



Conservation Agriculture and Sustainable Crop Intensification in Karatu District, Tanzania



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Cover photo:

The late Mzee Swalehe Shaban Swalehe, CA pioneer and lead farmer from Rhotia village, Karatu district (5th August 2011, in memoriam)

FOREWORD

Plant Production and Protection Division (AGP) in the Agriculture and Consumer Protection Department has elaborated its vision and concepts regarding sustainable crop production intensification that follows an ecosystem approach in which the enhancement of output and productivity go hand-in-hand with the delivery of ecosystem services. This is elaborated in the book *Save and Grow: The New Paradigm of Agriculture* launched by FAO in July 2011 as a policymaker's guide to the sustainable intensification of smallholder crop production.

The theme of sustainable crop production intensification is also embedded in the Objective 'A' in FAO's strategic framework for enhancing food security, alleviating poverty and addressing other global challenges such as environmental degradation and climate change. Conservation Agriculture (CA) is considered to be a core element of FAO's strategy for sustainable production intensification, and more field projects dealing with small-scale farmers are introducing CA as an essential production system base for enhancing production of crops and livestock, livelihood and quality of life.

Future global food security relies not only on high production and access to food but also on the need to address the destructive effects of current agricultural production systems on ecosystem services and increase the resilience of production systems to the effects of climate change. CA enables the sustainable intensification of agriculture by conserving and enhancing the quality of the soil, leading to higher yields and the protection of the local environment and ecosystem services.

This report is about the CA for Sustainable Agriculture and Rural Development (CA-SARD) project in Tanzania funded by the German Government and implemented by FAO and the Ministry of Agriculture of the United Republic of Tanzania. The publication describes the experiences of introducing CA as a concept for sustainable crop production intensification in farming communities of Karatu District, Arusha Province, Tanzania. The case study explains the adoption process and shows the impact of CA in terms of agricultural production, environment and ecosystem services, livelihoods and other socio-economic factors. The case study is directed to policy makers, scientists and environmentalists and should help decision making towards sustainable intensification concepts for agriculture.

Shivaji Pandey
Director

Plant Production and Protection Division (AGP)

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The project was carried out in the Karatu district in the Arusha region of the United Republic of Tanzania by the CA SARD Tanzania team based at the Zonal Selian Agricultural Research Institute, Arusha. The team is grateful to the Zonal Director, Dr. Ally S. Mbwana, for extending his full support to the project.

The facilitation, supervisory and backstopping roles of FAO (Food and Agriculture Organization), the Ministry of Agriculture and Food Security and Cooperatives and the African Conservation Tillage Network (ACT) during implementation of the project are acknowledged with much appreciation.

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The extensive collaboration and untiring support received from the Extension Services in both Karatu District Council and Rhotia Village Council are acknowledged with grateful thanks.

Last but not least the active participation, commitment and keen interest of our beloved farmers in Karatu deserve special acknowledgement and gratitude. In particular, the efforts made by the late Mzee Swalehe Shaban Swalehe in promoting Conservation Agriculture, through facilitation of FFS groups, use of botanicals for pests and disease control, his contribution in CA promotion and adoption will always be remembered.

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ACRONYMS AND ABBREVIATIONS

ACT	African Conservation Tillage network
AESA	Agro-Eco System Analysis
ASDS	Agricultural Sector Development Strategy
CA	Conservation Agriculture
CAADP	Comprehensive Africa Agricultural Development Program
CA-SARD	Conservation Agriculture for Sustainable Agriculture and Rural Development
CPAR	Canadian Physicians for Aid and Relief
FAO	Food and Agriculture Organisation of the United Nations
FFS	Farmer Field School
GDP	Gross Domestic Product
HIV	Human immunodeficiency virus
IPM	Integrated Pest Management
NGO	Non-governmental organisation
NSGRP	National Strategy for Growth and Reduction of Poverty
PRSP	Poverty Reduction Strategy Paper
RDP	Rural Development Policy
RECODA	Research, Community and Organizational Development Associates
SARI	Selian Agricultural Research Institute
TZS	Tanzania shilling – valued at 1500 to USD 1 in this report
US\$	United States dollar
VICOBA	Village Community Bank
WADEC	Women's Agriculture Development and Environmental Conservation

SUMMARY

Karatu district is one of five districts in Arusha Region, located in the Northern Zone of Tanzania. Agriculture plays an important role in the economy of Tanzania, contributing significantly to the country's GDP, accounting for 60 percent of export earnings and employing 84 percent of the rural population. Most smallholder farmers in the region grow maize, beans and pigeon pea, with some farmers able to cultivate rice and wheat and small scale vegetable production. Agricultural productivity in the district has decreased due to unreliable rainfall (erratic precipitation and lower annual totals) and poor soil fertility leading to a decline in yields and growing food insecurity amongst smallholder farmers. Heavy reliance on rain-fed crop production systems increases the risks faced from precipitation changes, highlighting the reality of climate change as a major threat to the livelihoods of smallholder farmers.

Since 2004 the Selian Agricultural Research Institute (SARI) has been promoting Conservation Agriculture (CA) techniques to smallholder farmers through the project known as Conservation Agriculture for Sustainable Agriculture and Rural Development (CA-SARD). The project objective was to improve food security and rural livelihoods and build a foundation for the expansion of conservation agriculture to contribute to agriculture and rural development through the use of Farmer Field Schools(FFS). This case study identifies four objectives of (1) protecting ecosystem services to enable sustainable crop production intensification and improved agricultural productivity; (2) contributing to secure livelihoods and reducing vulnerability through asset accumulation for smallholder farmers; (3) enhancing the social capital of small-scale producers with participation in farmer groups and access to networks; (4) creating an enabling environment for smallholder farmers to adopt conservation agriculture practices through the implementation of effective pro-poor policies and access to credit via local micro finance facilities like SACCO's, VICOBA etc.

In Karatu district, adoption of the three CA principles of minimum soil disturbance, permanent organic-matter soil cover and diversified crop rotations has protected and enhanced ecosystem services, contributing to sustainable agricultural productivity. This increased productivity has contributed to the accumulation of assets which enhance smallholders' potential to build sustainable livelihoods. Social capital is improved by smallholders' involvement in FFS which build relationships and trust in the community and encourages interaction with outside parties such as agricultural extension workers and NGOs including CPAR, Mazingira bora Karatu which can then be used to access further opportunities and information. CA adoption in Karatu district

has been successful because of the efforts of the (district council) government, NGOs and international institutions to create an enabling environment for smallholder farmers.

The key to the continued growth in adoption of CA by smallholder farmers in Karatu district and Tanzania lies in the expansion of FFS, Farmer led groups and their linkages with agricultural extension officers and NGOs. Although CA farmers have shown increases in production and an ability to build their asset base they have not as yet diversified into more lucrative off-farm income generating strategies, instead investing their money into livestock production. There is scope to train farmers to access off-farm opportunities through their experience with FFS. These farmer groups already have their individual identities, a build up of trust within the group and shared experience of working together on the demonstration plots. A transition from FFS being seen as training groups to small and medium enterprises (SME) could be facilitated with training from extension officers, NGOs and the private sectors and would enable these groups to become more focussed on effective income strategies.

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CHAPTER 1

Overview of the case study

Background and context

- The role of agriculture in Karatu district and its relevance to livelihoods.
- Land and soil degradation leading to loss of agricultural productivity.
- The threat of climate change for smallholder farmers in Karatu district.
- The potential for conservation agriculture (CA) to address productivity problems.

Objectives and activities

- Objectives of conservation agriculture for sustainable agriculture and rural development (CA-SARD) and areas of focus in the case study.
- Activities performed as part of the CA-SARD project.
- Social, economic and political barriers preventing adoption of CA by smallholder farmers.

Details of the case study

- Approach and methodology used to gather information for the case study.
- Results of observations and workshops held with farmer field schools (FFS).
- Key stakeholders involved in the CA-SARD project and in the case study.

Impacts and analysis

- Protecting ecosystem services to enable sustainable intensification.
- Contributing to secure livelihoods through asset accumulation.
- Enhancing social capital through farmer groups and access to networks.
- Creating an enabling environment through pro-poor policies.

Conclusion

- Review of the main outcomes of the case study.
- Barriers faced and suggestions for future upscaling of CA in Karatu district and Tanzania.

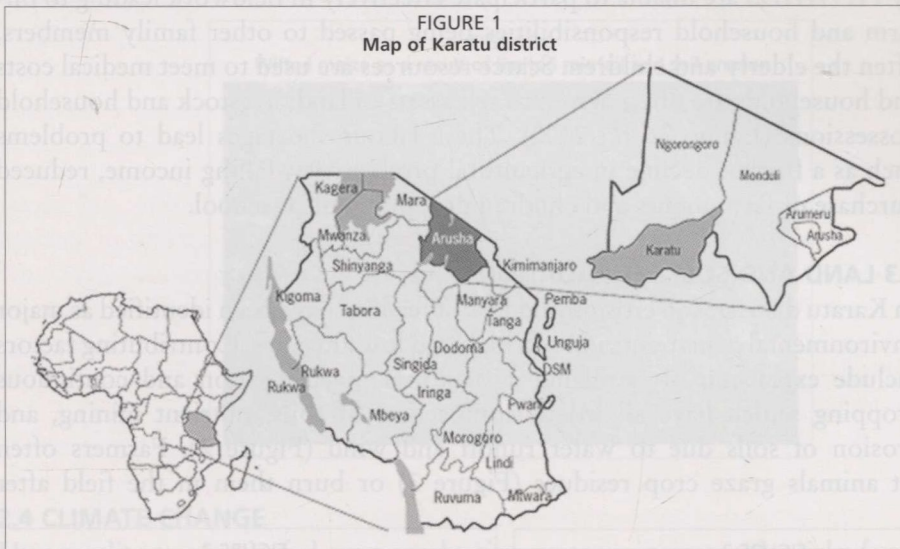
CHAPTER 2

Background and context

2.1 KARATU DISTRICT

Karatu district is one of five districts in Arusha Region, located in the Northern Zone of Tanzania (Figure 1). The district has three physiographic zones of uplands, midlands and lowlands, with altitude ranging from 1,000 to 1,900 metres. Rainfall in the district is bimodal; the short rains fall between October and December and the long rains between March and June (KDC, 2001). Annual rainfall may range from less than 400 mm in Eyasi Basin to over 1000 mm in the highlands with rain zones classified as semi-arid (300-700 mm/year) and subhumid (700-1200 mm/year).

FIGURE 1
Map of Karatu district



2.2 AGRICULTURE AND LIVELIHOODS

Agriculture plays an important role in the economy of Tanzania, contributing significantly to the country's GDP, accounting for 60 percent of export earnings and employing 84 percent of the rural population. In Karatu district, crop production and livestock production are by far the most important economic sectors, employing over 90 per cent of the labour force (Douwe and Kessler, 1997). Most smallholder farmers in the region grow maize, beans and pigeon pea, with some farmers able to cultivate rice and wheat and small scale vegetable production. There are also large scale farms growing coffee, vegetables and flowers in fertile highland areas.

Agricultural productivity in the district has decreased due to unreliable rainfall (erratic precipitation and lower annual totals) and poor soil fertility (KDC, 2001) leading to a decline in yields and growing food insecurity amongst smallholder farmers. Declining yields lead to negative impacts on the livelihoods of smallholder farmers including decreased food intake and nutrition and a lack of income to invest in assets such as farm inputs, education for children and household improvements. This limits a household's ability to improve their livelihoods, fuels the cyclical nature of poverty and increases vulnerability amongst poor communities.

With a decline in the productivity and profitability of agriculture, households are searching for alternative means of income, a trend which is contributing to rural to urban migration. With many young people leaving farming in search of more profitable employment in towns and cities, rural farming populations are ageing leading to labour shortages on farms. This labour shortage is escalated by the impact of an HIV rate in Karatu of 20 percent, which is higher than the national average of 8 percent (Bishop-Sambrook *et al.*, 2004). Farmers affected by HIV/AIDS are unable to participate effectively in fieldwork leading to on-farm and household responsibilities being passed to other family members, often the elderly and children. Scarce resources are used to meet medical costs and households are often driven to sell assets of land, livestock and household possessions (Lyimo *et al.*, 2002). These labour shortages lead to problems such as a further decline in agricultural productivity, falling income, reduced purchase of farm inputs and children dropping out of school.

2.3 LAND AND SOIL DEGRADATION

In Karatu district, soil erosion and loss of fertility have been identified as major environmental constraints in both high and low altitudes. Contributing factors include expansion of farmland, agricultural mechanisation and continuous cropping which have all led to compaction of soils, nutrient mining, and erosion of soils due to water runoff and wind (Figure 2). Farmers often let animals graze crop residues (Figure 3) or burn them in the field after

FIGURE 2
Soil degradation from rain water and wind erosion



FIGURE 3
Grazing animals leave soils bare and unprotected



harvesting (Figure 4), leaving the soil bare and susceptible to erosion (Figure 5). Eroded soils unsuitable for crop production coupled with low use of organic or inorganic fertilizer, poor quality seeds and limited moisture leads to low crop production (Figure 6) hence food insecurity, low incomes and resulting poverty.

FIGURE 4
Burning crop residues in the field



FIGURE 5
Formation of gullies and poor soil quality due to erosion



FIGURE 6
Wilted maize as a result of limited rainfall and soil erosion



2.4 CLIMATE CHANGE

Heavy reliance on rain-fed crop production systems increases the risks faced from precipitation changes, highlighting the reality of climate change as a major threat to the livelihoods of smallholder farmers. In Tanzania, temperatures are predicted to rise by 2-4 °C by the year 2100 with dry seasons likely to be prolonged and availability of water for crops diminished (Paavola, 2008). By 2050, 350-600 million Africans are predicted to be at risk from increased water stress (Hahn *et al.*, 2009). In Karatu district smallholder farmers are already experiencing the effects of climate change. Average annual rainfall has fallen by approximately 100mm over the last decade (Figure 7) with rainfall days decreasing by 20 during the same period (Figure 8).