

Reconciling forest conservation with food production in sub-Saharan Africa

Case studies from Ethiopia, Ghana and Tanzania

Phil Franks, Xiaoting Hou-Jones, Daniel Fikreyesus, Messay Sintayehu, Simret Mamuye, Elijah Yaw Danso, Charles K. Meshack, Iain McNicol and Arnout van Soesbergen



About the authors

Lead authors: Phil Franks* and Xiaoting Hou-Jones, IIED

Ethiopia section: Daniel Fikreyesus, Messay Sintayehu and Simret Mamuye, Echnoserve

Ghana section: Elijah Yaw Danso, PAB Development Consultants

Tanzania section: Charles, K Meshack, Tanzania Forest Conservation Group

Spatial mapping: Iain McNicol, University of Edinburgh, and Arnout van Soesbergen, United Nations Environment Programme World Conservation Monitoring Centre

*Corresponding author email

Phil Franks, IIED: phil.franks@iied.org

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International Institute for Environment and Development
80-86 Gray's Inn Road, London WC1X 8NH, UK

Tel: +44 (0)20 3463 7399

Fax: +44 (0)20 3514 9055

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Cover photos: Women harvest their rice crop in Mecehuri Forest Reserve, Mozambique (Credit: Mike Goldwater 2010)



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Executive summary

The area of land covered by natural forests, or by woodlands classified as forests, in sub-Saharan Africa (SSA) declined by nearly 10 per cent between 2000 and 2010. Three quarters of this decline was caused by forest conversion for agriculture, largely to serve rapidly growing domestic food demand. The escalation in food demand is due to the combined effects of population growth – which is considerably more rapid in SSA than in other world regions – and changing consumption patterns as a result of the high rates of economic growth achieved in many countries in SSA.

Focusing on major cereal crops in Ethiopia, Ghana and Tanzania, this report examines the trade-offs between food production and the conservation of natural forests, and how these trade-offs might be better managed in SSA. The research, conducted over 12 months in partnership with national consultants, involved a review of relevant documents, interviews with key informants, and stakeholder workshops to validate findings. Among other things, the report examines agricultural, forest, biodiversity, land-use and other policies in the three case-study countries and, in each, it identifies challenges and opportunities for reconciling food production and forest conservation goals.

Total demand for cereals in SSA is projected to increase by 127 per cent between 2010 and 2050, although this might be an underestimate. Most countries in SSA aim to boost agricultural production through ‘sustainable intensification’ (increased production per unit area) achieved by technological improvements and many have also committed to reducing deforestation. But cereal crop yields are expected to continue increasing only slowly, with massive investment needed in, for example, irrigation, supply chains, extension services and climate-change adaptation, which is likely to be forthcoming only gradually. This, combined with historical trends in SSA, suggests that agricultural expansion is likely to continue at rates well above those proposed in existing national forest, biodiversity and climate change policies and related strategies, including within the three case-study countries. This implies the existence of disconnects between policies on food production and forest conservation, a hypothesis explored in our case studies.

Ethiopia

Agricultural expansion is the most significant driver of deforestation and biodiversity loss in Ethiopia. Domestic cereal production increased by 249 per cent in the 20 years prior to 2014; although crop yields more than doubled, there was also an 88 per cent increase in production area.

Ethiopia's domestic demand for cereals is projected to increase by 162 per cent from 2010 to 2050, although this might be an underestimate. According to Ethiopia's Climate-Resilient Green Economy strategy, agricultural land will need to expand by 3.9 per cent (550,000 hectares) per year (in addition to yield increases) to achieve growth targets for the agriculture sector. In a business-as-usual scenario, 55 per cent of this expansion could be at the expense of forests and associated biodiversity and ecosystem services.

Ghana

At about 2 per cent per year, Ghana's deforestation rate is one of the highest in Africa. Remnant forests outside gazetted forest reserves are likely to be completely lost by 2025, with forest reserves coming under increasing pressure. The expansion of commodity crops such as cocoa, other tree-crop systems and food-crop farming is causing an estimated 50 per cent of Ghana's deforestation and forest degradation.

Ghana's domestic demand for cereals is projected to increase by 171 per cent from 2010 to 2050, although this might be an underestimate. Food-crop yields are likely to continue increasing at only a slow pace. An estimated 14 million hectares is considered agricultural land, of which only 56 per cent is under cultivation. The majority of additional land suitable for agriculture is forested, suggesting a potential conflict between increased food-crop production and forest and biodiversity conservation. Even though maize is the fastest expanding crop and is commonly grown in forest areas, the impact of this expansion on forests and biodiversity is poorly understood.

Tanzania

Agricultural expansion for crops and livestock is generally considered the main underlying driver of deforestation in Tanzania (energy is also a major issue, but the loss of forest for woodfuel is driven partly by agricultural expansion). The country's demand for cereals is projected to increase by 150 per cent from 2010 to 2050, although this might be an underestimate. About half of Tanzania's land area (44 million hectares) is considered arable, and about half of that (22 million hectares) is under cultivation. However, some of the ostensibly arable land is only marginally suitable for agricultural production due to factors such as soil infertility, soil erosion, degradation and drought. Moreover, large areas of land suitable for food-crop cultivation overlap with forests.

Discussion

Despite yield increases, the area of agricultural land is expanding in all three case-study countries to meet fast-growing food demand. Further expansion seems inevitable, given that agricultural policies within the three countries aim to ensure domestic food security and increased production for export. Each of the three countries is developing and

implementing policies and programmes to reduce and reverse deforestation, including REDD+. Ethiopia and Ghana have targets to dramatically reduce deforestation and biodiversity loss, and all three countries have ambitious goals for increasing forest cover.

This study therefore confirms the hypothesis that significant disconnects exist in the three case-study countries between agricultural and forest policies and their supporting strategies. It also confirms that an underestimation of risks and trade-offs is behind many of these policy disconnects, and this is likely to also be the case in other countries in SSA. If targets to reduce and reverse deforestation remain in place, agricultural and forest policies could be on a collision course, with serious implications for food self-sufficiency objectives and forest conservation. Challenges and opportunities for reducing and eliminating disconnects between food-production and forest-conservation goals include the following:

Sectoral silos

Sectoral ministries in all three countries promote their mandates, but mechanisms to align these mandates have often been weak and in implementation political pressures sometimes take precedence over evidence-based advice. All three countries are making efforts to establish effective cross-sectoral organisational arrangements to dissolve sectoral silos and support more coherent land-use policies and planning.

Scale disconnects

Discrepancies exist at various scales (eg national, subnational and local) in the capacities, responsibilities and priorities of key stakeholders in making and implementing land-use decisions. For example, there may be:

- Mismatches in priorities at different scales,
- Misalignment in the allocation of sectoral responsibilities between national and lower levels of governance, and
- Mismatches between responsibilities and resource distribution across scales.

Information gaps

In some cases, information necessary for the effective management of risks and trade-offs (eg spatial data on deforestation and threats to biodiversity) exists but is publicly unavailable; in other cases this information is lacking.

Funding constraints

Many SSA countries face serious budgetary constraints in putting sound policies into effect. In the three case-study countries, local governments are often responsible for implementing land-use policies but lack adequate budgetary support from central governments to do so.

Narrative of vacant or underused land

In all three case-study countries, there is a perception among key decision-makers that large tracts of vacant or underused land exist that are available for agriculture, plantation forestry and forest restoration. This narrative has a strong influence on policy and strategy development as well as land-use planning processes. There are clear indications, however, that estimates of vacant or underused land are overly optimistic in all three countries.

Land-use planning

Opportunities are emerging in all three case-study countries for participatory and cross-sectoral land-use planning processes. Ethiopia is embarking on a major programme to support land-use planning from the village to national scale. Ghana has a new law requiring district governments to have land-use plans, and its REDD+ strategy calls for a holistic and effective national land-use plan. Tanzania has rich experience in village-level land-use planning and an emerging national process that can build on that.

Political support for forest and biodiversity conservation

In all three countries, conservation organisations express concern over what they see as weak political support for biodiversity conservation compared with the strength of commitment to agricultural development. Some stakeholders framed this concern as an underestimate of the true value of forests to national economies. In all three countries, however, growing political commitment to the climate change agenda and associated increases in forest investment – notably through REDD+ – present good opportunities for forestry and biodiversity conservation.

Conclusion

The question of how to reconcile the demands of food production and forest conservation in the three case-study countries reflects tensions between some of the Sustainable Development Goals (SDGs) adopted by the United Nations, such as those addressing food security (SDG2) and forests and biodiversity (SDG15). Disconnects exist within and between sectoral policies and strategies and at different levels of governance, from local to global. Forest and biodiversity policymakers and key stakeholders appear to underestimate the extent to which natural forests in SSA could be lost to agricultural expansion in meeting growing food demand. Conversely, commitments to conserve natural forests could constrain certain agricultural development options as resource competition intensifies.

The political and economic forces in the food system are far stronger than those in the forest sector and are therefore likely to prevail in business-as-usual scenarios. Nevertheless, viable alternatives to such scenarios exist in which the better management of risks and trade-offs enables more informed decisions on where and how to intensify agriculture and which forest areas to lose, conserve and restore, thereby reducing the loss of natural forests and helping maintain crucial forest ecosystem services.

1

Introduction

Drawing on case studies in Ethiopia, Ghana and Tanzania, this report examines the trade-offs between efforts to increase food production (in order to achieve and surpass food security goals) and forest conservation, and how these might be better managed in sub-Saharan Africa (SSA). In terms of the Sustainable Development Goals (SDGs), this is about the potential tensions between SDG2 and SDG15. Food security – one of the subjects of SDG2 – has four key elements: availability, access, utilisation and stability. This report addresses the element of availability, which depends on production, stocks, trade and food waste. The focus is on cereals (maize, sorghum, millet, rice, wheat and barley, as well as teff in Ethiopia) as the most important group of staple crops for overall food production and agricultural expansion in SSA.

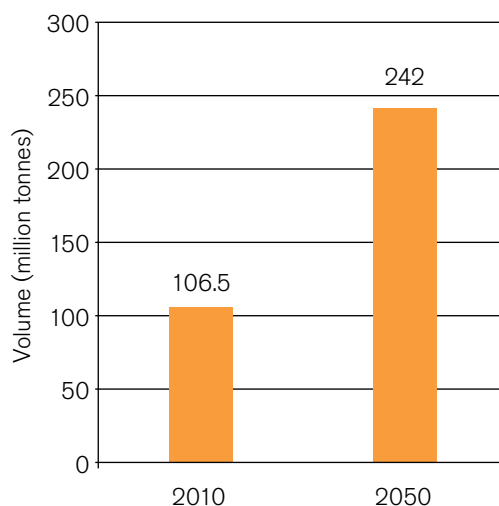
SDG 2: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.

SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss.

Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 1996).

The International Food Policy Research Institute (IFPRI) IMPACT model predicts that total demand for cereals in SSA will be 2.27 times (127 per cent) higher in 2050 than in 2010 (Figure 1) (Thomas, forthcoming). This may be an underestimate, however, because it assumes a population in SSA of 1.7 billion people in 2050, which is 0.4 billion fewer than projected by the United Nations (UN, 2015). The escalation in food demand is due to the combined effects of population growth – which is considerably more rapid in SSA than in other world regions – and changing consumption patterns as a result of the high rates of economic growth achieved in many countries in SSA.

Figure 1. Cereal consumption in SSA, 2010 and 2050 (projected)



Source: Thomas (forthcoming)

Reducing food waste

Food supply can be boosted by reducing losses before and after harvesting and in processing, distribution and consumption – although food losses are already lower in SSA than in any other region. There is the potential to reduce pre- and post-harvest losses, but it seems likely that such gains would be offset by increased losses in processing, distribution and consumption as food supply chains become longer, resulting in more waste (FAO, 2011).

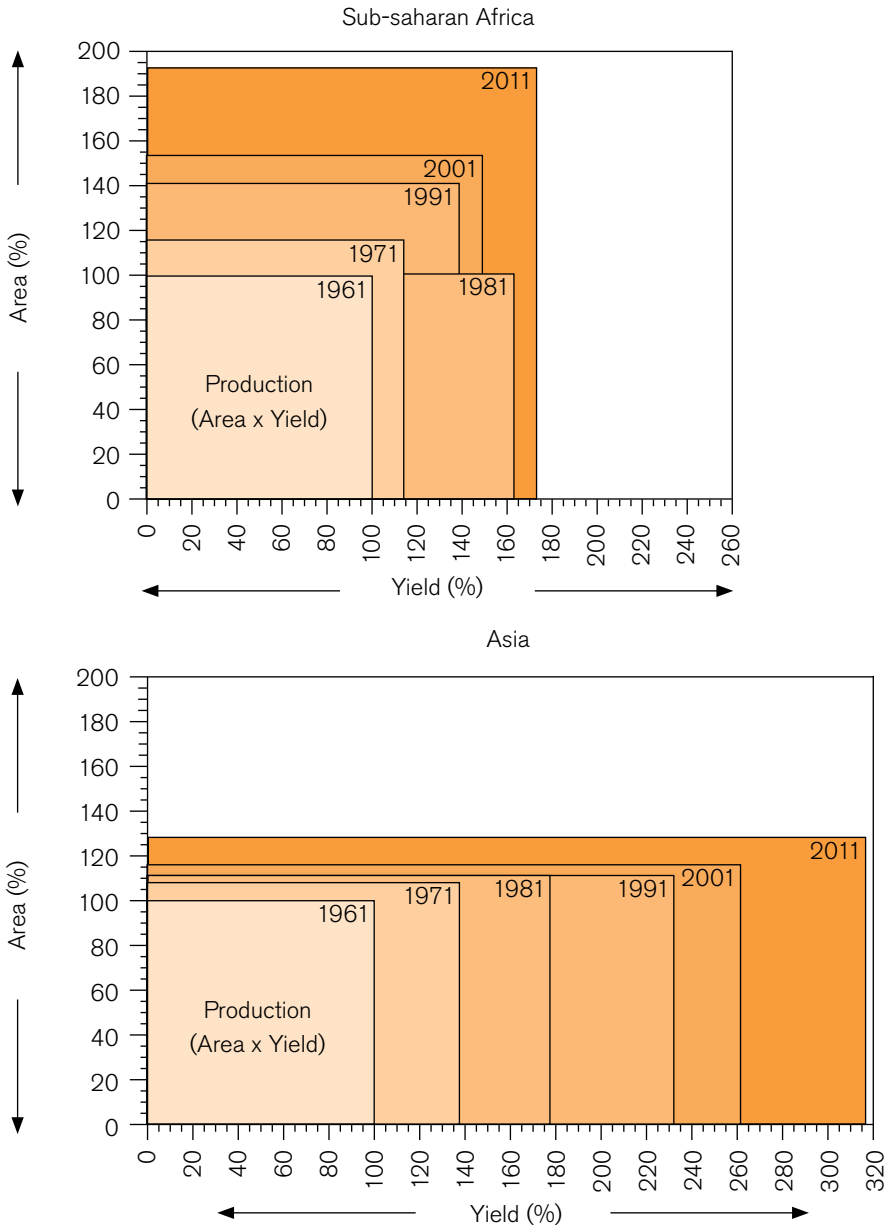
Increasing food imports

In the wake of the food price shocks felt in 2008 and 2009, which caused food insecurity and riots in some countries, few countries want to be dependent on imports and more exposed to fluctuations in global prices. For this and other reasons, such as a desire to reduce trade deficits and the cost of transport, many countries in SSA are aiming for at least self-sufficiency in primary staple food crops. Nevertheless, some analysts contend that national food self-sufficiency is unrealistic given the scale of projected demand growth in the region and the likely impacts of climate change.

Increasing crop yields

Historically, SSA has seen increased food-crop production from increasing cropped area than by increasing yield per unit area. This is in contrast to Asia, where almost all the increase in cereal (mainly rice) production has been achieved by increasing crop yields (Figure 2).

Figure 2. Changes in cereal production due to changing yield and area, SSA and Asia



Source: Jones and Franks (2015)

Most countries in SSA have ambitious plans to boost agricultural production through 'sustainable intensification' – that is, increased production per unit area. They aim to do this with technological improvements, including larger-scale mechanisation. Inherent in this strategy are a number of assumptions with varying risks, and there are also risks associated with factors beyond the control of farmers and policymakers, such as climate change and the volatility of food commodity prices.

Increasing pressure on forests due to food-crop area expansion

The area of land covered by natural forests, or by woodlands classified as forests, in SSA declined by 9.5 per cent between 2000 and 2010 (WDI, 2016), of which an estimated 75 per cent was due to conversion for agriculture (Hosonuma *et al.*, 2012). In SSA, a large part of forest conversion is for small-scale food-crop production; in contrast, large-scale commercial farming is the main driver in Latin America, notably for cattle ranching and soy production (Kissinger *et al.*, 2012).

Many countries in SSA are making ambitious commitments to reduce deforestation. As signatories to the New York Declaration on Forests, seven SSA countries and Nigeria's Cross River State have committed to eliminate deforestation in their territories by 2030, and 19 SSA countries are participants in REDD+ initiatives.¹ Many REDD+ countries place strong emphasis on sustainable agricultural intensification as a strategy for reducing the conversion of forests to agriculture.

A substantial increase in crop yields is a necessary but by no means sufficient condition for eliminating deforestation. Measures to protect existing forest areas must also be strengthened, especially in light of the risk of the 'Jevons paradox' (see box), in which agricultural intensification achieves the opposite of the intended impact (Byerlee *et al.*, 2012).

The **Jevons paradox** occurs when efforts to intensify the efficiency of using one resource – in this case agricultural land – to reduce demand for another – in this case forest land – have the reverse effect, because increased efficiency results in higher profits and therefore an incentive to use more, rather than less, of the resource.

¹ REDD+ is the term given to the efforts of countries to reduce emissions from deforestation and forest degradation and foster conservation, sustainable management of forests, and enhancement of forest carbon stocks. For more information see: www.forestcarbonpartnership.org/what-redd.

Purpose of this study

The analysis summarised above² suggests that the rapid loss of natural forests and woodlands in SSA has been due largely to smallholder farmers expanding the area of food-crop production, particularly cereal crop production. Historical trends suggest that the expansion is likely to continue at rates well above those proposed in existing national forest, biodiversity and climate-change policies and strategies. In some cases, there already appear to be significant disconnects among such policies and strategies. In other cases, although policies and strategies seem well aligned, disconnects between policy and practice could emerge over time if implementation fails to meet expectations.

A **disconnect** is a discrepancy or lack of connection within or between policies, strategies, plans, institutions and processes.

This report examines the situation in three countries — Ethiopia, Ghana and Tanzania — as case studies with the aim of increasing understanding of the nature of the disconnects: why they exist and persist and the challenges to, and opportunities for, reducing them (Table 1). The research is designed to help government agencies and other key actors in civil society and the private sector in the case study countries in making informed decisions in relevant policy, strategy development and planning processes. Although, in some instances, the report proposes possible responses, it does not make specific recommendations. Strategies and actions for addressing disconnects in policy and practice must emerge among key national stakeholders to ensure their appropriateness to the national context and to obtain the political support necessary for effective implementation.

² See also Jones and Franks (2015).

Table 1. Key facts on food and forests, Ethiopia, Ghana and Tanzania

		Ethiopia	Ghana	Tanzania
	Economic growth (% increase in gross domestic product, 2014)	11	7	7
Population	Population, 2015 (millions)	99.4	27.4	53.5
	Population density, 2015 (people per hectare)	0.89	1.14	0.60
	Projected population change, 2015–50 (%)	189	182	156
	Population in urban areas, 2015 (% of total population)	19.4	54.0	31.6
Domestic food demand	Key staple food crops	Cereals (teff, wheat, maize, sorghum and barley)	Cereals (mainly maize), roots and tubers	Maize, followed by rice, beans, cassava, sorghum and wheat
	Projected domestic increase in cereal demand, 2010–50 (%)	162 (2.62x)	171 (2.71x)	150 (2.5x)
Land use	Total land area (million hectares)	112	24	89
	Agricultural land (% of total)	15.2	32.8	11.4
	Cereal (% of total)	9.3	6.8	7.2
	Forest (% of total)	15.5	37.0	53.9

2

Methodology

The study is framed by the following five research questions:

- 1) How is forest defined and what is the current status of forests?
- 2) How has the area of food-crop production and forests changed over time, and what have been the main causes of these changes?
- 3) What likely future trends in domestic food demand and food production will drive deforestation over the next 35 years and what are the implications for forest conservation?
- 4) What policies, laws, regulations, institutional and governance arrangements and processes influence planning and decision making on agricultural expansion and its impacts on forests?
- 5) What are the key challenges to, and opportunities for, better reconciling the goals of food production and forest conservation?

Questions 1–4 address the first part of the study's objective (better understanding the disconnects and why they exist and persist) and question 5 addresses the second part (challenges to, and opportunities for, reducing the disconnects). Whilst addressing these questions for each of the three case-study countries, we look at social, political, economic and technical dimensions, drawing on elements of political economy analysis.

A **trade-off** is a compromise between two desirable but to some extent incompatible objectives: that is, achieving more of objective A means achieving less of objective B.

The report emphasises two issues identified in our initial analysis as key causes of disconnects in the context of competition between growing food and conserving forests in SSA:

- 1) Two types of unrecognised or underestimated **risk factors**: a) risk factors associated with the performance of key interventions that are largely under the control of a country (eg access to key inputs and markets for products) and b) risk factors lying beyond the influence of a country, notably those associated with climate change.
- 2) Unrecognised or underestimated **trade-offs** between objectives.

The following methods were used to address the five research questions:

- Review of relevant documents (questions 1–4)
- Key informant interviews (question 5 and filling in gaps in findings on questions 1–4), and
- Stakeholder workshop to validate findings for questions 1–4 and to further explore question 5.³

The study was conducted over 12 months. Additional resources from the Packard Foundation made it possible to conduct a more comprehensive analysis of the situation in Ethiopia, including pioneering work in the spatial analysis of biodiversity importance.

The study was conducted in partnership with national consultants in each country, who were selected for their understanding of the issues and their ability to interact with key stakeholders.

“Political economy is the study of both politics and economics, and specifically the interactions between them. It focuses on power and resources, how they are distributed and contested in different country and sector contexts, and the resulting implications for development outcomes.” (World Bank, 2011)

³ Note, however, that resources were insufficient to conduct a validation workshop in Ghana.

3

Ethiopia

3.1 Country profile

According to the World Bank, Ethiopia's gross domestic product (GDP) grew by an average of 10.8 per cent per year between 2003/04 and 2013/14, more than double the regional average of 5.0 per cent. The services and agriculture sectors contributed most to this growth, followed by the manufacturing sector.⁴ Key poverty indicators have improved substantially; for example, the prevalence of undernourishment declined from 43.3 per cent of the population in 1992 to 25.2 per cent in 2014 (WDI, 2016).

Agriculture is Ethiopia's most economically important sector, with crop production and livestock constituting 27.4 and 11.1 per cent of GDP respectively (CountryStat Ethiopia, 2016). Smallholder farmers account for 95 per cent of gross agriculture production, and 60 per cent of farms are less than 1 hectare in size (CSA, 2015).

The population of Ethiopia was 99.4 million in 2015, of which 19.4 per cent was urban. Ethiopia is the most populous nation in East Africa and the second most populous in Africa after Nigeria. Average life expectancy is 63.6 years, and fertility rates decreased from 6.1 to 4.6 births per woman between 2000 and 2014, with notably higher rates in rural areas. Ethiopia's population is expected to increase by 38 per cent by 2030, to 138 million and by 89 per cent, to 188 million by 2050. Projections to 2050 indicate that a higher percentage of the total population will be urban, although the majority will still be rural (UN, 2015).

The Ethiopian Highlands host about 80 per cent of the rural population and constitute one of the most densely populated regions in Africa. The preference for the highlands region is due to its better soils, higher rainfall and lower incidence of tropical pests and diseases compared with the lowlands (Headey *et al.*, 2013). However, migration

⁴ See www.worldbank.org/en/country/ethiopia/overview

trends between the lowlands and highlands are not well monitored and studied. Some observers argue that, with the land shortage in the highlands, more people are moving to the lowlands, but others suggest that droughts and commercial farming in the lowlands are pushing smallholders into the highlands in search of water and to clear forests for farming.

Agriculture, which is mostly rainfed, is the sector in Ethiopia most affected by climate change. Climate-related hazards include droughts, floods, heavy rains, strong winds and heat waves. Frequent drought, flooding and widespread land degradation have increased food insecurity in the country. Spring and summer rains have declined by 15–20 per cent since the mid-1970s in the southern, southwestern and southeastern parts of Ethiopia. There has been a 16 per cent spatial contraction in the distribution of *belg* rains⁵ over the last 20 years in the Southern Nations, Nationalities and Peoples Region (SNNPR) and the Oromia region in the heavily populated Rift Valley (Funk *et al.*, 2012). Although there is consensus that these climate change impacts will continue to negatively affect crop production in many areas, there is less certainty among climate change models on the likely magnitude of such impacts (CRGE, 2011b; Conway and Schipper, 2011).

3.2 Status of forests

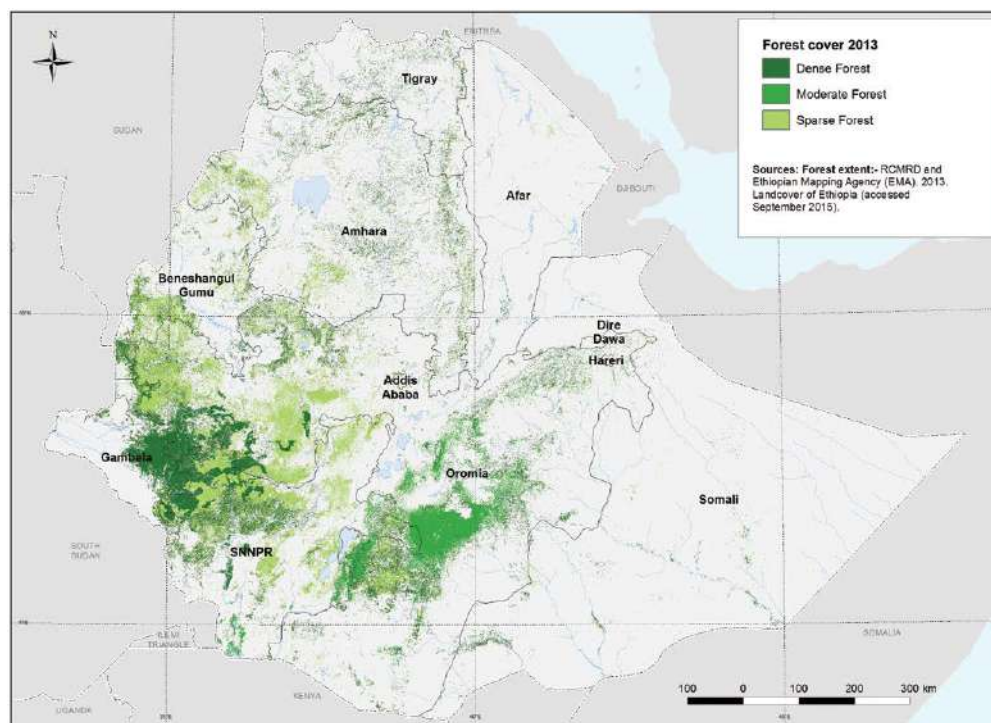
Forest cover

Under the new national definition of forests adopted in 2015⁶, forests in Ethiopia include everything from dense forests in high-rainfall areas to dense woodlands in drylands, covering in total 15.5 per cent of the land area (Figure 3). These forests host rich biodiversity and form key parts of two of the world's 36 biodiversity hotspots: the Eastern Afromontane and the Horn of Africa (EBI, 2014). Forest ecosystems underpin human wellbeing, climate resilience and sustainable development, notably through the provision of forest products, water supply, soil conservation, microclimatic amelioration, and climate change mitigation. Forests contributed around 12.9 per cent of GDP in 2012/13 through the production of woodfuel, livestock fodder, timber, coffee, honey and wild medicinal plants and the provision of ecosystem services such as cropland erosion control and pollination (UNREDD, forthcoming).

⁵ Ethiopia's rainy season occurs during March/April.

⁶ "Land of at least 0.5 hectares covered by trees and bamboo, attaining a height of at least 2 metres and a canopy cover of at least 20 per cent or trees with the potential to reach these thresholds in situ in due course" (GoE 2016).

Figure 3. Forest cover in Ethiopia, 2013



The three categories of forest shown in Figure 3 correlate broadly with the three main types of forest ecosystems (EBI, 2014):

- 1) Afromontane rainforest, mostly found in the southwest of the country at 1,500–2,600 metres above sea level.
- 2) Dry Afromontane forest, occurring in the north, central and southeastern highlands at 1,500–3,200 metres above sea level.
- 3) Lowland dry peripheral semi-deciduous Guineo-Congolian forest at 450–600 metres above sea level.

Forest biodiversity

Ethiopia has an estimated 6,000 plant species, of which 10 per cent are endemic, as well as 284 mammal and 861 bird species and at least 201 reptile, 200 fish, 63 amphibian and 1,225 arthropod species. Twenty nine mammals, 18 birds, 10 reptiles, 40 fish, 25 amphibians and 7 arthropods are endemic to Ethiopia. The country is a centre of origin for cultivated crops such as coffee, teff and enset, and a centre of diversity for durum wheat, barley and sorghum. Plant endemism is highest in the highlands, where it is estimated that 555 of the 5,200 plant species are endemic (West *et al.*, 2016).

Ethiopia has 6 critically endangered, 23 endangered and 70 vulnerable species of wild fauna on the International Union for Conservation of Nature (IUCN) Red List of Endangered Species (IUCN, 2014). Mammal species requiring urgent conservation action include the walia ibex (*Capra walie*), gelada baboon (*Theropithecus gelada*), mountain nyala (*Tragelaphus buxtoni*), Ethiopian wolf (*Canis simensis*) and Starck's hare (*Lepus starcki*) (IUCN, 2014). Some of these endangered species, such as the walia ibex, have very restricted distributions (EBI, 2014).

According to the Ethiopian Biodiversity Institute (EBI), biodiversity hotspots in Ethiopia are identified based on the endemism and diversity/richness of species. As part of this study, the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) used an innovative approach to map biodiversity importance in Ethiopia, dividing the country into 10 square kilometre 'cells' and assessing these for biodiversity, giving a higher weighting to endemism (Van Soesbergen *et al.*, 2016) (Figure 4).

Further analysis, where the map shown in Figure 4 was overlaid with a map of key ecosystem vegetation types (EMA, 2013), indicated that forests (incorporating woodlands) are second only to shrublands in their overall importance for faunal and floral biodiversity (Figure 5). Forests are second only to wetlands for their biodiversity importance per unit area (wetlands have high floral biodiversity), supporting 26 per cent of the country's overall biodiversity value on 15.5 per cent of the land area. Forests are the most important ecosystem type for endemic species, supporting more than 39 per cent of endemic biodiversity importance values, with shrub and grassland supporting around 27 per cent each.

Drivers of deforestation

Ethiopia has undergone severe losses of forest habitat and biodiversity, especially around the long-inhabited highlands area (CIFOR, 2015). The extent of national forest-cover change is uncertain due to a lack of regular forest assessments at this level; nevertheless, several location-specific studies have shed light on the severity of deforestation (CIFOR, 2015). The REDD+ readiness preparedness plan (GoE, 2011a) cites a 2004 study that estimated annual forest clearing rates for the country's three most forested regions at 1.16 per cent in Oromia, 1.28 per cent in Gambella and 2.35 per cent in the SNNPR. A comparison of LANDSAT⁷ satellite imagery between 2000 and 2013 shows an average annual forest loss of 84,882 hectares; the biggest losses were in the *Combretum–Terminalia* dry lowland woodlands (with around 650,000 hectares lost between 2000 and 2013) and the second-largest losses were in the moist Afromontane forest type in the highlands, with about 200,000 hectares lost between 2000 and 2013 (GoE, 2016). Smallholder and large-scale agricultural expansion, and forest fires are the main drivers of deforestation in Ethiopia. Small-scale agriculture occurs countrywide, but large-scale

⁷ See <http://landsat.gsfc.nasa.gov>

agriculture is centred in the lowlands where population densities are generally lower. Forest degradation is caused mainly by woodfuel extraction, livestock grazing, forest fires and illegal logging (MEF, 2014).

Figure 4. Combined faunal and floral biodiversity importance, Ethiopia

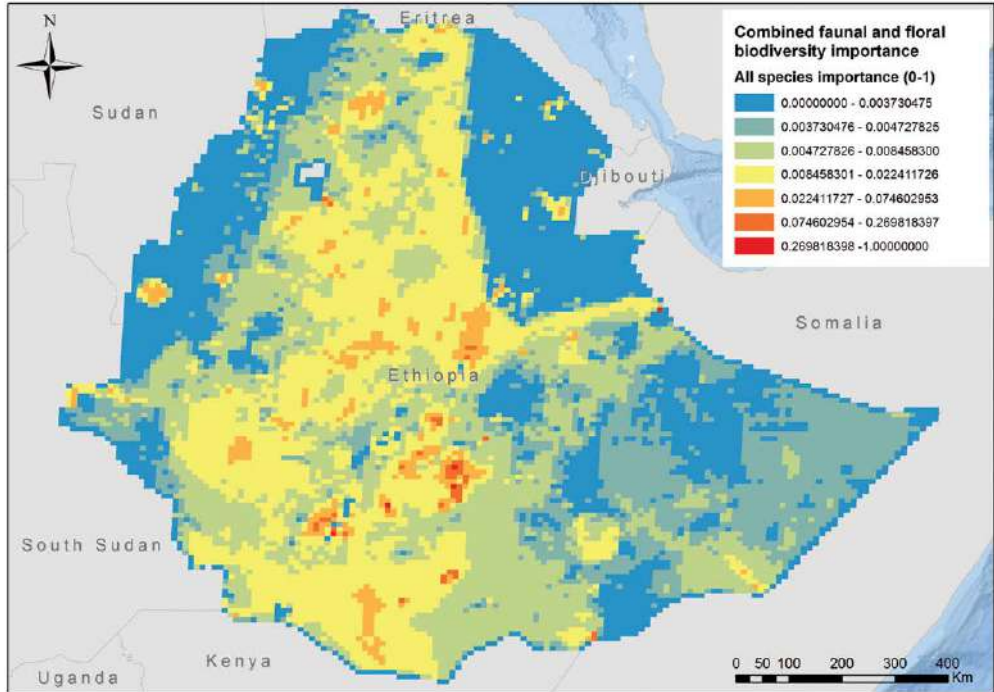
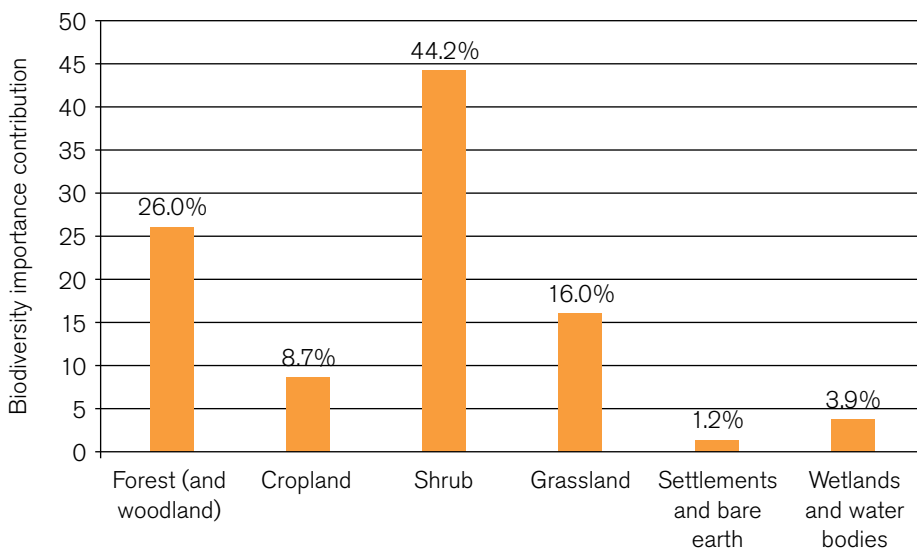


Figure 5. Contributions of ecosystem types to faunal and floral biodiversity in Ethiopia



3.3 Past and present agricultural production

Trends in crop production

Major food-crop yields have long been relatively low in Ethiopia, with more than half the historical increase in crop production being due to increases in the cultivated area (CSA, 2015a). In recent years, increases in yield per hectare have been more significant (such as for cereals – see Figure 6), but the rate of increase is insufficient to meet rising food demand, and the gap will continue to be met by area expansion and likely increases in net imports (mostly of wheat, maize and sorghum).

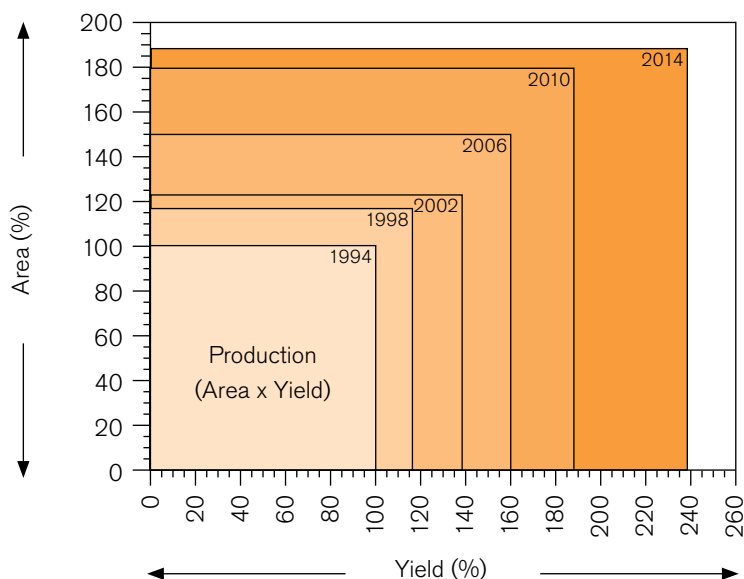
Agricultural expansion is the most significant driver of deforestation and loss of forest biodiversity in Ethiopia (GoE, 2011a; CIFOR, 2015). During the period 2000–2008, 80 per cent of new agricultural land came from the conversion of forests (including woodlands) and shrublands (GoE, 2011a). Most of this new agricultural land is used for crop cultivation; the total harvested cropland expanded by 5 million hectares (in a total land area of 112 million hectares) between 2001 and 2012, which was more than five times the expansion of pasture lands and permanent meadows (966,838 hectares) (CountryStat, 2016).

Five major cereals (teff, wheat, maize, sorghum and barley) constitute the core of Ethiopia's agricultural and food economy. Combined, they account for about 80 per cent of the total cultivated area, 65 per cent of agricultural GDP (30 per cent of total GDP) and 64 per cent of calories consumed (Taffesse *et al.*, 2012).

In the 20 years to 2014, domestic cereal production increased by 349 per cent (FAOSTAT, 2016). This was achieved through a remarkable 139 per cent increase in crop yields and an 88 per cent increase in the production area (Figure 6); the production increase was achieved more by intensification than expansion, but the area under cultivation still nearly doubled.

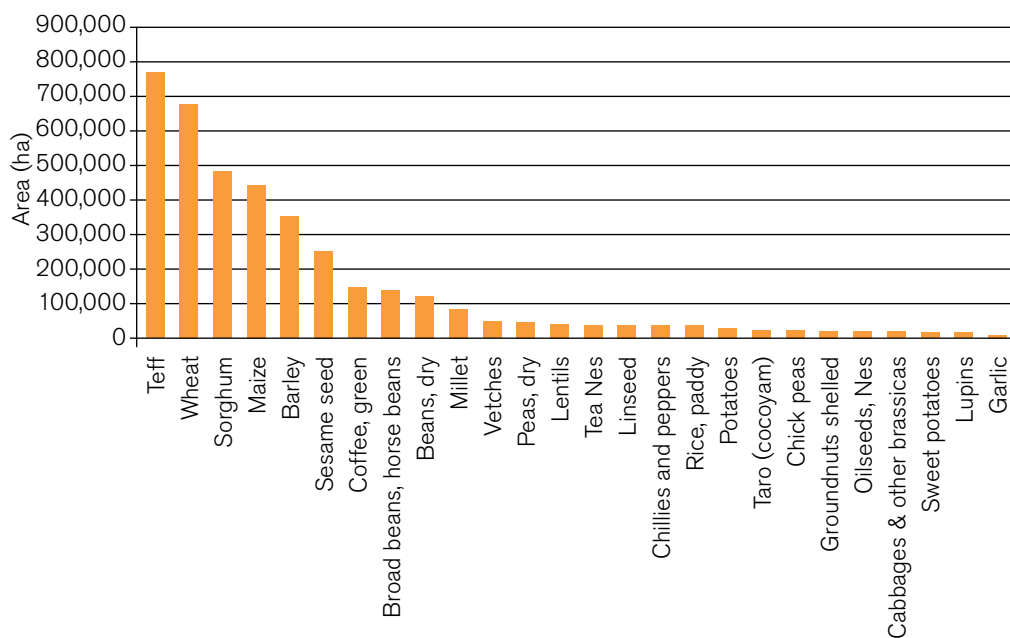
The area of croplands increased by 4.4 million hectares from 2001 to 2009. Of this, cereal crops accounted for 73 per cent and the main agricultural export commodities (coffee and sesame) accounted for only 9 per cent (CountryStat, 2016; Figure 7).

Figure 6. Change in cereal yield and cultivated area, Ethiopia, 1994–2014



(Data source: FAOSTAT)

Figure 7. Change in cultivation area of primary crops, Ethiopia, 2001–2009

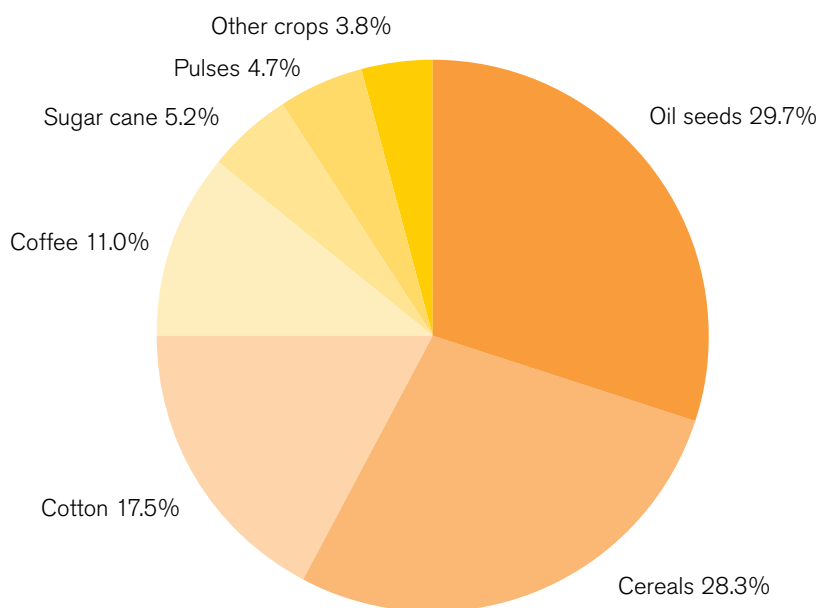


Who are the producers?

Smallholder farmers used 17.7 million hectares of land in 2014/15, of which 81 per cent was for crop production. Average farm size in Ethiopia has declined over time, especially in the highlands, with young farmers facing severe constraints in land availability and farm size (Headey *et al.*, 2013). Land availability is reportedly so tight that the government is requiring people who have government jobs to hand over their land to others who don't. The average holding per household was reported at 1.14 hectares in 2014. Nearly 60 per cent of households farm on less than 1 hectare, 24.8 per cent farm on 1–2 hectares, 13.9 per cent farm on 2–5 hectares, and 1.3 per cent farm on more than 5 hectares (CSA, 2015b). A recent Center for International Forestry Research (CIFOR) study revealed that trends in farm size vary depending on the commodities produced. Average farm size increased from 2007 to 2013 for vegetables, coffee, sugarcane and pulses but remained small for the main cereal crops (CIFOR, 2015).

Commercial farms accounted for 0.98 million hectares of farming land in Ethiopia in 2014/15.⁸ Figure 8 shows the main crops grown.

Figures 8. Main crops grown on commercial farms in Ethiopia



Source: CSA (2015c)

⁸ CSA (2015c) defined commercial farms as “farms that include state and private commercial farms mainly established for the purpose of profit making by selling agricultural products at local market and/or abroad. These farms are commonly owned and operated by government, private companies and non-governmental institutions, such as private individual investors, shareholders, religious and non-religious institutions ...”

The Ethiopian Central Statistical Agency (CSA) does not provide information on the average size and spatial distribution of commercial farms, unlike for smallholder farms (CSA, 2015c), and no clear information is available publicly on the impacts of commercial farms on forests and biodiversity. The CSA only surveys commercial farms (or parts thereof) registered with the government, and it may therefore be substantially underestimating the total area occupied by such farms. For example, a recent Development Bank of Ethiopia study reportedly found at least 1.94 million hectares of commercial farms in the country.⁹

In most cases, the leasers in recent large-scale land deals in Ethiopia have been domestic investors. Such investors tend not to accurately report their land investments to government, and records of their land acquisitions are often missing. Many of them have been found to be non-operational.⁷ In recent years, federal and regional governments in Ethiopia have sought to verify land allocations and check investments, but the capacity for monitoring and evaluation is low and progress has been limited (Keeley *et al.*, 2014).

The Government of Ethiopia promotes large-scale farms and private-sector investments in the agriculture sector. There are three main government sources for the allocation of large tracts of land: the federal land bank; regional and federal government sugar production; and regional governments. In the period 2002–2012, 1.7 million hectares of land were allocated to large-scale (that is, more than 1,000 hectares in size) commercial farms. The lion's share of this land was in three forested regions – Benishangul-Gumuz, Gambela and the SNNPR (Haile, 2016).

The proportion of land allocated to large-scale commercial farms that has been cultivated, and the impacts of such cultivation on forests, are unclear. However, the transfer of land to large-scale agriculture is becoming a significant driver of deforestation for at least two reasons. The agro-ecological requirements for the crops commonly grown on such farms overlaps with the country's forested areas; and large-scale commercial farms may displace local farmers, who might then migrate into forest areas. Field research indicates that forests and woodlands in protected areas have been included in some land transfers to commercial farms (CIFOR, 2015).

⁹ See <http://allafrica.com/stories/201604190793.html>

Farm size and crop yield

The most recent CSA agriculture sample survey indicated little difference in crop yields between commercial and smallholder farms, due in part to major investments in agricultural extension services for smallholder farmers (CSA, 2015).

Food imports and exports

Ethiopia is self-sufficient in all staple food crops except wheat, although external food aid may still be required in cases of crop failure.

3.4 Future food production and forests

Growing domestic food demand

Food consumption patterns in Ethiopia are diverse and different regions have preferences for different cereal crops. There is increasing demand for processed cereals and wheat, due largely to the preferences of an increasing urban population, but the traditional cereal, teff, is still the most important cereal crop in Ethiopia (Berhane *et al.*, 2011).

Taking changing consumption patterns and the increasing population into consideration, IFPRI's IMPACT Model (2015) projects that Ethiopia's domestic demand for cereals in 2050 will be 2.62 times higher than in 2010. This projection may be an underestimate because it assumes a total population in 2050 that is 13 per cent smaller than UN projections (Robinson *et al.*, 2015).

One of the major successes in the last five years has been achieving the target of national food self-sufficiency. The new national Growth and Transformation Plan (GTP II) for 2016–2020 aims to strengthen Ethiopia's capacity to maintain food self-sufficiency by increasing cereal productivity by 47 per cent by 2020 (NPC, 2016). This may be possible, but such large gains in productivity cannot be sustained. It seems inevitable, therefore, that there will be further expansion in the cropped area through forest conversion.

Spatial distribution of agricultural expansion into forests

According to Ethiopia's Climate-Resilient Green Economy strategy (CRGE), agricultural land will need to expand by 3.9 per cent per year, on top of continued yield increases, in order to achieve the growth targets set for the agriculture sector from 2010 to 2030. Under a business-as-usual scenario, 55 per cent of this agricultural land expansion (550,000 hectares per year) could be at the expense of forests, down from 69 per cent in 2011 (GoE, 2011b).

To determine where major staple food crops are likely to expand in the future, the University of Edinburgh conducted a spatial analysis, based on publically available spatial data, of:

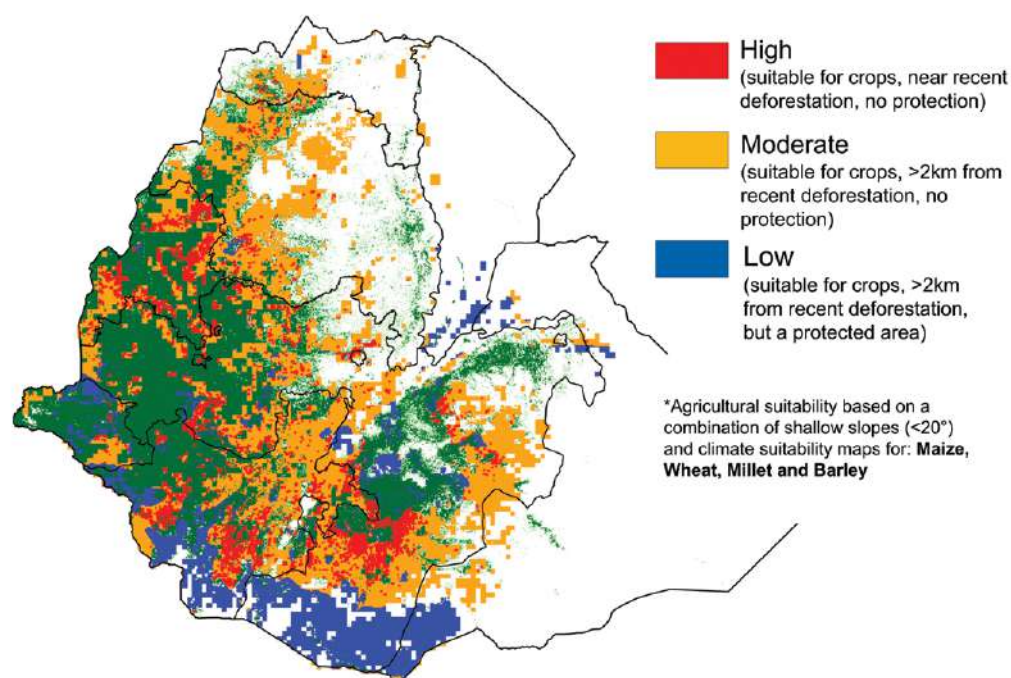
- Crop suitability for major staple food crops from the GAEZ programme,¹⁰
- Radar data on forest cover (Hansen *et al.*, 2013), and
- Protected area cover (derived from the World Database on Protected Areas – IUCN and UNEP-WCMC, 2016).

The analysis assumed that agriculture will remain predominantly low input (ie no improved cultivars or applications of nutrients or pesticides) and included only areas deemed to have 'good' to 'excellent' suitability, therefore reducing the potential area suitable for cultivation. Within those areas, the analysis assumed that an area is more likely to be cultivated if it is easily accessible, which is defined as being near a previous deforestation event (because people and infrastructure must be present in the area); it therefore included existing forest–agriculture frontiers, where agriculture is most likely to expand in coming years. Areas with an average slope of more than 20 degrees were excluded from the analysis because these are unlikely to be suitable for agriculture. Protected areas were also excluded because they are considered exempt from large-scale agricultural conversion in the short to medium term. Taking into account the exclusions and 'good' to 'excellent' agro-ecological suitability, the analysis deemed areas within two kilometres of previous deforestation events to have a high likelihood of agricultural conversion. Areas further than two kilometres from a previously deforested area were considered to have moderate suitability, and areas that met all the criteria but are under protection were deemed to have low suitability.

The suitability maps generated for Ethiopia cover four major staple food crops – wheat, barley, maize and millet – for which suitability data were available from the GAEZ programme (Figure 9). Major crop types not included were chat and the staple food crops teff and sorghum, which do not have associated suitability maps, meaning that the potentially suitable area with a high likelihood of conversion is probably underestimated. Of the area of moderate-to-high suitability/likelihood of being cultivated, 75 per cent is in areas with some forest cover (more than 0 per cent cover in 2007), and 50 per cent is in areas with a forest cover of more than 50 per cent.

¹⁰ See www.fao.org/nr/gaez

Figure 9. Likelihood of cereal crop expansion into forest in Ethiopia



3.5 Relevant policies, institutional arrangements and processes

Agriculture

The Government of Ethiopia adopted the Sustainable Development and Poverty Reduction Programme (SDPRP) between 2002/03 and 2004/05, identifying agriculture as the country's primary driving force for economic development and poverty reduction. The policy noted that the expansion of export crops (particularly non-traditional crops) could contribute significantly to poverty reduction, and it encouraged the establishment of medium-sized and large commercial farms in the lowlands. The policy promoted a labour-intensive strategy for agriculture, encompassing the adoption of modern agricultural technologies and the training of agricultural labour with effective skills. The programme prioritised agricultural land use by suggesting that "guaranteeing the availability of land for people who are able and willing to make a living out of farming is fundamental and is a step in the right direction for proper use of land resources" (MOFED, 2003).

In the period 2005/06 to 2009/10, the Ministry of Finance and Economic Development developed the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) based on the SDPRP. PASDEP stated that Ethiopia was to pursue an agricultural development-led industrialisation strategy, indicating that the key objectives were to build an economy with a modern and productive agriculture sector and to use technology and agro-industry to drive economic growth. PASDEP introduced a new emphasis on the commercialisation of agriculture as a stimulus for economic growth. It aimed to increase the total cultivated land under key crops¹¹ from 12.28 million hectares in 2004/05 to 12.65 million hectares in 2009/10, and total production from 16.7 to 38.21 million tonnes. At the end of the period encompassed by PASDEP, the land actually cultivated with key crops was 13.5 million hectares (almost 1 million hectares more than the target), and total production was 21.3 million tonnes (almost 17 million tonnes below the target) (CSA, 2015). Cereals were expected to contribute most to achieving the target, with the total area set to increase from 9.05 to 9.26 million hectares, and total production to increase from 12.99 to 32.25 million tonnes (MOFED, 2006).

The Growth and Transformation Plan (GTP I), which replaced PASDEP, set ambitious targets for agriculture in 2011–2015. The main goal of GTP I was to contribute to achieving the long-term objective under PASDEP of making Ethiopia a middle-income country by 2025 through agricultural-led industrialisation, and to achieve food security. GTP I's strategic direction was to ensure that smallholder agriculture remained the main source of agriculture growth and to transform subsistence agriculture to market-led production. Key agriculture targets for 2015 (NPC, 2016) included the following:

- Increase agriculture GDP growth from 7.6 to 8.7 per cent.
- Increase the area of major food crops from 11.25 to 12.17 million hectares.
- For cereals production, increase the production area from 9.1 to 9.6 million hectares.
- Increase major crop productivity from 1.87 to 2.43 tonnes per hectare.
- For coffee production, increase cultivated land by smallholder farmers from 0.46 to 0.81 million hectares, and total production from 0.34 to 0.83 million tonnes.
- Transfer around 3.3 million hectares to commercial farming investors in a transparent and accountable manner.

The government published its second Growth and Transformation Plan, GTP II, in mid-2016 to carry forward to 2020 the strategic vision of GTP I. Agriculture remains the main driver of “rapid and inclusive economic growth and development”. The plan includes sustainable agriculture in its strategic direction, and it aims to reduce carbon emissions in the sector by 25.97 million metric tonnes by 2020 and by an additional 51.93 million tonnes by 2030 through the use of low-emission inputs and by expanding small-scale

¹¹ The key crops were cereals, oil seeds, pulse, fibre crops, fruits, vegetable, coffee, tea and spices.

irrigation. The plan also aims to industrialise agricultural production and reduce the share of employment held by the sector by 7.5 per cent (from 75 to 67.5 per cent). For the first time, no area expansion targets are mentioned; the main targets pertain to the total production and productivity of sugarcane, cereals, pulses, oil seeds and coffee (NPC, 2016). GTP II aims to maintain self-sufficiency in most food commodities, as achieved under GTP I.

The government's intention to transform the agriculture sector is reflected in its establishment of the Agricultural Transformation Agency (ATA) under the Ministry of Agriculture and Natural Resources (MANR). The ATA has been tasked with developing innovative technologies, policies and programmes to support the GTP, and it envisages a shift from lower to higher value agricultural production. The results are expected to transform the national economy. Tasks undertaken by the ATA include developing a national soil map so that fertiliser distribution can be targeted based on soil type; research on smallholder mechanisation; and value chain analysis. The ATA was created as a collaborative partner of MANR with a view to providing technical inputs and assistance. Overlapping mandates and conflicts over implementation, however, have hindered the smooth transfer of skills and knowledge from the ATA to the ministry.

Forests

Until 2013, responsibility for the forest sector was assigned to MANR's Natural Resources Management Directorate. The priority given to the forest sector increased with the establishment of the Ministry of Environment and Forest in 2012.

GTP I had ambitious forestry targets, including increasing agroforestry coverage from 6.06 million hectares to 16.21 million hectares; increasing the area of forest land protected with management plans from 0.07 million hectares to 2.2 million hectares; and increasing the total forest area from 12 million to 18 million hectares. The target areas were mainly in the country's degraded highlands (MOFED, 2010).

The Ministry of Environment and Forest was renamed the Ministry of Environment, Forest and Climate Change (MEFCC) in 2015, and it prepared the GTP II forestry strategy. Under GTP II, forests are covered under 'climate change' rather than 'natural resources conservation and utilisation', as it was in GTP I. The GTP II target is to increase forest cover (as per the new forest definition) from 15.5 per cent of the total land area to 20 per cent (ie from about 16.67 million to 22.09 million hectares) (NPC, 2016).

The Government of Ethiopia has also set targets for forests in its REDD+ initiative and the CRGE strategy. Under the CRGE, supported with REDD+ finance, the target is to protect 4 million hectares of forest land (2 million hectares of highland forests and 2 million hectares of woodlands). This is to be achieved mainly in the Oromia and SNNPR

regions, with the selection of target areas to be determined by key stakeholders. The other major CRGE target is to reforest 3 million hectares with plantations (GoE, 2011b).

The Government of Ethiopia has pledged, in the Bonn Challenge, to restore 15 million hectares of degraded land by 2030 through reforestation and forest restoration, including agroforestry (MEFCC, 2016). This 15 million-hectare target seems to have come from politicians rather than technocrats, however, and there are concerns that, in trying to achieve this scale, existing users of the targeted degraded lands (eg pastoralists) will be excluded and thereby negatively affected. MEFCC is working with the World Resources Institute and IUCN to identify and map potential restoration areas. The extent to which the target is to be achieved with natural regeneration (which may have a risk of short-term negative social impacts) and potentially less problematic agroforestry interventions is unclear.

The Government of Ethiopia is finalising its REDD+ strategy and a five-year implementation plan, focusing on the country's two key drivers of deforestation: agricultural expansion and charcoal production. A subregional pilot REDD+ programme on participatory forest management (PFM) is also underway in the Oromia region. REDD+ is the only available vehicle for financing forest conservation in Ethiopia, although the government, with support from the Global Green Growth Institute, recently developed a mechanism for financing and implementing approaches such as payments for ecosystem services in the forest sector.

REDD+ activities are funded mainly by donors, notably the Government of Norway, which has committed to investing US\$100 million in Ethiopia. Fifty per cent of the funding will be used for afforestation, including plantations, and 50 per cent will be used in the protection of natural forests. MEFCC's assumption that a large amount of donor funding will be available for forest development has led it to develop ambitious plans. The Government of Ethiopia is working with the United Nations Development Programme (UNDP) to obtain access to funds in the Green Climate Fund. The proposal for up to US\$100 million will be cross-sectoral, and implementation will be mainly by MEFCC and MANR. Key elements of the proposal include food security, land rehabilitation and small-scale rural energy.

Biodiversity

EBI was under MANR until 2015, when it moved to the MEFCC. This institutional change has tended to create gaps because mandates, and budgets also shifted. On the other hand, the change reflects government thinking that biodiversity is more closely aligned with the environment and forests than with agriculture.

The national biodiversity strategy and action plan (NBSAP) have been the key policies guiding biodiversity conservation in Ethiopia. The first version of the NBSAP was

prepared for 2005–2010 in response to an international obligation under Article 6 of the Convention on Biological Diversity (CBD) calling for member states to come up with concrete action plans on biodiversity conservation. A second version of the NBSAP was submitted to the CBD in 2015 for the period 2015–2020. It has the following four strategic objectives:

- 1) Effective management of protected areas.
- 2) Sustainable use and management of ecosystems outside protected areas by 2020.
- 3) Equitable sharing of benefits among the community for further sustainable use and marketing of biodiversity.
- 4) Conservation of the country's biodiversity through a combination of in-situ and ex-situ conservation mechanisms.

The NBSAP builds on the Conservation Strategy of Ethiopia, which was developed to assess the country's natural resource base, analyse the direction of environmental governance, and enable a series of actions spanning the short and long terms. The Conservation Strategy resulted in the development of a comprehensive national environmental policy in 1997, which has been translated into a number of implementation laws.

The implementation of NBSAP I was not very successful. NBSAP II outlines the direction the government will take in the coming five years, and the biodiversity component of GTP II has been aligned with it.

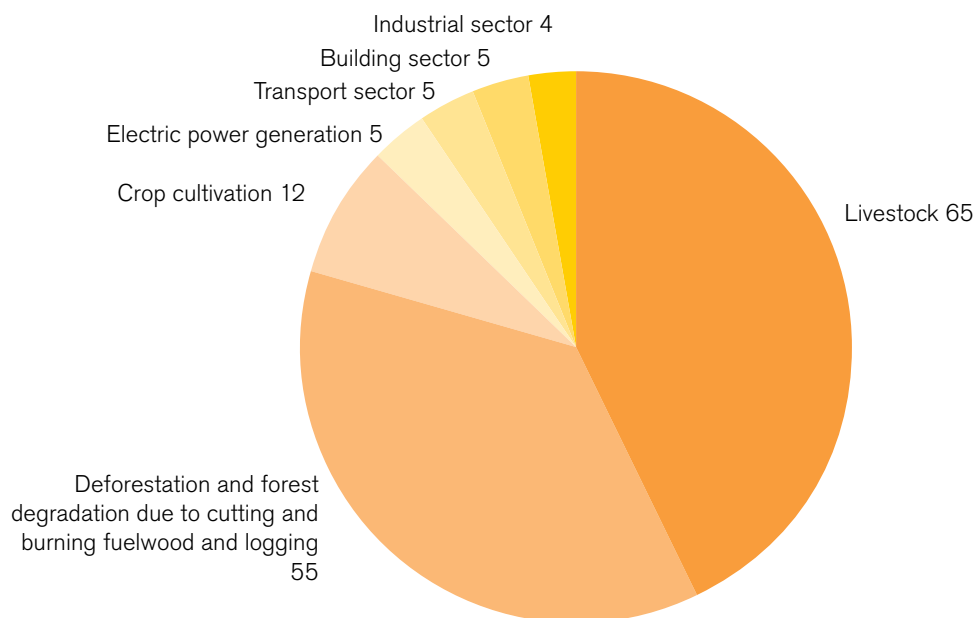
PASDEP and GTP I emphasised the conservation of high-economic-value species, especially those of value for wildlife-based tourism and agriculture development. GTP II sets more specific targets for the ex situ and in situ conservation of plants, microbial biodiversity and animal species.

Climate change and green economy

Climate change is affecting economic growth in Ethiopia, especially in the agriculture sector. The Government of Ethiopia developed the CRGE strategy in 2011 in an effort to mitigate and adapt to climate change and reduce its negative impacts on overall economic growth. The CRGE strategy identified significant trade-offs between increasing crop production and forest conservation: under a business-as-usual scenario, total cropland is projected to increase by 14.4 million hectares by 2030, and 55 per cent of the total new agriculture land (7.92 million hectares) will be converted from forests. Considering those trade-offs, the CRGE strategy proposes strategic actions to achieve economic development more sustainably across sectors, and it identifies agriculture (including livestock) and forestry as the key sectors to achieve abatement potential (GoE, 2011b).

Ethiopia's total greenhouse gas emissions in 2010 were 150 million tonnes carbon dioxide equivalent (MtCO₂e) (GoE, 2011b); Figure 10 shows these greenhouse gas emissions by source.

Figure 10. Ethiopia's greenhouse gas emissions, by sector, 2010. Unit: million tonnes carbon dioxide equivalent.



For the agriculture sector, the initiatives prioritised in the CRGE strategy to reduce pressure on forest lands and reduce soil-based greenhouse gas emissions are intensifying agriculture; improving inputs and better residue management; and creating new agricultural land in degraded areas through irrigation (GoE, 2011b).

For the forest sector, the CRGE strategy identifies REDD+ as one of its four fast-track initiatives. In addition to activities that will help reduce pressure on forests for conversion to agriculture, the strategy prioritises activities to reduce demand for woodfuel; afforestation/reforestation; and large-scale forest management programmes (as discussed above) (GoE, 2011b).

The GTP II enhances CRGE's role in aligning sectoral targets by including CRGE as one of its pillar strategies. GTP II states that the green economy agenda will be rigorously mainstreamed into macro and sectoral plans, programmes and projects and that its performance will be monitored to ensure accountability at all levels (NPC, 2016). An estimated US\$150 billion will be needed over 20 years to achieve CRGE goals.

Ethiopia's greenhouse gas emissions, and its ambitious commitments to reduce them, are clearly stated in its submission on its intended nationally determined contribution (INDC) to the United Nations Framework Convention on Climate Change. The submission states

that Ethiopia intends to limit its net greenhouse gas emissions in 2030 to 145 million tonnes of carbon dioxide equivalent or lower, which would constitute a 255 million tonnes of carbon dioxide equivalent reduction from projected business-as-usual emissions in 2030 and a 64 per cent reduction from the business-as-usual scenario in 2030. The INDC also states that Ethiopia intends to undertake adaptation initiatives to reduce the vulnerability of its population, environment and economy to the adverse effects of climate change, based on the CRGE (GoE, 2015).

Land tenure

The Ethiopian Constitution states that all land belongs to the state and peoples of Ethiopia and that land shall not be subject to sale or to other means of exchange (GoE, 1995). Federal land administration and land-use proclamations provide unlimited periods of use rights to farmers, pastoralists and semi-pastoralists, and they give the power to regions to enact their own proclamations with regard to federal proclamations. Following the issuance of the 2005 Federal Rural Land Use and Administration Proclamation, regional governments passed their own respective rural land laws. Both the federal and regional proclamations give rights to rural landholders to use rural lands for the purposes of agriculture and natural resource development and to inherit, bequeath and lease the land. The proclamations impose obligations on landholders to 'properly manage' and use rural lands, farmlands and grazing lands. The regional proclamations define 'properly manage' as protecting the land and conserving it through tree planting, bench terracing and the use of other favourable soil conservation activities in order to manage the land sustainably for the next generation (ANRS, 2006).

The Government of Ethiopia is implementing one of the largest, fastest and least expensive land registration and certification programmes in Africa (Bezu *et al.*, 2014). There are two types of land certification: 'first-level' land certification records only the name of the landholder, the size of the holding and the names of the neighbours on each of the four sides of the field. No mapping of fields is done, and field location is determined by recording the names of neighbours (USAID, 2004). First-level rural land certificates have been issued in the regions of Amhara, Oromia, SNNPR and Tigray, mainly with direct funding from the federal government. It is estimated that more than 95 per cent (comprising 50 million parcels) of about 13 million rural households have been certified in the four regions (Romano, 2013).

Second-level land certification adds an additional spatial component – a parcel map – to first-level certification. The issuance of second-level land certificates is underway in the regions of Amhara, Oromia, SNNPR and Tigray through the Land Investment for Transformation Programme, funded by the UK Department for International Development. The programme is implemented in partnership with the Government of Ethiopia through MANR's Rural Land Administration and Use Directorate. Reports indicate that about 1.9

million parcels had been demarcated in the four regions by April 2016. By the end of the programme, 6.1 million households are expected to have had their lands certified.¹²

Recent studies have found that first-level land certificates have increased investments in land, land productivity and land rentals, while second-level certificates primarily benefit the administration of land by government authorities (Bezu *et al.*, 2014).

GTP II aims to encourage more landholders to certify their lands; it sets a target of providing land certificates for an additional 7.2 million households and carrying out second-level certification for 28.6 million hectares of farmland in 359 *woredas* (districts) (NPC, 2016).

Land governance and management — national level

According to the 2005 Federal Rural Land Use and Administration Proclamation, MANR is responsible for administering and managing rural land and coordinating and providing technical support to regional authorities. The proclamation defines rural land administration as the process by which a rural landholding right or certificate is provided, land-use planning is implemented, disputes between rural landholders are resolved, the rights and obligations of rural landholders are enforced, and information on farm plots and grazing landholders is gathered, analysed and supplied to users. The proclamation defines rural land as “any land outside of a municipality holding or a town designated as such by the relevant law”. The Rural Land Administration and Use Directorate, a dedicated unit in MANR, is responsible for coordinating and providing technical support to regions in implementing the rural land administration proclamation.

A new forest management and land-use proclamation is being developed that will give ME FCC a mandate to manage forest land (ie the 15.5 per cent of the total land area currently designated as forest land). The changing mandates have caused confusion over land management, especially for reforestation on degraded agricultural land. MANR and ME FCC are both planning and implementing forest-related activities such as nursery development, forest plantations and the reforestation of degraded lands.

The Government of Ethiopia recognises the important role of effective planning in national development and it established the National Planning Commission in 2013. The commission's objective is to prepare five year national development plans and conduct periodic evaluations of their implementation. The commission, an autonomous federal government agency, coordinates the plans and policies of different ministries to deliver results against government targets, as set out in growth and transformation plans. The commission's mandate includes coordinating ministries (eg ME FCC and MANR) on rural lands.

¹² See www.gov.uk/government/world-location-news/lift-commences-issuing-second-level-land-certificates-to-farmers

A national integrated land-use plan and policy is under development. The prime minister's office is taking the lead, and the aim is to develop criteria for prioritising investments, especially in agriculture and forest resilience.

Land governance and management — regional and district level

The Ethiopian Constitution gives regions the power to administer land under the guidance of the Constitution and federal laws. The Federal Rural Land Use and Administration Proclamation further reinforces the powers of regional governments in land-use planning. This decentralised approach has resulted in great regional diversity in institutional arrangements for land-use administration. For example, Oromia has the Bureau of Rural Land and Environmental Protection, which is responsible for both land-use administration and environmental protection; SNNPR and Tigray each have a Bureau of Agriculture that is responsible for land administration.

Woredas are responsible for implementing regional and federal land-use policies and plans, but the implementation bodies may differ. In Amhara and Oromia, for example, the Rural Land Administration and Use Office is the responsible unit for land administration; in SNNPR and Tigray, the *woreda* agriculture office is the responsible unit.

Land governance and management — community level

At the community level, *kebeles* (the lowest administrative level) in Amhara, Oromia, SNNPR and Tigray have land-use and administration committees composed of elected members drawn from community residents. Working together with *kebele* administrations, the committees manage issues related to rural land use and resolve land disputes. The committees are established and mandated to act as the initial formal institutions for resolving land disputes, with the power to hand down decisions on cases brought to their attention, in line with regional land administration and land use proclamations (MANR-USAID, 2010).

3.6 Challenges in reconciling forest conservation with food production

Forest sector's economic potential is underestimated

Despite the importance the Government of Ethiopia has afforded the forest sector in recent years, there is still a lack of understanding of the economic value of forests — such as the value of their timber and of the watershed protection services they provide — among policymakers. Policies and strategies reflect the assumption that agriculture

is economically more important, and short time horizons in which the immediate returns on agricultural investments carry more weight than the longer-term benefits and avoided costs associated with forestry. Attitudes towards forestry may also be influenced by the fact that the economic contributions of forests are captured within the Ministry of Industry rather than MEFCC. Even if stronger evidence of the importance of forests were to be generated, however, in the absence of an ecological disaster, politicians are likely to always prioritise agriculture because it is more important to their grassroots constituencies and because commercial interests in the agriculture sector are more powerful than those in the forest sector.

Changes in institutional arrangements

The institutional reorganisation of agencies has created problems. Strategies in the agriculture and forest sectors were designed and implemented with quite a high degree of coordination until 2010, with both sectors under same ministry – MANR oversaw forest activities through its Natural Resources Directorate. The forest sector moved to a new ministry, the Ministry of Environment and Forest, in 2012, while agroforestry remained at MANR.

Collaboration between the agriculture and forest sectors at the federal level (MANR and MEFCC) is still relatively weak. It is unclear who is in charge of promoting and implementing key strategic activities, including reforestation and afforestation on agricultural lands and in watersheds. MEFCC has limited capacity at the regional and *woreda* levels and in some cases the Bureau of Agriculture still implements forestry. Moreover, certain overlapping activities, such as land rehabilitation, fall under both MANR and MEFCC, although at lower levels (*woredas* and regions), implementation is by MANR, even when planned by MEFCC.

REDD+ has become a prominent initiative in Ethiopia because of its relevance to the CRGE and because of substantial levels of funding provided directly and indirectly (eg through the World Bank) by the Government of Norway. REDD+ lacks strong institutional arrangements at the federal level however, reflecting the fact that the main drivers of deforestation fall within the mandates of the Ministry of Energy and MANR, and the lead agency for REDD+, MEFCC, is a relatively junior ministry. In late 2016, recognising that one of the main drivers of deforestation is energy, the Government of Ethiopia moved the cookstove programme from the Ministry of Water, Irrigation and Energy to MEFCC. The challenge of ensuring strong institutional arrangements relates to the fundamental construct of REDD+ and it is not unique to Ethiopia. A further challenge associated with REDD+ is that donors are focused on emissions reductions and the Government of Ethiopia gives at least equal emphasis to sustainable development benefits.

Lack of political support for biodiversity conservation

GTP II, and its strong alignment with CRGE, suggests that biodiversity is fairly high on the federal government's policy agenda. This high priority doesn't seem evident, however, at the sector levels, such as in agriculture and forestry. The mandate of the EBI seems to reflect that biodiversity conservation is, in reality, low on the government's agenda. Although the EBI is Ethiopia's CBD focal point, it has very little political power, and EBI experts are often left out of discussions on policies and programmes on forest and agriculture. In addition to the challenges posed by institutional change, there is a lack of appreciation among forest and agriculture policymakers of the importance of biodiversity and Ethiopia's commitments under the CBD, and the ground-level monitoring of biodiversity is very weak.

Lack of information on commercial farming

Commercial farms have been little monitored at both the federal and regional levels. Land available for investment is registered at either federal or regional banks, giving authority to both tiers of government to allocate land for investment. The boundary between regional and federal government responsibilities is unclear, however, and there appears to be an overlap. The Government of Ethiopia promotes commercial farming and gives land to commercial farms with the aim of achieving food security, but it does not monitor whether the land has been used or for the correct purpose, and how the land is being managed. This lack of monitoring is particularly an issue with domestic investors, who may underreport land use to reduce tax liabilities. Assessments of environmental and social impacts may also be avoided or inadequately conducted. Although the government has established the Agricultural Investment Land Administration Agency to manage and monitor investment lands, monitoring and evaluation remains a challenge due to a lack of capacity and resources. To address the information gap, the Government of Ethiopia, through the Development Bank of Ethiopia, is conducting a study of large-scale commercial farming, which is expected to provide the government with guidance in moving forward in addressing such challenges.

Lack of funding to support policy implementation

The Government of Ethiopia has strong political will for, and an interest in, increasing both agricultural production and forest cover. This is reflected in the policies and strategies in place, but a lack of funding for implementation is a key limitation. Since the finalisation of the CRGE, for example, a large portion of donor funds in the forest sector has been directed towards capacity building, documentation and strategy development and little to implementation on the ground. A limited number of projects have been implemented by international non-governmental organisations (NGOs) such as Farm Africa, and the Oromia Pilot REDD+ initiative is underway at a pilot scale. The effective implementation

of the CRGE is estimated to require US\$150 billion over 20 years (an average of US\$7.5 billion per year). Of this, an estimated one eighth (US\$18 billion in total, and US\$900 million per year) would be directed to the forest sector. By 2016, however, the CRGE facility had managed to mobilise only about US\$50 million and the forest sector had received only US\$6 million from the CRGE facility.

The interests of pastoralists who graze their livestock in forests and woodlands are little recognised in forest policies and institutional arrangements, partly because the pastoral sector falls under a separate institution, the Ministry of Federal Affairs and Pastoralist Development.

3.7 Opportunities for reconciling forest conservation with food production

The Climate Resilient Green Economy strategy

The CRGE is an important policy document that considers trade-offs between the agriculture and forest sectors and coordinates responses. Although now under the relatively junior MEFC, CRGE is already mainstreamed into GTP II. The key next step is building capacity and creating awareness at the local level, and providing implementation tools to engage local governments.

Change in forest definition

The revised forest definition is expected to receive legal backing through the forest proclamation, which is under revision. This will make it possible to include the country's vast, dense woodland resources under the MEFC, thereby strengthening its mandate for managing and conserving all forest types – including woodlands – countrywide and thereby reduce the expansion of agriculture into forests.

REDD+ as an opportunity to conserve forest biodiversity

Despite the recent emphasis on biodiversity conservation in GTP II, there is no clear funding for forest conservation other than through REDD+. REDD+ stresses biodiversity conservation in social and environmental safeguards developed with the support of the Global Green Growth Institute. REDD+, therefore, seems the best existing means for supporting forest biodiversity conservation, and REDD+ finance is focused on projects that support PFM in areas where biodiversity is high (eg the southern forests). Although implementing partners have indicated that biodiversity is an important consideration, some government actors have said that these PFM-focused projects do not prioritise biodiversity.

The emphasis of REDD+ on addressing the agricultural drivers of deforestation – including creating new land for agriculture by restoring degraded lands rather than by forest conversion (eg in the new Oromia subnational REDD+ programme) – has potential to substantially reduce the rate of loss of forest biodiversity. This is especially true if, as planned, biodiversity criteria are taken into account in the investment targeting strategy.

Establishing regional forest and wildlife enterprises

The Oromia Forest and Wildlife Enterprise was created in 2009 as a semi-independent forest entity to administer forests and implement forest-related activities. The Amhara National Regional State Forestry Enterprise was established in 2011 to provide similar services in the Amhara region. These enterprises function as autonomous entities under the regional governments. They partner with the private sector as well as NGOs: for example, the Oromia Forest and Wildlife Enterprise has a partnership with Farm Africa, and the Amhara National Regional State Forestry Enterprise has partnerships with the Sustainable Natural Resource Management Association and Tree Aid. By adding value to forest resources, these enterprise partnerships have the potential to alter the balance of costs and benefits between forest and agricultural land use in favour of sustainable forest management and conservation.

National integrated land-use plan and policy

Ethiopia did not have a well-integrated national land-use plan, although efforts have been made to institute land-use planning in various settings, such as at the regional, subzonal and river basin levels. Preparations are underway to design and introduce the first national integrated land-use plan and policy (NILUPP), which will be completed in 2018/19 and implemented during GTP III. To assist the development process, a NILUPP facilitation office has been established in the prime minister's office, supported by a ministerial steering committee and a technical committee. A NILUPP road map sets out clear directions and procedures for preparing the NILUPP. The government strongly believes that the NILUPP will address the long-prevailing problems of land use and land-use change and help in managing the trade-offs between competing land-use options – provided that regional and local governments have the political will, capacity and resources to enforce the provisions of the national plan.

4

Ghana

4.1 Country profile

Ghana has enjoyed steady recent economic growth, with an average annual GDP growth rate of about 7 per cent between 2000 and 2016. GDP growth slowed to 3.7 per cent in 2015, largely as a result of widespread power shortages, the rapid depreciation of the domestic currency, and falling global gold and oil prices. The key driver of economic growth is the services sector, which constituted 51.6 per cent of the economy in 2015, followed by industry at 28.4 per cent and agriculture at 20.1 per cent. Economic growth varies hugely across the country's regions, with the lowest growth rates in the north (Lal *et al.*, 2016).

Ghana's exports were worth US\$10.2 billion in 2014 and imports were worth US\$14.8 billion. The top export commodities by value were crude petroleum (26 per cent), gold (23 per cent) and cocoa beans (22 per cent). The top imports were refined petroleum (15 per cent), crude petroleum (3.7 per cent), gold (2.9 per cent) and rice (2.2 per cent).¹³ Ghana is a net importer of agricultural products, importing mainly food crops such as rice and wheat (FAO, 2015a).

Poverty has declined markedly in Ghana in the past 25 years, down from 52.7 per cent of the population below the poverty line in 1991 to 21.4 per cent in 2012 (Molini and Paci, 2015). There are increasing regional disparities, however, with the poverty rate in the north nearly twice that of the south (Feed the Future, 2016). One in three poor people now lives in the northern rural areas, compared with one in five in 1991 (Molini and Paci, 2015).

¹³ See <http://atlas.media.mit.edu/en/profile/country/gha/>

Ghana's food supply was recorded at 2,377 kilocalories per capita per day in 1996. This has increased steadily and was 3,003 kilocalories per capita per day in 2011. The increasing food supply corresponds with declining undernourishment: the prevalence of undernourishment is considered statistically insignificant today, compared with 7.1 per cent of the population in 1990–1992 (WDI, 2016).

Ghana's population was estimated at 27.4 million people in 2015. It is projected to grow to 36.8 million by 2030 and to 50 million by 2050 (UN, 2015), an 82 per cent increase compared with 2015. The proportion of people living in urban areas will increase from 54.0 per cent of the population in 2015 to 70.5 per cent by 2050 (UN, 2015).

National-level data indicate that there was a progressive rise in temperature and decrease in mean annual rainfall (and increasingly erratic weather such as extreme events, storm damage and flooding) in all agro-ecological zones in Ghana between 1960 and 2000. Rainfall decreases generally from south to north. Several staple cereal crops as well as roots and tubers are affected by a shortening of the growing season (RoG, 2013). Ghana's National Climate Policy predicts an average rate of increase in temperature of 0.21 degrees Celsius (°C) per decade (Ghana, 2013a), although an IFPRI report indicated that the mean annual temperature had increased by 1°C per decade since 1960 (De Pinto *et al.*, 2012).

The Government of Ghana makes conservative predictions of temperature increases of 1.7–2.04°C by 2030 in the northern savannah regions, with the maximum temperature rising as high as 41°C (RoG, 2013). A UNDP review of 15 global circulation models indicated a mean annual temperature increase of 1.0–3.0°C in the country by 2060 and of 1.5–5.2°C by 2090. Ghana's Second National Communication to the United Nations Framework Convention on Climate Change presented the results of an assessment of rainfall and temperature changes in decadal time series covering 1960–2000 (RoG, 2011a); notably, the general trends in the forest zone were increases in the mean annual daily temperature and decreases in total rainfall – more than in any other zone.¹⁴

An IFPRI assessment of the impacts of climate change on yields of rainfed maize, rice and groundnuts by 2050, and associated regional impacts, predicted an overall decrease in yields of all crops, with regional variations. Some areas were predicted to experience increases in yields and others to experience losses. Results for rainfed maize indicated decreases of less than 25 per cent in each region, although some models predicted increases in the Upper East, Western and Northern regions. Results for rainfed rice indicated moderate yield decreases, with variations between models (DePinto *et al.*, 2012). The extent and degree of rice yield declines were predicted to be less than those for maize, although this varied depending on the climate model applied (Nutsukpo *et al.*, 2012).

¹⁴ The other four eco-climatic zones are coastal savannah, transitional zone, Guinea savannah and Sudan savannah.

4.2 Status of forests

Forest definition and cover

A new national definition of forest has been developed for the national REDD+ strategy, after an intensive consultative process, in which forest is defined as land with a minimum area of one hectare, a minimum canopy cover of 15 per cent, and with trees that have the potential to reach or have reached a minimum height of five metres at maturity in situ. Forest plantations are included in this definition as long as they are not established at the expense of intact natural forests. Tree-crop plantations (eg cocoa and rubber) are not considered forests, but land-use systems that integrate tree crops with a significant shade canopy of forest trees may qualify (FC, 2015). The Ghana forest definition sets higher thresholds for forests than the definition used by the Food and Agriculture Organization of the United Nations (FAO).¹⁵

Ghana has a land area of 24 million hectares. Traditionally, the country has recognised six main ecological zones: High Rainforest; Semi-Deciduous Forest, Transition; Guinea Savannah; Sudan Savannah; and Coastal Savannah (Figure 11; RoG, 2011b). Forests occur in all ecological zones, ranging from moist evergreen forests to savannah woodlands (FC, 2015).

Ghana's national REDD+ strategy defines three main ecological zones – High Forest Zone (HFZ); Transition Zone (TZ); and Savannah Zone – and uses these to guide implementation (FC, 2015). It is unclear, however, how those zones are defined and how much land area is covered by the HFZ and the TZ. According to estimates published by FAO in 2005¹⁶, rainforests and deciduous forests account for 6 per cent of the country, the transitional zone for 28 per cent and the Guinea savannah for 63 per cent. These paint a very different picture of the southern part of Ghana to that shown in Figure 11, suggesting a much larger transitional area and a much smaller area of rainforests and deciduous forests.

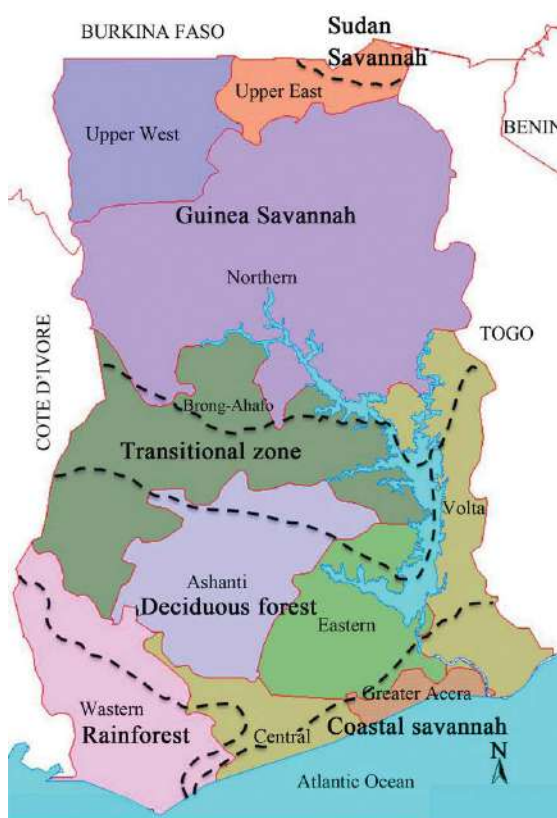
¹⁵ FAO's forest definition is: land with tree crown cover (or equivalent stocking level) of more than 10 per cent and area of more than 0.5 hectares. The trees should be able to reach a minimum height of 5 m at maturity in situ.

¹⁶ See www.fao.org/nr/water/aquastat/countries_regions/gha/index.stm

No data are available on Ghana's total forest area based on the new definition. FAO (2014) estimated forest area at around 37 per cent (9 million hectares) of the total land area based on data generated through remote sensing by the Forest Preservation Programme (FPP) in 2013. The data and spatial maps generated by the FPP were criticised for interpreting cocoa plantations, oil-palm plantations and rubber plantations as forests (FC, 2015). The total forest area estimate and the land-use and land-use change maps generated by the FPP were to be used as baselines for REDD+ in Ghana but are under revision.

There are 266 forest reserves in Ghana covering 2.6 million hectares (Figure 12). Much more reliable information is available for these reserves than for forests outside them. A recent IUCN assessment of crown cover in the 266 forest reserves found that forest degradation and deforestation are occurring inside the reserves (IUCN, 2016). There are forest reserves in all three of the main ecological zones but most are in the HFZ (Ghana, 2015). There are very few off-reserve forests in the HFZ: timber extraction is not managed outside reserves and off-reserve forests in the HFZ have been exploited heavily since enactment of the Concession Act¹⁷ in 1962.

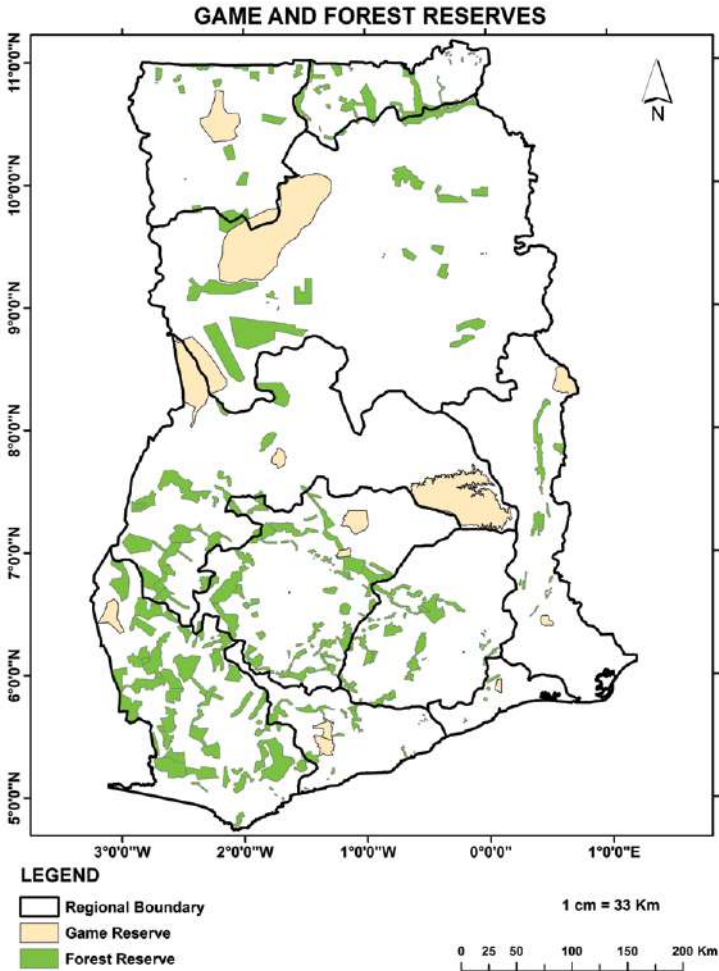
Figure 11. Ecological zones and administrative regions, Ghana



Source: Kemausuor *et al.* (2013)

¹⁷ The Concession Act vested all rights to timber trees on any land in the President, to be held in trust for the stools or landowners concerned. Thus, the state became responsible for off-reserve timber allocation, including for trees on farms, to the exclusion of farmers who manage such trees. The cooperation of farmers and landowners – which is needed for the effective control of off-reserve timber exploitation – was lost therefore, and various spurious activities and illegal timber extraction led to considerable degradation.

Figure 12. Canopy cover in Ghana's forest reserves



Source: Resource Management Support Centre, Ghana Forestry Commission

Forest biodiversity

The HFZ hosts the greater part of the country's faunal and floral diversity, accounting for 83 per cent of the total species recorded. The HFZ is part of the Guinean Forests of West Africa Biodiversity Hotspot, one of the world's 36 most important biodiversity areas (FC, 2015). Deforestation and forest degradation are the leading causes of biodiversity loss in the HFZ and have been estimated to cost 10 per cent of GDP (RoG, 2011a).

Information on species diversity and endemism in the savannah biomes is sparse. The savannah woodlands and gallery forests may be more species-rich than the dry savannahs.¹⁸

Drivers of deforestation

Ghana lost an estimated 2.7 million hectares of forest between 1950 and 2000. The country's current deforestation rate, at about 2 per cent per year, is among the highest in Africa. Remnant forests outside gazetted forest reserves are likely to be completely lost by 2025, and forest reserves will be under increasing pressure (FC, 2015). At the same time, however, FAO reported a total increase in forest cover of 710,000 hectares (8.6 per cent) between 1990 and 2015, due in part to a 235,039-hectare expansion of forest plantations on land classified as forest land and on non-forest land. Forest density is declining on forest lands, however, due to degradation (FAO, 2015b).

The main drivers of deforestation and forest degradation in Ghana are agricultural expansion (which accounts for 50 per cent), wood harvesting (35 per cent), population and development pressure (10 per cent), and mining and mineral exploitation (5 per cent) (GoE, 2011a). The key commodities causing agricultural expansion are cocoa, other tree-crop systems (eg rubber, citrus, oil palm, coffee, cashew and mango) and food-crop farming, including shifting cultivation (FC, 2015).

This study focuses on cereals, particularly maize, because the area of expansion is considerably greater for maize than for any other crop (Figure 13), and there is a large overlap between forests and the land with high potential for maize. Maize is the only cereal crop grown extensively in all ecological zones in Ghana.

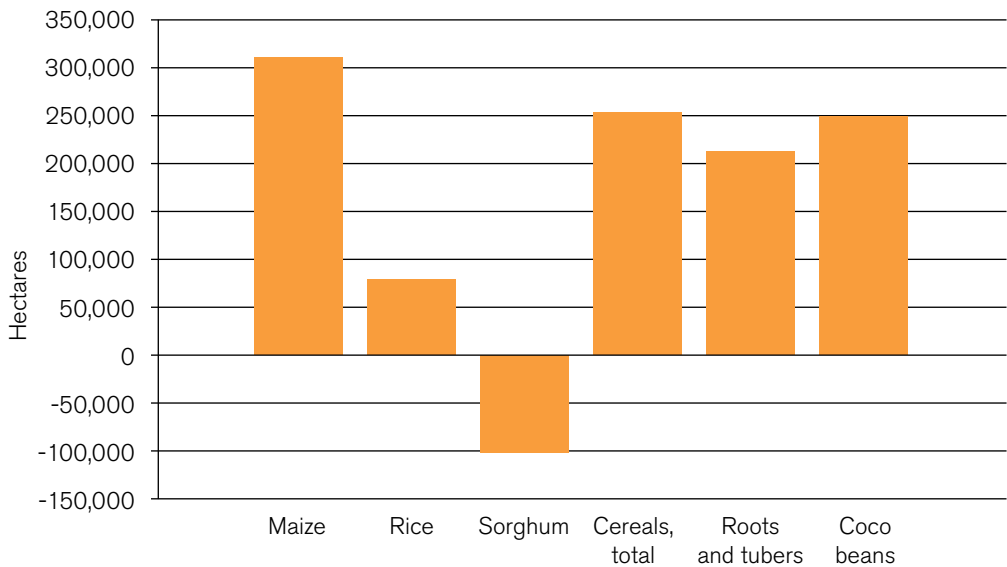
Even though maize has been expanding and is the most commonly cultivated crop in areas with forests, the impact of this expansion on forests and biodiversity is poorly understood; there is a similar lack of understanding of the impacts of expanding cassava and yam cultivation. Few of the stakeholders interviewed and key policies reviewed in this study considered the impacts of maize production when discussing drivers of deforestation and forest degradation in the HFZ and the TZ. There was more consensus that maize and rice expansion are major drivers of the loss of woodlands in the northern savannah regions.

¹⁸ See <http://gh.chm-cbd.net/biodiversity/status-ghanas-biodiversity>

In the HFZ, cocoa farming is considered the predominant driver of deforestation and forest degradation. But the intercropping of food crops (including cereals and roots and tubers) with cocoa may also result in more deforestation and forest degradation. Farmers plant cocoa in thinned forests together with other food crops, such as maize and cassava, which are planted before the cocoa to provide temporary shade. This intercropping of cocoa with other food crops in the first two years of cocoa establishment has led some farmers to the extreme practice of completely felling forest trees, thus depriving the cocoa plants of optimal conditions for growth and development (Ghana Ministry of Finance and EU, 2006).

Important drivers of biodiversity loss are considered to be the overexploitation of forest resources; invasive alien species; climate change; habitat change (including agriculture expansion into forest ecosystems); and pollution (RoG, 2015b).

Figure 13. Change in cultivated area for staple food crops and cocoa beans, Ghana, 2001–2013



Source: FAOSTAT

4.3 Past and present agricultural production

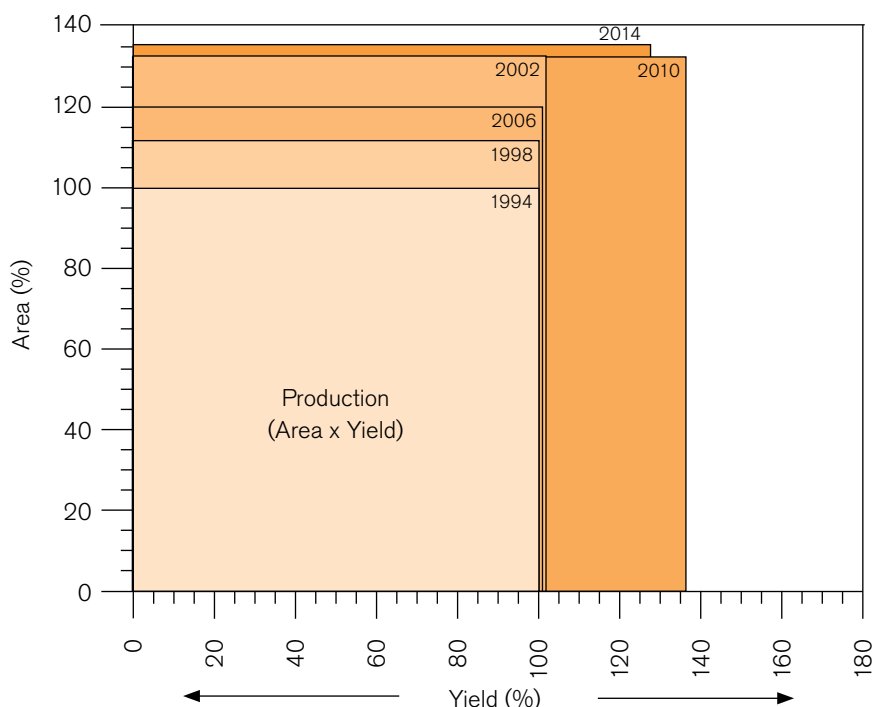
Trends in crop production

FAO data for 2013 indicate that maize and cassava are Ghana's most significant staple food crops in terms of planted areas by far – maize at 1.02 million hectares and cassava at 0.87 million hectares. Of the maize produced in Ghana, it is estimated that 85 per cent is used for food and 15 per cent is used for feed (mainly poultry) (FAO, 2012a).

Maize is produced countrywide because of its importance as a staple crop, and the majority of farmers commercialise some proportion of their production (FAO, 2012a). Combined, the Brong-Ahafo, Eastern, and Ashanti provinces grew 52 per cent of Ghana's maize crops in 2014; the central and northern regions were also major contributors (RoG, 2016).

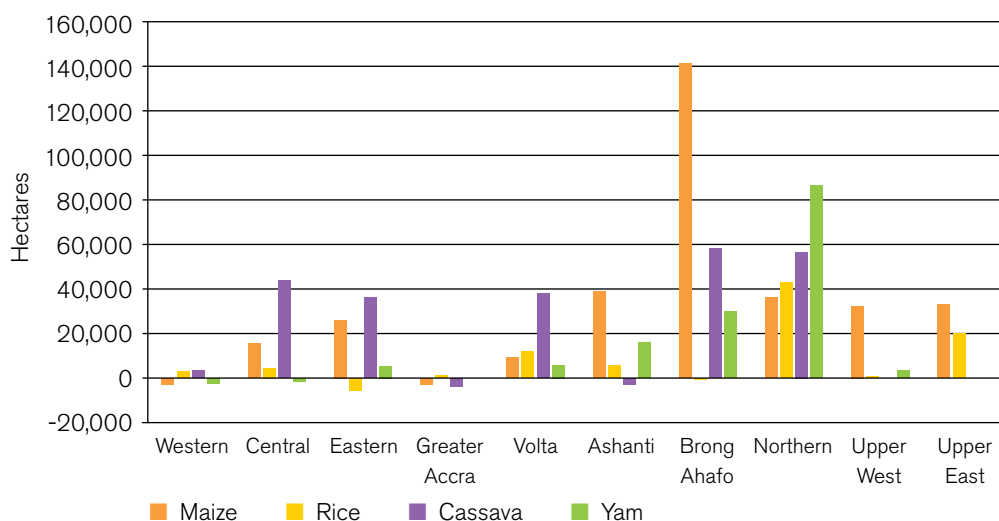
Domestic cereal production in Ghana increased by 74 per cent between 1994 and 2014 (FAOSTAT, 2016). This was achieved by a 28 per cent increase in crop yields and a 36 per cent increase in the production area (Figure 14).

Figure 14. Change in cereal yield and cultivated area, Ghana, 1994–2014



In the period 2000–2011, the expansion of the area of maize cultivation took place in all regions except the Western region: the largest expansion was in Brong-Ahafo, followed by Ashanti, Northern, and Upper West and Upper Eastern. Seventy per cent of the total expansion area for maize was in the HFZ and the TZ (Figure 15).

Figure 15. Change in cultivated area for staple food crops in Ghana, by region, 2010–2011



Source: RoG (2016)

Who are the producers?

Ghana's agriculture, which is mostly rainfed, employs 41.5 per cent of the working population, although the percentage has decreased in recent years (FAO, 2015a). About 2.74 million households operate a farm or keep livestock, or both. Around 80 per cent of agricultural production is by smallholder farmers, despite low levels of mechanisation on those farms (RoG, 2011b).

Estimates of the average size of smallholder farms vary. A figure used officially is that "90 per cent of farm holdings are less than two hectares in size" (Ghana, 2015a), but a 2007 report by IFPRI, based on survey data for 2005 and 2006, concluded that 70 per cent of farm holdings were less than 3 hectares in size. It also found regional differences: the average farm holding was larger in the savannah zone (at 4 hectares) than in the coastal zone (2.3 hectares) and the forest zone (3.1 hectares) (Chamberlin, 2007).¹⁹

¹⁹ The data used was generated by GLSS5 using three ecological zones: forest, savannah and coast. It is unclear how those zones were defined and whether the transition zone was included in the forest zone or gazetted into the forest and savannah zones.

Food imports and exports

Ghana is far from self-sufficient in rice and wheat, importing substantial quantities, but it is largely self-sufficient in other staple crops. The country can mostly meet its domestic demand for maize, with a relatively small amount (around 250,000 tonnes annually) imported for poultry feed. Although no official data are available, maize is exported to neighbouring countries through informal channels (USDA, 2014).

4.4 Future food production and forests

Growing domestic food demand

The Ghanaian diet is based largely on roots and tubers (cassava and yam), fruit (plantain) and cereals (maize and rice). Starchy roots and cereals supply almost three quarters of dietary energy (FAO, 2009). As they become more urbanised, Ghanaians are increasingly favouring cereals (especially rice) over roots and tubers (Diao *et al.*, 2016).

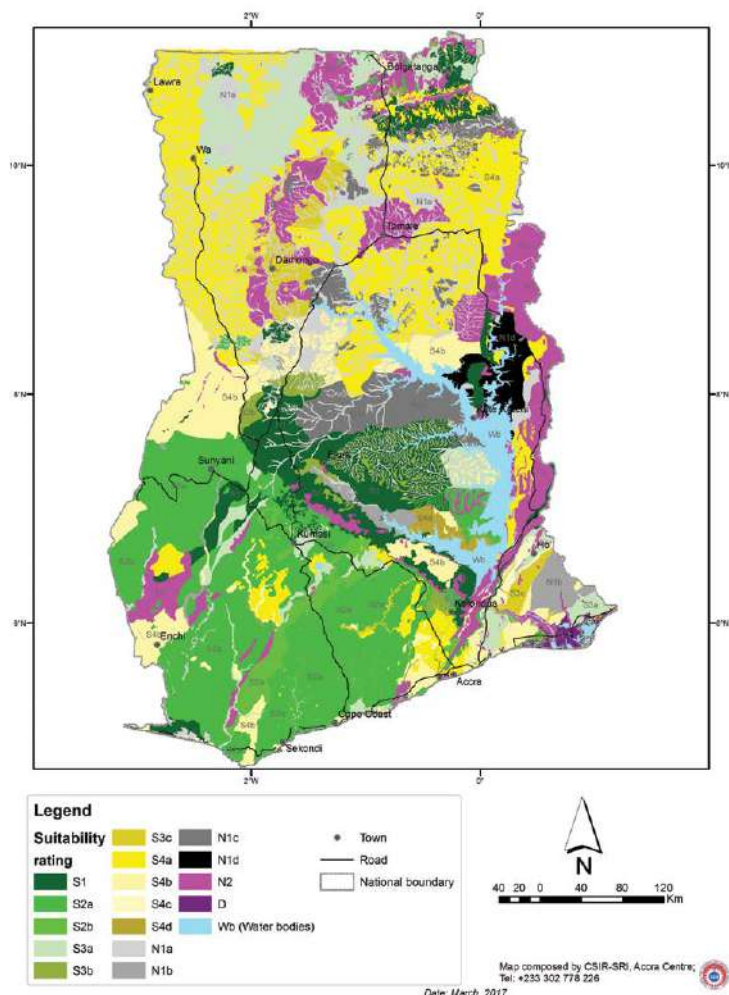
Taking into consideration changing consumption patterns and the increasing population, IFPRI's IMPACT Model (2015) projects that Ghana's domestic demand for cereals will increase by 171 per cent from 2015 to 2050 (Robinson *et al.*, 2015). This projection may well be an underestimate because it assumes a total population 13 per cent lower than UN projections.

Food-crop yields are likely to continue to increase in Ghana at a slow but steady pace. A more rapid increase will require massive investment to reduce post-harvest losses; improve rural infrastructure; support irrigation, mechanisation and fertilisation; build efficient supply chains; and adapt to climate change (RoG, 2014).

Spatial distribution of agricultural expansion into forests

An estimated 14 million hectares of land in Ghana (58.8 per cent of the total land area) is considered agricultural land, of which 55.8 per cent (7.8 million hectares) is under cultivation. Of the land under cultivation, only 0.4 per cent (28,304 hectares) is irrigated, although the potential irrigable land area is estimated at 500,000 hectares (RoG, 2015a; RoG, 2010). It is unclear, however, how agricultural lands are defined and where they lie. If soil-crop suitability is used as the criterion for defining agricultural land, the majority of suitable agricultural areas coincide with forests (RoG, 2015a) (Figure 16). This indicates potential conflicts between food-crop production and forest and biodiversity conservation.

Figure 16. Soil suitability map, Ghana



S1 Highly Suitable Areas for Extensive Mechanised Cultivation of Export and Food Crops.

S2 Suitable Areas for the Extensive Cultivation of Export and Food crops.

S2a The major upland soils are suitable for the cultivation of export and food crops but only limited mechanised cultivation can be practiced due to terrain. The low land soils are suitable for the cultivation of rice, sugarcane and vegetables.

S2b Crop suitability same as S2a above. Limitation to crop production may be due to either light or heavy textured soils

S3 Fairly Suitable Areas for the Cultivation of Crops

S3a Suitable for mechanized irrigation rice, sugarcane, maize, guinea corn, millet and vegetables. The areas can also be developed to livestock rearing in between the main wet and dry seasons.

S3b They are recommended for mainly maize and guinea corn, however, anti-erosion measures should be more rigidly enforced. The lowland alluvial soils are suitable for the cultivation of dry season sugarcane and vegetables.

S3c Mainly occupy the levees and terraces along the major rivers. Suitable for the cultivation of maize and vegetables.

S4 Fairly to Marginally Suitable Areas for Limited Cultivation of Crops

S4a Occurring on upland or undulating of very steep slopes. Unsuitable for mechanised cultivation but well suited for hand cultivation of cassava, citrus, oil palm and mangoes.

S4b Sandy areas may be used for groundnut and tiger nut cultivation.

S4c Limited areas on the summits, very unsuitable for cultivation and must as such be reserved for forestry, wildlife and or watershed protection purposes.

S4d May be mixed with organic manure for vegetable cultivation of pepper, tomatoes, onions and okro. Best suited for livestock grazing under improved pastures. Area within valley bottoms are suitable for the cultivation of rice and sugarcane.

N1 Unsuitable Areas for Upland Arable and Tree Crops

N1a May be suitable for the cultivation of rice, sugarcane and vegetables.

N1b May be suitable for maize, cassava and pepper cultivation.

N1c May be left to prevailing grass vegetation for rough grazing of livestock

N1d May be developed for paddy rice cultivation or vegetation should be left for rough grazing by livestock.

N2 Very Unsuitable Areas for Crop and Livestock Production

D Unsuitable for crop and livestock production and must be utilised for the mining of edible salt.

4.5 Relevant policies, institutional arrangements and processes

Agriculture

The 2007 Food and Agricultural Sector Development Policy II (FASDEP II) constitutes the key policy framework for promoting modernised agriculture and rural growth in Ghana. The policy acknowledges that “although past growth and poverty reduction was stimulated through support for export crops, support to increase productivity in staple crops, by virtue of the broad-based nature of their production, can generate faster growth and poverty reduction”, and it prioritises increasing the production of five staple food crops (cassava, cowpea, maize, rice and yam) to ensure food security. The policy emphasises subsidies for mechanisation and fertilisers, the establishment of block farms (large areas of arable land), and the stabilisation of output prices (RoG, 2007). To guide investment for implementing FASDEP II, the Government of Ghana released the Medium Term Agriculture Sector Investment Plan (METASIP) in 2010. METASIP included the following targets for 2015: a 20 per cent reduction in households vulnerable to food insecurity; 50 per cent increases in the yields of maize, rice and sorghum; post-harvest loss reductions of 30 per cent (maize), 35 per cent (rice), and 20 per cent (sorghum); increases of 25 per cent in irrigation productivity and 50 per cent in intensification; and the development of 22,590 hectares of micro-irrigation schemes. None of those targets were achieved (RoG, 2010).

Complementing these policies is the Ghana Shared Growth and Development Agenda 2014–2017 (GSGDA II), issued in 2014, which is a medium-term policy framework intended to operationalise development plans. Agriculture is a central component of the agenda, with expected growth of 6.4 per cent until at least 2017. Agricultural growth was well below this target in 2009–2012, averaging 3.7 per cent annually; it was driven largely by cocoa although livestock grew at 5 per cent. The agenda identifies low productivity in the agriculture sector as a major problem, with both direct and indirect impacts on food security and economic growth due to an overreliance on rainfed agriculture and low levels of mechanisation, fertiliser application and other technologies. Other issues include weak management along the value chain and limited access to extension services by farmers. GSGDA II continued GSGDA I's vision for agricultural modernisation and prioritised improving post-production management; developing an effective domestic market; and expanding agriculture exports. Improved post-production management entails improving supply-chain management for developing product clusters; better collaboration among public and private-sector institutions to promote agro-processing, storage and marketing; and promoting agro-processing industries (RoG, 2014).

Specific themes in Ghana's agriculture development programme include (FAO, 2015a):

- 1) Fertiliser subsidy: the government introduced a 50 per cent fertiliser subsidy in 2008 to address the spikes in domestic prices for food and fertilisers that occurred in that year. The total funding in 2008 was US\$10.8 million; this increased to US\$63 million in 2012 but the percentage subsidised was reduced to 21 per cent in 2013. The programme ceased in 2014 due to budgetary restrictions.
- 2) Block farming: the block farms programme, which was piloted in 2009 in six regions (Ashanti, Brong-Ahafo, Central, Northern, Upper East and Upper West), targets large tracts of arable land to establish farming businesses. Crops in the programme are maize, rice, soybeans, sorghum, tomato and onions.
- 3) Mechanisation: agricultural mechanisation service enterprise centres (AMSECs) assist the private sector (84 companies in total, by 2012) to provide farmers with agricultural mechanisation services in a timely and affordable manner. The aim is that all districts in the country will have one functioning AMSEC; as of 2015, 89 AMSECs had been established countrywide.
- 4) Food stocks: the National Food Buffer Stock Company (NAFCO), which was established in 2010, is a state-owned company that buys, preserves, stores, sells and distributes excess grain in warehouses across the country. NAFCO aims to reduce post-harvest losses and to guarantee minimum prices for farmers. It is financed by a US\$5 million government budget allocation and US\$10 million in donor funding through the Heavily Indebted Poor Country Grant. Seventy-three licensed companies are mandated to purchase maize, rice and soy beans from farmers at a minimum price that covers the total cost of production and a 10 per cent profit margin for farmers. NAFCO faces financial constraints and lacks the storage facilities to deliver its mission. The government is seeking a private partnership to alleviate funding pressures on NAFCO.

A recent study by IFPRI estimated that about 85 per cent of the budget of the Ministry of Food and Agriculture was allocated to the four programmes described above, leaving only 15 per cent for regional and district-level core activities (FAO, 2015a).

Rice has long been a priority staple food crop in Ghana. The National Rice Development Strategy has the goal (among others) of doubling domestic rice production by 2018, at an average annual growth rate of 10 per cent (FAO, 2013a). The strategy concludes that both intensification and area expansion must be pursued vigorously to ensure Ghana's self-sufficiency in rice.

Most donor-supported agricultural programmes focus on the savannah region, where poverty is high. One of the biggest donor-supported programmes is Feed the Future, a multi-year programme funded by the US government, mainly targeting Ghana's three

northern regions. Feed the Future concentrates on commercialising staple crop systems, given their large share of the sector. The programme prioritises “closing the yield gaps and reducing pre- and post-harvest losses of the country's major staple crops (focusing on rice, maize and soy), improving the efficiency of their value chains, and strengthening the regulatory system and policy frameworks to support regional trade” (USAID, 2011). The programme started in 2008, and its budget was US\$50 million in 2012.

Forests

REDD+

Ghana started designing REDD+ activities in 2008, and the World Bank approved its REDD+ readiness preparedness plan in 2010. In 2015, Ghana started transitioning out of the readiness phase by implementing its REDD+ demonstration activities (under the World Bank's Forest Investment Program) and developing its first subnational REDD+ programme, the Cocoa Forest REDD+ Programme.

The Ghana National REDD+ Strategy (GNRS), published in 2015 by the Forestry Commission of Ghana, is intended to be implemented and updated periodically over the next 20 years. Under the strategy, the initial focus of REDD+ will be in the HFZ, but it will scale up to cover the other major ecological zones, including the Savannah Zone. REDD+ activities aim to ensure economic growth in the country in an environmentally responsible way. The key criteria adopted to guide REDD+ activities are: economic development; environmental sustainability; measurability; inclusiveness; and marketability (ie whether the activity can generate revenue through markets, funds or alternative mechanisms).

The GNRS encourages a learning-by-doing approach and retains sufficient flexibility and openness to enable improvement over time. It lays out a vision to reduce emissions from deforestation and forest degradation by 40 per cent by 2025 while addressing threats that undermine ecosystem services and environmental integrity, including biodiversity. The GNRS aims to transform Ghana's major agriculture commodity production systems and landscapes so they are climate smart. Up to 2020, the commodity focus of REDD+ activities are cocoa, oil palm and other tree crops in the HFZ and shea and cashew in the savannah zones (FC, 2015).

The World Bank's Carbon Fund accepted Ghana's Emission Reductions Programme for the Cocoa Forest Mosaic Landscape into its pipeline in April 2014. The programme conservatively anticipates that it will reduce emissions by 18.5 million tonnes carbon dioxide equivalent between 2015 and 2020 and up to US\$50 million in funding from the World Bank (FC, 2015).

Ghana has received US\$3.4 million for its REDD+ readiness activities. In addition, US\$117 million was committed between 2009 and 2013 to support REDD+ in Ghana, and US\$18 million was disbursed to 23 in-country recipients. The majority of available

financing has been used to support national-level activities and the Cocoa Forest REDD+ Programme (FC, 2015).

The GNRS calls for intersectoral coordination between the Ministry of Lands and Natural Resources (MLNR) and other key ministries, such as the Ministry of Environment, Science, Technology and Innovation, the Ministry of Food and Agriculture, and the Ministry of Energy, but it provides no specific plan for this.

Forest plantations

The National Forest Plantation Development Programme was launched in September 2001 and largely implemented in degraded forest reserves. The programme was expanded in 2010 to include plantations on private lands outside forest reserves. The goal is to develop a sustainable resource base that will meet future demand for industrial timber, thereby relieving pressure on natural forests and increasing the total forest area. The five objectives of the programme listed on the Forestry Commission website are (FC, 2017):

- 1) Restore the forest cover of degraded forest lands.
- 2) Reduce the country's wood supply deficit.
- 3) Generate employment as a means to reduce rural poverty.
- 4) Improve environmental quality and provide an opportunity for the country to tap into the emerging benefits of the carbon markets and payments for environmental services.
- 5) Enhance the production of food crops and contribute to food security in the country.

The Forestry Commission launched the National Forest Plantation Strategy 2016–2040 in 2013 and revised it in 2016. The strategy aims to develop commercial forest plantations of recommended exotic and native species at a rate of 25,000 hectares per year (40 per cent established through public, public–private and public–community partnerships and 60 per cent established by the private sector) by 2040 (thereby adding a total of 625,000 hectares over the life of the strategy). An average of 5,000 hectares of 'understocked' and degraded forest reserves and community forests are to be enriched every year over a 20-year period using high-value indigenous tree species. The strategy has identified 3.1 million hectares for forest plantation establishment in Ghana: 135,000 hectares in forest reserves in the HFZ; 283,000 hectares in forest reserves in the Savannah Zone; and 2.68 million hectares outside forest reserves on fallow areas and shrublands (constituting about 20 per cent of the country's total fallow and shrubland area) (FC, 2016).

In 2014, Ghana pledged to restore 2 million hectares through forest landscape restoration by 2030 in the global Bonn Challenge – a much more ambitious target than that stated in the National Forest Plantation Strategy. The proposal is to meet the target primarily by planting trees in agricultural landscapes, with the remainder to be achieved by replanting

degraded reserves. Most of the finance for meeting the target is expected to come from the private sector, including timber companies, and from donor support. Planning for forest landscape restoration has identified two regions – Brong-Ahafo and Western – as having particularly high potential for carbon sequestration. With support from the World Bank, MLNR has prioritised these two regions in Ghana's Forest Investment Programme (IUCN, 2016).

Biodiversity

The Forest and Wildlife Policy was prepared in 2012 and the Forestry Development Master Plan was completed in 2016, including plans for biodiversity conservation. Central to each is 'biodiversity mainstreaming', which would involve (MLNR, 2016):

- Effective management of the network of protected areas, including Wildlife Protected Areas and Globally Significant Biodiversity Areas.
- The creation of biological corridors to link all important ecosystems by 2025.
- Improving community participation in wildlife management through appropriate models such as community resource management areas (CREMAs); 60 are to be in operation by 2040.

Biodiversity is not a key priority area for the government, but the productive use of land is. The hope is that ensuring more productive land uses will reduce pressure on remaining natural forests, and habitat corridors can also be planted to increase biodiversity and to link forest reserves.

Cross-sectoral

Ghana Vision 2020 was launched in 1995, in which Ghana is envisaged as a middle-income country by 2020. The ambition and priority for economic development is reflected in the policies of both the forest and agriculture sectors. For example, the agriculture sector aims to tap into both domestic and international markets (especially through high-value export cash crops); the forest sector prioritises forest plantations that can be used productively (RoG, 1995).

GSGDA II is a cross-sectoral policy supporting Ghana's vision to produce agricultural products for both domestic and international markets, but it also includes targets for natural resource management, including biodiversity management, protected area management and the restoration of degraded forests. It does not discuss or reflect on the potential conflicts among the ambitious goals of different sectors.

Climate change

Ghana's National Climate Change Policy notes that climate change is expected to have significant impacts on resource-dependent sectors, including forest and agriculture (RoG, 2013b). In 2015, the Ministry of Environment, Science, Technology and Innovation launched the Ghana National Climate Change Master Plan Action Programmes for Implementation: 2015–2020. This prioritises adaptation activities, including developing climate-resilient agriculture and food systems for all agro-ecological zones and human resource capacity for climate-resilient agriculture. Key mitigation actions include protected area management, plantation development and trees on farms (ie increasing carbon sinks) (RoG, 2015b).

Ghana's INDC aims to lower the country's greenhouse gas emissions unconditionally by 15 per cent relative to the business-as-usual scenario (emissions of 73.95 million tonnes carbon dioxide equivalent) by 2030. An additional 30 per cent reduction in emissions will be achieved if external support is made available to cover the full costs of further actions. Forestry is one of the key sectors for delivering mitigation goals: without external support, Ghana commits to an annual reforestation/afforestation target of 10,000 hectares on degraded land to contribute towards its mitigation targets. With external support, Ghana commits to an annual reforestation/afforestation target of an additional 10,000 hectares and additional activities, including enrichment planting; the enforcement of timber felling standards; the sustainable management of cocoa landscapes; and wildfire management. Adaptation strategies include conservation, climate-smart agriculture and the better management of forest resources (RoG, 2015c).

Land tenure

Land tenure in Ghana reflects legal pluralism involving both customary and statutory laws. A range of institutions and regulations has authority over land rights, and there are multiple bodies for resolving disputes.

The current land-tenure system in Ghana has been described as a cauldron of simmering tensions between customary and state interests and institutions – a struggle of communal and individual rights, opposing political forces and divergent economic interests stuck in a colonial paradigm in search of a future identity (Djokoto and Opoku, 2010). The 1992 Constitution vests the custodianship of lands in 'stools' and 'skins' under the authority of chiefs, and it divides land into public tenures (vested in the President in trust for the people of Ghana and managed by the Lands Commission) and customary tenures under chiefs. Thus, customary and statutory land tenure co-exist. The former is characterised by its largely unwritten nature, based on local practices and norms that are said to be flexible, negotiable and location specific. Customary land tenure is usually managed by a traditional ruler, earth priest, council of elders, family or lineage heads. Its principles stem from rights established through the first clearance of land, conquest or

settlement. Rights are vested in the stool and the subjects of the stool (ie citizens of that jurisdiction) have unlimited use rights to portions of the land based on families or clans.

The state tenurial land system, based on laws which have roots in colonial power, is usually codified in written statutes and regulations that outline what is acceptable and provide consequences for non-compliance (Agbosu *et al.*, 2007). The management of such codified systems is usually in the hands of government administrators and bodies with delegated authority – such as the Forestry Commission and the Lands Commission. The principles underpinning this system derive from citizenship, nation building, and constitutional rights. Land rights are allocated and confirmed through the issue of titles or other forms of registration of ownership.

Land governance and management

In recent years, there has been increasing recognition in Ghana of the importance of coherent land-use management, mainly through the REDD+ process. For example, the national REDD+ strategy identifies the lack of a holistic and effective land-use plan for Ghana as a significant challenge to the successful implementation of interventions that seek to limit unsustainable environmental practices such as unregulated or unsustainable agriculture expansion, illegal mining activities, and infrastructure development, which drive forest loss in the country (FC, 2015).

Ghana's Land Administration Project, which commenced in 2003, seeks to implement the policy actions recommended in the National Land Policy of 1999 over a 15–25 year period with the aim of addressing the challenges associated with the land sector in Ghana. Land-use planning, spearheaded by the Town and Country Planning Department, features strongly in the Land Administration Project. To date, however, work on land-use planning has focused on spatial planning for human settlements and urban development, and very little attention has been paid to other land uses, such as agriculture, forestry and mining (FC, 2015).

Starting from 2016, all districts are required to have district land-use planning officers. Ghana has 216 districts (comprising 6 metropolitan, 49 municipal and 161 district assemblies), and there may be a lack of capacity for developing land-use plans. A land-use law passed in 2016 requires all districts to have land-use spatial plans spanning 20-year periods, to be reviewed every five years by the National Development Commission. As with the Land Administration Project, land-use planning at the district level under the new law may focus more on urban planning than on rural land use.

The main government agencies responsible for forest management in Ghana are MLNR and the Forestry Commission. In line with the above framework, the Forestry Commission is mandated to manage, develop and regulate the use of the nation's forest and wildlife resources and to coordinate related policies. The Forestry Commission and its divisions

have centralised control over planning and resource coordination (FC, 2015). MLNR has ministerial responsibility for the development and monitoring of sound policies to ensure the sustainable management and development of Ghana's land and natural resources, including forests. In addition to the Forestry Commission, the Minerals Commission and the Land Commission are also part of MLNR.

The Ministry of Food and Agriculture has a more decentralised structure: the ministry provides the agriculture sector with a policy and strategy framework at the national level, and those policies are to be implemented by district-level agricultural development units with the support of, and monitored by, regional agricultural units. However, the budgets of district and regional units have to be approved and released by the national-level ministry, and budget cuts and delays can hamper decentralised implementation (Mogues and Omusu-Baah, 2014).

The Ministry of Food and Agriculture is responsible for all agricultural crops except cocoa, sheanut and coffee, for which ministerial responsibility lies with the Ministry of Finance, given the importance of cocoa to Ghana's export income. The Ministry of Finance oversees the Ghana Cocoa Board, which encourages and facilitates the production, processing and marking of good quality cocoa, sheanut and coffee.

4.6 Challenges in reconciling forest conservation with food production

Ambiguous ecological zoning

Given the very distinct ecological contexts in Ghana, ecological zones are used frequently in policies, national surveys and research for the designation of priority actions and in gathering data and understanding land use and land-use change. But different sectors and stakeholders — even in the same sector — often use different classifications of ecological zoning, without clear explanations of how those classes are defined. This makes it difficult to align zonally differentiated policy targets; achieve a nuanced understanding of agricultural drivers of deforestation; and coordinate cross-sectoral planning, including land-use planning.

Outdated and unclear land-use type definitions

The Ministry of Food and Agriculture classifies 58.8 per cent land area in Ghana as agricultural land, without clearly indicating the definition it uses. It has been reported that only 55.8 per cent of this land is cultivated, implying great potential for agricultural expansion. However, without a clearer understanding of how agricultural land is defined and where it is located, it is hard to know how much arable land there really is, the most suitable uses for it, and the extent to which there is overlap with high-biodiversity areas

and forests. At the same time, there is little understanding of the state of off-reserve forests (including savannah woodland) and which areas conform with Ghana's new forest definition. All these factors make it difficult to identify and characterise the potential trade-offs between agricultural and forest land uses.

Sectoral planning silos

The process of drafting cross-sectoral policies (such as the Ghana Shared Growth and Development Agenda) largely involves a collation of various sectoral targets, and there is no mechanism to address conflicting sectoral goals. Different ministries promote their own mandates with no platform for considering how well those mandates align with other sectors, leading to a plethora of priorities and incompatible targets. For example, the forest sector has pledged to restore 2 million hectares of forests by 2030, most of which will be in agricultural landscapes. At the same time, the agriculture sector's aims of meeting domestic food demand and increasing exports will require more land for agriculture.

Conflicting objectives in the middle of the country

A specific case of silo planning is the situation in the Brong-Ahafo and Ashanti regions in central Ghana, where the conflict between agricultural and forest objectives is particularly pronounced. A large share of the recent expansion of maize cultivation has occurred in Brong-Ahafo, and both Brong-Ahafo and Ashanti have highly suitable soils for the production of food crops. With increasing food demand, the cultivation of food crops (especially maize) is likely to continue expanding in these regions, where trade networks are well established. Although most rice production is in the north, the National Rice Development Strategy has identified large areas in both Brong-Ahafo and Ashanti as suitable for expanding rice production. The government's commercial forest plantation expansion plan also identifies these two regions as holding the most potential for forest plantations, and Brong-Ahafo has been identified as a priority area for implementing the latest national strategy on forest plantations. There have been no formal discussions on how competition for land is to be managed or the implications of expanding commercial forest plantations in these regions, which are the country's 'breadbasket'.

Can the north feed the country?

Most stakeholders interviewed during this study did not think there would be competing demands on land between forest conservation and staple food production because large areas of 'vacant' land in the north could be used for the latter. Although agricultural development in the north could certainly contribute more to food production, the north's capacity to become a breadbasket is less clear, particularly given climate change. Moreover, the north's soils are more degraded than elsewhere in Ghana, resulting in low

water-holding capacity and poor responses to fertilisers (RoG, 2011b). Thus, boosting food production in the north to reduce pressure on forest land further south, although justified in terms of poverty reduction, will be more expensive, riskier and less cost-effective in terms of forest conservation objectives.

Trade-offs between meeting domestic food demand and exports

Ghana has ambitions to produce food to meet both domestic demand and for export. But its food import dependency ratio has generally been increasing, with rice ranked as its biggest food import (by value) (FAO, 2015a). Cash-crop production takes up some of the most fertile land in the south. The key export crops of cocoa, sheanut and coffee are managed by the Ministry of Finance and enjoy dedicated investments in research and extension services. In 2015, for example, 411.82 million Ghanaian cedi was dedicated to the cocoa sector alone – more than the total budget allocated to the rest of agriculture sector, including for fertiliser subsidies, mechanisation services and block farm programmes. Given the pace of increasing domestic food demand, there will be more competition for fertile land between food crops and export crops, but there is a lack of discussion at the national level about how to manage this competition and the trade-offs involved.

Aligning national and local land-use priorities

As a result of the multiple rights that exist over land, land-use governance and planning is complicated – government usually lacks control over decisions on what can be done or not done on a piece of land, especially in agricultural landscapes. Stools and families control 85 per cent of rural lands. Government needs to rely more on ‘carrots’ than ‘sticks’ when engaging with landowners on land use. There is potential to support and encourage community land-use planning through chiefs and traditional institutions but, as experience has shown, for land-use planning to work for forest and biodiversity conservation, communities must have sufficient incentive. It is unclear what type of processes and incentives can help reconcile differing national and local priorities.

A bleak future for biodiversity

Policies in the forest and agriculture sectors prioritise economic development: for example, forest landscape restoration prioritises trees on farms and commercial plantations. Trees on farms may help increase carbon stocks but may not provide the same level of ecosystem services as natural forests over a larger area, nor provide sufficient habitat to restore or sustain biodiversity. Where biodiversity is promoted, its value is linked to its capacity to generate income through ecotourism and to other direct

income-generating opportunities. Policies do not emphasise the intrinsic value of the ecosystem services provided by biodiversity.

4.7 Opportunities for reconciling forest conservation with food production

Nuanced understanding of agricultural drivers of deforestation

Research and other programmes supported by government, donors and NGOs seek to understand the trade-offs and synergies between export crop production and forest conservation, but little work is being done to understand the trade-offs and synergies between staple food crops and forest conservation. Existing policy responses seem to greatly underestimate the increasing pressure arising from domestic demand and the implications that some proposed forest conservation measures might have for food security. For example, the priority crops identified in the national REDD+ strategy are mainly for export. Further research is needed to differentiate and deepen the understanding of the impacts of staple food crops on forests and biodiversity because the policy responses for staple food crops will have implications for both forest conservation and food security.

Cross-sectoral collaboration based on strong multistakeholder processes in the forest sector

The forest sector in Ghana has a long history of multistakeholder engagement and collaborative processes. For example, a civil society contact group was created to coordinate civil society inputs to negotiations in the Voluntary Partnership Agreement process. This contact group comprised a wide range of civil society stakeholders, including NGOs in the Forest Watch Ghana coalition; traditional authorities; the Domestic Lumber Trade Association (an umbrella body for timber operators and workers in the informal sector, including chainsaw operators); and Forest Forums. The process consisted of community and district forest forums, which are platforms for district-level forest stakeholders such as forest communities, district assemblies, fire services, police, judiciary, timber companies and community-based organisations. The experiences generated in this process can help in building a strong foundation for cross-sectoral collaboration at the national and district levels.

History of forest reserves as a strong foundation for conservation on reserve land

Forest reserves were negotiated with local people, and some were put under the management of communities. Before the declaration of forest reserves in the 1930s, the state followed complex procedures to ensure that the rights of landowners and others with usufruct interests were duly protected, and several benefits were identified as rights for local communities and landowners. Due to the elaborate nature of the forest reservation process, forest reserves were accepted and their boundaries respected by forest-fringe communities and local people in general. It is unlikely that new areas will now be designated as reserves, but the same principles are espoused in the creation of CREMAs, which promote the community management of forest and wildlife resources in landscapes close to protected areas. The strategy of the Forestry Commission and MLNR is to vigorously encourage the creation of CREMAs across the country.

REDD+ and new land-use law as an opportunity to conserve forests and biodiversity

The REDD+ process in Ghana aims to catalyse the discussions and institutional coordination needed to develop a more holistic land-use plan for Ghana that integrates the various land uses at the landscape scale (FC, 2015). The process has already built stronger collaboration between the Ministry of Finance (via the Cocoa Board) and MLNR (mainly via the Forestry Commission) and it can be broadened to include other ministries. The new land-use law can be used as a basis for encouraging land-use planning for rural lands, in addition to current urban land-use planning.

5

Tanzania

5.1 Country profile

Tanzania has enjoyed strong economic growth in recent years. Real GDP grew by 7.3 per cent in 2013 and by 7.0 per cent in 2014 (World Bank, 2016). Agriculture is the largest employer, engaging around 70 per cent of the total population and contributing 24.5 per cent to GDP (URT, 2015c). Food crops constitute 65 per cent of agriculture sector GDP, and the cereal sector produces 5–19 per cent more than basic cereal consumption requirements (FAO, 2013b). Maize is the most important food crop, comprising 20 per cent of agricultural GDP, followed by rice, beans, cassava, sorghum and wheat (URT, 2006).

Poverty is still widespread. Approximately 12 million Tanzanians live in poverty (ie below the national poverty line), and inequality has increased between urban and rural populations (World Bank, 2016). On the other hand, a higher percentage of the population is becoming food secure. The country is 95 per cent food self-sufficient (URT, 2013b), although IFPRI's Global Hunger Index still rates the hunger level in Tanzania as 'serious' (Global Hunger Index, 2015). An estimated 32.1 per cent of the population was undernourished in 2015, compared with 36.7 per cent in 2005 (WDI, 2016).

Tanzania's population was estimated at 53.5 million in 2015, of which 31.6 per cent was urban. The population is projected to increase by 156 per cent by 2050, to 137.1 million, and the urban population is projected to increase by 53 per cent (UN, 2015).

The impacts of climate change are being felt in Tanzania: most parts of the country are experiencing increased temperatures and seasonal shifts in rainfall patterns, particularly in highland areas. The semi-arid Central and Northern zones are highly vulnerable to climate variability. Global circulation model projections to 2100 indicate that areas with two rainy seasons – the northeastern highlands, Zanzibar, the Lake Victoria basin, and the northern coast – will experience increases in rainfall in March–May of up to 15 per cent and the

southern, southwestern, western and central areas will experience decreases in rainfall in March–May of up to 6 per cent (URT, 2012b). Under a warmer climate, forest ecosystems may shift their ranges and lose some biodiversity (URT, 2013a). There is no significant agreement among climate models on the impacts of climate change on agricultural production, and climate models are inconsistent in identifying areas in which yields will drop and increase due to changing rainfall patterns.

5.2 Status of forests

Forest definition and cover

The definition of forest used in Tanzania has been revised recently (see box). Under the new definition, 53.9 per cent of Tanzania is forested.

According to the latest land-use classification (Figure 17), production forests in which the primary objective is revenue generation occupy nearly 20 million hectares, which is 23 per cent of the country's total land area of 88 million hectares. About 7 per cent of the country's land area is classified as under shifting cultivation. Shifting cultivation plots tend to be large and contain forests in various stages of regrowth (although such forest will not recover fully into climax forest). Agriculture (including shifting cultivation) occupies 30 per cent of the land area.

Forest is defined in Tanzania as “land spanning more than 0.5 hectares with trees that have heights of more than five metres and a canopy cover of more than 10 per cent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.”

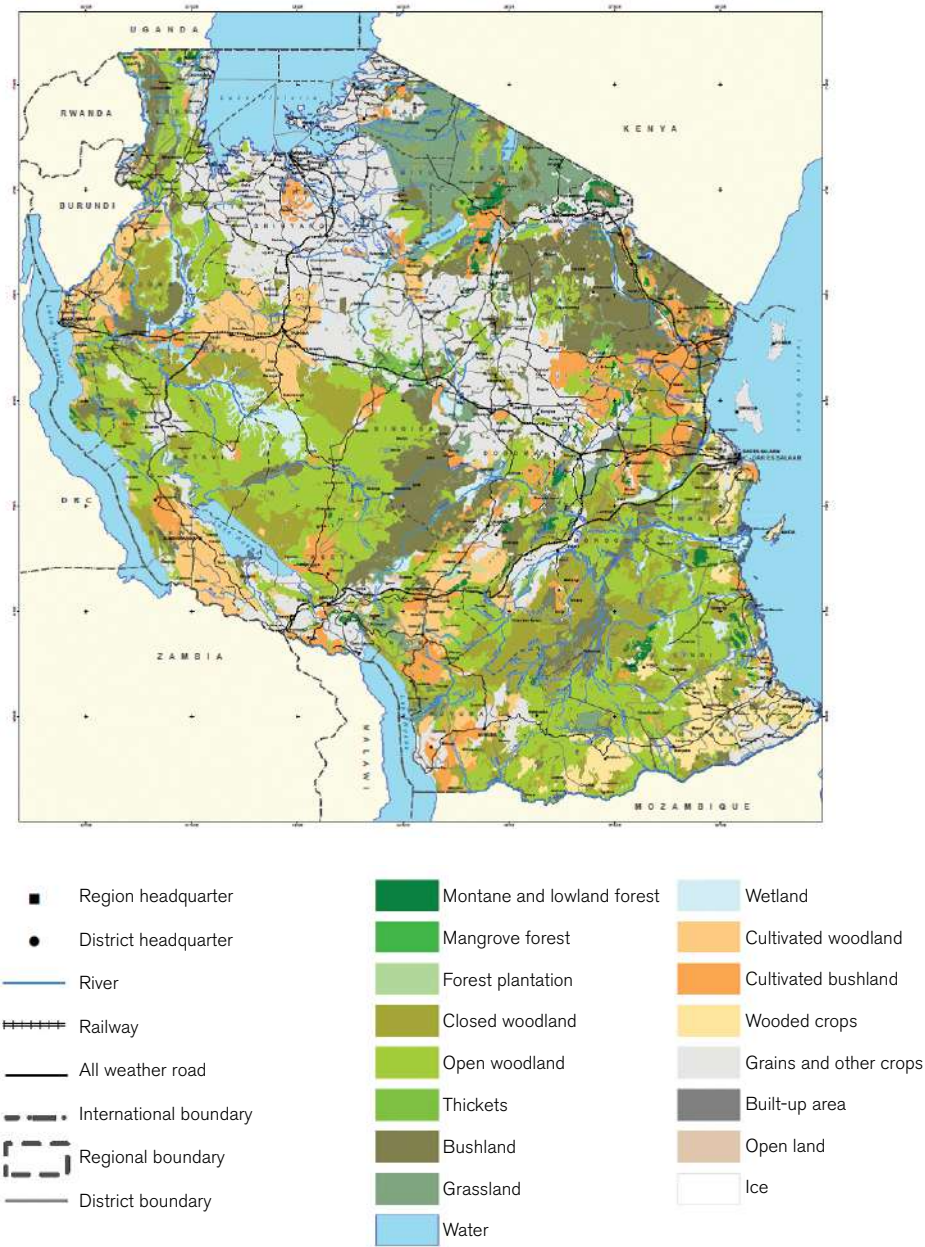
Forests comprise montane forests, lowland forests, plantations, mangroves, and open and closed woodlands (URT, 2015b).

Regions with high wood volumes are Morogoro Lindi, Ruvuma, Mbeya, Tabora and Katavi (URT, 2015b). The main forest types are the miombo woodlands and acacia savannahs; humid montane, lowland and coastal forests cover smaller areas and are fragmented and dispersed. There are montane forests in the north (Kweka *et al.*, 2015). Plantation forests are highly concentrated in the southern highlands (URT, 2015b).

Forest biodiversity

Tanzania's forests contain more than one third of the total plant species on the African continent; about one fifth of the continent's large mammal species are found in Tanzania. Tanzania ranks twelfth globally in terms of its bird species richness, and its fauna is the fourth-most species-rich in Africa (URT, 2015a). The highest level of terrestrial species

Figure 17. Tanzanian mainland land uses



Source: URT (2015b)

richness is in montane forest (USAID-Tanzania, 2012). Nearly one third (32.5 per cent) of the mainland area is under conservation, either as protection forests (10.5 per cent) or wildlife reserves (22 per cent); some of the latter have substantial areas of forest (URT, 2015b).

The Eastern Arc Mountains and Coastal Forests of Tanzania region is one of the world's 36 biodiversity hotspots, with exceptionally high concentrations of endemic species; for example, it is home to 4,000 plant species and 1,019 vertebrate species (Myers *et al.*, 2000). The region is also a frontier for biodiversity research: recent studies have discovered 27 vertebrate species that are new to science and 14 other species not previously known to exist in the area (Kideghesho, 2015).

Tanzania is ranked among 15 countries globally with the largest numbers of threatened species, with at least 900 threatened species on the IUCN Red List in 2013. Of its plant species, 305 are classified as threatened and 276 species are classified as endangered (URT, 2015a).

Drivers of deforestation

In many areas of the country, agricultural expansion for crops and grazing plays a very significant role in habitat fragmentation and loss and the associated loss of biodiversity (URT, 2015a). In some cases, this expansion is for subsistence, but increasingly the driver is income generation over and above basic needs, reflecting the crucial role of agriculture as a central pillar of the country's strategy for poverty reduction and economic growth.

It is estimated that Tanzania has lost at least one third of its important ecosystems and biodiversity in the past few decades (URT, 2015a), and the country's forest cover has declined by almost 38 per cent. The current rate of deforestation is estimated at 0.4 million hectares (0.9 per cent) annually; should this continue, the country will lose most of its forests in the next 50–80 years (FCPF, 2014). Eighteen per cent of the country's mangrove forest was lost from 1980 to 2005 (URT, 2015a). Only about 10 per cent (69,200 hectares) of the original Eastern Arc Mountains and Coastal Forests of Tanzania region remains in pristine condition (Conservation International, 2008). The highest rates of deforestation and forest degradation are in the south, which is the country's poorest region (Kweka *et al.*, 2015). Deforestation is occurring in both reserved and unreserved forests but is highest in unreserved forests (URT, 2016b).

Tanzania's REDD+ strategy identifies the following as key direct drivers of deforestation and forest degradation: firewood and charcoal production; illegal and unsustainable harvesting of forest products; forest fire; agricultural expansion; overgrazing and nomadic pastoral practices; infrastructure development; settlements; and the introduction of alien and invasive species. Indirect drivers include market and policy failures, population growth, and poverty (URT, 2013a).

Tanzania's agriculture mostly still comprises smallholder farming. Clearing land for agricultural expansion often goes hand-in-hand with firewood and charcoal production – that is, the two drivers are not independent. Nevertheless, agricultural expansion is generally considered to be the main underlying driver of deforestation, and firewood and charcoal production are viewed as immediate/direct drivers (Kessy *et al.*, 2016; Kweka *et al.*, 2016; USAID-MoA, 2012). A recent National Forest Resources Monitoring and Assessment (NAFORMA) survey of households living in forest frontiers showed that more than 90 per cent depend on agriculture as their primary source of income. Livestock is the predominant livelihood option in the north, and food crops are the main source of income in the rest of the country. Ninety-six per cent of households in Tanzania rely on woodfuel for energy (URT, 2015b).

5.3 Past and present agricultural production

Trends in crop production

Food-crop production is the main pillar of the agricultural economy, contributing 17.6 per cent of GDP in 2012 (by comparison, livestock production contributed 4.6 per cent of GDP). Most cropland is rainfed; only about 4 per cent of the cultivated area was under irrigation in 2013 (URT, 2013b).

Domestic cereal production increased by 74 per cent between 1994 and 2014 (FAOSTAT, 2016). This was achieved by a 46 per cent increase in crop yields and a 149 per cent increase in the production area (Figure 18).

Maize, sorghum, rice, wheat and millet comprised 62.6 per cent of total food crops in 2012/13 (URT, 2013b). The area of cereal production increased by 4 million hectares (4.5 per cent of the total land area) between 2001 and 2013, which was more than twice the expansion of oil crops, the next biggest agricultural commodity group in terms of total expansion area over the period (Figure 19). Of the cereals, the top two crops driving area expansion were maize and rice.

Maize is the most significant cereal crop in Tanzania, accounting for 20 per cent of agricultural GDP (URT, 2013b), and its expansion area is four times that of the other cereal crops combined (Figure 20). Maize cultivation accounts for 45 per cent of the country's total arable land, and it is grown by more than 50 per cent of Tanzanian farmers across all regions (USAID-MoA, 2012). Maize generates 50 per cent of rural incomes, and it comprised more than 70 per cent of all cereals produced between 2005 and 2010.

There is a lack of studies on the impacts of maize and rice production on forests and biodiversity. Nevertheless, the expansion by smallholder farmers of low-yield 'slash and burn' – used for both maize and rice – is considered one of the main causes of forest loss in Tanzania (USAID-MoA, 2012; URT, 2015c).

Figure 18. Change in cereal yield and cultivated area, Tanzania, 1994–2014

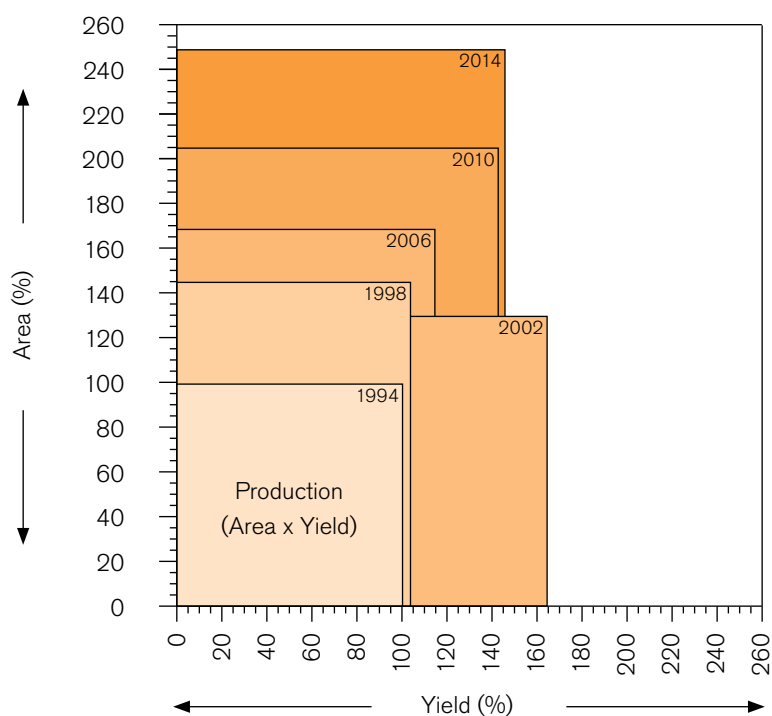
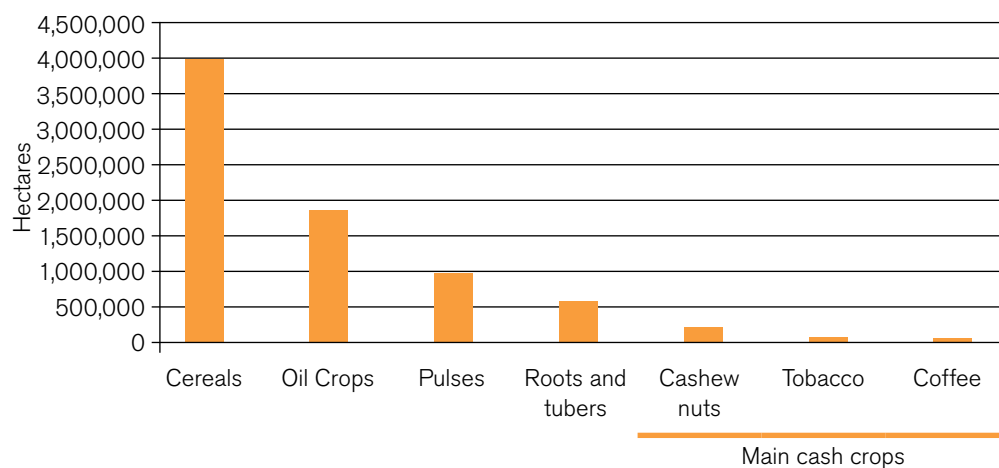
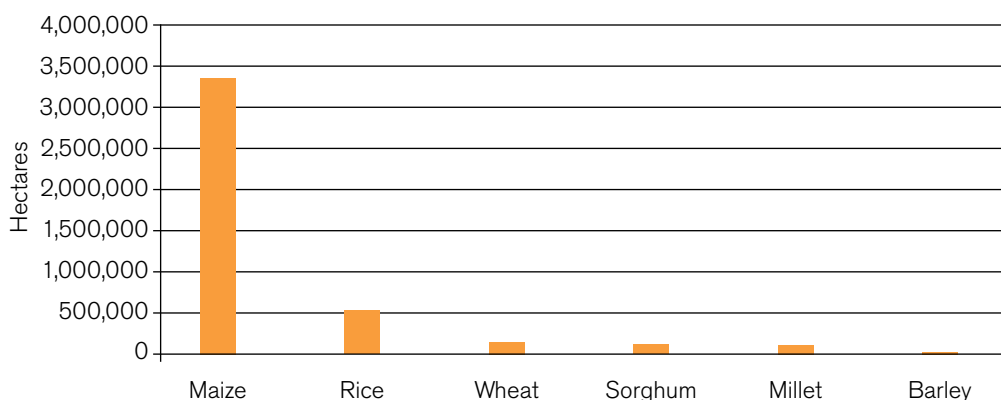


Figure 19. Expansion of the cultivation area of primary crops, Tanzania, 2001–2013



Source: FAOSTAT

Figure 20: Expansion of the cultivation area of primary cereal crops, Tanzania, 2001–2014



Source: FAOSTAT

Slash-and-burn practices are perfectly rational for farmers as a way to maximise returns from the most limiting resource (labour). Virgin forest lands are more fertile and productive: new farms cleared by burning forests have fewer weeds for about two seasons, are less infested by pests and better drained, and require less tillage before planting (Kideghesho, 2015). The pressure to clear forests for new agricultural land is particularly high in regions where poverty is widespread and forest governance is poor.

Who are the producers?

Over 80 per cent of arable land is farmed by smallholders on holdings of 0.2–2 hectares using traditional hand-farming methods and relying on rainfall (URT, 2011a). Less than 5 per cent of farming households use irrigation. Sixty-four per cent of farmers use hand hoes, 24 per cent use animal power and 12 per cent use tractors. The majority of smallholder farmers are women – more than 90.4 per cent of women of working age are engaged in agricultural activities, producing about 70 per cent of the country's food requirements (URT, 2015c).

Maize, rice, sorghum and millet are produced mainly through small-scale farming, and wheat is mainly produced on private-sector-owned, large-scale commercial farms in the north (FAO, 2013c). Only 1.5 million hectares of the total land area of 88 million hectares is used for medium- and large-scale farming (URT, 2011a).

Food imports and exports

Tanzania is a net importer of rice but is largely self-sufficient in other food crops. The country has become a net exporter of maize in recent years. In terms of value, maize exports rank fifth among crop exports after oilseeds, nuts, dried legumes and coffee (COMTRADE, 2016).

5.4 Future food production and forests

Growing domestic food demand

The Tanzanian diet relies heavily on starchy staples, with maize, rice and wheat the most preferred staple foods. On mainland Tanzania, maize provides over 40 per cent of household calories and rice more than 10 per cent. Annual per capita consumption of rice has grown sharply in recent years, largely due to shifting consumer preferences in an increasingly urbanised and wealthy population (Cochrane and D'Souza, 2015). Increasing demand has stimulated both domestic production and imports, but domestic rice is preferred (FAO, 2012b).

IFPRI's IMAGE model projects that the total demand for cereal in 2050 will be 20.6 million tonnes, 2.5 times the total demand in 2014 (Robinson *et al.*, 2015). This projection may well be an underestimate because it assumes a total population 13 per cent lower than recent UN projections.

Yields for cereal crops will continue to increase in Tanzania, but slowly. Massive investment is needed in rural infrastructure, irrigation, supply chains, extension services and climate-change adaptation to increase and maintain yields, and this is likely to be forthcoming only gradually (Jones and Franks, 2015; Nijbroek and Andelman, 2015). Thus, a substantial further expansion will be required in the area of cereal production that will be required – largely at the expense of forests – to meet domestic demand in 2050.

In addition to meeting growing domestic demand for cereals, the government aims to increase exports of cereal crops, and Tanzania is considered as a potential maize supplier for East African Community member countries (FAO, 2012b). There are no specific targets for increasing maize exports, but it is clear that any such growth would increase pressure to expand production areas.

Spatial distribution of agricultural expansion into forests

About half (44 million hectares) of Tanzania's mainland area is considered arable, and about half of this (22 million hectares) is under cultivation (URT, 2015b). Thus, Tanzania seems to have sufficient arable land to meet increasing food demand through area expansion. But land availability and crop suitability have been determined largely on the basis of soil and climatic conditions (Nijbroek and Andelman, 2015), and some of the ostensibly arable land is only marginally suitable for agricultural production due to factors such as soil infertility, soil erosion, degradation and drought (URT, 2015c). It is estimated that 61 per cent of the total land area in Tanzania is degraded (URT, 2016b).

To determine where major staple food crops are likely to expand in future, the University of Edinburgh conducted a spatial analysis, based on publically available spatial data, of:

- Crop suitability for major staple food crops from the GAEZ programme,²⁰
- Radar data on forest cover (Hansen *et al.*, 2013), and
- Protected area cover (from the World Database on Protected Areas; IUCN and UNEP-WCMC, 2016).

The analysis assumed that agriculture will remain predominantly low-input (ie no improved cultivars or applications of nutrients or pesticides), and it included only those areas deemed to have 'good' to 'excellent' suitability, therefore reducing the potential area suitable for cultivation. Within those areas, the analysis assumed that an area is more likely to be cultivated if it is easily accessible, which is defined as being near a previous deforestation event (because people and infrastructure must be present in the area); it therefore included current forest–agriculture frontiers, where agriculture is most likely to expand in coming years. Areas with an average slope of more than 20 degrees were excluded from the analysis because these are unlikely to be suitable for agriculture. Protected areas were also excluded because they are considered exempt from large-scale agricultural conversion in the short to medium term. Taking into account the exclusions and 'good' to 'excellent' agro-ecological suitability, the analysis deemed areas within 2 kilometres of previous deforestation events to have a high likelihood of agricultural conversion. Areas further than 2 kilometres from a previously deforested area were considered to have moderate suitability, and areas that met all the criteria but are under protection were deemed to have low suitability.

The results of this analysis are presented in Figure 21. Overall, the analysis shows that 52 per cent of the areas that are moderately or highly likely to be cultivated for maize and rice overlap with areas with more than 50 per cent forest cover, and 92 per cent overlap with areas with at least some forest cover (ie greater than zero 0 per cent). This is likely to be an underestimate of potential conflicts between forest and area expansion for maize and rice production, given that it excludes areas considered protected and areas suitable for production with higher inputs.

²⁰ See www.fao.org/nr/gaez

5.5 Relevant policies, institutional arrangements and processes

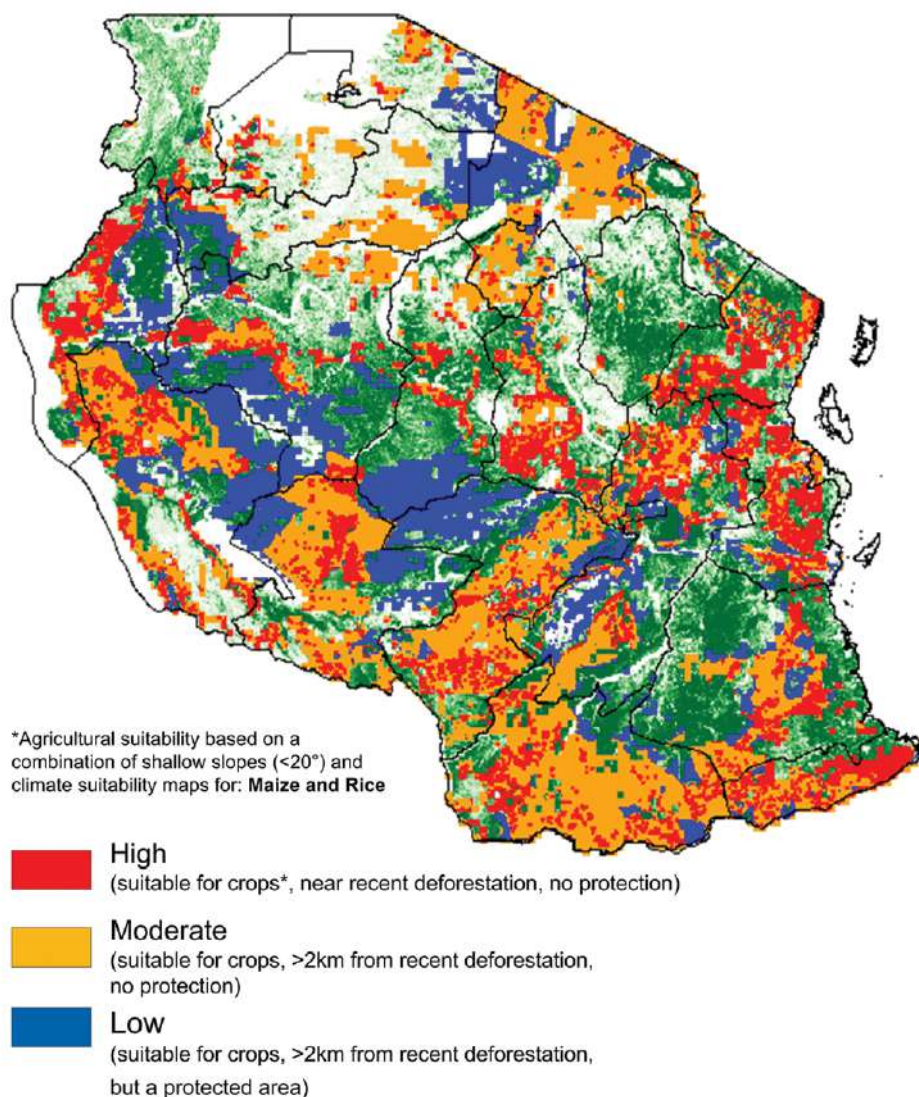
Agriculture

Tanzania is a signatory to the Comprehensive Agriculture Development Programme introduced by the African Union in 2003. Under the programme, Tanzania is committed to growing its agriculture sector by at least 6 per cent annually and to allocating 10 per cent of its national budget to the sector. Currently, about 8 per cent of the national budget is designated to agriculture (URT, 2015c). In addition to national budgetary support, the agriculture sector receives substantial development assistance. Under the Big Result Now initiative, which began in 2013, agriculture is identified as one of six priority areas for Tanzania's economy (the others being energy, water, education, transport and the mobilisation of resources) (FAO, 2013d).

The Tanzanian government has introduced numerous policies and programmes to support the development of both large-scale and small-scale agriculture. Most recent policies and programmes have focused on commercialisation and modernisation.

The Agriculture Sector Development Strategy of 2001 focuses on productivity, profitability and farm incomes on mainland Tanzania, and it was operationalised by the Agriculture Sector Development Programme (ASDP) of 2006, with an emphasis on increasing food production through private-sector-led investments. The ASDP decentralised responsibility for providing agricultural services to local government authorities, and the aim was to assign 75 per cent of the total programme budget to the local level. Ambitious ASDP targets included: increase private investment in agriculture by 5 per cent annually; increase the number of commercial agro-companies by 5 per cent annually; 55 per cent farmers to have access to crop extension services; 35 per cent of farms to use improved seed; and 20 per cent to use irrigation by 2013 (URT, 2006). None of those targets was attained.

Figure 21. Likelihood of cereal crop (maize and rice) expansion into forest in Tanzania



The *Kilimo Kwanza* ('Agriculture First') initiative, adopted in 2009, and the Tanzania Agriculture and Food Security Investment Plan (TAFSIP), which covers the period 2011/12–2020/21, are intended to coordinate and increase investment in agriculture. *Kilimo Kwanza* is a joint initiative of government and the private sector, and its key activities include the following (FAO, 2013d):

- Transform subsistence and small farmers into commercial farmers through increased productivity and market access.
- Promote medium- and large-scale farms.

- Establish the Tanzania Agricultural Development Bank with initial capital of US\$500 million.
- Encourage development partners and other ministries to support *Kilimo Kwanza*.
- Empower farmers' cooperatives.
- Legislate contract farming.
- Ensure land availability.
- Provide support for industrialisation.

TAFSIP is ASDP's financing mechanism and framework. It estimates that around 8.7 trillion Tanzanian shillings (or around US\$5.3 billion) was needed over the first five years (2011/12–2015/16) to achieve 6 per cent annual growth in the agriculture sector. Government budget and development funds were expected to be the main funding source, with additional contributions from the private sector, farmers and non-state actors. Key investment areas, in order of priority, are: production and rural commercialisation; irrigation development; policy and institutional reforms and support; rural infrastructure, market access and trade; food and nutrition security; disaster management and climate-change mitigation; and private-sector development. TAFSIP identifies the primary beneficiary groups of the investment plan as smallholder farmers, pastoralists and agro-pastoralists, and fishing households who adopt agricultural practices that increase food production (URT, 2011).

The National Agricultural Policy 2013 (NAP 2013) affirms the country's strategy to transform subsistence agriculture to commercial and modernised agriculture through crop intensification, diversification, technological advancement and infrastructural development. The policy also recognises the importance of the private sector and commits to creating an enabling environment for greater involvement by the private sector. NAP 2013 highlights that, to alleviate poverty, the agriculture sector needs to grow by 6–8 per cent per year, substantially more than the current average growth of 4.4 per cent (URT, 2013b).

The potential for agricultural expansion to boost production and support economic development and rural growth is recognised. One of *Kilimo Kwanza*'s key strategies is to increase the land available for agricultural development through rural land planning and by allocating land to 'land banks' for agricultural use. All key policies highlight the low percentage of arable land under cultivation in Tanzania, implying that area expansion is a source of growth for agricultural development. Nevertheless, there are no specific targets for area expansion. NAP 2013 places high importance on the protection of premium lands for agriculture (URT, 2013b).

Cereals are prioritised in key agricultural policies and programmes, not only because they are key to food security but also because of their increasing export potential in regional and international markets (URT, 2013b). Specific subsectoral policies related to cereals include the National Rice Development Strategy of 2008 and the Cereals and Other Produce Act of 2009; the latter created a cereals board with the power to intervene in rice and maize markets. The National Rice Development Strategy aims to commercialise the rice sector, focusing on increasing the uptake of improved seeds, expanding post harvesting technologies and value adding, promoting labour-saving technology, and constructing irrigation infrastructure. The strategy also encourages area expansion in the medium to long term, along with increased investment in processing (FAO, 2012b). Tanzania imposed a ban on exports of cereals (mainly maize) in 2012 to ensure that domestic demand was met, but this was later lifted (FAO, 2013d).

In 2011, the Tanzania government proposed the Southern Agriculture Growth Corridor of Tanzania (SAGCOT) as a potential public–private partnership programme that could increase agricultural production and thereby improve the incomes and food security of smallholder farmers in southern Tanzania. SAGCOT focuses on six areas (totalling 30.7 million hectares) with high potential for rapid agricultural development, stretching from Dar es Salaam through Iringa to Mbeya. Over a 20 year period, SAGCOT aims to develop 0.35 million hectares of commercial agriculture land, increase annual agricultural revenue by US\$1.2 billion, and lift 450,000 households out of poverty. However, an environment and social assessment published in 2013 revealed major environmental and social concerns (URT, 2013b); to address these, SAGCOT partnered with major environmental and social NGOs. SAGCOT has not yet attracted much private-sector interest despite strong government support, but the World Bank has recently committed US\$70 million to support its implementation. SAGCOT will be an important testing ground for managing the competing demands for land among sectors such as agriculture, forestry and conservation (URT, 2013c).

Forestry

The forest sector accounts for 3.7 per cent of GDP and employs 3 per cent of the country's paid labour, excluding employment in the informal forest-related sector (URT, 2014). The government budget for forestry has consistently been about 1 per cent of the total national budget. Donor contributions to forestry projects and related activities have accounted for over 70 per cent of total sectoral funding (Kweka *et al.*, 2015).

The main forest-sector policy is the National Forestry Policy (1998), which emphasises the establishment of new reserves; conservation and management that involves local communities and other stakeholders; and environmental impact assessments for investments that convert forest land to other land uses or which may cause damage to the forest environment (URT, 2015a).

The National Forest Programme (2001–2010) was drafted to operationalise the National Forestry Policy. It identified four implementation programmes:

- 1) Forest resource conservation and management.
- 2) Institutional and human resource development.
- 3) Legal and regulatory framework.
- 4) Forestry-based industries and sustainable livelihood.

The National Forest Programme promotes participatory forest resource management and prioritises land-use planning on village and general lands. The programme also focuses on building forest-based industries and it has set ambitious targets, including the following:

- Investment into mechanical and/or chemical forest industry to increase by 35 per cent.
- Production of industrially processed forest products to increase by 30 per cent.
- Employment in forest industry and related activities to increase by 25 per cent.
- Dependence on woodfuel in national energy consumption to reduce by 10 per cent (URT, 2001).

The most active forest-sector programme from 2010 to 2015 was REDD+, mainly supported bilaterally by Norway, Germany and Finland. REDD+ activities have progressed slowly, however, and no new funding is in place (Kweka *et al.*, 2015). The key policy document, the National Strategy for REDD+ (URT, 2013a), contains no specific targets for reducing emissions from deforestation and forest degradation, and no research was commissioned to provide an understanding of the significance of agricultural expansion as a driver of deforestation. Seven REDD+ pilot projects were developed and implemented by NGOs, mostly in the coastal forest region. All have now ended, most with little prospect of sustainability given the current carbon price.

The National Forest Programme identified building institutional capacity for forest inventories as a priority for the Forestry and Beekeeping Division under the Ministry of Natural Resources and Tourism (URT, 2015b). NAFORMA was established in May 2010 with support from the Finnish government with the aim of generating a baseline for a national carbon measuring, reporting and verification (MRV) process and a carbon reference level. The National Carbon Monitoring Center will be hosted at the Sokoine University of Agriculture to manage an effective national system of carbon MRV, with the long-term goal of expanding MRV to other sectors (eg agriculture, energy, transport and industry).

The Tanzania Forest Service Agency (TFS) was established in 2011 as a semi-autonomous agency under the Ministry of Natural Resources and Tourism, and it took over the majority of the responsibilities of the Forestry and Beekeeping Division.

A recent NAFORMA report estimated the annual consumption of wood at 62.3 million m³, which exceeds the annual sustainable allowable cut of 42.8 million cubic metres from all land uses including trees on farms. The current supply of wood is therefore unable to meet current demand sustainably: the wood deficit is around 19.5 million cubic metres per year (URT, 2015b). To meet the gap in wood availability, the TFS aims to improve forest management and production capacity by “enhancing protection of forest reserves, increasing area of forest plantations, encouraging private sector and community tree planting” (URT, 2014). The TFS aims to establish 50,000 hectares of new forest plantation and 100,000 hectares of new natural forest reserves between 2014 and 2019 (URT, 2014).

In 2016, TFS pledged to plant 185,000 hectares of forest (equivalent to 280 million trees) per year for 17 years. Potential areas for planting include degraded forest reserves, plantations outside forest reserves (eg in the southern highlands) and trees on farmland (by incentivising farmers). Achieving this target will require about US\$131.5 million per year for a total of US\$2.4 billion by 2030 (URT, 2016b), which seems unlikely to be forthcoming in the current financial climate.

Biodiversity

Tanzania has been a party to the CBD since 1996, and it is committing to its international obligation to protect and conserve its biodiversity as a global resource. Tanzania's NBSAP 2015–2020 seeks to address the 20 global 'Aichi' targets of the CBD based on national priorities that contribute to these. The targets include the following:

- Reduce the rate of ecosystem degradation and fragmentation and loss of habitat by 2020.
- Promote the sustainable management of forests and agriculture.
- Significantly increase financial resources for supporting biodiversity programmes.

The NBSAP 2015–2020 calls for the mainstreaming of biodiversity conservation into sectoral policies, plans and strategies. It recognises the increasing demand for food as a driver of biodiversity loss, and it prioritise actions to implement the existing policies, laws and strategies for biodiversity and agriculture, promote sustainable agricultural technology and practices, promote rangeland resource management, and strengthen and enforce sustainable land-use planning practices (URT, 2015a).

The Vice President's Office Division of the Environment (VPO-DoE) is mandated to coordinate biodiversity conservation at the national level. The National Environment Management Council is the technical advisory, coordinating and regulatory agency

responsible for the protection of the environment and the sustainable use of natural resources in Tanzania. Sectoral ministries and departments are responsible for implementing policies and strategies developed by the VPO-DoE and its supporting agencies.

According to the VPO-DoE, all large-scale (ie on a land area greater than 50 hectares) agricultural investments are required to undertake environmental and social impact assessments, although challenges exist in conducting and enforcing the recommendations of such assessments.

Biodiversity is also addressed in the REDD+ Safeguards document, which requires the REDD+ programme to maintain and enhance the conservation of Tanzania's biodiversity and other ecosystem services, considering the needs of forest-dependent communities and appropriate management and utilisation methods. The REDD+ Safeguards document requires that REDD+ will protect natural forests from degradation and conversion to other land uses, including forest plantations. It also states that the REDD+ programme is to analyse possible impacts on biodiversity and other ecosystem services when considering options for REDD+ actions (URT, 2013a).

Tourism contributes 17.2 per cent to Tanzania's GDP. Government economic development policies prioritise the conservation of biodiversity in national parks and conservation areas for tourism purposes (URT, 2016a). However, the northern savannah protected areas are much more popular than forest reserves as tourist destinations.

Cross-sectoral

The Tanzania Development Vision 2025 and its sister document, Vision 2020 for Zanzibar, guide long-term economic development to 2025. The ambition is to continue a GDP growth rate of 8–10 per cent, depending largely on the natural resource sector to deliver this. The National Strategy for Growth and Reduction of Poverty, MKUKUTA II, and the corresponding Zanzibar Strategy for Growth and Reduction of Poverty, MKUZA II, along with the five year development plans (FYDPs) for 2011–2016 and 2017–2021, are intended to implement the vision to 2025, with major development objectives of growth, poverty reduction and social wellbeing. Although cross-sectoral in nature, these strategies and plans focus on economic development and prioritise agriculture development. Both MKUKUTA I (2006–2010) and MKUKUTA II (2011–2016) identify increasing the productivity of cereals as one of the most effective strategies for reducing poverty (URT, 2010; URT, 2011b; URT, 2016a).

FYDP 2011–2016 included the following specific economic targets for the agriculture sector:

- Increase national food self-sufficiency for cereals and legumes to 120 per cent (104 per cent in 2010).

- Increase the irrigated area from 330,000 hectares to 1 million hectares.
- Increase average agricultural foreign exchange earnings by 114 per cent.

There were also the following specific forest-sector targets for 2015–2016:

- Recruit 172 new villages to participate in forest management.
- Reduce degradation and the loss of forest biodiversity by 5 per cent.
- Increase the area effectively managed for forest and biodiversity resources by 10 per cent.

FYDP 2017–2021 is titled 'Nurturing industrialisation for economic transformation and human development'; in line with this, it places high importance on industrialisation, private-sector involvement and agricultural commercialisation. Key agriculture sector targets for 2020/21 are:

- Achieve a growth rate of 7.6 per cent and maintain the share of GDP above 29 per cent.
- Increase the contribution to export earnings to 24.9 per cent.
- Reduce the share of total employment to 56.5 per cent.

Prioritised crops under FYDP 2017–2021 are maize, rice, sunflower, pulses, floriculture, cotton, sisal, grape and sesame. FYDP 2017–2021 includes a separate section on natural resource management, environment and climate change, with the following ambitious targets for 2020/21: increase natural forest cover by 130,000 hectares; 100 million trees planted countrywide; and 60 per cent reduction in charcoal consumption in urban areas. The estimated total budget for agriculture is almost 50 times that for the environment and natural resources. The former will draw on the resources of government, the private sector and development partners, and the latter is expected to be funded mainly by development partners (URT, 2016a).

Climate change

Supported mainly by development partners, Tanzania formulated its National Climate Change Strategy (NCCS) in 2012 and adopted a climate-smart agriculture programme for 2015–2025. Both are cross-sectoral in nature. The NCCS identifies key activities for all sectors for both mitigation and adaptation; although the activities in the agriculture sector are focused mainly on adaptation and increasing agricultural resilience, the forest sector is expected to be a key contributor to mitigation, mainly via REDD+ and tree planting (URT, 2012a). The differentiated sectoral priorities are also reflected in Tanzania's INDC (URT, 2015d). The climate-smart agriculture programme was developed to operationalise the NCCS and the Agriculture Climate Resilience Plan. It aims to support an agriculture sector that is climate resilient with sustainably increased productivity in line

with the Tanzania National Development Vision 2025. The NCCS highlights some of the key synergies between agriculture and the forest sector. Key targets for 2025 include (URT, 2015c):

- Yields of staple crops increased by 50 per cent, mainly through increased farm inputs.
- Post-harvest losses for staple food crops reduced by 30 per cent.
- Adoption of sustainable climate-smart technologies and sustainable land management practices by 5 million households.
- Farm/community forest cover increased by 20 per cent, which includes payments for ecosystem services and agroforestry activities.

Land tenure

In Tanzania, all land is vested in the President in trust for the people. Rights of occupancy are granted by the Commissioner for Lands, or they may be held through customs and tradition. Land falls into three categories: reserved land (such as national parks and forest and game reserves, managed by the respective ministries or agencies); village land (all land inside the boundaries of registered villages, managed at the village level); and general land (all other land, managed by the Commissioner for Lands). Government retains significant powers to reclassify and expropriate land, creating perceptions of insecurity at the village level.

Efforts are underway to establish a 'bank' of land ready to be leased to investors, clear of title and without formal or informal users, but there remains a widespread perception that this carries a significant risk of impacts on livelihoods due to land acquisition for commercial agriculture. Various laws cover compensation for land acquisition and assets, although these do not align fully with the resettlement process specified in the World Bank policy on persons whose livelihoods are affected by compulsory land acquisition (URT, 2013c).

'Reserved land' denotes all land set aside for protection or conservation purposes (such as game reserves, forest reserves and national parks), and its management is described in specific laws for each sector (for example the Wildlife Act, the Forest Act and the National Parks Ordinance).

Village land is further divided into: communal village land; individual, family or clan land when occupied and used under customary law; and unoccupied or unused land that may be made available for communal or individual purposes through allocation by village councils.

The two main laws on land ownership are the Land Act No. 4 of 1999 and the Village Land Act No. 5 of 1999. Land Act No. 4 constitutes the basic law in relation to land other than village land, the management of land and the settlement of disputes and related

matters. Village Land Act No. 5 provides for the management and administration of land in villages and for related matters. Despite the specialisation of these two laws, some actors have misunderstood the term 'general land'. Both laws define the term 'general land' in almost the same way (ie referring to "all public land, which is not reserved land or village land"), except that the Land Act also includes the text "includes unoccupied or unused village land", which does not appear in the Village Land Act. This has caused concern at the village level and contributed to unsustainable land-use practices such as unsustainable charcoal production because general land is supposed to be administered by the Commissioner for Lands and not by village governments (EMPAFORM, 2008).

About 11,817 villages are registered in Tanzania, and they manage 70 per cent of the total land area and support 80 per cent of the population. The reality on the ground, however, is that only about 12 per cent of land is demarcated and less than 1 per cent of land is titled to villages. In 2012, for example, only around 850 villages of the 11,500 villages then registered in Tanzania had been granted certificates of village land (TNRF, 2012).

Land governance and management

Agricultural land

The Ministry of Agriculture, Livestock and Fisheries formulates, coordinates, monitors and evaluates policies on agricultural land use. It is unclear how much of the 44 million hectares of arable land overlaps with forest and reserve lands; however, given that the combined area of arable land and forests is more than 3 million hectares greater than Tanzania's total land area, the potential overlap is significant. The area suitable for irrigation is estimated at about 29.4 million hectares, but only 0.34 million hectares is under irrigation (URT, 2011a). The Agriculture Land Act is under development to protect prime agricultural land from use for other purposes. As part of the preparations for this Act, the Department of Land Use Planning and Food Security under the Ministry of Agriculture, Livestock and Fisheries will evaluate the suitability of land/soil across the country.

Forest land

Of the 48 million hectares of total forest land, the central government manages 16.57 million hectares (35 per cent); local government manages 3.1 million hectares (7 per cent); villages manage 21.91 million hectares (45 per cent) (of which 2.3 million hectares is under PFM); and the private sector manages 3.51 million hectares (7 per cent). In addition, 2.73 million hectares (5 per cent) of forests are on general land and approximately 480,000 hectares (1 per cent) have other management categories, such as sacred forests (URT, 2014). More than half (11 million hectares) of village-owned forest land is in the southern and southern highlands zones. Industrial forest plantations in Tanzania cover about 150,000 hectares, of which about 90,000 hectares are under public ownership and about 60,000 hectares are held by the private sector. The TFS

manages about 506 forest reserves, including 1.4 million hectares of catchment forests; 115,000 hectares of mangrove forests; 233,837 hectares of nature reserves; and 91,606 hectares of plantation forests. The government also administers 161 forest reserves through local government authorities and supports PFM (URT, 2014). There are two major approaches for implementing PFM: community-based forest management (CBFM) and joint forest management (JFM). On village and private lands, CBFM applies where trees are owned and managed according to management plans by village governments through village natural resource committees. JFM applies to state-owned forest land, where management, income and other resources should be shared between the state and the communities through joint management agreements (URT, 2013). About 7.7 million hectares of forests are under PFM, of which 2.3 million hectares is subject to CBFM and 5.4 million hectares is subject to JFM (URT, 2012a).

Reserved land (game reserves, forest reserves, national parks)

About 33 per cent (28 million hectares) of Tanzania's land area is under legal protection (protected forests and wildlife reserves) (URT, 2015a). Of this, 19.9 million hectares is forest reserve (URT, 2015b) and 2.3 million hectares is managed as village land forest reserves (URT, 2012a). There is no official figure on the extent of overlap between reserved land, arable land and forest land. National parks are managed by Tanzania National Parks; forest reserves are managed by the TFS; game reserves and game controlled areas are managed by the Tanzania Wildlife Authority under the Ministry of Natural Resources and Tourism; the Ngorongoro Conservation Area is managed by the Ngorongoro Conservation Area Authority; and wildlife management areas are co-managed by locally formed community-based organisations and the Tanzania Wildlife Authority.

Land-use planning

Ministries formulate and coordinate policies governing land uses and local governments are tasked with implementing those policies. The National Land Use Planning Commission Act (2007) led to the establishment of the National Land Use Planning Commission to formulate land-use policies for implementation by government and to prepare regional land-use plans. To date, no additional land-use standards have been made pursuant to the Act, and most of the zonal regional land-use plans are outdated.

Land-use planning is not considered a priority at the national level, but substantial progress has been made with participatory land-use management at the village level, a process grounded in the national policy and legislative framework governing land tenure and local government. The legal basis for village land-use management is found in Tanzania's local government legislation (mainly the Local Government Act of 1982), which enables village governments to pass local by-laws. The relevant elected district council must approve these, after which they have legal force equivalent to any other law in Tanzania, and violators can be charged in courts of law (EMPFORM, 2008).

The demarcation and registration of village boundaries through participatory land-use management ensures that village areas are defined and management responsibility for land-tenure adjudication is vested in village governments. Village land certificates, issued by the Ministry of Lands, provide legal documentation of village land status and tenure (Mäkelä, 2015).

5.6 Challenges in reconciling forest conservation with food production

Sectoral silos

The process of drafting cross-sectoral policies (such as national five year plans) is largely a collation of various sectoral targets. There is no mechanism in place for addressing conflicting sectoral goals. Different ministries promote their own mandates with no platform to consider how those mandates align with other sectors. This has led to a plethora of priorities and incompatible targets (URT, 2016a). For example, the TFS pledges to plant more than 3 million hectares of trees in the next 17 years, while agriculture policies prioritise increasing food-crop production to meet domestic demands and increase exports. Although every target seems like a priority, political pressure at the implementation stage often triumphs over evidence-based expert advice. Very limited national resources are spread thinly across a myriad of initiatives, resulting in inadequate implementation (URT, 2016a). Most central-government funding is assigned to sectoral priorities in education, health, water and infrastructure rather than in agriculture, forestry and related land-use programmes.

Scale disconnects in land-use planning

There are robust processes for land-use planning at the village level and increasing investment in spatial planning at the national level, but these are not strongly linked, so national land-use priorities may not be reflected in village plans. Likewise, national priorities may not adequately reflect the priorities of local communities. At both the national and village levels, the interests of pastoralists may be marginalised.

Decentralised responsibilities without decentralised funding

Although both the agriculture and forest sectors are addressed comprehensively in national-level policies, the main responsibility for implementation rests with local governments, and such implementation is hindered by insufficient budgetary allocations to local government authorities. For example, most agricultural plans at the district level are underfunded, and agricultural research and development institutions have minimal governmental support. Funding for implementing village land-use plans and PFM is also

inadequate. Strengthening land tenure is complex, time-consuming and costly, and in some cases it is frustrated by politically driven changes at higher levels. On the other hand, the administrative splitting of villages, the time taken to address trade-offs between land uses (eg pastoralists and investors), and the extension of town council territories into surrounding rural district lands have been observed in some areas. Such challenges increase costs for villagers and, in some cases, weaken land and natural resource tenure.

Lack of accountability

Many targets are set for each sector, but systems for holding government agencies accountable for achieving such targets are weak. A lack of accountability at the local government level also often means that the implementation of laws and policies is weak.

The Jevons paradox

Policies that increase the productivity of agricultural land, if combined with weak governance, may drive up the deforestation rate in Tanzania, an example of the Jevons paradox (see Chapter 1). To avoid this paradox, priority should be given to improving land-use planning and forest governance in deforestation frontiers.

‘Orphaned’ forests outside reserves

About 17.3 million hectares of forests (about 36 per cent of forest land) in Tanzania is outside national forest reserves and village reserves, and these forests are most at risk of deforestation and forest degradation (URT, 2013a). There is no properly defined management regime for these forests; for example, the Tanzania Investment Centre may allocate land for investment without considering conservation and biodiversity values. To reduce risks to these forests, an accessible national database is needed that maps high conservation and biodiversity values in forests outside protected areas.

Poor understanding of fallowing

There is uncertainty about how much land is within medium-to-long-term farming cycles and how much is being cropped at any given time. This may produce flawed data and, in turn, inappropriate policies and practices.

Institutional incentives for community-based forest management

There is no longer a central or local government agency with a strong mission to support the expansion of CBFM. Indeed, the TFS may have a negative incentive to do so because it loses revenue where forests are handed over to villages. There is a perception and concern among some local-level TFS staff, therefore, that promoting enterprise-oriented CBFM will negatively affect their ability to meet TFS revenue targets.

Sensitivities on population growth

Tanzania is more than able to feed its growing population without the existing high rate of deforestation through a combination of sustainable intensification and land-use planning that restricts agricultural expansion to areas with low forest cover. However, sensitivities around the issue of population leads to reluctance in recognising increasing food demand due to population growth and therefore to a tendency to underestimate likely future rates of deforestation.

Information on food-crop exports

There is no reliable information on the level of food-crop exports to neighbouring countries and no political consensus on what an appropriate level would be. Partly as a consequence of this, there is occasional political concern that exports are too high, which has led to temporary export bans and associated price distortions and incentives for corruption.

The myth of unused land

There is a prevailing perception that there is plentiful unused land for future agriculture expansion and therefore competition for land is not severe. Key land-use policies cite the figure of 44 million hectares of arable land in Tanzania, of which 50 per cent is cultivated. As discussed above, however, part of this arable land is only marginally suitable for agricultural production due to a combination of factors such as soil infertility, soil erosion, degradation and drought. Degraded land (which constitutes 61 per cent of the country's total land area) requires considerable investment to become productive, which smallholder farmers often cannot afford. Some 'unused' land may also have contested land tenure, making investments difficult, or other key stakeholders (eg pastoralists) may use it on a seasonal basis. If environmental and social issues are taken into consideration, the land available for further agricultural expansion may be shown to be far more limited than generally assumed. A spatial analysis at the national level is required that takes into account the land's suitability for agricultural production and the environmental and social impacts of forest conversion.

Village land-use planning

Tanzania is a leader in village land-use planning, but there are weaknesses in many village land-use plans, which are often seen as an end in themselves. Where such plans have been implemented, there has often been little follow-up or monitoring and evaluation to enable problems to be rectified. Experience shows that setting up village land-use planning is expensive, which limits scaling up, and there is a lack of understanding of the concept among villagers, which may lead to the domination of the process by elites. Village land-use planning may also be driven by external actors, who may bias the

outcome in favour of their own agendas. In addition, localised land-use planning may be insufficient to mitigate increasing pressure on forests from agricultural expansion in the absence of strategic land-use policies at the national level. Experiences across Tanzania indicate that village land-use plans have tended to promote business-as-usual scenarios, where forest is cleared as demands for land increases in line with population trends, based on current use patterns.

Youth rural–urban migration

Tanzania's young people are increasingly unwilling to follow in the footsteps of their parents and take up small-scale farming as their source of livelihood, especially in areas where land has low agricultural potential or farming is very labour-intensive. Even though new technologies (eg agro-ecology and organic farming) can increase production with little or no external inputs, these can be even more labour-intensive. At the same time, better communication technologies are making young people more aware of other livelihood opportunities, largely in towns and cities. These factors combine to create incentives for rural youth to migrate to urban centres. This is not necessarily a bad thing, but it has profound implications for agricultural development strategies and may fuel deforestation as a means for young people to make the money they need to set up urban-based enterprises.

5.7 Opportunities for reconciling forest conservation with food production

Nuancing the understanding of agricultural drivers of deforestation

Although agricultural expansion is recognised as a driver of deforestation in Tanzania, policy responses seem to greatly underestimate the growing pressure linked to increasing domestic demand and the implications that some proposed measures have for food security. Further research is needed to differentiate and nuance the understanding of the impacts of staple food-crop and cash food-crop production on forests and biodiversity because the policy responses for staple food crops will have implications for both conservation and food security. Lessons can be learned from SAGCOT, the aim of which is to improve the incomes, employment opportunities and food security of smallholder farmers in southern Tanzania by linking them to internationally competitive supply chains and accelerating commercial agricultural development. SAGCOT uses foreign direct investment attracted by the removal of policy and infrastructural constraints to competitiveness and by facilitated access to land. In this way, SAGCOT is serving as a

model for stimulating cross-sectoral dialogue and land-use decision-making processes that address trade-offs among land uses.

High-level platforms for better coordination already exist

Reconciling and harmonising land-use priorities at the local and national levels could be discussed within the legal and institutional framework of the 1997 National Environmental Policy, which is now under review. At the national level, the VPO-DoE is responsible for all climate-related activities; it is both the National Climate Change Focal Point and the designated national authority for the Clean Development Mechanism under the Kyoto Protocol. The Environment Management Act (2004) provides for the establishment of various committees at both the national and local levels. At the national level, the National Climate Change Steering Committee, which is chaired by the Permanent Secretary of the VPO-DoE, provides policy guidance to the National Climate Change Focal Point to ensure coordinated actions and participation within sectors and institutions. The National Climate Change Technical Committee, chaired by the Director of Environment, is geared to provide technical advice to the National Climate Change Focal Point, stimulate the coordinated actions of actors, and broaden participation in addressing climate change and trade-offs in land-use change at the local and national levels.

Link participatory land-use planning practices with national priorities

Village-level land-use planning has proven to be an effective tool for developing community-wide agreements on balancing current and future economic activities, such as agriculture, with forest conservation and management. Guidelines on village land-use planning have been promoted by the National Land Use Planning Commission in the Ministry of Lands as a tool to help communities plan future land uses and to demarcate and formalise the boundaries of their villages. Usually, the district staff coordination land-use team works with a committee of elected villagers to identify and propose areas for agriculture (and agricultural expansion), forest conservation, grazing and settlement. The output of the process is a plan, which reflects the interests as well as current and future land-use needs within the village (Mäkelä, 2015). A participatory and cross-sectoral discussion at the national level on land-use planning can facilitate discussions on the trade-offs between agricultural production and conservation and lead to a shared national vision, which could further guide regional and local land-use planning.

6

Discussion

6.1 Patterns of increasing food production

Despite steady yield increases, all three case-study countries continue to expand their agricultural land to meet fast-growing food demand. The extent to which increasing demand is met through area expansion and yield increases varies. In the period 1980–2013, Ghana boosted cereal production more by increasing yields than by expanding area; in Ethiopia, the two factors made a more or less equivalent contribution; and, in Tanzania, the increase in cereal production came much more from area expansion than yield increases. Figures 6, 14 and 18 show that, in the 20 years to 2014, Tanzania remained on a similar trajectory to previous decades, but the trajectories of Ghana and Ethiopia changed markedly. In recent years, Ghana has achieved production increases slightly more through the means of area expansion than through yield increases. In delivering on its very ambitious food self-sufficiency targets, Ethiopia, on the other hand, has more than doubled crop yields per hectare while also nearly doubling the area of cereal production.

6.2 Expansion at the expense of forests

It is clear that the expansion of agriculture in SSA has been largely at the expense of forests. An analysis by Hosonuma *et al.* (2012) found that 75 per cent of forest loss in SSA in 2000–2010 was due primarily to the conversion of forest to agriculture, and there is no evidence to suggest that Ethiopia, Ghana and Tanzania are exceptions to this general pattern. It is also clear that the expansion of agriculture has been mainly the consequence of the expansion of smallholder production of food crops for domestic consumption, rather than the expansion of production of export commodities. This is very different to the case in Latin America and much of Southeast Asia, where deforestation is mainly driven by the relatively large-scale production of export commodities.

6.3 Smallholder farmers should not be blamed

Despite the rapid expansion of large-scale commercial agriculture in SSA in recent years, smallholder farmers are responsible for much of the conversion of forests, as they seek more fertile soils to produce the crops they need to realise their right to food and other basic human rights. Alternatives exist, including both the use of more external inputs and agro-ecological practices with reduced or zero external inputs – but smallholders in many parts of SSA lack access to these due to poor extension services and infrastructure, market failures, and the lack of an incentive to invest in such alternatives due to insecure land tenure. The power and duty to resolve these obstacles lies primarily with national governments, although the international community also has a key role to play, particularly in relation to climate-change mitigation and adaptation.

6.4 Agricultural and forest policies on a collision course?

With fast-growing populations and steadily growing economies, food demand in Ethiopia, Ghana and Tanzania will increase by at least 150 per cent by 2050 – notably for cereal crops partly because of increasing demand for meat from livestock, which will increasingly be cereal fed (Table 1). Similar increases in food demand are likely in many other countries in SSA.

In recent years, Tanzania, Ghana and especially Ethiopia have achieved substantial increases in the yields of food crops, and each country has ambitious agricultural policies, strategies and plans for the near future; the aim in Ethiopia, for example, is to boost cereal crop yields by 47 per cent over the period 2016–2020. Yield gap analysis indicates that large yield increases of this magnitude are theoretically possible, but such a growth rate cannot be sustained. Agricultural policies in the three countries have little to say about this risk, or about strategies for the further expansion of the agricultural area, which seems inevitable for many years to come as governments correctly keep the right to food at the top of their agendas. As evident in Latin America, there is a risk that increasing yields per unit area in the absence of effective land-use planning and governance can also serve as an incentive for further area expansion where intensification increases profits per unit area – the Jevon's Paradox (Byerlee, 2014).

In the forest sector, all three case-study countries are developing and implementing policies and programmes to reduce and reverse deforestation, including REDD+ programmes. Ethiopia and Ghana have ambitious targets to dramatically reduce deforestation and biodiversity loss: as a signatory to the New York Declaration on Forests, Ethiopia aims to eliminate the loss of natural forests by 2030. All three countries have also set ambitious goals for tree planting: Ethiopia aims to increase forest cover in the country by 5.4 million hectares (4.5 per cent of the total land area) between 2015 and 2020 (MEFCC, 2016); Ghana aims to plant 0.6 million hectares (2.5 per cent of the total land area) of forest plantations between 2016 and 2040, and the priority area for forest plantations is also the main region for maize production (FC, 2016); and Tanzania aims to plant 3.1 million hectares of trees (4.2 per cent of the total land area) between 2016 and 2035 (URT, 2016a).

Our study confirms that there are significant disconnects between agricultural and forest policies and their supporting strategies. In some cases, these disconnects are already evident. In other cases, although policies and strategies appear well aligned, they underestimate the risks and trade-offs that will hinder the implementation of those policies and strategies and lead to disconnects in the long term. The study also confirms our hypothesis that these underestimated risks and trade-offs are behind many of the existing and emerging policy disconnects in the context of food production and forest conservation in SSA. Trade-offs between forest conservation and food production have received relatively little attention in SSA compared with the positive contributions of forests to food production and synergies.

If all the targets to reduce and reverse deforestation remain in place, agricultural and forest policies could find themselves on a collision course, with serious implications for food self-sufficiency objectives — such as a need to import much more staple food than currently anticipated.

This study did not aim to identify and characterise the key policy disconnects and the specific risks and trade-offs to which they may relate. Rather, its purpose was to better understand the underlying reasons why some of the more significant disconnects exist and persist and to identify key opportunities to reduce and, where possible, eliminate them. The following section focuses on some of the more significant factors. Although a number of technical challenges remain, most of the factors discussed below lie beyond technology in the domains of governance and political economy.

6.5 Reconciling forest conservation and food production

This section presents and discusses challenges and opportunities in seven key thematic areas, for reducing and, where possible, eliminating key disconnects that appear to exist in reconciling the goals of forest conservation and food production.

1. Sectoral silos

Governments aspire to draft coherent cross-sectoral policies but, in practice, the drafting process may amount to little more than the collation of sectoral targets. Sectoral ministries in all three case-study countries promote their mandates, but there are few opportunities to consider how these might align with other sectors, leading to a plethora of priorities and, at times, incompatible targets. In some cases, political pressures have taken precedence over evidence-based advice in policy implementation. On the other hand, all three countries have cross-sectoral organisational arrangements that aim to break down sectoral silos. Ethiopia's overarching programming framework – the Climate Resilient Green Economy strategy – has agriculture and forestry at its heart, and this is now fully mainstreamed into the national development strategy, GTP II. The bottleneck in this challenge is less about the policies and strategies than the institutional arrangements for enabling implementation across sectors. Tanzania has strong institutional arrangements – the influential VPO-DoE coordinates across ministries and oversees environment protection – but no process is in place to align competing sectoral targets, and the mainstreaming of environmental issues in agricultural policies and strategies is less evident. In Ghana, the Land Administration Project, spearheaded by the Town and Country Planning Department, seeks to ensure sustainable land administration and management; to date, however, the programme has focused largely on urban planning, with little attention to rural land uses.

2. Scale disconnects

Discrepancies exist at various scales (eg national, subnational and local) in the capacities, responsibilities and priorities of key stakeholders in making and implementing land-use decisions. For example, there may be:

- Mismatches in priorities at different scales (in Tanzania, for example, the priorities of village land-use plans may not align strongly with national land-use priorities).
- Misalignment in the allocation of sectoral responsibilities between national and lower levels of governance (in Ethiopia, for example, MEFCC has limited capacity and institutional set-up to implement policies at the regional and local levels).

- Mismatches between responsibilities and resource distribution across scales (in Ghana, for example, local governments have to implement agricultural policies but resources are insufficient to support implementation). New land-use planning initiatives (see below) are showing promise in addressing some of these disconnects.

3. Information gaps

In some cases, information necessary for the effective management of risks and trade-offs exists but is publicly unavailable. For example, an information gap on the ownership and use of large commercial farms in Ethiopia hinders efforts to monitor and manage the environmental and social impacts of agricultural production.

The limitations of remote sensing technology in understanding agricultural drivers of deforestation in SSA

Reliable land-cover data are important for monitoring the impacts of deforestation and cropland expansion in Africa, but data uncertainties are considerable. A recent collaborative study by the University of Edinburgh and IIED examined 14 of the most commonly used land-cover data products. Its key findings were as follows:

- Forest and cropland area estimates vary widely between data products.
- Disagreement between data products is apparent at the continental, national and regional scales and is particularly elevated at the smallest spatial scales.
- Forest area estimates agree most strongly in areas of dense forest and where forest is clearly not present (eg deserts). Agreement between estimates of forest area is low in areas of woodland and savannah.
- Crop area estimates show greater disagreement than estimates of forest area, and they may be particularly uncertain where agriculture is small-scale and spatially scattered, as is dominant in much of Africa. Data products agree better for locations where agriculture is limited than where it is widespread.
- Most data products agree that Africa is undergoing a period of forest loss and cropland area expansion, although estimates of the magnitude of these changes do not yet appear to be robust.
- Data products disagree in part due to the use of varied definitions of forest and cropland, which can be difficult to harmonise.
- Classification error is likely to be significant, resulting in errors that are greater in magnitude than those associated with rates of land-cover change.

Source: Bowers *et al.* (2016)

In other cases, the necessary information is lacking. Despite the progress made under REDD+, there is a lack of reliable information on deforestation rates and spatial information in areas where deforestation and threats to biodiversity are most severe. This is due to a lack of historical data on forests; the limitations of remote sensing technology (Bowers *et al.*, 2016; see box); a lack of capacity to monitor land-use change and collect field data; and, in some cases, a lack of transparency. Reliable, spatially disaggregated information on biodiversity, forest ecosystem services and deforestation patterns is vital for prioritising conservation efforts and better managing agro-environmental trade-offs. In all three case-study countries, forest-sector strategies, including REDD+, acknowledge agricultural expansion as one of the main drivers of deforestation, but the impacts of staple food-crop production on forests are often underestimated. There is also a lack of understanding of the Jevons paradox, which has been highly significant in Latin America.

4. Funding constraints

Many African countries face serious budgetary constraints in putting sound policies into effect. Ethiopia's CRGE strategy, for example, is estimated to require US\$150 billion over 20 years, but only US\$50 million was mobilised between 2011 (its inception) and 2016. Given limited budgets, it is vital to adopt strategic and coherent policy priorities to avoid spreading resources too thinly across initiatives that, as a result, may never be fully implemented. In the three case-study countries, local governments are often responsible for implementing land-use policies, requiring adequate budgetary support from central governments.

5. Narrative of vacant or underused land

In all three case-study countries, there is a perception among key policymakers that large tracts of vacant or underused land exist that are available for agriculture, plantation forestry and forest restoration. This narrative has a strong influence on policy and strategy development and land-use planning processes. There are clear indications, however, that estimates of vacant or underused land are overly optimistic in all three countries. In Ghana, 69 per cent of the land area has moderate to very severe soil degradation; soil degradation is especially severe in the northern region, where vacant land is supposedly most abundant (RoG, 2011b). Each of the case-study countries has tried 'land bank' approaches for identifying, surveying and registering vacant land, but these are often fraught with land-rights disputes; in Tanzania, such disputes have meant that the land bank has much less land than originally envisaged. Of particular concern in some areas is the situation of semi-nomadic pastoralists, who may be unaware of new claims to land they customarily use; moreover, they often have little influence over land allocation and governance processes.

6. Land-use planning

For governments seeking to mitigate the impacts of forest conversion, land-use planning informed by spatial analysis of key agro-environmental trade-offs is an essential tool. A participatory and cross-sectoral land-use planning process at the national level can help in determining the trade-offs between agricultural production and conservation and lead to the development of shared national priorities that can guide regional and local land-use planning and decision making. Opportunities are emerging in all three case-study countries for participatory, cross-sectoral land-use planning processes. Ethiopia is embarking on a major new land-use programme that will support planning at the village to national scales. Ghana has a new land-use law requiring all district governments to have land-use plans, and its REDD+ strategy calls for a holistic and effective national land-use plan. Tanzania has rich experience in village-level land-use planning and an emerging national process that can build on that. Tanzania's bottom-up approach will work best if it can be rolled out across entire agricultural and forest landscapes (a challenge given the high cost); in the vertical dimension, processes will be needed to reconcile differences between national and local priorities. Land-use planning and associated spatial analysis also need to address the negative social impacts of forest conversion as part of strategies to minimise and mitigate these impacts.

Although there is much more to identifying and managing food–forest trade-offs than land-use planning, such planning has a crucial role to play in coming years – provided there is ownership and political buy-in at the relevant levels to implement the plans arising from planning processes. To achieve this level of ownership and buy-in may not be easy, but it is much more likely if this issue is addressed at the outset rather than at the end of an otherwise technocratic process. This seems to be the intention in all three countries, and it should be strongly encouraged by all key actors, even though it will make the process more complex and costly.

7. Political support for forest and biodiversity conservation

In all three countries, growing political commitment to the climate-change agenda and the associated increase in investment in forestry – notably through REDD+ – presents an opportunity for biodiversity conservation through social and environmental safeguards, which are increasingly attached to forest-sector funding.

Nonetheless, conservation organisations in all three countries have expressed concern over what they see as weak political support for goals related to natural-forest conservation and particularly biodiversity conservation compared with the strength of commitment to agricultural development and to food-security and national self-sufficiency targets. It was noted in discussions facilitated by this study that relatively strong

commitments to biodiversity conservation in some national policies and strategies linked to international commitments (such as the CBD) appear not to be evident in reality. In forestry, some stakeholders also framed the lack of commitment as an underestimate of the true value of forests to the national economy – in other words, an information gap. Further analysis of this issue is needed, but it may well be that this is more about what politicians believe will contribute more to electoral success. This is not peculiar to SSA – it is more a reflection of the basic rules of the game in democratic states.

7

Conclusion

The question of how to reconcile goals of forest conservation and food production in the three case-study countries reflects a broader issue of tensions between some of the SDGs, notably SDG2 and SDG15. There appear to be a number of disconnects within and between key sectoral policies and strategies that, with the exception of Ethiopia's CRGE strategy, are not addressed in overarching policies. As shown in this report, there are also disconnects between policy and planning processes at different levels, from local to global. Often these disconnects relate to risks and trade-offs that have been overlooked or underestimated. There are significant technical constraints and information gaps, but most of the issues go beyond technical fixes to organisational and governance aspects – and in many cases, to matters of political economy.

Many forest and biodiversity policymakers and key stakeholders seem to underestimate the degree to which natural forests in SSA will be lost to agricultural expansion to meet growing food demand. Policymakers and key stakeholders in agricultural development should also not overlook the potential significance of commitments to conserve natural forests in constraining certain agricultural development options as resource competition intensifies in coming years.

The political and economic forces in the food system are far stronger than those in the forest sector and are therefore likely to prevail in business-as-usual scenarios. Nevertheless, viable alternatives to such scenarios exist in which the better management of risks and trade-offs enables more informed decisions on where and how to intensify agriculture and which forest areas to lose, conserve and restore, thereby reducing the loss of natural forests and helping maintain crucial forest ecosystem services.

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Acronyms

AMSEC	Agricultural mechanisation services enterprises centre (Ghana)
ASDP	Agriculture Sector Development Program (Tanzania)
ATA	Agricultural Transformation Agency (Ethiopia)
CBD	Convention on Biological Diversity
CBFM	Community-based forest management
CIFOR	Center for International Forestry Research
CREMA	Community resource management area (Ghana)
CRGE	Climate-Resilient Green Economy (Ethiopia)
CSA	Central Statistical Agency (Ethiopia)
EBI	Ethiopian Biodiversity Institute
FAO	Food and Agriculture Organization of the United Nations
FASDEP	Food and Agricultural Sector Development Policy (Ghana)
FC	Forestry Commission of Ghana
FPP	Forest Preservation Programme (Ghana)
FYDP	Five-year development plan
GDP	Gross domestic product
GNRS	Ghana National REDD+ Strategy
GoE	Government of Ethiopia
GSGDA	Ghana Shared Growth and Development Agenda
GTP	Growth and Transformation Plan (Ethiopia)
HFZ	High Forest Zone (Ghana)
IFPRI	International Food Policy Research Institute
INDC	Intended nationally determined contribution
IUCN	International Union for Conservation of Nature
JFM	Joint forest management (Tanzania)
MANR	Ministry of Agriculture and Natural Resource Management (Ethiopia)
MEFCC	Ministry of Environment, Forest and Climate Change (Ethiopia)
METASIP	Medium Term Agriculture Sector Investment Plan (Ghana)
MLNR	Ministry of Lands and Natural Resources (Ghana)
MoA	Ministry of Agriculture (Tanzania)
MRV	Monitoring, reporting and verification
MtCO ₂ e	Million tonnes carbon dioxide equivalent
NAFCO	National Food Buffer Stock Company (Ghana)
NAFORMA	National Forest Resources Monitoring and Assessment (Tanzania)
NAP	National Agricultural Policy (Tanzania)
NBSAP	National Biodiversity Strategy and Action Plan

NCCS	National Climate Change Strategy (Tanzania)
NGO	Non-governmental organisation
NILUPP	National Integrated Land Use Plan and Policy (Ethiopia)
PASDEP	Plan for Accelerated and Sustained Development to End Poverty (Ethiopia)
PFM	Participatory forest management
REDD+	Reducing emissions from deforestation and forest degradation
RoG	Republic of Ghana
SAGCOT	Southern Agriculture Growth Corridor of Tanzania
SDG	Sustainable Development Goal
SDPRP	Sustainable Development and Poverty Reduction Programme (Ethiopia)
SNNPR	Southern Nations, Nationalities and Peoples Region (Ethiopia)
SSA	Sub-Saharan Africa
TAFSIP	Tanzania Agriculture and Food Security Investment Plan
TFS	Tanzania Forest Service Agency
TZ	Transition Zone (Ghana)
UNDP	United Nations Development Programme
UNEP-WCMC	United Nations Environment Programme-World Conservation Monitoring Centre
VPO-DoE	Vice President's Office Division of the Environment (Tanzania)

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Franks, P and Hou-Jones, X (2016) Managing trade-offs between growing food and conserving forests in sub-Saharan Africa. IIED Briefing, London. Available at: <http://pubs.iied.org/17412IIED/>

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Research Report

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Forests; Food and agriculture

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sub-Saharan Africa

Forest cover in sub-Saharan Africa declined by nearly 10 per cent between 2000 and 2010. Of this loss, 75 per cent was caused by the conversion of forest to agriculture, largely for food production to serve rapidly growing domestic food demand. Focusing on Ethiopia, Ghana and Tanzania, this study examines the very real trade-offs that exist between conserving forests and increasing food production. It explores how these trade-offs might be better managed through informed choices about where and how to intensify agriculture, and which areas of natural forest to conserve and which to lose. Inevitably, a considerable area of natural forest outside of reserves will still be lost, but less than would otherwise be the case, and more key forest ecosystem services will be preserved.

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International Institute for Environment and Development
80-86 Gray's Inn Road, London WC1X 8NH, UK

Tel: +44 (0)20 3463 7399
Fax: +44 (0)20 3514 9055
email: info@iied.org
www.iied.org



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