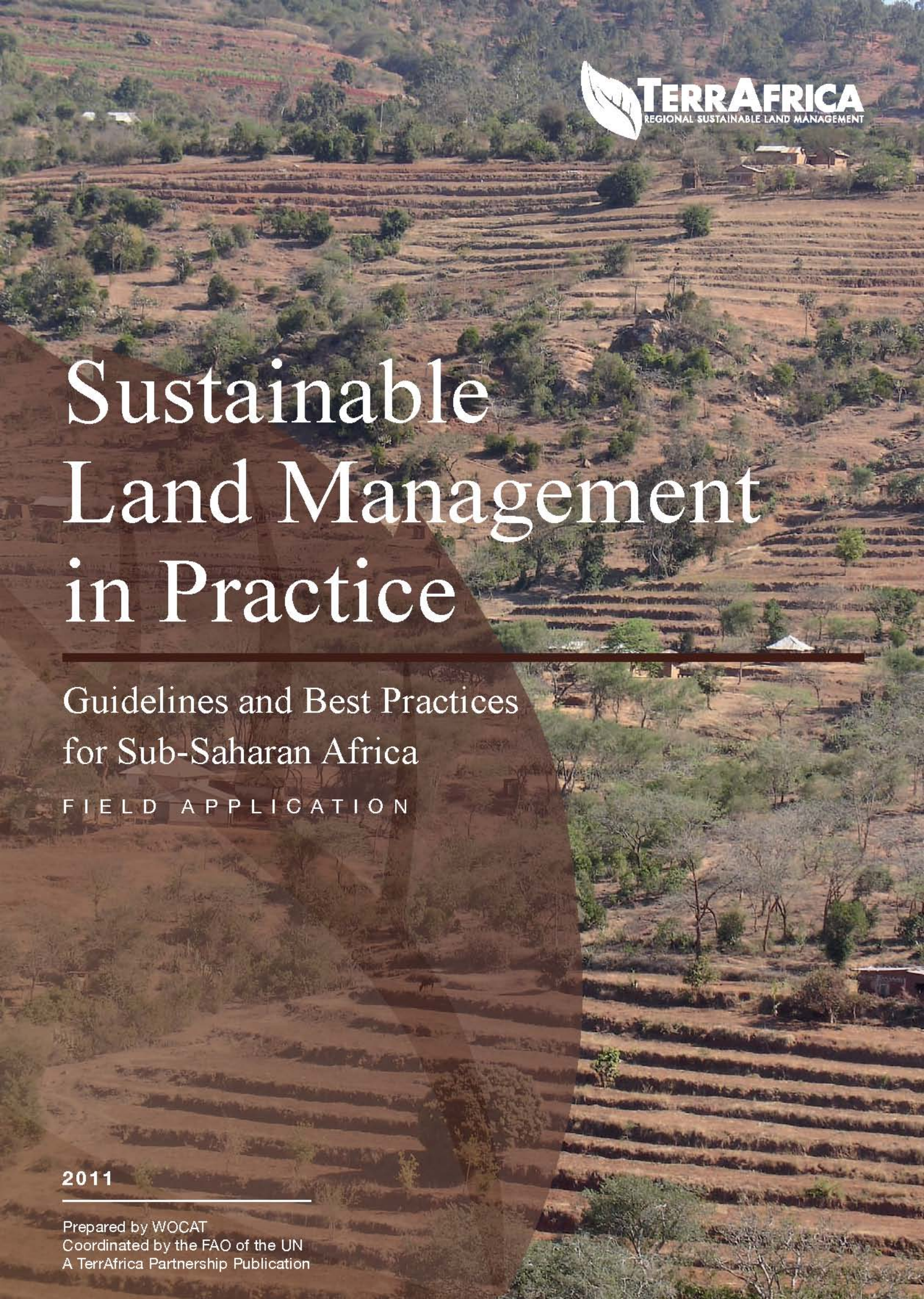

TERRAFRICA
REGIONAL SUSTAINABLE LAND MANAGEMENT

Sustainable Land Management in Practice

Guidelines and Best Practices for Sub-Saharan Africa

FIELD APPLICATION

2011

Prepared by WOCAT
Coordinated by the FAO of the UN
A TerrAfrica Partnership Publication

ISBN 978-92-5-000000-0

Sustainable Land Management in Practice

Guidelines and Best Practices for Sub-Saharan Africa

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Layout:	Simone Kummer
Citation:	Liniger, H.P., R. Mekdaschi Studer, C. Hauert and M. Gurtner. 2011. Sustainable Land Management in Practice – Guidelines and Best Practices for Sub-Saharan Africa. TerrAfrica, World Overview of Conservation Approaches and Technologies (WOCAT) and Food and Agriculture Organization of the United Nations (FAO)
Cover photo:	Sustainable Land Management practiced on small-scale farms in Machakos, Kenya: Protection of erosion-prone slopes through hand-dug terraces in combination with agroforestry (Hanspeter Liniger)

Table of Contents

Part 2: Best SLM practices for Sub-Saharan Africa

FOREWORD

Land is the true of wealth of Sub-Saharan Africa (SSA). The region is characterized by a very rich diversity of natural ecosystem resources, including soils, vegetation, water and genetic diversity. Together, these constitute the region's main natural capital. It is from these assets that the provision of food, water, wood, fibre and industrial products, and essential ecosystem services and functions are derived. And they must be maintained in order to support African populations into the future. Simultaneously, it is from the land that 60 percent of the people directly derive their livelihoods - from agriculture, freshwater fisheries, forestry and other natural resources (FAO 2004).

However, African land and water resources in some areas are seriously threatened through overuse although per capita availability is one of the highest in the world. This is a direct result of the increasing needs of a growing population, combined, often, with inappropriate land management practices. Thus, on the one hand, the African population is growing at over two percent a year (FAO 2008), requiring a doubling of food production by 2030 to keep pace with demand; on the other hand, productivity of natural resources is in general in decline. Additionally, the number of natural disasters has increased and climate change is already taking its toll.

A new system of management and governance of land resources is urgently needed; one that is able to respond in a systematic and integrated manner to this key development challenge. Sustainable land management (SLM) is a comprehensive approach, with the potential of making very significant and lasting differences in the near future, and over the long-term. But what is sustainable land management exactly? What are the principles, and above all, the practices that people can use? How can it make a real difference and provide concrete solutions for Africa? These are the key questions that this book wishes to address - and answers are provided through the case studies and analyses.

These guidelines have been developed based on FAO's and WOCAT's extensive experience. The book draws, in particular, on WOCAT's network and its database of SLM knowledge - as well as on WOCAT's first overview book entitled 'Where the land is greener'. These guidelines were implemented in the framework of the TerrAfrica partnership, whose main objective is to mainstream and upscale SLM in SSA, through the leveraging and harmonising of multisectoral investments at the local, country, subregional and regional levels.

This book is aimed at giving a strong boost to the adoption of SLM on the African continent. It is based on scientific and technical as well as practical and operational knowledge. It was written to provide clear guidance to countries, regional institutions and programmes, development partners and land users organizations that are ready and eager to change present investments towards a more sustainable direction.

The book presents 13 major groups of SLM technologies and approaches in a user-friendly manner, exemplified by 47 case studies from all over the region. It should be emphasized that, although comprehensive, these practices are not intended to be prescriptive or top-down, and in most cases can be improved and tailored to different situations. Users are therefore encouraged to adapt and modify them, based on specific conditions, integrating local knowledge and ingenuity.

Furthermore, the book addresses environmental issues that are the most pressing for SSA: thus not just combating land degradation, but also preserving ecosystem functions, ensuring food security, securing water resources within the land and confronting the climate change issues of adaptation and mitigation. Typical situations in SSA are addressed, and the potential for major contributions to improved livelihoods is emphasized.

It is expected that on-going major initiatives, such as country programmes and investment operations supported by TerrAfrica, national action plans and sector investment strategies, the Comprehensive Africa Agriculture Development Programme (CAADP) planning, as well as forest, water resources and climate change initiatives will facilitate operationalization and upscaling of these practices through multi-stakeholder partnerships. It is hoped that all stakeholders will benefit from the invaluable information contained in this guide and participate in the TerrAfrica partnership to expand and document the state of the knowledge.

Jacques Diouf
FAO Director-General

ACKNOWLEDGMENTS

This volume is a core knowledge product for the TerrAfrica platform, prepared under the Food and Agriculture Organisation's (FAO) leadership, and financed by the multi-donor TerrAfrica Leveraging Fund, the World Bank, FAO, Swiss Development Cooperation (SDC) and World Overview of Conservation Approaches and Technologies (WOCAT). These guidelines were prepared by Hanspeter Liniger, Rima Mekdaschi Studer, Christine Hauert and Mats Gurtner, initiated and coordinated by Dominique Lantieri of FAO, edited by William Critchley, CIS, VU-University Amsterdam and received support, technical contributions and reviews from Steve Danyo of the World Bank and Sally Bunning of FAO. The guidelines are based largely on an iterative process that tapped into the collected experiences of people and institutions both inside and outside Africa and could only be realised through the guidance, cooperation, and assistance of many contributors who champion SLM as a way to secure environmentally friendly and climate resilient livelihoods.

The SLM groups as they stand now could not have been realised without the review and technical inputs from the following resource persons: **Integrated Soil Fertility Management:** Jacqueline Gicheru, FAO; Stephen Twomlow, UNEP; Wairimu Mburathi, FAO; **Conservation Agriculture:** Amir Kassam, FAO; Josef Kienzle, FAO; Maimbo Malesu, ICRAF; Ric Coe, ICRAF; Theodor Friedrich, FAO; **Rainwater Harvesting:** Bancy Makanya Mati, ICRAF; Christoph Studer, Swiss College of Agriculture; Maimbo Malesu, ICRAF; Sally Bunning, FAO; **Smallholder Irrigation Management:** Bernard Keraita, IWMI; Chris Morger, Intercooperation; Pay Drechsel, IWMI; Sourakata Bangoura, FAO; Wairimu Mburathi, FAO; **Cross-Slope Barriers:** Hans Hurni, CDE; Jan De Graaff, WUR; Kithinji Mutunga, FAO; **Agroforestry:** Aichi Kityali, ICRAF; Chin Ong; Hubert de Foresta, Institute for Research and Development (IRD); Jeremias Mowo and Ric Coe, ICRAF; **Integrated Crop-Livestock Management:** Jonathan Davies, IUCN; **Pastoralism and Rangeland Management:** Eva Schlecht, University of Kassel; Jonathan Davies, IUCN; Pierre Hiernaux, CESBIO; **Sustainable Planted Forest Management:** Walter Kollert, FAO; **Sustainable Natural Forest Management in Drylands:** Anne Branthomme, FAO; Nora Berrahmouni, FAO; **Sustainable Rainforest Management:** Alain Billand, CIRAD; Carlos de Wasseige, projet FORAF, CIRAD; Nicolas Bayol, 'Forêt Ressources Management' (FRM); Richard Eba'a Atyi, projet FORAF; Robert Nasi, CIFOR; **Trends and new Opportunities:** William Critchley, CIS, VU-University Amsterdam; **SLM Approaches:** William Critchley, CIS, VU-University Amsterdam; Ernst Gabathuler, CDE

The authors are deeply indepted to the following persons who were either authors or contributed to the updating of the in the WOCAT database already existing case studies: Jens Aune, Norwegian University of Life Science, Norway; Sourakata Bangoura, FAO Central África; Jules Bayala, CORAF; Sally Bunning, FAO; Carolina Cenerini, FAO; William Critchley, CIS, VU-University Amsterdam; Daniel Danano, MoARD, Ethiopia; Etienne Jean Pascal De Pury, CEAS Neuchâtel, Switzerland; Toon Defoer, Agriculture R&D consultant, France; Friew Desta, Bureau of Agriculture, SNNPR, Ethiopia; Lopa Dosteus, CARE International, Tanzania; Deborah Duveskog, Regional FFS Advisor, FAO Kenya; Mawussi Gbenonchi, Université de Lomé, Togo; Paolo Groppo, FAO; Abraham Mehari Haile, UNESCO-IHE Institute for Water Education, The Netherlands; Andreas Hemp, University of Bayreuth, Germany; Claudia Hemp, University of Würzburg, Germany; Verina Ingram, CIFOR-Cameroon; Ceris Jones, Agronomica, UK; Franziska Kaguembèga, NGO newTree, Burkina Faso; Zeyaur R. Khan, ICIPE, Kenya; Frederick Kihara, Nanyuki, Kenya; Christian Kull, Monash University, Australia; Lehman Lindeque, Department of Agriculture, Forestry and Fisheries, South Africa; Maimbo Malesu, ICRAF; Joseph Mburu, MoA, Kenya; John Munene Mwaniki, Kenya; Kithinji Mutunga, FAO Kenya; James Njuki, MoA , Kenya; Adamou Oudou Noufou, Niger; Ahmed Oumarou, Ministry of Environment, Niger; Dov Pasternak, ICRISAT, Niger; Jimmy Pittchar, ICIPE, Kenya; Tony Rinaudo, World Vision, Australia; Eva Schlecht, University of Kassel, Germany; Abdoulaye Sambo Soumaila, GREAD, Niger; Déthié Soumaré Ndiaye, Centre de Suivi Ecologique, Senegal; Adjimon Souroudjaye, Volta Environmental Conservation Organization; Jacques Tavares, INIDA, Cape Verde; Donald Thomas, MoA, Kenya; Fabienne Thomas, Switzerland; Stephen Twomlow, UNEP; Larissa Varela, INIDA, Cape Verde; Flurina Wartmann, Biovision Foundation for ecological development, Switzerland; Marco Wopereis, Africa Rice Center, Benin; Lazare Yombi, Helvetas, Burkina Faso; Julie Zähringer, ETH Zürich, Switzerland; Iyob Zeremariam, MoA, Eritrea; Urs Scheidegger, Swiss College of Agriculture, SHL; Martin Dyer, Kisima Farm, Kenya; Bereket Tsehaye, Toker Integrated Communitiy Development, Eritrea

ABBREVIATIONS AND ACRONYMS

AfDB	African Development Bank
AU-NEPAD	African Union - New Partnership of African Development
CABI	Commonwealth Agricultural Bureaux International
CC	Climate Change
CDE	Centre for Development and Environment
CEAS	Centre écologique Albert Schweizer
CESBIO	Centre d'Etudes Spatiales de la BIOsphère
CGIAR	Consultative Group on International Agricultural Research
CIFOR	Centre for International Forestry Research
CIRAD	La recherche agronomique pour le développement; Agricultural Research for Development
CIS	Centre for International Cooperation (VU University Amsterdam)
CTA	Technical Centre for Agricultural and Rural Cooperation
FAO	Food & Agricultural Organization of the United Nations
FFS	Farmer Field School
FORAF	African Forest Observatory
GHG	Greenhouse gases
GREAD	Groupe de Recherche d'Etude et d'Action pour le Développement, Niger
ICIPE	International Centre for Insect Physiology and Ecology – African Insect Science for Food and Health
ICRAF	World Agroforestry Centre
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute
IPCC	Intergovernmental Panel on Climate Change
ILEIA	Centre for Learning on Sustainable Agriculture
INIDA	National Agrarian Development Institute, Cape Verde
ISRIC	World Soil Information
IUCN	International Union for Conservation of Nature
IWMI	International Water Management Institute
LADA	Land Degradation Assessment in drylands by FAO
M&A	Monitoring and Assessment
na	not applicable
NGO	Non Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
PES	Payment for Ecosystem Services
PRA	Participatory Rural Appraisal
R&D	Research and Development
SDC	Swiss Development Cooperation
SLM	Sustainable Land Management
SOC	Soil Organic Carbon
SOM	Soil Organic Matter
SSA	Sub-Saharan Africa
SWC	Soil and Water Conservation
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-REDD	United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degardation
USDA	United States Department of Agriculture
WB	World Bank
WOCAT	World Overview of Conservation Approaches and Technologies
WUR	Wageningen University & Research Centre

EXECUTIVE SUMMARY

PART 1: GUIDING PRINCIPLES

Introduction

Aims and structure

Production of guidelines for best sustainable land management (SLM) technologies and approaches in Sub-Saharan Africa (SSA) has been part of TerrAfrica's programme during 2009-2010. These guidelines and case studies are intended to help create a framework for investment related to SLM in SSA. The particular aim of these guidelines is to identify, analyse, discuss and disseminate promising SLM practices - including both technologies and approaches - in the light of the latest trends and new opportunities. The focus is, in particular, on those practices with rapid payback and profitability and / or other factors that drive adoption.

This document is targeted at key stakeholders in SLM programmes and projects at the design and implementation stages, including practitioners, managers, policy-makers, planners, together with, financial and technical institutions, and donors. The guidelines are divided into two main parts. Part 1 highlights the main principles behind SLM, and what considerations are important for technologies and approaches to qualify as 'best practices' suitable for upscaling. Part 2 presents twelve groups of SLM technologies as well as a section on SLM approaches. These are supported by specific case studies. Key resource persons and experts on SLM in SSA were asked to assist in finalising the SLM groups and to describe specific case studies. This strives to be a 'state of the art' product.

Focus on Sustainable Land Management in Sub-Saharan Africa

Sub-Saharan Africa is particularly vulnerable to threats of natural resource degradation and poverty. This is due to various factors including a high population growth rate and increasing population pressure, reliance on agriculture that is vulnerable to environmental change, fragile natural resources and ecosystems, high rates of erosion and land degradation, and both low yields and high post-harvest yield losses. On top of this can be added sensitivity to climate variability and long-term climate change,

In SSA concerted efforts to deal with land degradation through SLM must address water scarcity, soil fertility, organic matter and biodiversity. SLM seeks to increase production through both traditional and innovative systems, and to improve resilience to the various environmental threats.

Principles for best SLM practices

Increased land productivity

In order to increase production from the land, water use efficiency and productivity need to be improved. This can be achieved by reducing high water loss through run-off and unperceived evaporation from unprotected soil, harvesting water, improving infiltration, maximising water storage - as well as by upgrading irrigation and managing surplus water. The first priority must be given to improving water use efficiency in rainfed agriculture; here lies the greatest potential for improved yields with all the associated benefits. For irrigated agriculture, conveyance and distribution efficiency are key water-saving strategies. Each of the best practices presented in Part 2 of these guidelines include improved water management and water use efficiency; some of them are particularly focused on coping with water scarcity - such as water harvesting in drylands or protection against evaporation loss and runoff, through conservation agriculture, agroforestry or improved grazing land management.

Soil fertility decline due to unproductive nutrient losses (through leaching, erosion, loss to the atmosphere) and 'nutrient mining' is a major problem in SSA. An improvement to the current imbalance between removal and supply of nutrients can be achieved through various means. These include cover improvement, crop rotation, fallow and intercropping, application of animal and green manure, and compost through integrated crop-livestock systems, appropriate supplementation with inorganic fertilizer and trapping sediments and nutrients e.g. through

Integrated land use system with maize-bean intercropping and grass strips for fodder production in a high potential area (Hanspeter Liniger).

bunds, vegetative or structural barriers / traps. All these are part of an integrated soil fertility management leading to an improvement in soil organic matter and soil structure. Improved agronomy is an essential supplement to good SLM practices. Strategic choice of planting materials that are adapted to drought, pests, diseases, salinity and other constraints, together with effective management is a further opportunity.

Major potential to improve land productivity also lies in improving micro-climatic conditions. A favourable micro-climate in dry and warm areas can be created by reducing winds through windbreaks and shelterbelts, protecting against high temperature and radiation (using agroforestry and multistorey cropping) and by keeping conditions as moist as possible. Mulch and plant cover are important in this context. In humid areas the emphasis is on protecting soils against intensive rainfall.

Thus to increase land productivity it is essential to follow and combine the principles of improving water use efficiency and water productivity, increasing soil fertility, managing vegetation and attending to the micro-climate. These synergies can more than double productivity and yields in small-scale agriculture. Further increases in productivity can also be achieved by intensification and / or diversification of production.

Improved livelihoods

Despite the constraints and problems land users have, they are willing to adopt SLM practices if they provide higher net returns, lower risks or a combination of both. Cost efficiency, including short and longterm benefits, is the key issue for adoption of SLM. Land users are more willing to adopt practices that provide rapid and sustained pay-back in terms of food or income. Assistance for establishment of certain measures may be needed for small-scale subsistence land users if costs are beyond their means and if quick benefits are not guaranteed. Maintenance costs need to be covered by the land users to ensure self-initiative. This implies an accurate assessment of costs and benefits in monetary and non-monetary terms: herein lies a significant challenge.

Land users may require additional inputs to take up SLM practices. These are related to materials (machinery, seeds, fertilizers, equipment, etc.), labour, markets, and knowledge. Labour and inputs are of concern, especially in areas affected by, for example, outmigration. In these cases especially, SLM practices such as conservation agriculture, with the advantages of reduced labour and inputs, will stand a better chance of being adopted. Changes towards SLM should build on – and be sensitive to - values and norms, allow flexibility, adaptation and innovation to improve livelihoods. Most appropriate is the promotion of SLM practices that are easy to learn and thus require minimal training and capacity building.

Improved ecosystems: being environmentally friendly

Practices, to be truly sustainable, must be environmentally friendly, reduce current land degradation, improve biodiversity and increase resilience to climate variation and change. Given the current state of land in SSA, SLM interventions are vital to prevent, mitigate and rehabilitate land degradation. The main efforts should address the problems of water scarcity, low soil fertility, organic matter and reduced biodiversity. Priority should be given to low-input agronomic and vegetative measures, and only then consider the application of more demanding struc-

tural measures. Combinations of measures that lead to integrated soil and water, crop-livestock, fertility and pest management are promising. Spreading of local successes in combating degradation leads to compound impacts – the whole being greater than the sum of the parts - at the watershed, landscape and global levels.

A key concern in SLM and protecting ecosystem function in SSA is conservation of biodiversity. Plant and animal biodiversity are central to human well-being, most notably in supporting food production, but also as a source of fibre, wood, and medicines. They also have cultural, recreational and spiritual significance. Because African farming depends, still, very largely on local landraces of a wide variety of crops, the wealth of its agro-biodiversity must not be underestimated. In the protection of agro-biodiversity the precautionary principle needs to be applied: maintain as many varieties of plants and domestic animals as possible for their future potential.

Of immediate importance to people across SSA are the opportunities that SLM practices offer to help adapt to and mitigate climate change (CC). Adaptation to climate change can be achieved by adopting more versatile and CC-resilient technologies – but also through approaches which enhance flexibility and responsiveness to change. Some practices increase the amount of rainfall that infiltrates the soil (e.g. mulching, improved plant cover) as well as improving its capacity to store water (e.g. increased soil organic matter content) - while simultaneously helping protect the soil from extremes of temperature and more intense rainfall. Thus the most appropriate SLM practices for SSA are characterised by tolerance to increased temperatures, to climate variability, and to extreme events. If the SLM principles of improved water, soil fertility and plant management, and micro-climate are considered, the result will be better protection against natural disasters and increased resilience to climate variability and change. Diversification of production is an additional way to increase resilience.

Land users in SSA can also contribute to global efforts in mitigation of climate change primarily by adopting SLM that sequesters atmospheric carbon in the soil and in perennial vegetation. These technologies include afforestation, agroforestry, reduced tillage, improved grazing land management. Greenhouse gas emissions can also be reduced by limiting deforestation, reducing the use of fire, better livestock management, and better agronomic practices. In summary, the principles of improved water use efficiency, soil fertility, plant management and micro-climate underpin the best land management practices and they constitute win-win-win solutions for SSA. The SLM practices presented in Part 2 are based on these principles and contribute to the improvement of land productivity, livelihood and ecosystems.

Adoption and decision support for upscaling best practices

Despite continuous efforts to spread SLM practices adoption is still alarmingly low. Successful adoption of SLM depends on a combination of factors. All must be addressed.

Adoption - uptake and spread

Setting up institutional and policy frameworks to create an enabling environment for the adoption of SLM involves the strengthening of institutional capacities as well as collaboration and networking. Rules, regulations and by-laws need to be established, but must be relevant to be accepted and followed. Resource use rights and access are key entry points that give people individual and / or collective security and motivation for investment. Access to markets, where prices can change quickly, require flexible and adaptable SLM practices, open to innovation. These practices also need to be responsive to new trends and opportunities such as ecotourism or payment for ecosystem services.

A key aspect in adoption and spread of SLM is to ensure genuine participation of land users and professionals during all stages of implementation to incorporate their views and ensure commitment. At the same time off-site (e.g. downstream) interests may restrict freedom at the local level, such as the free use of water for irrigation. But it may equally provide an opportunity for collaboration, resulting in win-win solutions upstream and downstream.

Extension services need to be based on appropriate training and capacity building. These activities should involve individual land users (e.g. through farmer field schools, farmer–to-farmer exchange, support of local promoters) and communities, and not just depend on government

agents. Access to credit and financing schemes can be of vital help for rural people starting new SLM initiatives - but may also create dependency if incentives are not used judiciously. Financial support needs to be enhanced for institutions providing advice, plans and decision support to land users.

Monitoring and assessment of SLM practices and their impacts is needed to learn from the wealth of knowledge available. This embraces traditional, innovative, project and research experiences and lessons learnt – both successes and failures. Major efforts are required to fill knowledge gaps and shed light on where and how to invest in the future. While donors request more and better quality data related to spread, impacts and benefit-cost ratios of SLM, there are still too few efforts in assessment and harmonised knowledge management.

Decision support – upscaling SLM

Given the challenge of finding best SLM practices for diverse local conditions, it is essential to provide decision support for local land users and the specialists who advise them - as well as for planners and decision-makers. This requires sound procedures, tapping into existing knowledge and weighing criteria that are important at all levels of scale. A first step is to raise awareness of the importance of, and the need for, investments in knowledge management and decision support mechanisms.

The building up of a common and standardised pool of knowledge related to SLM technologies and approaches for implementation and dissemination provides the basis for successful upscaling. Making this information available, and providing tools for comparing, selecting and fine-tuning SLM practices for different environments, ecological, economic, social and cultural conditions is a further requirement. Proper mapping of SLM practices and their impacts, and comparison of these with areas of land degradation, provides the foundation for deciding where to locate SLM investments that are cost-efficient and have the highest on-site and off-site impacts. Given the limited resources for SLM, decisions must be aimed at maximising impact with the least input.

Future interventions need to promote the development of joint or 'hybrid' innovation that ensures making the best of local and scientific knowledge. However all developments must take into consideration markets, policies and institutional factors that can stimulate widespread smallholder investment.

The way forward

Part 1 of the guidelines ends by acknowledging the complexity of sound natural resource management and clearly shows the need for major shifts in emphasis to overcome bottlenecks and barriers to the spread of SLM in SSA. These shifts concern various aspects, at different levels, including technologies and approaches, institutional, policy, governance, economy, knowledge management and capacity building.

Investments in spreading SLM practices in Sub-Saharan Africa have great scope and can provide multiple benefits not only locally, but also regionally nationally and globally. Consolidated action towards better use of valuable knowledge at all levels is needed and will be beneficial in the future, as it can be anticipated that change will be even more pronounced with respect to global markets, climate change, demands on ecosystem services, etc. In short, investment in SLM and a sound knowledge management pays now - and will continue to do in the future.

PART 2: BEST SLM PRACTICES FOR SUB-SAHARAN AFRICA

Twelve groups of SLM technologies backed up by 41 case studies and a section on SLM approaches, with 6 case studies, are presented in Part 2 of the guidelines. The SLM groups follow the principles of best practices: increasing productivity, improving livelihoods and improving ecosystems. The approaches illustrated were proven successful in implementing and spreading of SLM in SSA. All groups and case studies are presented according to the standardised WOCAT format for documenting and disseminating SLM. There is no one miracle solution ('silver bullet') to solve the problems which land users in SSA face. The choice of the most appropriate SLM practice will be determined by the local context and particular situation of local stakeholders.