



Applying an Agriculture Green Growth Approach in the SAGCOT Clusters:

Challenges and Opportunities in Kilombero, Ihemi and Mbarali

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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)

Seth A. Shames, Sara J. Scherr, and Rachel Friedman

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

Jeffrey C. Milder, Abigail K. Hart, and Louise E. Buck

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

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Introduction

In 2011, the government of Tanzania, with public and private sector partners, developed a 'Blueprint' for accelerating agricultural development in the Southern Agricultural Growth Corridor of Tanzania (SAGCOT). To ensure that the development strategy fully incorporates the needs of smallholder farmers, as well as the valuable environmental assets of the Corridor, the strategy was further refined in a companion 'Greenprint' framework for Agriculture Green Growth (AGG) produced in early 2013.¹ As part of the Greenprint development process, a more in-depth assessment of AGG opportunities was undertaken in three of the SAGCOT Clusters. This document reports on the results of that analysis.

The SAGCOT Blueprint outlines a Cluster approach to the development of the Corridor. Of the six Clusters identified in the Blueprint as hubs for investment across the corridor, the SAGCOT Center highlighted Kilombero, Ihemi and Mbarali as three where opportunities are particularly ripe. To explore opportunities for pursuing an agriculture green growth (AGG) approach to investment in these Clusters, the green growth technical team visited each to interview leaders in key public, private and civic sectors; interviewed national leaders in Dar es Salaam and reviewed relevant documentation. The team obtained information about trends, issues and innovations that indicate opportunities for green growth investment. Finally, to learn more about investment opportunities, requirements and cautions in the Clusters, to stimulate ideas about ways that a green growth approach could be successfully pursued, and to engage leaders who will assume responsibilities for implementing green growth in the Clusters, the team supported the SAGCOT Center to conduct a workshop in May 2012.

The SAGCOT Green Growth Leaders Workshop brought together deliberately selected leaders from diverse sectors in Kilombero, Ihemi and Mbarali Clusters as well as some national leaders. Through dialogue and participatory mapping exercises the leaders identified and located prospective green growth opportunities that could promote sustainable agricultural production, processing and marketing while benefiting local communities, increasing food security and protecting ecosystem assets. The workshop also strengthened ties between leaders to help foster investment opportunities and initiate new partnerships. Thematic maps, case studies and opportunity analyses were designed to help participants highlight and locate promising innovations, to identify challenges, and to recommend 'quick win' technologies and approaches. Proceedings of the workshop including images of maps that were used are available on the AGG portal and the SAGCOT Center website.

This document briefly characterizes the three focal Clusters and highlights key issues and trends related to agriculture, conservation and livelihood development. AGG opportunities in each Cluster are then highlighted, including recommendations for helping to ensure that the design and implementation of green growth innovations are successful in the context of current development trajectories. Additional information about biophysical and social conditions in the corridor to be considered in designing AGG initiatives, particularly in Kilombero Cluster, may be found in Chapter 5 of the SAGCOT Strategic Regional Environmental and Social Assessment: Draft Report (December 2012). Ideas and recommendations for improving the enabling environment to realize AGG opportunities in the Clusters and throughout the Corridor are presented in Chapter 5 ('Creating Fertile Ground for AGG') of the main Greenprint report.

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.

Kilombero Cluster

Key features, trends and challenges

The Kilombero Cluster covers parts of Kilombero and Kilosa Districts in Morogoro region and a part of Kilolo District in Iringa Region. Nestled between the Kilombero River to the Southeast and the Udzungwa Mountains to the Northeast is the Cluster's most notable feature, the vast Kilombero floodplain known for its agricultural productivity and internationally recognized for its conservation value. The area experiences a bimodal rain pattern, with long rains from November to January and short rains from March to June. The rains result in annual flooding of the floodplain which supports smallholder rain-fed agriculture and dry season irrigation schemes on commercial farms. The permanent wetland adjoining the floodplain supports one of the largest inland fisheries in Tanzania. The majority of the population depends directly on the agriculture, livestock, fisheries and forestry systems supported by the floodplain.

To the North and South of the floodplain are two important protected areas connected to the floodplain, Udzungwa National Park and Selous Game Reserve. The forests in the Kilombero Valley are important corridors for wildlife seeking to migrate from one protected area to another. Human-wildlife conflict is a challenge for crop farmers and pastoralists in rural areas and small villages. Most of the Cluster is rural, although 27 per cent of the Cluster's 286,000 residents live in urban areas, especially in the main population centre, Ifakara. Although the Tanzania-Zambia railway passes near Ifakara, most residents rely on the network of roads for personal transportation and access to markets in Morogoro and Dar es Salaam.

The Kilombero floodplain was classified as a Ramsar site in 2002, and is managed by the Ministry of Natural Resources and Tourism with support from Belgium Technical Cooperation (BTC). Despite these efforts, the wetland has become progressively more degraded in recent years due to an influx of, and conflicts among, crop producers and grazers. There is little enforcement capacity to address these conflicts, to the detriment of wildlife, fisheries, and human livelihoods. In a similar vein, the expansion of smallholder agriculture (and to a lesser extent commercial farming) has interrupted, and may have now closed off, several key wildlife corridors that once connected the Udzungwa Mountains to the Kilombero floodplain and Selous Game Reserve. Over time, such changes are expected to increase levels of human-wildlife conflict while reducing game populations in the Selous and Udzungwa protected areas.

The Kilombero Valley is generally blessed with good soils suited to a variety of agricultural uses, although drainage and water management is necessary in some places. The Blueprint proposes a variety of new agricultural enterprises in the Cluster, including 14,000 hectares of new and upgraded rice plantations, 20,000 hectares of new sugar plantations, five mixed farms totalling 13,250 hectares, and additional investment in bananas, citrus, and value chain improvements. Given the patterns of land suitability, much of this investment would likely be concentrated in the rather narrow band of flat, dry land at the toe of the Udzungwa Mountains.

Land patterns

The Kilombero Valley Floodplain is one of the most important wetlands in Tanzania. Situated between Udzungwa National Park and Selous Game Reserve, this web of rivers, canals and lush plains surround the Kilombero River. These nearly 800,000 hectares of flood plain are among the most valuable in Tanzania for large scale paddy rice and sugarcane production due to seasonal flooding and potential for large scale irrigation schemes. Unlike the rest of Tanzania agriculture which is typically dominated by smallholders, only 23 per cent of the total area under

cultivation in the Kilombero Valley is cultivated by smallholders while 77 per cent is owned by large scale farmers (see Figure 1-1). At present more than 50 per cent of the floodplain is under cultivation. Increasingly, pastoralists from other parts of Tanzania are migrating into the Kilombero Valley Floodplain in search of large tracts of new grazing lands, increasing the pressure on the small area of land allotted to smallholders and inciting conflict with crop farmers.

The Cluster also has large areas of deciduous forests, including plantations managed for harvest as well as the natural forests. These areas are important habitat for wildlife, but growing populations and agricultural land use is causing these forests to become fragmented. Evergreen forests are found on the slopes of the Udzungwa Mountains. These forests are also becoming degraded by the smallholders who move from the increasingly crowded floodplain, up the slopes to clear cropland and harvest forest resources for fuel and timber. Cropland and cropland mosaics are found in the centre of the floodplain. Although productive, many smallholders do not live by their plots because of periodic flooding, and continue to live and harvest other resources in the upland areas.

Agriculture and commercial forestry

Agriculture is one of the most important economic activities in the Kilombero and Kilosa Districts, employing about 80 per cent of the labour force. As mentioned earlier, it is one of the most important, and productive regions in the country, especially for paddy and sugarcane. Other important crops in the Cluster are maize, cassava, bananas and sweet potatoes. Kilombero District is the second largest paddy producing region, but yields are low on average (~2 t/ha) when compared with other major rice producing regions, mostly due to dependence on rain-fed agriculture, basic tools like the hand hoe and traditional practices like shifting cultivation. Although the floodplain has high potential for irrigated agriculture, irrigation schemes in Kilombero Cluster are relatively new and primarily owned by large commercial farms. Developing affordable, accessible irrigation technologies for smallholders is one of the foremost challenges for scaling up agricultural production in this Cluster.

Out-grower schemes and block farming are two approaches which have provided smallholders with access to cropland, inputs and irrigation since the privatization of the large government-owned farms in the Cluster. In some cases, as with Kilombero Plantations Ltd., it has proven an effective arrangement for providing extension services on new techniques like the System of Rice Intensification (SRI) discussed in Annex B. Kilombero also has the oldest of the three well-developed cane grower associations in Tanzania. Kilombero Cane Growers Association (KCGA) is an example of a successful outgrower scheme, which supplies about 50 per cent of the cane processed

Figure 1-1. Proportion of land holdings by large scale farmers and the total distribution of cultivated land in Kilombero Valley.

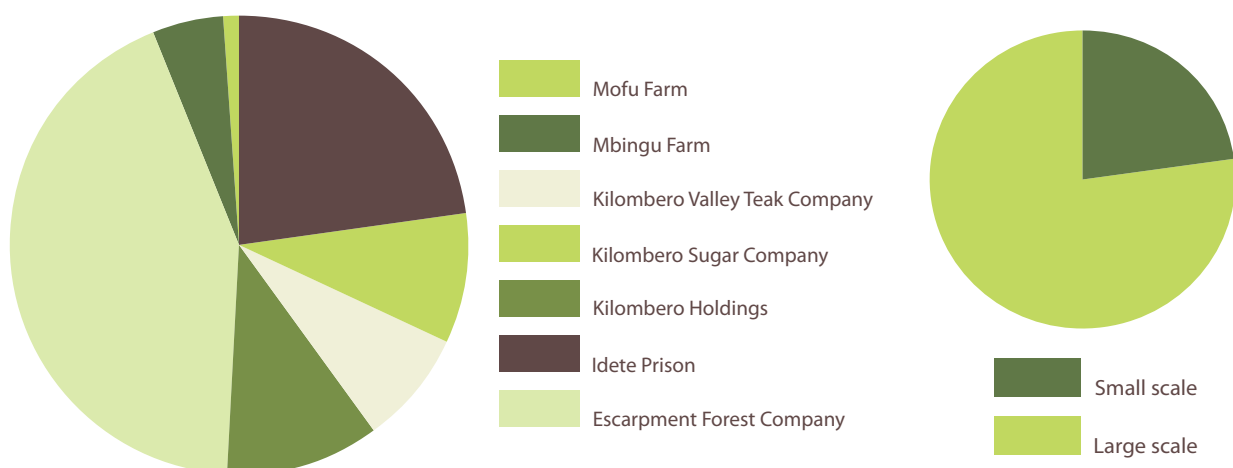


Table 1-1. Land cover in the Kilombero Cluster

Land cover	Area (sq. km.)	Per cent of total land
Artificial areas	6.4	0.1%
Croplands (crops occupy >70% of area)	190.0	3.5%
Mosaic croplands (crops occupy <70% of area)	672.5	12.2%
Evergreen forest	640.2	11.6%
Deciduous forest	3,172.2	57.6%
Woodland	698.9	12.7%
Shrubland	58.7	1.1%
Grassland	0.7	0.0%
Wetland	64.7	1.2%
Total land area	5,504.2	100.0%

by Kilombero Sugar Company Limited (KSCL). Under the umbrella organisation, Tanzania Sugar Growers Association (TSGA), KCGA provides important extension services to growers on farming, including sustainable techniques.

Maize, the third most abundant crop in the Cluster, is farmed almost exclusively by smallholders over approximately 26,000 ha in Kilombero District and 60,000 ha in Kilosa District in the foothills outside the floodplain. Maize is planted only in the rainy season and is the most common crop raided by migrating wildlife. Among smallholders, the use of agricultural inputs remains low, due to poor market access. Livestock production is also limited, accounting for only 10 per cent of the labour force. However, increasing immigration of pastoralists is creating more competition for land and water resources. Most cattle are indigenous breeds, with improved dairy breed representing less than 2 per cent of the ~67,000 head of cattle in Kilombero District. Herder field schools have been proposed as a means of raising awareness on land and water concerns, introduce new grazing practices and connect herders to district grazing lands.

Forestry is not a major source of income for smallholders, but large-scale commercial teak plantations to supply international tropical hardwood markets make up a large portion of the land holdings in Kilombero. While the teak plantations owned by Kilombero Teak Company provide a source of employment for many households in villages near the teak plantations, there is concern that the establishment of new teak plantations will negatively impact large mammals and other wildlife that use the habitat corridors of miombo woodlands and evergreen forests that are immediately adjacent to the plantations.

Conservation areas and issues

In 2000, Tanzania ratified the RAMSAR convention which requires wise use of wetlands which meet its standards. The Kilombero Valley wetlands gained RAMSAR status due to their importance for national and international wildlife; in particular the presence of 75 per cent of the world's remaining wetland dependent puku population. The wetland also has several species found only in the Rufiji River basin and provides important breeding grounds which support fish populations throughout the basin. Besides these concerns, there are two established elephant and buffalo corridors which cross the flood plain which are threatened to be cut off or discontinued by increasing

agricultural production, destruction of the miombo woodland ecosystem which surrounds the valley and conflict between humans and wildlife.

The wetland had no management plan until 2006, after which funding was provided through the Belgian government for wise management of the wetland's resources. However land use in the valley remains complicated by competing demands by agriculture, forestry, water and wildlife sectors. Official oversight through RAMSAR is provided by the Ministry of Natural Resources and Tourism. However this ministry can only establish policies on wildlife use and management, not for the other competing uses which, by Tanzania law, are under the jurisdiction of other ministries. Unfortunately, international recognition does not always translate to local awareness as 87 per cent of the population is not aware that the wetlands are legally protected under the RAMSAR convention.¹

Smallholder and conservationists are concerned with the increasing forest fragmentation and encroachment of agricultural land on forested areas. Surrounding the Udzungwa Mountains National Park are at least five forest reserves/areas upon which more than fifteen villages depend for food, income and fuel. Officially annexing these forest reserves to the national park or establishing joint or community forest management plans between villages and local stakeholder bodies would not only protect the communities' continued access to forest resources and services, but it would also protect highly important corridors for wildlife movement between protected areas. Several stakeholder meetings and workshops among community members have identified community interest in managing resources. They have also brought to light the need for flexible and integrated management plans that allow different types of use including certain types of agriculture upon which nearly the entire population of the valley depends.

Human-wildlife conflict (HWC) in Kilombero Valley is a challenge requiring immediate attention. Only two corridors remain in the valley for wildlife including buffalo, elephants and puku to cross from Selous Game

Table 1-2. Designated conservation areas in the Kilombero Cluster.

Conservation areas	Description	Area (sq. km.)	Per cent of total land
Forest Reserves	Thirteen forest reserves, primarily owned by villages	1,124.4	20.4%
Game Reserve / World Heritage Site	Selous Game Reserve, one of the largest remaining wilderness areas with large populations of game species	88.5	1.6%
National Park	Mikumi National Park, contiguous with Selous Game Reserve, has large populations of large game animals and Udzungwa National Park is known for biodiverse moist upland forests	1,258.9	22.9%
Kilombero Vally Ramsar site	Covers the wetland and parts of the surrounding floodplain that support critical habitat for indigenous and threatened species	2,556.4	46.4%
Total conservation area		5,028.2	91.4%
Total land area		5,504.2	100.0%

1 Mombo et al., 2011

Reserve to the Udzungwa Mountain National Park. Both of the corridors are critically threatened from pressure by livestock encroachment, deforestation and continuing immigration of human populations. The most important consideration in successfully managing these corridors is mitigating HTC. In the Nyanganje Corridor, between Nyangaje Forest Reserve and Selous, more than 80 per cent of residents reported elephants passing through their farms. Since this corridor is the shortest possible route across the valley, the elephants do not always pause to raid crops resulting in slightly lower levels of perceived conflict. However in the Ruipa corridor, near the Ruipa River, there is evidence of the corridor being closed off by hunting pressure, teak plantation and agricultural expansion. Here, where the animals must cross a larger distance to reach the next protected area, nearly half of the residents perceive conflict with large mammals passing through their land.

The southern part of the valley has been designated as a Game Controlled Area, which although it protects against illegal hunting has no control over the encroachment of livestock grazing or expansion of agriculture into wildlife corridors. Several new management approaches have been proposed however there is a lack of capacity and extension services that provide education on the importance of wildlife corridors to residents and sustainable forestry management that allows fuel wood and timber harvesting as well as some cultivation and controlled grazing.

Social and economic trends

Interestingly, although the Cluster has a wealth of opportunities for agriculture and water for hydropower, local residents have incomes far below the Tanzania average and only 1 per cent has access to electricity. Considering the wealth of natural resources and income generated by agriculture and water resources from the region, it seems clear that many of the benefits of development activities related to the wetland and floodplain are being externalized or diverted from the smallholders who manage much of the wetlands and forests in the region. Internalizing the costs and finding ways to compensate residents for wise management of natural resources could be an important part of developing the valley.

The lack of infrastructure for energy and transportation limit market access for smallholders. Similarly, infrastructure for health and education has not grown as fast as the local population. However, Kilombero District has been able to attract the attention of many NGOs and CBOs that report beneficiaries totalling more than half the district population, more than in any other district in Morogoro Region. In general the Cluster faces many of the challenges that are typical of rural areas. Development activities in the Cluster will most likely have positive indirect benefits for income, education, and social amenities particularly if investors are required to pay communities for the land and resources they use through provision of social services and amenities.

Opportunities for Agriculture Green Growth

With a high concentration of investment opportunities as well as risks in a relatively small land area, Kilombero may be the most obvious example of why integrated planning is necessary. The three-part planning process outlined in the previous chapter will be an important way to get a head start on recommendations for integrated planning made by the SRESA for developing Kilombero, and to harmonize planning that is already underway in the Ramsar site, CIPs, Udzungwa Mountains, and in the one-third of local villages that have completed VLUPs. One aim of such planning should be to designate blocks of land for commercial investment and different blocks for the maintenance (or restoration) of wildlife corridors. Several NGOs active in the Cluster have a wealth of knowledge on the appropriate design of such corridors. Where appropriate, corridors may be designated as compensation areas to offset environmental impacts of large-scale agricultural development. Given the limited availability of agricultural land of low environmental sensitivity, it will be imperative to integrate smallholders heavily into commercial farming schemes to ensure that they are not displaced to the wetland or forests.

Sustainable intensification of smallholder agriculture

In a similar vein, sustainable intensification of smallholder agriculture will be a critical strategy to improve livelihoods and reduce land conflicts, and the Cluster should be considered a high priority for the early roll-out of the AGG extension program. SRI has already been demonstrated locally and is suitable for rapid scaling-up. Conservation agriculture is also suitable for a range of field crops. Additional sustainable intensification opportunities to be explored further include mechanisms for sustaining wetland fisheries, developing integrated crop-livestock-aquaculture systems, and establishing herder field schools to increase livestock productivity while protecting the wetland. Nevertheless, training alone may not be adequate to address conflict between crop producers and livestock herders: land use zoning and corresponding enforcement may be needed to harmonize land users in an increasingly contested area by designating space for farmers, herders, forests, wildlife, and new investments.

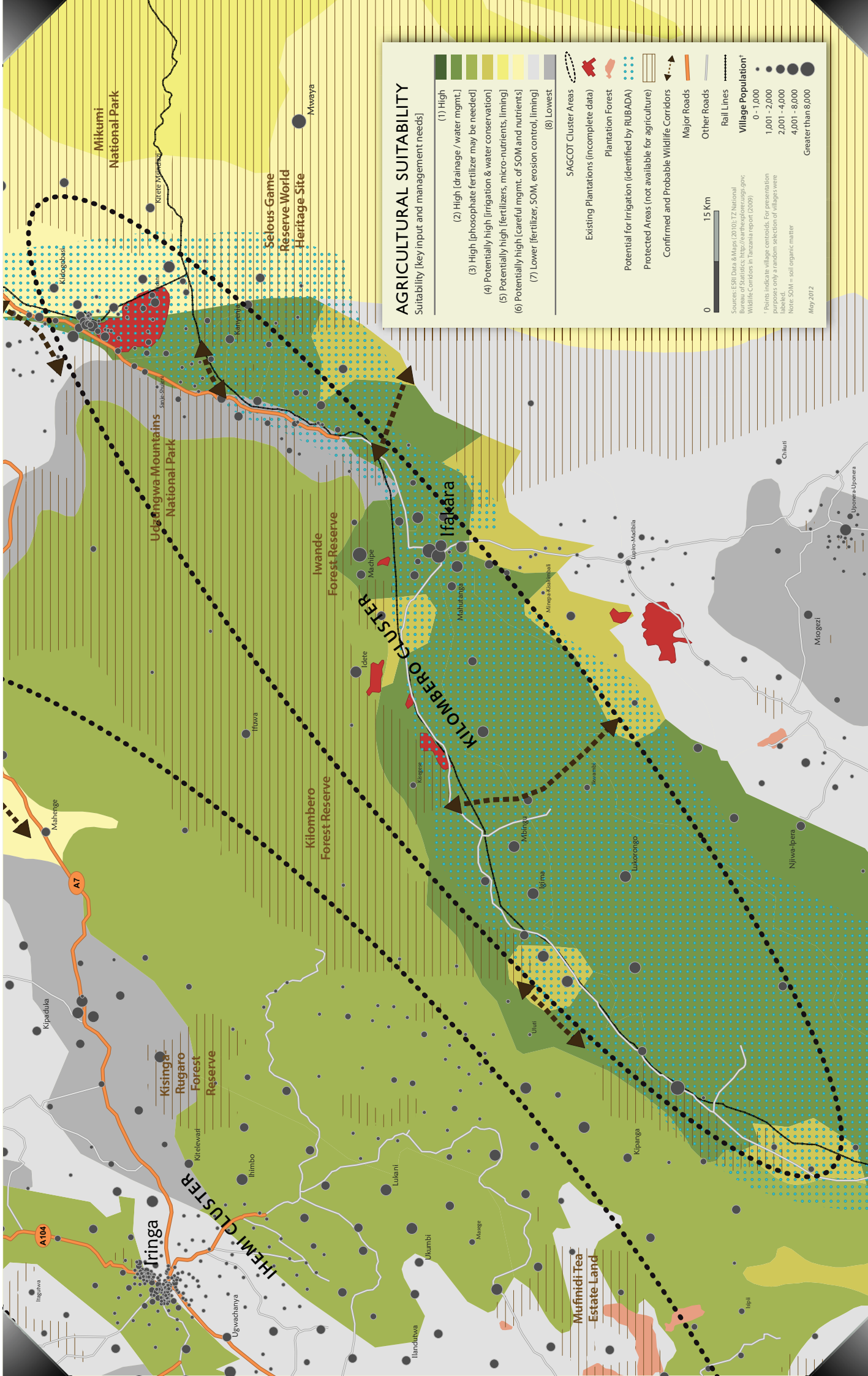
Linking conservation and food production

The connection between resource conservation and food production is especially clear in Kilombero Cluster, given that the Udzungwa Mountains furnish freshwater for much of the valley's agriculture, while the meandering waterways of the Kilombero floodplain provide an important fishery resource. Kilombero Plantations, Ltd., has already recognized this reality in its business model, and is working with upstream forest communities to conserve the headwaters that supply water to the farm. Similar systems of payment for ecosystem services should be explored for all major water users in the Cluster. In the long run, such systems may benefit all parties by reducing the risk of water non-availability to commercial farms while compensating upstream communities for any foregone activities. Kilombero Cluster may also be particularly ripe for REDD+ projects, given that agricultural expansion into forests and wetlands is currently significant, but could be curtailed through a mix of sustainable intensification, economic development, and conservation set-asides with appropriate enforcement. REDD+ funds could be disbursed to community members or, more likely, used to invest in local priorities such as feeder roads and social services.

Developing value-chains

Value-chain development is a high priority for Kilombero Cluster, and is already underway through the CIP and other efforts. Additional investment in local organisations and in small- and medium-sized storage, processing, and marketing facilities is needed to develop a value chain that is prepared to accept the increased crop volumes that the Cluster will soon produce.

Figure 1-2. Kilombero Cluster thematic map.



Ihemi Cluster

Key features, trends and challenges

Located in the eastern-most part of the southern highlands, Ihemi Cluster is one of Tanzania's agricultural strongholds and an important region for forest and perennial crop production. Large-scale commercial operations for tea, pulpwood and timber, active in the highlands at the southern edge of the Cluster, are already investigating sustainable production systems that engage smallholders. Both irrigated and rain-fed field crop production is common in the lowlands at the northern end of the Cluster. Iringa City, the main population centre, is located near the centre of the Cluster, at the confluence of the main Dar es Salaam-Mbeya road and the road to Dodoma. As in Kilombero Cluster, backbone road and power infrastructure reach the main city but, farther out, infrastructure is poor. Limited access to year-round transportation routes and reliable power sources inhibit economic development and smallholder access to information and improved technologies and inputs.

Along the southeastern edge of the Cluster, the diverse montane forests of the Udzungwa Mountains host critical biodiversity and forest resources. These forests are in high demand from commercial producers for pulpwood and tea plantations, while smallholders rely heavily on the forest for charcoal production. Wildlife also depends on the large tracts of forests as well as on forest reserves across the Iringa highlands to function as corridors between Udzungwa and Ruaha National Parks. In the case of the Ihemi Cluster, livestock production and charcoal production present the greatest threats to maintaining these corridors and halting further forest fragmentation.

Land patterns

The Ihemi Cluster, covering Iringa Urban District and part of Iringa Rural, Kilolo and Mufindi Districts, is up on the plateau of the southern highlands. The region's climate is unique in its heterogeneity, varying between the bimodal and unimodal rainfall patterns, which in turn results in diverse land uses. Forests, woodlands and mosaic cropping systems are the largest land uses in the Cluster. Forest types vary from managed to natural across the Cluster from more than 160,000 ha of montane forests high up the Udzungwa escarpment in Kilolo District to the lowlands in Iringa Rural District in the Northwest toward Ruaha National Park. Most of the large-scale commercial tea and pulp wood plantations are in Mufindi District along the main highway from Iringa to Mbeya. Cropland mosaics are found throughout the Cluster with more drought resistant crops in the lowlands.

Agriculture, livestock and commercial forestry

Besides being one of the 'Big Four' regions for maize production (Iringa, Mbeya, Ruvuma and Rukwa), Iringa is the country's leading region for potatoes (70 per cent of national production) and tomatoes and an important producer of timber, tea, sunflower and processed fruits and vegetables. Although there is generally enough water for two planting seasons, the region is very heterogeneous and increases in temperature and rainfall variability are affecting maize yields in some parts. Sunflower seed is an alternative crop that grows under similar conditions to maize but is less sensitive to climatic variability. The area under sunflower production has more than doubled over the last five years as farmers seek alternatives to maize in places where it is perceived as too risky. Farmers are exploring simsim (sesame) as another alternative to maize that could take advantage of the existing infrastructure for processing sunflower seeds.

Mufindi district is the second largest producer of tea in Tanzania. Most production takes place on large commercial tea estates, with smallholders participating through outgrower arrangements. Tea is processed in Mufindi and exported to both conventional and fair trade international markets. The Cluster also supplies

national markets with potatoes, tomatoes and onions. Most of these products are transported to Dar es Salaam for sale with the exception of tomatoes, most of which are sold to Dabaga, one of the largest fruit and vegetable processors in Tanzania. Irrigation is important for all of these crops. Many smallholders rely on traditional irrigation systems like vinyungu, which makes use of river valley bottoms for dry season production. Some commercial tea growers have modern, efficient irrigation systems, but economies of scale make these systems too costly for most smallholders.

Livestock is the second most important economic activity in the Cluster. In 2003, the region had a herd of nearly 500,000 head of cattle, managed primarily for meat. Dairy cattle make up less than 1 per cent of Iringa's herd, although the highlands are considered high potential for livestock development and dairy in particular because of the year-round availability of fodder, relative low prevalence of tick-borne diseases and high demand for dairy products. Only 3 per cent of the cattle in the region are improved breeds. At this point, infrastructure is insufficient to support sector development. Investments in veterinary services, watering facilities and dairy processing facilities would be necessary to scale-up production.

Commercial forestry has been an important part of the region's past and is expected to play a role in encouraging economic development through reforestation. The original owner, Southern Paper Mills, a subsidiary of a national company, was installed in 1965 with investments from domestic and international partners, however operations ceased in 1992 due to lack of national demand and inadequate energy resources to power the mill. Since then, Mufindi Paper Mills has taken over operations and plans to steer the business into sustainable production in partnership with the Sao Hill Plantations which will supply the pulp wood. Most commercial plantations are owned by large companies, however recent efforts have been made to involve smallholders in commercial forestry as a means of incorporating them into carbon trading markets.

Conservation areas and issues

The Cluster is part of the Great Ruaha River catchment. Competing demands for the Ruaha's water abound with a large regional population, important wildlife areas and highly productive irrigated agriculture downstream. Over-abstraction of water for irrigation and climatic changes has resulted in more frequent drying of the upper

Table 2-1. Land cover in the Ihemi Cluster

Land cover	Area (sq. km.)	Per cent of total land
Artificial areas	18.1	0.1%
Croplands (crops occupy >70% of area)	213.8	1.5%
Mosaic croplands (crops occupy <70% of area)	3,529.7	24.4%
Evergreen forest	738.7	5.1%
Deciduous forest	2,753.7	19.1%
Woodland	2,724.0	18.8%
Shrubland	3,232.4	22.4%
Grassland	1,114.6	7.7%
Wetland	115.0	0.8%
Total land area	14,451.3	100.0%

reaches of the basin. Just as the seasonal variability presents a challenge to rain fed agriculture, the periodic drying of surface water is a challenge to building and maintaining irrigation systems that provide regular access to water for agriculture without threatening the needs of downstream water users. While water shortages may be caused by misuse in the upper reaches of the basin outside of Ihemi Cluster, downstream users look toward upstream users immediately above the Mtera reservoir when water levels in the reservoir drop.

Unlike in some of the other Clusters, deforestation in Ihemi Cluster is not driven primarily by conversion to agriculture, but rather by charcoal, fuelwood, timber and pulp harvesting. Thanks to national policies on tree harvesting residents recognize the importance of maintaining tree cover for protection of water resources as well as the timber and pulp industries. In an effort to decrease deforestation, some communities are beginning to explore the use of biogas as an alternative for household cooking fuel. Perhaps it is due to the abundance of forest resources or dependence of villages on forest resources, Iringa region has dedicated large areas of land to PFM. It leads the country in area under JFM (274,193 ha) and has another 166,057 ha under CBFM. Forest reserves compose 9 per cent of the region's area and forest plantations for timber and pulp another 4 per cent. Apart from Udzungwa Mountains National Park and Ruaha National Park, which are managed by the central government, more than 120 villages are involved in Community-based Forest Management and more than 50 villages have Village Land Forest Reserves (VLFRs) formally recognized by the government compared to the occasional one or two VLFRs gazetted in other regions.

Social and economic trends

The abundant resources, established infrastructure, and high agriculture and forestry potential put this Cluster in a position to attract partners that are looking for quick wins. The government has invested in Export Processing Zones (EPZs), similar to free trade zones, to encourage investors from many sectors including agro-processing and agricultural equipment manufacturers. Additionally, an international airport being built not far away in Songwe, with plans to devote a terminal to agricultural and horticultural exports, serving as a dry port for regional producers.

Socio-economic conditions in the Cluster are mixed. Given that the labour force is overwhelming involved in agriculture just as in other Clusters (70-90 per cent outside of Iringa Urban district), incomes are surprisingly higher here than in most other parts of Tanzania except Dar es Salaam. In 2008 regional per capita GDP was

Table 2-2. Designated conservation areas in the Ihemi Cluster.

Conservation areas	Description	Area (sq. km.)	Per cent of total land
Forest Reserves	Kilombero Forest Reserve, and other forest reserves are often managed through participatory forest management across the Cluster	1,605.1	11.1%
Game Controlled Area	Lunda-Mkwabi Game Controlled Area, adjacent to the southeastern border of Ruaha National Park. Although formally gazetted, the area is not actively managed as a game controlled area	5.9	0.04%
Total conservation area		1,611.0	11.2%
Total land area		14,451.3	100.0%

861,564 Tz Shs compared to the national average of 627,787 Tz Shs.¹ This is most likely due to the productivity and diversity of the region's agriculture and forestry industries. However, HIV/AIDS prevalence is a serious challenge, with 16 per cent of the population affected compared to the national average of 5.7 per cent. The unbalanced sex ratio (89 males to 100 females) and age distribution of the population (45 per cent of the population less than 14 years old) are products of this higher incidence of HIV/AIDS in combination with emigration to urban centres. Promoting access to quality health care will be critical in enabling residents to take advantage of employment opportunities, participate in land use planning and management and engage in new partnerships with investors.

Opportunities for Agriculture Green Growth

Recognizing the Cluster's physical and agroecological diversity, the Blueprint proposes sixteen new mixed commercial farms and four banana farms, together comprising more than 42,000 hectares. It also proposes a range of other investments for storage, processing facilities and irrigation, although the number of storage and processing facilities proposed are roughly half of that proposed for Kilombero in order to allow for increased investment in irrigation, roads and power. The value adding investments are proposed to be concentrated in the highland plateau region, along the major Dar-Mbeya highway, while irrigation and infrastructure investments aim to reach farther out into the Cluster, mainly into the lowland regions to the north and west of the plateau.

Sustainable agricultural intensification

The diversity of Ihemi's natural and economic resources is likely one reason for the higher incomes seen in this Cluster compared to others. However, this diversity makes coordinating action and investment among actors in the Cluster particularly challenging. Several of the sustainable intensification strategies discussed in the Greenprint could effectively leverage major new investments in infrastructure and value chain facilities by making more efficient use of new irrigation through precision technologies, reusing crop residues as field cover or livestock fodder, and improving the yields of unaffiliated smallholders, thereby establishing greater and more stable input supplies for local processors. Similarly, sustainable intensification of mixed crop and livestock systems in the highland region could lower producers' input costs and reduce the potential for conflict over resources. The Sao Hill Cattle Ranch, Asas Dairy Farms and other large commercial livestock producers are ideally situated to begin introducing improved dairy and beef breeds, and serve as nuclei for extension of intensive livestock systems, inputs, range management and intensive fodder production.

Farmers and businesses in Ihemi Cluster can benefit from the many knowledge, technology, and input supply resources available in Iringa City, particularly if local expertise and knowledge hubs can be established in the hinterlands. For instance, some of the commercial tea plantations already use efficient modern irrigation systems. Concerted efforts to educate producers across the escarpment could lead to increased efficiency of both existing and new irrigation systems, thereby reducing costs and conserving water. In the lowlands, some producers are already experimenting with transitioning some of their land from maize to sunflower to mitigate drought-related crop failure and access oil seed markets. The management systems and processing facilities established for sunflower could be broadened to pilot production and value addition activities with other oilseeds. Rapid roll-out of the agricultural extension program proposed in the Greenprint would be a cost-effective way of linking actors throughout the Cluster and facilitating rapid exchange of information on AGG practices.

¹ National Bureau of Statistics and Iringa Regional Commissioner. 2011. Iringa Region GDP Report 2008. Dar es Salaam: National Bureau of Statistics.

Sustainable community forestry

The Iringa Region has been actively involved in participatory forest management (PFM) since the passing of the Forestry Act in 2002. However, villages are only one of many actors in the forests. Tea and pulpwood producers manage large areas of forest land and contract with many villagers to augment their raw material supplies. The Sao Hill and Mufindi Paper Mills both have the potential to attract REDD+ financing by pursuing sustainable harvest and afforestation strategies. A bigger challenge is to design PFM arrangements that link communities and commercial producers to bring REDD+ and other carbon finance to help reduce rural poverty and provide finance to catalyse village-level development. One option is to train local communities and develop nurseries to enable community members to plant and maintain high-biodiversity, carbon-rich mixed species plantations on both company and village lands. Conversely, large forestry companies can work with villages under the purview of PFM to commercialize new forest products for additional income streams. Expertise from the public, civic, and private sectors can be combined to develop appropriate extension systems.

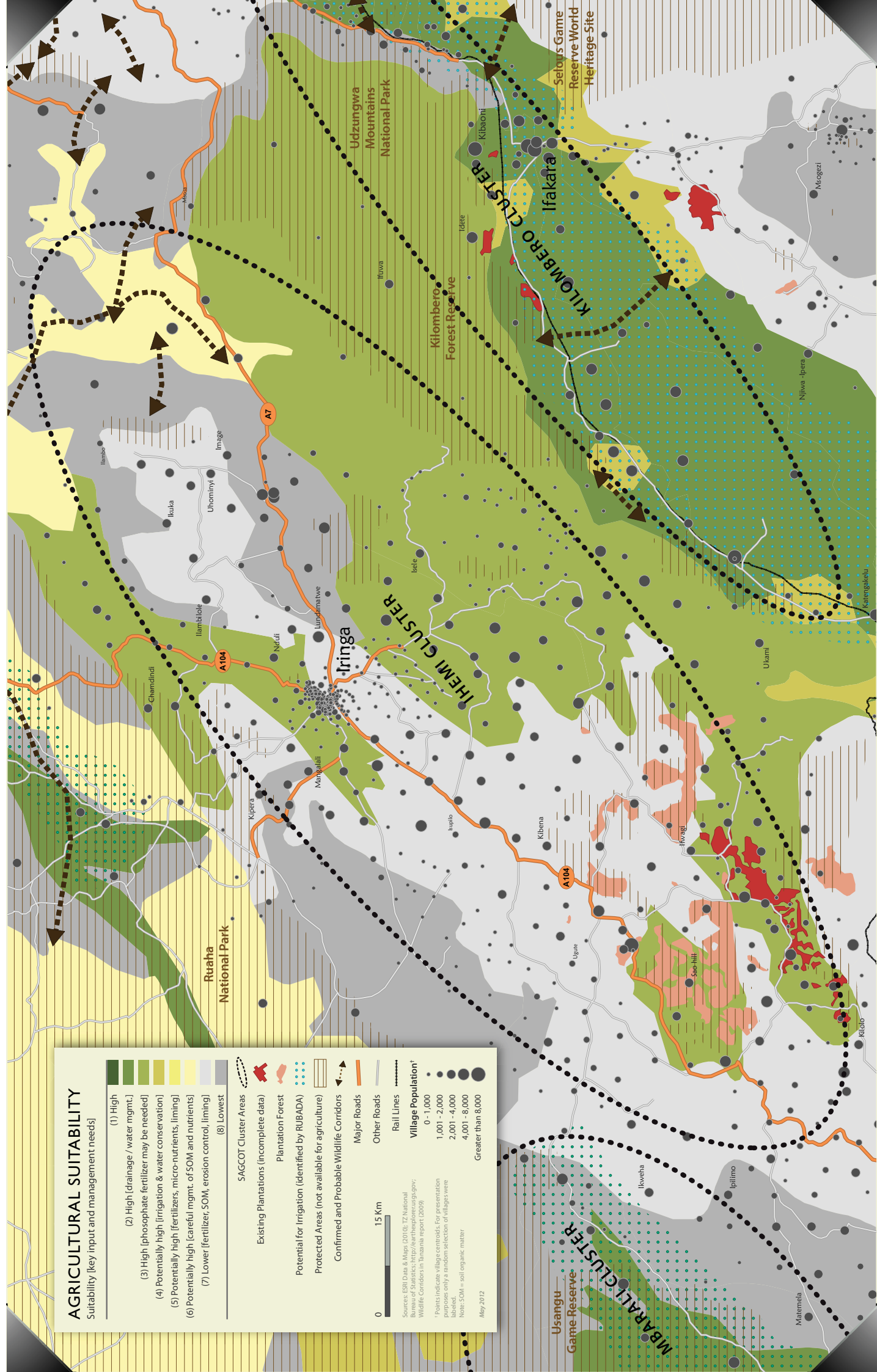
Linking AGG to human health and well-being

More than either of the other priority Clusters, Ihemi requires an integrated strategy that is sensitive to the social and health conditions in the Cluster. Extension services for agriculture, livestock and forestry need to take into account the high prevalence of HIV/AIDS in the region and adjust their programming accordingly. Coordinating extension activities with public health recommendations will be crucial. In specific terms, this may entail working with local extension teams to promote the AGG strategies that help increase household nutritional diversity and require less labour (or provide more flexibility in the timing of labour requirements); conservation agriculture is one example that has been successfully promoted to help households in other regions with a high disease burden. From a risk management perspective, it should be recognized that, although household income in Ihemi Cluster is higher on average, producers may not be willing to incur economic risk related to agricultural activities if they perceive the need to reserve large portions of their income for health costs.

Bioenergy production

Finally, because of the high biodiversity value of its forests—and the intense pressure from wood fuel demand—Ihemi Cluster should be considered as a high priority for finance and technical assistance related to biogas development. There are additional opportunities to generate energy and fertilizer from recycling agricultural residues on large estates and processing wastes from the existing and planned processing facilities in and around Iringa City.

Figure 2-1. Ihemi Cluster thematic map.



Mbarali Cluster

Key features, trends and challenges

Mbarali Cluster is located in the western reaches of the Southern Highlands. The Cluster contains no major cities and has generally poor access to backbone infrastructure, except at the southern end. Ruaha National Park encompasses a large portion of the Cluster, and was recently expanded to ensure suitable year-round water supplies for park wildlife. At the heart of the Cluster are the Usangu Flats, a mosaic of wetlands and agricultural fields whose importance for rice production is comparable to Kilombero Valley. The longstanding presence of irrigation schemes scattered throughout the flats and presence of large farmlands previously owned by the government have helped boost smallholder productivity in the region and connect them to national markets. The lack of backbone infrastructure, population centres and markets is a possible reason why few large scale commercial producers are located currently in the Cluster. The Ihefu wetlands, a protected portion of the Usangu Flats that is important for biodiversity, as well as Ruaha National Park are managed formally by TANAPA and are home to biodiversity of international importance. Both of these natural areas depend on water from the same rivers that are used to irrigate the Flats.

District-wide, maize is a close second in terms of area under production. Irrigated agriculture has been used in the Usangu flats since the early 1900s. Now irrigation is common throughout the Cluster except in forested and protected areas. Typically irrigation is used for paddy in the wet season and to plant additional horticultural crops in the dry season. Mbarali district has more than 85 irrigation schemes, which include traditional, improved and modern systems. The majority of the Cluster's irrigated land (about 25,000 ha of the total 35,000 ha) is irrigated by traditional systems that are now in ill repair and whose inefficiency is faulted for over-abstraction of water during the dry season. Livestock, another important piece of agriculture in the Cluster, was pointed to by downstream water users as the primary cause of the first zero flow periods in the Ruaha River in the 1900s due to the immigrant pastoralist populations moving in to water large herds during the dry season. Since then it has become apparent that irrigation, more than livestock, is causing the increasing number of zero-flow days seen downstream.

Livestock keeping is an important source of income for the Sukuma, who own 90 per cent of the cattle in the Usangu wetland area, and other traditionally pastoralist groups, but competition over land and water resources continues to cause conflict between pastoralists and crop producers. In the upper reaches of the basin, away from the flats these conflicts lessen and are primarily upstream-downstream user conflicts over water allocation. However, in the flats, where irrigation and crop production is more common, these conflicts are very often due to the crop and irrigation system damage caused by livestock driven in search of water.

Conflicts over water resources present a serious challenge for all sectors. The rivers and streams that supply water to the region's irrigation schemes flow through the Usangu wetlands to the Ruaha River and on to the Mtera dam, the nation's largest hydroelectric station. Besides the hydroelectric water use, commercial rice farmers, smallholder farmers, pastoralist and fishermen are all relying on the region's water resources. Also, residents contend for rights to access and manage the Ihefu wetlands. From 2006-2008 the government formally annexed the Ihefu wetland portion of the Usangu wetlands to Ruaha National Park, which is managed by the central government through TANAPA. This resulted in the displacement of several thousand residents, many of whom, although they received some compensation, are still in unstable land tenure arrangements. Before annexation Mbarali District was approximately 15,000 km², now the district is estimated at 5,000 km² but the size is uncertain due to ongoing

land and tenure disputes. The expansion of Ruaha National Park to include what was previously Usangu Game Reserve generated conflict. The government cited the need to annex the game reserve to preserve biodiversity and safeguard downstream hydroelectric provision by protecting the use of wetlands in the Usangu Game Reserve. Residents claimed they were not fairly compensated by their land and were not granted access to the permanent jobs available in the park. The expansion also made Ruaha National Park the largest national park in Tanzania, which has potential to increase tourism to the area as well.

Besides the recently annexed portion of Ruaha National Park and Kitulo National Park, WWF has supported the development of the Mpanga/Kipengere Game Reserve to protect biodiversity and water resources in the upper reaches of the catchment supplying the Usangu wetlands. About 20,000 ha of smaller forest reserves are scattered throughout the Cluster and under CBFM. Apart from cultivated crops, the forest reserves provide important sources of edible forest fruits which supplement the dietary staples. Providing an important source of habitat for migratory species during the dry season is the Igando-Igawa wildlife corridor, which follows the path of the rivers as flow from the Mpanga/Kipengere Game Reserve to the former Usangu Game Reserve and Ruaha National Park. Land use planning and forest management has not been strong in the region, possibly because recently resettled populations from the Usangu Game Reserve area remain in conflict with government officials about access to land, water and social resources that can support their families, crops and livestock.

In 2006, during a national process to privatize government-held farms in Mbarali, Kapunga, Ruvu and Dakawa, Highland Estates Company and the Export Trading Company LTD purchased the two largest rice farms in the Usangu plains which, previously, were a part of the National Agriculture and Food Company (NAFCO). Mbarali Rice Farm, a 5,842 ha farm was purchased for Tsh 3.5 billion by Highland Estates, which sublets almost half of the farm area to cooperative groups including more than 800 small-scale farmers. The second farm, Kapunga Rice Project, encompassing 7,450 ha of rice farm, was sold in 2006 to Export Trading Company for Tsh. 2.3 billion and sublets only around 800 ha of the farm to small-scale farmers and cooperatives. As a result of privatization, many of the improved and modern irrigation systems on the farms are now unavailable to smallholders. Irrigated agriculture is the base of the local economy. The maximum area of irrigated paddy is estimated to be 42,000 ha

Table 3-1. Land cover in the Mbarali Cluster

Land cover	Area (sq. km.)	Per cent of total land
Artificial areas	11.0	0.1%
Croplands (crops occupy >70% of area)	129.5	1.4%
Mosaic croplands (crops occupy <70% of area)	3,175.1	35.2%
Evergreen forest	--	--
Deciduous forest	91.7	1.0%
Woodland	380.5	4.2%
Shrubland	1,030.6	11.4%
Grassland	4,043.2	44.8%
Wetland	162.6	1.8%
Water bodies	0.7	0.0%
Total land area	9,024.9	100.0%

Table 3-2. Designated conservation areas in the Mbarali Cluster.

Conservation areas	Description	Area (sq. km.)	Per cent of total land
Forest Reserves		164.7	1.8%
Game Controlled Area		161.3	1.8%
Game Reserve		2,967.4	32.9%
Total conservation area		3,293.4	36.5
Total land area		9,024.9	100.0%

with a core area of 24,500 ha. Unresolved land tenure and lack of financial institutions to provide credit however, limit smallholder's ability to participate in highly productive and cost-effective irrigated agriculture. Also, the Cluster does not have a network of post-harvest storage facilities or warehouses that might help small farmers to work together for improved access to markets and capital.

Opportunities for Agriculture Green Growth

Improving water governance and irrigation efficiency

Water management perhaps is the greatest challenge faced by Mbarali Cluster residents and potential investors. There is growing evidence that irrigation inefficiency and oversubscription of river water in the Usangu Flats is causing the periodic dry spells at Mtera dam, which can severely affect the national power supply. While Mbarali currently has more irrigated land than any other Cluster, substantial public and private investment is needed to rehabilitate existing systems. Due to the variety of stakeholders dependent on these irrigation systems and existing conflicts over access to water resources, water allocation needs to be addressed through basin level planning processes. Based on evidence about water availability and flows, economic returns from alternative water uses, and stakeholder participation, such a process may be used to set appropriate water quotas by use (irrigation, livestock, commercial and domestic use, and flows to critical natural areas) and by area. Without a systematic process such as this, water allocation and distribution will continue to occur in an ad-hoc manner that is not equitable, efficient, sustainable or supportive of the SAGCOT development objectives. In addition to basin planning, there is a strong role to be played by water user associations (WUAs) to develop and enforce bylaws on local water use while building the capacity of local water users to become more efficient and productive with the limited water that is available.

Alternative grazing strategies for extension livestock production

Although localized data on soil type and quality are difficult to obtain for Mbarali, available soil maps show large portions of the basin to be poorly suited for agriculture but potentially valuable for grazing and conservation lands. The basin level planning processes and extension units proposed in the Greenprint could benefit from more detailed soil and water maps, paired with local knowledge of soil and water resources to identify target areas for expanding sustainable intensification in suitable areas. On the other hand, on lands that are marginal for agriculture, the district level planning processes could designate areas for communal grazing as well as village forest reserves generating a variety of products. Due to the potentially low opportunity cost of foregoing agriculture on marginal lands in the Cluster, villages and farmers may gain greater economic and environmental benefits by taking advantage of REDD+ financing for afforestation or conservation of brush and woodlands. Pressure on water resources by livestock grazers could be mitigated by recuperating some of the old irrigation systems on unsuitable agricultural lands for livestock watering areas. There is also the opportunity to use portions of

these lands to establish herder field schools as part of the AGG extension system to disseminate best practices. Establishing some public lands for migrant pastoralists could be an important step for reducing conflicts between crop producers and livestock grazers.

Improving market access for smallholder farmers

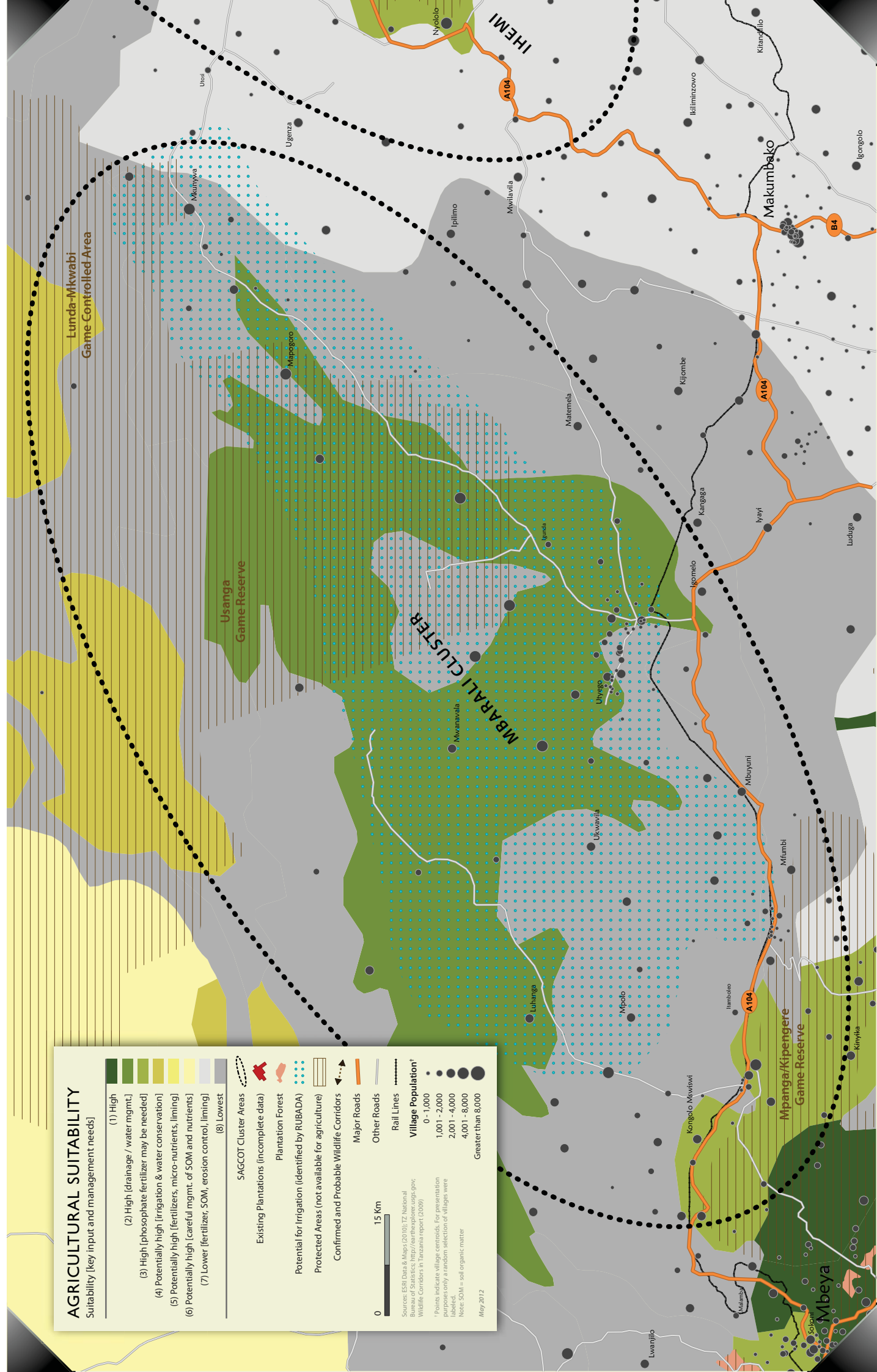
Market access is another challenge in Mbarali. Major non-perishable crops, such as rice and maize, are sold locally and nationally. Warehouse receipt systems have been successful in other areas for facilitating smallholder market access for such staple grains, and could be implemented more widely in Mbarali. Producer associations and local NGOs will also need to play a key role in helping smallholder farmers gain greater market access and negotiating power with higher levels of the value chain.

Since the Cluster itself does not have major population centres, the primary market for most of the Cluster's horticultural crops is Dar es Salaam. Given its distance from this market, Mbarali will not necessarily be able to compete as a low-cost supplier, unless there is further investment in processing facilities to turn horticulture crops into value-added food products. For less-perishable horticultural products, certification or sustainability labels that differentiate such products may draw more profits by accessing new international markets.

Expanding high-value horticulture production

Finally, given the increasing demand and escalating conflict related to water availability and use, the Cluster or district planning process for Mbarali should explicitly consider alternative irrigated crops to increase not just the production efficiency of irrigation water, but also the economic efficiency. For instance, high-value crops such as onions and tomatoes typically generate much greater income per unit of applied water, and may offer an attractive pathway for pursuing economic development under future water limitations in the Usangu Flats. Moving toward such crops would require investments in storage and processing facilities, as noted above, but could reduce smallholders' risk profile. Given the importance of water availability in farmers' risk profiles, one avenue to explore is the development of micro- and meso-financing mechanisms that preferentially favour farmers practicing sustainable intensification, whose fields are more likely to generate stable income in the face of future water availability conditions.

Figure 3-1 Mbarali Cluster thematic map.



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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