The West African state of Côte d’Ivoire has an area of 322,465 square kilometers, with a coastline of 540 kilometers along the Gulf of Guinea. It shares borders with Liberia in the southwest, Guinea in the northwest, Mali and Burkina Faso in the north, and Ghana in the east. The southern part of Côte d’Ivoire borders the Atlantic Ocean. In the western part of the coastal areas, there are only two seasons—wet and dry. Moving inland toward the east, a short dry season occurs during the middle of the wet season, creating an annual cycle of four seasons.

The entire country enjoys a humid climate, with at least seven rainy months and not less than 1,000 millimeters of annual rainfall. Most of the interior has an annual rainfall of between 1,000 and 1,500 millimeters. Temperatures are remarkably constant throughout the year, with the mean temperatures of the warmest and coldest months very close: 27°C and 24°C for Bouaké and Tabou, 28°C and 25°C for Abidjan, and 29°C and 26°C for Ferkessédougou. In the capital city, Abidjan, the mean annual air temperature is 26.2°C; March is the warmest month there, and August is the coolest month.

**Review of the Current Situation**

**Population**

In 2009 the estimated population of Côte d’Ivoire was 20.6 million. The population has doubled every 20 years since the country became independent in 1960, increasing from about 4 million in 1960 to 8 million in 1980 and 16 million in 2000. Figure 5.1 shows trends for the total population and the rural population (left axis), as well as the share of urban population (right axis). Côte d’Ivoire is one of the countries with a very large immigrant population from neighboring countries, as well as a non-African expatriate community composed of approximately 10,000 French nationals and as many as 60,000 Lebanese nationals.
Urbanization has increased in Côte d’Ivoire since 1960, when only 20 percent of the population lived in urban areas. In 2008 almost 50 percent of the Ivorian population lived in urban areas. The high urban population growth rate is reflected in Table 5.1. Between 2000 and 2008, the urban population growth rate was four times higher than rural population growth rate. Rural-to-urban migration as well as improved health conditions in the urban areas may be important factors in the rapid urban population growth.

### TABLE 5.1  Population growth rates in Côte d’Ivoire, 1960–2008 (percent)

<table>
<thead>
<tr>
<th>Decade</th>
<th>Total growth rate</th>
<th>Rural growth rate</th>
<th>Urban growth rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960–69</td>
<td>4.2</td>
<td>2.7</td>
<td>9.0</td>
</tr>
<tr>
<td>1970–79</td>
<td>4.8</td>
<td>3.5</td>
<td>7.5</td>
</tr>
<tr>
<td>1980–89</td>
<td>4.1</td>
<td>3.6</td>
<td>4.8</td>
</tr>
<tr>
<td>1990–99</td>
<td>3.2</td>
<td>2.6</td>
<td>4.1</td>
</tr>
<tr>
<td>2000–2008</td>
<td>2.2</td>
<td>0.9</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations based on World Development Indicators (World Bank 2009).
Figure 5.2 shows the geographic distribution of the population in Côte d’Ivoire. Population density is higher in the southern part of the country, which has more urban areas as well as large cocoa plantations that attract migrant labor, particularly from neighboring Burkina Faso.

**Income**

Figure 5.3 shows trends in the gross domestic product (GDP) per capita and the proportion of GDP from agriculture. Côte d’Ivoire produces 40 percent of the world’s cocoa crop and is a major exporter of other agricultural produce, as well as tropical wood products and tuna. However, reliance on commodity exports exposes the economy to international price swings. The GDP per capita increased in the 1960s and 1970s but then dropped dramatically. Conversely, the contribution of agriculture to GDP declined steadily from 1960 to 1980 as the manufacturing and service sectors of the economy improved after independence, then began to increase in the 1980s as other sectors of the economy continued to decline. Nevertheless, at the end of the first decade after independence, the government’s strategy for economic growth and development was proving successful. The production of cash crops expanded, and with the revenues from commodity sales the government
upgraded roads, improved communications, and raised the educational level of the workforce.

Increased aid flows, rigorous macroeconomic policies, and high international commodity prices, along with devaluation, yielded 6–7 percent annual GDP growth rates in 1994–98. Since that time, however, economic decline has resulted in declining living standards. Falling commodity prices, along with government corruption and fiscal mismanagement, had brought the economy to its knees by the end of 1999. At that point, a coup d’État and the installation of a military junta caused the cancellation of foreign assistance. Private foreign investment declined sharply, while the government’s internal and external debt ballooned. As a result, the economy contracted by −2.3 percent in 2000. Thereafter the economic situation further deteriorated as the political situation culminated in a division of the country between the North and the South, controlled by dissident soldiers and the government-backed army, respectively. However, stability is gradually being restored following the installation of a civilian government after the elections in 2010.
Vulnerability to Climate Change

Table 5.2 provides some data on Côte d’Ivoire’s performance on indicators of a country’s vulnerability or resiliency to economic shocks beyond that of income level: level of education, literacy, and concentration of labor in poorer or less dynamic sectors. Côte d’Ivoire, like other countries in the region, has a relatively higher enrollment in primary school (72.1 percent) than in secondary schools (24.6 percent). Adult literacy, although low, is relatively higher than in many countries in the region. The majority of the population is engaged in agriculture.

Figure 5.4 shows data for Côte d’Ivoire on two noneconomic correlates of poverty: life expectancy and under-five mortality. The Ivorian government recognized very early the need to invest in the social sectors—notably education, health, and basic socioeconomic infrastructure—in order to improve the population’s standard of living. After independence, life expectancy at birth increased from 40 years to 55 years in the late 1970s, while the under-five mortality rate decreased sharply, from 300 per 1,000 in the 1960s to less than 200 per 1,000 in 1980 and 125 per 1,000 in 2008.

As for poverty levels based on consumption measures, Wood et al. (2010) report that slightly fewer than half of Côte d’Ivoire’s 20 million people live below the poverty threshold based on the 2005 US dollar and the purchasing power parity measure.

Review of Land Use and Agriculture

Land Use Overview

Figure 5.5 shows land cover and land use in Côte d’Ivoire as of 2000. The southern part of the country is characterized by mosaic terrain, with cropland, trees, and other natural vegetation along with patches of tree cover.

| Table 5.2 Education and labor statistics for Côte d’Ivoire, 1990s and 2000s |
|---------------------------------|------|----------|
| Indicator                       | Year | Percent  |
| Primary school enrollment       | 2007 | 72.1     |
| Secondary school enrollment     | 2002 | 24.6     |
| Adult literacy rate             | 2000 | 48.7     |
| Percent employed in agriculture | 1996 | 60.0     |
| Under-five malnutrition         | 2006 | 16.7     |

Source: Authors’ calculations based on World Development Indicators (World Bank 2009).
(broadleaved evergreen forests). The northern region is characterized by tree cover (broadleaved, deciduous, open). Fifty-two percent of the total land area of more than 322,000 square kilometers is considered agricultural land, amounting to slightly more than 3.6 hectares per capita.

Figure 5.6 shows protected areas, including parks and reserves. These fragile environmental areas may also be important for the tourism industry. Côte d’Ivoire has nine parks and reserves. Tai National Park covers an area of approximately 536,000 hectares and is located in the southwestern department of Guiglo (Roth et al. 1979; UICN/BRAO 2008). It represents over 50 percent of the total West African forest areas given high protection status and is the largest intact rainforest in West Africa (Myers 1990). Tai National Park was classified as a Biosphere Reserve in 1978 and a World Heritage site in 1983.

Abokonamekro Game Reserve is located 60 kilometers from Yamoussoukro and covers 20,430 hectares. It hosts elephants, buffaloes, cobs de buffon, rhinos, and giraffes (UICN/BRAO 2008). Asagny National Park is located 100 kilometers from Abidjan, at the mouth of the Bandama River, and covers 19,400 hectares; it is mainly marshy savannah with palm trees. Elephants, bush pigs, buffaloes, monkeys, and several species of birds live there in harmony (UICN/BRAO 2008).
FIGURE 5.5  Land cover and land use in Côte d’Ivoire, 2000

Comoé National Park, founded in 1968 as the “Book of Bouna,” is located in Bouna and is the oldest and largest park in Côte d’Ivoire, at 1,149,250 hectares (UICN/BRAO 2008). The park has 500 kilometers of tracks suitable for motor vehicles and is home to a wide variety of wildlife: elephants, buffaloes, cobs de buffon, lions, hippos, cynocephali, and several species of birds (Chape et al. 2003). Other major national parks include Marahoué (101,000 hectares), located in the center-west region of Bouaflé, and Mount Sangbe National Park, located north of Man in the western part of the country (95,000 hectares) (UICN/BRAO 2008).

Figure 5.7 shows the travel time to urban areas, which are potential markets for agricultural products and sources of agricultural inputs and consumer goods for farmers. The road network is fairly good in Côte d’Ivoire, and all major towns are fairly well connected. The plantations are also accessible. The majority of the population lives either in or close to cities of 100,000 people or more. These urban areas and their immediate surrounding areas are associated with a variety of crop production activities. Average travel times are inversely related to population density: areas with larger populations have better road networks and therefore experience less travel time to nearby cities.
FIGURE 5.7  Travel time to urban areas of various sizes in Côte d’Ivoire, circa 2000

To cities of 500,000 or more people

To cities of 100,000 or more people

To towns and cities of 25,000 or more people

To towns and cities of 10,000 or more people

- Urban location
- < 1 hour
- 1−3 hours
- 3−5 hours
- 5−8 hours
- 8−11 hours
- 11−16 hours
- 16−26 hours
- > 26 hours

Source: Authors’ calculations.
**Agriculture Overview**

Tables 5.3–5.5 show key agricultural commodities in terms of the area harvested, the value of the harvest, and the provision of food for human consumption (ranked by weight). Cocoa is the major cash crop and occupies the largest

### TABLE 5.3

<table>
<thead>
<tr>
<th>Rank</th>
<th>Crop</th>
<th>Percent of total</th>
<th>Harvest area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td></td>
<td>100.0</td>
<td>6,940</td>
</tr>
<tr>
<td>1</td>
<td>Cocoa beans</td>
<td>31.0</td>
<td>2,151</td>
</tr>
<tr>
<td>2</td>
<td>Yams</td>
<td>10.4</td>
<td>723</td>
</tr>
<tr>
<td>3</td>
<td>Cashew nuts</td>
<td>9.5</td>
<td>657</td>
</tr>
<tr>
<td>4</td>
<td>Coffee</td>
<td>8.4</td>
<td>585</td>
</tr>
<tr>
<td>5</td>
<td>Plantains</td>
<td>5.5</td>
<td>382</td>
</tr>
<tr>
<td>6</td>
<td>Rice</td>
<td>5.4</td>
<td>375</td>
</tr>
<tr>
<td>7</td>
<td>Cassava</td>
<td>4.9</td>
<td>339</td>
</tr>
<tr>
<td>8</td>
<td>Maize</td>
<td>4.2</td>
<td>292</td>
</tr>
<tr>
<td>9</td>
<td>Seed cotton</td>
<td>3.6</td>
<td>247</td>
</tr>
<tr>
<td>10</td>
<td>Oil palm fruit</td>
<td>3.1</td>
<td>212</td>
</tr>
</tbody>
</table>

Source: FAOSTAT (FAO 2010).  
Note: All values are based on the three-year average for 2006–08.

### TABLE 5.4

<table>
<thead>
<tr>
<th>Rank</th>
<th>Crop</th>
<th>Percent of total</th>
<th>Value of production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td></td>
<td>100.0</td>
<td>3,871.4</td>
</tr>
<tr>
<td>1</td>
<td>Cocoa beans</td>
<td>24.5</td>
<td>949.2</td>
</tr>
<tr>
<td>2</td>
<td>Yams</td>
<td>22.4</td>
<td>869.0</td>
</tr>
<tr>
<td>3</td>
<td>Cassava</td>
<td>8.8</td>
<td>339.6</td>
</tr>
<tr>
<td>4</td>
<td>Plantains</td>
<td>7.8</td>
<td>303.8</td>
</tr>
<tr>
<td>5</td>
<td>Bananas</td>
<td>4.8</td>
<td>186.5</td>
</tr>
<tr>
<td>6</td>
<td>Rice</td>
<td>3.7</td>
<td>143.3</td>
</tr>
<tr>
<td>7</td>
<td>Coffee</td>
<td>3.6</td>
<td>139.1</td>
</tr>
<tr>
<td>8</td>
<td>Maize</td>
<td>3.1</td>
<td>121.7</td>
</tr>
<tr>
<td>9</td>
<td>Rubber</td>
<td>2.8</td>
<td>110.2</td>
</tr>
<tr>
<td>10</td>
<td>Seed cotton</td>
<td>2.3</td>
<td>89.8</td>
</tr>
</tbody>
</table>

Source: FAOSTAT (FAO 2010).  
Note: All values are based on the three-year average for 2005–07. US$ = US dollars.
area under cultivation, whereas yams occupy the largest area planted with foodcrops. Yams, cassava, and plantains are the major staples in Côte d’Ivoire. Other foodcrops include taro (in the south) and varieties of millet and sorghum (in the north).

The next four figures show the estimated current yields and growing areas for key crops. Yams and sweet potatoes are produced in all parts of the country (Figure 5.8), with yields ranging from 7 to 10 metric tons per hectare and production concentrated in the forest region, which is also the main region for cassava and plantain production (Figures 5.9 and 5.10). Cassava root yields range from 4 to 7 metric tons per hectare, and plantain and banana yields range from 2 to 4 metric tons per hectare. Coffee is grown mainly in the northern part of the country (Figure 5.11), with yields of less than 1 metric ton per hectare.

### Economic and Demographic Scenarios

#### Population

Figure 5.12 shows population projections for Côte d’Ivoire by the United Nations (UN) population office (UNPOP 2009) through 2050. All three scenarios show an increasing population until 2050—with the current population doubling by 2043 (based on the high variant) or by 2050 (based on the medium variant). Rapid increases in population have consequences for

### Table 5.5

Consumption of leading food commodities in Côte d’Ivoire, 2003–05 (thousands of metric tons)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Crop</th>
<th>Percent of total</th>
<th>Food consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>100.0</td>
<td>11,068</td>
</tr>
<tr>
<td>1</td>
<td>Yams</td>
<td>29.8</td>
<td>3,298</td>
</tr>
<tr>
<td>2</td>
<td>Cassava</td>
<td>17.2</td>
<td>1,899</td>
</tr>
<tr>
<td>3</td>
<td>Plantains</td>
<td>10.9</td>
<td>1,210</td>
</tr>
<tr>
<td>4</td>
<td>Rice</td>
<td>7.7</td>
<td>855</td>
</tr>
<tr>
<td>5</td>
<td>Other vegetables</td>
<td>5.7</td>
<td>636</td>
</tr>
<tr>
<td>6</td>
<td>Fermented beverages</td>
<td>4.0</td>
<td>446</td>
</tr>
<tr>
<td>7</td>
<td>Beer</td>
<td>3.4</td>
<td>380</td>
</tr>
<tr>
<td>8</td>
<td>Maize</td>
<td>3.4</td>
<td>380</td>
</tr>
<tr>
<td>9</td>
<td>Wheat</td>
<td>2.6</td>
<td>293</td>
</tr>
<tr>
<td>10</td>
<td>Sugar</td>
<td>1.8</td>
<td>203</td>
</tr>
</tbody>
</table>

Source: FAOSTAT (FAO 2010).

Note: All values are based on the three-year average for 2003–05.
FIGURE 5.8  Yield (metric tons per hectare) and harvest area density (hectares) for rainfed yams and sweet potatoes in Côte d’Ivoire, 2000

Sources: SPAM (Spatial Production Allocation Model) (You and Wood 2006; You, Wood, and Wood-Sichra 2006, 2009). Notes: ha = hectare; MT = metric tons.

FIGURE 5.9  Yield (metric tons per hectare) and harvest area density (hectares) for rainfed cassava in Côte d’Ivoire, 2000

Sources: SPAM (Spatial Production Allocation Model) (You and Wood 2006; You, Wood, and Wood-Sichra 2006, 2009). Notes: ha = hectare; MT = metric tons.
FIGURE 5.10 Yield (metric tons per hectare) and harvest area density (hectares) for rainfed plantains and bananas in Côte d’Ivoire, 2000

Notes: ha = hectare; MT = metric tons.

FIGURE 5.11 Yield (metric tons per hectare) and harvest area density (hectares) for rainfed coffee in Côte d’Ivoire, 2000

Notes: ha = hectare; MT = metric tons.
agriculture and for standards of living. Access to natural resources—especially agricultural land—will become increasingly difficult, and nutritional adequacy may suffer as a consequence. Increasing access to employment, as well as developing infrastructure for roads and social services such as schools and health centers, are additional challenges the country will face.

**Income**

Figure 5.13 presents three overall scenarios for Côte d’Ivoire’s GDP per capita, derived by combining three GDP scenarios with the three population scenarios of Figure 5.12 (based on UN population data). 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 a relatively insignificant increase in GDP per capita, whereas the optimistic scenario shows per capita GDP more than doubling by 2030 and increasing sharply thereafter, reaching more than US$6,000 (US dollars) by 2050.
Biophysical Scenarios

Climate Scenarios

Figure 5.14 shows projected annual precipitation changes under the four downscaled general circulation models (GCMs) in the A1B scenario.¹ CNRM-CM3 and ECHAM 5 show generally higher rainfall than CSIRO Mark 3 and MIROC 3.2.² CNRM-CM3 shows an increase in precipitation of 50–100 millimeters in the north and on the coast; ECHAM 5 shows a similar increase in the southwest. CSIRO Mark 3 shows a decrease in precipitation of –200 to –100 millimeters in the north, whereas MIROC 3.2 shows a decrease

---

¹ 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.

² CNRM-CM3 is National Meteorological Research Center–Climate Model 3. ECHAM 5 is a fifth-generation climate model developed at the Max Planck Institute for Meteorology in Hamburg. CSIRO is a climate model developed at the Australia Commonwealth Scientific and Industrial Research Organisation. MIROC is the Model for Interdisciplinary Research on Climate, developed at the University of Tokyo Center for Climate System Research.
FIGURE 5.14 Changes in mean annual precipitation in Côte d’Ivoire, 2000–2050, A1B scenario (millimeters)

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.
of up to –400 millimeters in the southwest and –200 to –100 millimeters in the southeast.

Figure 5.15 shows the change in the average daily maximum temperature for the warmest month of the year modeled on the basis of the A1B scenario. The CNRM-CM3 model shows an increase of 2.0°–2.5°C all over the country, whereas the ECHAM 5 GCM shows the same for only the northern part of the country but predicts that the southern half will experience an increase of only 1.5°–2.0°C. The CSIRO GCM has a spatial distribution similar to that of ECHAM 5 but predicts that temperatures will be a half-degree cooler across the board. The MIROC 3.2 medium-resolution GCM is the least pessimistic, showing a maximum rise in temperature of only 1.0°–1.5°C, with a substantial patch in the south projected to experience an increase of only 0.5°–1.0°C.

**Crop Physiological Response to Climate Change**

The effect of climate change on key crops is mapped in the next two sets of figures. Crop yields with 2050 climate are compared to the yields assuming an unchanged (2000) climate. The CSIRO, ECHAM 5, and MIROC 3.2 GCMs show a yield loss of 5–25 percent of baseline for rice in the central and northeast regions of the country (Figure 5.16). MIROC 3.2 shows a yield loss greater than 25 percent in a portion of the central part of the country. In contrast, CNRM-CM3 shows a yield gain of 5–25 percent of baseline in many parts of the country, with a small portion of the country showing losses of between 5 and 25 percent.

All models present a relatively more pessimistic scenario for maize compared to rice in Côte d’Ivoire (Figure 5.17). ECHAM 5 in particular predicts that most of the northwest quadrant will have a yield loss of greater than 25 percent, while CNRM predicts as many areas of gains as of losses.

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

The next four figures show simulation results from the IMPACT model associated with key agricultural crops of Côte d’Ivoire. The figure for each featured crop has five graphs: production, yield, area, net exports, and world price.

All scenarios show similar trends for sweet potatoes and yams in production, area under production, and net exports (Figure 5.18). Sweet potato and yam production is shown to increase slightly, to a maximum of 3.5–4.0 million
FIGURE 5.15  Change in monthly mean maximum daily temperature in Côte d’Ivoire for the warmest month, 2000–2050, 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 5.16  Yield change under climate change: Rainfed rice in Côte d’Ivoire, 2010–50, A1B scenario

Source: Authors’ estimates.
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 5.17  Yield change under climate change: Rainfed maize in Côte d’Ivoire, 2010–50, A1B scenario

Source: Authors’ estimates.
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.
metric tons in 2025, then to decrease to 3.0 million metric tons in 2050. The area planted with the crop is shown to decrease from 435,000 hectares in 2010 to 400,000 hectares in 2050; the yield per hectare will range between 8 and 10 metric tons. Net exports are projected to decline progressively despite the increase in world prices. From 2035 to 2050, the projected world prices for sweet potatoes and yams diverge increasingly between the pessimistic and optimistic scenarios.

Similar to the cases of sweet potatoes and yams, the production, land area, productivity, and world price for cassava increase in all the scenarios (Figure 5.19). Production of cassava and other roots and tubers in Côte d’Ivoire is shown to increase from 2.2 million metric tons in 2010 to 2.5–3.0 million metric tons from 2030 to 2050. The land area under cassava is not projected to change, while net exports will progressively decrease despite the increase in world price. A greater increase in population relative to the increase in cassava production could account for the declining net exports.

Trends for total rice production, yield per hectare, and area of production are similar in all the scenarios (Figure 5.20). Both total production and productivity are shown increasing, while the area devoted to the crop will increase by a very small amount. Production is predicted to grow from 700,000 metric tons in 2010 to close to 1.2 million metric tons in 2050 in the pessimistic scenario and to around 1.1 million metric tons in the optimistic scenario. Although net exports decrease in all scenarios, the decrease will be greater in the optimistic scenario than in the pessimistic scenario. This could be attributed to the lower projected world price in the optimistic scenario.

The trends for production, productivity, area cultivated, and the world market price of maize in Côte d’Ivoire are similar to those for both roots and tubers and rice (Figure 5.21). For exports, however—unlike in the case of rice and roots and tubers—the net maize exports are shown to increase initially and then fall after 2035. However, there is an increasing uncertainty in the trends for net exports and world prices in all of the scenarios as climate change effects become more pronounced.

Human Vulnerability Scenarios

Figure 5.22 shows the impact of future GDP and population scenarios on under-five malnutrition rates in Côte d’Ivoire. The box-and-whisker plots in the figure indicate the range of climate scenario effects. The number of malnourished children under five years of age decreases in both the baseline and the optimistic scenarios but to increase in the pessimistic scenario. The
FIGURE 5.18 Impact of changes in GDP and population on yams and sweet potatoes in Côte d’Ivoire, 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 5.19  Impact of changes in GDP and population on cassava in Côte d’Ivoire, 2010–50

Production

Yield

Area

Net exports

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.
FIGURE 5.20 Impact of changes in GDP and population on rice in Côte d’Ivoire, 2010–50

Production

Yield

Area

Net exports

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.
FIGURE 5.21 Impact of changes in GDP and population on maize in Côte d’Ivoire, 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.
optimistic scenario shows a decrease in malnourished children under age five, from 740,000 in 2010 to 240,000 in 2050, whereas the pessimistic scenario shows an increase to 880,000 in 2050. With the increase in population, even this increase in numbers of malnourished represents a decrease in percentage of children under 5 who are malnourished.

Figure 5.23 shows the available kilocalories per capita. The pessimistic scenario shows this indicator decreasing, from 2,400 in 2010 to 2,000 in 2050. The optimistic scenario shows an increase, to 3,000 in 2043 and 3,600 in 2050. These trends correlate with the scenarios for malnourished children under age five.

**Conclusions and Policy Recommendations**

Increased food production is needed to feed the rising population in Côte d’Ivoire, with the majority concentrated in urban areas. This challenge will require appropriate research interventions to ensure sustainable crop production without adversely affecting the natural resource base, particularly against the background of climate change challenges. Some models show a decrease
in precipitation, and all show an increase in temperature, with some showing increases of up to 2.5°C by 2050. The maize crop is shown to be particularly vulnerable to these adverse climatic conditions.

In view of the significant proportion of the population of Côte d’Ivoire deriving their livelihoods from the agricultural sector, government policies relating to agriculture should be re-examined and revised where necessary to support an environment and activities that will ensure the resilience of farmers in regard to the natural recourses base so that sustainable food production might be maintained against the background of a changing climate.

The Government of Côte d’Ivoire should reflect the importance of agriculture in the overall economy by formulating and supporting policies to slow population growth, support rapid agricultural growth, and provide a solid foundation for the growth of other sectors of the economy. Such policies should include measures to accomplish the following:

- Improve the system for recording daily weather data as well as developing seasonal predictions to help farmers select more appropriate technologies for the anticipated weather.
• Improve market infrastructure, including appropriate storage facilities and rural roads, to facilitate easy transport and storage of produce. Reliable communication networks will greatly enhance farmers’ ability to access relevant market information.

• Increase the funding to agricultural research and extension to support the development of appropriate technologies and management practices designed to optimize productivity in the face of climate change and consider whether incentives could be created to enhance participation in the development and distribution of such technologies by both the private and the nongovernmental sectors.

Possible agricultural interventions include the following:

• Developing varieties of major crops, particularly maize, that are adaptable to the changing climate and are compatible with associated crops.

• Determining appropriate times and patterns of planting in the changing climate.

• In addition to developing policies directly supporting agricultural adaptation, providing support for family planning and other interventions to slow population growth, which might reduce the demand for food and enhance food security for the nation.

Finally, policies for mitigating climate change, such as policies encouraging reforestation, augmentation of soil organic carbon, and modification of livestock management practices, might be considered, some of which would also improve yields. With a supportive policy environment and improved research and extension, farmers will have greater hope of adapting to the changing climate in the coming decades.

References


