Integrating climate change adaptation and mitigation into the watershed management approach in Eastern Africa
Discussion paper and good practices
Integrating climate change adaptation and mitigation into the watershed management approach in Eastern Africa: Discussion paper and good practices booklet
The FAO Sub-regional Office for Eastern Africa, in partnership with FAO Uganda, organized the Expert workshop on the identification and review of emerging good practices, lessons learned and policy opportunities around integrating climate change adaptation and mitigation (CCA&M) into the watershed management approach. The workshop was held in Kampala, Uganda from 9 to 11 December 2015.

This publication and the practices described (from page 17 to 52) are a result of that workshop and the agreed follow-up actions. The main objectives of this discussion paper are to elaborate on what is meant by integrating climate change adaptation and mitigation into the watershed management approach; describe the benefits of this approach; give examples of its use; and ultimately serve as a guide and advocacy tool for a greater focus on systematically integrating climate change adaptation and mitigation into watershed management – for environmental as well as social and economic benefits.

This publication was initiated by the FAO Sub-regional Office for Eastern Africa to identify, analyse and document existing watershed management practices in the Eastern Africa subregion that contribute to climate change adaptation and mitigation. There is opportunity to use this information to inform agriculture and watershed management-related policies, programmes and projects in the region, with the aim of sustainably increasing agricultural production and productivity, building resilience to climate-related hazards, and contributing to climate change mitigation.

Dr Patrick Kormawa
FAO Sub-regional Coordinator for Eastern Africa and Representative to the African Union and UNECA
ACKNOWLEDGEMENTS

This publication was prepared by Sebastian Grey (Natural Resources Officer) and Koen Joosten (Water Resources Officer) of the FAO Sub-Regional Office for Eastern Africa. It is the result of a subregional expert workshop, good practice documentation process, publications review, and consultations with practitioners working on watershed management, agriculture and food security in the subregion.

The authors would like to thank all contributors, without whom this document would not have been possible. In particular, the authors would like to acknowledge the following individuals for their contribution to the documentation and validation of practices that are part of this publication:

- Saleh Daoud Saleh, Ministry of Agriculture, Djibouti
- Abenet Mengistu, Ministry of Agriculture and Natural Resources, Ethiopia
- Didace Habamenshi, Ministry of Agriculture and Animal Resources, Rwanda
- Willy Kakuru, FAO Uganda
- Abdul Saboor Jawad, FAO Uganda
- Leone MagliochettiLombi, FAO Djibouti
- Placide KanyabujinjaNshuti, FAO Rwanda

The paper was reviewed by Edward Kilawe, Dario Cipolla, Leone MagliochettiLombi, and Abdul Saboor Jawad.
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<td>CBIWRM</td>
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<td>MAEPE-RH</td>
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INTEGRATING CLIMATE CHANGE ADAPTATION AND MITIGATION INTO THE WATERSHED MANAGEMENT APPROACH IN EASTERN AFRICA
EXECUTIVE SUMMARY

Without significant and well-planned adaptation efforts, climate change is predicted to have a marked effect on the agricultural sector in Eastern Africa – reducing agricultural yields and negatively impacting efforts to achieve food security and end hunger in the subregion. However, there is considerable potential to adapt to climate change, particularly through an enhanced focus on improved land and water management, the establishment of appropriate policies, capacity building of institutions and individuals, and the promotion of investments in land and water management. This can be done within the framework of the watershed management approach.

By employing this approach, it is possible to use agriculture and smallholder farmers as the driving force to restore the natural resource base in a manner that also contributes to climate change adaptation and mitigation – some of the major crosscutting themes of the Sustainable Development Goals (SDGs). In fact, of the 17 SDGs and their 169 associated targets, six SDGs and 16 targets contain wording that relates directly to the joint tackling of climate change and watershed management.

Watershed management, which can be defined as the management of all human activities and their effect on the environment within a geographical area defined by a watercourse, can be applied to promote coordinated actions and linkages between upstream and downstream environments and populations. There are compelling reasons for systematically integrating climate change adaptation and mitigation into the watershed management approach. Linking watershed management with climate change adaptation and mitigation:

- can provide not only environmental benefits at the watershed scale, but also livelihood, resilience, food security and poverty reduction benefits in addition to contributing to climate change mitigation;
- brings greater benefits than the individual benefits derived from undertaking climate change interventions at just the household level;
- can allow for diverse groups of stakeholders and institutions to work together to address issues (that were previously addressed in a sectoral way) in a harmonized and coordinated manner that maintains watershed/ecosystem services for all;
- allows for more efficient use of time and financial resources that would otherwise be spent conducting capacity building separately and in an uncoordinated manner;
- can facilitate the achievement of multiple objectives – in this case helping communities to adapt to climate change, contributing to the reduction of greenhouse gas emissions, conserving the environment and improving people’s lives and livelihoods.

Overall, it can be concluded that while the watershed approach can (and sometimes already does) contribute to climate change adaptation and mitigation, there is a need to find ways of systematically doing this while being able to measure the adaptation benefits for the inhabitants of these watersheds as well as the mitigation benefits accrued by the actions. A prolonged joint effort is required, as elaborated within the framework of the integrated watershed management approach, which takes consideration of livelihoods and resilience to climate change and the contribution of watersheds to climate change mitigation.
INTEGRATING CLIMATE CHANGE ADAPTATION AND MITIGATION INTO THE WATERSHED MANAGEMENT APPROACH IN EASTERN AFRICA
Background

The FAO Sub-regional Office for Eastern Africa, in partnership with FAO Uganda, organized the “Expert workshop on the identification and review of emerging good practices, lessons learned and policy opportunities around integrating climate change adaptation and mitigation (CCA&M) into the watershed management approach”. The workshop was held in Kampala, Uganda, from 9 to 11 December 2015.

Throughout the workshop the participants exchanged information on lessons learned and reviewed experiences and good practices, as well as opportunities and barriers encountered in integrating climate change adaptation and mitigation into the watershed management approach. The workshop was well attended by Ministries of Agriculture from six countries in Eastern Africa, FAO staff, IGAD and several development and research partners such as ICARDA, IWMI, GIZ, IUCN, Rain Foundation, and WLRC. The participants agreed to the documentation and sharing of at least one good practice per country as well as the development of a working paper elaborating some of the key issues related to integrating climate change adaptation and mitigation into the watershed management approach.

This booklet and the practices described from page 17 onwards resulted from that workshop and the agreed follow-up actions. The main objective of the booklet is to elaborate what is meant by integrating climate change adaptation and mitigation into the watershed management approach; describe the benefits of this approach; give brief examples of its use; and ultimately serve as a guide and advocacy tool for a greater focus on systematically integrating climate change adaptation and mitigation into watershed management, for environmental as well as social and economic benefits.
Agriculture, particularly smallholder farming, is the backbone of most Eastern African countries and plays a key role in their industrial development and trade. The sector employs about 80 percent of the region’s labour force and contributes more than 50 percent of raw materials to the industrial sector and 40 percent of the subregion’s GDP, with an efficiency of labour force of 1/6 of the other sectors.

The Eastern Africa region is prone to extreme weather events such as droughts, floods, tropical cyclones and storms, which often have devastating impacts on human health, agriculture, infrastructure and many other key socio-economic sectors. The effects of climate-related shocks on the performance of agricultural systems are exacerbated by the widespread degradation of soil, water and biodiversity as well as the high reliance of the rural population on rainfed agricultural production for food security and livelihoods. In addition, land holdings by smallholder farmers in the region are in many cases small and fragmented, often with low tenure security, thus resulting in low investment in and production from the land.

In addition, climate variability in the subregion is increasing and the frequency and intensity of climate hazards – especially drought – have increased over the past decades. The droughts in Djibouti, Ethiopia, Somalia and Kenya during the 2009-2011 period, for example, threatened the livelihood of 9.5 million people and left many farmers in precarious food security situations owing to the loss of livestock and crop harvests. These changes are predicted to worsen as a result of climate change and some areas will likely undergo more extreme and frequent periods of intense rainfall, and/or more frequent episodes of drought. These changes are likely to have significant implications for agriculture, food security, and soil and water resources. Some areas already facing water scarcity are becoming even drier. There are also indications that the carrying capacity of rangelands in the subregion is under critical stress, with increasing levels of overgrazing and water scarcity. Vegetation loss
in Eastern Africa has been accelerating and only a few countries in the subregion have managed to reverse the trends in deforestation.

Smallholder farmers, particularly women, are expected to bear the brunt of these changes because of their disproportionately high dependence on rainfed agriculture and natural resources such as rangelands. The subregion is also vulnerable to a range of climate-sensitive diseases including malaria, dengue fever, meningitis and rift valley fever – whose increased incidence and spread are driven by climate variability and change.

Without significant and well-planned adaptation efforts, climate change is predicted to affect the agricultural sector in Eastern Africa and ultimately to reduce agricultural yields and hamper efforts to achieve food security and end hunger in the subregion. Despite the urgent need to adapt to climate change, the subregion’s capacity to adapt, at both national and local levels, is low owing to the limited options for alternative livelihoods, lack of support for climate change adaptation actions, limited knowledge of climate change adaptation options, poor planning and limited knowledge of future climate change scenarios. There is considerable potential to adapt to climate change, particularly through an enhanced focus on improved land and water management, the establishment of appropriate policies, capacity building of institutions and individuals, as well as promotion of investments in land and water management. This can be done within the framework of the watershed management approach. While watershed management has been clearly defined over the last decades (see page 5), no framework or definition for “the watershed management approach” currently exists, but a number of programmes and projects are already systematically integrating climate change adaptation and mitigation aspects into watershed management programmes and projects.

Using the watershed management approach, it is possible to reverse the situation and use agriculture and smallholder farmers as the driving force to restore the natural resource base in a manner that also contributes to climate change adaptation and mitigation. Such an approach could have an impact on food and nutrition security and income generation in the short term, while bringing longer-term impacts on the physical environment through reducing land degradation and desertification, improving water availability and quality and reducing the incidence, severity and impact of climate hazards such as droughts and floods.

Good watershed management can support improved land and water management as well as promote effective actions related to climate change adaptation and mitigation (CCA&M). Examples from FAO projects in Uganda, Kenya, Rwanda and Ethiopia indicate that improving and strengthening watershed management can be very effective in addressing current land and water resource challenges, while at the same time providing a first step to meeting the challenges posed by climate change.
Fao has been involved in watershed management across the world since the 1970s. Watershed management is one of FAO’s key approaches and is defined as a set of actions aimed at ensuring the sustainable use of natural resources in a watershed. Watershed management can be thought of as the management of all human activities and their effect on the environment within a geographical area defined by a watercourse. It provides a framework for integrating different land-use and livelihood systems, e.g. forestry, pasture and agriculture, but also mixed systems. These actions focus on the geographical area drained by a watercourse, which can range from small-scale upland watersheds to extended river basin landscapes. Regardless of scale, an integrated landscape management approach is applied to promote coordinated actions within upland watersheds and linkages between upstream and downstream environments and populations.

Natural capital assets such as land and water are an obvious linkage between watershed management and livelihoods. However, watershed programmes that focus only on natural resources have limited impacts on livelihoods and poverty. With climate change come new challenges of also making sure that watershed management contributes to climate change adaptation and mitigation, where possible.
Box 1: What are watersheds?

Also known as ‘drainage areas’ or ‘river basins’, watersheds are the zones from which rain or melting snow drains downhill into a river, lake, dam, estuary, wetland, sea or ocean. A watershed can be as large as several thousand square kilometres (as in the case of major river basins), or as small as a few hectares (as in the case of farm micro-watersheds). Smaller watersheds are nearly always part of a larger watershed or river basin.

Watersheds are powered by the force of gravity, which makes water flow downstream according to the gradient of the slope. The watershed environment is highly dynamic. Highland rainfall is collected and delivered to downstream areas. Surface and underground water resources are created and recharged. Vegetation is irrigated and animals watered. Soil is enriched by the mineral and organic sediments carried by runoff. Seeds are transported.

Humans are often part of watershed ecology, and traces of human activities are clearly visible in watershed landscapes. Watershed management works, such as terraces and irrigation works, have significantly contributed to the development of human civilizations.

A watershed is the geographical area drained by a water course. The concept applies to units ranging from a farm crossed by a creek (a micro-watershed) to large river or lake basins.

A river basin corresponds to the complex system of watersheds and sub-watersheds crossed by a major river and its tributaries while flowing from the source to the mouth.

Integrated water resources management (IWRM) has been defined by the Global Water Partnership as "a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems".

Watershed management has evolved and passed through several developmental stages. In the initial stages, it was a subject of forestry and forestry-related hydrology, with little or no focus on people and socio-economic aspects. It has evolved into “participatory and integrated” watershed management, with involvement and contribution from local people. The involvement of communities in watershed management is essential as communities are affected by what happens in their watershed, while at the same time their actions have an impact on the state of the watershed as well as on downstream availability and quality of water and other ecosystem services.

Yet watershed management often only includes socio-economic development activities as complementary components of natural resource management interventions \(^1\) rather than systematically including these issues into the design of the interventions. In some cases, though, watershed management has focused on those aspects of sustainable livelihoods that are directly linked to natural capital assets, for example, by strengthening the capacity of local role players to manage agricultural land and community resources in ways that promote environmental stability (e.g. reducing erosion), food security, and water quality and availability.

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On 25 September 2015, the 193 Member States of the United Nations adopted the Sustainable Development Goals (SDGs), a set of 17 aspirational objectives with 169 targets expected to guide actions of governments, international agencies, civil society and other institutions over the next 15 years (2016-2030). Succeeding the Millennium Development Goals (MDGs), the ambitious 2030 Agenda is a global vision for people, for the planet and for long-term prosperity. It charts a plan for the future – shifting the world onto a sustainable and resilient course and leading to transformation in standards of living and to a transition to more inclusive, dynamic and sustainable pathways to development. The 17 SDGs aim at ending poverty and hunger while restoring and sustainably managing natural resources. They integrate the three dimensions of sustainable development – economic, social and environmental – with closely interwoven targets. The SDGs are indivisible – no one goal is separate from the others, and all call for comprehensive and participatory approaches. They are universal – the 2030 Agenda is as relevant to developed nations as it is to developing nations.

The 2030 Agenda recognizes that we can no longer look at food, livelihoods and the management of natural resources separately. A focus on rural development and investment in agriculture – crops, livestock, forestry, fisheries and aquaculture – are powerful tools to end poverty and hunger, and bring about sustainable development. Agriculture has a major role to play in combating climate change.

Tackling climate change and improving natural resources management are some of the major crosscutting themes of the sustainable development goals. Of the 17 SDGs and their 169 associated targets, six SDGs and 16 targets contain wording that relates directly to the joint tackling of climate change and watershed management.
Feeding a growing global population while nurturing the planet will be a monumental challenge, but it can be achieved by transforming food systems and agriculture, embracing sustainable living and working practices, improving governance and securing the political will to act. Achieving the global hunger eradication goals will require management of agro-ecosystems in a sustainable and environmentally sound manner, while simultaneously addressing issues of climate change, biodiversity loss and land degradation, which are threatening food production systems across the world.

Increasing food production while using less water is one of the greatest challenges to sustainable agricultural production, particularly in the context of increasing water scarcity in some parts of the world due largely to a changing climate.

The sustainable management and efficient use of natural resources, including land and water, are key aspects of promoting responsible consumption and production. To feed the world sustainably, farmers need to grow more food, while reducing negative environmental impacts such as soil erosion, soil nutrient depletion, water loss and waste, greenhouse gas emissions and degradation of agro-ecosystems and watersheds.

Agriculture has a major role to play in responding to climate change. While temperature rises and increasing weather variability pose a real threat to food production, investments in agriculture can simultaneously support climate change adaptation and mitigation while improving rural people’s livelihoods.

The sustainable use and management of terrestrial ecosystems, forests, mountains, biodiversity, land and soils is well articulated in this goal. The SDG includes a focus on the sustainable management of soils, forests, biodiversity and their role in climate change adaptation and mitigation.

Here the emphasis is on inclusive societies for sustainable development with effective, accountable and inclusive institutions at all levels. This is one of the key requirements for the sustainable management of natural resources and the tackling of climate change adaptation and mitigation through the watershed management approach, which requires the involvement of all stakeholders at all levels in a participatory and representative manner, supported by strong internal and external institutions. In addition, no infrastructural investment in agriculture, climate change adaptation and mitigation or environment will be sustainable or efficiently and effectively managed without a huge and continuous investment in human and institutional capacity. Already it is paradoxical that where the conditions are harsher and the need for investments in climate change adaptation and mitigation more needed, the institutions and the farmers themselves are often weaker and less knowledgeable; often abandoned to themselves and their traditional knowledge.

The above goals and their associated targets imply working to address food security, ecosystem management and environmental protection while tackling climate change for households and ecosystems, all of which can best be tackled at the watershed level. Table 1 further elaborates on watershed management, climate change and the SDGs.
<table>
<thead>
<tr>
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<th>Target related to watershed management and climate change adaptation</th>
<th>Target related to watershed management and climate change mitigation</th>
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<tr>
<td>2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.</td>
<td>2.3 Double the agricultural productivity and incomes of small-scale food producers 2.4 Ensure sustainable food-production systems and implement resilient agricultural practices 2.5 Maintain genetic diversity of seeds, plants and animals</td>
<td>2.3 Double the agricultural productivity and incomes of small-scale food producers 2.4 Ensure sustainable food-production systems and implement resilient agricultural practices</td>
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<td>6. Ensure availability and sustainable management of water and sanitation for all.</td>
<td>6.3 Improve water quality 6.5 Implement integrated water resources management 6.6 Protect and restore water-related ecosystems</td>
<td>6.4 Improve water-use efficiency</td>
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<td>12. Ensure sustainable consumption and production patterns.</td>
<td>12.3 Reduce food losses along production and supply chains</td>
<td>12.2 Achieve sustainable management and efficient use of natural resources 12.3 Reduce food losses along production and supply chains</td>
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<tr>
<td>13. Take urgent action to combat climate change and its impacts.</td>
<td>13.1 Strengthen resilience and adaptive capacity to climate-related hazards 13.2 Integrate climate change measures into national policies, strategies 13.3 Improve human and institutional capacity on climate change mitigation, adaptation, impact reduction</td>
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<tr>
<td>15. Protect, restore and promote sustainable use of terrestrial ecosystems.</td>
<td>15.1, 15.2, 15.4 Ensure conservation, restoration and sustainable management of all terrestrial ecosystems 15.3 Combat desertification, and restore degraded land and soil 15.5 Take urgent action to reduce degradation of natural habitat, halt the loss of biodiversity 15.9 Integrate ecosystem and biodiversity values into national and local planning</td>
<td>15.1, 15.2, 15.4 Ensure conservation, restoration and sustainable management of all terrestrial ecosystems 15.3 Combat desertification, and restore degraded land and soil 15.5 Take urgent action to reduce degradation of natural habitat, halt the loss of biodiversity 15.9 Integrate ecosystem and biodiversity values into national and local planning</td>
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<td>16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.</td>
<td>16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels</td>
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A number of compelling reasons for systematically integrating climate change adaptation and mitigation into the watershed management approach are described below.

As indicated in previous sections, traditional watershed management has focused largely on environmental aspects, with little and non-systematic integration of socio-economic aspects related to the livelihoods of those who live within the watershed. Climate change adaptation and mitigation add another challenge to watershed management, making it even more important to consider environmental, social, and economic aspects. Systematically integrating climate change adaptation and mitigation concerns into watershed management can provide not only environmental benefits at the watershed scale but also livelihood, resilience, food security and poverty reduction benefits in addition to contributing to climate change mitigation. Yet despite this, in most cases watershed management is undertaken without systematically incorporating climate change adaptation and mitigation and the needs of smallholder farmers living within those communities, and rather almost always focuses solely on the environmental component.

Watershed management can also be a sensitive issue – poor watershed management both within countries and across national boundaries may result in conflicts. Climate change adds a new dimension to this, as water and land resources are expected to become scarcer and competition for resources is set to increase. Therefore, watershed management needs to take consideration of climate change adaptation.
Box 2: The need for a landscape approach to climate change adaptation and mitigation

Experience has shown that by managing natural resources in a way that ensures the resilience of ecosystems, it will be possible to reverse natural resource degradation, safeguard agricultural productivity and maintain ecosystem services (e.g. the provision of water, control of pests and diseases, pollination and climate regulation). These healthy ecosystems then provide the basis for sustainable agriculture, forestry and fisheries. To achieve healthy ecosystems, participatory and people-centred approaches and management structures are needed. This approach will simultaneously improve the resilience of production systems and people’s livelihoods.

Source: Climate-smart Agriculture Source Book
http://www.fao.org/docrep/018/i3325e/i3325e00.htm

In the watershed approach, the management of natural resources and production systems covers an area large enough to produce vital ecosystem services necessary for human livelihoods. At the same time, the watershed unit is small enough to allow for involvement of the people living on and using the land in the management and sustainable utilization of their own natural resources for the benefit of the environment and natural resource base, as well as for the benefit of the people's own economic, food security and livelihood needs. Tackling climate change at a watershed level therefore brings greater benefits than the individual benefits derived from undertaking climate change interventions at just the household level. The approach can facilitate the achievement of multiple objectives, which in this case includes helping communities to adapt to climate change, contributing to the reduction of greenhouse gas emissions, conserving the environment and improving people's lives and livelihoods. Tackling climate change adaptation at the watershed level can also allow for diverse groups of stakeholders and institutions to work together to address issues – that were previously addressed in a sectoral way – in a harmonized and coordinated manner that maintains watershed/ecosystem services for all.

Like most environmental restoration programmes, watershed management often has a long-term focus which, by incorporating climate change considerations (particularly climate models and projections), can help to develop more sustainable management practices and interventions in the long term. Watershed management is often also approached two-dimensionally, focusing largely on a horizontal plane of action and concerned with the physical features and characteristics of the land. Incorporating weather and climate change considerations adds a third dimension in line with the hydrological cycle – which functions both horizontally and vertically and helps to improve planning, taking consideration of the open nature of the watershed system, which is not only affected by what happens on the horizontal axis, but also by what happens on the vertical axis (for example rainfall and evapotranspiration).

Both watershed management and climate change adaptation are based largely on the skills and expertise of people and the capacity of institutions. By tackling climate change adaptation and mitigation within the watershed management approach, the skills and capacity of both people and institutions on climate change adaptation and mitigation as well as watershed management can be simultaneously addressed. This allows for more efficient use of time and financial resources that would otherwise be spent conducting capacity-building initiatives separately and in an uncoordinated manner.

It should also be noted that the cost of restoring natural assets is high, though not comparable with the cost of not intervening at all. These intervention costs can be significantly reduced if focus is placed on multiple objectives of land restoration and protection, sustainable agricultural production and productivity, and climate change adaptation and mitigation. For example, an analysis conducted in Somaliland shows that the intervention costs of land conservation activities barely reach 10 percent of the losses caused by floods and droughts. The erosion caused by a flood after four hours of rain may take away the amount of soil that was formed over hundreds of years, and would need many centuries to restore it. In addition, by integrating climate change adaptation
and mitigation concerns into the watershed management approach, new possibilities for attracting climate finance are opened (such as through the Green Climate Fund). With the Paris Agreement now in force, and the need for all countries to contribute to climate change adaptation and mitigation as elaborated in the Nationally Determined Contributions (NDCs), many countries have identified synergies between climate change adaptation and mitigation in agriculture with a focus on managing ecosystems, landscapes and watersheds in a way that brings multiple benefits. Box 3 indicates some areas where the NDCs of countries have mentioned issues related to climate change adaptation and mitigation in the context of watershed management.

**Box 3: Watershed management in the Nationally Determined Contributions**

The Paris Agreement, which was finalized at the UNFCCC COP21 in Paris in December 2015, is built on the Intended Nationally Determined Contributions (INDCs) submitted by UNFCCC Parties. In their INDCs countries offer a clear indication of how they intend to respond to climate change, and where they require international support.

Potential synergies (between climate change adaptation and mitigation) are not always explicitly described in the INDCs. Countries often refer to activities such as cropland and nutrient management, land restoration, forest management (including mangroves), and protection and preservation of ecosystems that offer opportunities to achieve simultaneous climate change mitigation and adaptation benefits without explicitly acknowledging these synergies in their INDCs.

Some countries have, however, explicitly mentioned watershed management as a means of improving carbon sinks that also reduces risks of flooding and enhances water retention. Other countries advocate for an ecosystem approach focusing on restoring degraded ecosystems and/or often including specific measures like landscape/watershed management. Several countries aim to develop new or improve existing frameworks and mainstream climate change into sectoral plans (such as those for watershed management). Some countries identified the adaptive capacity of ecosystems as a priority action for both adaptation and mitigation, while the use of an ecosystem approach for managing the natural systems that support the agriculture sectors was also referred to by others.

These statements, while not always explicit, point to the need to integrate climate change adaptation and mitigation efforts with environmental management initiatives.

Source: The Agriculture Sectors in the Intended Nationally Determined Contributions: Analysis
http://www.fao.org/3/a-i5687e.pdf

Overall it can be concluded that, while the watershed approach can and sometimes does contribute to climate change adaptation and mitigation, there is a need to find ways of systematically doing this and also being able to measure the adaptation benefits for the inhabitants of these watersheds as well as the mitigation benefits accrued by the actions. Engaging in a systematic, coordinated effort to protect the livelihoods of smallholder farmers in the context of climate change, exceeds the capacity of any single ministry, donor or development agency. A prolonged joint effort is required, as elaborated within the framework of the integrated watershed management approach, which takes consideration of livelihoods and resilience to climate change and the contribution of watersheds to climate change mitigation.
Box 4: Principles of integrating climate change adaptation and mitigation into the watershed management approach

During the workshop organized by FAO in December 2015, some principles for integrating climate change adaptation and mitigation into the watershed management approach were identified. These include the following:

- Undertaking climate change adaptation and mitigation actions that bring benefits at both the household level and watershed/landscape scale.
- Targeting not only environmental or conservation benefits, but also productivity and economic benefits for households and communities residing in the watersheds.
- Not necessarily targeting individuals or households, but rather targeting communities living in particular watersheds and landscapes for more effective and efficient use of finances and more widespread benefits.
- Systematically incorporating climate change adaptation and mitigation rather than only having these as “accidental” co-benefits of watershed management actions.
- Involving all stakeholders in watershed management in an integrated manner to address multiple needs and objectives. These stakeholders include the community members, local governments and role players representing different sectors (rural development, water management, forestry, energy, environment, agriculture, health, livestock, weather and climate, etc.).
- Placing more focus on the people (socio-economic) dimension in watershed management rather than focusing only or largely on the environment dimension.
- Remembering the multiple objectives and needs of stakeholders in the watershed, e.g. water, fuelwood, fodder – one should use a participatory process to identify needs, conduct land-use planning and implement interventions.
- Understanding the socio-economic needs of the people and developing a range of interventions that assist in simultaneously addressing the watershed management, food security, livelihood and climate change adaptation and mitigation aspects of development.
- Considering, understanding and discussing tradeoffs between immediate community livelihood needs, long-term development goals, climate change adaptation benefits and climate change mitigation opportunities.

These are some of the principles that can guide an initial discussion around a more systematic integration of climate change adaptation and mitigation into watershed management.
**Watershed management** in Eastern Africa needs to move beyond primarily preserving and restoring natural resources, degraded land and water resources to an approach that integrates improved resilience to climate change and contributes to climate change mitigation while advancing household and national food security.

**Integrated watershed management** must be linked to the livelihoods of people and provide opportunities for improved incomes and increased resilience to climate change. All uses of land, water and natural resources within a watershed must be considered when undertaking watershed management, including domestic and productive use from household to community level. Identifying the needs at all levels will aid in identifying interventions that support environmental protection as well as climate change adaptation and mitigation at all levels.

**Short-term watershed management** projects that do not consider climate trends and long-term changes in climate may yield short-term results, but will ultimately be unsustainable in the long run. Hence long-term watershed management is required that takes consideration of climate trends and projections.

There is a need for a **systematic review of programmes and projects** that have attempted to integrate climate change adaptation and mitigation into the watershed management approach. This could facilitate the learning of crucial lessons and the development of an agreed-upon range of interventions relating to social, economic and biophysical aspects of watershed management that promote climate change adaptation and mitigation by building on past practices and experiences. This is especially important as it is normally not one practice but rather a range of practices that contribute to successful climate change adaptation and mitigation in the context of watershed management.

**Indigenous knowledge** must be recognised, and such knowledge must be documented to provide an opportunity to adapt traditional practices into the modern context, thereby encouraging uptake by farmers and promoting sustainability of the practices.

All stakeholders – including policy-makers, development practitioners and donors – need to better **incorporate climate change adaptation and mitigation** into their watershed management programming. Mainstreaming this approach and ensuring it is sufficiently funded is of particular importance in Eastern Africa – an area where food security and poverty eradication are highly interlinked with the intensification of sustainable agriculture and management of natural resources in highly fragile ecosystems.

There is a need to ensure that **watershed management financing targets interventions** that also bring benefits in terms of climate change adaptation and mitigation. At the same time, climate change finance should also incorporate interventions that bring both adaptation and mitigation benefits from household to community and landscape or watershed level.

**Monitoring and evaluation of climate change adaptation and mitigation** aspects in watershed management programmes and projects need to be strengthened through the development of appropriate methodologies and capacity building of all stakeholders relating to their use.
ANNEX 1: GOOD AND PROMISING PRACTICES IN DJIBOUTI, ETHIOPIA, RWANDA AND UGANDA

DJIBOUTI

Water table recharging using small dams

Water table recharging using small dams – Building resilience for (agro-) pastoralists in Djibouti through groundwater dams

Authors: Saleh Daoud Saleh, Ministry of Agriculture (Djibouti); Leone Magliochetti Lombi and Koen Joosten, FAO

Publisher: FAO and the Ministry of Agriculture, Djibouti

Target audience: Practitioners and policy-makers working on dryland agriculture and resilience

Objective: Increased awareness and understanding of the benefits of using groundwater dams in arid zones

Location: Djibouti:
- Damerjog
- Hamboukto
Introduction

The Republic of Djibouti (RoD) is extremely water-scarce, receives 150 mm of rainfall per year on average and has no permanent surface freshwater flow. The country has been facing several years of recurrent drought – less than 80 percent of average rainfall since 2007. On account of its climate, less than five percent of total rainfall reaches the groundwater table, with the remainder lost to either evapotranspiration (with evaporation of 2 000 mm per year) or flow to the sea, especially during flash floods. About 95 percent of total water use comes from groundwater aquifers, which are primarily recharged from rainwater runoff infiltration from seasonal streams (wadis or oueds).

The combined effects of higher temperature and reduced precipitation have increased water shortages, both for crop and livestock production. This is exacerbated by a rise in sea level that has impacted groundwater quality through saltwater intrusion of coastal aquifers. The Ministry of Agriculture, Water, Fishery, Livestock and Marine Resources (MAEPE-RH) has therefore prioritized water resource development, which includes the development of small (groundwater) dams for recharging of groundwater tables.

Groundwater dams, which store water under the ground, can store significant quantities of water for livestock and minor irrigation as well as for domestic use. If sited and built properly, these dams can enable crop and livestock production where it was not (or hardly) possible before. In fact, beneficiaries have confirmed that after the construction of the groundwater dams they were able to re-establish and make a profit from their vegetable farms. They indicate that they have benefited from a more reliable and accessible source of water for both crop production and livestock watering. Moreover, according to the MAEPE-RH, the groundwater dams have significantly reduced the impact of flash floods.

Stakeholders and partners

In close partnership with local communities and technically supported by the FAO Djibouti office, the MAEPE-RH led the feasibility study, design and implementation of the groundwater dams. Primary beneficiaries are the households directly upstream of the infrastructure, who benefit from higher groundwater tables. Communities downstream benefit from reduced impacts of flash floods – mainly related to soil erosion. Local cooperatives around the dams harvest the sand and clay that are deposited, without which the dam would quickly become useless on account of siltation. Cooperatives are able to sell the harvested materials, which means they benefit from the intervention as well.

Donors included FAO (through the European Union), FIDA, WFP (through the Buffet Foundation) and GEF.

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Methodological approach

In the RoD, both the surface and subsurface runoff are usually not utilized, but left flowing to waste. This presents a big loss in a water-scarce country like the RoD where every drop of water counts.

Groundwater dams are structures that intercept or obstruct the natural flow of groundwater and provide storage for water underground. The basic principle of the groundwater dam is that instead of storing the water in surface reservoirs, water is stored underground. These dams are used in areas where flows of groundwater vary considerably during the course of the year, from very high flows following rain to negligible flows during the dry season. The dams are usually divided into two types:

- **A subsurface dam** intercepts or obstructs the flow of an aquifer and reduces the variation of the level of the groundwater table upstream of the dam. It is built entirely underground.
- **A sand storage dam** is constructed above ground. Sand and soil particles transported during periods of high flow can settle in front of the dam, and water is stored in these soil deposits.

The dams used in the RoD are a combination of these two types. A particular characteristic of these dams is that they are not built to reach the bedrock. This means that part of the sub-surface flow is not blocked – making the dams less effective than when fully blocking the groundwater flow. However, construction is significantly cheaper and the dam still manages to raise the upstream groundwater table and block or reduce surface water flow.

On the basis of a geo-morphological analysis, a first site selection was made. This was followed by consultations with local communities, who selected the most suitable sites for the groundwater dams. Technical experts of the MAEPE-RH designed the infrastructure and oversaw the construction – during which labour from local communities was utilized as much as possible. After construction of the groundwater dams, vegetable gardens (which were abandoned in the 1980s) were re-established. These 2,500 m² gardens are irrigated using solar-powered pumps (provided by the MAEPE-RH, in the case of Damerjog) or diesel pumps (private property, in the case of Grand Barra).

Maintenance of the storage volume behind dams is ensured by establishing agreements with local cooperatives to harvest the sediments deposited by flash floods. These cooperatives sell the materials for brickmaking (clay) and construction (sand), which results in additional income.
The groundwater dam at Damerjog (©FAO/K.Joosten)

Downstream side of the groundwater dam at Damerjog (the slope and stones ensure that the dam will not be destroyed by erosion) (©FAO/K.Joosten)

Upstream side of the groundwater dam at Damerjog, which shows some sediment deposition (©FAO/K.Joosten)

Solar panels that provide the power to fill the water reservoir (left) from the well (in the back) in Damerjog (©FAO/K.Joosten)
Impact

In the extremely dry climate of the RoD, this promising practice contributes to increased resilience of agro-pastoralists and pastoralists by enabling crop production, increasing water availability for livestock, and reducing the effect of flash floods and soil erosion. A few hours after the passing of a flash flood, the surface of the sand-river may look dry again, but water (which in the meantime is stored in the reservoir) can be withdrawn for months. This has increased the resilience of agro-pastoralists and pastoralists in the target areas significantly as water is available for a much longer period. This reliability is of great importance in a water-scarce country like the RoD, where climate change is expected to increase the likelihood of extreme events.

Observed impacts include:
- **Significant increase in upstream groundwater tables that enable profitable vegetable production and longer livestock watering.** Vegetable gardens that were abandoned in the 1980s are now producing crops again after the construction of the dams. According to the Djibouti Ministry of Agriculture, each dam benefits about 100 households (600 people on average).
- **Reduction of the impact of flash floods and soil erosion behind the dams,** which have an upstream catchment of 35 to 50 km².
- **Reduced evaporation losses as water is stored underground.** Evaporation is confined to the upper layer of the soil in the reservoir. As the water sinks, the evaporation reduces and even stops completely when the water level sinks to about 60 cm below the surface.
- **Reduced risk of contamination of the stored water** as parasites cannot breed in underground water.
- **Walking distances to watering points have been significantly reduced, which benefits women in particular.** Time is saved for other domestic chores and tasks normally assigned to women.

Innovation

Using groundwater dams in drylands is not an innovation in itself as they have been used for centuries in a range of countries; however, specific innovations in the RoD include:
- **The decision of not extending the subsurface part of the dam to the bedrock.** This reduces the effectiveness of the dam, but lowers costs significantly. This decision seems to have worked out well as water tables have been raised sufficiently to enable vegetable production as well as more reliable livestock watering.
- **The use of solar-powered pumps to provide irrigation for 2 500 m² vegetable gardens.** Not only is it an environmentally friendly way of irrigating, the use of (lower capacity) solar pumps also avoids over-withdrawals from the groundwater source.
- **The agreement with local cooperatives for the maintenance of storage volume in the dam reservoir.** This keeps the dam functional, while at the same time providing additional income to local communities.
Constraints

For groundwater dams to remain effective, the storage reservoir needs to be maintained. This primarily means that sediments deposited during (flash) floods have to be removed regularly. Unless this service is provided by the government, agreements need to be made with local stakeholders for the provision of this service.

Furthermore, the vegetable gardens that have been re-established after the construction of the groundwater dams are under furrow irrigation. Considering the climate in Djibouti, this is not very efficient and results in huge water losses owing to evaporation. Drip irrigation would be more efficient, but also more expensive.

Sustainability

Sustainability of the groundwater dams’ results can be ensured if:

• Community participation and consultation are undertaken from the start – from the selection of appropriate sites to construction and the maintenance of the storage reservoir by local cooperatives. This also ensures ownership.
• Withdrawal volumes are appropriate – this can be ensured by making use of well-sized pumps (such as solar pumps).

Success factors

The main success factor was community participation in the selection of appropriate sites and the construction of the groundwater dams. This ensured that the site selection was based on local knowledge and priorities. Moreover, it assisted in maintenance of the storage volume behind dams by involving local cooperatives that harvest the sediments deposited by floods and sell them for brickmaking (clay) and construction (sand).

Replicability and/or up-scaling

This practice can be up-scaled to other regions of the RoD as well as to similar areas in the region, such as Somalia, Ethiopia and Kenya. In Djibouti, rivers flow only during the rainy season; and after heavy storms, the flow is often accompanied by flash floods, which makes it difficult to utilize this resource without appropriate infrastructure and management systems. In the dry seasons, rivers remain dry. Subsurface wells can be established in river beds where the water table is shallow. It is important that any physical interventions be undertaken in a participatory manner, with beneficiary (and other stakeholder) involvement right from the start.

Conclusion

This practice has been shown to contribute to increased resilience of agro-pastoralists and pastoralists in the Republic of Djibouti – by enabling crop production, increasing water availability for livestock, and reducing the effect of flash floods and soil erosion. Observed impacts include a significant increase in upstream groundwater tables that enable profitable vegetable production as well as longer (and more reliable) livestock watering, the reduction of the impact of flash floods and soil erosion, and the reduction of walking distances to watering points – which benefits women in particular. Groundwater dams are relatively easy to design and implement, and are a suitable technique for enabling crop production and increasing resilience in arid and semi-arid lands in the RoD and the wider Eastern Africa region.

Contact details

Saleh Daoud Saleh – daoudsaleh83@yahoo.fr
Leone MagliochettiLombi – leone.magliochettilombi@fao.org
Koen Joosten – koen.joosten@fao.org
### Climate Smart Initiative: Area closure

**Authors:** Abenet Mengistu, Senior SWC Expert and Coordinator – Ministry of Agriculture and Natural Resources, Ethiopia  

**Publisher**  
FAO and the Ministry of Agriculture and Natural Resources, Ethiopia

**Target audience**  
Policy-makers, practitioners and researchers in the area of climate change adaptation and mitigation and watershed management in East Africa

**Objective**  
The aim of area closures is to prevent further degradation of the ecosystems, advance re-vegetation/forest regeneration, and restore the overall ecological conditions of the area. This is done by closing off areas from interference and damage by both humans and animals, to allow for natural regeneration of the land.

**Location**  
This is a national initiative that was implemented within the context of Ethiopia’s Productive Safety Nets Programme (PSNP). The PSNP provides payments to able-bodied household members for participation in labour-intensive public works. The Government of Ethiopia launched the PSNP in 2005 to provide transfers of cash or food to food-insecure people, who in turn provide labour in public works (PW) projects. The PSNP’s PW programme is designed to address a key underlying cause of food insecurity, which is believed to be environmental degradation. To address this, PSNP-PW projects focus on soil and water conservation activities, along with roads, irrigation and other social infrastructure facilities such as health and education. The implementation plan was developed within a participatory (micro) watershed management planning framework.

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Introduction

The majority of Ethiopians live in rural areas as subsistence farmers and pastoralists relying on agriculture and livestock for their livelihoods\(^4\). However, population growth has led to a number of problems related to inappropriate cultivation, overgrazing, deforestation, soil erosion, soil fertility decline, water scarcity, lack of pasture, and a fuelwood crisis\(^5\). High seasonal climate variability, as well as weather extremes such as droughts and floods, place the livelihoods and food security of Ethiopian smallholder farmers in a precarious situation, compounded by the challenges of natural resource degradation. Demographic pressure in Ethiopia's part of the Nile Basin has resulted in tremendous pressure on natural resources to account for the increasing food and energy demand. This results in a rapidly increasing demand on productive use of both land and freshwater resources. In addition, it is estimated that up to 10 percent of the country’s population is chronically food insecure\(^6\). While Ethiopia’s economy has been steadily growing, it is recognized that agriculture (particularly smallholder agriculture) and natural resource management play a central role in the livelihoods and resilience of the majority of Ethiopians.

In the past, food aid was the main response to threats and crises such as drought. However, this is now known to be unsustainable and there is a shift to a more integrated manner of resilience to hazards and shocks, which involves, among other things, social protection measures, natural resource management, early-warning systems, disaster preparedness and development of appropriate response measures.

The Government of Ethiopia’s Food Security Programme aimed to address these challenges by implementing the PSNP and the Household Asset Building Programme (HABP) as a means of primarily providing social protection to chronically food-insecure households through a cash-for-work programme. The cash-for-work programme targets initiatives to restore and conserve degraded community land through practices such as soil and water conservation measures, area closure and reforestation through a (micro) watershed management approach.

Area closure, the good practice described here, is a practice applied on degraded land that has lost (most of) its vegetative cover and that has extremely low soil fertility. Area enclosure refers to the practice of land management whereby livestock and humans are excluded from accessing a severely degraded area of land to prevent further degradation of the ecosystems, advance re-vegetation/forest regeneration, and restore the overall ecological conditions of the area. This enhances the growth of grass and woody vegetation, helps to rehabilitate the specific area and improves the microclimate, which is a strong climate-adaptation mechanism. Moreover, area enclosure is an intervention measure that boosts land productivity and plays a key role in carbon sequestration, therefore mitigating climate change as well.

The practice is in line with Ethiopia’s Climate Resilient Green Economy Strategy (CRGE, 2010) that calls for “promoting area closure via rehabilitation of degraded pastureland and farmland, leading to enhanced soil fertility and thereby ensuring additional carbon sequestration (above and below ground)”\(^7\) as one of the strategies for protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks.

\(^4\) http://www.ltsi.co.uk/images/M_images/PSNP%20Coping%20with%20Change.pdf
\(^5\) Adapting to climate change through land and water management in Eastern Africa
Stakeholders and partners

The target beneficiaries are the largely chronically food-insecure smallholder farmers who rely on the land and natural resources for agriculture and food security. The community members, while being the main beneficiaries of the programme, are major partners too. The community members’ involvement is crucial for the implementation and sustainability of the area closures and their associated practices.

It is estimated that approximately 45,000 public works projects are completed every year, the majority of which involve area enclosures and soil and water conservation.

In terms of gender, women make up 25 to 50 percent of participants in the PSNP programme. Women are involved in labour activities and decision-making structures related to area enclosures and watershed management as a whole, however challenges have been noted in ensuring that women’s participation is not limited on account of their existing domestic responsibilities.

The Climate Smart Initiative (CSI) within which these area closures have been implemented has numerous partners, with the World Bank as the main donor. The programme is implemented by a consortium of organizations including CARE, SNV, Farm Africa, ORDA, REST and Mercy Corps, among others, who support this Government of Ethiopia initiative. The PSNP as a whole is funded by numerous donors.

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8 [Is Climate-Smart Agriculture effective? A review of selected cases, CCAFS Working Paper No. 129](https://cgspace.cgiar.org/rest/bitstreams/58510/retrieve)
Methodological approach

Degraded land is closed off from human and animal interference for at least three to five years in order to ensure the rehabilitation of the land. Sustainable land management (SLM) measures such as terracing, enrichment plantation and over-sowing of grass are among the activities that are often undertaken along with the area closure. These practices enhance the growth of natural vegetation and enrich biodiversity.

The area to be closed off is first identified in participation with development agents, community leaders and community members. According to one study\(^9\), the most important criterion for site selection was the extent of land degradation as evaluated by villagers and development agents, implying that the more an area is degraded, the more likely it is to be enclosed for regeneration.

Awareness-raising activities are undertaken to make local communities understand the methods and benefits of area enclosures. Development agents, in collaboration with community leaders, call a general community meeting and discuss the plan and its implementation on degraded land. Community members have an opportunity to voice their concerns and opinions. Both men and women are involved in the community consultations and awareness-raising activities.

The area to be closed off is then demarcated and fenced, in most cases with living fences, and guard duties assigned. The demarcation and fencing are largely conducted using labour from the local community on a cash-for-work basis and with involvement of the local administration and development agents.

The area closures implemented are mainly of two types:

- Only closing the area from interferences of human interventions (leaving it to natural regeneration); and
- Closing off degraded land while simultaneously implementing additional measures such as planting of tree seedlings, mulching and establishing water-harvesting structures to enhance and speed up the regeneration process.

In the context of the PSNP-Climate-Smart Initiative the second type is more common, and is conducted in conjunction with various additional measures aimed at improving the incomes, productivity and resilience of the communities. In some cases a percentage of the area enclosed is left to regenerate naturally, while a larger percentage is treated with additional soil and water conservation measures.

In principle, area closure requires locally available materials and labour from the local community. Local communities are expected to bring their own hand tools and equipment during the fencing and plantation of area closure. Planting materials can be prepared at any nursery nearby and/or by an organized group of farmers on temporary nursery sites. Some money is required to cover the costs for the guards, if necessary. However, recently fencing and guarding have been abandoned in favour of the establishment of local rules. For example, local by-laws have been used to regulate and protect enclosures from trespassers, livestock encroachment and deforestation. One who violates the rule will be punished and the kebele administration will confiscate illegally cut trees, for example.

There is also a maintenance component for area enclosures which involves activities such as replanting, maintaining of fences, pruning of trees and weeding. Some periodic repairs may be needed to physical structures.

For the effective implementation of area closures, a guideline\(^10\) was developed by the Ministry of Agriculture’s (MoA) Natural Resource Management Directorate, which has been adopted by regions based on their regional context.

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\(^9\) Assessing Farmers’ Perception of Enclosures, Kewot District, Northeastern Ethiopia

\(^10\) https://nrmdblog.wordpress.com/2016/04/16/enclosed-and-rehabilitated-area-management-guideline_draft/
Validation

Various studies have been conducted on the value of area closures in Ethiopia, all generally with an indication that the practice has both economic and environmental benefits, as well as benefits in terms of resilience and adaptation to climate change. It has moreover been found that in most cases community members also see the value of area closures. For example, an evaluation of the perception of community members to area closures in Kewot District, Northeastern Ethiopia\(^\text{11}\) showed that communities believe that the enclosures provided social, economic and environmental benefits and that area enclosure was generally perceived positively.

Area closure has been practiced in seriously degraded watersheds and the rehabilitation activities are (partly) implemented through community mass-mobilization efforts. Local people expressed their opinion that the enclosures had increased grass cover, decreased soil erosion, and increased water availability following the regeneration of vegetation on the degraded lands, particularly emphasizing the benefits gained from reduced soil erosion on the lower slopes of the watersheds (CSI, 2015).

It has also been found that the rate at which closed areas regenerate depends on the degree of degradation, climatic factors and the scale of management it receives. Experience shows that well-managed area enclosures rehabilitate fast when compared with poorly managed ones with few enforcement mechanisms.

\(^{11}\) Assessing Farmers’ Perception of Enclosures, Kewot District, Northeastern Ethiopia
Impact

Household, village and community-level impacts
Area closure directly or indirectly contributes to the improvement of rural incomes and livelihoods. The long-term benefits can be tremendous, especially in areas where productive land is scarce. It is expected that land previously unfit for production can be used again after three to five years of closure, although full rehabilitation can take seven to ten years depending on the species and type of vegetation within the enclosure. In some cases, if properly managed and if appropriate fodder species are planted, community members can begin cut and carry of fodder for livestock within one year of the closure of the land12.

Medium- to long-term benefits include increased wood and vegetation cover, increased availability of fodder for livestock feed, medicinal plants and bee forage, providing additional income sources and savings. If cash crops, trees or fodder bushes are grown on terraces and benches, farmers will receive income in the short and/or medium term, depending on the time needed for the first harvest. Wood for construction will become available to the community members after approximately seven years of regeneration.

Moreover, enclosures are usually integrated with other natural resource management activities such as the promotion of wood-saving and solar stoves, cropland management, grazing land management, development of biofuels, agro-forestry, apiculture, animal fattening and organization of farmers. These have a combined positive impact on the livelihoods of local people.

Area closure is critically important to improve the productivity of downstream farmlands and provide protection against floods. It contributes to the reduction of flood damage caused to reservoirs, villages and communities. The productivity of croplands is increased as a result of erosion control, improved soil depths and better soil quality and moisture content.

12 file:///c:/users/grey/downloads/WOCAT_QT_Summary-T_ETH025en.pdf
Environmental/ecosystem impacts
Through reduced land degradation, area closures can significantly reduce sediment loads coming from eroded upstream crop and rangelands. From both the small-scale effects and the larger landscape scale, it can be concluded that enclosures are an efficient soil-conservation tool. Significantly lower runoff coefficients and increased soil moisture availability are demonstrated in area closure sites when compared with degraded lands that are not closed off. Higher infiltration in enclosures is furthermore creating more favourable conditions for plant growth. On a landscape scale, highly erosive peak flows from steep slopes will be reduced by applying this good practice.

Above-ground biomass has been found to increase significantly on land under area closure, indicating an increase in carbon stock. The presence of young vegetation has also been found to increase, indicating good regeneration of vegetation.

The re-establishment of natural habitat furthermore offers an opportunity to realize significant biodiversity outcomes and improvement of wildlife habitat, floral and faunal diversity, and to enhance natural regeneration further through improved seed dispersal. Areas that were previously degraded farmlands or grazing lands have regenerated to either dense or open woodlands, with a subsequent substantial improvement in the vegetation cover. For instance, in Wanja-Asore and Ushe watersheds that were closed (and subsequently re-opened), warthogs and baboons have come back (CSI, 2015). Some of the flora that regenerated after the area closures include *Podocarpus* spp., *Olea* spp., *Juniperous* spp., *Croton* spp., *Vernonia* spp., *Euphorbia* spp., *Entada* spp., *Carisa* spp. and *Dodonea* spp. (PWIA, 2014).

Springs are also re-emerging after falling dry two or three decades ago. The rise in groundwater made irrigation more accessible, as farmers in some of the micro-watersheds started to dig wells – which has a positive impact on their incomes. Area closure management does not only revitalize dried springs and streams, but also boosts the volume of the discharge brought through the initiation and promotion of small-scale irrigation practices. This, in turn, improves livelihoods and contributes to food security efforts. In general, the strategy has boosted the yield of groundwater and increased the groundwater table in many catchments, so that communities have better opportunities to access water for domestic use and income-generating activities.

A cost-benefit analysis conducted on area closure as a practice showed that the practice has a positive net present value (NPV) and that its benefit-to-cost ratio (BCR) varied between 4.6 and 54.3; i.e. a birr or a dollar investment will bring at least 4 birr or 4 dollars through carbon credit (PWA, 2014). These economic benefits are in addition to the CO₂ sequestration benefits that accrue as the land fills with vegetation.

Figure 1. Contribution of area closures to the three pillars of sustainable development

13 Feasibility of PSNP-PW enclosures for CDM and the World Bank Bio-carbon Funding
Innovation

Linking area closure with other natural resource management, soil and water conservation and livelihood diversification practices has been the biggest innovation that has contributed to the sustainability, acceptability and broader impact of the practice in terms of environmental, social and economic aspects in addition to climate change adaptation and mitigation benefits. For example, in some instances beekeeping has been linked to area closure as the practice does not result in damage to the closed-off area, while beekeeping provides an alternative source of income and contributes to resilience to climate change through livelihood diversification. This ensures that the practice of area closure contributes to both climate change adaptation and mitigation.

Success factors

Area closures work best when considered in the context of a dynamic mix of practices aimed at providing multiple benefits in terms of adaptation, resilience, productivity and livelihood diversification in addition to climate change mitigation. Supporting households and communities to practice beekeeping and small-scale irrigation can help offset potential short-term losses of income from closed-off land, while at the same time making households more resilient to climate change. Supporting soil and water conservation measures can help reduce soil erosion and surface runoff while aiding infiltration and hence improving groundwater levels. These all contribute to increasing the acceptability and sustainability of area closures.

Good community engagement, involvement and awareness-raising on the value of area closures, both for the environment and for their livelihoods, is crucial for the success of the practice. In many cases, the communities themselves have formulated locally agreed upon rules and regulations regarding land for area closure, and such initiatives contribute to the success of the practice.

Constraints

- Communal lands in Ethiopia are used largely for livestock grazing and it can be difficult to convince the communities of the benefits of area closures. In many cases, due to the large need for grazing land and the expansion of crop cultivation into former grazing areas, hillsides that were previously covered with trees have been transformed into grazing areas. Continuously increasing livestock numbers and animal feed shortages are critical problems throughout the country. The demand for fuelwood and wood for construction is also posing a challenge.
- The concept of benefit sharing for different community members and groups can be a challenge as one group/person may realize tangible benefits of area closure while another group/person may not, and hence will not see the value. Therefore there can be some resistance from local communities to area closure, which has been observed when the area was used for grazing their livestock. To address this, participatory approaches in the identification of land for area closure as part of a broader watershed management plan are used, while sensitization and awareness raising on the short- and long-term benefits of area closures are conducted by development agents.
- The low survival rate of some trees and shrubs has been cited as a challenge, but communities are now realizing the value of caring for the trees and shrubs as a long-term investment in their livelihoods and resilience and not just as a land conservation measure. The use of locally appropriate trees and shrubs and investments in water-harvesting structures also help to increase the survival rates.
Lessons learned

• The practice of area closure can be used and is suitable for all areas where land degradation has taken place. While fallowing has in the past been practiced by local communities, the practice of area closure in the modern context, with its associated add-ons, is fairly new to communities and requires considerable community engagement, awareness raising and education on the benefits – particularly as the demand for agricultural and grazing land is greater than ever.

• Initially the practice of conducting area closures in Ethiopia involved only the fencing off of the area from external interference to allow natural regeneration to take place. Currently, a range of other sustainable land management activities such as tree planting, sowing with grasses, the establishment of physical soil and water conservation structures, rainwater harvesting and even support to conduct small-scale irrigation outside of the area closure are all included as part of a package approach.

• The advantage of area closure in comparison with other SLM technologies is that humans or animals will not interfere with the recovery of the degraded land. If other SLM measures, like contour strips, are implemented in addition to the closure of the area, the land will recover quickly.

• Targeting larger area enclosures is being explored as these can have added benefits in terms of mitigation and income and can possibly also qualify for carbon credits – for example through REDD+. In the second phase of the CSI, eight out of the ten enclosures are expected to qualify for carbon projects like REDD, as the size of enclosures is greater than 30 ha.

• While area closures and the additional support practices are highly valued, they must be implemented in the context of a rising population, youth unemployment, gender inequality, competition for land and other challenges, which can have a detrimental effect on the sustainability of area closures, either directly or indirectly.

Sustainability

As with many other practices involving shared resources (in this case communal land), the key issue for sustainability of the approach is involvement and ownership by farmers of the process and the results. For this to happen, a participatory process is used in the identification of the land for area closure as well as in the implementation, enforcement of closure and maintenance of the area. Extensive community engagement, awareness raising and sensitization on the issue of area closure and its benefits are needed before agreement can be reached on where the practice should be implemented and on how much land.

The multiple benefits identified from implementing area closures indicate their sustainability, while the fact that some farmers and communities have begun implementing area closures on their own initiative is even further evidence of this. Area closures can be implemented at low cost by communities, although support may be needed in the initial stages.

The practice of area closure meets the following criteria – stated in the SLM Best Practices Concept and Manual:

• Acceptance
• Effectiveness
• Efficiency
• Relevance
• Sustainability
• Replicability

Proposed interventions are always screened using the Environmental and Social Management Framework (ESMF) guideline to check whether they could have adverse environmental and social impacts. This shows a due attention to safeguarding environmental and social issues.
Replicability and/or up-scaling

It should be noted that the practice of area closure is suited to highly degraded land (caused by human activity) with low productivity. The second phase of the CSI aims for larger area closures with the possibility of qualifying for carbon credit programmes, which can aid replicability and sustainability in other parts of the country.

Conclusion

Area closure is a very suitable and, in most cases, a very necessary practice for areas that are highly degraded and not very productive. Area closures should be conducted in association with various other soil and water conservation practices such as trenches, terraces and tied ridges as part of a broader watershed management plan. Area closures integrated with other natural resource and income-generating activities such as soil and water conservation, promotion of wood-saving and solar stoves, cropland management, grazing land management plans, agro-forestry, apiculture, fodder production and community capacity building reflect the greatest success and sustainability.

Closed land has been shown to become productive again after three to five years of area closure, and even sooner if additional soil and water management practices are implemented in tandem. However, area closure is a practice that should be accompanied by considerable awareness raising and sensitization to enable farmers to understand the long-term benefits of the practice. In addition, initial external support is necessary to implement the practice in most cases as farmers cannot afford the costs associated with the fencing, guarding and additional SLM measures, if required.

In terms of supporting climate change adaptation and mitigation, area closure has emerged as a viable option to restore ecosystems and sequester CO₂ with the possibility of qualifying for carbon credit programmes. The incorporation of practices such as beekeeping, water harvesting and fodder production in area closures offers an opportunity for climate change resilience. Once regenerated, the enclosed areas help to regulate water flow and minimize the incidence of flash floods while also promoting rainwater infiltration, soil water storage and improved water tables, and hence improved availability of water during drought.

Related resources that have been developed


Contact details

Abenet Mengistu – abmengistu2003@gmail.com
Koen Joosten – Koen.Joosten@fao.org
The land-husbandry approach

**Authors:** Didace Habamenshi, Environmental Specialist, Ministry of Agriculture and Animal Resources, Rwanda
Sebastian Grey, Natural Resources Officer, FAO Sub-regional Office for Eastern Africa, Addis Ababa, Ethiopia

**Publisher**
FAO and Ministry of Agriculture and Animal Resources, Rwanda

**Target audience**
Policy-makers, practitioners and researchers in the area of climate change adaptation and mitigation through watershed management in Eastern Africa

**Objective**
The objective of the land-husbandry approach is to introduce sustainable land-husbandry measures for improvement of hillside agriculture, soil conservation and creating the opportunity for hillside irrigation. The approach aims to manage rainfall properly in order to minimize erosion/floods, improve productivity and manage climate change risks through:

- Terracing and evacuating water runoff effectively and safely for storing and re-use where irrigation systems are developed;
- Stabilizing erosion control structures with multi-purpose trees and grasses; and
- Improving the soil under cultivation with quality lime and compost.

Overall, the land-husbandry approach provides a means of better matching land use/land management with features of the landscape.

**Location**
Land-husbandry is a national initiative being promoted and conducted by the Ministry of Agriculture and Animal Resources in all parts of the country. The approach was first used in Karongi in the Western Province of Rwanda.
Introduction

Rwanda is a hilly country and between the hills there are streams and marshlands. Close to 70 percent of the population is dependent on agriculture for their livelihoods. Agriculture employs over 70 percent of the population and contributed 31 percent of the national GDP in the first quarter of 2015. On average, rural population density is 460 persons per km², making Rwanda one of the most densely populated countries in Africa. Farm sizes average only about 0.6 ha per household, and many households manage as little as 0.4 ha. Lands with a 16 to 40 percent slope cover nearly 45 percent of the country. While most of the hillside areas exceed the recommended slope for cultivation, population pressure compels the cultivation of these areas, which results in severe soil erosion that, in turn, lowers productivity. On the other hand, Rwanda has 589,713 ha of irrigation potential, of which 47 percent is on marshlands and 63 percent on hillsides (Irrigation Master Plan, 2010). However, irrigation in Rwanda currently stands at not more than three percent of the total potential. In terms of both quantity and quality, crop production is severely affected by the lack of water for crops during dry seasons, that have become even more erratic as a result of climate change. The lack of water for marshland and hillside agriculture has drastically affected productivity.

The situation is exacerbated by climate variability and change, which is resulting in periodic droughts or periods of short heavy rains that cause flooding and compound erosion. These climate hazards have an impact on farmer livelihoods as well as on the environment.

Maps 1-4: Rainfall distribution, temperature range, elevation and slope class for Rwanda

In order to sustain cultivation and productivity on such steep slopes while conserving land and soil resources, the implementation of a watershed management approach that takes household livelihoods and food security as well as an increasingly unreliable climate into account, has become a necessity and not a choice. This includes consideration of even the most costly soil conservation measures, such as those implemented under the land-husbandry approach\(^\text{15}\).

In order to do this, the Government of Rwanda, through the Ministry of Agriculture and Animal Resources, has been implementing various sustainable development programmes that utilize a modified watershed approach to introduce sustainable land-husbandry measures for hillside agriculture on selected sites, as well as develop hillside irrigation for subsections of each site. The Rural Sector Support Project and the Land-husbandry, Water Harvesting and Hillside Irrigation (LWH) Project are two of the development initiatives aimed at increasing productivity and commercialization of irrigated marshlands and hillsides, as well as improved rain-fed agriculture in parts of the water and command area catchments. The projects have developed and implemented a comprehensive model for land management, marshland and hillside irrigation, and extensive farmer capacity building that has proved to be successful in facilitating soil erosion control, improving land productivity and helping farmers transition from subsistence to commercial agriculture.

The main approach used in these projects is the land-husbandry approach (LHA). Land-husbandry\(^\text{16}\) is a term for soil and water conservation involving the careful management of land, water and plants with the aim of sustainably increasing productivity. Land-husbandry is a set of techniques used to improve land productivity (i.e. control erosion and restore soil fertility); effectively and safely drain excess rainfall to avoid flooding and landslides and for re-use where rainfall is limited; as well as improving plant cover and enhancing ecosystem function on sensitive land.


\(^{16}\) Land-husbandry as described in this good practice began in Rwanda in 2009. However, this is not to say that activities such as terracing, soil bunds, afforestation and other practices used within the approach had not been conducted before then – within the country or elsewhere.
Stakeholders and partners

The large-scale implementation of the land-husbandry approach began in 2009 with funding from the Government of Rwanda and the World Bank. The larger programme within which land-husbandry is implemented, now has a basket funding of USD$113.3 million, with funds from IDA (USD $34 million), GAFSP (USD $50 million), USAID (USD $14 million), CiDA (USD $8 million) and the Government of Rwanda (USD $7.33 million).

The land-husbandry approach includes extensive community sensitization and participatory approaches to ensure that people actively participate in the transformation of their agriculture and livelihoods. Communities are further supported to form farmer self-help groups, which in many cases lead to the formation of more formal cooperatives. A wide range of capacity-building programmes is carried out for farmers and institutions that support agriculture in the community, including local district offices, financial institutions and the private sector.

In terms of the private sector, examples of private sector partners that are supporting land-husbandry activities in Rwanda in one way or another include:

- The Rwanda Private Sector Federation – a body of private sector organizations that conduct advocacy, as well as help link farmers to markets and (micro) finance.
- The National Agricultural Export Development Board – links farmers to markets for horticultural produce.
Methodological approach

The land-husbandry approach consists of the infrastructural development of good land-husbandry practices in a sub-watershed setting by providing infrastructure appropriate to differing slope and soil depth categories (e.g. reforestation, range development, soil bunds, improved terraces, etc.). The approach involves the use of several land management techniques (soil bunds, terraces, cut-off drains, waterways, afforestation and reforestation), as well as the strengthening of terraces with risers to develop appropriate land-husbandry practices for both rain-fed and irrigated agriculture to allow for the introduction of modern agricultural techniques for higher production of annual and perennial crops. The approach does not use a blanket set of practices, but rather the land-husbandry practices implemented on each hillside depend on various criteria such as soil depth and slope. For example, soil bunds can be established on slopes of 6 to 16 percent, while terraces are recommended for slopes of 16 to 40 percent, narrow-bench terraces on slopes of 40 to 60 percent, and afforestation on slopes of greater than 60 percent. Therefore, in any specific watershed or slope, there will be different land management treatments applied based on the exact characteristics of the land.

Initial site selection is based on a feasibility study that looks not only at the physical aspects of the land, but also the characteristics of the people who live and earn a living on the land. If technically and socio-economically feasible, the next stage is normally community engagement, sensitization and mobilization.

During the implementation of the approach, the watershed is divided into five sections:
1. Water catchment (WC) – an area where all rain and runoff water is channelled into water storage infrastructure or a water reservoir.
2. Silt trap zone (STZ) – an area surrounding the water reservoir, covered with vegetation (trees, grasses) for siltation control.
3. Water reservoir – rain and runoff water retained/harvested to be used for irrigation or domestic purposes.
4. Command area (CA) – the area targeted for development with adequate land-husbandry technologies for irrigation purposes.
5. Command area catchment (CAC) – the area surrounding the command area.

The WC and CAC are developed with land-husbandry technologies for rain-fed agriculture, not only for the improvement of land productivity, but also for the protection of irrigation infrastructure. The criteria for the selection of different land-husbandry measures are presented in Table 2.
### Table 2: Criteria for selection of land-husbandry measures

<table>
<thead>
<tr>
<th>Slope category</th>
<th>Soil depth</th>
<th>Planned land-husbandry measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6 %</td>
<td>Greater than 50 cm</td>
<td>- Grass strips</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Agroforestry interventions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Intercropping with crop cover and green manuring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Applying manure/compost (10 tonnes/ha) and mulching</td>
</tr>
<tr>
<td>6-16 %</td>
<td>Greater than 50 cm</td>
<td>- Constructing soil bunds (level or graded as per agro-climatic zone) or ditches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Planting trees/shrubs along the lower side supporting the bunds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Protection of the drainage systems with check-dams and grasses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Applying lime in the treated area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Applying manure/compost (10 tonnes/ha)</td>
</tr>
<tr>
<td>16-40 %</td>
<td>Greater than 50 cm</td>
<td>- Constructing bench terraces (radical terraces)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Planting trees/shrubs along the lower side supporting the bench terraces or ditches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Protection of the drainage systems with check-dams and grasses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Applying lime in the treated area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Applying manure/compost (10 tonnes/ha)</td>
</tr>
<tr>
<td>40-60 %</td>
<td>Greater than 50 cm</td>
<td>- Constructing narrow cut bench terraces</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Planting trees/shrubs along the lower side supporting the narrow cut bench terraces</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Protection of the drainage systems with check-dams and grasses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Applying lime in the treated area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Applying manure/compost (10 tonnes/ha)</td>
</tr>
<tr>
<td>Slope &gt;60%</td>
<td>Any depth</td>
<td>Afforestation</td>
</tr>
<tr>
<td>Any slope</td>
<td>Shallow soil</td>
<td>Afforestation</td>
</tr>
<tr>
<td></td>
<td>(Less than 50 cm)</td>
<td>Pastures, trees planted in pastures</td>
</tr>
</tbody>
</table>

Area freshly treated with ditches, terraces and drainage systems (Image courtesy of the Ministry of Agriculture and Animal Resources, Rwanda)
The approach uses a participatory process involving local inhabitants and smallholder farmers themselves as key stakeholders and partners in land-husbandry. In addition, opinion leaders (people known to have influence in the community such as church leaders, cooperative leaders, business people and traditional leaders) are all engaged in the land-husbandry process. To better target the needs of people on specific hillslopes, a meeting is held for farmers on each hill. Meetings are held separately with women and other special interest groups such as the youth and the elderly. All community members including men, women, the elderly, the youth and the disabled participate in the process. Physical works are conducted almost entirely using local labour, however work is apportioned fairly, based on the ability of the individual without any discrimination so that all can participate and earn an income. For example, digging is allocated to men and strong and physically able people, while disabled and elderly people work in tree planting or even in care of the tree nursery.

Validation

While no substantive impact assessment has been conducted on the land-husbandry approach, it is widely agreed that the approach reaps benefits for farmers in terms of livelihoods and incomes, while also benefiting the environment in terms of reducing soil erosion and enhancing soil fertility. Farmers have testified to being more organized and having greater productivity and income after implementing land-husbandry practices on their land. The land is also better drained and less susceptible to flooding and waterlogging, while the opportunity for establishing irrigation on treated land brings resilience to droughts and dry spells for the farmers. Afforestation practices and planting of grasses also serve to contribute to the Rwanda Green growth plans and support the country’s climate change mitigation efforts.
Impact

The implementation of the land-husbandry approach in Rwanda has had an overall positive impact, including the following:

• All socioeconomic groups participate and earn an income during the civil works. Men, women, the elderly, the youth and even the disabled are paid a daily rate (cash for work) while implementing the physical land-husbandry works.

• Better organization of farmers and, in many cases, formation of cooperatives catalysed by the capacity-building actions undertaken as part of the land-husbandry approach. Cooperatives are also linked to processing companies and markets as part of the capacity-building components.

• Reduced soil erosion especially on steep hillsides, which are treated with appropriate practices such as afforestation and planting of grasses.

• A carbon-balance appraisal\(^\text{17}\) of some LWH activities (World Bank-financed component) using the FAO Ex-ACT tool found that implementation of the approach will yield "overall positive environmental co-benefits in terms of climate change mitigation" and that the mitigation potential is expected to rise with time. This is based on the analysis of the balance between the GHG emitted (mainly because of the use of agro-chemicals) and C sequestered (essentially through the expansion of forests and perennial crops and the adoption of improved agronomic practices on agricultural areas). Along with the reduction of soil erosion, LWH practice is therefore shown to deliver mitigation as well as adaptation benefits.

• Reduced occurrence of floods and waterlogging in fields due to enhanced drainage.

• Improved food security, incomes and livelihoods once the civil works are complete.

• Baseline data taken for some sites have shown significant increases in agricultural production and productivity after land-husbandry practices have been conducted.

• In some places, farmers have been able to grow crops that they were not growing before, e.g. some areas are now growing maize and harvesting up to four tonnes per hectare. This has also spawned other industries such as maize milling.

• Land-husbandry lays the foundation for the introduction of irrigation facilities that, in turn, provide additional opportunities for improving productivity, diversifying production and enhancing incomes.

Innovation

The land-husbandry approach takes a holistic, scientifically sound, ecologically based and farmer-centred view of the challenges of land, soil and water management. As part of the approach, a number of innovations have been identified:

- Farmers are organized into farmer groups at each site, and trained on agricultural technologies – post-harvest, marketing, business-planning, compost-making, tree nursery maintenance and saving. In some pilot sites these groups have now formed cooperatives linked to financial institutions, so they are able to access financial services, with which they can work on value addition. Grouping of the farmers serves a dual purpose: these farmers can conduct collective savings, collective purchase of inputs, collective sales and have better bargaining power. It also serves to bring structure and accountability to the maintenance of the land-husbandry works.
- Lime and compost are applied to the land during the implementation of the physical components of the land-husbandry approach to increase the fertility of the soil and lay a good foundation for improved agricultural production. Farmers are taught how to produce compost so that they can continually improve the productivity of their land and even sell some compost for income.
- Post-harvest storage facilities are planned to minimize post-harvest losses and enhance collective marketing.
- Improved farming methods, seeds and other inputs are also introduced as part of the approach.

Success factors

- Community participation right from the beginning is crucial in ensuring the success of the approach. Community members are not beneficiaries but rather key stakeholders and partners in achieving the mutual objectives of improving land sustainability and productivity.
- Land-husbandry does not use a blanket approach but rather an approach that seeks to match land use and land management to the actual characteristics of the land and the needs of its inhabitants.
- Physical works must be properly constructed, particularly the terraces. This is not always the case as farmers have different abilities and capacity. In some cases, terraces can collapse if not properly constructed or maintained.

Constraints

- There can be misconceptions about the value of terraces and other practices implemented under the land-husbandry approach. This is especially so when rains are poor and yields are low; some communities may believe that the approach does not work and in some cases may neglect the maintenance of the terraces.
- Terraces and other works conducted under the land-husbandry approach need regular maintenance long after the government and development partners have left. It requires good organization on the part of communities, accountability between community members and a high level of motivation to maintain the structures.
- It is not always easy to organize people in the communities on account of different personal issues, but the involvement of all community members is required for the successful implementation and maintenance of the approach.
- In cases where the capacity of farmers is low, considerable sensitization, technical capacity building and organization are required to ensure that farmers reap the benefits of the approach.
Lessons learned

- While terracing has been conducted in many countries for many decades, land-husbandry is not just about terracing – it is a combination of many techniques (of which terracing is one) used to conserve the land, make it suitable for improved agricultural production and promote resilience to climate change while contributing to climate change mitigation.
- Community mobilization, sensitization and involvement are crucial. Community members should not be regarded as beneficiaries of a government programme, but rather as key stakeholders and partners in the conservation of their land in a manner that also has significant positive impacts on their livelihoods.
- Apart from the physical work conducted under the land-husbandry approach, the organization and capacity building of farmers are also crucial. Organizing farmers into cooperatives; building their capacity in agriculture and land management as well as in business and financial management; and linking them to service providers, markets and finance all play a key role in the success of the land-husbandry approach.
- While land husbandry was originally implemented as part of a three-component approach involving land-husbandry, water harvesting and hillside irrigation, it was evident that water harvesting and hillside irrigation were not needed or immediately feasible everywhere (e.g. some areas have adequate rainfall), but all areas needed land husbandry. This was a key learning point that helped to put greater focus on the land-husbandry component.
- Terracing on its own can result in excess water and waterlogging and hence there is a need to develop adequate outlets for water drainage so that farmers do not end up with too much water that can negatively affect their crop production.

Sustainability

The key issue for the sustainability of the approach is involvement and ownership by farmers of the process and the results. Farmers are involved from the planning stage and are organized and given adequate capacity to maintain the structures and reap the benefits.

In terms of cost efficiency and effectiveness, it is recognized that the costs are high. However, measures such as those implemented under the land-husbandry approach are a necessity whose benefits (economically, socially and environmentally) far exceed the costs, especially in the long run. To support the cost effectiveness and efficiency of the approach, feasibility and socio-economic studies are conducted for each site, indicating the costs and the expected benefits. In sites where only land-husbandry is conducted, a process framework is conducted to analyse the costs and benefits of undertaking land-husbandry civil works. Even opportunity costs are factored into the approach. For example, if 100 ha of civil works are to be conducted over a period of three months, then this means the community will not be able to use that land for any other productive purpose during that period. This is compensated for by the cash-for-work programme, under which all community members are invited to participate and the rate of payment is set based on the money each farmer would have made if they had continued their cropping under the status quo. In the long run, apart from the environmental and ecological benefits, farmers are benefiting from improved production and productivity of their land and hence improved incomes, food security and livelihoods.
Replicability and/or up-scaling

The approach is already tried and tested and is targeted for scaling up to all parts of Rwanda. In terms of scaling up the approach to other countries in Eastern Africa, it should be noted that some countries are implementing various aspects of land, soil and water management including the use of afforestation, terracing and soil bunds. However, the approach used in Rwanda is one that can be learned from not only in terms of how it is used to conserve soil and land resources, but also in terms of how it is integrated with the needs and livelihoods of farmers and the challenges of climate variability and change. The integration of water harvesting and hillside irrigation as part of the complete LWH approach is moreover an excellent model to follow for scaling up across Eastern Africa and beyond. The key challenge to scaling up is that it is an expensive and labour-intensive approach. However, in Rwanda’s case considering even the most expensive soil conservation measures has become a necessity. The land-husbandry approach helps counter the costs by also integrating food security, agricultural productivity and livelihood benefits for farmers.

Conclusion

The practice has been shown to contribute to climate change resilience (reduced incidence of flooding and reduced impact of drought), farmer livelihoods, increased agricultural production and productivity, livelihood diversification and improved incomes, while at the same time reducing soil erosion, improving soil fertility and enhancing carbon sinks. While the practice is labour intensive and costly, the benefits, particularly in the long run, far outweigh the costs.

Contact details

Didace Habamenshi – didaceha@yahoo.fr
Koen Joosten – Koen.Joosten@fao.org
Related website: http://www.lwh-rssp.minagri.gov.rw/home/
Institutional reforms for catchment-based integrated water resources management

Authors: Abdul Saboor Jawad, FAO-Uganda
Koen Joosten, FAO Sub-regional Office for Eastern Africa, Addis Ababa, Ethiopia

Publisher: Food and Agriculture Organization of the United Nations

Target audience: Practitioners and policy-makers working on water resources management, both at technical and institutional/policy level

Objective: Review of the lessons that can be learned from Uganda’s institutional reforms to enhance water management

Location: All four water management zones (WMZs) in Uganda: Albert, Kyoga, Upper Nile and Victoria

Context: Uganda is a low-income, landlocked East African country with a per capita income of about US$558 and an estimated population of 34.6 million (2014 figures, Uganda Bureau of Statistics). The economy is largely dependent on agriculture, which accounts for 23 percent of GDP and supplied almost half of Uganda’s export value in 2011. In addition, 72 percent of Ugandans are economically active in the agriculture sector.

Water contributes directly to the socio-economic development of the country and is essential for energy production, irrigation, livestock, fishing, mining, wildlife, industry, aquaculture and maintaining the environment. Uganda’s quest for economic and social development is therefore increasingly related to water. Although Uganda is well-endowed with water resources, seasonal and spatial variability can be large, which is expected to be amplified by climate change.
Introduction

During the 1990s when the country was emerging from conflict, Uganda started shifting its approach to water management towards integrated water resources management (IWRM). This was firmly supported by international donors, and had a strong Nile Basin focus. Although strong emphasis was put on decentralisation of water management, practice showed that there was continued central government control (mainly from the Kampala/Entebbe offices). Throughout the 1990s and in the early 2000s, capacity and institutional constraints emerged, necessitating a more robust institutional framework.

Between 2003 and 2005 the country undertook a water resources management (WRM) reform study with the objective “To establish an effective framework for Water Resources Management in Uganda to ensure that water resources are managed in an integrated and sustainable manner”. One of the recommendations from the reform study was to ensure a paradigm shift in WRM from centralised to catchment/basin-based management, a form of de-concentration of services and activities to the lowest appropriate level.

In 2016, FAO in Uganda commissioned a study to capture, document, review and analyse the experience gained in implementing community-based water resources management in Uganda. The study focused on the institutional arrangements that have been put in place since the WRM reform study, and aimed to provide lessons learned, identify challenges encountered, and indicate priorities for future investments and policies for WRM. This factsheet draws on the findings from this report, but, in addition, tries to add value by looking at what lessons can be drawn from the case of Uganda, and how these can be up-scaled to similar regions/countries.

Catchment-based integrated water resource management (CBIWRM) and resilience

Catchment-based WRM is an integrated process that promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. If addressed inadequately, management of water resources can jeopardize progress measures that deal with climate variability. CBIWRM has the potential to build upon existing land and water management practices to create resilience to climate change and to enhance water security and thus directly contribute to development – including increasing the resilience of livelihoods to threats and crises that affect agriculture, food and nutrition.

Stakeholders and partners

The Ministry of Water and Environment (MWE) has the mandate to promote and ensure the rational and sustainable utilization, development and effective management of water and environmental resources for socio-economic development of the country. MWE has the overall responsibility for:
- setting national policies and standards;
- managing and regulating water resources; and
- determining priorities for water development and management.

In view of this, the implementation of CBIWRM is based on a partnership approach where MWE’s Directorate of Water Resources engages with other relevant organizations and builds on ongoing and planned WRM activities by the partners.

The following are some of the stakeholders and partners involved in the development and implementation of catchment management plans: FAO, GIZ, IUCN, Makerere University, CARE, CRS and ACF, National Forest Authority, the Coca Cola Africa Foundation, DfID, IIRR, and WWF.
Methodological approach

As part of the shift from centralized management to a CBIWRM system, the country was divided into four water management zones (WMZs). A strategic action and investment plan was developed with the aim to bring local government as well as development partners and the private sector into the decentralization of CBIWRM in Uganda.

Water resources management was de-concentrated to maximize economic and social benefits from water-related resources management and development. It is aimed at moving closer to where action is needed, and mobilizing local communities and other stakeholders to achieve catchment-based integrated water resources management. A number of operational-level water resources management functions are therefore being undertaken at WMZ level to improve efficiency and effectiveness in performing these functions while responding to stakeholder needs and challenges in a timely manner.

The following WMZs were established based on the hydrological set-up of Uganda:

1. **Albert WMZ** (yellow) – covers just over 45,000 km² and falls into two distinct terrain systems: the north-western sloping peneplain of the catchment, contributing to the Kyoga Nile downstream of Lake Kyoga, and the rift valley of the catchments downstream of Lake Edward discharging into Lake Albert.
2. **Kyoga WMZ** (purple) – covers an area of 57,080 km² in the north-eastern, eastern and central interior of the country.
3. **Upper Nile WMZ** (green) – covers an area of 50,000 km² of generally flat terrain.
4. **Victoria WMZ** (blue) – covers about 78,100 km².

Alongside the classification, a framework for CBIWRM was developed in 2010 to guide the establishment of catchment management structures and preparation of catchment management plans. The objectives of the framework are:

- To increase awareness and appreciation of water resource systems, and the challenges and costs associated with managing them sustainably;
- To institute sustainable and equitable approaches to WRM through strategic planning;
- To assure ‘buy-in’ to the objectives of WRM strategies and plans;
- To strengthen partnership working and concerted action to produce better WRM outcomes;
- To increase the sharing of information and experiences, leading to enhanced transparency and accountability in resources utilization; and
- To manage conflict in resources utilization.

In line with this, catchments have been demarcated and have become the units through which water and related resources are managed and developed considering that water does not follow administrative boundaries. Various operational documents have been developed to guide the teams, such as catchment planning guidelines, resource mobilization strategies, and WMZ operation manuals. The WMZ offices are now fully established and operational. Demand for their services in terms of laboratory services, water resources technical guidance and support to local governments, water users and other stakeholders continues to increase.

Each catchment has been transformed into a catchment management organization (CMO) – the level where stakeholder-driven IWRM and development are implemented. Catchment management plans (CMPs) – that are developed by the CMOS – contain priority investment and management measures needed to protect and restore the catchment while improving people’s livelihoods.

Gradually bringing decision-making down to the lowest appropriate level is the current aim of Uganda’s water resources reform. The terms used in the reform process are indicative of the gradual approach. For example, de-concentration is the operative word as opposed to a commitment to outright decentralization. Nonetheless, this is a drastic change from a traditional top-down water management approach to operating at (or at least closer to) where the effects of decisions are borne by people who were previously not involved in the planning and decision-making process. Obviously, this bottom-up and decentralized approach still has to be embedded and coordinated, and the overall institutional set-up and related responsibilities are divided between three levels:

**National level**
This is the level at which management and/or regulatory measures are formulated and appropriately integrated into the existing policy, legal and institutional framework. MWE’s Directorate of Water Resources Management is the lead agency for WRM in Uganda and has the primary responsibility for shaping national policies and legislation, as well as defining strategies, guidelines and instruments for CBWRM. At national level, several implementation and coordination mechanisms are put in place, such as the Water Policy Committee, which advises the Minister on water policy-related issues regarding WRM, and the Joint Sector Review.

**Regional level (WMZs)**
The regional (WMZs) level provides the interface between the top-down (central planning) and bottom-up (public interests) arrangements. The WMZ structures are the WMZ Advisory Committee and WMZ Technical Committee. Their roles and responsibilities include:

- Planning and coordinating the implementation of regional level activities (zone and catchment), including streamlining of initiatives, stakeholder engagement, awareness and sensitization efforts, and performance monitoring, evaluation and feedback;
- Coordinating, preparing and reviewing the integrated water resources management plans for WMZs in collaboration with other stakeholders;
- Supporting the catchment management committees (CMCs) to prepare and implement IWRM plans in the CMO; and
- Supporting CMCs to monitor and enforce relevant bylaws, guidelines, regulations, permits, plans and standards.
Catchment level

The establishment of catchment level structures and bodies ensures planning, implementing, monitoring and reporting on WRM and related activities in the catchment – as well as local ownership and public interest. These catchment structures and bodies consist of the catchment Stakeholder Forum, CMCs, Catchment Technical Committees, and CMO Secretariats.

Impact

Catchment management planning guidelines came into effect in 2013. These guidelines are aimed at streamlining the preparation process of CMPs. Implementation of interventions is ongoing in 10 catchments. Box 5 below is an example of the interventions undertaken in the Mpanga catchment.

Box 5: Mpanga catchment CBiWRM interventions

From the CMPs, pilot activities were undertaken in the upper, mid and lower catchment. In the upper part of the catchment, the interventions focused on soil and water conservation efforts wherein innovations of roadside rain-harvesting trenches, which lead into stormwater infiltration pits, were implemented.

The following were achieved in the upper catchment:

- Training of stakeholder groups and beneficiary community members in soil and water conservation measures;
- Implementation of activities for the control of erosion and reduction of sediment loads from the degraded steep slopes through:
  - promotion of terracing;
  - placement of soil bunds;
  - placement of stone bunds;
  - stabilization with grasses and trees; and
  - training farmers in implementing the 3R18 approaches within their fields (infiltrations pits, stormwater diversion drains).
- Rehabilitation of public stand posts for an existing gravity flow scheme for the homesteads – in order to ensure reliable water supply.

18 Recharge, Retention and Reuse
Demand for WMZ services in terms of laboratory services, water resources technical guidance and support to local governments, water users and other stakeholders continues to increase. This illustrates the impact of the institutional reforms. Moreover, according to the FAO review, performance of the traditional water resources functions of water resources monitoring, water quality testing, assessment of water permit applications, compliance monitoring and enforcement of permit conditions has greatly improved.

Innovation

Integrating communities and their social structures into micro-watershed (or similar) committees has been shown to lead to greater cohesion and unity. These types of committees give members control over their resources. As more communities are formed, the influence becomes basin-wide rather than locally focused, with a greater awareness and contribution to IWRM interventions. Multi-stakeholder participatory processes help to mobilize partnerships and relationships that are the basis for long-term sustainability of interventions. Furthermore, through these institutional reforms, Uganda is taking strides towards decoupling the hydrological and political/administrative barriers. This is likely to result in reduced political and budgetary pressure on watershed management activities, and hence improves water governance. Lastly, institutional reforms have enabled Uganda to start financing watershed management activities through a levy (three percent) on projects that have an impact on the watershed, as well as mobilize resources from corporate social responsibility schemes of private sector investors such as Coca Cola.

Success factors

FAO’s review of the WRM institutional reforms revealed that smaller activities at the outset – rather than “going in big” – allow for testing of partnerships and the establishment of working relationships before too much is committed and when changes become harder to make. This allows for better understanding of the issues on the ground, which is vital in the design of the larger-scale interventions that will evolve. Furthermore, communities have to see short-term tangible benefits if they are to support longer-term actions. People and organizations are more willing to participate when they see that their situation has changed for the better, for example through small-scale income-generation schemes, water supply facilitation and conflict reduction.
Constraints

About half of the CMPs have been finalized, while others are still under development. This shows that planning, implementing, monitoring and reporting on WRM and related activities at the local level are still very new to Uganda. The country is still in the transition from a situation whereby water was managed centrally, to a catchment-led approach. It will take a few more years before all impacts of this change will be documented and evaluated.

During the FAO review on CBIWRM, some general challenges in operationalizing the new approach to water management were identified:

- **Accessibility and availability of reliable hydrological, meteorological, and water quality data for use in local planning.** Most local government officials lament the challenges associated with accessing groundwater maps and other resource-monitoring data.

- **The process of catchment management planning, operationalizing the local structures, and community mobilization and engagement is very expensive.** For the reforms to be sustainable, sufficient, reliable and predictable funding is necessary.

- **There is still low appreciation of water resources issues among some sections of stakeholders.** For example, the issue of water source protection as per the new Water Source Protection Guidelines has not been fully embraced by water source developers/implementers. Moreover, major stakeholders such as district local governments and development partners are not fully aware of the catchment-based approach to water resources management. This is particularly evident in the Kyoga Water Management Zone where a number of development partners are still implementing water resources interventions in a very fragmented and ad-hoc manner.

- **Reconciling catchment management plans with existing development plans** that are still based on administrative boundaries remains a challenge.

Lessons learned

One of the key lessons learned is that IWRM is better embraced in an area that is experiencing serious water resources problems. In such circumstances stakeholders tend to associate more with a realistic risk and eminent danger for them to participate actively, especially for long-term planning. Furthermore, the preparation of CMPs is key in determining what needs to be done to ensure that catchments are fully protected and restored and that the livelihoods of the people are improved. Moreover, the planning process is an excellent opportunity for catchment stakeholders to anticipate changes to and pressures on water and related resources.

Through institutional reforms, Uganda is committed to a gradual process of decoupling the hydrological and political/administrative barriers. This will result in reduced political and budgetary pressure on watershed management activities, and improve water governance. It brings the decision-making to the local level, so that communities can decide on what is best for them.

Lastly, in such a complex and long-term process of shifting from centralized to decentralized water management, regular progress reviews and analyses are of great importance. They allow for the identification of good and bad practices, lessons learned and constraints encountered. The initiation of a thorough review by FAO Uganda of the water sector and its reforms/arrangements since the early 2000s will help policy- and decision-makers to review progress and plan ahead.
Sustainability

The institutional reforms of the water management sector in Uganda started in the mid-2000s. The institutional arrangements are now in place, as is evident from the establishment of WMZ offices. Currently, the results of these reforms are starting to be experienced on the ground, as CMPs are being developed and implemented. Institutional arrangements have been agreed and accepted by all stakeholders, which is essential for the sustainability of CBIWRM.

In general, multi-stakeholder participatory processes help to mobilize partnerships and relationships that are the basis for the long-term sustainability of watershed interventions. Establishing partnerships and mutual understanding between, for example, ministries, local government, NGOs and civil society, is vital to long-term action. These partnerships are the basis for the sustainability of projects and other interventions. To ensure sustainability it is vital that different stakeholders, including the Districts, buy into the proposed projects and programmes.

Conclusion

Catchment management interventions are key in ensuring that water of adequate quantity and good quality is available to meet the various demands of present and future generations. This requires collective action of all stakeholders in the catchment (communities, the private sector, civil society, local governments, other government agencies). The ongoing catchment management activities are already showing promising results despite limited available resources. The work being done is appreciated by communities and key water users including the private sector and the local communities.

From the period of paradigm shift towards the deconcentration of water resources management, and focusing on the catchments, the general conclusions are:

• CBIWRM is taking root but needs continued technical support from various stakeholders;
• CMPs are key in determining what needs to be done to ensure that catchments are fully protected and restored, and that the livelihoods of the people are improved by also considering future changes and pressures on water and related resources;
• A substantial amount of funding is needed to implement CBIWRM and fully operationalize the WMZs; and
• All role players and stakeholders have realized that effective planning and management of water resources needs to be carried out at the lowest appropriate level and should be based on hydrological catchments or basins – not administrative or political boundaries.

Contact details

FAO Uganda: Abdul Saboor Jawad – Abdul.Jawad@fao.org
FAO Subregional Office for Eastern Africa: Koen Joosten – Koen.Joosten@fao.org
Related website: http://www.mwe.go.ug/
## ANNEX 2: LIST OF WORKSHOP PARTICIPANTS WHOSE IDEAS AND DISCUSSIONS CONTRIBUTED TO THE DEVELOPMENT OF THIS BOOKLET

<table>
<thead>
<tr>
<th>Country</th>
<th>Name</th>
<th>Title</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethiopia</td>
<td>Abenet Mengistu Kassaye</td>
<td>Senior SWC Expert, Coordinator, PWCU</td>
<td>Ministry of Agriculture</td>
</tr>
<tr>
<td>Djibouti</td>
<td>Leone Maglochetti Lombi</td>
<td>Water Resources Officer</td>
<td>FAO Djibouti</td>
</tr>
<tr>
<td>Djibouti</td>
<td>Daher Elmi</td>
<td>Programme Manager</td>
<td>IGAD Secretariat</td>
</tr>
<tr>
<td>Djibouti</td>
<td>Saleh Daoud Saleh</td>
<td>Chef de Service Technique</td>
<td>Ministry of Agriculture</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>Sebastian Grey</td>
<td>Natural Resources Officer (Climate Change)</td>
<td>FAO SFE</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>Koen Joosten</td>
<td>Water Resources Officer</td>
<td>FAO SFE</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>Georg Deichert</td>
<td>Senior Advisor/Agriculture Economics</td>
<td>GIZ</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>Simon Langan</td>
<td>Principal Researcher</td>
<td>IWMI East Africa</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>Gizaw Desta</td>
<td>Director of Knowledge Management Division</td>
<td>WLRC</td>
</tr>
<tr>
<td>Italy</td>
<td>Sophie Treinen</td>
<td>Knowledge Outreach Team Leader</td>
<td>FAO Headquarters</td>
</tr>
<tr>
<td>Jordan</td>
<td>Claudio Zucca</td>
<td>Soil Conservation and Land Management</td>
<td>ICARDA</td>
</tr>
<tr>
<td>Jordan</td>
<td>Bezaieit Dessalegn</td>
<td>Livelihood and M&amp;E Specialist</td>
<td>ICARDA</td>
</tr>
<tr>
<td>Kenya</td>
<td>Dr Mohammed Hassan</td>
<td>Hydrologist</td>
<td>IGAD ICPAC</td>
</tr>
<tr>
<td>Kenya</td>
<td>Geoffrey Sabitti</td>
<td>Climate Change Specialist</td>
<td>IGAD ICPAC</td>
</tr>
<tr>
<td>Kenya</td>
<td>Joseph Mahonga Wala</td>
<td>Principal Fisheries Officer</td>
<td>Ministry of Agriculture</td>
</tr>
<tr>
<td>Rwanda</td>
<td>Habamenshi Didace</td>
<td>Environmental Specialist</td>
<td>Ministry of Agriculture</td>
</tr>
<tr>
<td>Somalia</td>
<td>Hussein Gadain</td>
<td>Chief Technical Advisor SWALIM</td>
<td>FAO Somalia</td>
</tr>
<tr>
<td>Somalia</td>
<td>Dario Cipolla</td>
<td>Agricultural Inputs and Knowledge</td>
<td>FAO Somalia</td>
</tr>
<tr>
<td>Somalia</td>
<td>Abdullahi Hassan Hussein</td>
<td>Head of Water Section</td>
<td>Ministry of Agriculture, Federal Government of Somalia</td>
</tr>
<tr>
<td>Somalia</td>
<td>Ibrahim Omar Kahin</td>
<td>Director</td>
<td>Ministry of Agriculture, Somaliland</td>
</tr>
<tr>
<td>Somalia</td>
<td>Abdourachid Hachi Osman</td>
<td>Technical Advisor</td>
<td>Somaliland Development Fund (SDF), Ministry of Agriculture</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Alan Nicol</td>
<td>Theme Leader - Gender and Poverty Reduction</td>
<td>IWMI HQ</td>
</tr>
<tr>
<td>Uganda</td>
<td>Paul Emuria</td>
<td>Field Officer</td>
<td>FAO Uganda</td>
</tr>
<tr>
<td>Uganda</td>
<td>Andrew Atiingi</td>
<td>Field Officer</td>
<td>FAO Uganda</td>
</tr>
<tr>
<td>Uganda</td>
<td>Kennedy Igbokwe</td>
<td>Project Manager, GCCA</td>
<td>FAO Uganda</td>
</tr>
<tr>
<td>Uganda</td>
<td>Emelda Berejena</td>
<td>Technical Officer, GCCA</td>
<td>FAO Uganda</td>
</tr>
<tr>
<td>Uganda</td>
<td>Saboor Jawaad</td>
<td>Food Security and Water Management Officer</td>
<td>FAO Uganda</td>
</tr>
<tr>
<td>Uganda</td>
<td>Johannes Rumohr</td>
<td>Departmental Head</td>
<td>GIZ</td>
</tr>
<tr>
<td>Uganda</td>
<td>Sophie Kutegeka</td>
<td>Head of Office</td>
<td>IUCN</td>
</tr>
<tr>
<td>Uganda</td>
<td>Richard Musota</td>
<td>Team Leader, Victoria Water Management Zone</td>
<td>Ministry of Water and Environment</td>
</tr>
<tr>
<td>Uganda</td>
<td>Jackson Kitamirike</td>
<td>Senior Water Analyst, Albert Water Management Zone</td>
<td>Ministry of Water and Environment</td>
</tr>
<tr>
<td>Uganda</td>
<td>Emmanuel Olet</td>
<td>Senior Water Officer, Upper Nile Water Management Zone</td>
<td>Ministry of Water and Environment</td>
</tr>
<tr>
<td>Uganda</td>
<td>Christine Mukwaya</td>
<td>Senior Water Officer, Kyoga Water Management Zone</td>
<td>Ministry of Water and Environment</td>
</tr>
<tr>
<td>Uganda</td>
<td>James Kisekka</td>
<td>Project Officer</td>
<td>Rain Foundation</td>
</tr>
<tr>
<td>Uganda</td>
<td>Massimo Castiello</td>
<td>FAO Deputy Representative</td>
<td>FAO Uganda</td>
</tr>
</tbody>
</table>
This discussion paper and good practices booklet for Eastern Africa was produced by the FAO. The publication results from an expert workshop on the identification and review of emerging good practices, lessons learned and policy opportunities around integrating climate change adaptation and mitigation into the watershed management approach. The workshop was held in Uganda in December 2015.

For further information, please contact:

**Koen Joosten**  
*Water Resources Officer*  
FAO Sub-regional Office for Eastern Africa  
Addis Ababa, Ethiopia  
Tel: +251 11 647 8888  
E-mail: Koen.Joosten@fao.org

**Edward Kilawe**  
*Forestry Officer*  
FAO Sub-regional Office for Eastern Africa  
Addis Ababa, Ethiopia  
Tel: +251 11 647 8888  
E-mail: Edward.Kilawe@fao.org

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