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Southern Africa's Dryland Forests, Climate Change and the Water–Energy–Food Security Nexus

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ABOUT THE PROJECT

This paper is one of the outputs following a conference titled *Best Practice in the Governance of Africa's Dryland Forests: Implications for Southern Africa*, co-hosted by SAIIA's GARP and SADC's Food, Agriculture and Natural Resources (FANR) Directorate in October 2013, with generous support from the Norwegian Ministry of Foreign Affairs and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

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Please note that all currencies are in US$ unless otherwise indicated.

ABSTRACT

Forests and trees in Southern Africa's drylands provide a multitude of goods and services, ranging from timber and non-timber forest products (NTFPs) to carbon sequestration and the protection of watersheds and biodiversity. These benefits are threatened by high levels of deforestation and forest degradation, the direct causes of which include conversion of forested land for agricultural use and extraction of timber and NTFPs (notably for fuel wood and charcoal). Climate change and encroaching desertification add additional stressors in a region already under pressure. In the context of these very real pressures, the forestry sector is easily marginalised or even pitted against sectors such as water or agriculture. In reality, however, these sectors are intricately linked. This paper identifies the water–energy–food security (WEF) nexus as an appropriate conceptual lens through which to explore interdependencies among these sectors and forestry, in the context of climate change. Instead of a default adversarial position, it is argued that policymakers should first consider possible win-win solutions. Where trade-offs cannot be avoided, a nexus approach can provide a basis for negotiation and assist in minimising adverse outcomes.

ABOUT THE AUTHOR

Mari-Lise du Preez wrote this paper in her capacity as Programme Manager of SAIIA's Governance of Africa's Resources Programme (GARP). She is currently an independent consultant and remains interested in issues related to the governance of Africa's natural resources, and the continent's drylands in particular.
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ABBREVIATIONS AND ACRONYMS

CBD	UN Convention on Biological Diversity
CDM	Clean Development Mechanism
CIFOR	Center for International Forestry Research
COP	Conference of the Parties
DRC	Democratic Republic of Congo
FANR	Food, Agriculture and Natural Resources
FAO	Food and Agriculture Organization of the UN
FMNR	farmer-managed natural regeneration
GDP	gross domestic product
GGWSSI	Great Green Wall for the Sahara and the Sahel Initiative
GHG	greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IUCN	International Union for Conservation of Nature
MRV	Measurement, Reporting and Verification
NTFPs	non-timber forest products
PES	payments for ecosystem services
PWS	payments for watershed services
REDD+	Reducing Emissions from Deforestation and Forest Degradation
UNCCD	UN Convention to Combat Desertification
UNFCCC	UN Framework Convention on Climate Change
UNFF	UN Forum on Forests
WEF	water–energy–food security

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INTRODUCTION

Close to half of the African continent is covered by drylands, spread over 15 countries in West and Central Africa, and 17 countries in East and Southern Africa.[1] These ecosystems support over 60% of Africa's people and provide them with a wide range of environmental goods and services, many of which are derived from the region's dryland forests and woodlands. The value of dryland forests goes beyond the products they provide, including timber and non-timber forest products (NTFPs) such as charcoal, fodder, honey or resin. There is increasing global recognition of the multiple ecosystem services provided by forests. In addition to storing and sequestering carbon, forests provide services related to the protection of watersheds and biodiversity. Watershed services include flood and water yield regulation, the control of soil erosion and the regulation of regional rainfall.[2] From a biodiversity perspective, forests serve as habitats for up to two-thirds of terrestrial animal and plant species – a rich genetic diversity that contributes to human health and wellbeing through enhancing dietary diversity and providing building blocks for pharmaceutical and technological innovation.

In the case of Southern Africa, however, these benefits are threatened by deforestation and forest degradation. The region has the highest rate of deforestation in Africa,[3] with rates in countries such as Zambia and Malawi among the highest in the world.[4] Direct causes of deforestation and forest degradation in Southern Africa include land conversion (notably from forest/woodland to agricultural land, but also for infrastructural or industrial expansion) and extraction (notably for timber, fuel wood and charcoal).[5] Often these two activities are linked. Pressures on forests are also increasing as rapid population growth and urbanisation lead to a concomitant rise in demand for food and energy. The demographic challenges are compounded by governance-related ones. Chief among these is the fact that the contribution of forests – and particularly dryland forests – to regional economies and livelihoods is not sufficiently recognised. This has led to the marginalisation of the forestry sector throughout the region. Finally, environmental factors relating to climate change and encroaching desertification act as additional stress factors in what is already a region under pressure.

One of the principal problems encountered in trying to reverse the deforestation/degradation trend is the fact that some of the main challenges faced by the sector originate from outside forestry, in sectors such as agriculture or energy, over which foresters have little control. In a region like Southern Africa, energy and food security are legitimate priorities. Policymakers in these sectors rarely have reason to consider forestry, apart from the occasional conflict over resources such as land or water. When such conflicts occur, forestry is easily relegated to a lower priority. This is even easier to do in the case of dryland forests (compared to tropical dense rainforests, whose significance is more widely acknowledged). For its part, the forestry sector laments being marginalised. It is also easy for policymakers in this sector to blame those in agriculture or energy as the source of their problems.

However, both of these approaches ignore the interdependencies among these sectors. This paper argues that a more integrated approach could help to make the case for the forestry sector as a whole, and for Southern Africa's dryland forests in particular. The water–energy–food security (WEF) nexus[6] is identified as an appropriate conceptual lens through which to explore interdependencies among these sectors and forestry. Such a

lens not only allows for the identification of potential win-win solutions but also makes inevitable trade-offs explicit.[7]

The overarching objective of this paper is to explore the interactions between Southern Africa's dryland forests and issues of water, energy and food security, in the context of climate change. In terms of audience, the paper aims firstly to provide policymakers and stakeholders in Southern Africa's forestry sector with a number of entry points for discussion with colleagues in other sectors. The WEF nexus is compatible with approaches to integrated forest management, including ecosystem- and landscape-based approaches.[8] Secondly, stakeholders working on issues related to water, energy, food security and climate change in Southern Africa are invited to consider the role played by forests/woodlands and trees in the region's extensive dryland areas. Finally, a nexus approach is of use to policymakers responsible for integrated planning and/or policy mainstreaming. Since the World Economic Forum identified the WEF nexus – including its links to climate change and environmental stress – as one of three major clusters of risks today,[9] the lens has been applied extensively not only to issues relating directly to water, energy, food security and climate change but also to sectors such as mining. By applying it to forestry, this paper shows how this sector is intricately linked to some of the major issues of our time.

The paper is a follow-up to the conference on *Best Practice in the Governance of Africa's Dryland Forests: Implications for Southern Africa*, co-hosted by SAIIA's Governance of Africa's Resources Programme and SADC's Food, Agriculture and Natural Resources (FANR) Directorate with the support of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), in October 2013.[10] More information about the event is contained in the annex to this publication. Suffice to note here that each of the sessions at the two-day conference focused on a strategic programme area identified in the SADC Forest Strategy 2010–2020.[11] The strategy provides a framework for regional co-operation and international engagement on forest issues, motivated by the vision of 'a vibrant and evolving forest sector that contributes significantly to rural development, poverty reduction, industrial progress and vital environmental services'.[12] The strategic programme areas identified in the strategy (and discussed at the conference) include three areas of direct relevance to this paper, namely:

- climate change mitigation and adaptation;
- the protection of key water catchment forests; and
- energy supply and poverty reduction.

Notwithstanding the importance of other programme areas (eg, enhanced intra-regional trade in forest products or co-operation in trans-boundary forest and fire management), these will only be touched on in this paper to the extent that they relate to the particular topic under discussion.

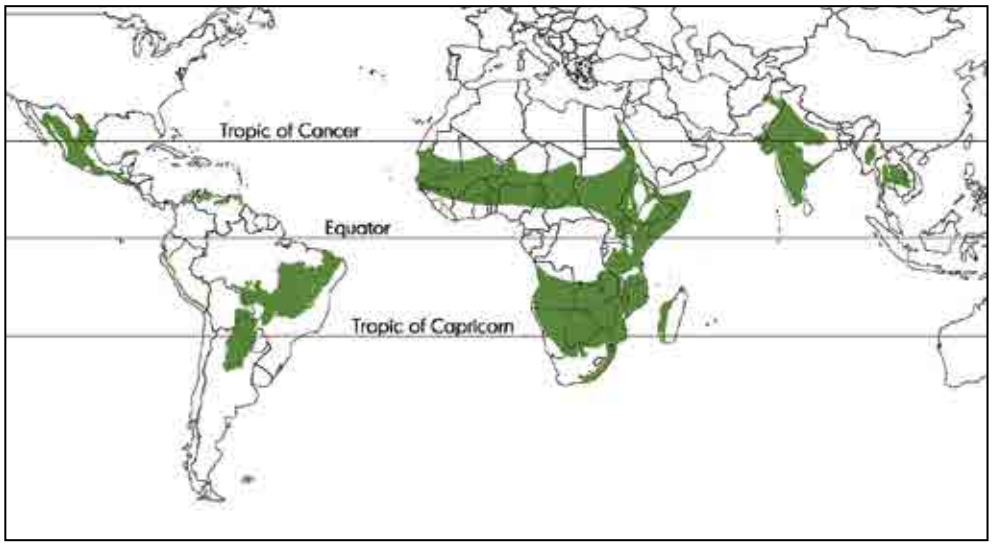
The paper is structured as follows. This introduction is followed by an overview of Southern Africa's dryland forests and woodlands. The third section elaborates the challenges faced in the governance of Southern Africa's dryland forests and shows how an integrated approach can assist in addressing these. It also introduces the WEF nexus. Section four considers the cross-cutting challenge of climate change and looks at the role of dryland forests in climate change mitigation and adaptation. Sections five, six and seven

explore the relationship between dryland forests and each of the arms of the nexus: water, energy and food security. Section eight concludes the paper.

DEFINITION OF DRYLAND FORESTS AND EXTENT IN SOUTHERN AFRICA

This paper aims to look beyond tropical rainforests, which in Southern Africa are found in countries such as the Democratic Republic of Congo (DRC), Angola and Madagascar. Its focus is rather on dryland forests in Southern African countries, primarily Angola, Botswana, south-eastern DRC, Madagascar, Malawi, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe. Broadly defined, dryland forests are those forests, woodlands and tree formations found in arid, semi-arid and dry sub-humid areas where the mean annual precipitation is lower than the potential evapotranspiration.[13] As the extent of natural forest cover is closely correlated to precipitation,[14] forest patches are rare in arid areas. However, dryland forests and woodlands are widespread across the semi-arid and dry sub-humid (or tropical dry) parts of Southern Africa. In fact, dryland forests and woodlands are the dominant forest type in the region.

Figure 1: The location of the world's dryland forests



Source: Dupuy B, Maître HF & I Amsallem, 'Tropical Forest Management Techniques: A Review of the Sustainability of Forest Management Practices in Tropical Countries', FAO Working Paper FAO/FPIRS/04, World Bank Forest Policy Implementation Review and Strategy, July 1999, p. 11

Southern Africa is home to Africa's Miombo woodlands – the most extensive dryland forest formation on the continent and among the top five eco-zones considered fundamental to biodiversity conservation.[15] Miombo woodlands are typified by trees from the *Ceasalpinoideae* sub-family,[16] including of the genera *Brachystegia*, *Isoberlinia* and *Julbernardia*.[17] The Miombo woodlands cover a substantial area, stretching from Zambia,

Zimbabwe, Mozambique and Malawi to Angola and northwards into Tanzania and south-eastern DRC[18] (see Figure 1).

The Kalahari Sands woodlands – also dominated by species from the *Ceasalpinoideae* sub-family – cover much of northern Namibia, southern Angola and parts of Botswana, northern Zimbabwe and western Zambia.[19] Mopane woodlands – dominated by *Colophospermum mopane*, but also including a wide range of other species – are found in pockets across the Miombo and Kalahari Sands regions, including in Mozambique, northern Namibia, southern Angola and large parts of Zimbabwe and Botswana.[20] The greater Kalahari Sands woodlands region is also home to the drier Zambezian Baikiaea woodlands (including the species *Baikiaea plurijuga* or Zambezi teak) and the Kalahari Acacia/Baikiaea woodlands.[21]

In addition to these extensive woodland formations, the region is home to 'rich patch' forest vegetation, including riverine forests (or riparian woodlands) and, at higher elevations, dry montane forests.[22] An example is the Afromontane archipelago forests, represented by forest patches in the Eastern Arc Mountains of Tanzania, the Mulanje Massif in Malawi and the Drakensberg in South Africa.[23] These also form part of the dryland forests discussed in this paper. To quote Edmund Barrow, the director of the International Union for Conservation of Nature's (IUCN) Global Ecosystem Management Programme, these rich patch forests 'have an importance totally out of proportion to their actual size'.[24] They are centres of unique plant and bird endemism, provide valuable dry season habitat for several mammal, reptile and bird species,[25] and fulfil a number of important environmental services, including those related to the hydrological cycle.

Beyond intact forests and woodlands, it is also worth considering trees on farms in dryland areas. As will be discussed later, there is a strong case to be made for integrated forest-agricultural and forest-pastoral systems – agroforestry – in the drylands. Some scholars even define dryland forestry more broadly as 'the management and often establishment of trees and shrubs to improve the livelihood and quality of life for people in dryland regions'.[26]

As the focus here is on indigenous forest types, this paper does not go into any great detail about plantation forestry, except in as far as these relate to natural forests. Plantations of exotic species, including eucalyptus and pine, have a different set of opportunities and challenges. On the one hand, plantation forestry can provide timber and other products that can serve to relieve the pressure on natural forests. On the other, these are often thirsty species and their propensity to spread has earned them the unenviable title of 'invasive alien species'.

CHALLENGES IN THE GOVERNANCE OF SOUTHERN AFRICA'S DRYLAND FORESTS

The multi-layered causes of deforestation and forest degradation in Southern Africa were mentioned earlier. Direct causes of forest loss in the SADC region include agricultural expansion and extraction for timber and biomass energy. In combination, these two factors contribute to the fact that in most of Southern Africa, greenhouse gas (GHG) emissions from land-use change and forestry exceed those from fossil fuels (South Africa and Angola are notable exceptions).[27] The region is also characterised by its dependence on the natural

resource base, which is in part linked to poverty. As the demand for food and energy rises, these pressures are likely to increase. Demographic challenges are compounded by environmental ones, including challenges related to climate change and encroaching desertification.

However, the focus here is on governance-related challenges. The forestry sector is marginalised across most of the region. This is reflected, for instance, in low budgetary allocations to the sector, resulting in under-capacitated forestry departments. This in turn leads to under-staffed forestry departments, the use of outdated technologies (for instance, old and inefficient saws) and inadequate data and information (including forest resource assessments). Forestry departments usually have a low status and are often lumped with other departments that are prioritised even within the mother ministry (eg, agriculture, water or environment). In Malawi, for instance, forestry falls under the Ministry for Natural Resources, Energy and Environmental Affairs, which also looks after energy, mining, climate change and environmental affairs. In South Africa, Angola and Mozambique, forestry falls under the ministry responsible for agriculture (and sometimes fisheries). The problem, however, is not the fact that they share these ministries (which could in theory assist with integrated management), but that forestry is not prioritised.

These are all symptoms of a sector whose contribution is not valued. Part of the problem may be the fact that many of the benefits provided by the forestry sector are invisible in state accounts. Across most of the region – barring South Africa with its large plantation forests – forestry's formal contribution to gross domestic product (GDP) is small or negligible. A significant portion of the trade in these timber and other forest products is informal and/or illegal, and therefore not reflected in GDP calculations. Moreover, using GDP as a measure excludes forestry's contribution to local livelihoods. Many goods (eg, wood) and services (eg, watershed protection) provided by the sector are regarded as free. Equally, the effects of forest ecosystem degradation are not factored in. For example, coastal ecosystems such as mangroves or forest ecosystems situated on hills form a buffer against natural disasters such as floods and rising sea levels. When these forests disappear, this natural or 'green infrastructure' needs to be replaced with so-called 'grey infrastructure' or traditional engineering solutions, which cost money. In addition, countries have to increase their budgets for disaster risk mitigation. Moreover, some of the traditional solutions are questioned by new science.

The marginalisation of dryland forests is also a challenge at the international level, although forestry in general has risen in prominence on the global stage over the last decade. Tropical dense rainforests were the first forestry type to rise to the top of the sustainable development agenda. Although there has long been a public sense that these forests are important, tropical rainforests in particular received a big boost when reports such as the 2006 Stern Review of the Economics of Climate Change reaffirmed their central role in climate change mitigation. In short, forests sequester carbon, which is released back into the atmosphere when trees are cut down or die. The importance of these forests was successfully pushed in international forums, including by African states and the Congo Basin countries in particular, as members of an international coalition of tropical rainforest states.

Today forestry occupies centre stage in the UN Framework Convention on Climate Change (UNFCCC) – the forum where agreement was reached on the innovative financing scheme known as Reducing Emissions from Deforestation and Forest Degradation

(REDD+). Forestry is also prominent in the UN Convention on Biological Diversity (CBD) and the UN Convention to Combat Desertification (UNCCD – particularly relevant to drylands). Together, these three sustainable development conventions are known as the Rio Conventions. There is also a push for an international agreement on forestry under the purview of the UN Forum on Forests (UNFF).

Dryland forests have also risen in prominence, thanks in part to examples such as the Great Green Wall for the Sahara and the Sahel Initiative (GGWSSI) – a mosaic of sustainable land management practices that have galvanised the support of policymakers, civil society, farmers and implementation partners alike. Not disregarding work done on Southern Africa's dryland forests, including a significant body of work on the Miombo woodlands, this paper argues that there is room to raise the profile of Southern Africa's dryland forests among a broader audience, both locally and internationally. This could build on the region's increasing activity relating to both the Rio Conventions and the UNFF. For instance, SADC has been pushing for cross-border ecosystem approaches to REDD+ implementation. Among other benefits, this would allow the region greater access to REDD+ funds.[28]

Towards an integrated approach

In recognition of the multiple benefits provided by the sector, international best practice dictates that forests are governed for multiple goods and services. Similarly, forested areas are increasingly considered part of multifunctional landscapes. This is particularly true of dryland forests. The expansive nature of these types of forests, coupled with the lower density of tree cover, sees this sector sharing the land with other uses, including agriculture and pastoralism. In arid and semi-arid regions, people might also prefer to live near forested areas to make use of forest goods and services.

Many of the challenges faced by the forestry sector originate from outside the sector. For instance, decision-makers rarely consider the full implications of converting forested land for alternative uses such as mining, agriculture (including plantation forestry) and industrial expansion.[29]

For these reasons, it is important that forestry's contribution is also acknowledged outside forestry circles. A starting point would be to get multi-sector recognition of its value, including but not limited to forestry's economic contributions. In order to do this, countries first need to know what they have in terms of forests. This underscores the need for forest resource assessments. Secondly, they need to know what these benefits are worth. Ecological economics can go some way in quantifying forest goods and services. Thirdly, it is necessary to make a convincing case for the sector. The need for a compelling narrative for dryland forests was emphasised by several keynote speakers at Forest Day 5, held on the fringes of the 11th Conference of the Parties (COP) to the UNFCCC in 2011 and focusing particularly on these types of forests.[30] SADC also hosted a side event on the potential of cross-border ecosystem approaches to REDD+ implementation. The importance of narratives and discourses has also found its way into the academic literature on dryland forests.[31]

One example of a change in the forestry story is the way in which the relationship between forestry and agriculture is presented. For many years agriculture has been pitted against forestry. Over the last couple of years, however, the global trend has been shifting

towards a more integrated view. This is reflected, for instance, in the shift from separate forest[32] and agriculture days on the sidelines of the UNFCCC COP meetings to a forum focusing on integrated landscapes in 2012/2013.[33]

This paper shows how a similar case could be made for the relationship between the forestry and water sectors, or between forestry and energy. One attempt to conceptualise these interdependencies is the WEF nexus. Viewing the forestry sector through a nexus lens reveals many opportunities for win-win solutions, while also making trade-offs explicit. A nexus lens is compatible with the integrated approaches to forest governance introduced below.

Today's integrated approaches are by no means new, and in many ways build on older ones. About 20 years ago, the ecosystem-based approach was a paradigm shift towards a more holistic view of nature as a complex adaptive system.[34] This approach to conservation emphasised integration across relevant sectors and scales. Its primary concern was the balance – and integration of – conservation with the sustainable use of biological diversity.[35] In practice, this translated into such innovations as integrated land-use planning and a focus on adaptive natural resource management.

Over time, this ecosystem-based approach expanded beyond the field of conservation to include broader development concerns.[36] According to this approach, the success (or failure) of natural resource governance should be measured using both socio-economic and environmental indicators. This fits in with the SADC Regional Indicative Strategic Development Plan's focus on poverty reduction and development. It is also compatible with the SADC Protocol on Forestry and Forest Strategy, which views the sector as having the potential to contribute substantially, equitably and sustainably to regional development. Such an approach allows for synergies among conservation and development goals. After all, a system is only economically sustainable in the long term if it is also environmentally and socially sustainable. That said, an integrated approach has to acknowledge that trade-offs are sometimes inevitable.

Such an expanded ecosystems approach is today often referred to as a 'landscapes approach'. The director general of the Center for International Forestry Research (CIFOR) conceptualises a landscape as 'a place with governance in place'[37] – a very broad definition that encompasses both the geographic and institutional dimensions of the approach. In short, natural resource governance happens at the intersection of two complex systems, namely a natural one and a social one. This broad conceptualisation acknowledges that both natural and social systems operate at multiple scales. In the case of social systems, one could focus from the family level up through the community, local and national levels to the sub-regional, regional or global level. Moreover, these systems are not always neatly nested. In the case of social movements or networks, for instance, loyalties often transcend and/or cut across the boundaries mentioned above. Similarly, natural systems also exist at multiple scales. The effective governance of socio-ecological systems integrates scientific knowledge and so-called indigenous knowledge systems, which have often evolved to work with natural systems.

As mentioned above, these integrated approaches are compatible with the WEF nexus lens. A nexus lens has the added advantage of making the topic accessible to policymakers and stakeholders outside the forestry sector. However, the nexus is simply a lens, not a comprehensive approach to governance. Integrated approaches, including ecosystem- and landscape-based approaches, therefore remain highly relevant. This paper stops short of

a comprehensive approach or solution. It merely explores the interaction of the forestry sector – and Southern Africa's dryland forests in particular – with other resource sectors in the economy, notably the water, energy and agriculture sectors, in the context of climate change.

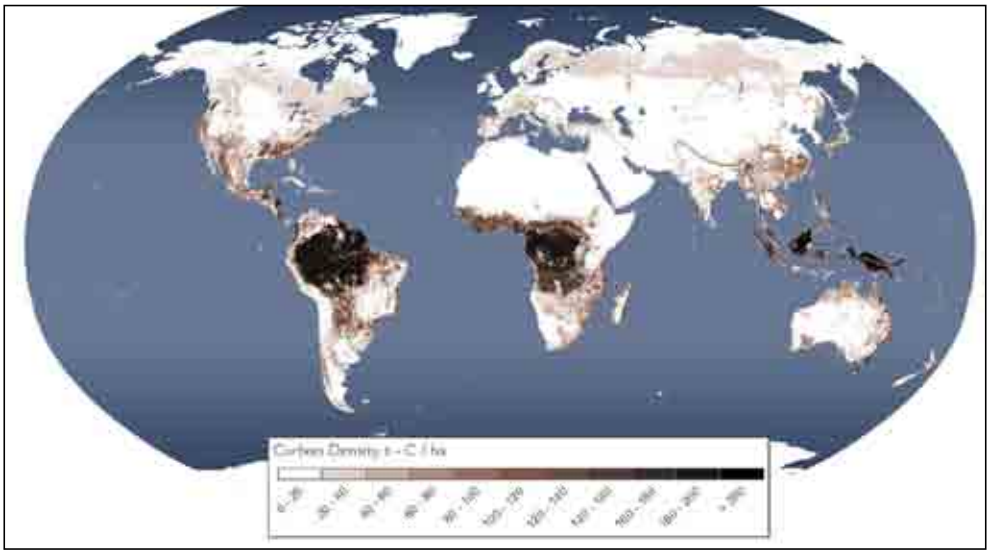
DRYLAND FORESTS AND CLIMATE CHANGE MITIGATION AND ADAPTATION

It is now widely recognised that countries that have historically contributed to factors driving climate change (such as carbon emission) are among the most vulnerable to the impact of climate change. With some notable exceptions, sub-Saharan African countries fall squarely in this category. For instance, the African continent emits only 3% of global fossil fuel carbon and 5.3% of the global greenhouse gases from all non-land-use sectors.[38] However, when it comes to emissions from land-use change and forestry, Africa's contribution is disproportionately high. Africa has lost more forest than any other continent over the period from 1990 to 2005. Moreover, since 1990 Southern Africa's rate of deforestation has been the highest in Africa.[39] Drivers of deforestation in Southern Africa were mentioned earlier and include agricultural expansion, energy demand, population growth and poverty. These pressures are set to increase. High rates of deforestation and forest degradation mean that the region – and its forestry sector in particular – should be considered a significant actor in mitigation actions. Emissions contributions aside, the region is highly vulnerable to the effects of climate change, which means that the continental emphasis on climate change adaptation (including financing) remains relevant here. The region's forests, and dryland forests in particular, play an important role in climate change adaptation. Both mitigation and adaptation are discussed below.

Southern Africa's dryland forests and climate change mitigation

International recognition of the role of forests in climate change mitigation is reflected in the priority accorded to the REDD+ scheme and other similar initiatives in climate change negotiations. This significance derives from forests' ability to sequester carbon: carbon is released into the atmosphere when trees are burned, cut down or die naturally. Whereas REDD+ initially focused largely on tropical dense rainforests, its expansion to other forest types has broadened the scope for Southern Africa's participation. Although dryland landscapes store less carbon per hectare than tropical forests, the extensive nature of these landscapes translates into significant carbon storage potential (see Figure 2). Moreover, high rates of deforestation and forest degradation in Southern Africa should translate into opportunities for REDD+.

Figure 2: Global above- and below-ground living biomass carbon density



Source: Ruesch A & HK Gibbs, *New IPCC Tier-1 Global Biomass Carbon Map For the Year 2000*, available online from the Carbon Dioxide Information Analysis Center, http://cdiac.ornl.gov/epubs/ndp/global_carbon/FINAL_DATASETS.jpg, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 2008.

That said, questions remain about the eligibility of dryland forest types as well as the potential benefits of innovative financing mechanisms – including REDD+ and the Clean Development Mechanism (CDM) – in these regions. For these mechanisms to be effective they have to address the main drivers of deforestation and forest degradation in dryland regions. In Southern Africa this includes unsustainable agricultural and land management practices as well as the demand for energy. Although the original CDM allowed for afforestation and reforestation projects and did result in a handful of forestry projects – specifically forest-energy-related ones – the mechanism was not regarded as being particularly forest friendly or Africa friendly. Reasons for the CDM's bad reputation in Africa include the complexity of rules and processes (including for the measurement, reporting and verification (MRV) of emissions reduction); prohibitive costs, coupled with a lack of necessary capital and long-term investment; and inadequate institutional capacity to bring projects to completion. Africa – including Southern Africa – was also not active enough in the negotiation phase of the CDM, which meant that the resulting initiative did not reflect the continent's interests.[40] Recent changes to the CDM attempt to address these challenges. For a rare example of a successful forest-related CDM project in an African dryland region, see Box 1.

Box 1: Humbo Assisted Natural Regeneration: Lessons from a successful CDM project in Ethiopia

As presented by Hailu Tefera, World Vision Ethiopia

The Humbo Natural Regeneration Project is a CDM project in a mountainous area in south-western Ethiopia. One of the main challenges earmarked for the project was the high demand for firewood and charcoal – a need that was met by clearing natural forest. This resulted in denuded mountains, soil erosion and flooding, the formation of large gullies, silt loads on farmland and – over time – a shortage of firewood. This is a situation familiar to the rest of Ethiopia.

It is in this context that the World Bank and World Vision partnered to facilitate the design and implementation of a CDM pilot project aimed at sequestering carbon through the restoration of 2 728 ha of native forest, while alleviating poverty through income from certified emissions reductions and other forest and non-forest benefits. The 10-year project was launched in December 2006.

Specific objectives include

- regenerating the native forest through farmer-managed natural regeneration (FMNR) techniques;
- establishing legal frameworks and local institutions for forest ownership and management;
- improving the hydrological system in the area; and
- enhancing land productivity through reduced soil erosion.

In addition to demonstrating and implementing the FMNR practices, project interventions included extensive consultations with the government and communities, the securing of land user right certification, legalisation of forest co-operatives and various other institutional capacity-building activities.

In line with its objectives, the project tracks environmental, economic and social results. Five years into the project, over 73 000 tonnes of CO_2 have been sequestered, or 44% of the total agreed with the World Bank. There are also encouraging signs of a decrease in downstream soil erosion, an increase in biodiversity and an improved micro-climate. The first five years also saw the development of a water scheme in the area. On the economic side, the $322,629 in carbon revenue transferred to the community is supplemented with income from the sale of forest seed, firewood (sustainably harvested from pruned branches) and honey and service fees from the use of a new mill. Communities also harvest grass in the area. From a social perspective, milestones include the securing of land user rights, legal recognition of forest co-operatives and the successful uptake of the FMNR technique. This is coupled with greater institutional capacity and community empowerment.

The project offers many lessons on process, governance and benefit-sharing. For the purposes of this paper, it is useful to focus on only a handful of these. Firstly, FMNR is a simple and cost-effective technique that forms part of the larger story of the Great Green Wall. The Humbo project is only one example of sustainable land management practices that are spreading

across the rest of Ethiopia and the Sahelian belt. The case study also emphasises the multi-functional role of forests: beyond reducing GHG emissions, dryland forests can improve land productivity, protect watersheds, diversify income and increase community resilience.

For more information, see the full presentation at http://www.saiia.org.za/events/making-the-case-for-southern-africas-dryland-forests.

In the case of REDD+ one of the challenges is the inconsistent – and, some would argue, often narrow – definition of forests. For instance, a broader definition that includes agroforestry systems (integrated forest-agricultural and forest-pastoral systems) would be of benefit to dryland systems,[41] as would the inclusion of soil carbon.[42] However, the exact carbon storage potential in dryland forests remains uncertain. Some preliminary studies, including one on soil and stem carbon in the Miombo woodlands in Mozambique's Nhambita region,[43] demonstrated highly variable levels of soil carbon in dryland forests. In this context, a project to develop integrated MRV systems for REDD+ in the SADC region should lead to significant learning and knowledge creation. The focus of the three-year (to February 2015) EUR[44] 3.365 million project implemented jointly by the SADC FANR Directorate and GIZ is to take an inventory of the region's forest resources, which would be used to calculate carbon stocks. The three pilot sites selected for the project all represent dryland forest types, namely Mopane (in Mozambique), Baikiaea (in Botswana) and Miombo woodlands (a trans-boundary site straddling Malawi and Zambia).[45] In addition, this project would have the added benefit of contributing to increased knowledge of these forests in general (ie, not just their carbon potential).

The potential of REDD+ (and CDM) projects in dryland regions would increase if co-benefits were taken into account. In REDD+ parlance 'co-benefits' refer to the non-carbon benefits of a REDD+ project. This includes the restoration of degraded land and the reduction of run-off, erosion and soil compaction.[46] The people who live in dryland forests and landscapes also benefit from forest goods, including timber and NTFPs, and the income that they derive from these. From the perspective of local communities, these 'co-benefits' are often the most tangible benefits from forest and tree resources. From this perspective it might make more sense to consider REDD+ as an added incentive or as a part of integrated landscape management. Moreover, many of these co-benefits relate closely to adaptation.

Southern Africa's dryland forests and climate change adaptation

While Africa's dryland forests and landscapes do have an important role to play in climate change mitigation, adaptation remains of paramount importance. As stated earlier, the African continent is among those regions that are most vulnerable to the impacts of climate change, firstly because some of the most adverse effects will be felt here, and secondly because Africa's people and governments are among the least equipped to deal with these changes. For instance, in Southern Africa – a region that is already water-stressed – climate-related changes will lead to an estimated 10–15% decline in rainfall,

causing a 5–8% expansion of arid and semi-arid lands.[47] This will have a potentially devastating impact on a region that relies heavily on its natural resource base and rain-fed agriculture in particular.

In addition to agriculture, forestry is one of the key sectors that will be affected by climate change.[48] Countries in the Miombo region – including Tanzania, Mozambique, Zimbabwe, southern Zambia, northern Namibia and southern Angola – lie within an arc that is expected to experience the highest possible impact of climate change, including a 3–7 °C increase in temperature and up to 30% less rainfall in 2080–2099 than in 1980–1999.[49]

The following are some of the projected impacts on the forestry sector:

- increasing aridity, leading to an increase in the frequency and intensity of fires;[50]
- increasing predisposition to pest and disease outbreaks;[51] in particular as insects expand their ranges;[52]
- a shift northward in the distribution of some species of natural woodlands and forests, due to increased aridity;[53]
- an increase in the spread of invasive alien species;[54] and
- changes to the growth and productivity in both natural and plantation forests (increases in some areas, decreases in others).[55]

More detailed analysis is ongoing, including through the Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL)[56] – a joint initiative of Angola, Botswana, Namibia, South Africa, Zambia and Germany. One of its research projects looks at the impacts of climate change in the region.[57] This project addresses both regional climate projections and climate change impacts in the form of modelled impacts for the agriculture, water, forestry and biodiversity sectors.

The relationship between forests and adaptation is usually approached from two angles. Firstly, the vulnerability of forests to climate change will require changes in the ways that forests are managed.[58] This includes much more dynamic decision-making processes that are able to respond or adapt to sudden changes, coupled with more integrated approaches that mainstream climate-related concerns across sectors and geographical scales.[59] In this policy briefing[60] on climate change adaptation and Southern Africa's dryland forests, Nicholas King discusses the independent and sometimes unpredictable ways in which plants are already responding to climate-related changes. He recommends that adaptation planning should monitor and ideally clear corridors – including, where necessary, keeping areas clear of roads, agricultural monocultures and urban areas – in order to enable biodiversity to respond optimally to changes.[61] This builds on and goes beyond the idea of 'escape corridors' discussed in the SADC Forestry Strategy.[62] SASSCAL is also conducting a research project on adaptation strategies for the South African, Namibian and Zambian dryland forests and timber plantations,[63] with one of its aims being a secure supply of timber, fibre and other non-timber resources from forests for socio-economic growth and development across the region.

Secondly, forests facilitate adaptation by providing ecosystem services that reduce societies' vulnerability to the impacts of climate change.[64] This aspect of adaptation is referred to as ecosystem-based adaptation. By providing vital services such as desertification control, the prevention of water run-off and soil erosion, forests in drylands

can help people adapt to changing climatic conditions. Trees also provide 'safety nets' in harsh environments. For instance, foliage from the Miombo woodlands serves as fodder during dry periods when animal feed is scarce.[65] Forest products are often more resilient to climate shocks than crops, so when crops fail due to droughts or are destroyed during floods, communities can live off or sell forest and tree products.[66] Trees on farmland also protect crops and livestock from climate variability by protecting the soil and regulating water and the microclimate. Similarly, in urban settings green infrastructure can assist in regulating temperatures or contribute to hydrological services.[67] In the case of ecosystems-based adaptation, sectors such as forestry often serve other sectors, including agriculture or water. This is discussed in greater detail below.

SADC has also been active on this front. In recognition of the importance of climate change adaptation for the forestry sector, SADC and the Food and Agriculture Organisation (FAO) – with the support of the Belgian government – co-hosted a workshop in June 2013 on Forests, Rangelands and Climate Change Adaptation in Southern Africa. This resulted in the development of a draft climate change adaptation plan, which includes elements such as:[68]

- revising relevant national and regional policies to ensure that climate change adaptation is mainstreamed in forest, climate change and broader development policies;
- implementing ecosystem restoration initiatives in key forests, rangelands and wetland areas;
- strengthening fire management strategies (the SADC regional fire management programme[69] has already made considerable progress on this front);
- promoting climate-resilient livelihoods for forest-dependent communities;
- ensuring that relevant adaptation technology is transferred to targeted groups; and
- improving risk and vulnerability assessments, including fire modelling and other information systems.

In summary, climate change adaptation is a priority for Africa. This is an immediate need, as the continent is already experiencing the devastating impacts of a changing climate. However, there is recognition that mitigation is the only long-term solution.[70] In terms of mitigation the forestry and land-use sectors – including in dryland areas – provide both challenges and potential.

Representing Southern Africa's dryland forests in international negotiations

In the past, Africa's voice has been under-represented in international forums related to climate change and sustainable development.[71] The same can be said for drylands and dryland forests. Fortunately, there are indications of change on both fronts. The African continent now rallies behind the shared goal of 'preventing another CDM'.[72]

One of main benefits of regional co-operation is greater bargaining power in international forums. SADC has been active, although there is still potential for increased collaboration within the region, as well as between the region and other groupings (eg, the Central African Forests Commission, or COMIFAC, and other dryland regions, including the GGWSSI and the dryland mountains agenda within the Global Mountains Partnership). This will ensure that Southern Africa, and specifically its dryland forests, are

better represented in forums such as the UNFF and the Rio Conventions (the UNFCCC, UNCCD and CBD) and the related instruments, including REDD+ and the CDM. It is also important to note potential synergies among these conventions and agreements.[73]

One of the first steps in ensuring greater recognition of the role of dryland forests is to push for an expanded definition of forests and/or eligibility criteria, so as to include different forest types (dryland forests, but also mangroves, tidal marshes, sea grasses and other ecosystems). Another important dimension relates to finance (both forest finance and climate finance); in this regard, the progress made at UNFCCC COP19 in Warsaw should be noted. The meeting saw finance-related decisions on both REDD+ and adaptation. On REDD+, the decisions that were taken related to results-based finance and the co-ordination of finance. On adaptation, decisions were made to enhance support to non-Annex 1 countries (developing countries parties to the UNFCCC),[74] least developed countries and small island developing states. This includes $100 billion pledged towards an adaptation fund and the creation of a loss and damage mechanism.[75]

FOREST–WATER RELATIONS

The type and location of trees have an impact on the quality and quantity of water available. This is significant, especially in a water-stressed region such as Southern Africa. Although there is broad agreement that a relationship exists between forests and water, the exact nature of that relationship is still being debated. The reality is that forests and trees can have both positive and negative impacts on water yield and quality, depending on a number of factors.

At the most basic level, trees and forests – and in particular plantations – are considered water users. Forestry has even been seen as competing for water with other sectors, including agriculture, energy and industry.[76] Moreover, small-scale studies have shown that tree cover increases terrestrial interception, evaporation and transpiration, thus reducing local level run-off.[77] Because of its potential to significantly alter the local water balance, afforestation in arid and semi-arid land is today approached with much more caution than in the second half of the twentieth century, when the benefits of plantation programmes (sand dune fixation, fuel wood production, etc.) were touted.[78] Of particular concern are thirsty and/or invasive alien species. Commercial timber and paper plantations are today also seen as having significant water stewardship responsibilities.[79]

However, even as forests and trees may contribute to reducing water at the local level, on a larger scale they enhance the water cycle by facilitating the movement of moisture from the ocean inland and – through evapotranspiration – across borders and continents.[80] Equally, from a regional perspective, deforestation in one area could be linked to reduced precipitation and more frequent or severe droughts in another.[81]

In addition to the impact forests and trees have on water yield or availability (ie, water quantity), they also supply a number of ecosystem services that contribute to water quality. These include reducing soil erosion and sedimentation, filtering litter and even taking up pollutants from water and soil through their roots and turning them into less harmful substances.[82]

Finally, forests and trees could offer protection against extreme weather. They soak up rainfall during wet seasons and slowly release it during times of drought. Maintaining

vegetation cover – including forests – in watersheds can also reduce flash flooding and flood peaks.[83] Conversely, denuded hills are more prone to soil erosion and mud slides. Through the watershed services they provide, forests and trees contribute to climate change adaptation.

Forests' watershed services serve as the motivation for including the protection of key catchment forests as a priority area in the SADC Forestry Strategy 2010–2020. The strategy argues that '[the] protection of key river catchments is a vital forestry function, but for which the forest sector does not normally receive its due recognition'.[84] It goes on to identify potential beneficiaries of healthy watersheds, including the agriculture and hydropower industries.

For these reasons, forests – like wetlands – could be considered key components of green infrastructure. As the case studies illustrate, forestry often has a role to play in payment for watershed services (PWS) schemes. There is as yet unexploited potential to expand these innovative financing mechanisms in Southern Africa. As in the case described in the first case study (Box 1), most PWS schemes focus on the beneficial role of forests and trees. However, as the second case study (Box 2) illustrates, it is equally possible to design schemes that deal with their more adverse effects, for instance alien invasive species. At the core of all PWS schemes – in fact, of all payment for ecosystem services (PES) schemes – is the principle that environmental services should not be considered free. That being said, in a region like Southern Africa it is crucial that PES incentives are pro-poor. This is the main aim of a project of the World Agroforestry Centre entitled 'Pro-poor rewards for environmental services in Africa (PRESA)'.[85] In the case of PWS, the protection of watersheds is the main benefit, with potential co-benefits being carbon sequestration or the protection of biodiversity.

In short, when it comes to forest–water relations, it is important to consider both the type and location of trees and forests. A distinction can be made between natural forests and plantations, and between indigenous and alien species. Even then, it is not as simple as saying one is good and the other bad. It also depends where the forests and trees are located and how they are managed. For instance, an approach to plantation forestry known as New Generation Plantations pays particular attention to managing plantations in an environmentally and socially responsible way. Small changes, such as including a buffer zone between plantations and riverbanks, could make a big difference. In the same way, forest restoration or agroforestry could play an important role in the sustainable management of key forested watersheds.

The SADC Forestry Strategy aims to identify major river catchment forests in the region, mentioning the Congo (DRC), Okavango (Angola) and Zambezi (Zambia) rivers as possible examples. Another example is the Eastern Highlands in Zimbabwe and Mozambique – an important mountain catchment which, among others, is threatened by the spread of invasive alien species. The two case studies discussed below could potentially offer valuable lessons.

Box 2: PWS project: Tanzania's Uluguru Mountains

As presented by Shadrack Mwakalila, University of Dar es Salaam

The Eastern Arc Mountains that stretch from the Taita Hills in Kenya to southern Tanzania have been identified as one of 34 global biodiversity hotspots. The value of this ecosystem in supplying water for households, agriculture and power generation acts as a major incentive for forest conservation in the region.

At a more local level, Tanzania's Uluguru Mountains serve as a sub-catchment of the Ruvu River – the main water source for the city of Dar es Salaam and surrounding towns. The area also has carbon sequestration potential, and provides a basis for ecotourism as well as a number of forest and non-forest products. However, these benefits are under threat. A high rate of deforestation and watershed degradation is resulting in declining water flow, increasing water turbidity and a high sediment load that affects various uses downstream. Causes of degradation include unsustainable farming and irrigation practices, encroachment on forest and water source areas and illegal gold mining in river systems and forest reserves. All of this is compounded by poverty.

It is in this context that the Uluguru Mountains PWS project is implemented jointly by CARE International in Tanzania and the WWF Tanzania country office. The project is located in four villages in the Kibungo sub-catchment of the Ruvu River. Objectives include establishing long-term financial investment for watershed conservation as well as a payment mechanism that transfers rewards from those who benefit from the watershed service to those who manage it.

Phase I of the project included identifying sellers (upstream farmers) and buyers (the Dar es Salaam Water and Sewerage Corporation, or DAWASCO, and Coca Cola Kwanza Ltd.), developing the business case and signing memorandums of understanding. Phase II saw the implementation of land use change interventions, including agroforestry, reforestation, grass strip farming, contour farming, and terracing and riparian zone restoration. This phase also saw the establishment of the payment mechanism. In short, farmers were paid in cash depending on the type of sustainable land management practice adopted and the size of the land.

Again, the project tracks environmental, economic and social results. On the environmental front, the project has led to a reduction in soil erosion and sediment load, increased tree cover (including timber trees, fruit trees and agroforestry) and reduced incidences of fire. Improved land management practices have also led to improved soil moisture and nutrients, which contribute to increasing land productivity. Improvements from the project baseline in 2009 to 2012 include an increase in maize production from 400 kg/acre to 1 600 kg/acre, an increase in the average number of meals per day from 1.5 to 3, as well as significant increases in income from the sale of crops. This in turn has contributed to an increased ability to pay for health services and school fees.

This project offers a number of lessons, only some of which will be mentioned here.

- It is usually easier to get sellers than buyers for these kinds of services, as people tend to feel that conservation is someone else's responsibility.
- External support is often needed at the early stages, when costs are high.
- Many of the benefits (for instance, improvements in water quality) are not realised immediately, therefore requiring longer timeframes.

This project is being replicated in other parts of Tanzania. Tanzania's Water Act as well as the revised National Forestry Policy make provision for PES.

For more information, see the full presentation at http://www.saiia.org.za/events/making-the-case-for-southern-africas-dryland-forests.

FOREST–ENERGY RELATIONS

When it comes to forest–energy relations, there are multiple entry points. The most obvious one is biomass energy which, in the case of sub-Saharan Africa, is specifically charcoal and firewood. As mentioned above, there is also a link between forests and hydropower. Finally, biofuel crops often grow well in forested areas, which is in turn connected to food security, as discussed below.

Biomass is the dominant energy source in sub-Saharan Africa, meeting 80–90% (or even more[86]) of the residential energy needs of low-income households in much of sub-Saharan Africa:[87] firewood in rural areas; and charcoal in urban areas.[88] The demand for charcoal is growing in step with urbanisation. This is in contrast to the rest of the world, where reliance on traditional biomass is projected to stagnate or shrink (see Table 2). Wood fuels are often the biggest forest source of household energy in the region.[89] However, there are some environmental and socio-economic concerns around the use of firewood and charcoal for energy.

Table 2: People relying on traditional biomass

Country	2004	2015	2030
sub-Sahara Africa	575	627	720
North Africa	4	5	5
India	740	777	782
China	480	453	394
Indonesia	156	171	180
Rest of Africa	489	521	561
Brazil	23	26	27
Rest of Latin America	60	60	58
Total	**2 528**	**2 640**	**2 727**

Source: Von Maltitz G, 'The role of biomass energy in Southern Africa', presentation at the Best Practice in the Governance of Africa's Dryland Forests: Implications for Southern Africa conference hosted by SADC & SAIIA, Johannesburg, South Africa, 22–23 October 2013. Original data from World Energy Outlook, 2006

Rural Africa is highly dependent on firewood, which – because it is usually free – represents an important saving to households. There are mixed messages about firewood and deforestation, although it is interesting to note that the continent is not facing the crisis foreseen in the 1970s.[90] Firewood is usually harvested within a sustainable cycle of tree generation[91] (though this can change, depending on a number of variables, including population growth) and is largely carbon neutral.[92]

Charcoal presents a more complicated, and potentially problematic, case. The industry is driven from both the demand side (mainly growing urban centres in need of energy) and the supply side (largely poor rural areas in need of income). Urban dwellers prefer charcoal for its higher energy density, lower transport costs and relatively clean burn (though it releases more carbon monoxide than wood).[93] Between 2000 and 2010 the continent's average annual consumption of charcoal grew by 3%. Supply-side drivers identified in a study[94] on Zambia are not unique to that country and include poverty, limited employment opportunities, and the fact that charcoal production is a quick and easy business.

On the positive side, charcoal may well be the biggest cash earner in Miombo regions: in Dar es Salaam alone the industry is worth an estimated $350 million compared with coffee and tea, which contribute $60 million and $45 million respectively to the Tanzanian economy.[95] A study done by the World Agroforestry Centre (ICRAF) estimated that in 2007, the charcoal industry in sub-Saharan Africa was worth in excess of $8 billion and employed more than 7 million people.[96] However, despite the significant job creation potential and the broad-based income the charcoal business provides, there are concerns that it may serve as a poverty trap and that benefits are unequally distributed.[97] In contrast to the West African Sahel, where selective cutting and chopping is favoured, in East and Southern Africa charcoal production more often leads to clear-cutting or felling of desirable commercial species. This sees landscapes transformed from woodland to bush, and from bush to shrub.[98] In some cases charcoal production is a by-product of land clearing for agricultural expansion.[99]

Efforts towards ensuring the greater sustainability of the charcoal industry include improvements in production and consumption efficiency.[100] On the production side, agroforestry (trees for charcoal on farms) offers some potential, as does the creation of briquettes from agricultural by-products and/or invasive alien species. On the consumption side, there has been an emphasis on fuel-efficient stoves. There have also been attempts at developing more sustainable and equitable supply chains. This is coupled with a focus on the policy and institutional environment: policies are often non-existent or, where they exist (in Namibia and Kenya, for instance), are complex, multi-layered and unclear.[101] The study on Zambia's charcoal industry also recommended better organisation of charcoal producers and the use of local-level institutions, instead of moving sanctions to the state.[102] Some of these solutions can be integrated in the project design of innovative financial mechanisms, such as the CDM. See, for example, the case study in Box 1.

Of course, having alternative sources of energy and income could reduce the pressure on forest and tree resources. Then again, these alternatives bring their own dynamics, costs and benefits. At least two of these alternatives have implications for Southern Africa's dryland forests and people. The link between hydropower and forestry was briefly mentioned above. The case of Malawi presents an illustrative example (see Box 4).

Box 4: Hydropower and forestry in Malawi

Malawi relies on hydropower from the Shire River Basin for well over 90% of its electricity supply. Recently, heavy siltation of the basin has led to energy-supply issues as well as significant costs for the Electric Supply Company of Malawi (Escom). The siltation is the result of unsustainable land management practices, including deforestation. This has led to the development of a public-private partnership funded by the Global Environment Facility (GEF) and the UN Development Fund (UNDP). This pilot PWS mechanism will initially be implemented in four river basin districts, with plans to expand it to a basin-wide sustainable land management programme. Beyond Southern Africa, there has also been considerable interest in PWS in West and East Africa. For instance, Gabon's government is considering integrating such mechanisms into future hydropower development.

Source: Bennett G, Nathaniel C & K Hamilton, *Charting New Waters: State of Watershed Payments 2012*. Washington, DC: Forest Trends, 2013, p. 19. Available online at http://www.ecosystemmarketplace.com/reports/sowp2012

Finally, the biofuels industry also has a strong forestry dimension. These fuels include ethanol (produced from sugarcane or cassava) and biodiesel (produced from any oil, but most commonly jatropha). Biofuel crops often grow well in forested areas. Southern Africa has been identified as a region with significant biofuels potential, with the biofuels industry expressing strong interest in countries such as Mozambique – identified as the most promising country – Zambia, Tanzania, Madagascar, Namibia, the DRC and parts of Zimbabwe and South Africa.[103] The Miombo woodlands in particular have been identified as having a favourable climate and a low population density, creating the perception that this land is underutilised and available for biomass production.

However, this perception has been challenged by those who point out that the complexities of Africa's drylands (including inherent discontinuities, dynamism and spatial diversity) are badly understood[104] and who express concern at the carrying capacity of these lands.[105] In addition, it is not only the suitability of the land and its carrying capacity that need to be scrutinised, but also the extent to which the land is utilised, including by small-scale farmers, and land tenure.[106] To date, biofuels have most often been grown on large-scale mono-crop plantations. This has not contributed to their reputation, with concerns being raised about land grabs, property rights and other such challenges. Clearly, more detailed analysis on the dynamics of these ecosystems and the people who depend on them was needed before moving ahead. Some of this analysis is now forthcoming.

Local specificities aside, it is today generally accepted that converting natural vegetation – and forested areas in particular – to growing biofuels feedstock is a bad idea.[107] Abandoned or degraded land may hold more potential.[108] When considering converting existing cropland to biofuel feedstock production, a precautionary approach should be followed, taking into account the impact on food security.

To date, African biofuels have been produced mostly for foreign markets, where they have been pushed as renewable energy sources that contribute to GHG reductions.

However, when emissions from land-use change are taken into account, the GHG equations change substantially.[109] For their part, African governments have considered biofuels firstly as a mechanism for national development and the revitalisation of the rural farming economy and only secondly as a contributor to energy security on the continent.

Overall, so-called 'first generation biofuels' have yielded mixed results, at best. Many investors and farmers burnt their fingers and the momentum for biofuels appears to have slowed. Even so, there have been some instances of better practices, and a lot of learning along the way. For example, a project in Karnataka, India, produces biofuels from multiple native non-food species. This project forms part of a programme implemented by ICRAF aimed at the development of alternative biofuel crops and sustainable value chains.[110] Closer to home, a company called CleanStar Enterprises in Mozambique sees farmers producing cassava as part of a mixed agroforestry system.[111] Cassava is mainly a food crop, with the surplus used to produce biofuels for domestic consumption. The project's revenue comes from selling an energy solution (bio-ethanol and high-performance stoves), food products, and CDM-certified emissions reductions. This business case – described by some as an example of 'doing business at the bottom of the pyramid'[112] – could hold lessons for the rest of the region.

Finally, it is worth mentioning that cautious optimism has been expressed about so-called 'second generation biofuels', produced from non-food, woody crops, agricultural residues or waste.

FORESTS, AGRICULTURE AND FOOD SECURITY

The forestry and agriculture sectors have too often been viewed as motivated by different sets of objectives, even conflicting ones. For instance, agricultural expansion has been identified as one of the main drivers of deforestation in Southern Africa. Similarly, if forced to choose between spending on agriculture or forest conservation in a poor and food-insecure region such as Southern Africa, most people would choose agriculture. However, in many ways this may well be a false choice, or at least an overly simplified one. The director general of CIFOR, Peter Holmgren, speaks of a 'false dichotomy between forestry and agriculture'.[113] He is not alone. An integrated approach to agriculture and forestry has been gaining momentum in forums such as the UNFCCC. There are many ways in which the forestry sector supports food security, particularly in drylands.

Most obviously, forests contribute to food security among the rural poor through direct provisioning[114] of goods. Forests provide both food (bush meat, insects, fruits, leaves, seeds, nuts, honey, roots, tubers and mushrooms) and the fuel to cook it (fuel wood or charcoal). The diversity of these foodstuffs provides essential micronutrients, thereby contributing to nutrition security. Trees in forests and on farms as well as understorey shrubs and grasses serve as browsing and fodder for livestock.[115]

It is important to note that these products do not only contribute to subsistence living but also have great market potential. According to the FAO, in 2008 the global export value of edible tree commodities was more than $126 billion.[116] This figure includes valuable commodities such as coffee, palm oil, fruits, tree nuts and edible gums. Valuable commodities from the African Sahel include gum arabic, which was valued at $80 million in 2011, and shea butter, valued at between $90 million and $200 million a year and

benefitting over 3 million people, the majority of whom are women.[117] In fact, women often carry much of the responsibility for collecting and preparing NTFPs.[118] In Southern Africa, marketable non-timber forest products include marula and baobab products (fruit and oil), hoodia and pelargonium.[119] Hoodia and pelargonium are examples of medicinal NTFPs, and Allanblackia oil is used in food and cosmetics (See Box 5).

Box 5: Case study: Domestication of Allanblackia

As presented by Daniel Ofori, World Agroforestry Centre (ICRAF)

Allanblackia is the name of a tree found in forests across West, Central and East Africa. It was relatively unknown until consumer goods company Unilever found that its seeds contain a valuable oil with great potential for use in food and cosmetics. However, the company quickly realised that wild trees could not meet its annual projected demand, so it approached ICRAF to assist in domestication of the species. This led to the launch of a multi-country public-private partnership (PPP) in 2002, involving not only Unilever, ICRAF and other research institutions but also Novel International (specialising in supply chains, marketing and distribution), the IUCN (specialising in biodiversity conservation), the Union for Ethical BioTrade (specialising in organic and fair trade certification) and smallholder farmers. There are currently two pilot plantations run by local organisations in Ghana and Nigeria. However, the plan is to integrate the cash crop into agroforestry farming systems, which would allow smallholder farmers to grow it profitably.

The Allanblackia project has already yielded significant lessons related to tree domestication and PPP models. What is of particular relevance here is the agroforestry approach. Such an approach stands in contrast to that traditionally followed in the case of palm oil and for which companies have come under fire, namely clearing huge tracts of forested land in order to plant mono-crop plantations. Equally, the partnership model marks a change in the historically often adversarial relationships between multinational companies and conservation organisations, and potentially between multinational companies and smallholder farmers. Finally, the integration of science/research and business has the potential to be mutually advantageous. It would be interesting to monitor progress on the Allanblackia project and similar ones, with a view to learning lessons that could be applied in Southern Africa.

For more information, see the full presentation at http://www.saiia.org.za/events/making-the-case-for-southern-africas-dryland-forests.

Additional source: Pye-Smith C, *Seeds of hope: A public-private partnership to domesticate a native tree, Allanblackia, is transforming lives in rural Africa*. Nairobi: World Agroforestry Centre, 2009

Secondly, forests and trees provide ecosystem services that contribute to sustainable and productive agricultural systems[120] (the relationship between forestry and water was discussed earlier). Forests and trees also contribute to soil fertility, pollination, seed dispersal and nutrient cycling from woodlands to fields.[121] The biodiversity found in natural or uncultivated areas provides valuable genetic material needed for future nutritional and medicinal innovation.[122] In drylands, forests and woodlands also play a role in the way livestock is managed, while animal manure can be used as organic fertilizer.

Finally, forests and woodlands assist in the adaptation of food and agricultural systems to climate change, as well as other rapid changes. Wild foods fulfil a 'safety net' function in times of low agricultural productivity, whether these form part of normal cycles or of climate-related stress. In the Southern African dry season when animal feed is scarce, Miombo flush serves as fodder for livestock. Leaf litter is also composted and dug into agricultural fields, thereby increasing yields and improving moisture management in soil.[123] Across the Sahel, examples exist of the role of sustainable land management practices in mitigating desertification.

This paper does not argue for reverting to wild harvesting for the bulk of the region's food supply. Rather, it argues that integrated agroforestry or agro-livestock systems are particularly well suited to drylands. A strong case could be made for agroforestry (which has been proven to increase soil carbon 4–5 times when compared with conventional techniques such as mulching or no tilling) and silvi-pastoralism. Such approaches, including climate-smart agriculture and evergreen agriculture, are championed by ICRAF in its capacity as a member of the Consultative Group on International Agricultural Research (CGIAR), a major international consortium.

Beyond forests and woodlands, these approaches extend to the promotion of trees on farmland. This has the potential to contribute to climate change mitigation and adaptation even as it increases yields and incomes. A noteworthy example is the Faidherbia species found in West Africa and extending southwards into Zambia and Malawi, where field trials have shown that maize yields can be doubled when intercropped with Faidherbia.[124] Faidherbia loses its leaves during the wet season and so does not compete with annual crops. It is a leguminous species, which means that its leaves and nitrogen-rich roots can contribute to boosting yields even on badly depleted soils.[125] In East Africa, evergreen agriculture entails promoting the inclusion of appropriate high-value tree species in annual dryland cropping[126] – an approach that could probably be applied in Southern Africa as well.

This paper also calls for integrated, landscape-level planning for forests and land. This is already happening to some extent in the Sahel region, whose GGWSSI consists of a mosaic of sustainable land management practices, many involving forestry or woodlands, as well as trees on farmland. Although there are already a number of success stories coming from that region, there is more room to upscale and mainstream these approaches. One initiative that aims to upscale many of the lessons mentioned previously across the world's forests, notably emphasising dryland forests, is the Global Partnership for Forest Landscape Restoration.[127] Southern Africa stands to gain significantly through such initiatives and partnerships.

CONCLUSION

The potential of integrated solutions to the governance of dryland forests is by now recognised among key forestry actors on the global stage. Much of the discussion in this paper is therefore not new. Examples involving the forestry sector are prominent in a repository of best practice examples of sustainable land management emerging from across the drylands of Africa. Although Southern Africa has not been left out of this narrative – and not disregarding the substantial body of knowledge on the Miombo woodlands – there is still great potential to build on lessons emerging from regions such as the Sahel and East Africa. The aim of the conference co-hosted by SADC and SAIIA in October 2013 was to share best practice examples of dryland forest management among forestry stakeholders on the continent, and specifically with those from Southern Africa.

In building on the examples of best practices on dryland forests presented at that conference, this paper argues that it is necessary to make a stronger case – especially for Southern Africa's dryland forests – beyond the limited circle of stakeholders involved in the forestry sector. One of the main reasons for this is that several challenges faced by the forestry sector emanate from dynamics outside the sector. Moreover, the forestry sector is too often simplistically pitted against sectors such as agriculture, energy and water. The WEF nexus is identified as an appropriate conceptual lens through which to identify interdependencies between these sectors and forestry, in the context of climate change. A key objective of this paper is to provide forestry policymakers with a number of entry-points for discussion with stakeholders in other sectors. Instead of a default adversarial position, it has been demonstrated here that policymakers can first consider possible win-win solutions. If trade-offs cannot be avoided, a nexus approach could provide a basis for negotiation and assist in minimising adverse outcomes.

Finally, by viewing dryland forests through a WEF nexus lens, this paper also elucidates the underlying challenges of the forestry sector for a broader policy audience in the Southern African region. The nexus approach has been growing in popularity among stakeholders in the water, energy and agriculture sectors. It is also increasingly being applied as a lens through which to view other natural resource sectors (for example, mining). However, to date this has rarely been applied to the forestry sector specifically. As the preceding analyses show, drawing these connections opens up vast potential and opportunities for a holistic policy consideration that integrates forestry concerns with those in interdependent sectors.

APPENDIX

CONFERENCE PROGRAMME

Best practice in the governance of Africa's dryland forests: Implications for Southern Africa

Date: 22-23 October 2013

Venue: Birchwood Hotel, Johannesburg, South Africa

Close to half of the African continent is covered by drylands, spread entirely or partially over 15 countries of the Sahel, and 15 countries of East and Southern Africa. These ecosystems support 64% of Africa's people with a wide range of environmental goods and services, many of which are derived from the region's dryland forests and woodlands. If these forests are properly valued and sustainably managed, they have the potential to contribute to economic development, poverty reduction and food security. In addition, the value of dryland forests stretches beyond the products they provide; beyond timber and even non-timber forest products (NTFPs). There is increasing global recognition of the multiple ecosystem services provided by dryland forests. In addition to sequestering carbon, dryland forests also provide services related to the protection of watersheds and biodiversity. These services are critical for ensuring long-term food security in arid regions.

Despite their critical importance, dryland ecosystems are particularly threatened by a range of impending threats, including inadequate land-use policies, complex land tenure issues, encroaching desertification and climate change-related phenomena. Poor governance, in terms of weak regulatory and legislative frameworks, ineffective and poorly resourced governing institutions and the absence of inclusive and participatory systems, are also overarching challenges in the management of these areas. Moreover, the contribution of forests and woodland resources to regional economies and livelihoods is not sufficiently recognised. This has led to a lack of adequate investment in sustainable management plans and measures throughout the Southern African region.

These very real challenges threaten to obscure a repository of best practice examples that exist across the dryland forests of sub-Saharan Africa. It is with this in mind that the Governance of Africa's Resources Programme at the South African Institute of International Affairs (SAIIA) and the Food, Agriculture and Natural Resources (FANR) Directorate of the Southern African Development Community (SADC) are co-hosting a two-day conference to explore best practice experiences in the governance of Africa's dryland forests for Southern Africa. We are proud to be hosting participants from all SADC member states. Each panel discussion is specifically designed to add impetus to the SADC Forest Strategy 2010–2020 and to explore priority areas identified in the Strategy. Speakers from the public and private sectors will share lessons and best practice examples of dryland management and use from Southern Africa, the Sahel and East Africa.

** This event has been kindly co-sponsored by the Norwegian Embassy in South Africa and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH**

DAY 1:

9:00 – 9:30 Welcoming remarks

- Mr Nyambe Nyambe (Senior Policy Officer, Food, Agriculture and Natural Resources (FANR) Directorate, SADC Secretariat)
- Dr Ola Bello (Programme Head, Governance of Africa's Resources Programme, SAIIA)

9:30 – 11: 00 Keynote addresses

- Valuing the dryland forests of Southern Africa, by Mr Edmund Barrow (Head, IUCN Global Ecosystem Management Programme)
- The Great Green Wall and the African Union, by Mr Almami Dampha (Policy Officer, Rural Economy and Agriculture Department, AU Commission)

11:00 – 11:30 TEA BREAK

11:30 – 13:00 Session 1: Climate change mitigation and adaptation (chaired by Romy Chevallier, SAIIA)

There is increasing global recognition of the importance of forests in climate change mitigation. This is reflected, for instance, in the priority accorded to schemes for reducing emissions from deforestation and forest degradation (REDD+) in international climate change negotiations. Whereas REDD+ initially focused largely on tropical dense rainforests, its expansion to other forest types has broadened the scope for Southern Africa's participation. Although dryland landscapes store less carbon per hectare than tropical forests, the extensive nature of these landscapes translates into significant carbon storage potential and therefore new opportunities for the SADC region's participation in mitigation activities.

Forests are also critically important from an adaptation perspective, by providing ecosystem services that reduce societies' vulnerability to the impacts of climate change. By providing vital services such as desertification control, the prevention of water run-off and soil erosion, forests in drylands can help people adapt to changing climatic conditions. Trees also provide "safety nets" in harsh environments. For instance, during dry periods when animal feed is scarce, leaves from the Miombo woodlands serve as fodder.

It is therefore important that the interests of SADC member states are better represented in international negotiations and in platforms such as the United Nations Forum on Forestry (UNFF), as well as the Rio Conventions (the UNFCCC, the UNCCD and the CBD) and the related instruments, including REDD+ and the Clean Development Mechanism (CDM). This session will consider some best practice examples related to the role of dryland forests in climate change mitigation and adaptation.

Setting the scene: Africa in the UNFCCC: Implications for the forestry sector in Southern Africa, by Hlobsile Sikhosana (Ministry of Tourism and Environmental Affairs, Swaziland – current chair of the Africa Group)

Discussants:

- Humbo Assisted Natural Regeneration: A successful CDM project in Ethiopia, by Hailu Tefera Ayele, (World Vision Ethiopia)
- SADC/GIZ's Monitoring, Reporting and Verification (MRV) Project, by Alexandra Mueller (SADC/GIZ REDD+ Project)
- Climate change impacts on forests, water and biodiversity, by Dr Nick King (independent researcher)

13:00 – 14:00 LUNCH BREAK

14:00 – 15:30 Session 2: Forests, water and biodiversity (chaired by Mari-Lise du Preez, SAIIA)

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The protection of key river catchments is a vital forestry function, but for which the forest sector does not normally receive its due recognition. Forests' hydrological services are of particular significance in a region familiar with water shortages. That said, the relationship between forests and water remains a complex one. For instance, plantation forests are dominated by thirsty, exotic species. Discussions of indigenous and exotic species also relate closely to issues around biodiversity. In light of this, the SADC Forest Strategy prioritises the protection and sustainable management of representative forest ecosystems and of key catchment forests.

This session will include some innovative governance solutions and financing mechanisms for protecting two sets of crucial ecosystem services provided by the forestry sector, namely hydrological and biodiversity services.

Setting the scene: Forest-Water relations: What do we know? by Phosiso Sola (CIFOR, Kenya)

- Payment for watershed services in East Africa: The case of Uluguru Mountains, by Shadrack Mwakalila (WWF Tanzania)
- Managing the control of invasive alien species in dryland ecosystems: The case of Prosopis in Botswana, Namibia and South Africa, by Lael Walsh and Cathrine Mutambirwa (IUCN ESARO)

15:30 – 15:45 TEA BREAK

15:45 – 17:15 Session 3: Energy supply and poverty reduction (chaired by Phosiso Sola, CIFOR)

The importance of forests to livelihoods is reflected in the fact that income from woodlands products typically account for between 10-50% of everything a rural African household uses. By way of example, around 90% of rural Africa is reliant on wood fuel as the main source of energy. Even in urban areas, charcoal dominates as an energy source across much of the continent. This is the case also in most of Southern Africa. Unfortunately, the reality of the rural households' dependence on forests and woodlands are met with marginalisation of the sector in policy-making circles. Part of the reason for this relates to the small contribution of the sector to the formal economy, often mentioned as a percentage of GDP. Combined, the two factors – dependence and neglect – undermine both the potential of the forestry sector and its sustainability. The magnitude of the challenge is illustrated by the fact that Southern Africa is the region with the highest rate of deforestation on the continent.

This session will consider opportunities to enhance the forestry sector's contribution to poverty alleviation and energy provision, while safeguarding environmental and food security objectives. Meeting these multiple objectives will require an integrated approach to the governance of the sector.

Setting the scene: Drylands and the Water-Energy-Food security (WEF) nexus, by Anthony Turton (South Africa WEF Forum)

- The role of biomass energy in Southern Africa, by Graham von Maltitz (CSIR)
- Charcoal use in Zambia, by Davison Gumbo (CIFOR, Zambia)
- Rethinking bio-energy: Value chains that put farmers first, by Navin Sharma (ICRAF)

17:15 – 17:30 CLOSING

DAY 2

9:00 – 9:30 Opening Day 2

9:30 – 11:00 Session 4: Trade in forest products (chaired by Mari-Lise du Preez, SAIIA)

The regional timber sector in Southern Africa is characterised by unrealised potential. In most states, the sector's formal economic contribution is small or even negligible. Part of the problem is that many of the

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benefits from the forestry sector are invisible in state accounts. In the case of the regional timber trade specifically, this near invisibility is in large part due to the trade's informal nature. SADC proposes to enhance the trade in timber through initiatives aimed at professionalising the sector. Again, this is only possible if this trade is conducted sustainably. Also, to facilitate a growth in timber supplies to the local and regional markets, partnerships and grant schemes could assist plantation forestry projects. Timber from pine and eucalyptus could presumably assist in ensuring that indigenous forests are not over-utilised or unsustainably harvested. This session will also consider the potential of the trade in non-timber forest products (NTFPs).

Setting the scene: Ten years of EU-FLEGT in the Congo Basin - lessons for Southern Africa, by Paolo Cerutti (CIFOR)

- Public-Private Partnerships: Uganda's Sawlog Production Grant Scheme, by Robert Nabanyumya
- The role and potential of the SADC timber association, by Paul Makolosi (SADC Timber Association)
- Public-private partnerships for sustainable agroforestry and business development: Allanblackia species as a case study, by Daniel Ofori (ICRAF)

11:00 – 11:30 TEA BREAK

11:30 – 13:00 Session 5: Transfrontier areas and participatory forest management (chaired by Romy Chevallier, SAIIA)

In the SADC region the premise is that trans-boundary parks seek to promote the conservation and sustainable management of ecosystems that transcend international boundaries. SADC's Transfrontier Conservation Areas (TFCAs) are recognised as important tools in promoting the conservation of biodiversity and endangered ecosystems, as well as in contributing to the welfare and standards of living of communities in the sub-region. Collaboration across borders requires efforts not only from the relevant forestry, wildlife and tourism departments, but also from the agriculture and livestock sectors.

In order for TFCAs to promote the legitimate components of regional development programmes for poverty alleviation and community development, community participation needs to be more central. This session will focus on the opportunities to empower communities and to facilitate the involvement of the private sector to better participate in forest governance. This includes the devolution of rights to own, manage and receive benefits from the forestry and related wildlife sectors. Consultative and participatory community-based forest management approaches have the potential to contribute to job creation and poverty reduction. There have been various models tried and tested in the SADC region over the last 15 years.

This session will discuss some best case examples of initiatives such as nature-based tourism and conservation enterprises that have brought about sustainable economic development through benefit-sharing with communities living in and around reserve areas. Trans-boundary collaboration and community involvement is also required on fire, pest and disease control.

Setting the scene: SADC Transboundary Use and Protection of Natural Resources Project, by Moses Chakanga (SADC FANR Directorate)

- Community ownership and responsible tourism: Mozambique's Chemucane ecotourist lodge in the Lubombo TFCA, by Steve Collins (African Safari Foundation)
- Gender, tenure and community forestry in Uganda, by Awboli Banana (Makerere University)
- Chibememe Earth Healing Association in Zimbabwe, by Gladman Chibememe (CHIEHA, Zimbabwe)

13:00 – 14:00 LUNCH BREAK

14:00 – 16:00 Session 6: General reflections from member states and presenters, and way forward (chaired by Nyambe Nyambe, SADC FANR)

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