A mosaic of tea, maize and other annual crop production, eucalyptus woodlots and forest fragments comprises much of the Kericho landscape.
Photo credit: Mark Moroge

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CHAPTER 22

Operationalizing climate-smart agricultural landscapes: the case of a tea-producing landscape in Kericho, Kenya

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Highlights

- Despite the conceptual appeal of climate-smart landscape approaches, there is little information available on how to operationalize them
- We developed an assessment tool to evaluate climate-smart landscape needs and opportunities in six key activity domains: on-farm management practices, landscape planning and coordination, energy systems, training and technical assistance, policy support, and technology and information
- We applied the tool in the agricultural landscape around Kericho, Kenya, an important tea-growing region where agriculture and ecosystem services are expected to be strongly affected by climate change
- The assessment revealed a strong foundation of existing activities and actors supporting climate-smart agriculture in Kericho and also highlighted priority areas for additional investment that could leverage current activities and fill critical gaps
- Structured tools such as the one profiled here can help translate climate-smart agriculture from a general concept into an operational strategy advanced through tangible sets of priorities and investments in specific landscapes

1. Introduction

The term 'climate-smart agriculture' (CSA) refers to production systems designed to increase food security, improve the resilience of agriculture to environmental change, and mitigate climate change (FAO, 2010; World Bank, 2011). While recently framed as a concept for the climate change and agricultural development communities, CSA includes many field- and farm-scale agricultural practices already well documented and in wide use, such as conservation tillage, agroforestry, crop residue management, water harvesting, agrobiodiversity conservation and use, and others (Campbell et al., 2011; World Bank, 2011; FAO, 2013).

Much of the focus of CSA has been on applying and improving these field- and farm-level practices to increase farm and household resilience in the context of a changing climate.

However, proponents of CSA have recognized that resilient agricultural systems also require appropriate land management and institutional support beyond the farm scale. Others have argued that for the CSA concept to drive transformational change, it must be understood and applied through holistic management and governance of socio-ecological systems (Neufeldt et al., 2013). Accordingly, CSA has been defined as requiring landscape level, ecosystem-based management as well as improved policy, investment, and institutional frameworks (FAO, 2011).

Landscape approaches to climate-smart agriculture, or 'climate-smart landscapes' (Scherr et al., 2012; Harvey et al., 2013), apply the principles of integrated landscape management to incorporate climate change adaptation and mitigation goals into multifunctional rural landscapes. Specifically, such approaches seek to increase positive synergies and reduce tradeoffs among stakeholder objectives related to food production, ecosystem conservation, and rural livelihoods. They do so by carrying out landscape-scale planning, policy, land management, or support activities; improving coordination and alignment of activities, policies, and investments among sectors and scales (e.g., ministries, local government entities, farmer and community organizations, and the private sector); and fostering participatory adaptive management processes that build capacity for climate change adaptation (Estrada-Carmona et al., 2014; Milder et al., 2014). In practical terms, climate-smart landscape management may entail activities such as watershed management that links farm and community water harvesting at local scales to water planning and allocation at larger scales. It typically also involves management of diverse land uses, species, and crop and livestock varieties to help build ecosystem resilience and livelihood diversification, thereby reducing vulnerability in the face of environmental variability.

But while the landscape approach has been identified as an important component of CSA, operationalizing it may require land managers, development professionals, policymakers, and rural communities to work in new ways, beyond what has typically been their purview, area of expertise, or frame of reference. New tools can help support this process by clarifying the needs and opportunities for landscape-scale management to help deliver CSA objectives for multiple stakeholders. To this end, the purpose of this study was to develop and test a methodology for assessing the status, needs, and gaps for CSA landscape implementation. In this chapter, we first summarize the assessment method and the process of developing it. We then report results from a field trial of this methodology in a tea-producing landscape around Kericho, Kenya. We conclude with reflections on the utility of the methodology and opportunities to support stakeholders in operationalizing climate-smart landscapes in regions of critical need.

2. Methodology

2.1 Assessment method

The CSA assessment method is a structured tool that guides the collection of information related to six 'domains': on-farm management practices, landscape planning and coordination, energy systems, training and technical assistance, policy support, and technology and information. The tool facilitates systematization of information on these themes by prompting users to develop an inventory and description of current activities in the landscape as well as gaps and opportunities (i.e., potential future activities) related to implementing a climate-smart landscape approach. For current and potential future activities, the implementing actors, indicative costs (when available), and source(s) of

funding are also identified. For potential future activities, users are also prompted to identify the benefits, challenges, and barriers related to implementation, and to define potential supporting actors. The tool organizes and systematizes this information in a series of matrices.

The assessment tool is designed to be applied by multi-stakeholder groups in rural landscapes for the purpose of diagnosing and designing CSA activities, investments, or projects, including both externally funded efforts and community-led initiatives. Data are provided by landscape stakeholders through one-on-one interviews, small focus groups, workshops, or any combination of these. Typically, the assessment process would be facilitated by a community leader, local government entity, researcher, or non-governmental organization (NGO).

2.2 Site description

We field-tested the assessment tool in the tea-growing landscape around Kericho, Kenya (hereafter the "Kericho landscape"). This landscape is a cool, fertile, highlands region of the Rift Valley Province of western Kenya, located just west of the Great Rift Valley (Figure 22.1). The landscape is a mosaic of tea production areas, annual crop parcels producing potatoes, corn, beans, and other crops, small-scale eucalyptus woodlots, forest conservation areas, and urban and rural settlements (Figure 22.2). The landscape's

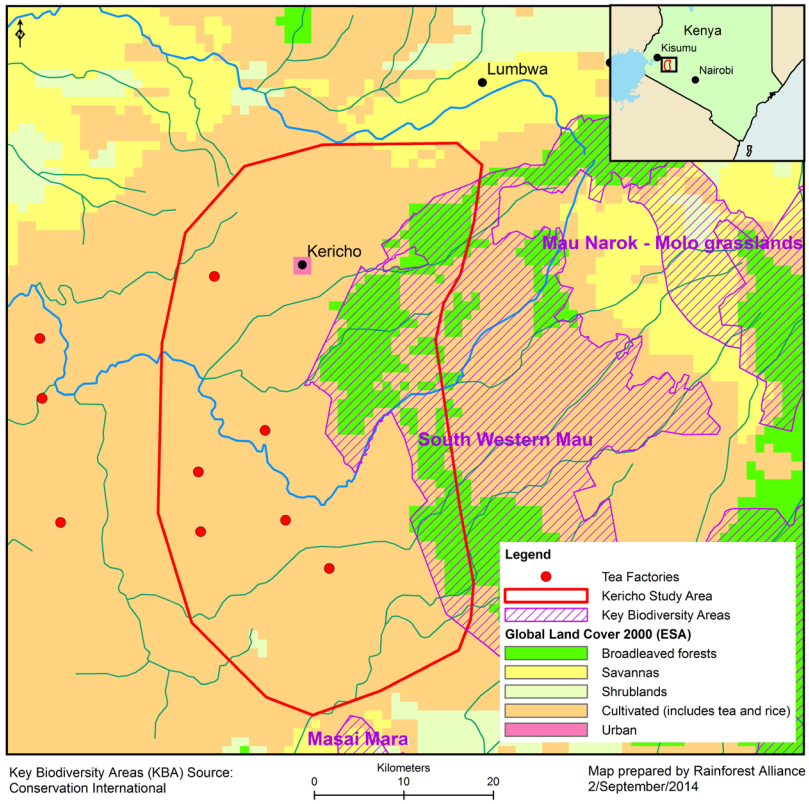

Figure 22.1 Map of the Kericho landscape. The approximate area of the landscape, outlined in red, contains six KTDA tea factories, each with an associated supply-shed of smallholder tea farms.

Figure 22.2 View of the Kericho landscape, which consists of a mosaic of tea production areas, annual crop parcels, eucalyptus woodlots, forest conservation areas, and human settlements.

unifying feature is tea, which is produced by large estates as well as smallholder farmers between the altitudes of approximately 1,800 and 2,200 meters. Smallholder farms are typically less than half a hectare in size, with most of the land planted with tea and usually no more than 20% reserved for food crops. Rural livelihoods reflect the composition of the land-use mosaic, with tea providing a primary income source, through wage labour on large tea estates as well as the sale of smallholder-grown tea. Additional livelihood sources include annual crop production for household consumption or sale in local markets and the sale of eucalyptus trees.

Above the tea-growing zone is the 135,000 hectare Mau forest complex, including the largest closed-canopy forest system in Kenya and the source of water for millions of Kenyans by way of twelve rivers and six major lakes fed by this headwaters area. Kericho County has a population of about 750,000 and covers an area of 247,900 hectares. Kericho town, the area's largest urban centre, has a population of about 100,000 (CRA, 2011). The Mau forest complex has a far lower population density, but is still inhabited by about 35,000 households.

The Kericho landscape is a prime tea producing area for Kenya, which is the world's largest exporter of black tea (Intergovernmental Group on Tea, 2012). As a crop, tea is potentially vulnerable to climate change, and such vulnerabilities are manifest in Kericho. First, the climate has been warming progressively over the past three decades (Omumbo et al., 2011), a trend that is likely to shift the optimal altitudinal band for growing tea and may pose new agronomic challenges or exacerbate existing ones. Second, the landscape is experiencing increased demand for eucalyptus, the preferred fuel source for tea processing, but a notoriously water-intensive species that is competing with tea, subsistence farming and natural forest cover for space in the landscape. Third, the Mau forest has experienced

Box 22.1

Sustainable agriculture certification in the tea sector

The global tea industry is in the midst of a transition to sustainable agriculture certification. In 2007, Unilever announced all Lipton tea-branded products (global market share of roughly 12%) would be entirely sourced from Rainforest Alliance Certified™ farms by 2015. More recently, Tata Global Beverages committed to sourcing all tea for its Tetley brand – another large global brand – from Rainforest Alliance Certified farms by 2016. More broadly, the Ethical Tea Partnership, an alliance of tea packers totalling around 50 brands, is working to improve the sustainability of the tea sector by setting a global sustainability standard and benchmarking it against leading standards such as Fairtrade, Sustainable Agriculture Network / Rainforest Alliance, and UTZ Certified to help reduce costs, avoid duplication, and mainstream sustainable practices throughout the sector.

Commitments from these global brands and alliances have spurred the widespread adoption of improved farming practices in the Kenyan tea industry. Smallholders and estates alike pursue certification to improve social and environmental management practices, increase productivity and product quality, and participate in the burgeoning market for certified tea. Most notably, the Kenya Tea Development Agency (KTDA), in collaboration with Unilever and Rainforest Alliance, has now nearly met its ambitious goal of having all of its factories achieve Rainforest Alliance Certification. KTDA has more than 65 factories sourcing from over 600,000 smallholder farmers. As of April 2014, over 430,000 hectares of tea have been Rainforest Alliance certified in Kenya. On the ground, Rainforest Alliance certification requires farms to adhere to the Sustainable Agriculture Network (SAN) Sustainable Agriculture Standard, which requires improved practices such as conserving and restoring forests, implementing boundary plantings and reforestation with native species, minimizing use of agrochemicals, applying integrated management plans to conserve water and recycle waste, and providing improved working conditions and worker benefits on plantations (SAN, 2010; Ochieng, 2013). Many of the agronomic requirements of the SAN standard are consistent with CSA principles.

extensive deforestation in recent decades, threatening biodiversity and the forest's critical watershed protection function (see Figure 22.1). Collectively, these trends highlight the need for integrated landscape management strategies that consider multiple scales of management and emphasize climate change adaptation.

Numerous actors are taking these challenges seriously and considering how best to respond to climate change and increasing pressure on land, water, and biomass resources to ensure the continued viability of tea production. Among other initiatives, tea producers have obtained Rainforest Alliance certification to gain market recognition for adopting socially and environmentally sustainable practices on their farms (see Box 22.1). In this context, the Kericho landscape provides an excellent setting in which to explore the feasibility of operationalizing CSA at the landscape scale and to apply the assessment method in support of this goal.

2.3 Field-testing the assessment method

We applied the assessment tool in March 2012 through approximately two dozen semi-structured interviews with key landscape stakeholders, in addition to a day-long workshop with a subset of these individuals. Several of these discussions took place during visits to tea farms and processing factories to help triangulate conditions on the ground with

stakeholder knowledge. The involved stakeholders included representatives of private sector tea businesses, government and multilateral agencies, technical assistance providers, and NGOs active in the tea industry. Given that the main purpose of applying this tool in the Kericho landscape was to identify CSA priorities and opportunities for the tea sector, our focus was on stakeholders associated with tea production. Other key landscape actors—such as protected area managers and groups focused on staple crop production—were not directly involved in the assessment.

3. Results

Results of the assessment are organized according to the six climate-smart landscape domains described above. These are summarized in Table 22.1 and discussed further below. For each domain, we characterize existing climate-smart activities as well as key gaps and opportunities identified by stakeholders to improve climate change adaptation and mitigation in the Kericho landscape.

3.1 On-farm management practices

Among tea estates and smallholders, there has already been significant adoption of farming practices that increase productivity, improve water management and drought resistance, and protect and restore native vegetation (Table 22.1). Practices that may especially support CSA include integrated pest management, construction of lagoons and wetlands on farms to increase water storage, conservation of riparian buffers, and improved soil fertility management. These practices are encouraged by voluntary certification programmes and government recommendations alike. In the case of the Sustainable Agriculture Network (SAN) Standard, certification is a whole-farm approach, such that CSA practices are applied not only to tea production areas but also to food crop parcels and conservation areas. Several local tea estates have begun implementing additional climate change adaptation and mitigation practices identified in the SAN Climate Module, a voluntary add-on to the basic SAN standard (SAN, 2011). Extension services that promote CSA practices to tea smallholders are delivered through multiple channels, typically in the context of KTDA supply-sheds, and are supported by tea-buying companies, donors, and other actors.

Gaps and opportunities: Stakeholders believed that the existing suite of climate-smart farming practices being adopted and promoted in the landscape was appropriate; therefore, the primary identified need was to scale up adoption. Doing so will require addressing barriers to adoption through additional farmer training and technical assistance, information dissemination, and efforts to improve the effectiveness and profitability of CSA practices. Stakeholders also identified the need for improved tea varieties that are likely to thrive under future climatic conditions. The Tea Research Foundation of Kenya and several private companies are developing drought resistant clonal tea varieties, but further research, pilot-testing, and dissemination efforts will be needed before such varieties can become widely available to smallholders.

3.2 Landscape planning and coordination

Due to the scale and clout of the tea industry in Kenya, as well as the national and international importance of the Mau Forest complex, the Kericho landscape is the subject of several efforts to foster cross-scale coordination, decision-making, and synergistic

Table 22.1 Highlights of results of the climate-smart landscape assessment process in each of the six activity domains. In each domain, stakeholders identified existing climate-smart agriculture (CSA) activities in the Kericho landscape as well as key opportunities and gaps ('potential activities') to support CSA in the future.

Current activities	Potential activities
On-farm management practices	
On-farm agricultural production practices, including: • Planting of trees on farms, including native species • More efficient and targeted use of fertilizers based on regular nutrient analyses • Integrated Pest Management practices • Tea bush infilling to increase productivity and reduce erosion risk • Tea plucking at more frequent intervals to increase productivity and quality	Continue and expand current practices on estates and small farms (scaling-up improved practices) Analyze economic opportunities and tradeoffs for smallholders to transition from seedling tea to drought-resistant clonal varieties
Ecosystem conservation on, and adjacent to, farms: • Protection of riparian buffers • Protection of forest reserves on farms, particularly adjacent to the Mau forest • Construction of lagoons and wetlands for water conservation and water quality	

Current activities	Potential activities
Landscape planning and coordination	
Climate Change Adaptation Working Group convenes tea companies, KTDA, FAO, government ministries, and NGOs to coordinate industry-wide to address climate change KTDA and the Tea Board of Kenya help align NGO activities so that they can be implemented across all factories in an area to improve service delivery	Strengthen the landscape planning and coordination functions of the Climate Change Adaptation Working Group Conduct feasibility assessment for a landscape label for Kericho products and for value-added processing businesses based in the landscape Coordinate tea industry efforts with Mau Forest protection and restoration efforts Establish a pre-competitive community of practice to share knowledge, experience, and best practices for climate-smart tea production
Energy systems	
Limited implementation of energy efficiency technologies in tea facilities, including: • Energy efficient dryers, graters, cyclones and other machinery • Solarwall technology that pre-heats boiler intake air and reduces fuelwood demand • High efficiency, triple pass boilers for tea processing • Infrared drying for tea processing Improved cookstoves for smallholders to reduce fuelwood consumption and improve indoor air quality	Improve management of eucalyptus woodlots by introducing longer rotation periods combined with periodic thinning and coppicing Conduct research to clarify optimal scenarios for smallholder eucalyptus production, considering both vegetative propagation techniques and superior seed sources Conduct energy audits of tea factories to identify hotspots of energy use and emissions and prescribe appropriate technologies to improve efficiency Evaluate water conserving fuelwood alternatives to eucalyptus Introduce Forest Stewardship Council management principles and certification to improve eucalyptus management Reduce wood demand through improved fuelwood storage methods and alternative materials for transport pallets

Current activities	Potential activities
Training and technical assistance	
Smallholder training on sustainable agriculture delivered by the Rainforest Alliance and partners in the context of SAN/Rainforest Alliance certification, and coordinated by KTDA at the factory level	Expand current successful programmes to reach additional farmers, support continuous improvement, and incorporate climate change themes more strongly into existing programmes
Smallholder training offered by tea companies, NGOs, and the Tea Research Foundation of Kenya on sustainable agriculture practices, product quality, and climate change adaptation	Expand and strengthen existing technology transfer between company tea estates and KTDA smallholders to promote improved practices and higher productivity and quality of smallholder-grown tea (some of which is purchased by company-owned factories)
Policy support	
Agriculture Sector Reform will establish tea industry development funds and dispute resolution mechanisms	Through the authority of the Tea Board of Kenya, establish regulations or economic incentives for the tea industry to adopt climate-smart practices and support climate-smart landscape initiatives
Kenya's National Climate Change Response Strategy includes plans for adaptation and mitigation in agriculture, including the tea industry	Strengthen engagement of tea industry actors in climate change policymaking at the national and international level
FAO is supporting a national programme to promote CSA in the tea industry	Strengthen alignment of CSA investments between the public and private sectors; for instance, establish a coordination mechanism to blend investment across different time horizons or activities to cover smallholder transition costs to adopt improved practices
Technology and information	
Research organizations and tea companies are developing drought- and frost-tolerant clonal tea bushes	Incorporate newly improved climate change models to guide tea planting decisions; for instance, revise the 'brown line' designations established by the tea industry to delineate where tea should and should not be planted, in consideration of potential climate changes
Companies are developing early warning systems to prepare for extreme weather events	Develop new technologies and management systems to improve yields and water efficiency of fuelwood production
Several local actors are collecting temperature and precipitation data to guide agricultural management decisions	
The Tea Research Foundation of Kenya advances a tea research program, including on CSA topics	

landscape management. The tea industry has worked proactively to address the potential effects of climate change. For instance, the Tea Board of Kenya has established a Climate Change Adaptation Working Group, which convenes the multinational tea companies, KTDA, relevant government ministries, the Kenya office of the UN Food and Agriculture Organization (FAO), the Ethical Tea Partnership, and NGOs such as the Rainforest Alliance. The working group addresses shared priorities including the assessment of potential climate change impacts on the sector and coordination of industry responses to climate change. Additionally, the entire tea industry has prioritized the sustainable management of fuelwood resources. At a local level, KTDA coordinates farmer field schools to support groups of smallholders within a catchment or other geographic area to conduct participatory assessments of priority issues and then receive training on these topics. The process can be slow-moving, and KTDA needs additional capacity to implement it effectively, but stakeholders report that the participatory process promotes commitment and follow-up among farmers.

Gaps and opportunities: To date, the proliferation of initiatives related to sustainable tea production has been coordinated only to a very limited degree. Similarly, there are nascent efforts toward landscape-level coordination in the Kericho landscape, but key stakeholder commitments and appropriate institutions to support such collaboration are mostly lacking. Stakeholders identified the Climate Change Adaptation Working Group as a promising platform, which, with additional resources and facilitation, could address landscape-scale issues that no single actor can effectively solve, such as water conservation, fuelwood management, and ecosystem-based adaptation. Other platforms for pre-competitive collaboration may also be needed, particularly to share knowledge and experience, best farming practices, and new technologies related to climate change adaptation. A more innovative opportunity identified through the assessment was to create a 'landscape label' (see Ghazoul et al., 2009) for the Kericho landscape to recognize tea produced in ways that are climate-smart and protective of the landscape's forests. Building on current acceptance of certification, this approach could provide additional market incentives to support CSA investment in the Kericho landscape.

3.3 Energy systems

Stakeholders emphasized that the sustainability of wood supplies to fuel the tea drying process is one of the most urgent issues facing Kenya's tea industry. For every three hectares of tea fields, roughly one hectare of high calorific value fuelwood (such as eucalyptus) is required as energy for tea drying. Currently, the majority of fuelwood used for drying in the KTDA factories in the Kericho landscape is sourced from off-farm. In the absence of strong governance of forest resources, this demand can contribute to deforestation and forest degradation, leading to greenhouse gas emissions, a priority concern identified under Kenya's Reducing Emissions from Deforestation and Forest Degradation (REDD)+ Readiness Preparation Proposal (KFS, 2010).

In response to these challenges, tea industry stakeholders have begun pursuing new alternatives that could reduce energy needs and help conserve natural forests. Local companies are experimenting with a variety of energy efficiency innovations (Table 22.1). Recognizing that domestic cooking is another major use of fuelwood in the landscape, several organizations are also supporting efficient cookstoves for smallholder households.

Gaps and opportunities: Stakeholders noted that all of the energy efficiency technologies now being promoted locally have the potential to be scaled up. For energy-efficient tea drying systems, investment cost is a major barrier. For cookstoves, access and knowledge are key challenges, but could be addressed, in part, through more intensive outreach to women's groups and cooperatives. Beyond energy efficiency initiatives, stakeholders suggested that local wood demand could be reduced through improved storage (to prevent wood dampening) and by substituting alternative materials for wood transport pallets. On the supply side, improved management of both natural forests and exotic tree plantations is critically needed. Such improvements will require action on the part of forestry technical assistance providers, multinational estates (through the development and implementation of forest management plans), the Kenya Forest Service, and the Kenya Forestry Research Institute. More sustainable management of forest resources may entail, for instance, longer rotation periods for eucalyptus woodlots combined with periodic thinning and coppicing. Stakeholders identified the Forest Stewardship Council certification system as a potentially promising framework for defining best management principles to improve forest productivity and conservation values.

3.4 Farmer training and technical assistance

Currently, smallholder training and technical assistance is delivered through methods such as farmer field schools (FFS) and lead farmer/model farmer systems, both designed to reach large numbers of farmers. The KTDA, local partners and the Rainforest Alliance coordinate closely to provide farmer training on sustainable tea production, particularly for smallholders. This training takes a whole-farm perspective, considering not only the tea crop but also food crops and trees on smallholder farms. Many other actors also provide farmer training in support of CSA, including larger tea estates (e.g., James Finlay, George Williamson) with their smallholder outgrowers. KTDA coordinates technical assistance programmes for smallholders by working through existing tea factory organizational structures on agricultural and non-agricultural topics identified by the farmers such as crop diversification, productivity improvements, shade planting, livestock management, education, and health. Other programmes on sustainable agriculture, product quality, and climate change adaptation and mitigation are offered by a combination of private consultants, NGOs, and research institutions such as the Tea Research Foundation of Kenya. Collectively, these programmes have already delivered foundational training on sustainable agricultural practices to over 250,000 smallholder tea farmers in the Kericho landscape.

Gaps and opportunities: Despite the major training accomplishments to date, smallholders still apply climate-smart practices at a far lower rate than tea estates, and commonly achieve tea yields of only one-third of those achieved on the estates. Many smallholders are still not aware of the potential impacts of climate change on tea production, or of the actions they can take to support long-term productivity in a changing climate. Recognizing these challenges, stakeholders identified scaling-up smallholder training to reach all farmers as a top priority, but noted that funding and capacity limitations have constrained these efforts. Stakeholders also suggested that the KTDA training programme could include climate change adaptation and mitigation themes more explicitly, including information on emerging best practices and technologies to ensure that there is not a lag in

reaching smallholders with these innovations. Participatory climate adaptation planning, which is required under the SAN Climate Module and also promoted by KTDA, was seen as a useful means for farmers to pro-actively identify climate change vulnerabilities and define actions and training needs to address them.

3.5 Policy support

Kenyan agricultural and climate change policy affecting the tea sector has been developed largely at the national level. As part of Kenya's Vision 2030 development planning process (GoK, 2007), the country has developed an Agriculture Sector Reform Bill that earmarks tea industry development funds and establishes dispute resolution mechanisms. Kenya's National Climate Change Response Strategy (GoK, 2010) and companion Action Plan (GoK, 2013) include agriculture as part of a broad plan to integrate climate change adaptation and mitigation measures into all government planning, budgeting and development objectives. However, the funding and implementation mechanisms remain unclear. Simultaneously, FAO is helping to develop a national programme to support CSA in the tea industry. Finally, the Tea Board of Kenya establishes regulations with which the KTDA and estates must comply. Current regulations do not explicitly address climate change, but the Board has considered new regulations for tea farming that would improve adaptive capacity and help reduce greenhouse gas emissions.

Gaps and opportunities: Stakeholders highlighted the opportunity to support CSA in the tea sector through targeted national policies, regulations, and industry standards. For example, minimum energy efficiency requirements for factory processing equipment could reduce costs, greenhouse gas emissions, and pressure on natural and planted forests. Regulation could also address on-farm management to ensure that recognized best practices for adaptation in the tea industry are operationalized, including best practices for fuelwood management and use. Stakeholders also noted that the tea industry could be more proactive in climate change policy-making processes at the national and international level, including in REDD+ discussions, which are relevant for the Kericho landscape and its bordering forests.

3.6 Technology and information

The sensitivity of tea productivity and quality to climate change has motivated the tea industry to develop new tea varieties, collect critical climate data, and identify best practices for adapting tea production systems to climate change. Much of the tea-related research in Kenya is conducted by multinational companies and by the Tea Research Foundation of Kenya. The latter, for instance, is breeding drought-tolerant tea varieties and collecting temperature and precipitation data in tea zones. The tea companies collect their own data on local climate and biodiversity, and have worked on early warning systems to prepare for extreme weather events. The Tea Research Foundation of Kenya organizes a quarterly tea industry stakeholder forum to disseminate research results and guide future research agendas through a multi-stakeholder advisory board.

Gaps and opportunities: Although important developments are being made in technology and research to support CSA in the Kericho landscape, stakeholders identified a long list of additional needs. Key among these was the need to localize climate change data and innovative CSA strategies to the local context. A top priority, for instance, is to use the latest climate change models to revise the 'brown lines' established by the tea industry to delineate where tea should and should not be planted. New technology is also needed

to devise solutions to the landscape's fuelwood constraints. For instance, stakeholders suggested that vegetative propagation techniques could help increase eucalyptus yields, or more water-efficient alternatives to eucalyptus could be sought.

4. Discussion

4.1 CSA in the Kericho landscape

The assessment process revealed that numerous CSA activities are already ongoing in the Kericho landscape, and several institutions are active in seeking solutions to climate-related challenges. However, the assessment also identified significant gaps and needs, particularly related to building capacity and mainstreaming climate-smart practices among smallholders and to addressing fuelwood energy needs and associated deforestation. In addition, stakeholders recognized the need for improved coordination of the proliferation of initiatives around tea sustainability to achieve greater impact. The assessment revealed that the Kericho landscape has an important advantage in this regard in that substantial elements of a coordination framework are already in place due to a strong and relatively consolidated tea industry. There also appears to be significant capacity and commitment by some industry actors to support not only those climate-smart activities that will provide direct benefits to them, but also those that will benefit the wider landscape and its communities. These types of commitments—such as investments in improved cookstoves for smallholders, research on climate-resilient tea varieties and cultivation practices, and efforts to mitigate the landscape-wide fuelwood shortage—stem from an awareness of the collective nature of both the problems and potential solutions related to natural resource limitations and climate change.

Our focus for this study was on the stakeholders in the Kericho landscape most closely related to the tea industry. Stakeholders related to the Mau Forest were underrepresented in the assessment process, though recognized as important actors in the landscape. A next step to address more comprehensively the context and needs for CSA in the Kericho landscape would be to expand the assessment to incorporate perspectives from these stakeholder groups.

4.2 An assessment tool to support CSA

The field-test of the assessment tool highlights the benefit of taking a structured approach to CSA assessment and planning. Specifically, given that CSA and climate-smart landscapes are construed as depending on multiple interacting social, ecological, and agronomic systems, it is helpful to characterize these elements systematically to understand the context for CSA as holistically as possible. An inclusive, stakeholder-centric approach is essential, as knowledge on these different components resides with diverse individuals and institutions within a landscape. The assessment tool, developed and tested here, is quite simple and could be applied or adapted by local NGOs, government agencies, or community groups as the first step in planning for a set of CSA projects or initiatives. We estimate that the application of this tool in the Kericho landscape cost between US $20,000 and $30,000 inclusive of personnel, international and local travel, and other expenses for the in-person interviews and workshop, data analysis and systematization, and development of a synthesis report. The modest cost suggests that multi-stakeholder assessments for climate-smart landscape development should be widely feasible to implement in the places where they are warranted.

4.3 Implications for CSA finance and policy

As illustrated through the assessment process, CSA investments are being supported by a wide range of stakeholders, from private industry to individual smallholder farmers to government and civil society actors. Major tea industry actors have already invested significantly in CSA in Kenya and appear poised to invest further to address critical natural resource- and climate-related challenges that could pose substantial business risks. Small-scale farmers have exhibited interest and some ability to invest in CSA practices, but access to affordable capital remains a significant barrier. Finance constraints are likely to be greater for investments with a longer payoff window, such as tea bush renovation. These observations point to ways in which national and international 'climate finance' streams might best be targeted to fill critical gaps in the existing mosaic of resources being deployed to support CSA. Of the many potential investments that stakeholders identified across the six domains, landscape planning and coordination efforts may be among the most strategic, potentially requiring modest investment while helping to leverage existing activities and investments across the landscape to greater effect.

4.4 Conclusion

Effective implementation of CSA often requires an integrated landscape management strategy that synergistically combines a diversity of land uses and economic activities. The Kericho landscape was a useful case for considering how local stakeholders could play an active role in assessing and defining a holistic programme of CSA investment within a priority landscape. Research and planning tools, such as the one developed for this study, provide a framework for landscape stakeholders to identify the concrete steps that can move them toward a climate-smart landscape. Such tools should continue to be refined, and, as more landscapes begin to plan and implement climate-smart activities, experiences from using them should be documented systematically and shared widely to support the mainstream practice of climate-smart agriculture.

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