



Six Opportunities to Green Agricultural Production in the Southern Agricultural Growth Corridor of Tanzania (SAGCOT)

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The development of this document was led by a team from EcoAgriculture Partners, reporting to the SAGCOT Centre and the SAGCOT Green Reference Group.

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The **SAGCOT Vision for Agriculture Green Growth** is described in a set of documents produced in 2013. Follow the hyperlinks in the list below to access any of the documents.

A Vision for Agriculture Green Growth in the Southern Agricultural Growth Corridor of Tanzania (SAGCOT): Overview

Sara J. Scherr, Jeffrey C. Milder, Louise E. Buck, Abigail K. Hart, and Seth A. Shames

A Framework for Agriculture Green Growth: Greenprint for the Southern Agricultural Growth Corridor of Tanzania (SAGCOT)

Jeffrey C. Milder, Louise E. Buck, Abigail K. Hart, Sara J. Scherr, and Seth A. Shames

Green Growth Opportunities for Businesses and Investors: Greenprint for the Southern Agricultural Growth Corridor of Tanzania (SAGCOT)

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Applying an Agriculture Green Growth Approach in the SAGCOT Clusters: Challenges and Opportunities in Kilombero, Ihemi and Mbarali

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Contents

Introduction	1
Conservation Agriculture	2
What is conservation agriculture?	2
Current and prior experience with conservation agriculture	2
<i>Potential benefits</i>	2
Current uptake in SAGCOT and beyond	3
<i>Potential and barriers for scaling-up in SAGCOT</i>	3
What would it take to scale-up effective adoption of this AGG innovation?	4
Resources	6
System of Rice Intensification (SRI)	7
What is the System of Rice Intensification?	7
Current and prior experience with SRI	7
<i>Potential benefits</i>	7
<i>Current uptake in SAGCOT and beyond</i>	8
Potential and barriers for scaling-up in SAGCOT	9
What would it take to scale-up effective adoption of this innovation?	10
Resources	11
Precision Agriculture	12
What is precision agriculture?	12
Precision agriculture outcomes and benefits	12
Current and prior experience with precision agriculture	13
What would it take to scale-up effective adoption of this innovation?	14
Resources	16
Sustainable Intensification of Beef Production	17
What is sustainable intensification of beef production?	17
Potential benefits of this AGG opportunity	17
Opportunities for SAGCOT	18
<i>Potential opportunities for improved meat slaughtering facilities</i>	21
<i>Additional supporting activities</i>	21
An Enterprise Approach to Community Forestry	23
What are community forest and agroforest enterprises?	23
Experience with community forest enterprises	23
<i>Current activity in Tanzania</i>	23
<i>Current activity in SAGCOT</i>	24
Potential and barriers for scaling-up community forest enterprises in SAGCOT	25
<i>Barriers to scaling up</i>	26
Differentiated Markets for Sustainable Agriculture	27
What are differentiated markets for sustainable agriculture?	27
Potential benefits of this AGG opportunity	27
Current experiences in SAGCOT and beyond	28
<i>Certification institutions and capacity</i>	29

Scaling-up differentiated agricultural markets for SAGCOT.....	30
<i>Promising opportunities</i>	30
<i>Key challenges and barriers</i>	31

Tables

Table 1-1. Potential benefits of CA adoption on maize farms in Mbeya Rural district.	4
Table 6-1. Tanzania organic agricultural product exports, 2009.	28
Table 6-2. Organic production in the SAGCOT region, 2009.	29

Boxes

Box 1-1. Getting to scale: Lessons from CA initiatives in Zambia and Kazakhstan	5
Box 2-1. Getting to scale: Lessons from SRI initiatives in Bihar State, India	9
Box 3-1. Precision agriculture in sugarcane: learning from experience in Brazil and Mauritius	13
Box 4-1. Third-party sustainability standards: new opportunities for marketing and value addition.....	18
Box 4-2. The business case for sustainable beef: an example from Brazil	20
Box 6-1. Getting to scale: Integrating smallholders into organic fruit value chains with EPOPA	30
Box 6-2. A triple-win: Certified tea for Unilever in Kericho, Kenya	32

Introduction

The ‘SAGCOT Greenprint’¹ outlines a number of Agriculture Green Growth (AGG) strategies that have the potential to transform smallholder and commercial agriculture in the Southern Agricultural Growth Corridor of Tanzania (SAGCOT). While some of the strategies will require investments in infrastructure, institutions and policies before they can be effectively scaled up, others are ripe for investment. These AGG opportunities were identified through an analysis of the priority clusters that included site visits, an extensive series of interviews with key leaders and a Green Growth Leaders Workshop to bring together leaders from three of the priority clusters identified in the Blueprint (Kilombero, Ihemi, and Mbarali). These leaders from private, public and civic sectors engaged in participatory dialogue and mapping exercises to identify key opportunities and locations where these opportunities could result in quick wins for communities and investors. This document presents six AGG Opportunity Analyses which assess some of the ‘best bet’ AGG strategies discussed by participants of the Green Growth Leaders Workshop.

These six Opportunity Analyses include a sub-set of the opportunities described in Chapter 4 of the Greenprint. The analyses include a detailed description of the practice or innovation; its benefits; and key opportunities, barriers, and strategies for scaling-up the innovation in the Southern Corridor. The document includes the following Opportunity Analyses: 1) Conservation Agriculture, 2) System of Rice Intensification, 3) Precision Agriculture, 4) Sustainable Intensification of Beef Production, 5) An Enterprise Approach to Community Forestry, and 6) Differentiated Markets for Sustainable Agriculture.

1 Milder, J. C., Buck, L. E., Hart, A. K., Scherr, S. J., and Shames, S. A. 2013. A framework for Agriculture Green Growth: Greenprint for the Southern Agricultural Growth Corridor of Tanzania (SAGCOT). Dar es Salaam: SAGCOT Centre.

Opportunity Analysis 1

Conservation Agriculture

What is conservation agriculture?

Conservation agriculture (CA) is a farming approach that manages soils, cropping cycles, crop residues, and other natural resources to increase yields, improve soil health, and reduce environmental impact. The system includes three core practices: 1) minimizing tillage and other soil disturbance, 2) maintaining permanent soil cover, and 3) diversifying crop rotations. CA can be used for a wide variety of the crops grown in the corridor including maize, sunflower, beans, peas, sorghum, and vegetables. It can be readily adapted to both small- and large-scale farms.

The three core CA practices can be adapted and combined with other practices, depending on the local context. For instance, in dry areas, planting basins can be used to increase moisture availability to crops and concentrate fertilizer at the crop root. On large farms, specialized machinery such as tractor-driven direct-seeding planters are used, whereas simple hand- or animal-driven tools and machines are used by small-scale farmers. Although organic or inorganic fertilizers are usually needed to obtain maximum yields, CA is also an excellent strategy for increasing productivity when fertilizers are not available or affordable. Good quality seeds and appropriate seed spacing are critical in all cases.

In Tanzania, Zambia, and other African countries, farmers use the ‘evergreen agriculture’ system to combine CA with the planting of *Faidherbia albida* fertilizer trees. Interspersed with maize or other crops, these trees provide an abundant source of nitrogen, but do not compete for light because they drop their leaves in the rainy season. Pods of this tree are also an excellent dietary supplement for livestock. Other leguminous species such as cowpea, pigeon pea, and *Gliricidia* may also be used as intercrops to supply nitrogen fertilizer.

As seen by these examples, CA must be locally adapted to each farm or community; it is not a simple recipe or technology package. For this reason, extension, farmer training, and farmer experimentation are critical. Equipped with basic knowledge about CA principles and access to technical support, farmers across Africa have shown great capacity to apply and adapt CA to a wide range of contexts.

Current and prior experience with conservation agriculture

CA has been demonstrated as a win-win-win solution for yield, profitability, and environmental conservation. For this reason, farmers have adopted CA across more than 110 million hectares worldwide, while many government and donor programmes have supported CA in Africa.

Potential benefits

CA has several important benefits that are widely observed:

- Yields generally increase relative to conventional farming techniques. For instance, across a wide range of settings, yield increases for maize have typically been 20-120 per cent, and often higher.
- Income increases as higher yields are often combined with lower input costs.
- Soil erosion decreases while rainfall infiltration increases. Moisture conservation reduces farmers’ susceptibility to drought and reduces the risk of crop failure.
- Overall, labour requirements decrease and are spread more evenly throughout the year.
- CA systems generally use less water per unit of crop produced than conventional agriculture.

Although CA is broadly beneficial to farmers, it is important to note that sometimes CA does not generate net benefits in its first year, or even its first few years. Farmers may initially face higher labour demands, greater weed problems, or the need to buy new machinery. To overcome this hurdle may require access to loans, establishment of long-term demonstration sites or model farms, long-term extension, or some combination of these.

Current uptake in SAGCOT and beyond

CA first came to the corridor in the 1990s. In the Southern Highlands, particularly drought affected areas in Mbeya and Njombe, CA has begun to take hold through long-term extension and farmer field schools. Smallholders in these districts have seen their maize and sunflower yields more than double on average, with less labour, leaving time to cultivate more land or save money by not having to hire help during the planting season. The Alliance for a Green Revolution in Africa is beginning to promote CA for maize/legume intercropping in Mbeya and Sumbawanga districts. However, despite the efforts of various projects and initiatives to promote CA in southern Tanzania, the approach is still not very widely used.

Potential and barriers for scaling-up in SAGCOT

Because CA is so adaptable to a wide range of contexts, it holds great potential throughout the corridor. However, several areas should be considered as particular priorities for CA investment to increase yield and food security while reducing risk. In the smallholder sector, these areas include:

1. Agricultural zones where maize is the dominant or preferred crop and rainfall is insufficient to ensure a consistently good crop.
2. Agricultural zones subject to significant soil degradation.
3. Agricultural zones where the unavailability or sensitivity of nearby land compels farmers to intensify production on existing plots, but with little access to fertilizer or irrigation.

For large-scale agriculture, CA may be promoted widely for new and existing farms growing maize, sunflower, and various types of beans and legumes.

If widely adopted in the SAGCOT region, CA could have very significant benefits for agricultural output, profitability, and environmental quality. Table C1-1 estimates the impacts of CA if applied to maize-growing areas in Mbeya Rural district. These yield estimates are conservative because they are based on the experience of farmers in Mbeya using little nitrogen fertilizer. With access to fertilizer, yields and water-use efficiency could both increase significantly.

Despite the significant potential benefits of CA, several barriers have impeded widespread adoption in southern Tanzania. For small-scale farmers, the greatest impediment is lack of information and technical assistance to design context-appropriate CA farming systems. Most parts of SAGCOT lack the dense network of government, private, or non-governmental (NGO) extension services that is needed to introduce and demonstrate new practices; set up demonstration plots, farmer field schools, or other outreach methods; and help farmers experiment and problem-solve as they introduce the new practices on their own land.

Limited access to inputs is another important constraint. To perform well, CA requires quality seeds, including seeds for rotation crops or cover crops that may not currently be widely available. Herbicides and fertilizers may also assist with the initial establishment of the farming system, and support ongoing productivity. Finally, CA requires new tools such as direct-seeding planters or rippers. Agro-dealers must be trained or assisted to source and sell such tools, or, alternatively, local artisans may be trained to create suitable locally-built tools.

Table 1-1. Potential benefits of CA adoption on maize farms in Mbeya Rural district.

Outcome	Current condition	With CA	Net change
Area under maize cultivation (ha) (a)	53,000	53,000	0
Yield (tons/ha) (b)	1.5	2.6	+1.1
Yield (tons)	79,000	137,800	+58,800
Crop value (USD) (c)	18,328,000	31,969,600	+13,641,600
Crop water efficiency (litres use per ton maize) (d)	3,200,000	1,800,000	-1,400,000
Total water use (litres)	253 billion	248 billion	-5 billion
Soil carbon storage (tons) (e)	baseline condition	additional ~500,000 to 1,000,000	+500,000 to 1,000,000

(a) Ministry of Agriculture statistics

(b) Current yield: Ministry of Agriculture statistics. CA yield: averages from the Mbeya case study from 'Conservation agriculture as practiced in Tanzania: three case studies'

(c) Based on 2008 maize price in Mbeya of \$232/ton

(d) Mean estimates from 'Conservation farming strategies in East and Southern Africa: yields and rain water productivity from on-farm action research' (J. Rockstrom et al. 2009)

(e) Based on literature review in 'Performance and potential of conservation agriculture for climate change adaptation and mitigation in sub-Saharan Africa' (Milder et al. 2011)

Large-scale farmers are less likely to face severe constraints related to knowledge and inputs, but more likely to face constraints related to the availability of suitable machinery, such as direct-seeding tractor attachments. Such equipment will likely need to be imported. In addition, if large-scale farmers are not facing severe erosion problems, and if labour is abundant and inexpensive, they may have insufficient incentive to switch from conventional tillage-based systems. However, CA can provide a variety of public benefits such as improved water-use efficiency, reduced erosion, and reduced water pollution. Policies can be designed to encourage farmers to consider such factors in their choice of farming system.

What would it take to scale-up effective adoption of this AGG innovation?

As the experience from Zambia, Kazakhstan, Brazil, and other countries demonstrates, there are several different approaches to promote CA. All of them, however, involve working directly with farmers to share knowledge, demonstrate productive and profitable practices, and make available the necessary inputs and tools.

In SAGCOT, the most important and cost-effective strategy for scaling-up CA is likely to be the establishment of CA-oriented extension services. Many good models for participatory extension for CA already exist, such as those used by CARE in Morogoro region. Extension services may be provided by a combination of government, private, and NGO extension workers. As was done in Zambia, the government could establish a network of CA training centres throughout the corridor where extension workers, agriculture officers, and agro-dealers would be trained in CA practices and made familiar with the input, financing, and technical assistance resources available to farmers. This 'knowledge resource' could be complemented by supportive government policies to encourage CA adoption. Finally, existing programmes to work with agro-dealers on input supply chains (e.g., programmes supported by AGRA) could be adapted to ensure that agro-dealers carry the seeds, herbicides, and equipment needed to implement CA in an optimal fashion.

Box 1-1. Getting to scale: Lessons from CA initiatives in Zambia and Kazakhstan

Several countries around the world have successfully scaled-up the use of CA through combinations of farmer innovation, support, and policy. Tanzania can learn from these successful examples as it seeks to promote CA in the corridor. Two contrasting experiences—from Zambia and Kazakhstan—illustrate different approaches that Tanzania could follow to scaling up CA adoption. The Zambian case focuses on CA adoption for small-scale farmers, while the Kazakhstan example focuses on adoption by large-scale, mechanized farmers.

In Zambia, the government first turned to CA in the mid-1990s after years of prolonged food insecurity among small-scale farmers, even in years of good rainfall. The government established the Conservation Farming Unit (CFU) in 1995 and, in 1999, formally endorsed CA as government policy and as a focus of the national extension programme. With support from the World Bank and others, the government trained 620 field extension workers in CA techniques; set up a network of demonstration farms and learning plots; and established simplified CA implementation protocols for each agroecological region. Simultaneously, multiple sources of government, donor, and NGO support to the smallholder agriculture sector—including input packages, input subsidies, and food-for-work programmes—were aligned to encourage the adoption of CA. As a result of these programmes and the dedicated extension and outreach work by the CFU and its partners, uptake of CA spread from 20,000 small-scale farmers in 2001 to an estimated 250,000 (30 per cent of all Zambian smallholders) in 2011.¹

In Kazakhstan, wheat farming areas were in decline in the 1990s after the collapse of the Soviet Union. Low levels of rainfall, strong wind, and poor soil management led to serious erosion and soil degradation, combined with falling yields. In this context, the Food and Agriculture Organisation (FAO) worked with ministries of agriculture in Kazakhstan and nearby parts of Mongolia to establish nine CA demonstration plots of 100 ha each. The system included no-tillage, mechanized direct seeding, retention of crop residues, chemical weed control, and crop rotations where possible. The demonstrations showed significant yield increases, along with reductions in fuel and labour costs. CA also provided more reliable yields during drought years. Economic returns to farmers were negative in the first year due to the need for up-front investment, but turned positive by the second year, and yielded an overall internal rate of return (IRR) of 28 per cent.

On the strength of these trials, the Government of Kazakhstan established a package of supportive pro-CA policies. Critical to this effort was political commitment from the highest levels, which filtered down to ministry and sub-national actions. For instance, the CA approach was promoted within public and private extension services, and the government provided initial subsidies for herbicides and no-till seeding equipment to overcome the first-year investment hurdle. The government also waived protectionist policies in the agricultural machinery sector to permit the importation of no-till seeding equipment. These policies unleashed rapid innovation and uptake by the private sector. In 2004, CA was practiced on less than 1,000 hectares in Kazakhstan. By 2011, CA had spread to 1.6 million hectares, while conservation tillage is now used on an additional 10 million hectares in northern Kazakhstan.²

1 For further information, please see ‘Conservation agriculture in Zambia: a case study of Southern Province,’ by F. Baudron et al. (FAO, CIRAD, ICRAF, and ACT, 2007).

2 ‘Conservation agriculture in northern Kazakhstan and Mongolia,’ by S. Hickmann. (FAO, 2006). ‘Adoption of conservation agriculture and the role of policy and institutional support,’ by T. Friedrich, A. Kassam, and F. Thaler (FAO, 2009).

Since the yield gap between current and potential crop production is generally much greater for small-scale farmers than for large-scale farmers in the corridor, public-sector support for CA is likely to be most cost-effective if oriented toward small-scale farmers. However, there is also great potential for large-scale farmers to use CA to increase yield and profitability while reducing environmental impacts. The SAGCOT Centre or appropriate personnel in the Ministry of Agriculture could work with prospective large-scale investors to identify and help overcome specific constraints to CA. In addition, as mentioned above, agricultural policy related to input subsidies, water, and other factors can shift the incentives for large-scale farmers to encourage the adoption of CA.

Resources

Ample resources on CA are available on the internet. A few of particular relevance to SAGCOT include:

- Conservation agriculture case studies for Tanzania and Zambia: http://www.fao.org/ag/ca/doc/Tanzania_casestudy.pdf; www.fao.org/ag/ca/doc/Zambia_casestudy.pdf



Opportunity Analysis 2

System of Rice Intensification (SRI)

What is the System of Rice Intensification?

Originally developed in Madagascar in the 1980s, SRI is an agroecological methodology for increasing the productivity of irrigated rice by changing the management of plants, soil, water and nutrients. Its methods have been adapted also to upland rice production in several countries, and now also to other crops, called System of Crop Intensification (SCI) in India and 'planting with spacing' in Ethiopia; improving productivity also for wheat, finger millet, sugarcane, and teff, for example.

SRI practices, based on sound agronomic principles, seek to create optimal growing environments for crops above and especially below ground. Compared to conventional cultivation, SRI methods reduce the applications of water (no flooding for irrigated rice), the number of seeds that are planted per unit area or seed rates (reduced plant populations), and use of chemical fertilizers and pesticides (relying more or even completely on organic inputs). The resulting crops give higher yields, more net income, and greater labour productivity. SRI does require more knowledge and skill, and initially more labour. Because SRI enables farmers to reduce their inputs and lower costs of production, household incomes can increase by more than the increase in yield.

SRI practices, suitably adapted to local conditions, raise the productivity of land, labour and water by improving soil structure and functioning, facilitating root growth, and promoting the biodiversity and activity of beneficial soil organisms. Six main practices are usually recommended for SRI:

1. Transplanting young seedlings (8-12 days old), moved quickly and carefully from the nursery into the field,
2. Spacing plants in a square grid pattern, usually 25 cm apart,
3. Planting only 1 seedling or sometimes 2 seedlings per hill, with roots placed carefully just under the soil surface,
4. Applying water to the field intermittently, with no continuous flooding,
5. Weeding several times, starting at 10-12 days after transplanting, preferably with a mechanical weeder which aerates the soil, and
6. Providing organic matter to the soil, as much as possible, complemented with targeted chemical fertilizer if needed.

Current and prior experience with SRI

Reports of SRI's success in raising resource productivity have come in from almost 50 countries around the world (see <http://sri.ciifad.cornell.edu>) and this simple set of practices is becoming increasingly recognized as an important component of climate-smart agriculture in rice systems. We are interested to hear what opportunities you see for taking advantage of SRI methods and where SRI could be practiced within the SAGCOT.

Potential benefits

SRI has several benefits that are widely seen in addition to improving yields and household incomes:

- Because irrigated rice is grown with a minimum of water or alternate wetting and drying, there is usually considerable savings of water, 30-50 per cent, and much greater crop per drop. This is increasingly important in water-constrained areas.
- Crops grown with SRI methods are generally more drought-resistant and able to resist storm damage because of better root systems and more robust canopies.

- They are also more resistant to pests and diseases, making application of agrochemicals less necessary and less profitable.
- SRI paddy (unmilled) rice usually gives 10-15 per cent higher outturn of polished (milled) rice because of fewer unfilled grains (less chaff) and more whole grains (less breakage), which further adds to food supply and rice profitability.
- Soil quality and fertility are enhanced by the amendments of organic matter and by plant root exudation. When combined with conservation agriculture (CA), e.g., on permanent raised beds, there is further improvement of fertility, reduction of erosion, and utilization of rainfall.
- While more labour time is required initially, as the new methods are learned, farmers in most Asian countries have found SRI cultivation to be labour saving, and usually women's labour burdens are reduced.

SRI is not necessarily an organic methodology, as chemical fertilizer can be used with the other methods. Where the soil is not very fertile, this may be advisable. But factorial trials have shown that very high yields can be obtained with organic SRI production, and the cost savings for farmers can make this more profitable. The management practices usually build up soil fertility over time, so that higher yields can be obtained with further reductions in the number of plants per m².

Many of the SRI practices are counter-intuitive, but experience is showing that higher yields can be obtained with fewer inputs of seed, water, labour and cash. Initially SRI was discounted as too good to be true, and African farmers were often averse to intensified management, which required more attention and time. But expansion of SRI use in Mali, Kenya and Burundi, starting from knowledge gained from Madagascar, has shown the potential of SRI in the continent.

- In Vietnam, where less than 10,000 farmers were using the methods in 2007 when the Ministry of Agriculture and Rural Development officially endorsed SRI, based on its own evaluations, the number grew to over 1 million farmers in four years' time.
- In China, SRI use in Sichuan province has spread from 1,133 ha in 2004 to over 300,000 ha in 2010. The extra 1.66 million tons of paddy rice produced by SRI farmers, and attributed to the new methods by the Provincial Department of Agriculture, were valued at over USD 300 million.

Unlike many innovations moving to more agroecological management which may not give immediate or short-term benefits, SRI usually is more profitable from the first year. As confidence and skill in the methods builds up, yields rise further while costs of production, including labour input, decrease. This is observed for most other crops improved with these ideas, such as wheat, finger millet and teff.

- In Tigray province of Ethiopia, where finger millet yields are normally about 2.8 tons/ha, the Institute for Sustainable Development (ISD) in Addis Ababa reports with SCI practices called 'planting with spacing,' yield has reached 7.6 tons, with as many as 39 panicles (heads) on a single plant.
- Yields of teff, the nationally preferred cereal grain in Ethiopia, which are usually about 1 ton/hectare, have increased to 4.8 to 6.0 tons with modified crop management. Transplanting young seedlings and other SRI practices adapted to teff produce plants that have many times more tillers and larger panicles. STI is now being promoted by the Ethiopian Government's Agency for Transformation of Agriculture.

Current uptake in SAGCOT and beyond

In 2009, Kilombero Plantations Ltd. (KPL) piloted a programme for smallholders providing training and tools for growing rice with SRI methods. In the first year, with the help of extension services from an expert from the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), fifteen demonstration plots were established on neighbouring farms.

In 2010, with improved seed from KPL, each of the fifteen farmers in the pilot group planted 0.25 acres with the SRI methodology on their small 2.5 acre farms. Yields from the first trial were double the local average of 2.9 tons/ha, between 4.7-7 tons/ha.

In 2011, the programme expanded to include 250 new farming families who were given improved seeds and special tools for implementing SRI, along with training workshops in SRI practices. Again, yields were more than doubled, increasing production from 2-3 tons/ha to 5-8 tons/ha. Two of the fifteen pilot group farmers who expanded SRI cultivation on their farms had average yields of 6.2-6.9 tons/ha. This year 1,350 new farmers will be trained, on track with KPL's goal to train 4,000 smallholder farmers in SRI in four years.

Potential and barriers for scaling-up in SAGCOT

Since SRI practices are usually different than traditional rice cultivation methods, investment in adequate extension is needed from the government and NGO extension programmes. Also, while SRI has been successful in rain-fed agriculture systems, SRI with irrigation can improve the regional average of about 2 tons/ha to 10 tons/ha. Access to appropriately designed and built, but simple, mechanical hand weeders will enhance yield and economize on labour time. Motorized mechanical weeders are being developed in India, Malaysia and Philippines, so importing some of these on a trial basis, and possibly starting local artisan manufacture of these implements, could increase the attractiveness of SRI and accelerate adoption.

Box 2-1. Getting to scale: Lessons from SRI initiatives in Bihar State, India

Bihar is one of the most impoverished states in the country. SRI was introduced here in 2007 by an NGO (PRADAN), with 128 farmers. By 2010, the number had expanded to 19,911, with the state-supported Bihar Rural Livelihood Promotion Society (BRLPS) using World Bank (IDA) funding to enable PRADAN and several other selected NGOs to train and supervise community-based NGOs and farmer organisations to spread SRI knowledge further. 2010 was a drought year, but average SRI yields, 3.22 tons/ha, were double those that the same farmers got with their usual crop management methods on the same farms, 1.66 tons/ha. The normal average paddy yield in the state is 2.3 tons/ha.

The NGOs trained government extension staff as well so that the Department of Agriculture became a source of farmer support for SRI. In 2011, the government's goal was 10 per cent of the state's total paddy area, and in 2012, this target was raised to 40 per cent, 1.4 million ha.

In the kharif season 2011, one first-time SRI farmer reached a yield of 22.4 tons/ha, measured by DOA personnel with hundreds of observers and accepted as a new world record by the Indian Council for Agricultural Research. Four other farmers in the same village reached 19 or 20 tons/ha. These farmers, who planted hybrid varieties, relied primarily on organic fertilization (green manure, vermicompost, and P-solubilizing bacteria), supplemented with just 40 kg of nitrogen. With conventional crop management, these hybrids on the same farms produced only about one-third as much as with SRI cultivation methods.

In Bihar, the uptake of new management methods for growing wheat in the winter season has spread even more rapidly. In 2008-09, 415 farmers, mostly women, tried out SWI under PRADAN guidance. In the next two seasons, the number expanded to 25,235 and then 48,521 farmers, with BRLPS supporting the work of NGOs which in turn worked with both community organisations and state extension personnel. The spread was fueled by good results, as with SRI; In 2009-10, average wheat yields were 4.5 tons/ha with SWI management compared with 1.6 tons/ha using farmers' usual methods. SRI methods have been adapted to other crops in Bihar: mustard, legumes, tomatoes, chilies, even eggplant.

What would it take to scale-up effective adoption of this innovation?

Investment from the private, civic and public sectors will be needed to facilitate the adoption of SRI in SAGCOT. Already KPL has invested in irrigation and capacity development for the Magneta farm; similar investments in small-scale irrigation for smallholders could dramatically boost regional productivity for rice. Other investments in financial products for smallholders, like credit and loans, would help farmers to access the capital needed to purchase farm implements and improved varieties for SRI. Investment is needed in cost-effective farmer-to-farmer extension, facilitated by NGOs as well as public-supported extension services. Investment is needed also in small businesses to build and sell simple and inexpensive implements. Opportunities for extension, irrigation and financial products are each complex themes that require further consideration, so each of these topics will be addressed in turn by future agriculture green growth opportunity analyses.

Other measures that would contribute to the scaling up of SRI and SCI practices involve developing markets for local rice varieties that can be very popular with consumers, in Tanzania and abroad. It would be worthwhile and cost-effective to test which local varieties respond best to SRI management and can command the highest market price to boost farmers' profitability.



Resources

Ample resources on SRI are available on the internet. A few of particular relevance to SAGCOT include:

- Africare, Oxfam America, WWF-ICRISAT Project. 2010. More rice for people, more water for the planet. WWF-ICRISAT Project, Hyderabad, India. <http://www.oxfamamerica.org/files/more-rice-for-people-more-water-for-the-planet-sri.pdf>
- Goud, V. V. 2010. SRI in Tanzania. System of Rice Intensification WWF Newsletter 2(1), January-March 2010. <http://www.scribd.com/doc/41901944/System-of-Rice-Intensification-WWF-Newsletter-Vol-II-Issue-1-Jan-March-2010>
- SRI - Achieving More with Less: A New Way of Rice Cultivation. A multimedia toolkit produced by the World Bank Institute. <http://sri.ciifad.cornell.edu/extmats/engmanual.pdf> Also see, toolkit with videos: <http://vle.worldbank.org/moodle/course/view.php?id=336>.
- How to Help Rice Plants to Grow Better and Produce More: Teach Yourself and Others. System of Rice Intensification website. <http://sri.ciifad.cornell.edu/extmats/engmanual.pdf>
- Flooded Cellars video on YouTube depicting the spread of SRI from Madagascar to Rwanda to Burundi http://www.youtube.com/watch?v=AbU7_i9vW_w

Opportunity Analysis 3

Precision agriculture

What is precision agriculture?

Precision Agriculture (PA), also named Precision Farming, is a farm management approach that uses technologies such as sensors, enhanced machinery, and enhanced information systems to improve plant health and productivity, increase input use efficiency, increase profit, and reduce environmental impact. The core underlying principle of PA is to monitor and manage variability within crop fields or animal herds in order to apply the optimal quantity of inputs such as water or fertilizer at the optimal locations and times. In this way, farmers can achieve comparable or greater yields with fewer inputs, thus improving production efficiency and the sustainability of agriculture. PA has the potential to be a core Agriculture Green Growth (AGG) strategy for SAGCOT due to its strong win-win potential for enhancing productivity, profitability, and environmental quality.

As it has been adopted on large commercial farms, PA emphasizes information technologies and modern precision machinery. Key practices include:

- Laser levelling of fields during land preparation, which also eliminates irrigation water runoff;
- Spatial yield monitors that assess variability in crop yields throughout a farm;
- Sub-field assessment of conditions, and adjustment of inputs, to optimize moisture and nutrients for plant growth without encouraging weed growth or waste;
- Global Positioning Systems (GPS) guided equipment and other systems to apply inputs according to sub-field assessments, including computerized drip irrigation systems that deliver water according to plant locations and existing soil moisture conditions; and
- Real-time adaptive management based on environmental conditions (e.g., weather, pest populations).

The principles of PA may also be applied to small-scale farms through low-technology adaptations, such as fertilizer and manure micro-dosing, manual drip irrigation systems, and systematic crop monitoring.

Precision agriculture outcomes and benefits

Key benefits of PA stem from increased input use efficiency. For farmers, a primary benefit is improved efficiency, reduced waste, and increased profit. However, the environment also benefits through reduced water use, reduced agrochemical pollution and nutrient leaching, and fewer greenhouse gas emissions. Evidence of these benefits has been widely documented through research.¹ Additional environmental benefits may include reduced erosion and improved soil structure.

Research on outcomes of PA on Brazilian sugarcane farms are relevant to the Southern Corridor, where sugarcane expansion is being targeted. Several studies have found that the use of PA on these sugar farms has been a key factor in enabling Brazilian sugarcane ethanol to be produced less expensively than ethanol derived from other feedstocks, such as corn or sugar beet in the United States and Europe. In Brazil's San Paulo state, research found that companies adopting PA were more efficient, had lower costs, higher yields, better sugarcane quality, and fewer environmental impacts than non-adopters. All of the sugar farmers that had adopted PA planned to maintain or expand its use due to these favourable results.

¹ Studies reviewed in Milder et al. 2012, 'Moving beyond ideology to close yield gaps and 'nature gaps' in 21st century agriculture: An assessment of the multi-functionality of agroecological intensification.'

Current and prior experience with precision agriculture

Precision agriculture has been widely adopted in areas such as the United States, Europe and Australia, while also being applied in the commercial sector in Brazil, and through research programmes and limited commercial investments in Africa, Asia and Latin America. In the United States, for instance, precision yield monitoring is applied on about 40 per cent of all wheat, corn, and soy crops, while other technologies such as GPS and variable-rate input application technology are used on 35 per cent of the soy crop and up to 15 per cent of other grain.

In Brazil, an estimated 50 million hectares of annual crops, 9 million hectares of sugarcane, 1 million hectares of citrus, and 2.5 million hectares of coffee, among others, use at least one PA practice. The practices most commonly used have been grid soil sampling (annual crops, sugarcane), variable rate lime and fertilizer applications (annual crops, sugarcane), auto steering tractors and harvesters (annual crops, sugarcane), yield maps (grain crops), variable rate insecticides and herbicides, optical sensors for nitrogen management (small grains, corn, sugarcane), and the use of aerial and satellite imagery for farm monitoring.

Uptake of PA in Africa has been more limited, but there are some examples in the commercial sector. For instance, the company Agricultura Cientifica S.A. is currently developing large scale mechanized direct seeded rice projects utilizing GPS precision surveys, design, supervision and cultivation of rice fields in East, West, and Southern Africa. By their own reporting, these strategies have accounted for a 20 per cent overall increase in yield in some cases.² In Sudan, Golder Associated Africa has introduced the first auto steer tractor, which has been successful at reducing the average planting time by 60 per cent compared with previous seasons, resulting in lower requirements for tractor power and fuel.

While PA has mainly been adopted in the commercial sector by large-scale farmers, precision principles and practices are already applied in smallholder systems, including in the Southern Corridor, through such practices as drip irrigation. However, drip irrigation is found only in isolated instances, likely due to a lack of farmer demand given that increased irrigation efficiency is a low priority for many individual farmers, though it is a critical issue in terms of its aggregate benefits and impacts.

Potential and barriers for scaling-up in SAGCOT

PA has high potential to be a core AGG approach in the Southern Corridor, particularly on large-scale farms that have or are planning to invest in modern machinery. Priority crops to target for PA adoption include sugarcane, soy, wheat, and tea. For the latter, implementation costs are generally low since tea is already grown in structured

Box 3-1. Precision agriculture in sugarcane: learning from experience in Brazil and Mauritius

Research from numerous countries has demonstrated that sugarcane is ideally suited to the adoption of PA due to its tendency to be grown in large, well-capitalized operations, as well as the sensitivity of the crop to optimal agronomy and nutrient management. In Brazil and elsewhere, tractor automatic pilot technology has been successfully applied to reduce soil compaction, reduce operator fatigue and lower fuel costs, and increase speed, thereby improving productivity. Another benefit of the adoption of auto steering is an improvement in harvest operations, by allowing the harvester to cut the sugarcane rows more precisely based on crop mapping. Other PA practices such as yield monitoring have resulted in improved management of cane loading operations in Mauritius. These experiences suggest that the potential for PA in Tanzanian large-scale sugarcane operations is high. Ensuring open access to appropriate machinery and training for operators and technicians will be important in enabling adoption of these technologies.

² For more information, see <http://agrocheck.com>.

blocks and typically already has a structured yield recoding system. A specific GIS application package for integrated plantation management for tea was already under development in India in 2009.

In smallholder systems, farmers' detailed knowledge of their own fields is a great asset for supporting PA. Many farmers already use such knowledge and 'mental maps' to apply variable management strategies in different parts of their fields. However, some simple tools may aid farmers in more effectively monitoring farm variability and responding accordingly. For instance, leaf colour charts (LCC) and chlorophyll meters are simple, user-friendly tools for assessing crop nitrogen deficiencies so that they may be corrected before crop yields are seriously impacted. Initial reviews from farmers' cooperatives working with the LCC in Bangladesh, Philippines, Vietnam, India and Indonesia were positive. Another low cost PA technology for smallholder farmers—already in wide use in Bangladesh—is fertilizer deep placement through the use of fertilizer briquettes placed in the root zone, as an alternative to spraying or top-dressing nitrogen fertilizers. This practice has typically reduced fertilizer use by up to 40 per cent increased yields by 15%, and reduced water pollution from nitrogen runoff.

Water-use efficiency is a key goal of PA, and may be accomplished through drip irrigation, hand watering, planting basins, and automated technologies that dispense irrigation water based on current soil moisture and crop conditions. For instance, on a pilot precision irrigation trial on tea farms in Tanzania, soil moisture neutron probes were combined with low cost drip irrigation systems to optimize water management. The result was tea yields of 8500 kg/ha, or 17 times the yield achieved in rain-fed areas and double the yield in sprinkler-irrigated tea. Water consumption was reduced by 75 per cent relative to the sprinkler irrigation system. Similar technology is being applied in Kenya on such high-value crops as tomatoes, where yields have increased twenty-fold. This is just one example of the technology that could be used to update some of the outdated and inefficient irrigation systems currently operating in the Southern Corridor to increase yields while making better use of the region's limited water resources.

Some of the general challenges to adopting PA for large-scale commercial farming operators have been the maintenance of highly specialized equipment, training of local technicians, and effective integration of PA into current practices. Success is also dependent on the availability of knowledgeable equipment dealers and skilled professionals who can help adapt technologies to specific crops and local conditions. For Brazilian sugarcane farmers who chose not to adopt PA, the greatest barriers were the long period of time before seeing a return on investments, operational difficulties, lack of specialized professionals, lack of information about potential, and resistance to change within companies. Potential barriers for small-scale farmers in the Southern Corridor include lack of knowledge and training as well as access to PA tools.

What would it take to scale-up effective adoption of this innovation?

As with every region of the world, the Southern Corridor will need to adopt its own context-appropriate mix of PA strategies, both high-technology and low-technology. The Government of Tanzania, civic sector, and SAGCOT stakeholders can take several actions to promote beneficial uptake of PA:

1. Appropriate PA tools, technologies, and practices can be incorporated into an AGG extension programme for smallholders in the Corridor, as described in the SAGCOT Greenprint.
2. For large-scale farmers, a platform can be developed to share knowledge and advocate collectively for key policies or supports. A good example of such a platform is the South African Farmer's Forum on Local Development.³

³ The South African Farmers Forum on Local Development (FFLD) is an interactive dialogue platform for development and commercial agriculture aiming to promote agribusiness. The objectives of the forum are to support farmers with information on precision agriculture, access to markets, best farming practices, mechanization and efficient farm management

3. General awareness-raising about PA and its potential benefits can be achieved through multiple channels, including as part of the SAGCOT Investment Partnership Program and subsequently through agricultural extension and research institutions.
4. Recognizing the potential barrier of access to highly specialized equipment—and its efficient use—the SAGCOT Centre or other entities may facilitate the development of programmes to share equipment, remote-sensing based monitoring, or technicians to support farms in the efficient use and repair of equipment. This type of system may be established around the commercial farming hubs that are proposed in the Blueprint. Agro-dealers and consultants can also play an important role in providing such services.

Additionally, more research is needed to understand the specific technologies that could best deliver PA management and benefits for both large-scale and small-scale farmers in the Southern Corridor. Place-specific data on precision management practices and outcomes should be shared and analysed systematically so that localized management recommendations may be developed for farms who wish to increase yield and efficiency. The Afsis project is currently developing digital soil maps for all of Africa, which could later be utilized as a national GIS database to develop targeted recommendations for nutrient application rates for different crops in different portions of the Southern Corridor.⁴ Such web-based GIS systems that offer farmers free information via the Internet on soil properties, soil fertility and nutrient status and help to plan agricultural land use are already popular in government programmes in Korea, Taiwan and Japan. Other applications of such a national database

approaches, and to increase profitability; to promote shared resources among local farmers through business to business relations, among others. More information can be found on the website <http://www.farmersforum.co.za/>.

⁴ For more information see <http://www.africasoils.net>.



in Tanzania could utilize text messaging to provide information and answer services, including information on best practices, climate conditions and effects, and yield volume predictions. General farmer information kiosks and local knowledge centres offering weather and market information have already been scaled-up in Africa through a number of government and donor programmes, and could be expanded in the Southern Corridor to include science-based information services on farm and crop specific advice for use of PA approaches.

For small-scale farmers, on-farm adaptive research facilitated through participatory extension programmes, Farmer Field Schools, and other methods can help farmers adapt specific technologies to local soil, crop and environmental conditions.

Resources

Key resources on PA of relevance to SAGCOT:

- Precision Agriculture (<http://www.springer.com/life+sciences/agriculture/journal/11119>). Precision Agriculture is a peer-reviewed scientific journal. The full text of articles are available online.
- Precision Farming: A Comprehensive Approach, Virginia Cooperative Extension, Virginia Tech, and Virginia State University (<http://pubs.ext.vt.edu/442/442-500/442-500.html>). This resource provides a good overview of terminology and basics of precision farming in an easy-to-access format. It provides links to a number of extension fact sheets for specific technologies.

Opportunity Analysis 4

Sustainable intensification of beef production

What is sustainable intensification of beef production?

Sustainable intensification of livestock production involves management to increase meat or dairy output per unit area, while reducing overall impacts on the environment. As with sustainable crop intensification, the key principles of this approach include increasing input use efficiency; deliberately managing the agroecosystem to increase biological productivity, soil health, and nutrient cycling; and selecting appropriate genetic stock (livestock breeds). Specific practices include:

- Range management to increase fodder and biomass production;
- Optimization of stocking rates and grazing rotations for cattle weight gain and resource conservation;
- Adoption of locally appropriate high-yielding breeds;
- Modern reproduction and veterinary services;
- Modern slaughter and processing facilities, which, in the case of the Southern Corridor, can also function as hubs for processing cattle from nearby small-scale livestock keepers; and
- Protection of key natural features—including waterways and high conservation value habitats—from livestock grazing, erosion, and soil compaction. This is achieved through integrated ranch planning to identify and delineate areas for cattle pasture, ecosystem conservation and restoration, restricted and vulnerable areas and other land uses.

Currently, most livestock in Tanzania are kept in one of four farming systems: mixed farming, agro-pastoral, pastoral, and commercial. Here we focus on the commercial sector because of the ‘quick win’ opportunities to redevelop several government cattle ranches to improve productivity, profitability, and sustainability, while establishing local processing and service hubs that benefit nearby small-scale livestock producers. Nevertheless, sustainable intensification of livestock is equally important and achievable on small-scale farms.

One approach to sustainable cattle production that has proven successful in southern Africa is holistic grazing management. This system is based on the premise that cattle can be managed (through stocking rates and rotations) to mimic the behaviour of wild herbivores and thereby help regenerate native vegetation, increase range productivity, and reverse desertification. One of the most successful management practices in holistic grazing management has been the use of a mobile overnight kraal or cattle pen, in which livestock are kraaled on successive crop fields at night to break up the soil with their hooves and deposit nutrient rich dung and urine to fertilize the hoof-prepared soil. This practice facilitates the trampling down of old grass so the soil is covered, making it less prone to the drying effects of sun and wind. In this approach, burning is to be avoided because it exposes the soil to erosion. Holistic livestock management is a particularly relevant strategy for the 900,000 ha of land allocated for livestock development by villages through the Corridor, and could be adapted for systems of shared tenure and community grazing under established village management.

Potential benefits of this AGG opportunity

Investment potential in the livestock sector, including for meat, is high in Tanzania. Currently, the Southern Corridor has more than 2.5 million cattle, but 90 per cent of these are unimproved breeds that generally provide low yields and inferior meat quality. Despite its enormous land and water footprint, the livestock sector accounts for only one per cent of Tanzania’s exports, in part because little value addition is provided. Potential benefits of sustainable intensification include:

- **Increased Yield:** Results from a decade of implementation of holistic grazing management on the African Centre for Holistic Management Farm in Zimbabwe include a doubling of meat yields, a fourfold increase in forage yields, a 66 per cent increase in litter cover, a 12 per cent increase in perennial grasses, the restoration of degraded lands, and the renewed flow of the Dimbangombe River.
- **Improvements in Meat Quality:** Investments in abattoirs (slaughterhouses) and other modern processing equipment has the potential to increase production of higher quality meats for both domestic and export markets. Existing facilities cannot meet current demand, and potential investments exist for joint ventures with existing abattoirs, purchase of semi-finished abattoirs, and construction of new abattoirs and processing facilities.
- **Improved Marketability and Product Differentiation:** Green labelling, eco-certification and supply chain standards are generating increasing interest and have great potential for improving the marketing of sustainably produced beef and dairy products in the Southern Corridor (see Box C4-1). Use of certification standards may also create opportunities for new revenue streams from the underlying ecosystem services, such as carbon credits.
- **Increased Profitability:** All of the above factors may increase farm productivity.

Opportunities for SAGCOT

National Ranching Company (NARCO) ranches where land titles are clear but ranch management is sub-optimal are ripe with opportunities for investors to enter the landscape with a number of ‘quick win’ investments in sustainable livestock intensification. NARCO owns a total of about 519,000 hectares of land, including eight ranches comprising 230,000 hectares and an additional 289,000 hectares subdivided into 124 small ranches and subleased to Tanzanian investors. Together, the NARCO ranches have a carrying capacity of 80,000 to 90,000

Box 4-1. Third-party sustainability standards: new opportunities for marketing and value addition

Third-party sustainability standards differentiate sustainable products in the marketplace, thus allowing producers to gain advantages such as increased prices and improved market access (see Opportunity Analysis #6 for additional information). Rainforest Alliance and GreenChoice Alliance/ Biodiversity and Red Meat Initiative (BRI) are two initiatives that include third-party sustainability standards for meat production.

Rainforest Alliance Certified cattle production criteria apply to pasture-fed cattle in Latin America, Asia, Africa and Oceania. The criteria aim to meet multiple goals for economically viable beef production, biodiversity conservation, and worker wellbeing, and emphasize integrated management systems, animal welfare, sustainable pasture management, and the reduction of greenhouse gas emissions. The ‘critical criteria’ (which must be achieved in order to attain certification) for cattle farms consist of limitations on where cattle can be purchased, the requirements for animal identification and tracking, and specifications on the types of feed and medications that may be given to cattle. Examples of the types of production and management criteria for Rainforest Alliance Certified cattle farms include conservation of trees in pasture, forest reserves or as live fences, creation or management of protected areas for natural forest buffer and shelter and migration routes for wildlife, protection of waterways, and the management of cattle and wild species interactions.

GreenChoice is a multi-stakeholder project, supported by Conservation International and WWF-South Africa with multiple goals to improve sustainable production and conservation of biodiversity. The Biodiversity and Red Meat Initiative (BRI), part of the GreenChoice Alliance, is an independent association comprised of over 50 communal livestock farmers in the Kamiesberg, Northern Cape and covers more than 21,000 ha. Some of the land management practices and criteria that farmers have agreed to follow in ‘stewardship agreements’ as part of the BRI include land stewardship and soil and rangelands conservation, eradication of water-thirsty alien invasive plants, reduced use and improved handling of agrochemicals to reduce run-off, and conservation of riparian buffer zones to improve water quality and quantity.

cattle under extensive management conditions with potential for very large increases (in many cases nearly 100,000 additional head of cattle per ranch) if there was a shift to intensified management with feedlots. However, current stocking is only about 28,000 cattle and 2,700 small ruminants. Key areas for investment in sustainable intensification include:

- Increasing livestock population in each of the ranches in order to attain their maximum carrying capacities. This would entail purchase of quality breeder animals, purchase of immature animals for feedlotting, infrastructure development, pasture and water facility improvement, and optimal management of feed resources;
- Investment in livestock multiplication, an area where capacity is far below demand; and
- New domestic value addition activities, such as hide processing, to capture such revenue locally rather than exporting raw hides for processing elsewhere.

Four NARCO ranches are found in the Corridor, each with specific investment opportunities for sustainable intensification. These are summarized below.

Kongwa Ranch is located 80 km east of Dodoma Municipality along the Dar es Salaam-Dodoma Highway. The ranch has 38,000 hectares. Currently, the ranch has 8,063 cattle, with capacity to hold 14,000 head. However, with optimal livestock and range management along with a shift toward feedlot management, it is estimated that the ranch could support a far greater number of cattle. The ranch has basic infrastructure for livestock production, including ground water reservoirs, water reserve tanks, two cattle dips, and one mini-abattoir. The nucleus herd are all indigenous Boran cattle, which are bred strategically for herd improvement but have not been crossed with improved breeds for beef production. All cattle are pastured throughout the year. The ranch has the advantage of being connected to the National Power Grid, and the extensive area provides the opportunity to develop wind and solar power generation. Cattle fattening is also performed on the ranch with immature livestock sourced from many of the surrounding districts (Mpwapwa, Kongwa, Chamwino, Bahi, Manyoni, Kiteto, Kondoa and Simanjiro). The 'Kongwas Beef' brand represents the beef from this and other NARCO ranches. The ranch has several employees and access to the National Livestock Research Institute and the Veterinary Investigation Centre for extension support.

Ruvu Ranch, highlighted as one of the 15 'early win' investment sites by the Blueprint, is situated in Coast Region in Bagamoyo District. This 43,000 hectare ranch currently has 3,762 cattle with the capacity to hold up to 10,238 head of cattle under existing conditions. As with Kongwa Ranch, implementing feedlot management at Ruvu Ranch could increase the ranch's capacity significantly. Existing infrastructure to support cattle management includes dams, one cattle dip, a modern butchering facility and one mini-abattoir. The ranch has the advantage of being close to Dar es Salaam, a major international airport and a major port. Ruvu Ranch is also connected to the National Power Grid. The ranch's location along the main Dar es Salaam – Morogoro highway, as well as the central railroad allows for easy access to domestic and international markets and relatively low transportation costs. Immature cattle are sourced from Bagamoyo, Morogoro, Handeni and Korogwe Districts for fattening. An export-quality abattoir and meat processing facility are under construction currently. Veterinary and zoosanitary services are available in Kibaha Town and Dar es Salaam (Central Veterinary Laboratory and Kwala Zoosanitary Facility). The Blueprint projects a \$6.3 million investment for improving range management, infrastructure and herd quality at Ruvu would result in a profit increase of more than \$300 per head, as well as provide 2,700 new jobs, both on-site and in near-by meat processing facilities.

Mkata Ranch is located 58 km from Morogoro Town off Morogoro-Iringa Highway. There are currently 2,329 cattle on the ranch's 19,446 hectares of land, but it is estimated that the ranch has a capacity of 7,000 head of cattle under extensive management. Some infrastructure, such as a few dams, one water tank and 50 acres of

fenced land are already in place for cattle management. Although the ranch lacks some important infrastructure, it is situated near the Tanzania Pride Meat Abattoir in Mvomero District in Morogoro. The ranch has fairly developed infrastructures with dams, one water tank, and 50 acres of fencing. The ranch has the advantages of being connected to the National Power Grid, and located along the Dar es Salaam – Iringa highway and the central railroad. Mkata is also used for fattening cattle sourced from Kilosa, Mvomero, Morogoro Rural, Kongwa, Bagamoyo and Kiteto. Domestic markets include tourist hotels, power stations, Mtibwa and Kilombero Sugar Factories, as well as universities and supermarkets in Morogoro and metropolitan Dar es Salaam. Veterinary and livestock extension are available at Sokoine University of Agriculture in Morogoro. Mkata ranch has high potential for shifting to intensified feedlot production due to the close proximity of sugar processing facilities whose by-products could supplement concentrated feed.

Kalambo Ranch, in Rukwa Region, is located 45km South-west of Sumbawanga Municipality, close to the southern tip of Lake Tanganyika and the border with Zambia. The ranch currently holds 1,733 head of cattle with potential to expand extensive production up to 8,730 head of cattle. The ranch includes several dams and water troughs, one water tank and 2 cattle dips. It also has a number of permanent springs and rivers for watering cattle and maintaining pasture year-round. Sumbawanga Agricultural and Animal Feeds Industry (SAAFI) is the primary local processor with a modern abattoir. Beef is sold domestically in Mbeya, Rukwa and Katavi at mining facilities, hotels, factories and supermarkets. Primary opportunities for export are to the countries on Tanzania's Western border (Zambia, Malawi and the Democratic Republic of Congo). Transportation of beef to other regions is available by train along the central railroad, and eventually by air once the Mbalizi International Airport in Mbeya Region is completed. Like the other ranches in the Corridor, Kalambo Ranch sources immature cattle from neighbouring districts (Sumbawanga, Nkasi, Chunya, Mpanda and Mbozi) for fattening.

Box 4-2. The business case for sustainable beef: an example from Brazil

The Brazilian Sustainable Beef Working Group was founded in 2007 in an effort to improve the sector's profitability by addressing the serious challenges faced by the livestock sector in managing degraded lands and complying with recent social and environmental policies adopted by producers, industry and retailers. The Working Group includes a wide spectrum of representatives of industries and industry organisations, associations of farmers, retailers, banks, civil society organisations, research centres and universities. The steering committee includes civil society institutions such as WWF Brazil; Financial institutions include Rabobank Brazil and IFC; commerce and service groups including Dow AgroSciences and Walmart; and industry institutions such as Abiec, or the Brazilian Association of Meat Export Industries. The Working Group members established one central commitment to 'no-deforestation, with the creation of conditions and ways of compensation to make it viable.' This central commitment is achieved by monitoring deforestation, defining the social and environmental principles for production and trade, developing a traceability mechanism and disseminating best practices that will help recover degraded lands and reduce socio-environmental liabilities. Mutual commitment to the principles set by the Working Group protects the profitability of the beef sector by guaranteeing that the sector is able to meet domestic and international policy requirements for beef production as well as public policies regarding environmental degradation. The economic incentive task force works within this framework to develop mechanisms that provide incentives for sustainable livestock management, such as improved credit management for sustainable ranches, establishment of payments for environmental services schemes, and development of new public policies that allow long-term financing for sustainable cattle farming that is differentiated from conventional cattle farming finance. In order to be successful, actors along the entire value-chain must be committed to transparent and active participation in the establishment and implementation of the principles of sustainable cattle ranching.

Potential opportunities for improved meat slaughtering facilities

NARCO is also investing in livestock marketing infrastructure that will purchase cattle from small-scale livestock farmers. NARCO aims to contribute to the livestock sector through the establishment of modern meat slaughtering and handling facilities and infrastructure, including the establishment of a hygienic abattoir and integrated rendering facilities. These products will be geared towards export markets that will both improve quality and increase quantities while meeting international standards.

The Government, in collaboration with the private sector, is currently supporting the construction of new abattoirs with a processing capacity of 150 -200 animals per day. Yet this investment alone will be unable to meet the demand for processed meat in the domestic and international markets. The Ruvu Abattoir is one possible ‘quick win’ opportunity for joint ventures to meet the remaining market demand. Located about 70 km North-west of Dar es Salaam City along the Dar es Salaam – Morogoro highway, this abattoir is under NARCO’s management. Both the neighbouring Ruvu Ranch and Kwala Holding Ground could supply the abattoir. The establishment has an area of about 2,000 ha which could be renovated to support some feedlot production on site. At its current capacity, the facility can slaughter 400 cattle in each 8 hour work shift. The abattoir also has reliable water and electricity to support its operations. Livestock for the abattoir could be sourced from the following areas: Ruvu Ranch, Pugu Livestock Market, Bagamoyo, Morogoro, Dodoma, Handeni and Korogwe. The Ruvu Abattoir supplies beef and mutton to domestic markets, including mining centres, hotels, supermarkets and select markets in Dar es Salaam, as well as export markets in the Gulf states, and countries throughout East Africa.

Additional supporting activities

Since there are few examples of sustainable and efficient commercial beef production in the Corridor, investment in research and monitoring will be important to test and evaluate specific improved management practices in the Corridor, such as rotational grazing, holistic grazing management, silvopastoralism, and biogas digesters. Over time, this knowledge base can be used to support the dissemination of best practices and management options for livestock producers in different parts of the Corridor.

Knowledge sharing and industry collaboration for sustainable intensification of beef production may also help develop the opportunities for economic gains (See Box C4-2).



Opportunity Analysis 5

An enterprise approach to community forestry

What are community forest and agroforest enterprises?

Commercialization of tree products from farms and community managed forests can provide important sources of cash income for farming households and communities, and diversify economic development. By adding economic value to forest resources, forest and agroforest enterprises increase incentives for forest conservation and restoration, sustain the benefits from forests for local subsistence (foods, medicines, feed, raw materials, fuel, building materials), as well as for ecosystem services and biodiversity, and climate benefits. Forest enterprise development can be an important component of strategies for landscape restoration, forest protection (including REDD+) and agricultural intensification.

Already burgeoning commercial demand for forest products in the SAGCOT region will be accelerated by planned agricultural and infrastructure investments and income growth. This demand could either threaten the region's rich forest resources, or become a positive driver of economic growth and poverty reduction if farmer and community forest enterprises can be scaled up. Agricultural Green Growth in SAGCOT can enable coordinated investment in crops, livestock and forest resources, by promoting extension systems, credit, enterprise training, etc., that include the full range of land-based commercial enterprises in the Corridor.

Forest and tree crop industry companies and investors can partner with farmer and community forest organisations, as outgrowers, contract producers, joint investors, or other business arrangements, with support from other government and civil society actors.

Experience with community forest enterprises

The potential of community forest enterprises has been systematically promoted only in the past few decades; the previous focus was on large-scale private forest concessions and government management and sales from public forests. In fact, small and medium sized enterprises (SME) dominate the forest industry worldwide, accounting for 50 per cent of wood harvested in the European Union and United States, and 95 per cent of the forest industry in Brazil and India. As rights to own and manage forests have reverted increasingly to communities, and potentials for growing trees on farms have been recognized, CFE investments are growing rapidly (see Box 1).

Current activity in Tanzania

In Tanzania, apart from traditional commercial smallholder coffee and coconut, and some minor exports, most of the smallholder and community forestry enterprises are for local and informal national markets.

Participatory forest management (PFM) was introduced into Tanzanian law with the passing of the Forest Act in 2002. This act provides a clear legal basis for communities across Tanzania to own, manage or co-manage forests under a wide range of conditions. The law recognizes two types of PFM: (i) Community Based Forest Management (CBFM) which allows communities to declare and gazette village, group or private reserves; (ii) Joint Forest Management (JFM) that allows communities to enter into co-management agreements with government and other forest owners and share commercial benefits. By 2007, 719 communities were engaged in CBFM and 209 Forest Reserves were under Joint Forest Management arrangements covering a total of 1.61 million hectares. As communities have become aware of the true commercial value of timber on their lands there are positive signs that they have begun to defend their own forest resources (rather than collude with illegal extraction as in the past) (MacQueen 2010).

In the SULEDO Forests of Kiteto District, nine communities own and manage a 167,400 ha Village Land Forest Reserve through an apex body known as the Zonal Environmental Committee (ZEC). They have been among the first in Tanzania to develop a sustainable harvesting plan (with a 60-year rotation) for valuable timber species such as *Dalbergia melanoxylon* (MacQueen 2010). There are many market enterprises in the agroforestry systems around Kilimanjaro. In Shinyanga, farmers' earnings vary widely from products sold locally from community-managed forests. Households producing for HoneyCare (which also operates in Kenya, Uganda and the Sudan) earn \$1800-2500/year. The Novella Partnership backed by Unilever in Tanzania, Ghana and Nigeria, is actively promoting commercialization of indigenous *Allanblackia*, with support from IUCN-Tanzania (Buss, et al 2011).

Current activity in SAGCOT

A number of community forestry development projects are underway in the SAGCOT region. One of the most notable is TAGRODE, which is building the supply base of higher-value forest products and community capacity to establish and manage them, mainly in Iringa District, located within SAGCOT's Ihemi Cluster. Presently the organisation is focusing in three villages to promote planting of agroforestry trees on farms for soil fertility improvement and commercial harvesting. TAGRODE also enhances the capacity of community and village leaders to engage in participatory forest management. Beyond their afforestation activities, the organisation is beginning participatory programmes for protecting, monitoring and managing natural forest boundaries and water catchments. Already 225,000 trees of a variety of species have been planted on farms, while 1.5 million agroforestry trees have been raised in nurseries to supply farms and commercial forestry plantations. There has been an increase in the planting and survival of indigenous multipurpose trees, especially *Uapaca kirkiana* (Mkusu in Swahili) and *Vangueria infausta*.

Project activities in the ELCT Iringa Diocese were initiated in 2010 to reduce deforestation and improve the living standards of people surrounding the Diocese through planting trees for income generation and natural regeneration of existing forest. The communities are located in Kilolo, Iringa Rural, and Mufindi Districts. Project objectives are to plant one million trees within the Iringa Diocese by the year 2015, and to train and sensitize 50,000 people around Iringa Diocese on the importance of forest conservation. The annual budget is 12 million TZSH (USD 8,000), and local people help finance 20 per cent of the cost of the project through Iringa Diocese.

There is a close link with agriculture. The Kikombwe Sustainable Agricultural Project (KISADEP) and Mlolo Sustainable Integrated Project (MSIPRO), funded by Gorta-Ireland, promote conservation farming through agroforestry in Mlolo division. The practices of conservation farming with trees include disturbing the soil as little as possible, and keeping the soil covered with organic material to replenish soil nutrients. The farmers are trained on Integrated Pest Management (IPM) and the efficient use of inorganic fertilizers, as well as sustainable land use and forest management and community rights to manage their own forests as stipulated in the forest act of 2002. Working with WWF-Tanzania (and EnterpriseWorks), TAGRODE works with the Iringa District Council and the Kilombwe, Malagosi and Lyamugungwe villages, to enhance the skills and capacities of communities and village leaders.

In 2010-11 the community managed to distribute and plant 205,000 Pine (*Saligna*) seedlings and 25,000 Eucalyptus seedlings. Three schools in the area have planted over 2,500 trees in their compounds, while over 600 households planted over 10,000 trees. TAGRODE-supported activities have significantly enhanced the forest resource base and its commercial value: a halt to burning of the forest, and increased undergrowth that has checked soil erosion; Increase in the amount of natural dead wood that is collected for firewood; Increased natural grass and shrub cover that can be used to graze livestock; Increased availability of wild mushrooms, natural fruits and medicinal shrubs; Increased bee activity, that has led to youth establishing a bee-hive making business for apiary; Increased community awareness of a healthier environment due to forestry; and better social cohesion because the

community members meet frequently in various afforestation forums. Product demand is growing rapidly and more organized enterprise development is starting to take advantage of these resources.

Capacity building has included: decision making on village forest boundaries and planting of beacons for the boundaries; policy analysis and advocacy; training for Participatory Forest Assessment Team (PFAT), forestry data collection and analysis, management plans by village council and local authorities, monitoring and evaluation. Villages have been assisted to develop by-laws for management of the adjacent forest, to establish Village Forest Scouts (20 in each village) who protect the forest on a voluntary basis, primary school environmental committees, and development of Ward tree planting plan. The plan has a resolution that each household should plant at least 15 trees, each village council plants 100, and each school plants 100 trees.

Potential and barriers for scaling-up community forest enterprises in SAGCOT

Although the level of investment so far in the commercialization of community based forest and tree resources is modest, promising AGG investments are evident which if scaled up can help to increase product supply, increase farmer and community incomes, and benefit ecosystems, biodiversity and climate. Tree nursery establishment is relatively easy; the current cost of raising, distributing and planting 100,000 tree seedling is TSh 12 million. Providing advisory services for market development, entrepreneurship, business finance, negotiation and forest-agroforestry management can be linked to SAGCOT extension and business development investments. Table 1 illustrates the potential scale of supply and income impacts from accelerated development building on the existing



TAGRODE base in Ihemi Cluster. TAGRODE is interested to expand activities to other Phase 1 SAGCOT Clusters.

Barriers to scaling up

TAGRODE identified the following constraints to scaling: 1) inadequate community awareness of the importance of tree planting in relation to climate change, 2) lack of relevant knowledge on soil properties for informed decisions on the right trees for planting, 3) inadequate tree seedlings to distribute to as many people and institutions as might like them, 4) lack of security to protect the planted tree seedlings from grazing and trampling by cattle, 5) insufficient funds in villages for tree nursery establishment, 6) lack of sufficient fruit trees for distribution, and 7) poor quality seeds and other germplasm. In addition, farmers and community forest management groups have limited knowledge of income generation through forestry, so that social organisations need to become viable business entities, and develop competitive business capacity.

Farmers and communities would value collaboration with socially and environmentally responsible forest product companies to improve commercial quality and business management. Pilot investments can help to identify appropriate business arrangements and provide financing to cover critical costs. Guidelines have been developed for African economic contexts to facilitate profitable and equitable deals and partnerships (Buss, et al 2011). Successful outgrower models, already in place in parts of Africa, could include:

1. Wood-processing companies obtain their supplies through trading intermediaries who buy from growers;
2. Wood-processing companies lease land under contract for a specific period from landholders to grow the trees themselves;
3. Wood-processing companies enter into a contract with farmers to grow trees that are then sold to the companies;
4. Cropshare joint ventures in which contract agreements between landowners and a wood processing company (investor) specify the responsibilities of each partner and sharing of costs and benefits throughout the life of the tree crop; returns from the harvest are determined by the market price;
5. Guaranteed tree ventures in which a wood processor guarantees the sale of trees/wood for the tree grower based on a specified market price. In return, the grower offers the processing company partner the first option to purchase the trees/wood with provision that the grower may sell to another purchaser who offers a better price (Mayers and Vermeulen 2002).

Opportunity Analysis 5

Differentiated markets for sustainable agriculture

What are differentiated markets for sustainable agriculture?

Many farmers and food processors in the Southern Agricultural Growth Corridor of Tanzania (SAGCOT) adhere to high standards for food product quality, environmental management, and social benefit. But to be able to benefit financially from these practices, producers need a way to distinguish their superior products in the marketplace. Differentiated markets can help them do so by linking buyers who seek a steady supply of high-quality products with producers who are able to meet this demand by complying with specific production and processing standards.

Producers may differentiate their products by adhering to standards for food quality, environmental performance, and/or social performance, such as:

- Organic production standards
- Agricultural product standards imposed by importing countries for internationally traded goods (e.g., Good Agricultural Practices or GAP standards)
- Requirements of regional or national exporting bodies
- Private sector standards, such as sourcing guidelines of international food companies
- Third-party eco-standards, such as Fairtrade, Rainforest Alliance, or Forest Stewardship Council certification

Compliance with such standards can offer a significant business opportunity for SAGCOT producers by: 1) enabling them to receive price premiums for their products; 2) increasing access to foreign markets or niche markets; and 3) ensuring more stable or guaranteed demand for their products. But adherence to agricultural production and processing standards may also be costly and complicated. These barriers can be especially challenging for small-scale producers.

This Agriculture Green Growth (AGG) opportunity analysis evaluates existing differentiated agricultural value chains and institutions in the SAGCOT region. It then identifies changes that could allow SAGCOT farmers—especially smallholders—to participate more fully in differentiated markets to increase the productivity, profitability, and sustainability of agriculture in the corridor.

Potential benefits of this AGG opportunity

In addition to their marketing and price-premium benefits, agricultural standards may also help farmers adopt practices that are more sustainable, use inputs more efficiently, and are more resilient to drought and climate change. Across Africa, 93% of certified organic producers report improved soil fertility, water supply, flood control and on-farm biodiversity. Whereas many small-scale African farmers have historically managed their land organically by default (i.e., because they could not afford to purchase chemical inputs), the adoption of production standards can help increase yield and efficiency through more systematic management. For instance, strategic use of green manure, cover crops, integrated nutrient management, and application of locally available organic inputs can improve soil fertility, reduce erosion, and conserve soil moisture. Adoption of good agricultural practices (GAP) and good manufacturing practices (GMP) required for organic certification can significantly increase productivity.

For large-scale producers and associations of small-scale producers, participation in differentiated markets through certification often provides the opportunity to access shorter value-chains, resulting in a greater percentage of product revenues being received by producers themselves. Certification requirements may also require upgrading

the value chain infrastructure of processing and distribution. This requires up-front investment but returns dividends through higher quality and more valuable products.

Current experiences in SAGCOT and beyond

The global market for organic products has grown rapidly over the past several years, increasing from US\$18 billion in 2000 to US\$55 billion in 2009. Meanwhile, major agri-food companies are moving toward supply chain-wide adoption of sustainable sourcing standards. For instance, 30 per cent of Unilever's agricultural raw materials already adhere to a broad set of social and environmental sustainability standards, and this figure is planned to increase to 100 per cent by 2020. There has also been exponential growth in the adoption of third party sustainability standards, thereby shifting sustainably certified products from a small market niche to a mainstream force in international agribusiness. For instance, the volume of Rainforest Alliance certified tea has grown from a minimal amount in 2007 to more than 250,000 tons (6.6 per cent of the total world market) in 2011. These trends indicate that sustainability standards and differentiated markets should be a central part of any forward-looking strategy for SAGCOT.

In Tanzania, there are nearly 90,000 certified organic producers, managing about 62,000 hectares, or 0.2 per cent of the country's agricultural land. Organic production in Tanzania increased more than five-fold from 2001 to 2009. Yet, the sector remains relatively small compared to neighbouring countries such as Uganda, which has nearly 300,000 ha of certified organic agriculture. More than 90 per cent of Tanzania's certified organic products are exported, while the remaining portion are consumed primarily by expatriate, not Tanzanian, consumers. The largest organic value chains are for cocoa, cashews, vanilla, tea, and coffee (Table C6-1). Domestic organic value

Table 6-1. Tanzania organic agricultural product exports, 2009.

Product	Metric tons	Farm gate price (Euro/kg)	Total value (farm gate) (Euro)
Cocoa	3,822	0.95	3,630,900
Cashews	2,671	0.95	2,537,450
Coffee	590	1.00	590,000
Tea	500	2.10	1,050,000
Spices	400		
- Pepper	160	0.48	76,800
- Lemon grass	120	0.08	9,600
- Cardamom	60	0.80	53,400
- Cloves	50	2.10	105,000
- Cinnamon	10	1.47	14,700
Sesame	273	0.94	256,620
Pineapple	196	0.12	23,520
Cotton	151	0.47	70,970
Vanilla	74	20.00	1,480,000
Total			9,898,960

Source: TOAM and field data Kledal 2009.

chains are focused on fresh fruits and juice, vegetables, tea, and instant coffee. There are only two organic food processors in the country: Dubaga in Iringa and Chemi in Dar es Salaam. Packers and processors are reportedly requesting greater organic production from producers. Given global demand trends relative to existing sector development, there is significant potential for increased organic sector development throughout SAGCOT.

The SAGCOT region has more than 35,000 hectares of high-value horticulture, coffee, tea, cocoa, and other crops currently under organic production, engaging more than 41,000 farmers, mostly through outgrower schemes (Table C6-2). Other sustainability standards are also in use. In Kyela district, for instance, more than 20,000 cocoa farmers received Rainforest Alliance certification in 2011 to enable them to sell certified cocoa to Dagoba Organic Chocolate (a brand owned by The Hershey Company). As one of Rainforest Alliance's largest-ever group certifications, the scheme enabled small-scale farmers to benefit from more stable market access and prices, without the need to bear the high costs of individual certification. Unilever has also obtained Rainforest Alliance certification on portions of its 20,000 ha of tea estates in Mufindi district. For instance, on the 4,000 ha Lugoda estate, the major portion of the property is dedicated to forests, wetlands, and grassland, which conserve biodiversity, protect critical water supplies, and provide a woodfuel resource for the farm. The estate also works with local communities to conserve forests through tree planting, education, and an efficient cookstove project. Rainforest Alliance certification enables Unilever to benefit from these sustainability credentials by differentiating its product in the marketplace.

Certification institutions and capacity

In 2003, TanCert was established as a national certification body for organics. TanCert works closely with the Tanzania Organic Agriculture Movement (TOAM), which organizes producers, processors and exporters to facilitate organic sector development for domestic and international markets. A major milestone was the launch of the East African Organic Products Standard (EAOPS) in 2006, along with its own label in 2007. In 2008, TanCert received accreditation from the International Federation of Organic Agriculture Movements (IFOAM), which allowed locally certified products to be recognized as certified organic by importing countries. Establishment of regional standards and a national certification body have improved the credibility of Tanzania's organic sector in global markets while significantly reducing certification costs for producers.

Following the establishment of EAOPS, the Ministry of Agriculture, Food Security and Cooperatives is working alongside TOAM, exporters, and producers to implement the National Organic Agriculture Development Programme (NOADP). This programme aims to set clear policy goals for developing the organic sector through

Table 6-2. Organic production in the SAGCOT region, 2009.

District	No. of enterprises	Major products	Hectares	Outgrowers / farm members**
Morogoro	3	Fruit, spices, cocoa	1,362	1,198 / 25
Pwani	5			
Iringa	2	Pineapple, tea, cotton, sesame	9,600	3,300 /
Singida	1			
Mbeya	4	Cocoa, coffee, vegetables	24,655	36,979 / 63

Source: TOAM and field data Kledal 2009.

* Includes some enterprises that are not yet certified

** Farm members are part of a farm association or a cooperative

2015. With the initiation of a supportive national policy framework, combined with the organic sector's high rate of growth, the door is open for new investments in the organic agriculture sector.

Scaling-up differentiated agricultural markets for SAGCOT

Given the strong demand, there is potential for a significant portion of the 350,000 hectares of new agriculture planned for SAGCOT to be managed under profitable, sustainable production through certified or differentiated value chains. This section identifies the most promising opportunities for scaling-up certified agricultural production and differentiated markets for sustainable products. It also highlights several barriers that appear to be inhibiting the development of the certified market segment.

Promising opportunities

There are significant opportunities for increasing certified sustainable production in several sectors including fruit, horticulture, tea and coffee, floriculture, spices, and even basic grains. Many of these opportunities would align well with the cluster development model proposed for SAGCOT wherein investments are spatially coordinated to integrate production, processing, distribution, and knowledge/extension services in target areas, linking smallholder and commercial operators.

Fruit and horticulture for export: Of the six regions most suitable for horticultural production in Tanzania, three are in the corridor (Morogoro, Iringa, and Mbeya). Major vegetable crops in these regions include tomato, cabbage, onion and carrot. Even in cases where producers cannot meet organic production standards, other certifications for good agricultural practices (GAP) can give producers access to high-value European markets. Following such practices can increase both revenues and yields. For instance, in one case, GlobalGAP certified producers of baby corn, green beans, and peas increased yields 10-32 per cent, while increasing per-kg revenues by 10-24 per cent relative to un-certified producers. Because horticulture crops tend to yield high per-hectare gross revenues relative to staple grain crops, they may be a particularly efficient focus for new irrigation schemes. However, irrigation infrastructure for the horticulture sector in SAGCOT is currently minimal. Additional barriers to development of this sector include very limited processing and transport infrastructure.

Horticulture enterprises are well suited to smallholder participation through outgrower schemes, and also offer abundant employment opportunities. Smallholders may also be able to participate readily in certified fruit markets, provided that processing infrastructure is available nearby, as suggested by the following case.

Box 6-1. Getting to scale: Integrating smallholders into organic fruit value chains with EPOPA

The Dabaga Fruit and Vegetable Canning Company has been operating near Njombe, Iringa region since 1979, producing processed fruit and vegetable products from smallholder suppliers. The company started by processing tomatoes, one of the most profitable and abundant high-value crops in the Iringa region. In 2005, Dabaga joined the EPOPA (Export Promotion of Organic Products from Africa) project to begin offering organic pineapple products certified by HACCP and Naturland. First introduced to the Iringa region in 1976, pineapple is now raised by 50 per cent of all families in the region. Due to a lack of access to chemical fertilizers and pesticides, many smallholders were practicing organic pineapple production by default. Through EPOPA, farmers receive extension and training services in improved organic production techniques, which has increased yield to up to 10 tons per acre. Organic pineapple products sell at prices 260 per cent higher than non-certified pineapple. Following the project's inception, smallholder incomes increased and product quality improved. Also, now that Dabaga is a certified organic processor, the company can add new organic products with reduced upgrading costs.

Differentiated tea, coffee, and cocoa: As discussed above, certification of major export crops such as tea, coffee, and cocoa can help improve livelihoods for smallholder producers while providing incentives and technical assistance for support more sustainable, biodiversity-friendly production practices. Increased use of certification may be supported by investments by producers' associations (accessing various sources of small enterprise finance), development projects, and/or companies seeking to purchase certified products. The case example from Kericho, Kenya, describes the latter approach, and some of the benefits that have resulted for local people and the environment.

Smallholder staple crops: In developing countries, market differentiation of staple grains tends to be more difficult than for fruits, vegetables, and specialty products, but it is not impossible. Certified sustainable labels for domestic and regional markets have been established successfully in several developing countries. In Zambia, for instance, the 'Its Wild' label distinguishes food products grown according to organic, wildlife-friendly production standards—including whole ground nuts, peanut butter, honey, chama rice, dried beans, and maize meal. A similar approach could be applied in SAGCOT.

Smallholder spices: Although spices are not a major commodity group in the region, organic spice value chains may be easier for smallholders to access. The challenges of poor infrastructure affecting processing and transportation have less effect on this value chain, as farmers can often dry and process species locally and enter a shorter post-harvest value chain. Converting to organic production is rarely difficult as most spices are naturally pest-repellant and can be grown easily in intercropped or mixed cropping systems.

Floriculture: The floriculture sector is currently undeveloped in SAGCOT, although parts of Mbeya, Iringa and Morogoro regions are considered high potential areas for investment in floriculture. While Kenya leads East Africa by far in floriculture production, demand for floriculture products, and now particularly organic floriculture products, from Europe remains high. Floriculture businesses in the Lake Naivasha region have successfully upgraded their practices and facilities to be environmentally sustainable and attractive to specialty markets. Developing the floriculture sector in SAGCOT would present many of the same challenges as high value fruit and vegetable production, with the additional challenge of the lack of local leading enterprises. However, this space could be open to foreign investors or to domestic investors from Arusha, where floriculture is already well established.

The newly constructed Songwe Airport in Mbeya presents an opportunity to stimulate export of high-value and certified products from the corridor, particularly for horticulture and floriculture. However, investments in packing and shipping facilities must be paired with government investments in transportation infrastructure for moving products from the centre of the corridor to the new airport. With respect to both horticulture and floriculture, as newly developing sectors in SAGCOT these industries and their investors should be encouraged to leapfrog conventional production methods to gain the benefits of improved market access, price premiums, and reduce environmental impact associated with certified sustainable or organic production.

Key challenges and barriers

Some of the above opportunities appear ripe for implementation, but await interested investors. In other cases, there are important structural limitations. The following key barriers and limitations will need to be overcome to scale-up opportunities for producers to participate in profitable differentiated value chains.

Transport and distribution: For organic or other certified vegetable and fruit production, transportation from remote regions presents a significant barrier. There are few certified processors in the region and the only certified exporters for the corridor are found in Dar es Salaam. Some products can be processed or dried on farms; however, individual farmers usually lack the capacity or capital to upgrade their facilities to the standards demanded by

certifying bodies. In Kenya and Zambia, a similar situation has resulted in the exclusion of smallholders from organic fresh fruit and vegetable value chains driven by large supermarkets and urban consumers. In the centre of the corridor, the focus should be on developing new processing facilities for highly perishable or fragile produce that cannot be transported raw.

Cost of certification: In the past, organic certification has been a time-intensive and expensive process. International third-party certification is often so expensive that only large-scale farmers can afford it. Furthermore, to participate in international markets, producers may be required to meet multiple sets of standards, and this burden shows signs of growing as importing countries place more stringent requirements on producers. In this

Box 6-2. A triple-win: Certified tea for Unilever in Kericho, Kenya

Since 1999, the Unilever Corporation, a Europe-based international conglomerate, has been executing a pilot programme on its tea estates in Kericho, Kenya, to continuously improve environmental management and productivity over the farms' total 13,000 hectares. Tea is planted using mulch and intercrops, which help increase levels of soil organic matter, while bunds (embankments), micro-catchments and drainage systems enhance soil and water conservation. No insecticides, acaricides (pesticides that kill mites), or fungicides are used in the tea fields. The programme has also addressed the estate's energy needs by planting fuelwood, which is used for drying the tea, and by developing a hydro-electric facility to provide most of the company's electricity.

The plantations are managed as ecological landscapes providing clean water and habitat in addition to tea. Dispersed throughout the tea fields are patches of forests, small wetlands, and windbreaks consisting of eucalyptus and grevillea trees. Riparian forests make up over 10 per cent of the estate, extending at least 30 meters from all water bodies. By conserving indigenous trees and shrubs, the programme seeks to enhance the conservation and social value of forest remnants. The programme also acts as an educational resource for nearby communities and helps build capacity of local workers, for instance through courses on the management of indigenous tree nurseries.

Recently, Unilever expanded the scope of its sustainable agriculture programme with a decision to pursue certification from Rainforest Alliance, a process that required greater protection of wildlife, natural habitat, workers' rights, and benefits for local communities. Rainforest Alliance certification requires that workers earn fair wages (typically about three times the local agricultural minimum wage) and be provided with access to adequate housing, education and healthcare. These benefits extend to the estate's 16,000 employees and their 65,000 dependents. Unilever admits that it will take time to recoup up-front investment in implementing the new standards. But in the long-run, these changes are expected to give a strategic edge to Unilever tea brands such as Lipton, PG Tips, and Lyons. Investment in productive soils, clean water, and supportive local communities will also bring long-term benefits.

The programme is part of two broader initiatives to mainstream sustainable agriculture within major international agri-food companies. For Unilever, it is part of a commitment to source 100 per cent of agricultural raw materials sustainably by 2020. Unilever's Sustainable Agriculture Code defines parameters for sustainability in relation to soils, water, biodiversity, agrochemicals, energy, waste, and other categories. The programme also relates to the Sustainable Agriculture Initiative (SAI) Platform, a food industry initiative mainstreaming sustainable agriculture through the food value chain. Unilever was a founding member of the SAI Platform, along with Nestlé and Danone. The SAI Platform also has developed guidelines related to farming systems, and social, environmental, and economic performance, to assist member food companies and their suppliers in transitioning to sustainable, profitable production systems.

Sourcing standards and guidelines such as those put forth by Unilever and the SAI Platform point to a future in which the most competitive producers will be those that incorporate sustainability into their core business model. The Kericho example suggests how these guidelines may be implemented in practice to benefit local communities and the environment.

context, national and regional coordinating entities can be helpful for developing harmonized local interpretations of various international standards. For instance, TanCert serves as an intermediary between Tanzania's organic producers and international standard-setters. The group recently participated in the development of regional standards that should give East African countries the chance to vie for more flexible and regionally appropriate applications of international standards. Similar efforts can continue to make certified value chains more accessible to producers.

A related need is to ensure that accredited certification bodies and audit/verification services are accessible to farmers throughout the corridor. This may require additional support for certification bodies, for instance to establish regional offices and ensure adequate staff capacity to meet growing demand.

Extension and research support: To date there has been little extension and research for organic agriculture and other 'certification-ready' farming systems in the corridor. One apparent reason is that organic (or low external input) and conventional systems have been viewed as competing approaches to agriculture. Extension support for meeting the specifications of particular certification standards may be beyond the purview of most government or local NGO extension workers, and will require additional investment or specialized training to enable extension workers to provide this support.

Investment in export-oriented aggregators and processing facilities: Existing successful examples from the corridor and elsewhere indicate that a certified processing facility or aggregator can serve as a nucleus to catalyze sustainable, profitable production for thousands of small-scale farmers. Such investment could come from international companies, from exporters, or from producer associations that are able to secure stable sales contracts with foreign buyers. As yet there is little competition among exporters in Tanzania, and foreign exporters currently dominate certified export value chains. There is a strong need to establish new processing facilities or upgrade current facilities to meet the standards required to export to Europe and North America, including for certified sustainable or organic products. Additional investment in wholesale businesses that establish strong relationships with domestic and international grocers and agri-food companies to supply certified sustainable high-value commodities and niche market products can help spark local demand for producers to obtain certification and reap its benefits.



The development of the SAGCOT Framework for Agriculture Green Growth was led by a team from EcoAgriculture Partners, reporting to the SAGCOT Centre and the Green Growth Reference Group.

About EcoAgriculture Partners

EcoAgriculture Partners is a non-governmental organisation that works internationally to support the integrated management of rural landscapes to simultaneously improve rural livelihoods, sustainably produce food and fiber, and conserve healthy ecosystems. The organisation does so by providing training, research, policy solutions, and support to farmers, communities and organisations at the local, national and international levels.

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About the SAGCOT Centre

The SAGCOT Centre seeks to improve the economic performance of the Tanzanian agricultural sector and secure a place for Tanzania farmers in global value chains by coordinating, supporting and facilitating activities in the Southern Corridor and fostering an environment where innovation can thrive and dedicated leaders can make a real difference.

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