TO LONG-TERM SUSTAINABLE LAND USE/BUSINESS PLANS”

This way, the project’s support enables rural farmers to invest in sustainable resource management using payments received in installments after activities have been monitored. The logic behind this ex-ante performance-based payment model is that, by the tenth year, sustainable interventions will be fully established, providing livelihood benefits for farmers, and with no incentive to revert back to the previous system.

The TGB PES model is designed in such a way that creates a sustainable flow of financing, tailored to the different needs of the various stages of the sustainable land use enterprises. TGB for example enables access to credit through linking the performance-based PES payments to Village Savings and Loans Associations (VSLAs). The farmers are able to use the PES agreements as collateral for loans and use the subsequent payments to offset

the loans. This way, the scheme provides short-term cash needs, allowing farmers to invest in sustainable land use, which generates the long-term benefits, including biodiversity conservation. Farmers are able to use part of

their land to develop assets in form of trees for fruit production, timber, medicinal extracts and poles. Extra activities (e.g. nursery establishment and production of seedlings) provide additional income to rural communities.

CONCLUSION

TGB demonstrates that through a combination of effective participation and efficient financing models, it is possible to address the combined challenge of poverty, ecosystem degradation and climate change. Effective participation enables the design of initiatives that are relevant and practicable to the local population, whereas sustainable financing enables the investment in these initiatives. The sustainable flow of financing along the different stages of the agroforestry enterprise has been instrumental in reducing risks, making agroforestry a competitive livelihood strategy for smallholders and thus incentivizing its adoption. By creating opportunities for smallholders to tap into multiple funding sources at different stages of their enterprises, TGB has enabled farmers to benefit from increased incomes and improved land management while contributing to biodiversity conservation and global climate benefits. Every tonne of carbon emissions offset through smallholder-led schemes such as Trees for Global Benefit brings a family closer to eradication of poverty and at the same time improves biodiversity and ecosystem quality.



Photo: ©FAO/Luis Tato

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The World Charter for

Nature

revisited: an
African initiative

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SUMMARY

The birth in Africa of the seminal World Charter for Nature of 1982 is outlined in this paper, followed by a sampling of the 24 precepts it promulgates. Suggestions for its implementation and dissemination include the importance of incorporating it into school curricula and making it available in all secondary schools. The Charter is of lasting global significance that must continue to be strengthened and disseminated.

Introduction

The United Nations Environment Programme (UNEP) was established in 1972 in clear recognition that the natural world was coming under increasing human pressure. Shortly after, the Government of the Democratic Republic of the Congo (then Zaïre) recognized the need for a set of appropriate guiding principles for many states and peoples of the world to follow. In 1975, it turned to the International Union for Conservation of Nature (IUCN) to produce a draft document, which was refined by UNEP for final submission to the United Nations General Assembly as the World Charter for Nature. It was adopted on 28 October 1982 as Resolution No. 37/7.

Discussion

The World Charter for Nature — available in at least Arabic, Chinese, English, French, German, Russian and Spanish — establishes 24 precepts (some with several parts). Some notable ones:

“Nature shall be respected and its essential processes shall not be impaired” (§ 1);

“Nature shall be secured against degradation caused by warfare or other hostile activities” (§ 5);

“In formulating long-term plans for economic development, population growth, and the improvement of standards of living, due account shall be taken of the long-term capacity of natural systems to ensure the subsistence and settlement of the populations concerned, recognizing that this capacity may be enhanced through science and technology” (§ 8);

“Living resources shall not be utilized in excess of their natural capacity for regeneration” (§ 10.a);

“Agriculture, grazing, forestry and fisheries practices shall be adapted to the natural characteristics and constraints of given areas” (§ 11.d);

and, as a UN precedent,

“Each person has a duty to act in accordance with the provisions of the present Charter; acting individually, in association with others, or through participation in the political process, each person shall strive to ensure that the objectives and requirements of the present Charter are met” (§ 24).

(The full Charter is available at: < <https://www.cambridge.org/core/services/aop-cambridge-core/content/view/S0376892900011917> >.)



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Implementation

The World Charter for Nature suggests, *inter alia*, that “the principles set forth in the present Charter shall be reflected in the law and practice of each State, as well as at the international level” (§ 14). To that end, by way of example, the Government of the State of Eritrea incorporated the Charter into its “Eritrean National Code of Conduct for Environmental Security” as part of its 1995 National Environmental Management Plan for Eritrea. Additionally, the Revised African Convention on the Conservation of Nature and Natural Resources of 2003 takes note of the Charter. Regrettably, the more emotional Universal Declaration of Rights of Mother Earth proposed by Bolivia in 2010 did not refer back to the Charter.

Among other means of dissemination, the World Charter for Nature should certainly be made

available for inspection and study in every secondary school as a framed poster — and that it become part of both the science and social studies curricula for careful study and serious discussion. Indeed, the Charter itself so aptly states that, “knowledge of nature shall be broadly disseminated by all possible means, particularly by ecological education as an integral part of general education” (§ 15). This becomes so important because it will be the informed and motivated students of today who offer the best hope for achieving a socially and environmentally sustainable future for their country, their region, and beyond before

it becomes too late to do so. And it would certainly not be amiss for the concepts embedded in the Charter also be discussed and embraced in the home.

Conclusion

The World Charter for Nature is an important document because it reflected an emerging cultural norm regarding environmental protection arising in Africa in 1975 on behalf of the entire globe. Today, this cultural norm is still timely relevant and should certainly be heeded with ever greater vigour throughout the continent.

For further reading

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Country



Nature

Solutions

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-based

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Community ecotourism, a means to reconnect humans with their environment: Case of the Sitatunga Valley Community Natural Park

Martial Kouderin,¹ Damien Martin¹ and Joseph Dhoussou¹

SUMMARY

The Sitatunga Valley Community Natural Park is a protected area in Benin covering 670 km² that was able to transform a threat – its proximity to the two largest urban centers of Southern Benin (Abomey-Calavi and Cotonou) – into an opportunity to develop local ecotourism.

Since 2007, it welcomes thousands of visitors every year. Eighty percent of these are Beninese, of which 50 percent are pupils. This influx of visitors created notable and interesting effects on the area visited. These are felt at social, environmental and economic levels. The aim of this article is thus to collect and highlight these effects.

Introduction

A natural heritage of national interest at the doorstep of the economic capital

The Sitatunga Valley Community Natural Park (PNCVS²) is a Category VI protected area according to the International

Union for the Conservation of Nature (IUCN). Created in 2007 by the Centre régional de recherche et d'éducation pour un développement intégré (CREDI-ONG³), today the Sitatunga Valley spans 670 km² of the RAMSAR site 1018 wetlands. Three municipalities manage it jointly in an intercommunality spirit involving over 150 000 inhabitants. These municipalities are Abomey-Calavi, Sô-Ava and Zè. Over 1 000 animal and plant species are recorded there in the midst of ecosystems typical of southern Benin. About 30 of them are threatened at national or international level, among which the Sitatunga or swamp-dwelling antelope (*Tragelaphus spekei*). This

is a species of antelope confined to swampy areas that we have selected as an umbrella species. The Sitatunga valley is located about 30 km from Cotonou, the economic capital city of Benin and about 20 km from the center of Abomey-Calavi. Almost 2 000 000 inhabitants thus live at the doorsteps of the protected area. This proximity breeds big threats for the protected area. It leads to the loss of natural habitats in favor of urbanization and peri-urban agriculture; the increased risks of organic and chemical pollution of wetland ecosystems; the accelerated overexploitation of natural resources (wood, non-wood forest products, fish, etc.).

¹ Centre régional de recherche et d'éducation pour un développement intégré (CREDI-ONG)

² Parc naturel communautaire de la Vallée du Sitatunga in French

³ Regional Research and Education Centre for Integrated Development

This trend is perfectly illustrated by the results of the study on land occupation dynamics in the lower delta of Ouémé commissioned by CREDI-ONG which, on the basis of the diachronic analysis of satellite images, shows the disappearance of over 50 percent of natural stands between 1999 and 2017. Unfortunately, this trend is likely to continue due to rural migration and the current annual population growth estimated at more than 2.7 percent (INSAE, 2017). In this context, the State and local authorities have a hard time ensuring compliance with the environment-related texts but also their various territorial plans. For that reason, from the onset of its initiative, CREDI-ONG opted for a so-called community-based approach. This approach is based on the principle that natural resources should be managed by and for local communities. Thus, we rely mostly on the emergence of a territorial identity and collective ecocitizenship conscience to counter the threats on biodiversity. To that effect, from 2017, CREDI-ONG chose to develop community-based ecotourism.

1. Various infrastructures for various ecotouristic services

To carry out its ecotourism-enhanced strategy within the Park, CREDI-ONG opened up its agro-ecologic and learning farm in 2007.



Photo: Public Stock

Located along the swamp in the Kpotomey village, the village hosted the first ecotouristic developments: a wildlife observatory, an aquatic channel for interpreting the landscape and a 20-bed eco-lodge. Later in 2009, CREDI-ONG officially opened in the same village the Green Museum of the Sitatunga Valley which became in 2016 the Animal Shelter of the Sitatunga Valley. In 2011, the Hunting Museum in the village of Dédo, about ten kilometers away from the first sites, was inaugurated. Since then, either alone or in partnership with local tourism stakeholders, the organization offers a camping site, accommodation with locals, bioclimatic bungalows, a shop selling artefacts, etc. Today, CREDI-ONG offers several-day stays, ecotouristic trips lasting from 2 hours to a day by mountain bike, on foot or in a canoe.



Photo: ©flickr/Susanne Nilsson

These trips enable the public to discover the park's biodiversity but also its culture and the people who keep it alive. These diverse infrastructures and ecotouristic services help welcome all types of visitors and expectations.

2. Increasing number of visitors

According to internal statistics of the organization, between 2007 and 2018, PNCVS welcomed 18 345 visitors. This is essentially community-based ecotourism since 83 percent of the visitors are Beninese and 17 percent are foreigners. It should be noted that of the national visitors, a little over 50 percent are pupils. The annual average growth rate of 39 percent tends to show an increasing interest of this category of visitors for the services offered by the organization.

3. A driver for change

Social benefits

Prior to the creation of the Park in 2007, its territory had no particular touristic appeal. Today, with its typical high-level attendance, the park helps create a buzz around the rise of a territorial identity formerly unknown to the general public. Since the beginning of its ecotouristic activities, CREDI-ONG levies 23 percent of the ecotouristic benefits to feed into the Local Development Social Fund (FSDL⁴). Hence, since 2012, over USD 4 300 have been paid back into the Fund which is also replenished by various development partners

who discovered our work through a single ecotouristic visit. Thanks to the fund, about 30 socio-community support activities have been carried out (boreholes, public places, remedial classes, etc.) to improve access to basic services for the Park's communities.

Economic benefits

Ecotourism within the Sitatunga Valley has facilitated the direct creation of nine permanent jobs (permanent guides, caterers, animal caretakers, watchmen, cleaners, etc.) and about 30 occasional jobs (local guides, caterers, motorbike and automobile

riders, etc.). Since 2012, the direct benefits of ecotouristic activities on the territory have been estimated at over USD 52 500. The indirect benefits of ecotourism are deemed to be more than double the direct economic benefits over the same period.

Environmental benefits

The PNCVS has facilitated several conducive changes since significant improvements have been observed in the practices and involvement of communities *vis-à-vis* the environment. Regarding species, in spite of its status as a threatened species, the Sitatunga was very



Photo: ©flickr/ Valerie Abbott

⁴ Fonds social de développement local in French.

little known within the Park and completely unknown by the general public in Benin. Today, it is so popular that even football and sport clubs bear its name. The formerly systematic poaching of the species prior to the creation of the Park, has declined by 95 percent, simply under social pressure. Moreover, the PNCVS has also had a beneficial impact on other species listed on the IUCN Red List, namely, the dwarf crocodile (*Osteoleamus tetraspis*) or the Anambra Waxbill (*Estrilada polioptera*). The PNCVS is truly an animal shelter that contributes to preserving biodiversity by welcoming and caring for a vulnerable local wildlife: seizure by the Forestry Services, accidental capture, wounding, parentless litter, etc.; 45 percent of the animals that are tended to are later on reintroduced into a natural habitat. The others are kept in captivity, allowing the general public (especially from the cities) to discover – often for the first time – species that they share a territory with. There are also specific exhibitions dedicated to waste management and to the definition and interest of protected areas. The shelter is thus a wonderful learning tool to create awareness among the general public on environmental issues.

CONCLUSION

It should be noted that the Sitatunga Valley Community Natural Park now enjoys a significant relevance at local level and is highly recognized at national and international levels. Our diagnostic shows that this recognition is closely linked to the existence of an ecotouristic activity on the territory. With over 18 000 visitors since the creation of the park, a cumulated turnover of more than USD 52 500, and an average annual attendance growth estimated at 39 percent, ecotourism has a strong impact on the territory and its communities. Granted, a few negative impacts such as the increase in waste generated by visitors have been mentioned, but the ecotourism established by CREDI-ONG has mostly had positive impacts. For example, it has enabled local communities and the general public to get acquainted with biodiversity in southern Benin and to be aware of its conservation issues.

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Nature-based Solutions in Botswana



Photo: Public Stock

Developing a framework for sustainable coexistence between ecotourism and agriculture

Patricia K. Mogomotsi,^{1,2} Melville Saayman² and Andrea Saayman²

SUMMARY

Ecotourism plays a significant role in growing economies in Southern and Eastern African countries. However, it has affected socio-economic development, as well as the environment, negatively.

It has been observed that since most ecotourist resorts and activities in these countries are located in rural areas, ecotourism often affects the lives and agricultural production of local communities negatively. This leads to conflicts over land use between ecotourism and agricultural activities in many parts of these countries. Ecologically-sensitive areas such as the Okavango Delta in Botswana are experiencing such conflicts and top-down spatial planning have exacerbated these. Despite the prevalence of land-use conflicts in the Okavango Delta and other areas, there is a dearth of studies that analyze such conflicts, especially from an

institutional perspective. Therefore, the present article develops and proposes an institutional framework that will allow for the sustainable coexistence of both the ecotourism and agriculture sectors in Botswana, using the Okavango Delta as a case study. The proposed framework recommends that the institutional environment for sustainable land-use planning and management should attain a balance between contemporary and traditional land uses in order to simultaneously improve the productivity and livelihoods for farmers and develop the business environment for ecotourism-related enterprises.

Introduction

According to Kironde (2009), about 60 percent of Africa's population derive their income and livelihood from land utilization through various agricultural activities. However, it is argued that contemporary land-use practices pose a threat to the benefits of land to traditional farmers and agrarian societies in Africa (Torres and Momsen, 2004). This is in part due to the delayed incorporation of contemporary land-use strategies such as ecotourism into the countries' overall rural development and poverty-reduction strategies (Ashley, 2000; Torres and Momsen, 2004). Over the

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years, some developing countries in Southern and Eastern Africa have devised various strategies to improve the economic benefits of ecotourism at national and local (i.e. community and household) levels. For instance, in Namibia, policies have been enacted to enable exclusive wildlife-based tourism in farms as an effort to increase sustainable economic output from land through land-use diversification (Krugmann, 2001). Honey and Gilpin (2009) argue that generally, governments have a mandate to create a link between ecotourism and agriculture through developing relevant institutions to promote the effective contribution of ecotourism in agrarian communities. It is argued that the link between agriculture and ecotourism could contribute to the stimulation of local agricultural returns (Torres and Momsen, 2004).

In Botswana, only a few studies have been conducted to define traditional and contemporary land-use patterns as well as socio-economic activities. The Okavango Delta is not an exception to the dearth of studies on sustainable coexistence between ecotourism and the livelihoods of rural communities (Bendsen and Meyer, 2003; Kgathi, 2002; Mbaiwa *et al.*, 2008). Even fewer studies have been carried out on the institutions managing natural resources in the delta (Darkoh and Mbaiwa 2005). The authors, however, did not analyse natural resources institutions and the role that such institutions play



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in promoting coexistence and reducing conflict between several users with diverse interests.

There is an imminent need to develop and implement approaches that will ensure maintenance of the balance between conservation of natural resources in and around the Okavango Delta and sustainable use of resources for socio-economic benefits of rural communities in the delta amidst inherent conflicts. The attainment of a mutually beneficial balance is dependent on the establishment of quick access and occupancy rights and the creation of a robust institutional environment with the core aim of helping to attain sustainable land use. The aim of this study is, therefore, to develop and propose an institutional framework to policy-makers that will allow

for the sustainable coexistence of ecotourism and rural communities in Botswana, using the Okavango Delta as a case study. In this study, institutions are defined as stable rules, crystallised in customs, laws and traditions (North, 1990). Formal institutions, on the one hand, are defined as consciously written rules (such as legislative enactments, regulations and contracts) which structure the political, social and economic interactions of agents in the society (North, 1990). Informal institutions, on the other hand, are self-imposed, self-monitored conventions and norms that structure the interactions and relations between agents and their environment. Informal institutions are usually deeply embedded in culture and societal ideology of traditional rural communities (Colding and Folke, 2001).

Research methodology

In order to address the article's objective, document analysis was used. The document analysis depended on a systematic reviewing technique. The technique provides "a meticulous way of finding relevant, high-quality studies; and integrating their findings to give a clearer and more comprehensive picture than any single study can produce" (Gough *et al.*, 2013: 5). The systematic review process was performed in three weeks in June 2018. The available literature sources were systematically identified in several electronic databases. The search used keywords such as sustainable tourism, agriculture, Botswana land legislation and traditional stakeholders, among others. In total, the search generated 1611 documents, ranging from policy documents, newspaper articles, peer-reviewed and non-peer-reviewed journal articles, books and book chapters. However, the number of documents retrieved was inflated by duplicate studies as well as policy documents and institutions saved in different names and different search engines.

In order to sieve the relevant literature, the exclusion criteria comprised of documents that were not written in English and Setswana. Studies and documents that contained the keywords with clear publication details were included. Using the criteria, 946 abstracts were reviewed after the removal of duplicate studies and

replica institutions. A further 864 studies were excluded and only 86 full texts were reviewed. Of the 86, only 42 were directly related to the article's objective.

Results and discussions

Before the enactment of the Botswana's Tribal Land Act of 1968, the land in the Okavango Delta was primarily tribal land, governed by customary law. The land zoning process guided by the Tribal Land Act relocated and dispossessed some of the traditional land users, such as farmers. The spatial planning exercise inherent in the land zoning process was ill-planned with minimal and no consultation with farmers and other stakeholders (Perkins, 1991; White, 1993; Campbell *et al.*, 2006; Sapignoli and Hitchcock, 2013). The failure to consult the traditional land users and other land users have consequently resulted in the marginalisation and adverse effects on livelihoods of small-scale farmers and the poor (Sapignoli and Hitchcock, 2013; Mogomotsi, 2019). The top-down approach of spatial planning resulted in land dispossession and the relocations of rural communities, small-scale farmers and their herds. Furthermore, the areas of some farming lands were significantly reduced (Sapignoli and Hitchcock, 2013).

In Botswana, the land-use laws and strategies, such as the Tribal Land Act, have failed in their production, conservation and equity objectives



Photo: akamaraqu - Fotolia

(White, 1993; Campbell *et al.*, 2006; Sapignoli and Hitchcock, 2013).

The failure is not only manifested in the propagation of inequalities and the rich-poor divide (Sapignoli and Hitchcock, 2013; Mogomotsi, 2019) but also in their role in instigating conflicts between traditional and contemporary land uses. Agricultural productivity is negatively affected by wildlife due to constant raiding and/or trampling of crops by ungulates, for example by the vast overpopulation of elephants in the country, and livestock predation by wild predators, as well as the killing of people by animals such as elephants and predators (Mogomotsi, 2019). The affected farmers decry low rates of compensation for crop raiding and livestock predation by wildlife (Mogomotsi, 2019). In addition, it has been established that the linkages between ecotourism and agriculture are weak (Mogomotsi, 2019). One of the key failures of institutions that govern land use in Botswana, noted by Mogomotsi (2019), is lack of communication with and consultation of local communities when land use changes are made, or when new land uses are introduced. In the light of these concerns, this study proposes a sustainable institutional environment premised on four key activities, which form a continuous process (Figure 1).

STEP 1:**Participatory formulation of land-use policies and strategies**

The first step towards the creation of a sustainable institutional environment proposed by the framework is the participatory formulation of institutions. The participation should include traditional land users, contemporary land users and all other stakeholders. This could promote the development of institutions that are site specific or at least acknowledge the complexities, conflicts and resource-use dynamics that are prevalent within a geographical setting. The institutions that govern land use need to be informed by stakeholders and their realities, as well as by the ecological needs. The realities may be influenced by such factors as history and the existing power dynamics. This may provide a more holistic understanding of the agriculture–ecotourism interaction and interference, or the relations between land uses in general, within a setting. The incorporation of local needs and knowledge during the formulation stages of institutions can never be underestimated (Madigele, 2017).

STEP 2:**Participatory land-use planning**

A participatory land-use planning approach could promote the zoning, allocation and development of land in a transparent, democratic and accountable manner. This follows the Participatory Learning for Action (PLA) approach, which benefits from information generated by local communities using their local realities. The bottom-up and participatory land-use planning could also offer local and affected communities a considerable role to play in influencing land resources utilisation towards sustainability (Pienaar *et al.*, 2013). Some institutional economists argue that improved community participation often leads to increased incentives to preserve and conserve natural resources by communities (Ostrom, 1990; Pienaar *et al.*, 2013). Participatory land-use planning ought to be followed by the third step, which is the implementation of policy and strategies.

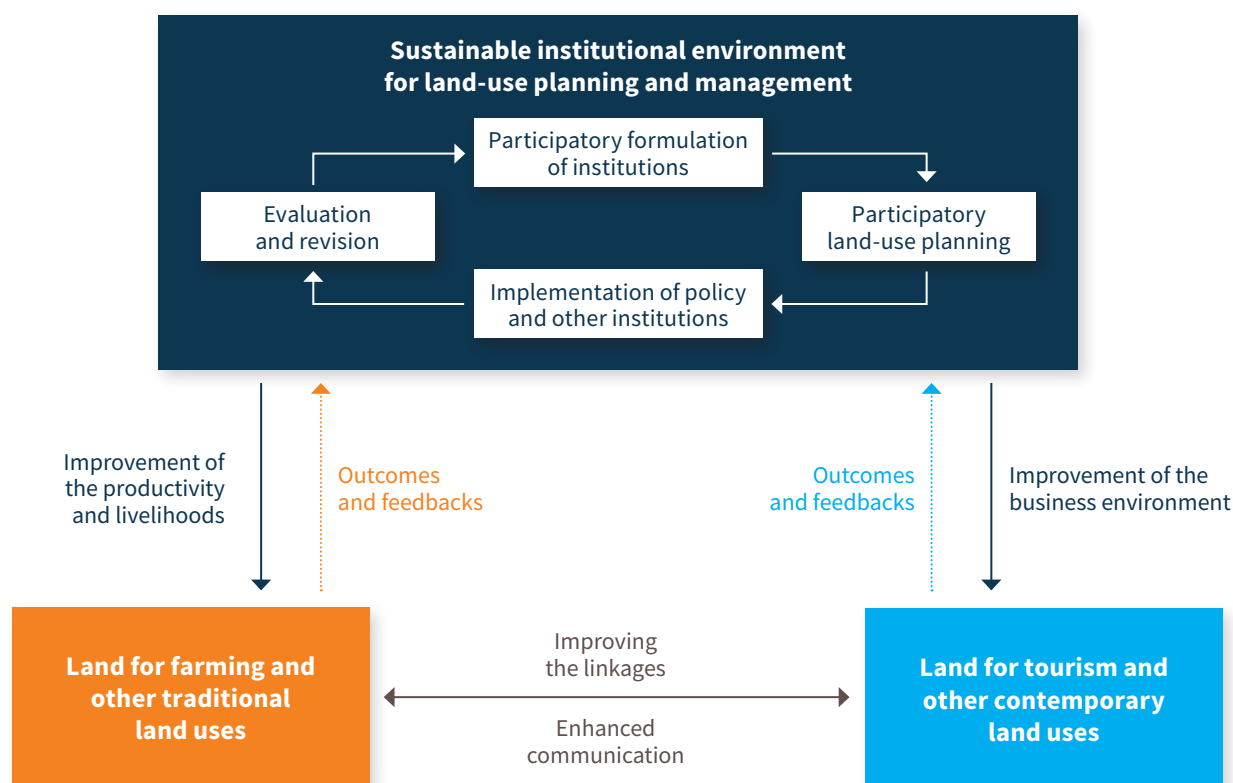
STEP 3:**Implementation of policies and strategies**

Due to the participatory nature of the formulation of strategies for land-use planning, this study proposes a decentralised implementation. This is because a decentralized approach is argued to be a robust and inclusive approach preferred for achieving sustainable resource use in a way that responds to individual local community needs through transmitting control to communities and creating incentives for decision-making aligned to their specific needs (Elobeid, 2012). It has the potential to make institutions more responsive to local needs, thereby improving the efficiency and effectiveness of formal strategies. However, the implementation should not be treated as an end on its own, but rather as a means to an end. The evolving and dynamic resource needs require responsive strategies. Therefore, constant monitoring, evaluation and revision of the strategies are proposed as the fourth step within the continuous cycle of creating a sustainable institutional environment for land-use planning and management.

STEP 4:**Evaluation and revision of policies and strategies**

The sustainable institutional environment ought to be geared towards responding to the land needs of all stakeholders through a process of engagement, communication and consultation. The evaluation and revision processes could help in innovating responses and solutions for conflict resolutions through lessons learnt. Through the processes of evaluation and revision of strategies, the sustainable institutional environment for land-use planning and management could be enhanced by making the strategies adaptable and dynamic to the changing land use needs that are site specific. The process could also be useful in offering guidance and alternative approaches to promoting the coexistence of agriculture and tourism within a setting.

FIGURE 1. A sustainable institutional framework for promoting coexistence between tourism and agriculture
(Source: Author's conceptualisation)



CONCLUSIONS AND RECOMMENDATIONS

Over the years, Botswana has experienced a changing institutional landscape of natural resources governance and management in the form of land reforms, policy revisions and enactment of legislature. The changing institutional landscape has consequently created room for the central government to take full control of the natural resources, which used to be in tribal. The Okavango Delta is particularly affected. Although the study uses the case of the Okavango Delta, the framework has been designed in such a way that the emphasis is not narrowly on tourism–agriculture conflicts, but instead on traditional *vis-à-vis* contemporary land uses in general. Therefore, it can be applied in Botswana, and other cases where there are conflicting land uses and livelihood activities. This article makes a clarion call to land-use institutions to provide viable, effective and affordable options from addressing land-use conflicts. This could promote environmental management and encourage biodiversity conservation that are sensitive to the needs of local communities.

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Human-gorilla conflicts around the Lobéké National Park: Implications for conservation and local development

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SUMMARY

Several studies have shown the relevance of knowledge about human-gorilla conflicts in developing protected area management strategies.

The shortage of data on these conflicts is the motivation behind the current study on the Lobéké National Park (LNP), the Cameroonian section of the Sangha Trinational Park (STP) located between Cameroon, the Central African Republic and Congo. Surveys were conducted with households in nine villages around the park and concluded that about 59 percent of households have recorded damages to their crops with huge financial losses. Moreover, the dry season and the distance between the farm and the village have significant impacts on the occurrence of these conflicts. The study recommends a zoning

with a land-use plan, but also the sensitization and education of populations on the best farming practices and compliance with the existing legislation.

Introduction

In Africa, human-gorilla conflicts are not new phenomena (Hockings and Humle, 2009; Masi *et al.*, 2009) as they date back to the period when several protected areas (PA) were created (Madden, 2008). In most cases, these areas were established without considering the future needs and demographic growth of riparian populations who simply fled away and were thus

deprived of the various traditional uses of lands and forests. With the accelerated destruction of natural habitats, gorillas (*Gorilla gorilla*) are living increasingly closer to human populations (Hockings and Humle, 2009). This coexistence implies the use of the same resources in the same spaces. In the context of this conflict, the damages to crops, habitat degradation and poaching are by far the main features (Marchal and Hill, 2009). Wildlife remains a major source of animal protein for over 75 percent of the human population in the Congo Basin (De Wasseige *et al.*, 2014).

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While in Uganda human-gorilla conflicts were dutifully handled and economic and ecological impacts recorded (Muyambi, 2004; Ahaikundira and Tweheyo, 2011), in the Congo Basin, human-gorilla conflicts are hardly documented even though riparian populations incur huge material and financial losses each year (Hockings and Humle, 2009). Moreover, most existing studies deal in priority with human-elephant conflicts (Tchamba and Foguekem, 2012; Granados and Weladji, 2012).

Without conclusive data on human-gorilla conflicts, no concerted and participatory management strategy devised by LNP would succeed. In order to take effective management decisions, there is a need to assess these losses and their impact on conservation and local development. This study aims at determining the types of conflicts, the factors that affect them, as well as their impacts on local populations and on conservation.

Methodology

The surveys were conducted in the nine riparian villages of the park (Figure 1) with 95 households chosen randomly. The data collected was analyzed using SPSS 15.0. The Generalized Linear Mixed Model (GLMM) was used to assess the reaction of some factors on the occurrence of human-gorilla conflicts.



Photo: Public Stock

FIGURE 1. Locations of the various villages surveyed around the Lobéké National Park in the eastern region of Cameroon
(Source: Field data and topographic map funds NA-33-NO)



Results

The GLMM (Table 1) shows that the season ($P = 0.001$) and the distance between the farm and the village ($P = 0.004$) have significant effects on the occurrence of human-gorilla conflicts. In fact, it appears that the occurrence of damage is higher during the dry season than during the rainy season. Our analyses also reveal that the level of damage in the farms increases with the distance between the farm and the village (coefficient = 0.094; $P = 0.004$) varying from one village to the other. On the other side, the surface area of farms ($P = 0.509$) as

well as the space occupied by the most attacked cultivars ($P = 0.694$) do not affect the occurrence of human-gorilla conflicts (Table 1).

According to the 45 percent of households, poaching is exacerbated by poverty and the lack of alternatives to bushmeat at local level. The gorilla is by far the main species responsible for raiding crops, according to 94 percent of the respondents. Over half of the households (59 percent) have had their farms raided by gorillas during the year, with financial

losses exceeding XOF 100 000 (EUR 1 = XOF 655). According to the data, more than 12 cultivated species are preferred by the gorillas, including the plantain tree (*Musa paradisiaca*), cassava (*Manihot esculenta*), maize (*Zea mays* L.) and cocoa husks (*Theobroma cacao*). The most mentioned wild products were *Irvingia gabonensis*, *Annonidium mannii* and *Tricocephala accumulata*. Human-gorilla conflicts also created a general psychosis in the villages, thus limiting the movements of communities.

TABLE 1. Estimation of the GLMM parameters on the occurrence of human-gorilla conflicts in the Lobéké National Park. "Conflict season" is a 2-level factor, dry season and rainy season, rainy season being the reference.

Factors	F	P	Coefficient	t	P	CI to 95 percent
Conflict season	11.388	0.001				
Dry season			1.076	3.375	0.001	0.442–1.709
Rainy season			0.000			
Farm surface area	0.447	0.505	0.076	0.669	0.505	-0.149–0.3
Space occupied by the most attacked cultivars	0.156	0.694	-0.107	-0.395	0.694	-0.645–0.431
Distance between the farm and the village	8.664	0.004	0.094	2.943	0.004	0.030–0.157

CI: Confidence interval; t: Student test; F: Fischer test; P: probability
(Source: Summary of survey data)



Photo: ©FAO/Steve Terrill

DISCUSSION AND CONCLUSION

The main types of human-gorilla conflicts are the raiding of farms by gorillas, poaching and habitat destruction. This conflict typology described around PNL is similar to that of other authors (Hockings and Humle, 2009; Madden, 2008). Despite the households' reluctance to admit it, the commercial poaching of gorillas has been a real scourge for some time now (Hockings and Humle, 2009). This could explain the fact that over 75 percent of the human population in the Congo Basin still rely on game for their animal protein needs (De Wasseige *et al.*, 2014), hence an increase of the human pressure on the resource (Agrawal and Gibson, 1999).

The most destroyed crops form the basis of riparian communities' food intake and their sale enables them to meet their needs for essential products. The damage caused by gorillas to these crops regularly creates the fear of a decline in food supply and bodes a worrisome future for any planned conservation strategy. The destruction of plantain trees by gorillas is confirmed by Muyambi's studies (2004) in Uganda. The isolation of farms near conservation areas makes them easy targets for gorillas' raids. The GLMM showed that conflicts are more frequent during the dry season and in the most remote farms. In fact, when fruit production decreases during the dry season, some gorillas moved to the marginal zones where damages to the crops have been recorded (Masi *et al.*, 2009).

At the end of our study, we recommend that the monitoring of farms against gorilla raids take into account the seasonal character of their movements. It is also important to encourage home gardens and their enrichment with forest species that are of interest for the communities. A study should be conducted to better define the agroforestry characteristics of these species. This study highly recommends a zoning of the site with mainly a buffer zone around the park to restrict contacts with wildlife. This zoning should be followed, at the marginal areas, with a land-use plan that takes into account the concerns of all the social categories concerned. Additional efforts would be needed to increase crop productivity so as to reduce pressure on the lands. Community awareness and education programmes should be planned to facilitate a better understanding of wildlife behaviour and a good appreciation of their value, as well as that of the park in favor of conservation. Regulating conflicts would be efficient only if the existing compensation approaches and the strengthening of compliance with existing legislation are revisited.

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Nature-based Solutions in Ethiopia



Photo: Public Stock

Freshwater fish diversity and its role in improving the livelihood of communities

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SUMMARY

Endowed with a large extent of surface water bodies, Ethiopia's standing water area is roughly 13 637 square kilometres with a running water length of about 8 000 kilometres. There is considerable potential for fish production in these water bodies. However, the role of the capture fisheries and its sustainable utilization has not been adequately articulated.

This manuscript will address the importance of the capture fisheries in improving the livelihoods of the fisher communities, its contribution to the economy of the country, its challenges, and possible management issues. Currently, the diversity of the fish fauna of Ethiopia stands at 200 species, of which 191 are indigenous (native) and 9 exotic. Forty-five species are endemic to the country. The most important commercial fish species include Nile tilapia, African catfish, Nile perch, giant catfish and the exotic common carp.

Several communities living along the rivers and lakeshores are largely dependent on fish for

household consumption and income generation. Most notable are communities of the Gambella region, the Omo Delta, and those living along the Rift Valley and the highland lakes. In 2014, nearly 45 000 fishers were in the primary sector with 30 percent of the employed on a full-time basis. However, there are several challenges to the freshwater systems and the fisheries, and these include overfishing, catchment degradation, introduction of exotic fish species and, invasion by aquatic weeds like water hyacinth. There are also additional issues on pollution, poor data



recording and monitoring, inefficient coordination among institutions, and lack of human and infrastructural capacity to manage the resources. The intervention measures needed to alleviate the problems require the involvement of various stakeholders to develop appropriate sustainable fisheries management plans and enforcement of regulations. Conserving and managing the natural environment, strengthening the fishers' cooperatives, and improving infrastructures and facilities will help the sector to grow and to contribute to a prosperous future for Ethiopia.

Photo: Public Stock

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Introduction

Africa has large swathes of arid land, but Ethiopia is often called the “water tower of Eastern Africa”. The country has around 13 637 square kilometres of standing water with a length of around 8 000 kilometres of flowing water. Based on similarities of the fauna (especially the fish fauna) and following the model of freshwater ecoregions of Africa (Thieme *et al.*,

2005) the freshwater systems of Ethiopia can be conveniently placed under six freshwater ecoregions. These freshwater ecoregions can further be divided into drainage basins. According to Mesfin Woldemariam in Shibru Tedla (1973), the Ethiopian freshwater system can be classified into seven drainage basins. These are the Abay, Awash, Baro Akobo, Omo-

Gibe, Rift Lakes, Tekeze and Wabi Shebele-Genale basins (Figure 1). The drainage pattern in Ethiopia is the result of the uplifting during the Tertiary period, which created the Rift Valley and consequently the two separate highlands (Mohr, 1966; Westphal, 1975). Since water bodies found in one drainage basin are interconnected, similarity in their biota is evident.

FIGURE 1. The main drainage basins of Ethiopia
(Source: Stiassny and Getahun, 2007)





Generally, the diversity of the fish in Ethiopia is relatively very high. There is also considerable potential for fish production in these water bodies. However, the role of the capture fisheries and its sustainable utilization has not been adequately articulated.

The fish species diversity

The freshwater fish fauna of Ethiopia is of particular interest since it contains a mixture of Nilo-Sudanic, Eastern African, and endemic forms (Roberts, 1975; Getahun and Stiasny, 1998). The Nilo-Sudanic forms are represented by a large number of species found in the Baro-Akobo, Omo-Gibe, and Abay drainage basins (e.g. members of the genera *Alestes*, *Bagrus*, *Citharinus*, *Hydrocynus*, *Hyperopisus*, *Labeo*, *Mormyrus* etc.). The southern Rift Valley (Lakes Abaya and Chamo), and the Shebele-Genale basins also

have elements of these forms. It is believed that these lakes and river basins had former connections with the upper White Nile (through Lake Turkana in the former case) as recently as 7 500 years ago (Roberts, 1975). These Nilo-Sudanic forms are related to Western African fishes and also believed to be due to past connections with the Nile to Central and Western African river systems (Nichols and Griscom, 1917; Nichols, 1928).

The highland Eastern African forms are found in the northern Rift Valley lakes (e.g. Lakes Hawassa, Ziwai, Langano), the highland lakes (e.g. Tana and Hayq) and associated river systems, and the Awash drainage basin. These include members of the genera *Barbus*, *Labeobarbus*, *Clarias*, *Garra*, *Oreochromis*, and *Varicorhinus*. They are related to fishes of Eastern, Northern and Southern Africa. Some elements are shared with waters of Western

Africa. Nilotic fishes are almost entirely absent from the Awash and northern Rift Valley lakes.

The country's fish diversity currently consists of about 191 indigenous species of which about 45 species are endemic to Ethiopia and 9 exotic species. The highest species diversity is recorded from Baro-Akobo Basin (119 species) and the highest endemism from Abay Basin. It appears that this high diversity is partly attributable to the presence of highly diverse and rich habitats, but probably also to relatively high level of exploration and collections done in these relatively accessible water bodies. Endemism seems to be highest in Abay and Awash basins due to the endemic "species flock" of Lake Tana and the presence of some endemic fishes adapted to localized habitats in small streams in the highlands of north and central Ethiopia.

The Fisheries

Data on the Ethiopian fisheries is scanty and not very well organized. This is due to the fact that fishery statistics are not properly collected and organized around water bodies of the country where fishery activities are taking place. The fishery potential of the country is relatively low (estimated at about 94 000 tonnes/year) and the actual catch is about half of the potential (45 000 to 50 000 tonnes per year). The most important commercial fish species include Nile tilapia (*Oreochromis niloticus*), African catfish (*Clarias gariepinus*), Nile perch (*Lates niloticus*), giant catfish (*Bagrus* spp.) and the exotic common carp (*Cyprinus carpio*). Approximately 60 to 80 percent of the catch is tilapia, although Nile perch is caught in large quantities on Lakes Chamo and Abaya, as well as in major riverine fisheries. Most of the remainder of the lake catches consists of catfish and large *Barbus* spp.

Several communities living along the rivers and lakeshores are largely dependent on these fishes for household consumption and livelihoods. Most noted are communities of the Gambella region and around the Omo Delta and those living along and surrounding the Rift Valley lakes (e.g. Lakes Koka, Ziway, Langeno, Hawassa, Abaya, Chamo and Turkana) and around the highland lakes (e.g. Lakes Tana and Hayq). Significant workforce is employed both directly and indirectly by Ethiopia's capture fisheries, which also help

in sustaining local communities. In 2014, nearly 45 000 fishers were employed in the primary sector with 30 percent employed fulltime. This is in addition to nearly 700 people who are engaged in aquaculture. In 2016, total fish production was 45 500 tonnes from 18 058 tonnes in 2010 (FAO, 2016).

Fisheries are mainly artisanal and conducted by reed boats. Motorized boats are few and old. Commercial fishery is concentrated to Lakes Tana, Chamo, Ziway, Abaya and Turkana. The overall production and consumption of fish compared to the size of

the population is minimal. The per capita fish production is less than 0.5 kilograms per person per year, which is one of the lowest in the world. (The world's per capita production is about 21 kilograms with Africa pegged at 8 kilograms.) This has impact on the food balance of the population. The fish protein consumption is about 0.1 kilogram per person per year, in which fish contributes only 1.6 percent of the animal protein and only 0.6 percent of the total protein in the country. Moreover, the infrastructures and facilities used in the production are in very poor status and market accessibility difficult.

FIGURE 2. Fish handling, processing and marketing in Ethiopia
Photo: Abebe Getahun and flickr/Richard Mortel.



Therefore, all the above calls upon the need to produce more fishes using improved and sustainable technologies from the existing water bodies and the newly created big reservoirs (like the Great Ethiopian Renaissance Dam and Gibe III and IV). This should be augmented by fish production through aquaculture.

FIGURE 3. Fresh water fish caught by fishers (Photo: FAO/Petterik Wiggers)



Conservation problems and management of fish resources

Aquatic species are at a higher risk of extinction than animals living in terrestrial habitats, especially because of human activities.

Runoff from agricultural and urban areas, the invasion of **exotic species**, and the creation of **dams** and **water diversion** have been identified as the greatest challenges to freshwater environments.

Overexploitation of aquatic

organisms for various purposes is also one of the greatest threats to aquatic environments. This calls for the need for sustainable exploitation. Other threats to aquatic biodiversity include **urban development** and resource-based industries, such as **mining** and **deforestation** that destroy or reduce natural habitats. In addition, **air and water pollution**, **sedimentation**, **erosion**, and **climate change** also pose threats to aquatic biodiversity. **Dams** block fish spawning migrations and isolate fish from upstream spawning and nursery areas, causing populations of migratory fishes to decline. There are several introduced exotic fish species now dominating the fisheries of the rift lakes, especially Lakes Koka and Ziway (dominated by carp species—*Cyprinus carpio*, *Crassius carassius* and *Coptodon zillii*), and its effect on the indigenous species is not fully known.

Overexploitation of species leads to loss of genetic diversity and the loss in the relative species abundance of both individual and/or groups of interacting species. Overfishing causes change in the genetic structure of fish populations due to loss of some alleles. This results in the reduction of genetic diversity. Many of the large lakes along the Rift Valley (Lakes Ziway, Hawassa, Chamo) and the highland lakes (Lakes Tana and Hayq) are facing overexploitation problems, since they are largely open access

and easily reachable. As a result, the catch is further decreasing, which affect communities that totally depend on the fisheries.

Conservation approaches: What can we do?

In order for biodiversity conservation to be effective, management measures must be broad-based. Aquatic areas that have been damaged or suffered habitat loss or degradation can be **restored**. Even species populations that have suffered a decline can be targeted for restoration.

The following solutions can contribute to restoration:

- **Establishing aquatic bioreserves:** An aquatic bioreserve is a defined space within a water body in which fishing is banned or other restrictions are placed in an effort to protect plants, animals, and habitats, which will ultimately conserve biodiversity. Many of the water bodies currently used for capture fisheries (e.g, Lakes Chamo, Ziway, Langeno, etc.) should be conserved as bioreserves with closed seasons and the fisheries production shifting to aquaculture. These bioreserves can then be used for educational purposes, recreation, and tourism as well as potentially increasing fishery yields by enhancing the declining fish populations. This entails rehabilitating the degraded riparian zones of these water bodies and designating buffer zones along their shores.

- **Promoting bioregional management:** Bioregional management is a holistic ecosystem strategy, which regulates factors affecting aquatic biodiversity by balancing conservation, economic, and social needs within an area. This consists of both small-scale biosphere reserves and larger reserves, as being implemented in Lake Tana and its environs.
- **Sustainable Watershed management:** This is an important approach that supports aquatic diversity conservation. Rivers and streams, regardless of their condition, often go unprotected since they often pass through more than one political jurisdiction, making it difficult to enforce conservation and management of resources. Activities would include, for example, **planting native trees and shrubs** along riverbanks to protect water quality and improve

wildlife habitat. Plantation of trees in the catchment area of water bodies (for example, Alwero Reservoir and Gillo River in Gambella (Figure 4)) prevent soil erosion and subsequently reduce the problem of siltation in water body, resulting in better survival of aquatic organisms.

It is obvious that many hotels and recreation centers are positioned at coasts of water bodies because of their scenic beauty (e.g. Bishoftu lakes and Lakes Hwassa and Tana). However, the fisheries of the adjacent lakes are being affected by the waste discharged into the respective lakes without being treated. One of the causes suspected for the falling fisheries in Lake Babogaya recently is the waste being discharged from hotels constructed along the coast of the lake. As a result, several fishermen are forced to abandon their fishing

activity in that lake. There are also reports that there are flower farms established along the coasts of lakes (e.g. Lake Ziway), which are affecting the fisheries in those lakes. Therefore, it is mandatory to conduct Environmental Impact Assessment studies before the establishment of **industries, chemical plants, hotels, farms and thermal power plants** near the water resources as their discharge affect the ecology of water body, resulting in loss of biodiversity. Regulatory measures must be taken on **wastewater discharge** into the water body to conserve biological diversity.

The following are also vital management measures on the fisheries based on the specific conditions of the aquatic ecosystem, the organisms inhabiting it and the community dependent on it.

FIGURE 4. Relatively well protected water bodies in Gambella Region (Gillo River and Alwero Reservoir)

Photo: Getahun, A.



Closing the fishery during the spawning months

Evidence showed that low recruitment is already a major problem for fish stocks in several water bodies. It is, therefore, very important to reduce the fishing pressure on the breeding population. To achieve this, it will be important to determine the breeding seasons of the fishes and fishing should be closed or restricted during the main spawning months.

Prevention of destructive fishing methods

Destructive fishing such as poisoning, explosives, as well as fishing practices that can hinder the free movement of spawning stocks, such as fencing the rivers, beach seines and trawls should be strictly forbidden. Fish inspectors have the duty to check if any of these destructive fishing methods are in use. Monofilament nets are currently creating great problems in different fishing areas.

Mesh size regulations should be implemented seriously and the aim is to allow immature fish to escape from being caught by gill nets.

Ecosystem Approach for Fisheries (EAF)

EAF is a strategy for the integration of the activity within the wider ecosystem, which promotes sustainable development, equity, and resilience of interlinked socio-ecological systems. In Ethiopian fisheries management strategy EAF, the approach developed by FAO must be incorporated. It will address holistically the human and ecosystem interaction on a sustainable way.

Licensing of fishers and enforcing the control of illegal fishing

Any fishing for commercial purposes should be licensed. A license commits the fishers to respect the fishery regulation. The Bureau of Agriculture should

approve the directives for providing fishing license. The license will limit the number of gillnets per boat and number of fishing days per week.

Enforcement of management measures

It is obvious that fishery can play a significant role in the lives of the fishing communities and contribute to the economy if its sustainable yield is maintained. It is crucial, therefore, to design a management plan with clear objectives to utilize the fish resource in a sustainable way. Given that the resource is open access, it is subjected to an influx of fishers and other illegal users. Recognizing the dangers posed on most water bodies in the country, a National Fisheries Proclamation was ratified by the Federal Parliament in 2003. It provides broad guidelines related to resource conservation, food safety and aquaculture.

FIGURE 5. Destructive monofilament nets being used in several water bodies
Photo: flickr/Carsten ten Brink



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Nature-based Solutions in Namibia and Tanzania

Protecting Africa's soil in protected areas against crusting, compaction and erosion in the context of Sustainable Development Goals (SDGs) of the United Nations: case studies

G.P. Nortjé¹

SUMMARY

Results of studies in two protected areas, namely, Kleins Camp Concession (KCC) area in the northeastern part of the Serengeti National Park and Etosha Heights Private Reserve (EH), on the southern boundary of Etosha National Park, Namibia, indicate clearly that ecotourism activities like off-road driving (ORD) have negative impacts on the biodiversity (soil, vegetation and wildlife).

Most protected areas in Africa focus on wildlife tourism and are financially dependent on tourists visiting these areas to see the so-called “Big Five” of the animal kingdom, namely, elephant, rhino, buffalo, lion and leopard. However, problems arise when these tourists are driven off-road in order to see the “Big Five”. Off-road driving is ecologically not sustainable and creates soil degradation (erosion, crusting and compaction). These then can lead to *soil degradation, reduced vegetation, reduced wildlife and declining ecotourism*—a vicious circle of biodiversity destruction. The approach in these two studies

was to map and classify the soils in order to identify the sensitive soil areas, map the predator and “Big Five” sightings over time and overlay the road maps onto these. This information gave a clear picture of where and when the animals occur during the year. All this information was then used to redesign the road networks to optimise game drive activities, in order to eliminate off-road driving.

Introduction

Research has shown that the impacts of ORD has strong negative impacts on soil crusting

and subsoil compaction (Nortjé *et al.*, 2012; Nortjé, 2014; Laker and Nortjé, 2019). The negative impacts of ORD occur during both dry and wet soil conditions. The negative impact of ORD on soil compaction has, thus, much wider impacts, such as decreasing water infiltration and availability, limited root penetration, less vegetation cover and reduced recovery of soil compaction (resilience) and vegetation. Root penetration and, therefore, root area distribution was drastically reduced in research to quantify the impacts of ORD on root area distribution (Nortjé *et al.*, 2016).

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“OFF-ROAD DRIVING IS ECOLOGICALLY NOT SUSTAINABLE AND CREATES SOIL DEGRADATION...”

Nortjé and Mearns (2017) indicated a need for improved visitor/ecotourist education on the possible negative impacts of demands for ORD. The results also indicated that game guides and tourism operators could play a major role in educating the ecotourist. The results demonstrate that both an understanding of the chemical and physical factors influencing soil compaction, as well as tourists' environmental views, are important in formulating management strategies to control and manage these impacts.

The soils in Africa, in general, require close management to ensure sustainability for agriculture, rangeland and conservation purposes (Nortjé and Nortjé, 2017). Proper land-use planning is critical, in which soil surveying and appropriate land suitability assessments should play a major role. This is very important in wildlife ecotourism areas and their surrounding pastoral lands. Therefore, there is a need to develop new policies for rangeland management that support both wildlife populations and livestock herds. Selective grazing and overstocking, by Maasai livestock, causes soil and vegetation degradation in specific areas in KCC (Nortjé and Nortjé, 2017). In selective grazing, animals



graze out the best grass species, leaving inferior species behind, which eventually take over. This leads to increased erosion, as proven by South African research (Laker, 2004).

The 15th Sustainable Development Goal (SDG 15) of the United Nations states the following: “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss”. This is particularly important in Africa's protected areas. Although judicious management of soils is critical to advancing most of these goals, the word soil is not once mentioned in any of these laudable goals. SDG 15, for example, mentions land degradation but does not specifically focus on soils.

In line with previous UN programmes, SDGs thus reflect an utter lack of awareness of the importance of the most basic of all natural resources on which depends all terrestrial life—soils (Lal *et al.*, 2018). The aspect of terrestrial conservation continues to demand accelerated action to protect biodiversity, land productivity and genetic resources and to curtail the loss of species. Protected areas help to meet the Sustainable

Development Goals. Soil loss and the protection of soils, especially in protected areas, form the basis of biodiversity conservation.

Factors relating to the protection of soils in protected areas include:

- soil degradation due to soil erosion, soil crusting and sub-surface compaction
- ecotourism and game drive management (ORD)
- co-existence between ecotourism and traditional livelihoods (i.e. Maasai livestock) and
- rehabilitation of degraded soil.

In order to highlight the above-mentioned aspects, two case studies were undertaken, one in the Etosha Heights Private Reserve, in Namibia (Nortjé, 2019) and the other in Kleins Camp Concession (KCC) in the Serengeti National Park in Tanzania (Nortjé and Nortjé, 2017). The objectives below address the four aspects mentioned above:

1. To limit or prevent overgrazing of sensitive areas, so as to prevent development of barren areas that would lead to soil erosion and/or inhibit re-vegetation due to soil crusting;
2. To control and effectively manage harmful game drive activities, such as ORD, so as to avoid soil and vegetation degradation by these activities, especially in sensitive areas;



Photo: ©David Berkowitz

3. To develop and effectively implement a program of soil and road management and rehabilitation;
4. To institute official agreements between the land users – ecotourists and local communities.

The studies, in the two selected protected areas, were aimed at meeting Objective 2 above. A set of recommendations are presented based on these studies and on earlier research by the author.

Research methodology

The methodologies described below were followed in both case studies.

Soil survey and mapping

Google Earth images were used and DEMs (digital elevation models) were created to generate base maps for semi-detailed soil surveys at a scale of 1:25 000. Soil profile description and auger sampling points were identified, sampled and classified. The latitude and longitude of each sampling point were determined by GPS during the field soil surveys.

During the field soil surveys, the individual soil profiles were investigated and the important soil properties were described following standard procedures as prescribed

by the Institute for Soil, Climate and Water, in Pretoria. Based on recognizable, as well as inferred properties, the soils were classified according to both the South African (Soil Classification Working Group, 1991) and international World Reference Base for Soil Resources Classification System (WRB, 1998) soil classification systems.

These systems are based on the recognition of diagnostic soil horizons and materials. Soil forms in the South African system are defined in terms of the type and vertical sequence of diagnostic horizons or materials. Soil maps were created with the application of Predictive Soil Mapping or Digital Soil Mapping (DSM).

This was done to be able to identify sensitive areas, to take action that would enable meeting Objectives 1 and 2.

Predator sightings determination

One of the main goals of ecotourism, in the two protected areas, is to provide a wildlife (environment and animals) experience to tourists. Ecotourists in Southern and Eastern Africa prefer viewing the “Big Five” animals (elephant, rhino, buffalo, lion and leopard) (Nortjé and Mearns, 2017). Elephant, rhino and buffalo are usually seen in

the open, but to enable tourists to view the predators (lion and leopard) at close range, game drive guides sometimes drive off-road, sometimes for appreciable distances, even up to two kilometres (Nortjé, 2014; Nortjé *et al.*, 2012).

In order to meet Objective 2, it was necessary to plan a road network that would eliminate or substantially reduce the need for ORD to enable close range viewing of the predators. For this, the spatial distribution of predator sightings has to be known. Thus, data regarding the sites of predator sightings were collected and GPS referenced over a specific time period for Etosha Heights Private Reserve (EH) and Kleins Camp Concession (KCC), respectively. From these sighting density maps were then prepared.

Road network planning

Predator sighting density maps were used to determine where (geographical position) and when these animals roam and are sighted most during the year. The soil maps were then superimposed on these to demarcate sensitive areas. Road networks could then be planned that would afford tourists the biggest opportunity to see these animals at close range without game drive vehicles needing to drive off-road.

Findings

The road networks for game drive activities needed to be adapted (changed, decreased or increased) at both EH and KCC. At EH extra

roads were proposed according to the predator sightings. Permanent, well-managed roads are better than ORD. At KCC the road network needed to be adapted according to the predator sightings and new

roads were proposed. Figure 1 indicates the predator sightings densities at EH and Figure 2 the soil map with current and new roads. Figure 3 indicates the dominant soil types and predator sightings at KCC.

FIGURE 1. Predator sightings at EH

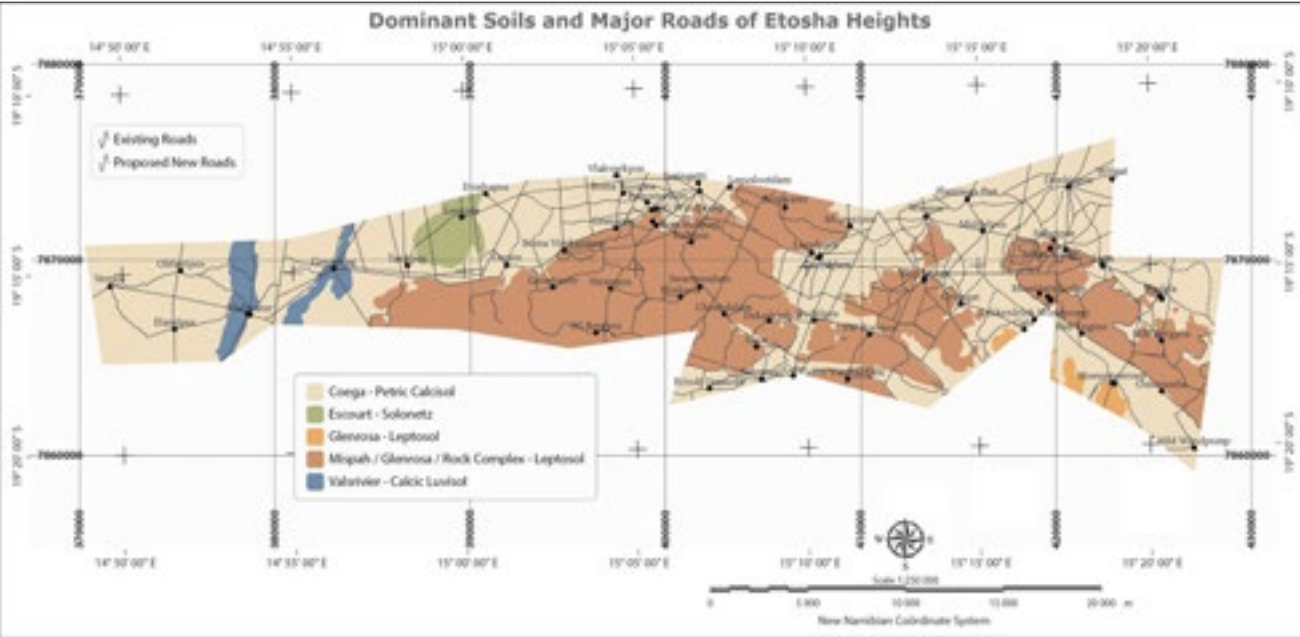


FIGURE 2. Dominant soils, current road network and proposed new roads at EH

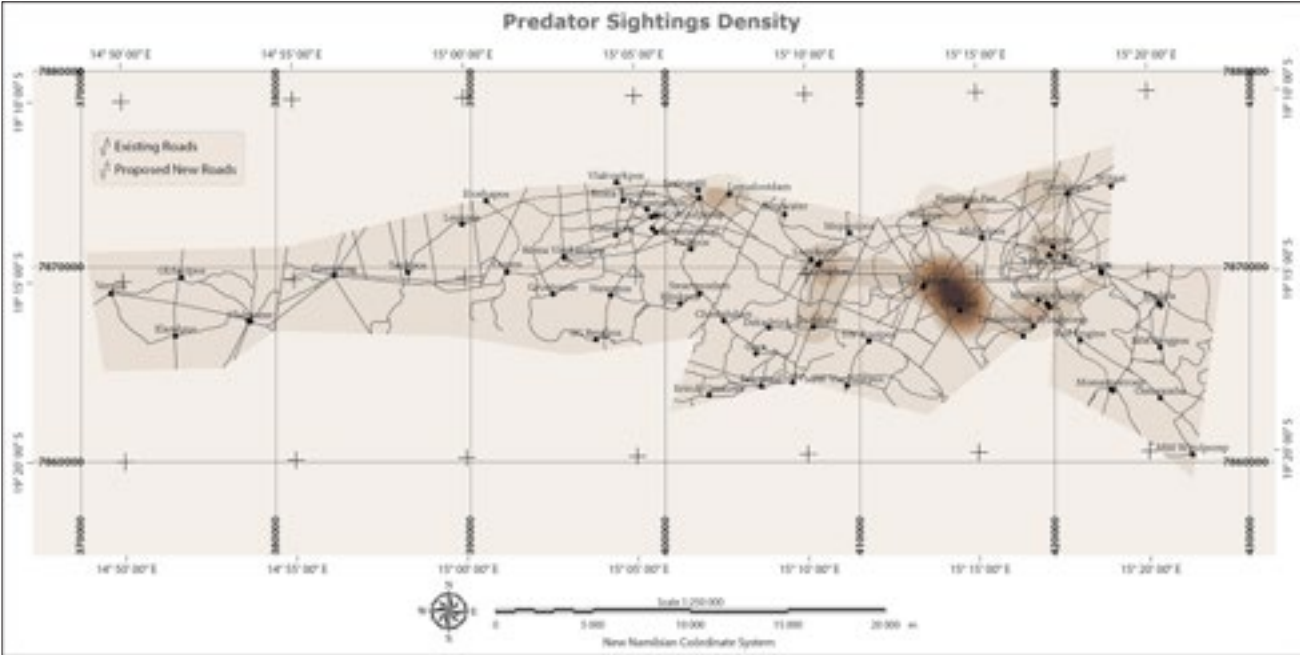
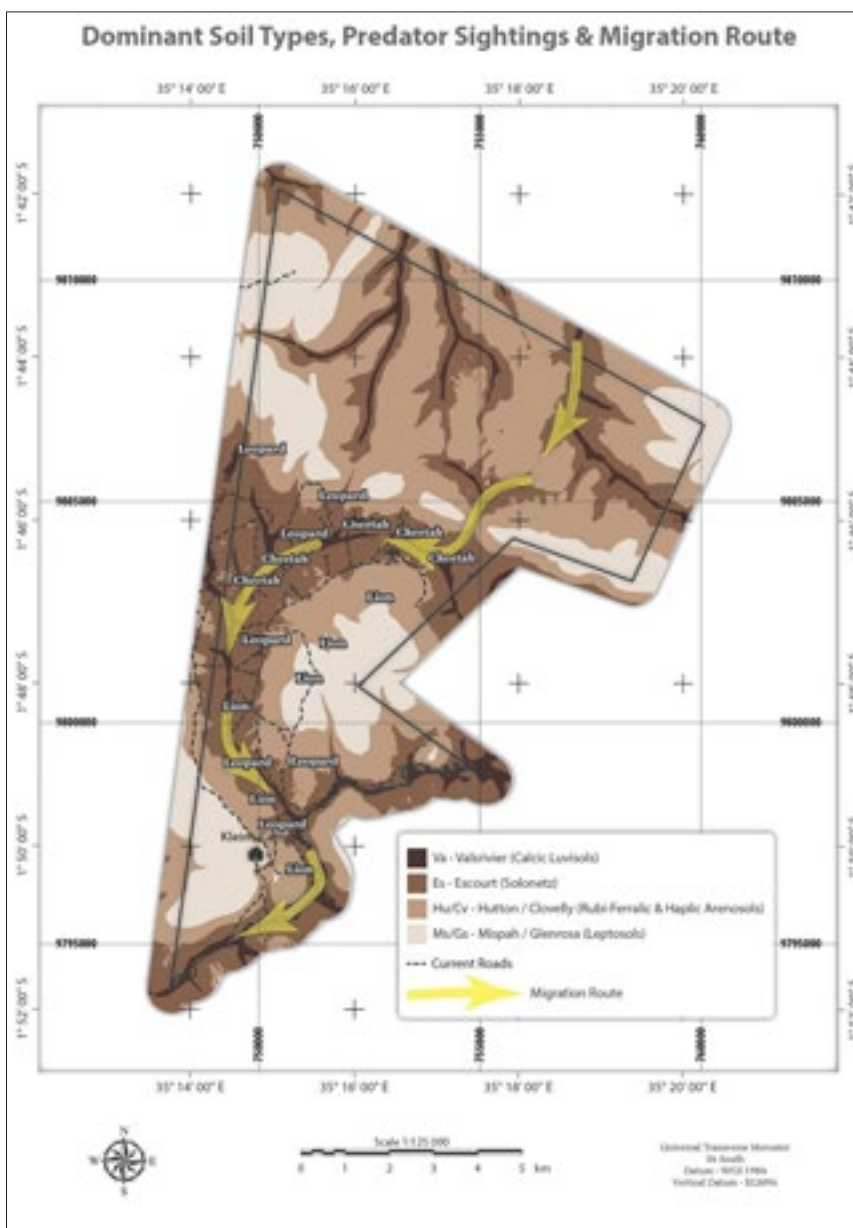


FIGURE 3. Dominant soil types and predator sightings at KCC



Discussion

Road network routes and densities should be as optimal as possible to minimize negative impacts on the soil and environment. In order to eliminate or substantially reduce ORD, it is necessary to establish a road network that is ecologically sustainable, but also eco-tourism sustainable. The proposed road map suggests that only permanent roads should be established and be managed as such. Permanent roads in the right areas (planned according to predator sightings and soil type), can limit the need for ORD. This in turn will limit soil crusting, soil compaction and soil erosion, which have earlier been identified as serious consequences of ORD (Laker, 2004; Laker and Nortjé, 2019; Nortjé, 2014; Nortjé *et al.*, 2012; Nortjé *et al.*, 2016; Nortjé, 2019).

Management recommendations

In order to promote maintenance of biodiversity in ecotourism protected areas by limiting damage to vegetation and soils, the author wishes to make a number of management recommendations, based on previous research (Nortjé, 2014; Nortjé *et al.*, 2012; Nortjé *et al.*, 2016; Nortjé and Nortjé, 2017; Nortjé and Mearns, 2017), which has led to the studies highlighted in this paper.

The management recommendations focus on prevention of land degradation and soil erosion as well as road network planning. The recommendations and suggestions

concerning soil and vegetation management should seriously be considered, investigated and implemented in order to ensure the long-term survival and sustainability of the soils, vegetation and wildlife (Nortjé and Nortjé, 2017). The following are highly recommended:

- prevent further bare soil development by not allowing overgrazing or unnecessary ORD;
- design/redesign road networks according to a detailed soil map, to minimize soil and vegetation degradation due to runoff and erosion from roads, while at the same time enabling excellent animal sightings without the need for ORD;
- prohibit ORD in the following areas: Ramsar pans, vleis and soils with Prisma-cutanic B-horizons (so-called 'sodic' sites, silt-loam soils and soils with high (fine sand + silt) contents, sandy soils with less than 15 percent clay content, barren areas with no grass cover ('Solonetz' soils);
- further research regarding soil, game sightings and the road network utilization, should be initiated;
- rehabilitate damaged areas in particular with available non expensive approaches and techniques;
- investigate possible ways to promote packages for walking safaris in wilderness areas;



Photo: ©flickr/Megan Coughlin

- no water points on the 'Estcourt' (Solonetz) soil or on steep slopes;

Regarding ORD, the following recommendations should apply: **No ORD**. However, if ORD is necessary in exceptional circumstances, follow the following rules:

- no ORD to be allowed from Class A (main) roads;
- ORD may only be undertaken in the event of a confirmed sighting of leopard, lion, rhino, buffalo, wild dog and cheetah;
- ORD should not be permitted in areas where Red List Plant species are known to exist or in any other areas that EH and KCC are using for conservation or other management purposes;
- vehicles driving off-road must under all circumstances follow the tracks of another vehicle;
- NO ORD should be permitted at river crossings;
- use the lowest possible tyre pressure on game drive vehicles;
- ORD is not permitted in wet conditions, on sodic patches ('Solonetz' soils) or duplex soils (Valsrivier); and
- any off-road damage to be repaired immediately (compaction reversed; ruts erased).

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Plant cover trends in a context of drought and pastoral activities' resilience in the Matam Region: The case of the Ferlo Biosphere Reserve (RBF¹)

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SUMMARY

The Matam Region is affected by the impacts of climate change exacerbated by human activities. Its vegetation is typically Sahelian with mostly thorn trees and has worsened due to recurring droughts, farmland expansion, logging and bushfires. Restoring and conserving natural resources, especially within the Ferlo Biosphere Reserve (RBF) is an essential element of the resilience strategy of livestock production in this agropastoralism-based area.

Introduction

Western Africa remains highly sensitive to climate variations (Ba *et al.*, 2018; Quarto and Thiam, 2018). The successive droughts combined with man-made pressure are 'socio-natural' environmental degradation factors (Sy and Sow, 2018). They impact both the soils and nature and plant cover density (Ba, 2018). However, the morphological organization of soils

is a fundamental element of their fertility; it expresses in various ways the possible links between soil and plant (Ruelan and Dosso, 1993). The Matam Region has a large potential for pastoral activities. Traditional extensive husbandry occupies almost 70 percent of the population (CRM, 2004) either as a major or secondary activity, and contributes tremendously to food security. However, this activity is still facing, as is the case for the

entire Senegalese Sahel, a highly precarious situation related to its geographical location and its land management choices, thus perfectly showcasing the challenges associated with drought and environmental degradation (Ba, 2018). That is why, RBF which mostly falls under the Matam Region surface area, aims at reconciling biodiversity conservation with its sustainable use.

¹ *Reserve de biosphère de Ferlo (RBF)* in French

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Materials, methods and results

1.1. Introducing the area under study

The region is located between 14°20' and 16°10' north latitude and 12°40' and 14°60' west longitude, upstream the Middle Valley of the Senegal River and stretches over part of the Ferlo (Figure 1).

The economy in the region is dominated by agropastoral activities (Kaéré, 2004). Due to climatic stresses, the region has become a marginal farming region for rainfed agriculture, compensated by large irrigated agriculture developments and recession crops in Walo (area of hydro-clay soils).

1.2. Methods

The study was mostly based on a survey conducted with the communities in the area. The survey involved plant cover trends and the adaptation strategies developed by populations and the authorities. The survey used a questionnaire and interviews in the three departments: Matam, Kanel and Ranérou. The interviews were conducted with resource persons such as grassroots organizations leaders and the service heads involved while the questionnaire targeted the populations.

The selection of respondents was based on their activities with a preference for pastoralists. It was also based on their place of residence since there was a need to interview both the residents of

ecogeographical areas of *Walo* (or alluvial plain), *Diéri*, the part that is not submersed by the Senegal River flooding, and *Ferlo*. Some of the questions targeted exclusively farmers or only pastoralists. In total, 400 people were interviewed: a 150 in the Matam Department, a 150 in the Kanel Department and 100 in the Ranérou Ferlo Department. The localities visited included Ranérou, Louguéré Thiolly, Kanel, Bow, Sinthiou Bamambé, Matam, Boyinadji and Tiguéré Yéné. The data collected was extracted and analyzed using the Sphinx software.

1.3. Results

1.3.1. An increasingly sparse plant cover

The plant cover is mostly made up of Sahelian tree steppes dominated by species such as *Acacia nilotica* in the *Walo* area on *hollalde* soils. Depending on the geographical zones, thorn trees abound with species such as *Balanites aegyptiaca*, *Acacia seyal* and *Ziziphus mauritania*. The other tree species are *Combretum glutinosum*, *Boscia senegalensis* and *Tamaris senegalensis*. There is also an almost essentially seasonal herbaceous stratum, dense during the raining season and quasi inexistent during the rest of the year except for *Cenchrus biflorus* (cram-cram) that could be found throughout the year. *Azadirachta indica* (neem) is often planted inside residences to provide shade.

FIGURE 1. Location of the area under study
(Source: Ba Djibrirou Daouda, 2018)



The diagnostic survey reveals that the plant cover is worsening. Farmers who know about the previous situation all agree that perennial grasses had a more prominent place prior to the 1970's drought.

1.3.2. Man-made pressure: an exacerbating factor of plant cover degradation

Over the past years, charcoal production has drastically declined in the Matam Region. However, the impact of these activities is still felt in the Senegal River plain, especially in the Matam Department. Rehabilitating the plant cover is an ongoing process that has been slowed down by the actions of shepherds who prune the trees during the dry season, and the sale of fuelwood (Figure 2) facilitated by the rehabilitation of the Matam-Linguère road:

In fact, the isolation of Ferlo accentuates logging with the sale of fuelwood for the inland and capital cities' consumption. In the Ranérou Department, one can frequently observe large quantities of fuelwood arranged on both sides of the National Road. Another important factor in soil and plant cover degradation is overgrazing by the large number of livestock heads in pastoral areas and around water points. Bushfires have also been mentioned by 60 percent of the respondents,

and by over 90 percent of breeders in Ranérou as a major ecological challenge (Figure 3).

In Ferlo, bushfires are considered the most frequent disaster as they not only swiftly burn the grass cover but also affect its regeneration capacity.

In order to counter these challenges and restore the resilience and adaptation of these ecosystems, there would be a need to focus

FIGURE 2. Sale of fuelwood near Ranérou
Photo: Djibrirou D. Ba



FIGURE 3. Bushfire in Ferlo.
Photo: Ndiaye P.A.



on their conservation and restoration. Thus, the Department in charge of Waters and Forests initiated the planting of fodder species. However, this project was constrained to the pilot phase due to a water unavailability. However, the idea resurfaced with the increase of boreholes in the context of the Project for the Integrated management of Ecosystems in Senegal (PGIES³) within a framework of participatory community involvement, the services involved and the partners within the context of the FAO-initiated Farmer Field Schools (FFS) programme to counter climate change. This is how most of these strategies were started in RBF.

1.3.3. The Ferlo Biosphere Reserve (RBF): the main adaptation strategy

Located in the northeastern part of Senegal between 14°20' and 16°10' north latitude and 12°40' and 14°60' west longitude, RBF covers a total surface area of 2 058 214 ha (Ngom *et al.*, 2012). It stretches over the administrative regions of Matam, Louga and Saint-Louis. It is composed of several areas with various complementary functions. The central area which is under constant surveillance, covers the Ferlo North and Ferlo South wildlife reserves protected by decrees since 21 March 1972; traditional harvesting carried out by the local communities are authorized. The

³ *Projet de gestion intégrée des écosystèmes du Sénégal (PGIES)* in French

buffer zone covering 56 percent of RBF is allocated to the communities for their use such as the livestock rangeland, and pruning and trimming of fodder species only if conservation objectives are not compromised. In the transition or cooperation area that integrates the Pastoral units (PU) of Malandou, Loumbol, and Winde, land use varies according to human settlements, pastures, farming areas and transhumance corridors.

Hence, RBF favors the sound use of pastoral resources and transhumance, ecosystem rehabilitation and restoration, and easier access to water through boreholes and wells. Moreover, it enables, on the one part, to also explore opportunities of

cooperation with national and subregional biosphere reserves, and on the other part, to conduct research on plant and animal species in the region and the forms of silvopastoral management. Thus, RBF fulfills various essential functions including the preservation of various ecosystems: savannahs and pastures, gallery forests, shrub-steppes, valleys (mostly fossils) including that of Ferlo, Mboune, Thiangol Mangol and Thiangol Gaiparadji, the numerous pans and temporary backwaters, and the plants, especially those of *Pterocarpus lucens* in the south, and of *Acacia* and *Boscia angustifolia* in the north. This initiative offers a policy framework for the establishment of regional

investment plans with the aim of managing and enhancing Ferlo. All these adaptation strategies of agropastoral activities are part of the mainstreaming of issues and challenges associated with logging and animal production (Figure 4).

In the context of climate change, environmental degradation has been observed with areas of wind erosion and an increasingly sparse plant cover (Figure 5).

These challenges include land degradation, the decline in pastoral productivity and the reduction of perennial vegetation. Consequently, even though it is hard to assess livestock production resilience, it is related to its intensification and to livestock genetic improvement.

FIGURE 4. Female farmer with livestock.
Photo: ©FAO/Luis Tato



FIGURE 5. Wind erosion area in the Matam Department.
Photo credit: Djibrirou D. Ba



2. Discussion

According to some authors (Ibrahim, 2012; Sy, 2013) the Sahel is going through a long drought cycle which continues up till today with the desertification exacerbated by deforestation and rainfall deficit (Ibrahim, 2012). The gradual destruction of forest stands appears inevitable in Ferlo since bushfires remain a serious concern there (OCDE/CSAO, 2008; Ndiaye, 2012). The results also agree with Sy and Sow (2018) who believe that man-made deforestation worsens the natural processes. Consequently, the development of extensive pastoralism in Ferlo should take



Photo: Public Stock

into account climate variability (Kamile and Labordière, 2010). Thus, in Ferlo where the nomads have returned due to more clement climatic conditions, they still desire to clear new lands for settlements (Bas, 2018). The impacts of human activity, including bushfires, combined with recurrent droughts, have affected natural resources both at plant and animal levels (ANSD/SRSD, 2015).

Moreover, some strategies such as the CEP are in harmony with the United Nations Sustainable Development Goals that aim at strengthening rural populations' livelihoods

by ensuring, among others, food security, while reducing pressure on natural resources (FAO, 2017). The results are also in tune with those of Ngom *et al.*, (2012) who believe that as a wildlife acclimation site, RBF also aims at developing experimental activities in the area of wildlife husbandry, including fish farming. Similarly, RBF aims at improving traditional activities through management actions in the context of pastoral units. To improve the sustainable use of plant biodiversity, there is a need to strengthen the synergy among stakeholders as recommended by the Ministry of Environment's report (MEDD, 2015).

CONCLUSION AND OUTLOOK

The Matam region is characterized by plant cover degradation with increasingly sparse thorn trees. The climate is not the only factor behind this trend since human activities largely contribute to it. Man-made activities also contribute to the reduced biological diversity and productivity and have led, over the past years, to severe breakages in the vital ecological processes. The restoration, improvement and sound management of these ecosystems are thus the basic features that would facilitate economic development in the Matam Region. The creation of RBF is a good strategy for enhancing resilience of pastoral activities. There is a need to strengthen its management so as to fulfill its sustainable development goals. Moreover, the study of the contribution of animal production to food security in relation to the abundance of plant species and their regeneration ratio, would be an exciting research subject.

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Ecotourism and sustainable development in rural communities bordering protected areas: a case study of opportunities and challenges for Mahenye, Chipinge District

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SUMMARY

This study is aimed at assessing the opportunities and challenges for sustainable development provided by the community ecotourism project at Mahenye Ward located adjacent to Gonarezhou National Park, southeast Zimbabwe in the context of socio-economic and climate change adaptation.

The study was based on the review of literature and authors' experiences of the study area. The opportunities include the awareness by local people of the importance of conserving nature due to environmental education, availability of unique and diverse natural resources that are attractive to ecotourists, wildlife viewing within the Jamanda community game ranch and the Great Limpopo Transfrontier Conservation Area (GLTFCA) initiative. The challenges include insecure tenure over natural resources, withdrawal of donor funding leading to local failures of

leadership, increased incidences of droughts and frequent cyclones associated with climate change and the international anti-hunting lobby. The paper concludes that community ecotourism at Mahenye needs to continue relying on both safari hunting and non-consumptive ecotourism while also further diversifying income-generating activities in order for the approach to end perpetual reliance on aid donors and government subventions. The paper also recommends that the ecotourism players should lobby the Zimbabwean Government to

devolve authority to sub-Rural District Council (RDC) institutions by granting *de jure* ownership of natural resources to local communities while ensuring communities are capacitated to effectively manage and market the resources in the face of socio-economic and climate change.

Introduction

Community ecotourism falls under the Community Based Natural Resources Management (CBNRM) programme, which subscribes to the concept of community-based

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visitor management for socio-economic benefits (Cetin and Sevik, 2016). It represents a shift from fortress conservation toward more active local participation in natural resources conservation by giving local communities a great stake in conservation (Boonzaaier, 2012; Chigonda, 2018). Community ecotourism is also supportive of pro-poor tourism initiatives whereby marginalized local communities living close to or around resource rich protected areas can accrue socio-economic benefits through tourism (Goodwin, 2009). Research by Montana and Mlambo (2018) has also shown that environmental awareness was highest in communities most exposed to the Gwayi Valley Conservation Area. Community ecotourism is also embedded in the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) in Zimbabwe and has potential to significantly contribute to local community development and environmental sustainability (Scheyvens, 2007; Snyman, 2017).

Ecotourism in Zimbabwe is based on both consumptive and non-consumptive activities. Consumptive ecotourism encompass activities such as trophy hunting and fishing while non-consumptive involves game viewing, wildlife-based photographic safaris, scenic views, boat cruises and bird photography and identification (Machena, Mwakiwa and Gandiwa, 2017).



Photo: ©flickr/Erin Johnson

These ecotourism activities are all available at Mahenye Ward which presents an opportunity for local socio-economic development (Murphree, 2001; Mudzengi and Chiutsi, 2014).

Community ecotourism at Mahenye has been resilient in the face of international wildlife trade restrictions, local socio-economic and climate changes (Murphree, 2001; Machena, Mwakiwa and Gandiwa, 2017). Factors associated with this resilience include intra-communal cohesiveness, ecotourism resource richness and enlightened private sector involvement (Murphree, 2001).

Community ecotourism was established at Mahenye in the year 1990 and through to 2004, the project was largely successful. This was epitomized by the development of upmarket ecotourist lodges, namely, Mahenye Safari Lodge in

1994 and Chilo Lodge in 1996 in partnership with private tourism corporations (Mudzengi and Chiutsi, 2014). However, there were challenges related to climate change as the elephant trophy hunting quota was not achieved from 1993 to 1996 due to a severe drought in 1992 (Murphree, 2001). From 2004 to 2009, the project was on the decline due to withdrawal of funding by international donors in 2003, local failures of leadership and reduced ecotourism visitation numbers as the socio-economic and political conditions in the country characterized by hyperinflation, foreign currency shortages and contested elections continued to deteriorate.

This post-2000 socio-economic and political instability is associated with the implementation of an accelerated land redistribution programme to address racial land imbalances inherited from colonial



Photo: Public Stock

“MAHENYE OFFERS MANY OPPORTUNITIES FOR ECOTOURISM DEVELOPMENT... IT IS POSSIBLE TO ATTAIN SUSTAINABLE COMMUNITY ECOTOURISM DEVELOPMENT IN THE FACE OF SOCIO-ECONOMIC AND CLIMATE CHANGES WITH STRATEGIC PLANNING”

settler rule and struggles over the country's political future (Balint and Mashinya, 2006; Gandiwa *et al.*, 2014). The Mahenye Safari Lodge was also extensively damaged by flooding of the Save River in 2008 after heavy rains, leading to its closure (Chigonda, 2014). Then from 2009 to 2018, due to the stabilizing effect of the Government of National Unity (2009–2013) and the opportunity presented by co-hosting the United Nations Tourism Organization assembly with Zambia in August 2013 to work on the bad image the international community has on the country (Mudzengi and Chiutsi, 2013), the project was on the mend. This is evidenced by increasing ecotourist arrivals and current innovative attempts of creating the Jamanda community game ranch (Mudzengi and Chiutsi, 2014; Wild Programme, 2015; Parliament Budget Office, 2018). The game ranch represents a further step in devolution of user rights over biophysical resources from the Chipinge Rural District Council (RDC) to the local communal community if implemented successfully. However, the Mahenye ecotourism project is susceptible to wildlife

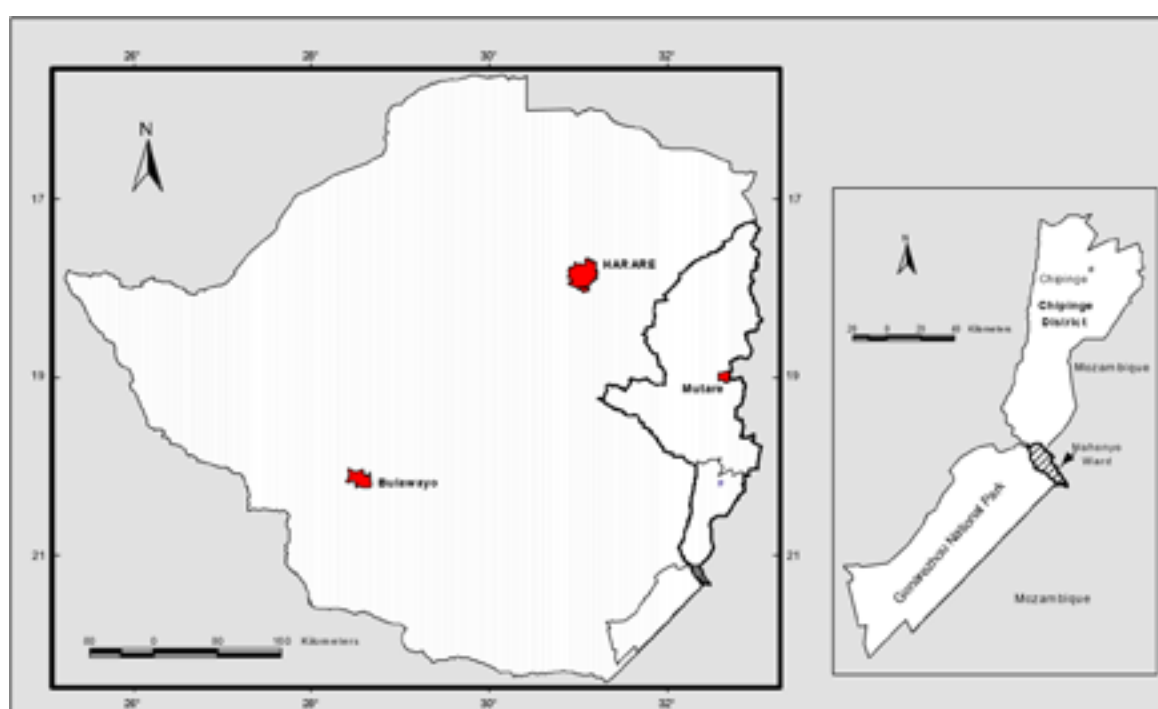
trade restrictions due to its heavy reliance on safari hunting (Machena, Mwakiwa and Gandiwa, 2017).

The purpose of this study was to examine the opportunities and challenges for ecotourism at Mahenye Ward within the socio-economic and climate change adaptation framework. The selection of Mahenye was based on its great potential for ecotourism development, as it is part of the Great Limpopo Transfrontier Conservation Area (GLTCA) initiative. Community ecotourism at Mahenye has also been resilient in the face of environmental changes in Zimbabwe, enabling it to remain running from 1990 to present. The significance of this study promotes ecotourism and sustainable development in rural communities that are bordering protected wildlife areas. The specific objectives of the study were: (i) to explore the strengths, weaknesses, opportunities and challenges of community ecotourism at Mahenye and (ii) to recommend strategies that will make the ecotourism model at Mahenye more successful in the face of socio-economic and climate changes.

Study Area

Ecotourism at Mahenye Ward is a community private partnership project between the local Shangaan-speaking peoples and River Lodges of Africa, which owns Chilo Lodge. Mahenye lies at the extreme southern end of Chipinge District, covering a spatial area of about 210 square kilometers (Figure 1). Annual average rainfall is low, ranging between 450 and 500 millimetres and supports little rain-fed crop cultivation, thus making ecotourism an important non-agricultural source of livelihood (Murphree, 2001; Gandiwa, 2011). Mahenye is also characterized by intra-communal cohesiveness rooted in history and strong adherence to traditional customs (Wild Programme, 2015). Incidences of extreme climate events such as drought and intense cyclones are increasing in the area. The Mahenye area is characterized by a tropical savanna ecosystem experiencing alternating dry cool winters and wet hot summers. The area is mainly covered by mixed mopane (*Colophospermum mopane*) and combretum (*Combretum*) woodland but a dense riverine forest is found along the Save River supporting a broad range of floral and avian species.

FIGURE 1. Location of Mahenye in southeast Zimbabwe
(Source: Authors)



Some of the avian species are rare in Zimbabwe, such as the southern banded snake eagle (*Circaetus fasciolatus*), Madagascar squacco heron (*Ardeola idea*), green coucal, also known as Blue Malkoha (*Ceuthmochares aereus*) and barred cuckoo (*Cercococcyx montanus*) (Murphree, 2001). A wide variety of animal species are also found in the area, including the African elephant (*Loxodonta africana*),

leopard (*Panthera pardus*), buffalo (*Syncerus caffer*), giraffe (*Giraffa camelopardalis*), zebra (*Equus burchelli*), hippopotamus (*Hippopotamus amphibius*) and kudu (*Tragelaphus strepsiceros*).

Methods

The data obtained from the review of literature is presented using the Strengths, Weaknesses, Opportunities and Challenges

(SWOC) analysis. The SWOC analysis was also made feasible by the authors' experiences of the study area spanning 14 years while undertaking research work.

Results and Discussion

The results are presented using SWOC analysis (Table 1). Strategies are also proposed to enhance ecotourism development at Mahenye.

TABLE 1. SWOC Analysis and recommendations for Mahenye community ecotourism project

	Strengths <ol style="list-style-type: none"> 1. Unique and diverse natural resources 2. Part of GLTFCA 3. Presence of upmarket lodges 4. Easily accessible by ecotourists 5. Existence of community private partnerships with private corporations, non-governmental organizations (NGOs) and conservation agencies 6. Government support for CAMPFIRE 7. Intra-communal cohesiveness 	Weaknesses <ol style="list-style-type: none"> 1. Weak natural resources property rights 2. Increased poaching incidences during periods of drought-related socio-economic hardships 3. Heavy reliance on the international trophy-hunting market, therefore, susceptible to trade restrictions
Opportunities <ol style="list-style-type: none"> 1. Awareness by local people of the importance of conserving nature due to environmental education 2. Attractive ecotourism resource base 3. Wildlife viewing within the Jamanda community game ranch and GLTFCA 4. Generation of sustainable income through partnerships with lodge owners, NGOs and conservation agencies 5. Generation of substantial income from safari hunting 	Opportunity-Strength Strategies <ol style="list-style-type: none"> 1. Partnership with NGOs and conservation agencies to create a holistic environmental education hub at Mahenye 2. Spatial planning that accommodates both safari hunting and non-consumptive ecotourism 3. Forge further partnerships with international volunteer programmes that pay to come, live and work in the community 4. Improve community private partnerships to enhance ecotourism skills and technological transfers to the local community 5. Enhance partnerships with GLTFCA management, conservation agencies and universities to increase the marketability of ecotourism products in order for the project to be self-sustaining by attracting more fee-paying ecotourists rather than perpetual reliance on aid donors and government subventions 	Opportunity-Weakness Strategies <ol style="list-style-type: none"> 1. Planning and enforcing of rigid natural property rights 2. Planning of proper anti-poaching units 3. Enhancing the marketing of non-consumptive ecotourism combined with safari hunting 4. Planning for the diversification of ecotourism income-generating activities by promoting beekeeping, fisheries, selling of traditional wild foods and beverages, crafts, oils and natural healthcare products
Challenges <ol style="list-style-type: none"> 1. Insecure tenure over natural resources as RDC and central government seek to retain control 2. Withdrawal of donor support in community capacity-building leading to local failures of leadership 3. Strong international anti-hunting lobby 4. Strong reliance on the international ecotourism market which is freckle as visitation fluctuate depending on socio-economic and political stability 5. Climate change-related issues including increased theft of fauna and shortage of water for the wild animals during drought years as well as flood-induced damage of buildings and roads 	Challenge-Strength Strategies <ol style="list-style-type: none"> 1. Lobbying government to devolve authority to sub-RDC institutions in order to reduce conflicts between the local community and the RDC and central government bureaucrats as well as enable the locals to solely own and manage the ecotourism project 2. Capacity-building in effective leadership skills by NGOs and conservation agencies 3. Conflict resolution with international and national ecotourism stakeholders 4. Engaging stakeholders in developing a hunting code of ethics 5. Ensuring the local people receive greater benefits than costs from wildlife in order for them to be actively engaged in preventing poaching 	Challenge-Weakness Strategies <ol style="list-style-type: none"> 1. Promotion of climate change-compatible ecotourism development 2. Promotion of climate-proof ecotourism by pumping underground water to ensure sufficient water for the wild animals during drought years and constructing climate-smart buildings and roads 3. Benchmarking with Challenge-Strength Strategies 1–5

CONCLUSIONS AND RECOMMENDATIONS

Mahenye offers many opportunities for ecotourism development. There is, however, need to enhance partnerships and cooperation with all ecotourism stakeholders for the Mahenye ecotourism model to be more successful and self-sustaining in the face of socio-economic and climatic changes. This is also supported by other studies in China (Huang and Chen, 2015) and in Finland (Bjork, 2000). Community ecotourism at Mahenye also needs to continue relying on both safari hunting and non-consumptive ecotourism while also further diversifying income-generating activities in order for the approach to end perpetual reliance on aid donors and government subventions. The Mahenye ecotourism project also faces the challenge of insecure tenure of natural resources (Balint and Mashinya, 2008; Frost and Bond, 2008) as is the case in most parts of Africa where property rights are not clearly defined (Mbaya, 2010; Romano and Reeb, 2010). Climate change and its adverse impacts affect large herbivore populations (Prato, 2009; Gandiwa, 2014) and infrastructure (Chigonda, 2014) also poses a challenge to community ecotourism. The development of climate change-compatible ecotourism is, therefore, key.

This study has shown that it is possible to attain sustainable community ecotourism development in the face of socio-economic and climate changes with strategic planning. To address the issue of insecure tenure of natural resources being faced by Mahenye ecotourism, it is important for ecotourism players to lobby the Zimbabwean Government to devolve authority by granting *de jure* ownership of natural resources to local communities. This will enable the local Mahenye community to effectively own and manage the ecotourism project while reducing conflicts with the Chipinge RDC and other government departments and ministries. The community sees the RDC as financially predatory and manipulative

especially in the awarding of hunting concessions and sharing of benefits. These conflicts arise from the fact that as things stand in Zimbabwe's current legislation, formal authority over Mahenye's land and natural resources is vested in the Chipinge RDC, not with the ward's people and their leadership who only have *de facto* ownership. Political and economic elites are less willing to give power to local communities as they fear losing their control and benefits as noted by Muboko and Murindagomo (2014). Devolving legal authority over the management of natural resources and ecotourism to community institutions has led to more secure property rights and socio-economic benefits for communal people in Namibia, leading to the enhanced sustainability of Living in a Finite Environment CBNRM project (Machena, Mwakiwa and Gandiwa, 2017). Further research can explore the forging of partnerships between Mahenye ecotourism project and universities to undertake research on climate change mitigation and adaptation, including developing strategies that will ensure sufficient water and food sources during periods of extreme climatic events for the wild animals so important to ecotourism. The research can also explore the development of other options for ecotourists in case wildlife declines due to climate change. Climate change mitigation research can also integrate indigenous knowledge systems with modern scientific climate know-how, taking advantage of Mahenye community's strong adherence to traditional customs. The utility of local ecological knowledge in adapting and coping with climate change has been shown by some research in the Middle Zambezi Biosphere Reserve (Kupika *et al.*, 2019). Future studies can also seek to carry quantifiable SWOC analysis that adopts the concept of Multiple-Criteria Decision Making to simplify complex problems related to ecotourism development.

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Addressing



human-v

conflict in Africa:
challenges and
achievements

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Photo: Public Stock

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wildlife

SUMMARY

This article provides an overview of the current state of affairs on human-wildlife conflict (HWC) in Africa, and showcases FAO's efforts in supporting its member countries in effective management of HWC. HWC is one of the most pressing threats to conservation of biodiversity and a significant barrier towards achieving the Sustainable Development Goals (SDGs) and the Aichi Biodiversity Targets.



Livestock kraals in the Binga District, Zimbabwe.
Photo: FAO/Rodina

HWC jeopardizes the healthy co-existence of people and wildlife, and undermines conservation efforts and rural development in the African continent. The multifaceted nature of HWC requires that a cross-sectoral and coordinated approach be undertaken, involving various and, at times, quite distinct sectors. FAO is exceptionally well positioned to play a connector role, by facilitating dialogue between those who have the knowledge and those who need it and, furthermore, by bringing critical partners and stakeholders together to the same table.

Human-wildlife conflict: scale and impacts

More than 1.2 billion people currently live in Africa and this population will almost double by 2050 (UN DESA 2019). The ever-growing human population significantly increases demand for natural resources, which in turn leads to degradation and fragmentation of wildlife habitats, as humans and livestock encroach

on them. Wildlife is increasingly competing with humans for limited natural resources, resulting in an increase in the number of human and wildlife conflicts (HWCs). HWC is defined as negative interactions between people and wild animals, with consequences for both people and their resources and wildlife and their habitats (IUCN, 2020).

In Africa, HWCs are not restricted to a particular geographical location and occur in all areas where wildlife and human populations co-exist and must make use of nature's limited resource (Le Bel, 2011). HWCs currently rank among the major threats to the survival of many wildlife species (including endangered), as well as the security and well-being of communities and their livelihoods. In recent years, in several African countries, communities suffer frequent encounters with wildlife, which has led to a significant increase in the number of recorded HWC. In Zambia, an average of 4 600 HWC incidents have been reported annually, over the past eight years (Zyambo, 2019).

In Uganda, the number of reported cases has increased by 37 percent between 2010 and 2019 (Owoyesigire, 2019). In Namibia alone, 8 000 HWC occurrences were reported in 2017 (World Bank, 2019).

HWC are also a growing problem for communities located at the borders of protected areas. The livelihoods of these communities often involve the direct exploitation of natural resources, bringing the communities into direct conflict with wildlife and parks authorities. For example, in South Africa, approximately 30 to 55 percent of local community members reported HWC occurrences due to problem animals from neighbouring protected areas (Spenceley, 2005).

On the whole, HWC causes the destruction of crops, reduced farm productivity, increased competition for grazing lands and water, livestock predation, injury and death to farmers, damage to infrastructure and an increased risk of disease transmission among wildlife and livestock (FAO, 2019).

More specifically to forests, HWC incidents cause negative impacts on forest resources, mainly in the form of the loss of viable trees and the destruction of planted forests, especially when seedlings are still vulnerable (Nolte and Dykzeul, 2000). Forest damage caused by HWCs leads to reduced productivity and forest regeneration and can affect restoration efforts and have serious economic consequences. Prevention and mitigation of HWCs should be considered as an integral element in restoration efforts, in particular in the forthcoming UN Decade on Ecosystem Restoration (2021–2030)².

Between 2014 and 2016, agro-based communities in the southern Zimbabwe incurred in average annual losses of USD 834.65 per household due to elephant crop raiding and lions killing livestock (Clayton *et al.*, 2018); and within the Game Management Areas in Zambia, damages due to monkeys and elephants raiding caused 31 percent and 20 percent in loss of crops, respectively (Subakanya *et al.*, 2018).

² <https://www.decadeonrestoration.org/>

The inability of poor communities to afford fencing, grow alternative crops or implement other preventive measures magnifies the impact HWC have on these already resource-limited communities, exacerbating food insecurity in Africa.

Drawbacks of today's HWC management

Considering the current growth rate of human population, the increasing demand for natural resources and the growing pressure for access to land, HWC poses ongoing challenges that are likely to escalate. There is a pressing need to learn how to effectively reduce or offset such conflicts, to bring them to a level where communities are willing to tolerate long-term coexistence with wildlife (CPW, 2016).

Each case of HWC is unique and its successful management requires understanding of complex social, political and ecological processes. In order to assess the enabling environment and current challenges and capacities of member countries in Africa to deal with HWC, FAO conducted an online survey with technical government officials from the Ministries of Natural Resources, Forestry and Wildlife³, in September 2019.

The survey's findings revealed the three most pressing obstacles that needed to be overcome in dealing with HWC, in their countries, namely: lack of funding; inadequate policy and legal framework and poor law enforcement; and capacity shortcomings, including people, and technical knowledge. The lack of engagement and dialogue among relevant ministries and other public and private sectors was also pointed out by the survey respondents.

A sizeable amount of respondents (68 percent) indicated that a clear mandate to deal with HWC and the issues it causes has been given to a specific ministry or government agency in their country. However, in the current state of affairs, HWC interventions are not adequately framed within a national mandate of many countries. Furthermore, there are significant disparities in the policy and legal frameworks of different countries when tackling HWC. The lack of supportive national frameworks and standalone strategies to deal with HWC, poor enforcement, and inadequately well-defined responsibilities are what primarily deters the implementation of an integrated response to HWC issues.

The survey results clearly suggest that HWC issues at a regional level would benefit from transboundary collaboration and the facilitation of

the exchange of experiences among member countries. It is worth noting that apart from choosing training as the preferred means for improving knowledge and skills on this subject, the survey findings show that developing case studies on HWC and establishing knowledge exchange and expert forums are also recommended. The survey did not contend to entirely assess the full scope of HWC in Africa, but rather provided a snapshot of governments' perceptions of the issue itself, the future needs and priorities at the national level, and what they perceive should be FAO's role in helping them confront this issue in moving forward.

FAO's efforts to reduce HWC and enhance co-existence

In tackling HWCs, FAO uses a multisectorial approach that deliberately brings together all stakeholders affected and involved in the HWC itself. When managing HWC it is paramount to appropriately identify and meaningfully engage key stakeholders and correctly record the occurrence of HWCs in order to ensure that they and their underlying, are well understood. In turn, correct sound testing, adapting and communication strategies can be formulated, which should have the ultimate

³ In total, 61 technical government officials from 31 countries, which are members of the African Forestry and Wildlife Commission, completed the survey. In terms of the geographical distribution, 29 percent of respondents were from Eastern Africa, 25 percent from Western Africa, 20 percent from Central Africa, 14 percent from Southern Africa and 12 percent from Northern Africa.

goal of building trust and an operational basis to work with the local communities affected.

FAO has been supporting the efforts of member countries in managing HWCs by providing technical assistance in various fields. For example, FAO's support includes assistance in the development and implementation of a clear policy and legal framework in Mozambique, Gabon and Zimbabwe; development of a HWC toolkit for use by rural farmers and local communities, in collaboration with CIRAD, BIO-HUB, WWF and CAMPFIRE Association; production and distribution of general and species-specific HWC guidelines and manuals; and delivery of training on how to use the HWC toolkit in Kenya.

As many African countries increasingly grapple with this multifaceted challenge, HWC is beginning to be taken into account in a number of national policies and strategies for wildlife, development and poverty alleviation. However, the current situation has shown that there is a pressing need for transferable interdisciplinary approaches to be further developed and that cross-sectoral collaboration be improved across forestry, wildlife, agriculture, livestock, health and other relevant sectors, at national level.

In recent years, FAO's African Forestry and Wildlife Commission (AFWC) has put greater emphasis



Multisectoral Dialogue to address issues at the human-wildlife-livestock- ecosystem interface (Accra, October 2019). Photo: FAO/RAF

on HWC and its consequences. Specifically, at its 21st Session held in Senegal in 2018, the AFWC requested that FAO provide a platform to exchange good practices and lessons learned from initiatives related to HWC and facilitate capacity-building on sustainable wildlife management.

Following the AFWC's request, and in recognition of the importance of intersectoral collaboration, FAO organized, together with technical government officials from 11 AFWC countries, a Multisectoral Dialogue to address issues at the human-wildlife-livestock-ecosystem interface, in Ghana, in October 2019.⁴ The Dialogue took stock of current efforts to manage HWCs and diseases at the interface and practical experiences at different levels; identified country-specific priorities, including areas of cross-sectoral actions; and helped to formulate a plan with next steps to be taken at a national and transboundary level.

The Dialogue also recognized the importance of understanding the underlying causes of HWC, and better considering the

idiosyncrasies of different people and different cultures in addressing this issue.

Coexistence between humans and wildlife is possible only if local communities inherently recognize the tangible value and benefits derived from wildlife itself, and if such a perspective becomes intrinsically cultural. For this to be achieved, efforts in mitigating HWC must be co-designed and co-owned by the affected community – this lies at the heart of FAO's work in dealing with HWC and diminishing its detrimental impacts on communities and their livelihoods.

The ongoing field activities in Zimbabwe are a prominent example of FAO's efforts to engage local communities from the very beginning when designing initiatives to manage HWC. In July 2019, in close collaboration with CIRAD and BIO-HUB Trust, FAO facilitated the dialogue with local authorities and the affected communities in the Binga Rural District by conducting two field workshops. These workshops had the explicit goal of formulating a *HWC mitigation strategy* at the

⁴ FO:AFWC/2020/inf.4



Local communities discuss the human-wildlife conflict strategy, the Binga Rural District, Zimbabwe. Photo: FAO/Rodina

district level. The Binga District is located in the Kavango-Zambezi Transfrontier Conservation Area (KAZA), which is one of 12 pilot sites of the Sustainable Wildlife Management (SWM) Programme.⁵ Further efforts in implementing the *HWC mitigation strategy* and strengthening the capacity of local communities to deal with HWC are expected to be continued in the coming years, through the implementation process of the SWM Programme.

In the Hurungwe District of Zimbabwe, since March 2019, FAO is implementing a project promoting the sustainable management of HWC and appropriate agricultural practices among vulnerable food and nutrition-insecure communities. FAO supports the local government by promoting sustainable natural resource

management for alternative livelihoods, vaccination of livestock against Foot and Mouth Disease, and by building capacity to implement a wildlife serosurveillance programme.

In Botswana, FAO has completed a technical cooperation project (TCP) which aimed at improving livelihoods in wildlife dominated landscapes and had a strong HWC component. In partnership with the Botswana Predator Conservation Trust and Panthera, local capacity was built in order to prevent and mitigate HWC by ensuring monitoring of the area by community scouts, better livestock management (including herding practices), the construction of predator-proof bomas, and by engaging local communities in ecotourism and wildlife-based businesses.

CONCLUSION

Addressing human-wildlife conflict is a critical element for the successful achievement of several SDGs, specifically the ones related to tackling the root causes of poverty and hunger, namely, SDG 1 (No poverty), and SGD 2 (Zero Hunger), and through its relation with forest management and biodiversity, SDG 15 (Life on Land). The multifaceted nature of the issue of HWC requires cross-sectoral collaboration among various sectors, including forestry, wildlife, agriculture, livestock, health and others. FAO will continue to play a critical role of *connector* by facilitating multisectoral dialogue, guided by its Strategy on Mainstreaming Biodiversity across Agricultural Sectors,⁶ which has been adopted at the 163rd Session of the FAO Council in December 2019, and also through its Biodiversity Mainstreaming Platform.⁷

⁵ Further info about the SWM Programme: <http://www.fao.org/forestry/wildlife/95602/en/>

⁶ <http://www.fao.org/3/ca7175en/ca7175en.pdf>

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Diversity of restoration



plants

for Africa's Great Green
Wall implementation

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Photo: Public Stock

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SUMMARY

FAO's Action Against Desertification (AAD) was conceived by an understanding that development challenges are interlinked and require integrated solutions. In support of the implementation of Africa's Great Green Wall Initiative (GGWI), the project addresses the three pillars of sustainable development – environmental protection, economic viability, and social equity.

Over the last decade, FAO has become a key technical partner in building this programme of opportunities for Africa's drylands and its people. In five years, Action Against Desertification has brought 50 000 hectares of degraded land under restoration, planting 25 million diverse trees and fodder herbaceous species useful to rural communities. A total of 90 tonnes of forest seed and over 5 million seedlings of 110 woody and herbaceous fodder species were produced and planted in support of its land restoration work. Plant diversity is crucial to sustainably produce enough nutritious food in the face of challenges, such as climate change, emerging diseases, pressure on feed and water supplies, and shifting market demands of a growing human population. Promoting biological diversity is important both for food production and conservation of the ecological bases that are necessary to sustain life and build rural livelihoods. This land restoration approach is being replicated elsewhere and has great potential to be upscaled.

Introduction

On the global scale, biodiversity erosion is such that current trends are already deemed by the scientific community to foster the extinction of an estimated one million species currently at risk (IPBES, 2019). According to IPBES, human actions threaten more species with global extinction now than ever before, and on average, around 25 percent of species in assessed animal and plant groups are threatened. However, one most promising trend is that forests in protected land areas or protected by conservation schemes are very likely to survive the impacts of human development (Chazdon *et al.*, 2016). During the last decades, many reforestation efforts and initiatives have tried to reduce the further disappearance of species not only that of a degraded and fragile ecosystems but also of a continuously degrading ones. For some species of which stand at the brink of extinction (IUCN Red List, 2016), sowing diversified endemic and naturalized tree and grass help to restore the spatial patterns of the original Sahel forest fragments while recreating

its original landscapes. Such re-greening efforts are sustained through the implementation of the ambitious Africa's Great Green Wall initiated in 2007 by the African Union (AUC, 2012), aiming to restore 100 million hectares of degraded agrosylvopastoral lands by 2030, as recently pledged at the UNCCD COP 14. Moreover, African countries at the Paris climate summit in 2015 have committed substantial pledges for the AFR100 with the goal to also restore 100 million hectares in Africa by 2030.

Globally, there are almost 400 000 plant species, of which there are more than 60 000 tree species in the world (Beech *et al.*, 2017). Around 2 400 species of trees, shrubs, palms and bamboo are actively managed for products and/or services. A little over 6 000 plants species have been cultivated as food crops. In general, natural forest areas are decreasing and planted forest areas are increasing. The global annual net loss of natural forests decreased from some 10.6 million hectares in the 1990s to 6.5 million hectares between 2010 and 2015 (FAO-FRA report).

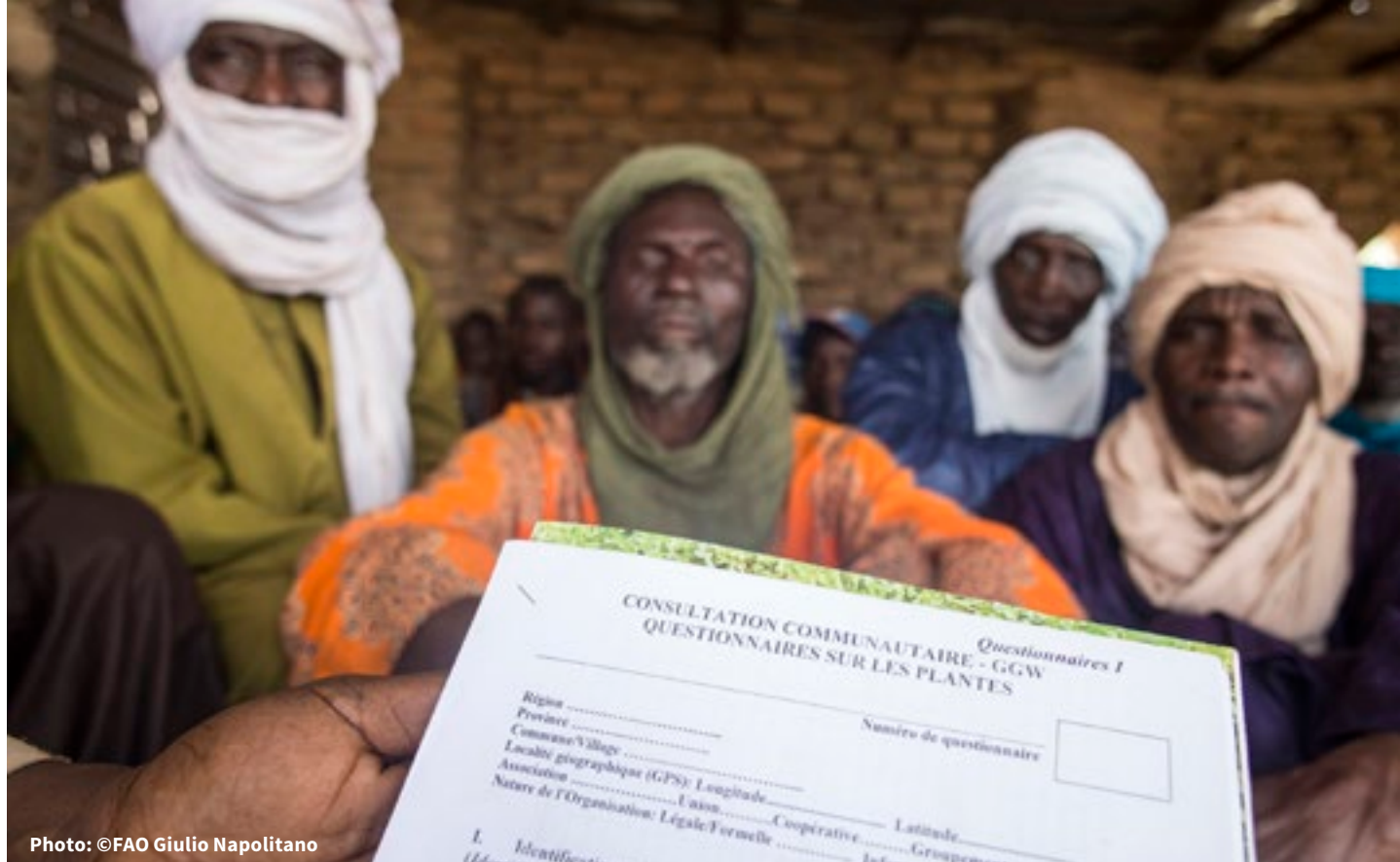


Photo: ©FAO Giulio Napolitano

In its 2018 report on land degradation, IPBES warned that land degradation negatively affects 3.2 billion people and represents an economic loss in the order of 10 percent of annual global gross product. According to IPBES, “combatting land degradation... is an urgent priority in order to protect the biodiversity and ecosystem services that are vital to all life on Earth and to ensure human well-being”. Desertification, land degradation and drought are grave challenges. They lead to hunger and poverty, drive unemployment, force migration and conflict while increasing the risk of extreme weather. Together, they have far-reaching negative effects on human health, physical infrastructure, natural resources, and security.

Many well-tested land restoration practices and techniques, both traditional and modern, can help

avoid or reverse degradation and maintain biodiversity, and successful examples are found in different ecosystems. On average, the benefits of restoration are 10 times higher than the costs, and include food security, reduced negative effects of climate change and biodiversity protection (IPBES, 2018). Without such actions to restore, there will be a further acceleration in the global rate of species extinction.

FAO is a long-standing supporter of the Great Green Wall Initiative, Africa’s flagship programme to combat climate change and desertification. Launched as a tree-planting scheme to hold back the desert, it is now an integrated rural development programme, championing a grassroots-driven, science-based approach to environmental restoration and sustainable development (Sacande & Berrahmouni, 2018).

The Great Green Wall can be a game-changer for Africa, transforming the lives of millions of people by creating a great mosaic of green, biodiverse and productive landscapes across North Africa, the Sahel and the Horn.

FAO’s Action Against Desertification (AAD) supports restoration interventions recognized as a priority by the Great Green Wall countries. It is estimated that 166 million hectares of the GGW core area provide opportunity for restoration and to reach this target by 2030, 10 million hectares need to be restored each year (Berrahmouni *et al.*, 2016). But how will it be possible to translate these numbers into reality? And how will it be possible to win the race for restoration against time? We present here the achievements of Action Against Desertification in restoring degraded land with well-adapted multipurpose species.

Diversity of community priority restoration plant species

1: Community mobilisation and selection of restoration species

Experience has shown that the level of community participation from the early stages of restoration often determines the degree of success in restoration. Communities are central in the restoration process and may be directly involved in the selection of sites to restore, species selection, seed collection, planting and management of the restored areas. The selection of species used in restoration in particular has to be carried out based on community's needs and priorities (Sacande and Berrahmouni, 2016).

Engaging with rural communities

For restoration to succeed, communities needs and concerns have to be well understood (Figure 1). As for any project or development activities affecting them or their territories, communities have the right to give or withhold consent to a restoration project. They need to be able to conduct their own independent and collective discussions and decision-making. Free, Prior and Informed Consent (FPIC) provides a set of guiding principles that guarantee indigenous communities these rights, and uses participatory assessments to understand and document people's needs and concerns.

Consultation meetings with communities can allow assessing their commitment and motivation but also their needs and requirements for restoration. Moreover, these meetings provide a forum for communities to suggest possible sites for restoration. Clear land tenure is a prerequisite for restoration activities to begin.

Selecting useful species for restoration

A key factor of success is if communities determine which plant species (of trees, shrubs and grasses) they want to use in restoration and how well those species are adapted to the local landscapes. Due to the fact that traditional ecological knowledge is usually poorly documented and may only be captured through local surveys, AAD uses questionnaire surveys and focus group discussions to capture traditional or local

knowledge on species, their uses in the communities and their presence in the area. The categories and proportions of native species selected and preferred by communities are presented in Figure 2.

Once the preferred species have been identified, a prioritization exercise can be carried out by community members according to their lifestyles, well-being aspirations and opportunities to generate value from their environment. It is important to complement local knowledge and preferences for species with accurate and up-to-date botanical and ecological analyses, as some of the species desired by community members may not be suitable for restoration in the targeted sites, such is the case for exotic species or species adapted to more humid environments. Native species should be preferred, as they are adapted to local ecological conditions and are more suitable for the natural re-establishment of the native flora and fauna species, thus contributing to ecosystem resilience (Le Houerou, 1989). Exotic species, on the other hand, may cause major environmental disruptions, especially invasive species that compete with and replace native species. However, on communities' request, some of those exotic species are planted, not for restoration but for other purpose such as home/nutrition gardens, firewood production, etc.

Across the eight African AAD countries, over 200 species including at least 86 tree species were mentioned as useful species by communities (Figure 3). Plant use data was also recorded and used to classify species. Species with multiple uses and high market value were usually preferred, with the largest proportion of given uses respectively human and veterinary medicine, food and livestock feed (Figure 2). *Acacia senegal*, (also known as *Senegalia senegal*), for example, is a major restoration species with multiple uses, mainly improving soil fertility and used to produce gum arabic, but it is also a source of food, fodder and honey (NGARA, 2017; Sacande and Parfondry, 2018).

2: Restoration interventions

The large-scale restoration approach of AAD in support of the GGW is implemented at the landscape scale and across land uses and production agrosilvopastoral systems. It involves many sectors and groups, and it puts communities – and their livelihoods – at the centre (Sacande and Berrahmouni 2018; Sacande *et al.*, 2020). Restoration must be understood, planned and tackled along the entire value chain, from land and seed to end products and markets, so that to serve both economy and ecology. Restoration success requires supportive policies; good governance; sufficient technical, operational and financial capacities; incentives for communities to sustain their actions; and continuous monitoring and learning. AAD intervention actions according to contexts and landscapes include:

- (i) **Promoting natural regeneration**, in which farmers protect and manage the natural regeneration of and enrichment with native species in forest woodlands, croplands and grasslands (most likely to be effective in the dry subhumid and semi-arid zones).
- (ii) **Investing in large-scale land preparation and enrichment planting** where degradation is so severe that natural vegetation will not regenerate on its own. Mechanized ploughs are used to prepare land at bigger scale 50 to 200 ha per village and communities select the native woody and grass species to be planted (most likely to be required in the arid and semi-arid zones). On any given site, the diversity of planted species amounts to a minimum of ten species per hectare, combining grasses, trees and shrubs, so as to maximize ecological functions and build better resilience on the ground (see Figure 4; Sacande *et al.*, 2020).
- (iii) **Fighting sand encroachment** by establishing and protecting native woody and grassy vegetation adapted to sandy and arid environments (most likely to be required in the arid, hyperarid zone).
- (iv) **Mobilizing high-quality seeds and planting materials** of well-adapted native woody and herbaceous fodder species to build ecological and social resilience.
- (v) **Developing comprehensive value chains** that benefit local communities and countries and enable the flourishing of green economies and enterprises.
- (vi) **Building simple, cost effective, robust, participatory monitoring systems** to support baseline assessments, identify interventions, track progress, inform stakeholders and investors, and aid learning and adaptive management.



Photo: ©FAO Benedicte Kurzen

FIGURE 1. AAD's large-scale restoration approach with the rural communities at the heart, with dual benefits to their livelihoods and the agrosylvopastoral landscapes.

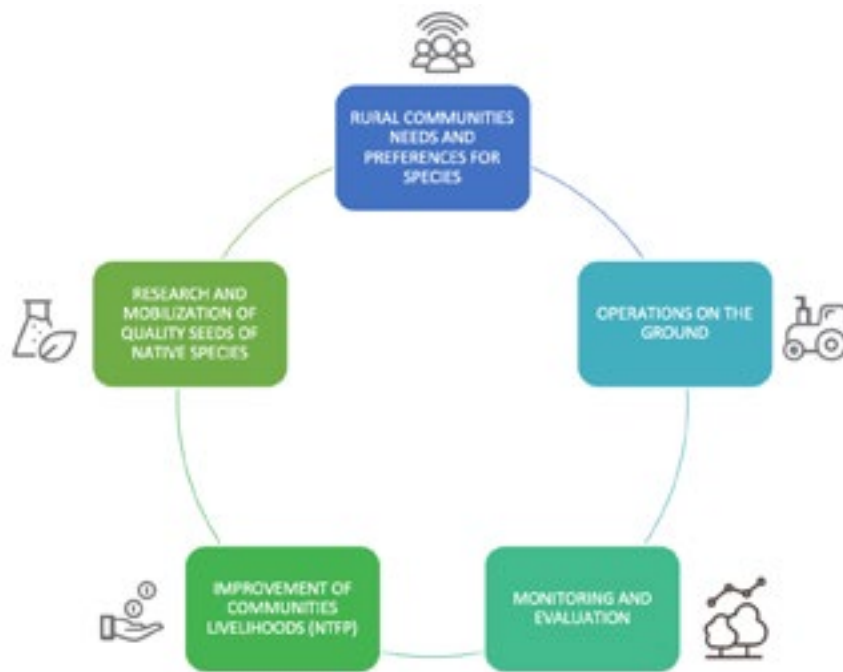


FIGURE 2. A diversity and important plant species selected and used by AAD's rural communities for their livelihoods in eight African GGW countries (Burkina Faso, Ethiopia, the Gambia, Mauritania, the Niger, Nigeria, Senegal and the Sudan). Only native species are planted for restoring degraded lands in agrosylvopastoral landscapes, while the exotic species are planted in home gardens.

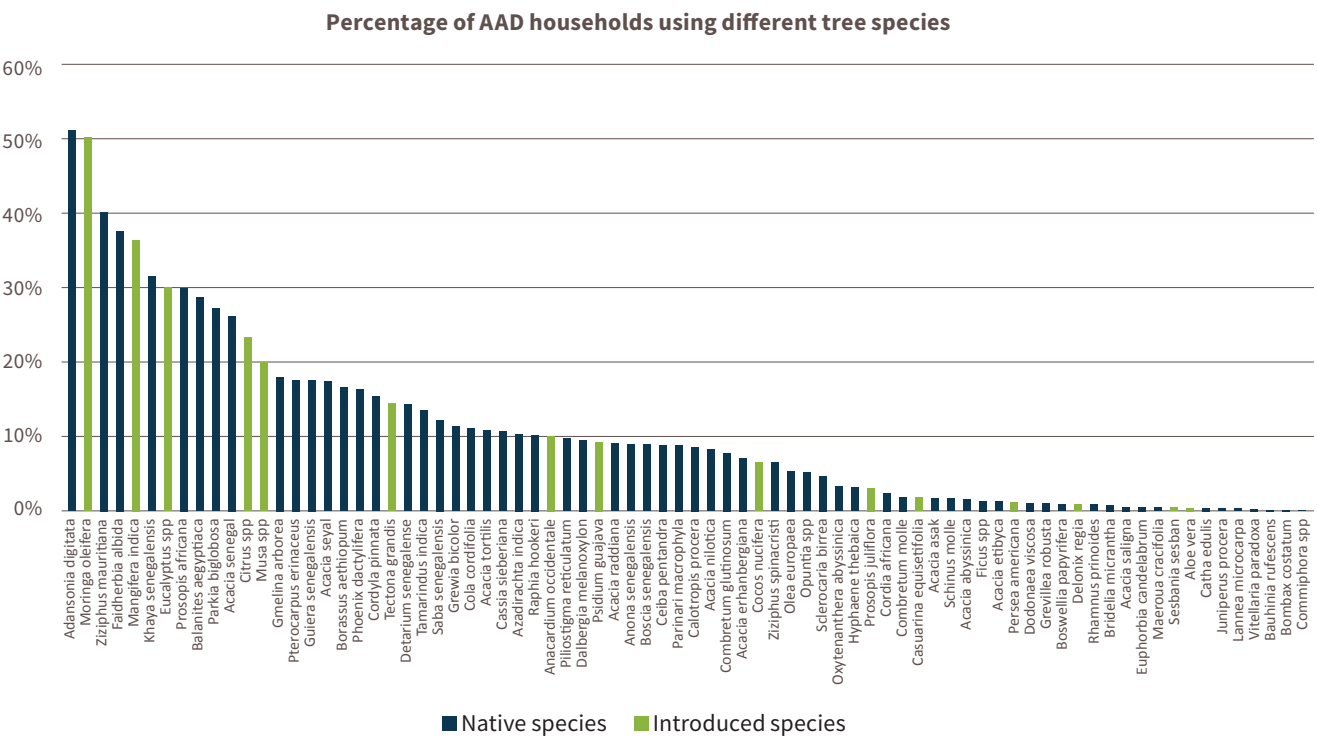
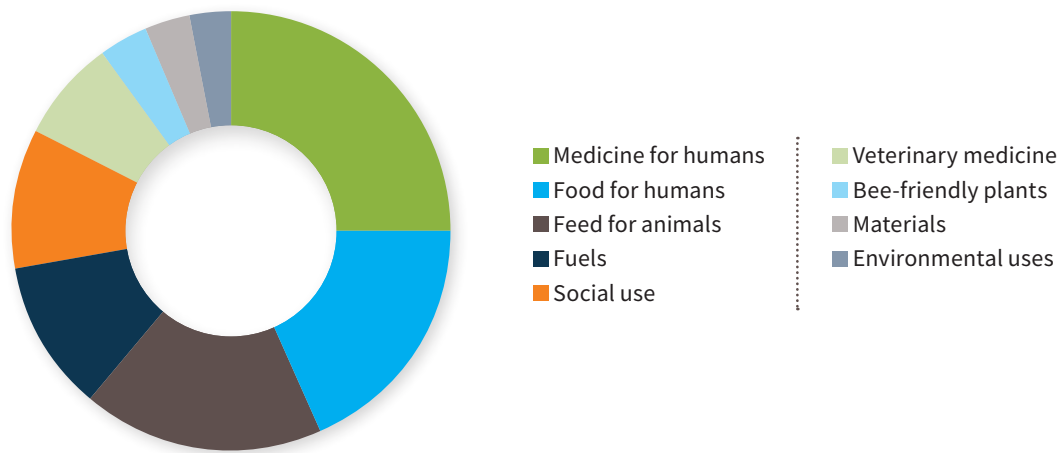


FIGURE 3. Classification of species by use category defined by the rural communities in AAD intervention areas. Out of the 150 preferred species, most are multipurpose and plants with high market value were usually preferred, with the largest proportion for human and veterinarian medicine, food and livestock feed.



Benefits of large-scale restoration to communities

Action Against Desertification is not about the planting of trees, shrubs and grasses and increasing biomass only. Its interventions help rural communities to earn a decent income by supporting the development of value chains of non-timber forest products, including beekeeping and honey production. So far, there are two categories of restoration benefits to communities: the primary benefits being for farmers who directly take part in the interventions (whether through participation in training courses, capacity-strengthening or a planting campaign, for example) and the benefits derived from access to and development of non-timber forest products. An estimation of investment costs comes to about USD 400 per hectare including

initial land preparation (manual and/or mechanised), planting with multispecies and maintaining planted plots over a period of five years (2014–2019). The reclaimed restored land is managed in a sustainable way, aiming at increased agricultural productivity, while improving the resilience of the agrosylvopastoral systems. At the same time, five main sectors of dryland non-timber forest products are developed to reach local, national and international markets. These include production and transformation of (i) feed, including selected herbaceous fodder, and food (adapted pulses); (ii) gums, including gum Arabic, and resins; (iii) native dryland plant oil (including balanites); (iv) restoration seeds, wild fruits (including *Citrullus*, a group of melons); and (v) hides and skin for leather (livestock).

Results of two products, i.e. planted herbaceous fodder and collected *Balanites aegyptiaca* fruits (desert dates, planted as seedlings but fruits collected from existing natural stands) show that there are substantial direct benefits from restoration interventions and plant diversity. In Burkina Faso, an average of 1 200 kg of planted herbaceous fodder per hectare was harvested on restored plots just one year after planting, generating revenues of USD 40 per hectare, equivalent to half of Burkina's monthly minimum wage. One can speculate that the over 10 000 ha under restoration in Burkina potentially yield USD 400 000 per year as direct benefit from fodder only to Burkinabe farmers. Women making soap from balanites oil, which is also edible, saw their incomes double, with one harvest per year.

“PLANT DIVERSITY IS CRUCIAL AS A SOLUTION TO SUSTAINABLY PRODUCE ENOUGH NUTRITIOUS FOOD IN THE FACE OF CHALLENGES, SUCH AS CLIMATE CHANGE, EMERGING DISEASES, PRESSURES ON FEED AND WATER SUPPLIES AND SHIFTING MARKET DEMANDS OF A GROWING HUMAN POPULATION”

A specific recent study on the socio-economic impacts of AAD interventions finds similar results in Senegal. The report highlights that during the last two years 2017–2019 in the dry season (November to May), the village communities that benefited about 4 000 ha degraded lands planted for restoration, issued a token system for fodder harvesting in their plots. They earned 2 USD per donkey cart or 4 USD for a car, (a volume of fodder of about 100 kg). At an estimated biomass production of 1 ton of hay per hectare sold at 10 carts/ha, this

operation generated 80 000 USD on average per yearly harvest for the communities. In the same localities, women groups are supported in transforming fruits of balanites, the desert dates, into products including its edible oil sold 4 USD per litre, its soap sold at 1.5 USD/100 g and its jam at 2 USD the litre (Vrydagh, 2019).

A recent comparative study on ecological restoration contributions to fodder supply and food security of local communities by the Institute National de Recherche

Agronomique of Niger (INRAN, 2019 forthcoming) concludes that in FAO's AAD intervention areas, ecological restoration efforts in sylvopastoral systems is improving biodiversity, increasing biomass and vegetation cover. Of 28 plant species investigated, including 15 woody and 13 herbaceous species, the cattle diet in rainy season was composed of all of the 13 planted herbaceous species, then decreasing to nine of those species after the rainy season and to just three species in the hot dry season.

FIGURE 4. An example of large-scale restoration interventions and the transformative change of the 200 ha landscape in Burkina Faso. The diversity of planted species amounts to a minimum of 10 useful native species per hectare, combining fodder grasses, trees and shrubs, so as to maximize ecological functions and build better resilience on the ground.





These cases illustrate that the restoration impacts that seem to be the most important to the population are those that can be observed directly or in a short time, as well as those that will have economic benefits. These criteria of speed and economic interest seem essential. The needed trees with slower growth, it is in the years to come that the inhabitants will be able to measure the benefits. By all means, this highlights that land degradation cannot be tackled without unleashing the economic potential of Africa's drylands.

Expanding Africa's Great Green Wall of opportunities

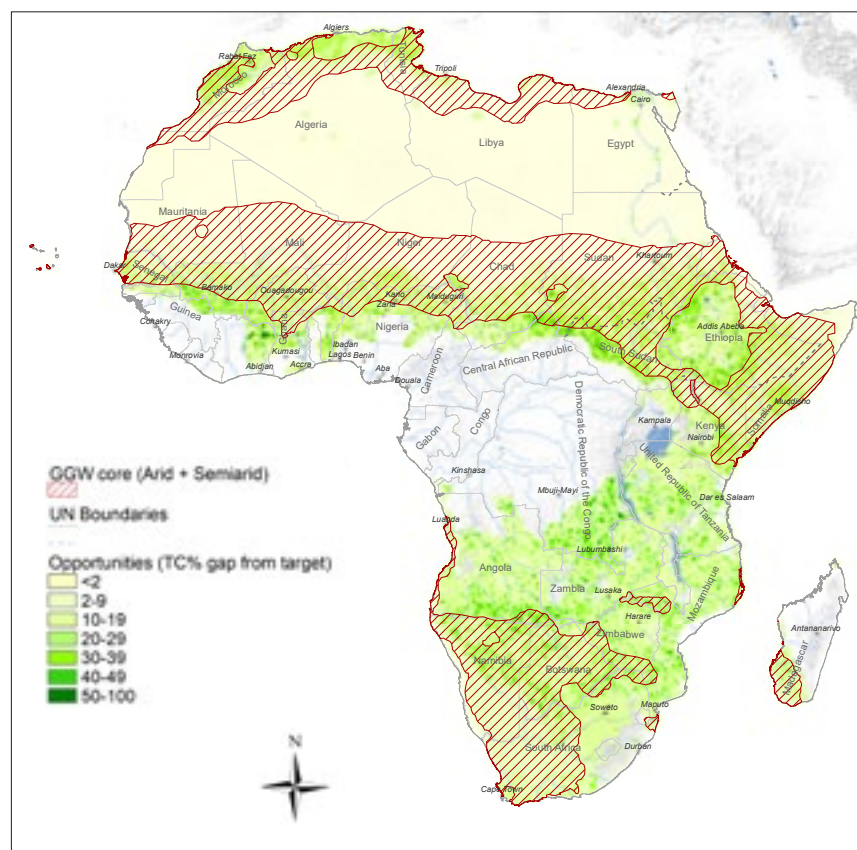
What has started in the GGW for the Northern Africa, the African Union is now expanding it to

sub-Saharan African communities and their drylands. FAO and partners are working with the regional/SADC countries on a similar operational programme and approach to address desertification and land degradation issues. As a whole, 221 million hectares of Africa's drylands are restorable – 166 million in the north and 55 million in the south of the continent. Overall, the Great Green Wall core area of arid and semi-arid zones covers nearly one billion hectares – 780 million in the north and 228 million in the south. Two hundred and fifty-six million people live there – a ratio of 4 hectares per person.

GGW Sahel core area is estimated at 780 million ha with 166 million ha restorable (see

Berrahmouni *et al.*, 2016). Using a similar analyses from the global dryland assessment data, AAD has derived the GGW/SADC core area estimated 228 million hectares, within which the restoration needs and opportunities cover 55 million hectares in the drylands of that sub-Saharan African region (see Figure 5). Taken together, a global potential of 221 million hectares in Africa's drylands are restorable. These are, therefore, huge opportunities to make the most of 'unused' and/or non-arable lands fertile again, providing a massive prospect for mitigating climate change and for socio-economic prosperity for the continent, the scale of which is unparalleled and never seen before.

FIGURE 5. Mapping landscape restoration needs and opportunities in Africa's drylands, estimated 221 million hectares in arid and semi-arid zones (all green within hatched lines). High restoration needs and opportunities (in dark green); Low or no need/opportunity for restoration (in light green); GWG core areas are shown within the borders with hatched lines.



GLOBAL SCALE

GGW Sahara-Sahel

- 780 million ha core area
- 166 million ha restorable

GGW Kalahari-Namib

- 228 million ha core area
- 55 million ha restorable

Total = 1.008 billion ha core areas

People living in these drylands

GGW Sahara-Sahel - 232 million

GGW Kalahari-Namib - 24 million

**Total = 0.256 billion -
equivalent 4 ha/person**

CONCLUSION

The conception of FAO's Action Against Desertification was guided by an understanding that development challenges are interlinked and require integrated solutions. The project was designed to address the three pillars of sustainable development – environmental protection, economic viability and social equity. Plant diversity is crucial as a solution to sustainably produce enough nutritious food in the face of challenges, such as climate change, emerging diseases, pressures on feed and water supplies and shifting market demands of a growing human population. In agricultural ecosystems, safeguarding biological diversity is important both for food production and conservation of ecological bases necessary to sustain life and build rural livelihoods. In five years, Action Against Desertification has brought 50 000 hectares of degraded land under restoration, planting 25 million trees and reaching 500 000 people in 325 communities. Over 100 useful woody and herbaceous fodder species were used in land restoration work.

The land restoration approach developed by AAD (biophysical and socio-economic) is being replicated elsewhere and has great potential to be upscaled massively. After nearly a decade of involvement in dryland restoration, culminating in Action Against Desertification, the devised blueprint for large-scale restoration of drylands in Africa can make a substantial contribution to achieve land degradation neutrality by 2030.

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► For further information, see:

AAD Website: <http://www.fao.org/in-action/action-against-desertification>

Africa's



biodive

mainstreaming across
agricultural sectors

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Photo: Public Stock

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rsity

Africa's biodiversity: rich but at risk

Biodiversity at all levels – genetic, species and ecosystems – is critical for safeguarding global food security, underpinning healthy and nutritious diets, improving rural livelihoods, and enhancing the resilience of people and communities.

Biodiversity, coupled with a wealth of traditional knowledge of the continent, play a key role in promoting resilience in production systems, improving livelihoods and supporting food security and nutrition.

Africa hosts 25 percent of the global biodiversity, but its biodiversity is alarmingly under pressure. Recent findings on the threats of biodiversity loss and ecosystem degradation from the Food and Agriculture Organization of the United Nations (FAO)'s *The State of the World's Biodiversity for Food and Agriculture* and *The Global Assessment Report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* have put agriculture at the crosshairs of an intense debate about sustaining the future of the people and the planet.

Despite several positive developments that support biodiversity conservation and sustainable use in Africa, great challenges are still faced because the true value of biodiversity

contributions to human well-being is still underappreciated, particularly in decision-making processes and investments. Biodiversity is still and often taken for granted. The fast-paced economic development, rapid urbanization and population growth are major threats to the rich biodiversity of Africa, which continues to be depleted at an alarming scale. The current economic growth model can no longer be sustained since the earth's carrying capacity can no longer meet the demands of the growing population and urbanization in the region.

Africa's current population of 1.25 billion is likely to double by 2050 and will put severe pressure on the continent's biodiversity. Unless appropriate policies, investments and strategies are adopted and effectively implemented, especially in this region which is extremely vulnerable to the impacts of climate change, the ability of nature to satisfactorily contribute to people's survival will greatly diminish.

Mainstreaming biodiversity across agriculture sectors is the answer

With the critical need to address this issue immediately, the FAO Conference in 2017 welcomed FAO's initiative to act as the Biodiversity Mainstreaming Platform.⁵ The Conference recommended FAO to facilitate, in collaboration with its partners such as the Convention on Biological Diversity (CBD) and other UN organizations, the integration and coherence of actions on the conservation, sustainable use, management and restoration of biological diversity across agricultural sectors at national, regional and international levels.

In 2018, FAO co-organized the first global multistakeholder dialogue on biodiversity mainstreaming in Rome, which was followed by a series of regional dialogues. The African Regional Dialogue was held on 4–5 November 2019 in Kigali, Rwanda.

⁵ C 2017/REP, paragraph 55. The Biodiversity Mainstreaming Platform Brochure is available at: <http://www.fao.org/3/CA2403EN/ca2403en.pdf>



Photo: ©FAO Petterik Wiggers

An Africa Multistakeholder Dialogue geared towards action

During the two-day event, highly participatory and vibrant dialogues highlighted the main biodiversity challenges in Africa. These challenges include land conversion, deforestation, encroachment, unsustainable land and agriculture practices, climate change, drought and water scarcity, conflicts, land tenure insecurity, inadequate investments for biodiversity-friendly practices, lack of integrated planning for local-level implementation, lack of access to markets, and

weak enabling environment for cross-sectoral collaboration among different ministries.

Conference participants discussed at length new opportunities to bring biodiversity actions at the fore of the global, regional, national and local level awareness. At the global level, the development by the CBD of the Post-2020 Global Biodiversity Framework, the UN Decade on Ecosystem Restoration (2021–2030) co-led by FAO and UNEP, the UN Decade on Family Farming (2019–2028) co-led by FAO and IFAD, and FAO's Strategy on Mainstreaming Biodiversity across Agriculture Sectors⁶ are highly relevant opportunities and spaces for

agriculture sectors to be engaged and ensure that biodiversity is mainstreamed across agricultural, environment, finance, education, culture and other sectors.

Additionally, FAO global biodiversity-related instruments, such as the International Treaty on Plant Genetic Resource⁷ and the Global Plans of Action of the Commission on Genetic Resources for Food and Agriculture,⁸ provide tools and entry points for regional and national actions. The FAO Committee on Agriculture (COAG), Committee on Fisheries (COFI) and Committee on Forestry (COFO) have also integrated biodiversity mainstreaming in their agendas.

“THE CURRENT ECONOMIC GROWTH MODEL CAN NO LONGER BE SUSTAINED SINCE THE EARTH’S CARRYING CAPACITY CAN NO LONGER MEET THE DEMANDS OF THE GROWING POPULATION AND URBANIZATION IN THE REGION”

⁶ CL 163/11 Rev.1

⁷ <http://www.fao.org/plant-treaty/en/>

⁸ <http://www.fao.org/cgrfa/en/>

At the regional level, the following initiatives and/or platforms can be built upon:

- Africa's Great Green Wall under the leadership of the African Union Commission and member countries;
- The African Forest Landscape Restoration Initiative (AFR100) under the coordination of the African Union Development Agency (AUDA-NEPAD), engaging 29 countries committed to restore over 100 million hectares by 2030;
- The Pan-African Agenda on Ecosystem Restoration for Increased Resilience as part of Africa's contribution to the UN Decade on Ecosystem Restoration (2021–2030);
- The Sustainable Forest Management Framework for Africa (2020–2030) endorsed at technical and ministerial levels by the AU Specialized Technical Committee on Agriculture, Rural Development, Water and Environment, held on 21–23 October 2019 in Addis Ababa, Ethiopia;
- The AU Strategy on Combatting Illicit Exploitation and Trade in Wild Fauna and Flora;
- The Africa Youth Ambassadors;
- The AU Eco-Agriculture Initiative; and
- FAO regional statutory and governance bodies such as the African Forestry and Wildlife Commission and the African Regional Conference.

In some countries, national and local level participatory platforms or mechanisms have been put in place. Biodiversity-friendly agriculture practices, which are very familiar to most Africans, should not be difficult for scaling-up and adoption. There are interesting innovations with youth playing significant roles in many global, regional and national projects and programmes that make them the 'agents of change' in an interconnected world through the use of Information and Communications Technology (ICT) and technologies in agriculture. There are ongoing inclusive national training initiatives for agribusiness and entrepreneurs, targeting the 60 percent of the population of women and youth in many African countries, which are boosting job creations and vibrant opportunities.



Photo: ©FAO

Recommendations and next steps

Participants of the African Regional Dialogue agreed to put forward the following recommendations to the global and regional intergovernmental institutions, financial partners and national governments, and to FAO specifically:

1. Awareness-Raising and Identifying “Country Champions” on Biodiversity Mainstreaming across Agriculture Sectors.

- Participants called for a “paradigm shift” of agriculture and food systems, taking into account the urgent need for all stakeholders to ensure that biodiversity is mainstreamed in agriculture sectors. The call for a “paradigm shift” of the agriculture and food systems would require:
- Connecting biodiversity conservation and sustainable use with food security and nutrition, neglected crops species, human health, climate resilience, among others;
 - Recognizing and fostering the conservation of neglected and traditional crops and breeds, and practices, which increase the provisions of ecosystem services such as pollination, among others;
 - Enabling biodiversity-friendly and conscious decision-making along biodiversity-based products and ecosystem services value chains;
 - Considering the true value of biodiversity contributions to human well-being and ecosystems services and in return investing proactively in its conservation and sustainable use by decision-makers, governments and investors;
 - Identifying the champion countries that will promote the institutionalization of biodiversity-friendly interventions, policies and investments and serve as examples for others.

2. Research, Documentation and Development of New Tools for Biodiversity-Friendly Agriculture Business Case Models.

- The lack of evidence-based information should be given a priority. Traditional practices are often not acknowledged and there is a need to bring together science and traditional knowledge. Several African countries started to capture the value of biodiversity-friendly practices through natural capital accounting, paving the way for new policies and incentive schemes. Participants recommended:
- Building the business case for agriculture sectors that are biodiversity-friendly and viable;
 - Committing to a stocktaking exercise of documenting and exchanging (accessible and cost-effective) good practices to provide good insights for replication and scaling-up, and more importantly as support to policy instruments on biodiversity mainstreaming in agriculture sectors.

3. Knowledge and Information Sharing to Create Synergies toward the Redesign of New Agriculture and Food Systems.

- Knowledge should be coordinated coherently across Africa, shared at national level and trickled down to community levels. Participants recommended to FAO to develop:
- A searchable, web-based database of policies, tools, guidance and business cases for sustainable use, conservation and valuation of biodiversity;
 - A participatory regional web-based discussion forum and information-sharing mechanism (new tools, success stories and failures, events, funding opportunities).



Recommendations (Cont.)

- ◀ **4. Multistakeholder National Platforms for Networking, Alliances and Partnerships** on biodiversity sustainable use and conservation should be strengthened and institutionalized. Participants recommended:

- Upon request by governments, FAO country offices would act as facilitators for national biodiversity dialogues across sectors of agriculture, including crops and livestock, forestry, fisheries and aquaculture, environment, planning, finance, education, culture, among others. These dialogues should include representatives from national and local levels and build and strengthen alliances among women, youth, farmers, pastoralists, forest users and producers, traditional leaders, private sector, academia, research, etc.

- 5. Capacity-Development including Training, Especially Targeting Youth and Women** that constitute 60 percent of the population, enabling them to work with their communities with technical and financial tools. Participants recommended:

- Harnessing fresh graduates who would like to give back to their communities by giving them start-up kits and training for biodiversity social entrepreneurship in agriculture sectors;
- Supporting producers, especially youth and women, with new models of vocational training (away from traditional classroom models);
- Developing education programmes on biodiversity values, conservation and sustainable use, across different learning curriculum, formal and informal education.

- 6. Strengthened Integrated Ecosystem Approaches for Uptake by Governments.** Participants recommended:

- Scaling up existing successful projects and experiences into larger programmes, such as national initiatives on sustainable fisheries and aquaculture, sustainable forest management, landscape restoration, conservation agriculture,

agroecology, agroforestry, in-situ and ex-situ conservation of genetic resources for food and agriculture, pollinators, conservation of heritage and traditional agricultural practices and sites like Globally Important Agricultural Heritage Systems (GIAHS).

- 7. Strengthened Enabling Laws, Regulations and Policy Frameworks.** The national implementation of already ratified biodiversity-related global treaties and protocols remains a challenge. Few countries exemplified their enactment of laws and policies that are directly related to biodiversity. Insecure land tenure remains a major challenge in Africa. Since youth are “agents of change” in agriculture sectors, it is essential to make agriculture sectors attractive for youth through creating attractive livelihoods in rural areas and reducing the drudgery of work. Participants recommended:

- Giving women and youth the opportunity to become leaders and to express their voices in policy fora;
- Investing in rural development and diverse markets, and work-saving technologies such as ICT, mechanized agriculture and other innovations.

- 8. Involving of the Private Sector in Biodiversity Financing.** Participants recommended:

- Considering and developing innovative funding models for biodiversity-friendly investment, such as blended financing, public-private partnerships and private sector initiatives.

- 9. Reviewing and revising value chains** to allow for the development of markets for biodiversity-friendly products.

- 10. As a follow-up to these above recommendations,** FAO will prepare regional priority actions for the development of the Action Plan for the implementation of the FAO Strategy on Mainstreaming Biodiversity.

For further read on Biodiversity



The State of the World's Biodiversity for Food and Agriculture (2019)

The *State of the World's Biodiversity for Food and Agriculture* presents the first global assessment of

biodiversity for food and agriculture worldwide. The report complements other global assessments prepared under the auspices of the Commission on Genetic Resources for Food and Agriculture, which have focused on the state of genetic resources within particular sectors of food and agriculture.

🔗 Link: <http://www.fao.org/3/CA3129EN/ca3129en.pdf>



Africa Regional Synthesis for The State of the World's Biodiversity for Food and Agriculture (2019)

This report summarizes the state of biodiversity for food

and agriculture in Africa based on the information provided in country reports submitted to FAO as part of the reporting process for *The State of the World's Biodiversity for Food and Agriculture*.

🔗 Link: <http://www.fao.org/3/ca4643en/ca4643en.pdf>



Restoration in Action Against Desertification (2020)

This publication supports processes related to rural communities' resilience in implementing land restoration of the Great Green

Wall programme on the ground. It serves a dual purpose of consolidating biophysical operations and socio-economic assessments, and is mainly built on five-year interventions and practical experiences gathered through Action Against Desertification.

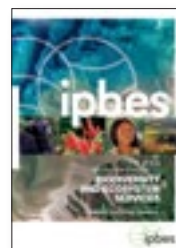
🔗 Link: <http://www.fao.org/3/ca6932en/CA6932EN.pdf>



The Sustainable Forest Management Framework for Africa 2020-2030 (2020)

AU Sustainable Forest Management Framework (2020-2030) was collaboratively developed with

the active participation of AU Member States and the Regional Economic Communities under the coordination of the African Union Commission. This framework serves as a guideline for AU Member States and other African stakeholders in the forestry sector to assist them in their efforts to eliminate deforestation and forest degradation by 2063.



The IPBES Global Assessment Report on Biodiversity and Ecosystem services (2019)

The *IPBES Global Assessment Report on Biodiversity and Ecosystem Services* is the first intergovernmental report

and builds on the landmark Millennium Ecosystem Assessment of 2005, introducing innovative ways of evaluating evidence. The Report assesses changes over the past five decades, providing a comprehensive picture of the relationship between economic development pathways and their impacts on nature.

🔗 Link: https://ipbes.net/sites/default/files/inline/files/ipbes_global_assessment_report_summary_for_policymakers.pdf

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