

Preface

Africa is one of the continents mostly severely affected by climate change, for two main reasons. The first reason is because the geographical characteristics of the African continent make it highly vulnerable to the effects of climate change, especially from the projected changes in the rainy seasons and intensitivity of droughts, which in turn may affect agriculture and other human activities.

The second reason for high vulnerability of African countries is related to their limited capacity to adapt. By not having access to required technological and financial resources that are needed to implement substantial adaptation programmes, many African nations are finding it difficult to handle the many challenges that climate change poses to them.

Climate change is also one of the major challenges that the agricultural research community is facing in recent years. Compared to many other biophysical constraints that the smallholder farmer is facing, climate change is a difficult problem to address for various reasons. First, climate change is a future problem and there are problems in assessing the magnitude and direction of these changes accurately, especially at local level. Second, while temperature projections seem to be fairly certain, changes in rainfall both in quantity and in variability are difficult to predict and rainfall is the major factor influencing productivity and profitability of the agricultural systems. Third, our understanding of impacts of projected changes in climate on crop growth and performance, especially the role of changes in carbon dioxide concentration, is limited. Despite these limitations, significant progress has been made in understanding the impacts of climate change on smallholder agricultural systems and in identifying appropriate management options to adapt. Unfortunately, much of the fieldwork carried out in many African countries remained inaccessible to the global community.

The conference “Transforming Rural Livelihoods in Africa: How can land and water management contribute to enhanced food security and address climate change adaptation and mitigation?” organized by the Soil Science Society of East Africa (SSSEA) in collaboration with African Soil Science Society (ASSS) and held in Nakuru, Kenya during 20–25 October 2013 served as an important platform for scientists in the Eastern Africa region to share their findings and experiences.

The targeted are researchers, policy makers, farmers, extension agents, among others, involved in and/or having interest in soil science and land and water management. This book contains various papers presented at the 2013 Nakuru Conference, as well as other contributions written by teams of African experts and/or by international researchers working in Africa.

Presentations at the conference covered a wide range of topics and presented a diverse set of viewpoints and perceptions on several of aspects of climate change and its impacts on agriculture. This book includes selected papers, based on their relevance and interest for the climate change research community, from the large number of presentations made during the conference. The papers are sequenced according to their focus in addressing a range of issues from methodological to technological and policy options for adapting agriculture to projected changes in climate.

Progressive changes in climate are hard to predict and assessing impacts of these changes on performance and productivity of crops is still harder. Since crop performance is an outcome of a number of interrelated factors it is difficult to predict how these factors independently and interactively affect the performance of crops under different climatic conditions. One of the promising approaches is the use of analogue sites, which are locations whose climate today appears as a likely analogue to the projected future climate of another location. The paper by Leal Filho and De Trinchiera outlines this approach. The overall aim of climate change research is to find options that contribute to reduced vulnerability to climate variability and promotion of climate resilience in development investments, enhancing biodiversity, increasing yields and lowering greenhouse gas emissions. The second paper by Stephen Kimani highlights some of the measures that can be put in place to improve incomes and livelihoods of farmers in the semi-arid regions of Africa. The paper by Kwena Kizito dwells on the issue of how research generated information is availed and used. Through a review, this paper assessed the extent to which scientific information has been used to inform climate change adaptation policies, plans and strategies in Kenya as well as the effectiveness of existing platforms for sharing climate change information in the country. The paper by Sospeter Nyamwaro is based on information about the climate change-related projects undertaken in Kenya over the past five years. It analyses the areas covered by these projects and identified the high and low focus areas.

The next four papers deal with issues related to assessing and characterizing climate variability (Oscar Kisaka) and the potential impacts of climate variability and change on water resources (Sridhar Gummadi) and crop performance (Justice Nyamangara). One key aspect of climate change impact assessment studies is lack of information on how these impacts are felt differently by different gender, age and social class differentiated groups. The paper by Kumbiari Musiyiwa using the data collected through surveys conducted at analogue locations highlights this aspect of climate change and identifies gender sensitive adaptation options.

Among the key options for adapting agriculture to climate change, soil and water management measures including irrigation figure prominently. This is mainly because of the expected increase in the demand for water by crops due to increased

evaporation and transpiration under warmer temperatures. The papers by Musyimi, Ngugi, Evans Mutuma and Geoffrey Gathyungu provide some insights into the potential role of water conservation in mitigating the water stress on some important food crops. The study reported by P.N.M. Njeru tried to compare and contrast farmer and scientific evaluation of various climate change adaptation options that integrate soil water and soil fertility management practices aimed at improving productivity of sorghum.

The final set of four papers explores the use of drought tolerant crops and varieties as an alternative adaptation strategy. Finyange N. Pole evaluated a number of maize genotypes to identify varieties that are efficient in both nutrient and water use. While Fabian Bagarama explored the performance of tomato as an alternate crop under warmer climates, studies reported by Cyrus M. Githunguri assessed the potential of traditional food crops as alternatives. Interest in research on issues related to climate change in Africa has been high over the past decade. It is important that this remains high and these efforts will be successful in identifying robust management options that help smallholder farmers make best use of the variable climatic conditions while helping in adapting to future changes.

This book is also an output of the project *Adapting agriculture to climate change: Developing promising strategies using analogue locations in Eastern and Southern Africa (CALESA)*, funded by the German International Agency for Cooperation (GIZ) and undertaken by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in collaboration with Kenya Agricultural Research Institute (KARI), Kenya Meteorological Department (KMD), Zimbabwe Meteorological Department (ZMD), Midlands State University (MSU) and the Hamburg University of Applied Sciences (HAW) in Germany.

Using a combination of model-based *ex ante* analyses and iterative field-based research on station and in farmers' fields, the project has tested potential agricultural adaptation strategies for rainfed agriculture in the semi-arid and dry sub-humid tropics. This has been achieved through choosing four currently important crop production zones (two in Kenya and two in Zimbabwe) and then identifying corresponding 'spatial analogue locations' for each production zone, providing eight study locations in all. This book contains a set of chapters which describe some of the results achieved as part of the project.

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Due to its scope, the actuality of the topic and its importance in documenting and promoting experiences of climate change adaptation in Africa, this book will provide timely assistance to the current and future adaptation efforts in the African continent.

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Transforming Rural Livelihoods

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