

**TOGO**

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**L**ocated on the coast of the Gulf of Guinea in West Africa, Togo has a surface area of 56,600 square kilometers, bordering the Atlantic Ocean in the south, Burkina Faso in the north, Benin in the east, and Ghana in the west. The Togolese population was estimated at 6.3 million inhabitants in 2007. The Human Development Index ranked Togo 152nd out of 177 countries across the world, with an index of 0.512 (UNDP 2007).

The agricultural sector employs approximately 70 percent of the country's workforce and plays a crucial economic and social role in Togo, contributing to food security, creating jobs, and generating income as well as providing goods and services. Agriculture accounts for 38 percent of Togo's gross domestic product (GDP): 26.0 percent from foodcrops, 3.4 percent from cash crops, 5.1 percent from livestock products, 1.4 percent from fishery products and aquaculture, and 2.1 percent from forestry production. It produces 20 percent of the country's export earnings (Togo 2009). The Togolese agricultural sector is dominated by the small-scale rainfed farming of millet, sorghum, maize, and rice.

Productivity is generally low in Togolese agriculture for several reasons, including limited banking facilities, minimal training, and such natural factors as variable climate and poor soils. Togo's agricultural sector and the country's economic development are thus particularly susceptible to the effects of climate change. According to some climate scenarios, Togo is located in the area that will experience a decrease in rainfall and a rise in temperature, with an adverse impact on agricultural productivity and thus on the well-being of the population, particularly in rural areas.

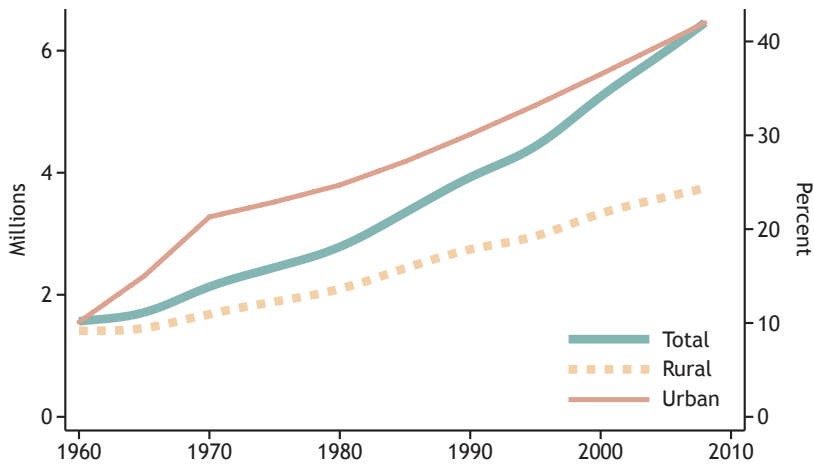
Some national policy strategies have been adopted by the government to improve agricultural production and the well-being of rural dwellers, as summarized in the conclusions to this chapter. These strategies need to be revisited to mainstream adaptation to climate change and thus ensure that the expected results will be achieved.

## Review of the Current Situation

### Population

Figure 13.1 shows total and rural population trends in Togo (left axis) and the share of the urban population (right axis). The population of Togo approximately doubled between 1985 and 2010, with increasing urbanization (currently over 40 percent of the population lives in urban areas). The overall population growth rate has been declining slightly since 1980 (Table 13.1).

**FIGURE 13.1** Population trends in Togo: Total population, rural population, and percent urban, 1960–2008

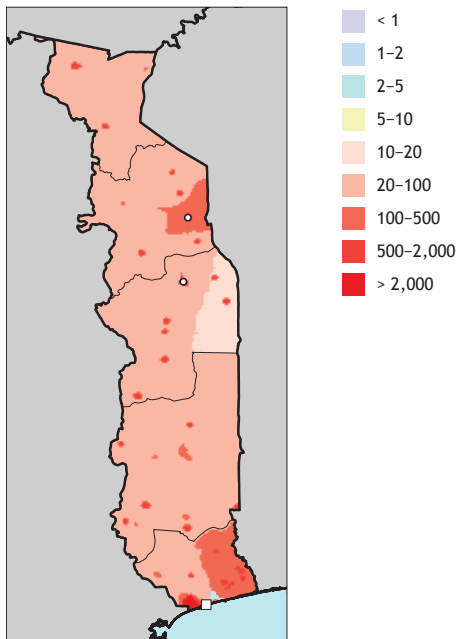


Source: World Development Indicators (World Bank 2009).

**TABLE 13.1** Population growth rates in Togo, 1960–2008 (percent)

Decade	Total growth rate	Rural growth rate	Urban growth rate
1960–69	3.0	1.7	10.5
1970–79	2.6	2.1	4.0
1980–89	3.6	2.8	5.5
1990–99	2.8	1.9	4.8
2000–2008	2.6	1.4	4.3

Source: Authors' calculations based on World Development Indicators (World Bank 2009).

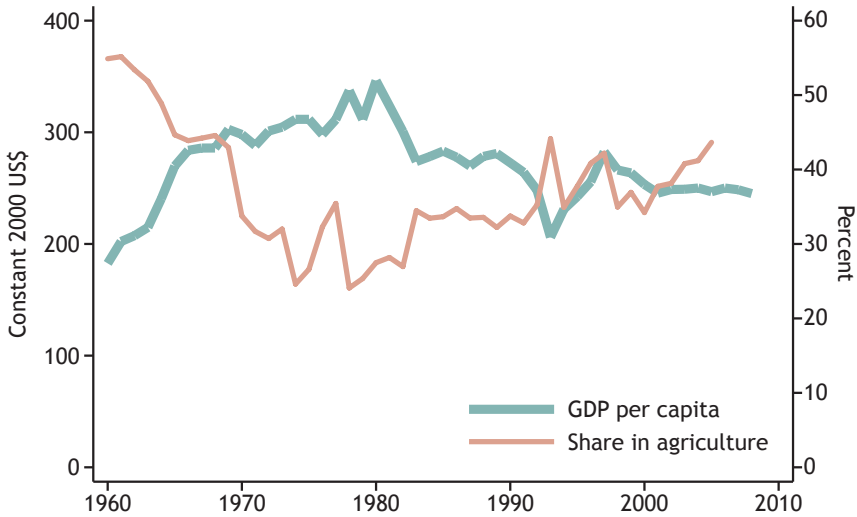
**FIGURE 13.2** Population distribution in Togo, 2000 (persons per square kilometer)

Source: CIESIN et al. (2004).

Figure 13.2 shows the geographic distribution of the population in Togo in 2000. The population is very unevenly distributed; arable areas (mostly in the south) as well as the areas around the capital city host more than 66 percent of the total population. All the major urban areas have population densities of 100–500 people per square kilometer, while the rural areas have a density of 20–100 people per square kilometer. Higher population densities continue to present serious challenges to governments including the Togolese government, particularly with regard to providing essential infrastructure and social services for the people. On the other hand, the largely human labor–intensive agriculture in rural areas has an increasingly dwindling labor force.

### Income

Figure 13.3 shows trends in GDP per capita in Togo as well as the proportion of GDP from agriculture. GDP per capita, estimated at about US\$180 (US dollars) in 1960, had almost doubled by 1980, reflecting the increased production of cash crops (coffee, cocoa, and cotton) and the mining sector (mainly phosphate). GDP per capita decreased sharply thereafter until 1994, to a low

**FIGURE 13.3** Per capita GDP in Togo, 1960–2008 (constant 2000 US\$) and share of GDP from agriculture (percent)

Source: World Development Indicators (World Bank 2009).

Notes: GDP = gross domestic product; US\$ = US dollars.

of around US\$200, due to structural adjustments imposed by the World Bank. GDP per capita then increased sharply and peaked at the level of the 1980s, followed by a more moderate decline and stabilizing at just below US\$250 in the mid-2000s. The reduction in donor funding as a consequence of bad governance largely accounted for the stagnation of the economy after 2000.

The agricultural sector occupies a prominent place in Togo's economy, accounting for 38 percent or more of GDP in recent years and providing over 20 percent of export earnings. During the past 10 years, while GDP per capita has been stagnant, the contribution of agricultural gross domestic product has been increasing.

### Vulnerability to Climate Change

Table 13.2 provides some data on Togo's performance on several indicators of a population's vulnerability and resiliency to economic shocks: level of education, literacy, and concentration of labor in poorer or less dynamic sectors. School enrollment is 97.1 percent in primary school but only 39.3 percent in secondary

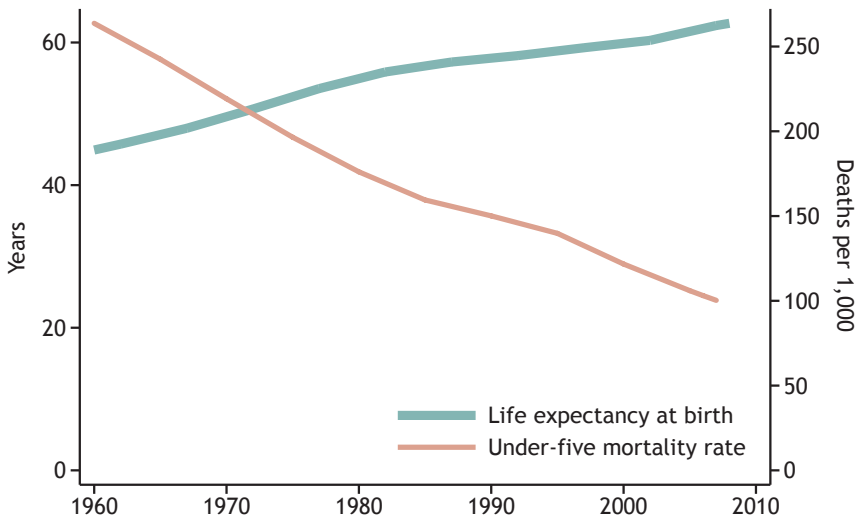
**TABLE 13.2** Education and labor statistics for Togo, 1990s and 2000s

Indicator	Year	Percent
Primary school enrollment (percent gross, three-year average)	2007	97.1
Secondary school enrollment (percent gross, three-year average)	2007	39.3
Adult literacy rate	2000	53.2
Percent employed in agriculture	2010	66.0
Under-five malnutrition (weight for age)	1998	23.2

Source: Authors' calculations based on World Development Indicators (World Bank 2009).

school. The high dropout rate between primary and secondary levels is driven by such factors as the need for farm labor, an inability to pay school fees, and early marriage for girls. Only about half of the population is literate.

Figure 13.4 shows Togo's performance on two noneconomic correlates of poverty: life expectancy and under-five mortality. Life expectancy increased from 45 years in 1960 to 57 years in 1990 and then continued to increase slightly to around 63 years in 2008; infant mortality has been reduced by more than half, from more than 260 deaths per 1,000 in 1960 to about 100 per 1,000 in 2008.

**FIGURE 13.4** Well-being indicators in Togo, 1960–2008

Source: World Development Indicators (World Bank 2009).

The vaccination of children as well as urbanization—which gives people better access to medical and social services—may partly account for these improvements.

Wood et al. (2010) report that 69 percent of the country is living on less than US\$2 per person per day based on the 2005 US dollar and the purchasing power parity measure. Poverty is overwhelmingly rural: the rural incidence is 74.3 percent, representing 79.9 percent of the poor (Togo, MEF 2008). In urban areas the incidence of poverty is 36.7 percent. In general, the Savanna Region is the poorest (90.5 percent incidence), followed by the Central Region (77.7 percent), Kara (75.0 percent), Maritime (69.4 percent), Plateaux (56.2 percent), and Lomé, the least poor region (24.5 percent). Except for the city of Lomé and the Plateaux Region, all the regions have urban poverty rates of at least 50 percent; in the Savannah Region, 76.8 percent of the urban population is poor (Togo, MEF 2008).

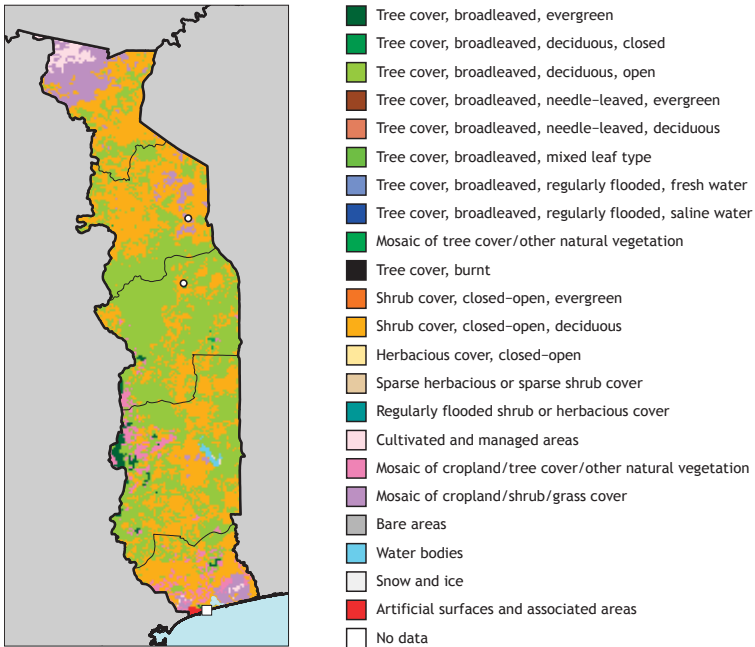
## **Review of Land Use and Agriculture**

### **Land Use Overview**

Figure 13.5 shows the land cover and land use in Togo. Approximately 17 percent of Togo is forested, of which about 90 percent (3,480 square kilometers) is natural forest and 10 percent (380 square kilometers) is plantation (USAID Togo 2008). The Guinean savanna, an area of dry forests in the middle of the country, is the single most extensive vegetation cover; the major crops grown there are maize, sorghum, and cassava. The second-largest area of land cover is the Sudanian savanna in the far north of the country, with some parts in dry forests; there the major crops are cereals (maize, sorghum, millet, and rice) and legumes (peanuts, beans, and soy). In part of the Guinean savannah there is a zone of semideciduous forests where the major crops are maize, coffee, cocoa, and cassava.

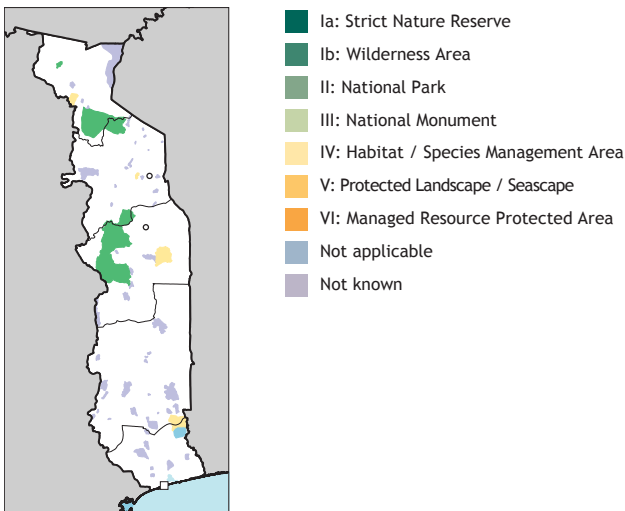
Figure 13.6 shows the locations of protected areas, including parks and reserves. Togo has 83 protected areas covering 14 percent of the land, but most of these areas have been invaded by settlements, and at best about 10 percent of Togo has protected status (Amegadje 2007). This encroachment began occurring following the political turmoil that started in the 1990s. The government's rehabilitation program of protected areas (1999–2002) has set a goal of restoring and securing 578,246 hectares of 10 of the 83 priority protected areas, representing 10.2 percent of the national territory (Togo, MERF 2009). These areas are designed to conserve biodiversity and to improve the environments and living conditions of the people. The following existing protected areas are considered priorities: Malfakassa, Anié,

**FIGURE 13.5** Land cover and land use in Togo, 2000



Source: GLC2000 (Bartholome and Belward 2005).

**FIGURE 13.6** Protected areas in Togo, 2009



Sources: Protected areas are from the World Database on Protected Areas (UNEP and IUCN 2009). Water bodies are from the World Wildlife Fund's Global Lakes and Wetlands Database (Lehner and Döll 2004).

Abdoulaye, Oti-Keran, Oti-Mandouri Aledjo, Togodo–South, North Togodo, Bayeme, Amu Mono, Galangashi, Tchilla-Monot, Fosse aux Lions, and Assévé Godjinmé. These protected areas cover nearly 595,848 hectares. By 2009 an estimated 7.22 percent of the protected areas had been reclassified and their boundaries delineated with the participation of local populations. Only the following protected areas can be classified according to the International Union for the Conservation of Nature categories: Aledjo, Togodo–South, North Togodo, Bayeme, Galangashi, and Fosse aux Lions. Several of the protected areas in northern Togo are part of a transboundary conservation corridor providing a large area for the migration of large game animals like elephants. Flora and fauna are threatened by anthropogenic activities, such as hunting pressure, overharvesting, and converting land to agriculture (USAID Togo 2008).

Figure 13.7 shows travel times to urban areas of various sizes in Togo as potential markets for agricultural products and as sources of agricultural inputs and consumer goods for rural households. The underdeveloped road transport infrastructure remains a problem for the growth of the Togolese economy, especially agricultural activities. Only 21 percent of the national road network is paved, and paved roads and engineering structures (bridges) are largely in disrepair due to a lack of maintenance and monitoring in recent years. The feeder roads linking major agricultural production areas with potential markets are often not passable, particularly during the rainy season, and some areas remain isolated.

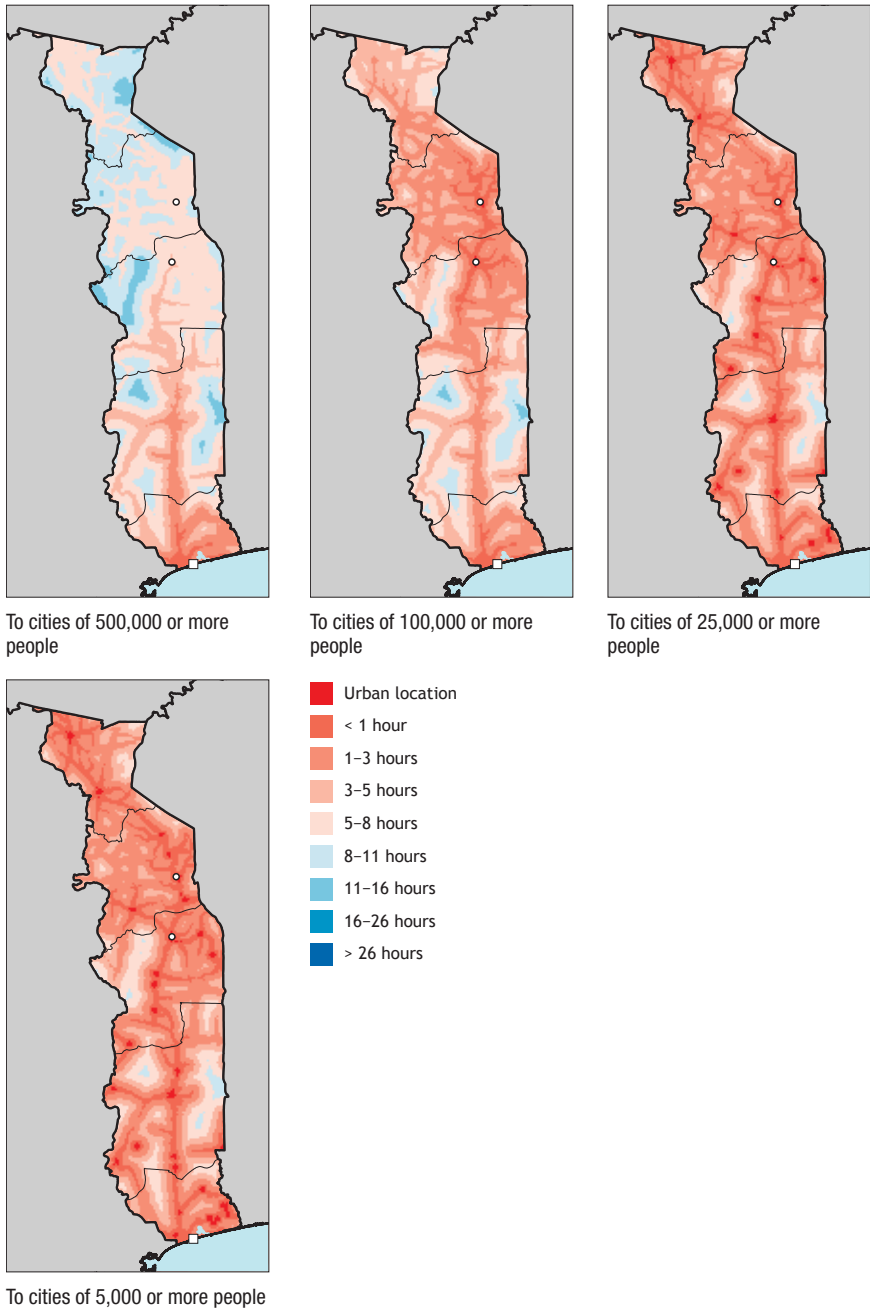
It is difficult for farmers in remote areas to sell their agricultural produce in an urban center with more than 100,000 inhabitants (such as Lomé or Kara) with larger markets and better prices. Generally farmers must sell their products in smaller urban centers of fewer than 10,000 inhabitants, particularly in periodic markets.

### **Agriculture**

Togo has two principal climate zones, north and south. In the north the rainy season extends from May to October, and the dry season lasts from November to April. Rainfall varies from 900 to 1,100 millimeters per year in this region, with an average temperature of 28°C. The southern region has two wet seasons of unequal duration, with annual rainfall between 1,000 and 1,600 millimeters and an average temperature of 27°C.

Tables 13.3–13.5 show key agricultural commodities in terms of area harvested, the value of the harvest, and the provision of food for human

**FIGURE 13.7** Travel time to urban areas of various sizes in Togo, circa 2000



Source: Authors' calculations.

**TABLE 13.3** Harvest area of leading agricultural commodities in Togo, 2006–08 (thousands of hectares)

Rank	Crop	Percent of total	Harvest area
	Total	100.0	1,532
1	Maize	31.0	475
2	Sorghum	14.4	221
3	Beans	12.3	188
4	Cassava	8.5	130
5	Cocoa beans	6.8	104
6	Millet	4.5	69
7	Seed cotton	4.4	67
8	Yams	3.9	60
9	Groundnuts	3.7	57
10	Coffee	2.2	34

Source: FAOSTAT (FAO 2010).

Note: All values are based on the three-year average for 2006–08.

consumption (ranked by weight). Maize has the largest area under cultivation. Cassava has the largest area for roots and tubers, and cocoa has the largest area for a cash crop (see Table 13.3). The greatest potential value is derived from cocoa beans followed by maize (see Table 13.4); cassava and yams are the first and second major foodcrops consumed in the country in terms of weight consumed (see Table 13.5).

The next five figures show the estimated yield and growing areas of key crops. Maize is the most widely cultivated crop in Togo (Figure 13.8). It is grown in all parts of the country, with yields ranging from 1 to 2 metric tons per hectare, though in some areas the yields are lower.<sup>1</sup> Sorghum, also widely grown, is concentrated mostly in the central and extreme southern parts of the country (Figure 13.9). In many areas the sorghum yields are also in the range of 1–2 tons per hectare. Beans are grown mainly in the middle belt, with a yield of less than 0.5 tons per hectare (Figure 13.10). Both cassava (Figure 13.11) and sweet potatoes and yams (Figure 13.12) are grown in the south and middle parts of Togo, though cassava is grown far more in the middle part of the country and cassava is grown in the far north as well. Cassava yields are mostly in the range of 4–7 tons per hectare, whereas yam and sweet potato yields are mostly in the category of yields greater than 10 tons per hectare.

<sup>1</sup> All tons are metric tons.

**TABLE 13.4** Value of production of leading agricultural commodities in Togo, 2005–07 (millions of US\$)

Rank	Crop	Percent of total	Value of production
	Total	100.0	783.4
1	Cocoa beans	20.3	159.3
2	Maize	16.7	130.9
3	Yams	16.0	125.0
4	Other fresh vegetables	12.9	100.9
5	Cassava	10.4	81.5
6	Sorghum	7.6	59.8
7	Beans	3.5	27.5
8	Rice	2.5	19.4
9	Groundnuts	2.0	15.5
10	Seed cotton	1.9	15.1

Source: FAOSTAT (FAO 2010).

Note: All values are based on the three-year average for 2005–07. US\$ = US dollars.

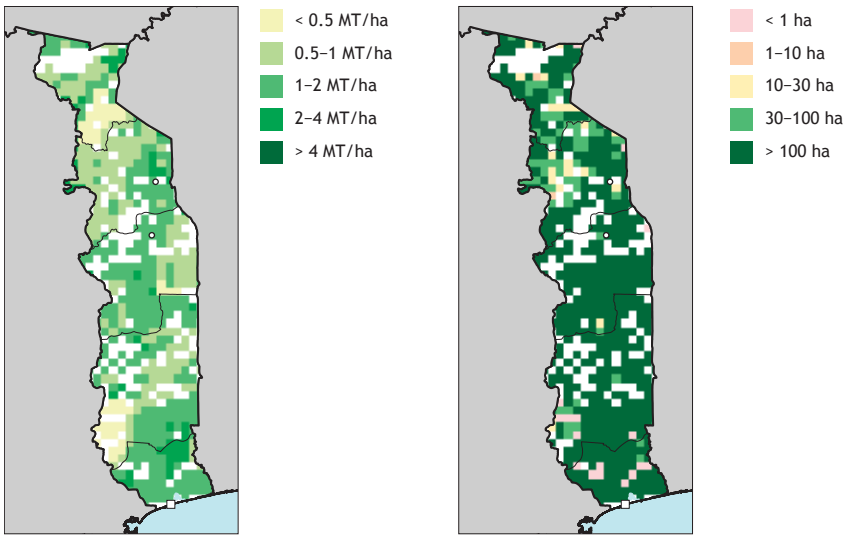
**TABLE 13.5** Consumption of leading food commodities in Togo, 2003–05 (thousands of metric tons)

Rank	Crop	Percent of total	Food consumption
	Total	100.0	2,314
1	Cassava	26.5	614
2	Yams	19.7	456
3	Maize	15.7	363
4	Rice	5.7	132
5	Other vegetables	5.2	119
6	Sorghum	4.9	113
7	Wheat	3.1	73
8	Beans	2.0	46
9	Beer	1.5	34
10	Sugar	1.4	32

Source: FAOSTAT (FAO 2010).

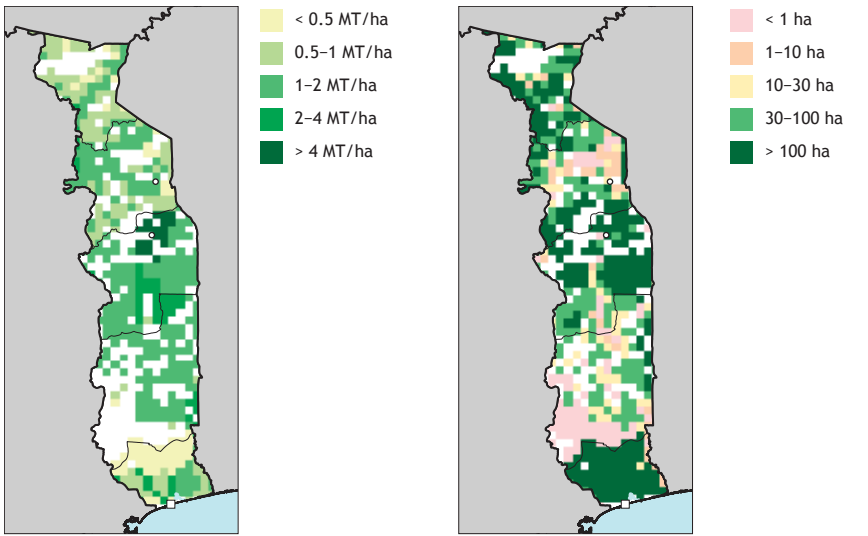
Note: All values are based on the three-year average for 2003–05.

**FIGURE 13.8** Yield (metric tons per hectare) and harvest area density (hectares) for rainfed maize in Togo, 2000



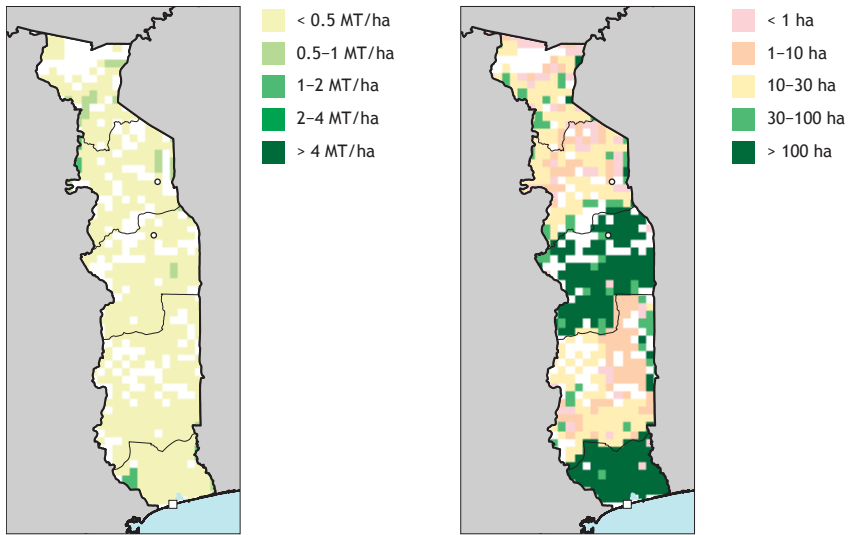
Sources: SPAM (Spatial Production Allocation Model) (You and Wood 2006; You, Wood, and Wood-Sichra 2006, 2009).

**FIGURE 13.9** Yield (metric tons per hectare) and harvest area density (hectares) for rainfed sorghum in Togo, 2000



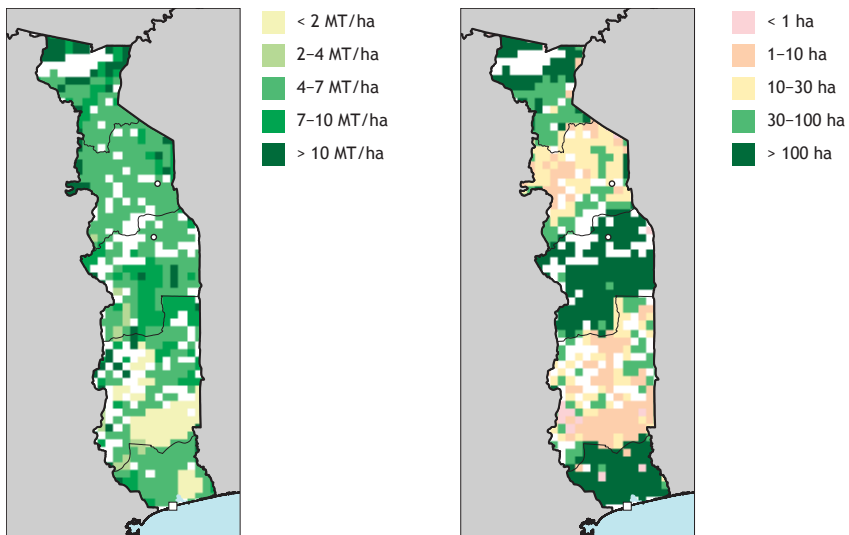
Sources: SPAM (Spatial Production Allocation Model) (You and Wood 2006; You, Wood, and Wood-Sichra 2006, 2009).

**FIGURE 13.10** Yield (metric tons per hectare) and harvest area density (hectares) for rainfed beans in Togo, 2000



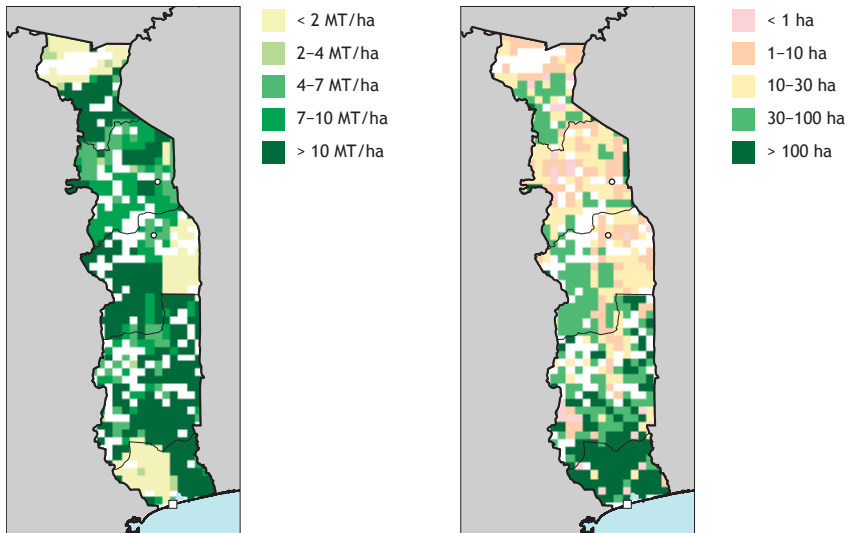
Sources: SPAM (Spatial Production Allocation Model) (You and Wood 2006; You, Wood, and Wood-Sichra 2006, 2009).

**FIGURE 13.11** Yield (metric tons per hectare) and harvest area density (hectares) for rainfed cassava in Togo, 2000



Sources: SPAM (Spatial Production Allocation Model) (You and Wood 2006; You, Wood, and Wood-Sichra 2006, 2009).

**FIGURE 13.12** Yield (metric tons per hectare) and harvest area density (hectares) for rainfed yams and sweet potatoes in Togo, 2000



Sources: SPAM (Spatial Production Allocation Model) (You and Wood 2006; You, Wood, and Wood-Sichra 2006, 2009).

## Economic and Demographic Scenarios

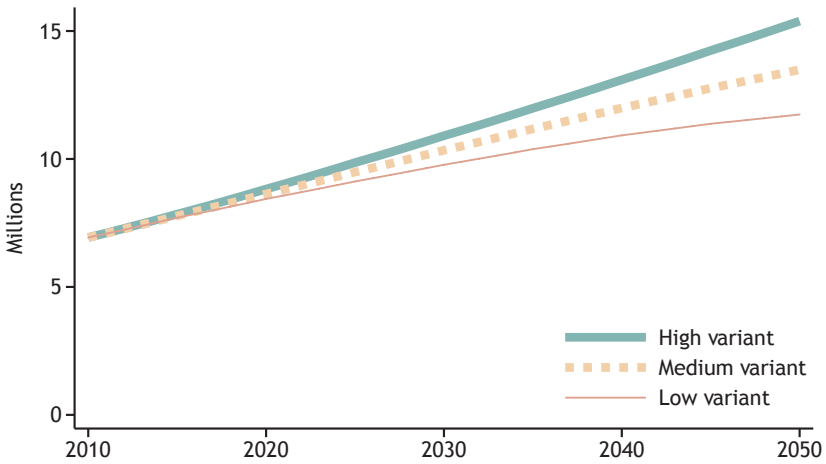
### Population

Figure 13.13 shows population projections for Togo by the United Nations (UN) population office through 2050 (UNPOP 2009). The population in 2050 is projected to be 15 million people (high variant scenario), 13 million (medium variant scenario), or almost 12 million (low variant scenario). These projected population levels will pose serious challenges to feed the increasing number of people. Population growth also poses serious environmental problems, including deforestation, bush fires, reduction of the length of the fallow period, inadequate farming techniques (leading to soil loss due to erosion), and overgrazing. Other challenges related to overcrowding include those related to the management of solid waste and industrial and commercial waste, pollution of the air and water, the emergence of toxic waste, and emissions of greenhouse gases.

### Income

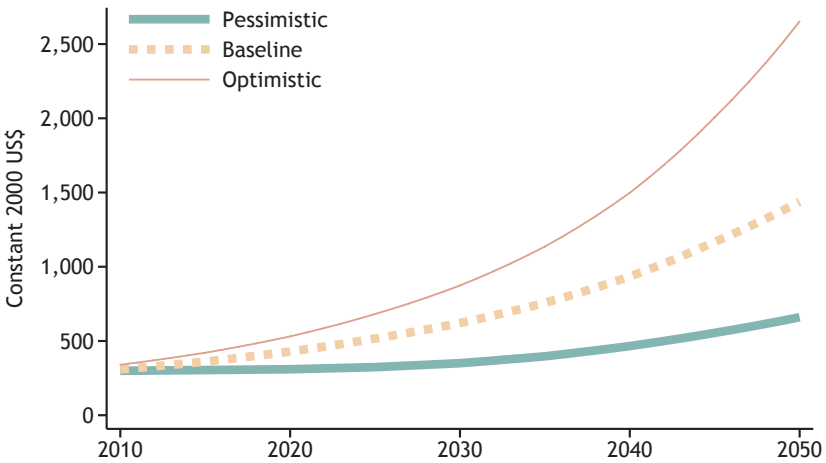
Figure 13.14 presents three overall scenarios for Togo's GDP per capita derived by combining three GDP scenarios with the three population scenarios of

**FIGURE 13.13** Population projections for Togo, 2010–50



Source: UNPOP (2009).

**FIGURE 13.14** Gross domestic product (GDP) per capita in Togo, future scenarios, 2010–50



Sources: Computed from GDP data from the World Bank Economic Adaptation to Climate Change project (World Bank 2010), from the Millennium Ecosystem Assessment (2005) reports, and from population data from the United Nations (UNPOP 2009).  
 Note: US\$ = US dollars.

Figure 13.13 (based on UN population projections). The optimistic scenario combines high GDP with low population scenarios for all countries, the baseline scenario combines the medium GDP projection with the medium population scenario, and the pessimistic scenario combines the low GDP scenario with the high population scenario. The agricultural modeling in the next section uses these scenarios.

The pessimistic scenario shows GDP per capita increasing only very slightly between 2030 and 2040, with a high of just US\$700 in 2050. In the optimistic scenario GDP per capita is shown to double by 2025, reaching more than US\$2,600 in 2050; the baseline scenario shows GDP per capita reaching about US\$1,400 in 2050.

## Biophysical Scenarios

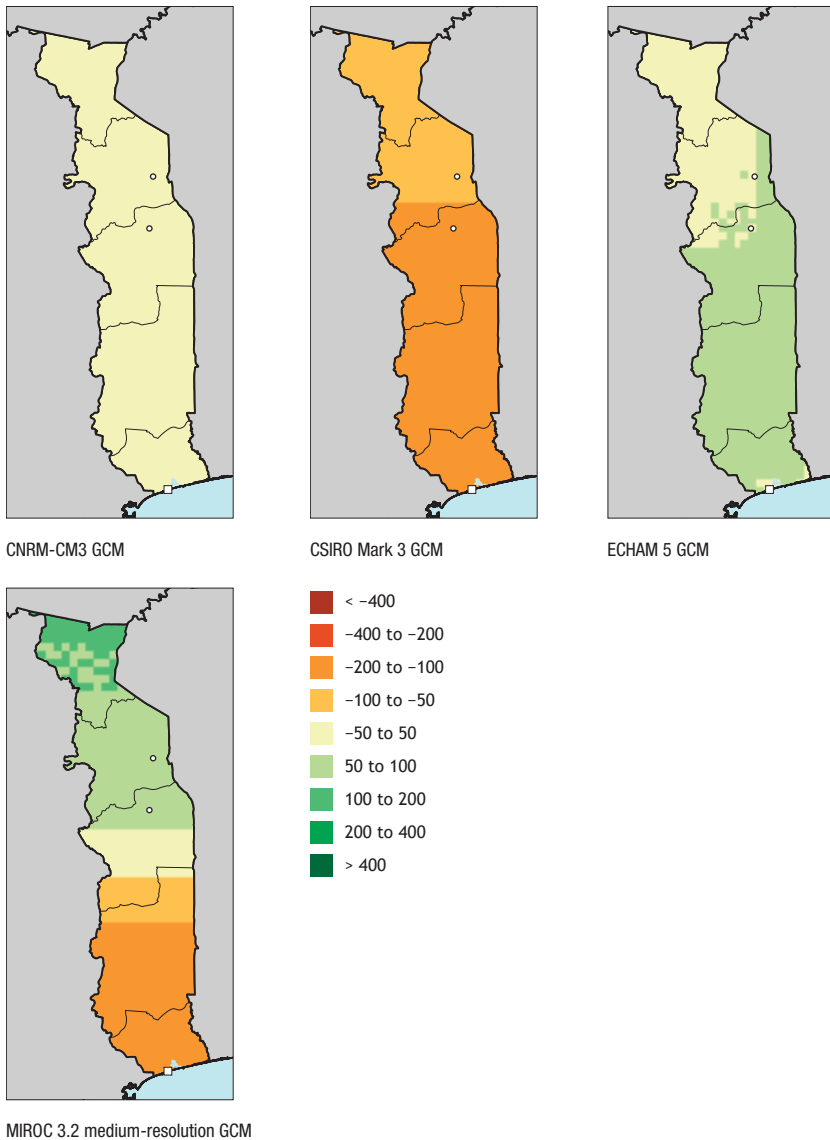
### Climate Scenarios

Figure 13.15 shows precipitation changes in the four downscaled general circulation models (GCMs) we use in this chapter in the A1B scenario.<sup>2</sup> The models show varying scenarios: the CNRM-CM3 GCM shows the average rainfall for 2000–2050 changing very little (between –50 and 50 millimeters) across the entire country; the CSIRO Mark 3 GCM, the most pessimistic model, shows for the same period a reduction of –100 to –50 millimeters for the far north (the Maritime Region and much of the Kara Region) and –200 to –100 millimeters for the rest of the country; the ECHAM 5 GCM shows little change (between –50 and 50 millimeters) in the extreme north (the Savanna Region and much of the Kara Region) and a moderate increase (between 50 and 100 millimeters) in the south; and the MIROC 3.2 medium-resolution GCM shows rainfall increasing in the north (100 to 200 millimeters) and diminishing southward, with substantial rainfall decreases in the southern third of the country (–200 to –100 millimeters).<sup>3</sup>

2 The A1B scenario is a greenhouse gas emissions scenario that assumes fast economic growth, a population that peaks midcentury, and the development of new and efficient technologies, along with a balanced use of energy sources.

3 CNRM-CM3 is the National Meteorological Research Center–Climate Model 3. CSIRO is a climate model developed at the Australia Commonwealth Scientific and Industrial Research Organisation. ECHAM 5 is a fifth-generation climate model developed at the Max Planck Institute for Meteorology in Hamburg. MIROC is the Model for Interdisciplinary Research on Climate, developed at the University of Tokyo Center for Climate System Research.

**FIGURE 13.15** Changes in mean annual precipitation in Togo, 2000–2050, A1B scenario (millimeters)



Source: Authors' calculations based on Jones, Thornton, and Heineke (2009).

Notes: A1B = greenhouse gas emissions scenario that assumes fast economic growth, a population that peaks midcentury, and the development of new and efficient technologies, along with a balanced use of energy sources; CNRM-CM3 = National Meteorological Research Center–Climate Model 3; CSIRO = climate model developed at the Australia Commonwealth Scientific and Industrial Research Organisation; ECHAM 5 = fifth-generation climate model developed at the Max Planck Institute for Meteorology (Hamburg); GCM = general circulation model; MIROC = Model for Interdisciplinary Research on Climate, developed at the University of Tokyo Center for Climate System Research.

Figure 13.16 shows the change in average daily maximum temperature for the warmest month in Togo in the A1B scenario according to various GCMs. CNRM-CM3 and MIROC 3.2 each show a uniform increase in temperature across the country of differing amounts. CNRM-CM3 is the most pessimistic of the four, with an increase of 2.0°–2.5°C; MIROC 3.2 shows the least increase, 1°–1.5 °C. CSIRO Mark 3 and ECHAM 5 show increases in most parts of the country in the range of 1.5°–2.0°C. Overall, the models show a minimum temperature increase of 1°C and a maximum of 2.5°C. Any sustained increase in temperature, especially with declining rains, could pose a serious challenge to the resource-poor farmers in the country.

### **Crop Scenarios**

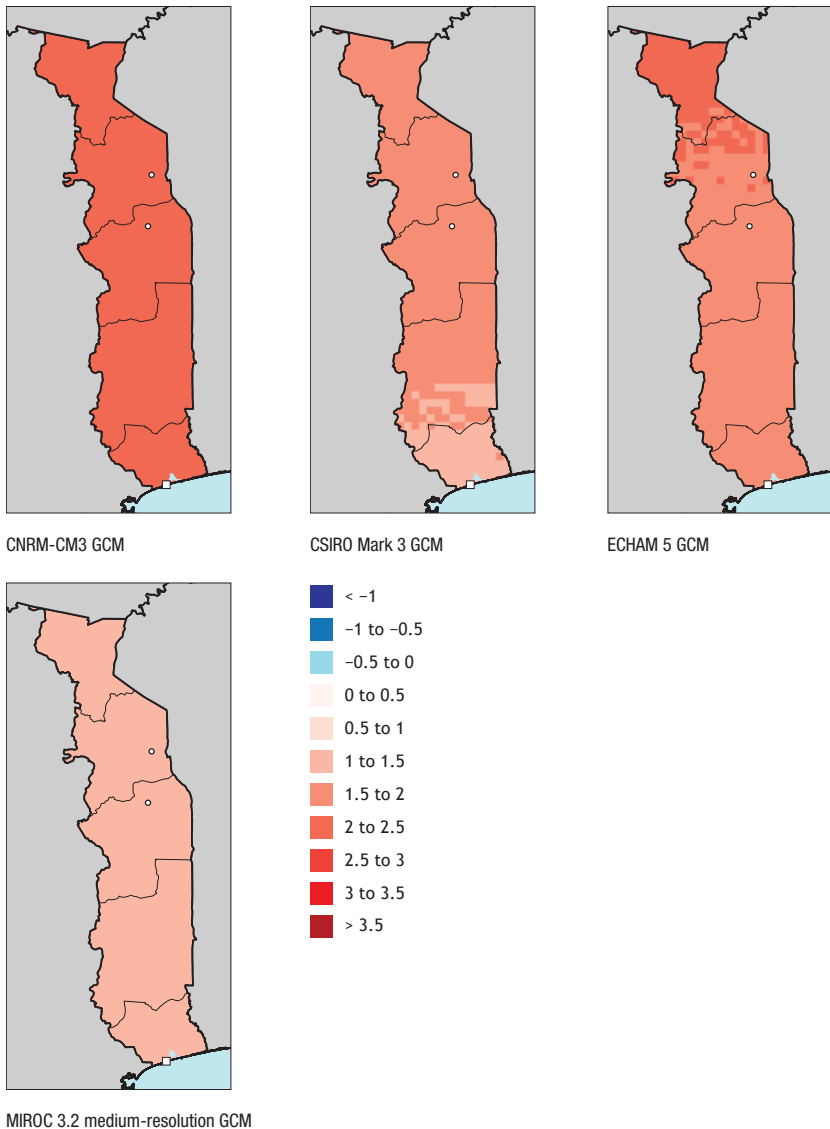
The effect of climate change on maize is mapped in Figure 13.17 as a comparison of 2050 crop yields under climate change with yields assuming an unchanged (2000) climate. All the models show a widespread reduction in the maize yield of varying degrees, ranging from 5 to 25 percent of baseline for CNRM-CM3 and ECHAM 5 to a loss of more than 25 percent for parts of the country in CSIRO Mark 3 and MIROC 3.2. However, all models show an increase of 5–25 percent of baseline in some grids in the northern part of the country.

### **Agricultural Vulnerability Scenarios (Crop-Specific)**

The next three figures show simulation results from the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) associated with key agricultural crops in Togo. The figure for each featured crop has five graphs: production, yield, area, net exports, and world price. The box-and-whisker graphs in the figure indicate the range of possible climate change effects for each of the overall scenarios.

Maize production increases through 2030 and stabilizes thereafter, while the area under cultivation decreases from 2015 onward (Figure 13.18). The increase in production will thus be driven by productivity increases, reflecting the increased use of inputs and improved management practices as well as improved varieties. All scenarios suggest that there will be declining net exports after 2025, even though the world market price for maize is projected to continue to rise. The decline might be due to the increased domestic demand for maize as a result of population growth, as well as increased demand from the feed industry.

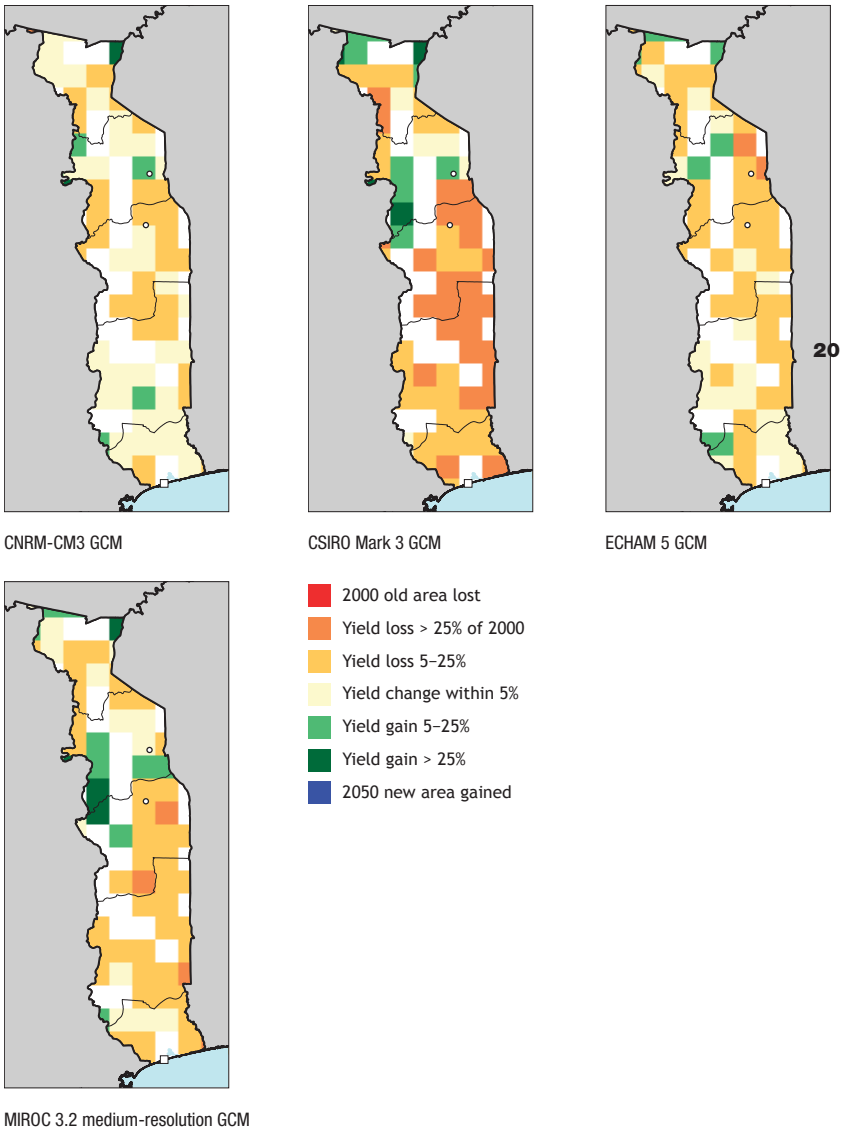
**FIGURE 13.16** Change in the daily maximum temperature in Togo for the warmest month, 2010–50, A1B scenario (°C)



Source: Authors' calculations based on Jones, Thornton, and Heinke (2009).

Notes: A1B = greenhouse gas emissions scenario that assumes fast economic growth, a population that peaks midcentury, and the development of new and efficient technologies, along with a balanced use of energy sources; CNRM-CM3 = National Meteorological Research Center–Climate Model 3; CSIRO = climate model developed at the Australia Commonwealth Scientific and Industrial Research Organisation; ECHAM 5 = fifth-generation climate model developed at the Max Planck Institute for Meteorology (Hamburg); GCM = general circulation model; MIROC = Model for Interdisciplinary Research on Climate, developed at the University of Tokyo Center for Climate System Research.

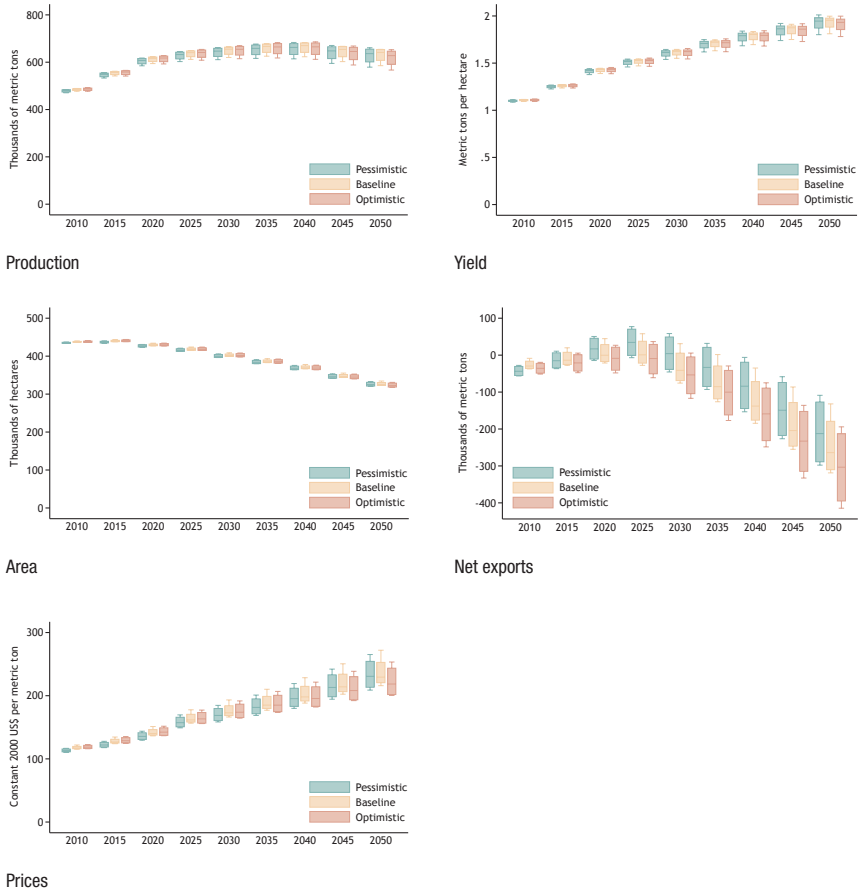
**FIGURE 13.17** Yield change under climate change: Rainfed maize in Togo, 2000–2050, A1B scenario



Source: Authors' calculations based on Jones, Thornton, and Heinke (2009).

Notes: A1B = greenhouse gas emissions scenario that assumes fast economic growth, a population that peaks midcentury, and the development of new and efficient technologies, along with a balanced use of energy sources; CNRM-CM3 = National Meteorological Research Center–Climate Model 3; CSIRO = climate model developed at the Australia Commonwealth Scientific and Industrial Research Organisation; ECHAM 5 = fifth-generation climate model developed at the Max Planck Institute for Meteorology (Hamburg); GCM = general circulation model; MIROC = Model for Interdisciplinary Research on Climate, developed at the University of Tokyo Center for Climate System Research.

**FIGURE 13.18** Impact of changes in GDP and population on maize in Togo, 2010–50



Prices

Source: Based on analysis conducted for Nelson et al. (2010).

Notes: The box and whiskers plot for each socioeconomic scenario shows the range of effects from the four future climate scenarios. GDP = gross domestic product; US\$ = US dollars.

Sorghum production, productivity, and area increase until 2050 (Figure 13.19). The world market price increases until 2030 and then stabilizes through 2050. In the optimistic scenario net exports decline as the world market price stabilizes in 2030; in the pessimistic scenario net exports will continue to increase. The trend in the baseline scenario is similar to that in the optimistic scenario.

Cassava production and productivity in Togo increase even while the area planted with the crop decreases (Figure 13.20). Increased productivity will be driven by technological improvements. The world price for cassava increases, and net exports are shown to decline after around 2030.

### **Human Vulnerability Scenarios**

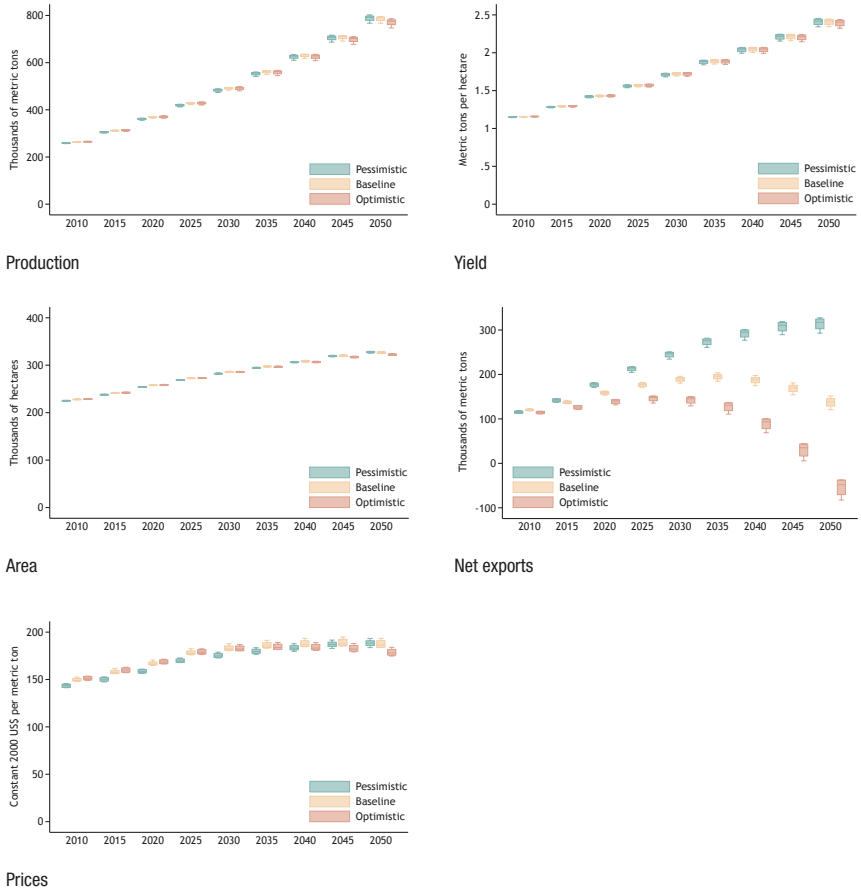
In addition to agricultural scenarios, IMPACT also estimates the number of malnourished children under the age of five, as well as the available kilocalories per capita. Figure 13.21 shows the impact of future GDP and population scenarios on under-five malnutrition rates in Togo. The box-and-whisker plots in the figure indicate the range of climate scenario effects. Based on the pessimistic scenario, the number of malnourished children under age five will be somewhat higher in 2050 (about 300,000) than at present (260,000); the optimistic scenario shows a reduction of more than 50 percent (from 260,000 to 100,000) by 2050. Although the pessimistic scenario shows an increase in the absolute number of malnourished children, with the population rising this probably represents a decline in the percentage of malnourished children under age five.

Figure 13.22 shows the average kilocalories per capita available. The pessimistic scenario shows fewer kilocalories available in 2050 than today; the optimistic scenario shows an increase, from about 2,000 kilocalories per person now to about 3,000 in 2050.

### **Conclusions and Policy Recommendations**

Like other countries of the region, Togo is currently experiencing climate disruption characterized by irregularity in onset as well as overall shortening of the rainy season. There is also poor distribution of rainfall over the year. These changes are adversely affecting agricultural production. In the future (specifically by 2050), precipitation may rise or fall on average, depending on which model we look to. The temperature is expected to increase between 1°C and 2.5°C.

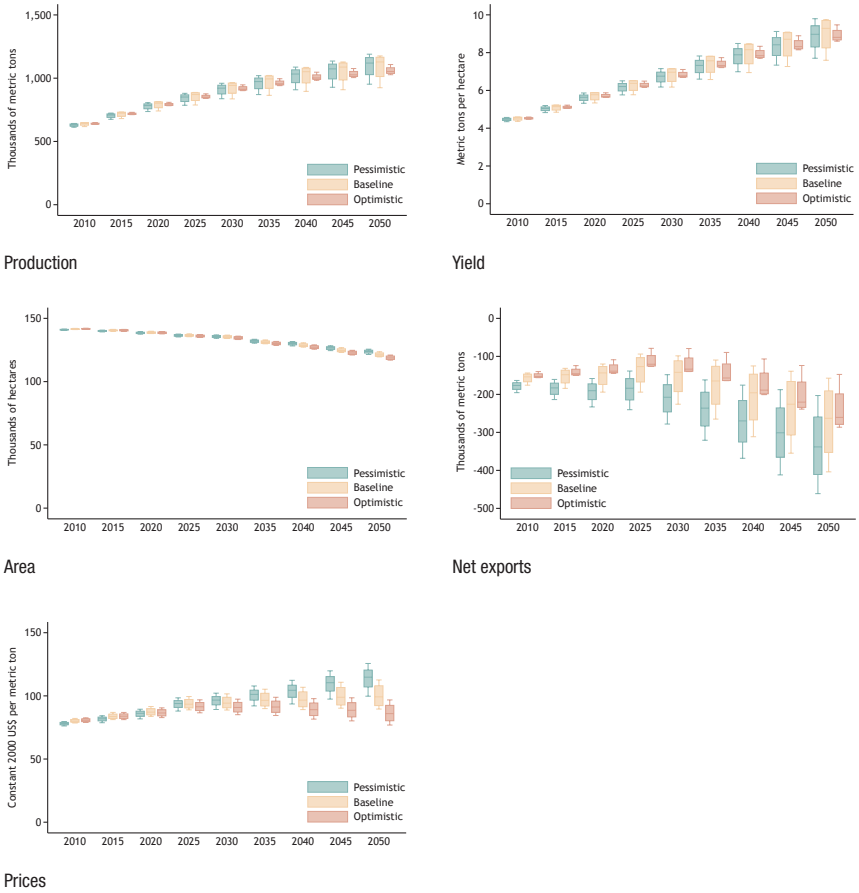
**FIGURE 13.19** Impact of changes in GDP and population on sorghum in Togo, 2010–50



Source: Based on analysis conducted for Nelson et al. (2010).

Notes: The box and whiskers plot for each socioeconomic scenario shows the range of effects from the four future climate scenarios. GDP = gross domestic product; US\$ = US dollars.

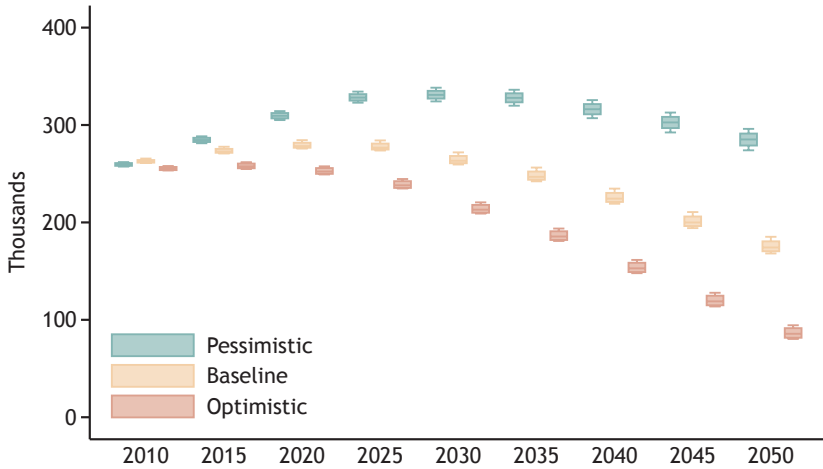
**FIGURE 13.20** Impact of changes in GDP and population on cassava in Togo, 2010–50



Source: Based on analysis conducted for Nelson et al. (2010).

Notes: The box and whiskers plot for each socioeconomic scenario shows the range of effects from the four future climate scenarios. GDP = gross domestic product; US\$ = US dollars.

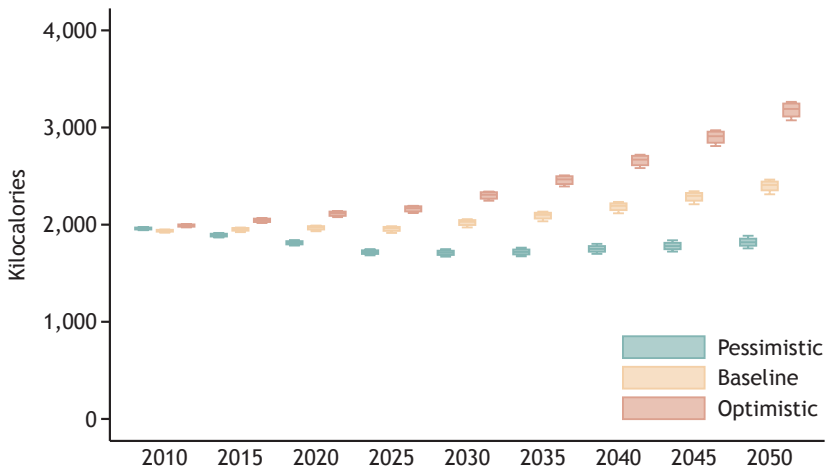
**FIGURE 13.21** Number of malnourished children under five years of age in Togo in multiple income and climate scenarios, 2010–50



Source: Based on analysis conducted for Nelson et al. (2010).

Note: The box and whiskers plot for each socioeconomic scenario shows the range of effects from the four future climate scenarios.

**FIGURE 13.22** Kilocalories per capita in Togo in multiple income and climate scenarios, 2010–50



Source: Based on analysis conducted for Nelson et al. (2010).

Note: The box and whiskers plot for each socioeconomic scenario shows the range of effects from the four future climate scenarios.

In general, Togolese agriculture, which depends almost entirely on rainfall, will be strongly influenced by climate change. All models show declines in the yield of maize of between 5 and 25 percent due to adverse climate conditions, taking into consideration only climate impacts. However, the total production of maize, sorghum, and roots and tubers is shown to increase when anticipated technological improvement is factored in. The increase in productivity could be due to the development of adaptive varieties and improved management. It is therefore imperative that the required policies be developed and implemented to ensure that improved productivity is realized and sustained. The following are therefore suggested policy priorities to respond to the urgent threat to food production posed by climate change and to mitigate potential future harm.

- Support meteorological services to effectively monitor the weather and make relevant information available that will guide farmers in timing their operations and taking other important measures.
- Support the development of small-scale irrigation in lowland areas.
- Promote and encourage the diversification of crops so that the risk of failure of one crop is minimized.
- Provide adequate support for the National Agricultural Research System to develop appropriate crop varieties as well as improved management systems that will ensure improved productivity even under adverse weather conditions.
- Ensure the ability of the agricultural extension services to present their research to farmers in such a way that the farmers will be able to put the findings into practice.
- Create income-generating activities as alternative livelihoods to climate-sensitive activities.
- Strengthen prevention efforts related to flood-related disasters and other risks to the agricultural sector.
- Build technical capacity to manage climate change risks and impacts.

Some national policy strategies have been adopted by the government to improve agricultural production and the well-being of rural populations. The following strategies need to be revisited to mainstream climate change in all relevant programs and policies:

- The Agricultural Policy Note providing a strategic framework for interventions in the agricultural sector over the period 2007–11, adopted in December 2006
- The growth strategy of the agricultural and rural sectors, adopted in June 2004
- The strategy and action plan to boost agricultural production in 2008–11, adopted in July 2008
- The poverty reduction strategy, adopted in May 2009
- The long-term national strategy based on the UN Millennium Development Goals, ratified in May 2007
- The national food security program, adopted in December 2008
- The national agricultural investment program, discussed with development partners in July 2009

Although the structural transition may reduce the importance of agriculture in the overall economy, agriculture is likely to remain an important sector in Togo for both income and employment in the foreseeable future. Climate change may act to slow agricultural growth, but continued investment in agriculture can counteract the slowing and enable rural people to share in the overall economic growth that Togo is expected to enjoy in the decades to come.

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