

2012

GLOBAL HUNGER INDEX

THE CHALLENGE OF HUNGER: ENSURING SUSTAINABLE FOOD SECURITY
UNDER LAND, WATER, AND ENERGY STRESSES



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2012

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IFPRI:

Klaus von Grebmer, Claudia Ringler, Mark W. Rosegrant,
Tolulope Olofinbiyi, Doris Wiesmann, Heidi Fritschel,
Ousmane Badiane, Maximo Torero, Yisehac Yohannes

Concern Worldwide:

Jennifer Thompson

Welthungerhilfe and Green Scenery:

Constanze von Oppeln, Joseph Rahall

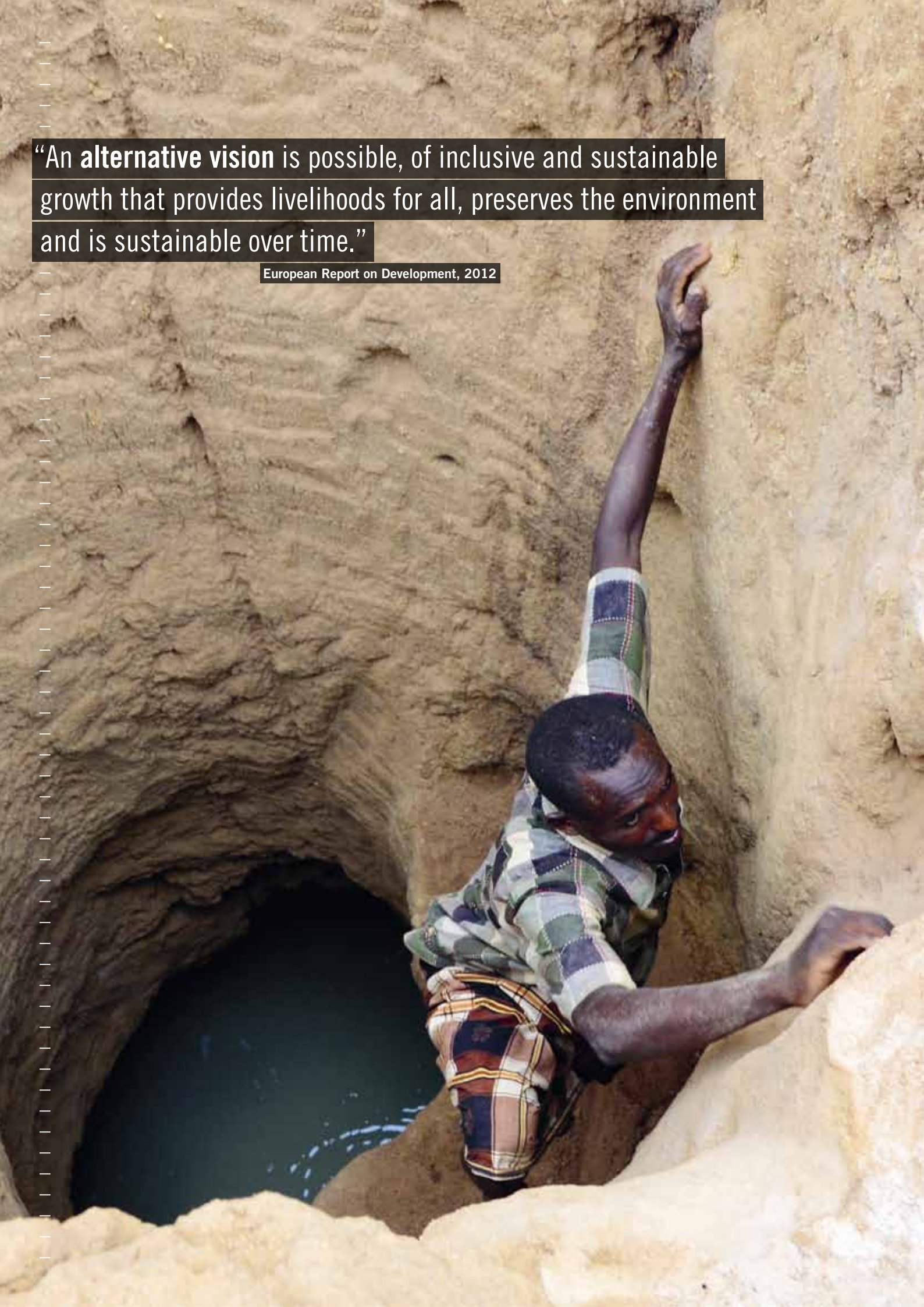
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“An **alternative vision** is possible, of inclusive and sustainable growth that provides livelihoods for all, preserves the environment and is sustainable over time.”

European Report on Development, 2012



FOREWORD

Is there enough planet for all of us?

Recent events—drought, scrambles to invest in farmland around the world, shifts in energy prices, and shocks in energy supplies—underline the scarcity of resources we depend on to produce the world's food supply. It is increasingly clear that sustainably feeding 9 billion people—the projected world population in 2050—who will consume at the rate of 12 billion people, if they follow the current consumption pattern of industrialized countries, will require a much more careful and integrated approach to the use of land, water, and energy than we currently apply.

It is an absolute must that we start now to produce more food using fewer resources and to use the harvest more efficiently. But we also face the reality that decades of effort and rhetoric have so far failed to eradicate hunger. The 2012 Global Hunger Index, published jointly by the International Food Policy Research Institute (IFPRI), Concern Worldwide, and Welthungerhilfe, shows that progress in reducing the proportion of hungry people in the world has been tragically slow. According to the Index, hunger on a global scale remains “serious.” Twenty countries still have levels of hunger that are “alarming” or “extremely alarming.” Among the world's regions, South Asia and Sub-Saharan Africa continue to have the highest levels of hunger. These results represent extreme suffering for millions of poor people.

This is the seventh year that IFPRI has calculated the Global Hunger Index and analyzed this multidimensional measure of global hunger. It is important to note that the GHI scores present country averages: even in countries classified as having “moderate” or “serious” hunger, there can be areas where the situation is “alarming” or “extremely alarming.” This report offers a picture not of the present, but of the recent past. The calculation of the GHI reflects the most recent data available from governments and international agencies, but these data suffer from significant time lags. Because up-to-the-minute data on global hunger are not available, the report does not reflect the impact of the latest events. We hope that governments and international agencies will work together to gather more timely and complete data on hunger in their countries and worldwide.

The 2012 GHI report focuses particularly on the issue of how to ensure sustainable food security under conditions of water, land, and energy stress. Demographic changes, rising incomes and associated consumption patterns, and climate change, alongside persistent poverty and inadequate policies and institutions, are all placing serious pressure on natural resources. In this report, IFPRI describes the evidence on land, water, and energy scarcity in developing countries and offers two visions of a future global food system—an unsustainable scenario in which current trends in resource use continue, and a sustainable scenario in which access to food, modern energy, and clean water improves significantly and ecosystem degradation is halted or reversed. Concern Worldwide and Welthungerhilfe provide on-the-ground perspectives on the issues of land tenure and title as well as the impacts of scarce land, water, and energy on poor people in Sierra Leone and Tanzania and describe the work of their organizations in helping to alleviate these impacts.

Based on these research findings and experiences in the field, IFPRI, Concern Worldwide, and Welthungerhilfe propose holistic strategies for dealing with all four sectors—land, water, energy, and food. These strategies involve governing natural resources more responsibly, scaling up innovative solutions for using scarce resources, and addressing the factors that contribute to natural resource scarcity, including climate change. Such strategies will not emerge spontaneously; they must be expressly designed and implemented. All disciplines that can contribute must do so—from the water specialist to the energy expert, from researcher to practitioner, from farmer to policymaker, and from economist to nutritionist.

There is enough planet for all of us—if we don't waste it.



Dr. Wolfgang Jamann
Secretary General and
Chairperson
Welthungerhilfe



Dr. Shenggen Fan
Director General
International Food Policy
Research Institute



Tom Arnold
Chief Executive
Concern Worldwide

CONTENTS

SUMMARY	5
CHAPTER	
01 The Concept of the Global Hunger Index	6
02 Global, Regional, and National Trends	10
03 Sustainable Food Security under Land, Water, and Energy Stresses	22
04 The Centrality of Land, Water, and Energy for Smallholders	34
05 Policy Recommendations	46
APPENDIXES	
A Data Sources and Calculation of the 1990, 1996, 2001, and 2012 Global Hunger Index Scores	54
B Data Underlying the Calculation of the 1990, 1996, 2001, and 2012 Global Hunger Index Scores	55
C Country Trends for the 1990, 1996, 2001, and 2012 Global Hunger Index Scores	57
BIBLIOGRAPHY	61
PARTNERS	67

SUMMARY

World hunger, according to the 2012 Global Hunger Index (GHI), has declined somewhat since 1990 but remains “serious.” The global average masks dramatic differences among regions and countries. Regionally, the highest GHI scores are in South Asia and Sub-Saharan Africa. South Asia reduced its GHI score significantly between 1990 and 1996—mainly by reducing the share of underweight children—but could not maintain this rapid progress. Though Sub-Saharan Africa made less progress than South Asia in the 1990s, it has caught up since the turn of the millennium, with its 2012 GHI score falling below that of South Asia.

From the 1990 GHI to the 2012 GHI, 15 countries reduced their scores by 50 percent or more. In terms of absolute progress, between the 1990 GHI and the 2012 GHI, Angola, Bangladesh, Ethiopia, Malawi, Nicaragua, Niger, and Vietnam saw the largest improvements in their scores.

Twenty countries still have levels of hunger that are “extremely alarming” or “alarming.” Most of the countries with alarming GHI scores are in Sub-Saharan Africa and South Asia (the 2012 GHI does not, however, reflect the recent crisis in the Horn of Africa, which intensified in 2011, or the uncertain food situation in the Sahel). Two of the three countries with extremely alarming 2012 GHI scores—Burundi and Eritrea—are in Sub-Saharan Africa; the third country with an extremely alarming score is Haiti. Its GHI score fell by about one quarter from 1990 to 2001, but most of this improvement was reversed in subsequent years. The devastating January 2010 earthquake, although not yet fully captured by the 2012 GHI because of insufficient availability of recent data, pushed Haiti back into the category of “extremely alarming.” In contrast to recent years, the Democratic Republic of Congo is not listed as “extremely alarming,” because insufficient data are available to calculate the country’s GHI score. Current and reliable data are urgently needed to appraise the situation in the country.

Recent developments in the land, water, and energy sectors have been wake-up calls for global food security: the stark reality is that the world needs to produce more food with fewer resources, while eliminating wasteful practices and policies. Demographic changes, income increases, climate change, and poor policies and institutions are driving natural resource scarcity in ways that threaten food production and the environment on which it depends. Food security is now inextricably linked to developments in the water, energy, and land sectors. Rising energy prices affect farmers’ costs for fuel and fertilizer, increase demand for biofuel crops relative to food crops, and raise the price of water use. Agriculture already occurs within a context of land scarcity in terms of both quantity and quality: the world’s best arable land is already under cultivation, and unsustainable agricultural practices have led to significant land degradation. The scarcity of farmland coupled with shortsighted bioenergy policies has led to major foreign

investments in land in a number of developing countries, putting local people’s land rights at risk. In addition, water is scarce and likely to become scarcer with climate change.

To halt this trend, more holistic strategies are needed for dealing with land, water, energy, and food, and they are needed soon. To manage natural resources sustainably, it is important to secure land and water rights; phase out inefficient subsidies on water, energy, and fertilizers; and create a macroeconomic environment that promotes efficient use of natural resources. It is important to scale up technical solutions, particularly those that conserve natural resources and foster more efficient and effective use of land, energy, and water along the value chain. It is also crucial to tame the drivers of natural resource scarcity by, for example, addressing demographic change, women’s access to education, and reproductive health; raising incomes and lowering inequality; and mitigating and adapting to climate change through agriculture.

Food security under land, water, and energy stress poses daunting challenges. The policy steps described in this report show how we can meet these challenges in a sustainable and affordable way.

01



High levels of hunger are generally found in those countries and regions where access and property rights to land, water, and energy are limited or contested.

THE CONCEPT OF THE GLOBAL HUNGER INDEX

The Global Hunger Index (GHI) is a tool designed to comprehensively measure and track hunger globally and by region and country.¹ Calculated each year by the International Food Policy Research Institute (IFPRI), the GHI highlights successes and failures in hunger reduction and provides insights into the drivers of hunger. By raising awareness and understanding of regional and country differences in hunger, the GHI will, it is hoped, trigger actions to reduce hunger.

A number of different indicators can be used to measure hunger (see “Concepts of Hunger” on page 9). To reflect the multidimensional nature of hunger, the GHI combines three equally weighted indicators in one index:

- 1. Undernourishment:** the proportion of undernourished people as a percentage of the population (reflecting the share of the population with insufficient caloric intake)
- 2. Child underweight:** the proportion of children younger than age five who are underweight (that is, have low weight for their age, reflecting wasting, stunted growth, or both), which is one indicator of child undernutrition
- 3. Child mortality:** the mortality rate of children younger than age five (partially reflecting the fatal synergy of inadequate caloric intake and unhealthy environments)

This multidimensional approach offers several advantages. It reflects the nutrition situation not only of the population as a whole, but also of a physiologically vulnerable group—children—for whom a lack of nutrients leads to a high risk of illness, poor physical and cognitive development, and death. In addition, by combining independently measured indicators, it reduces the effects of random measurement errors.²

The GHI ranks countries on a 100-point scale in which zero is the best score (no hunger) and 100 the worst, although neither of these extremes is reached in practice. The scale in Box 1.1 on the following pages shows the severity of hunger—from “low” to “extremely alarming”—associated with the range of possible GHI scores. The 2012 GHI is calculated for 120 countries for which data on the three components are available and for which measuring hunger is considered most relevant. (The GHI calculation excludes some higher-income countries because the prevalence of hunger there is very low.)

The GHI is only as current as the data for its three component indicators. This year’s GHI reflects data from 2005 to 2010—the most recent available country-level data on the three GHI components. It is thus a snapshot not of the present, but of the recent past. For some countries, such as Afghanistan, Iraq, Papua New Guinea,

and Somalia, and now also for the Democratic Republic of Congo and Myanmar, lack of data on undernourishment prevents the calculation of GHI scores.³ Despite the existence of abundant technological tools to collect and assess data almost instantaneously, enormous time lags persist in reporting vital statistics on hunger. More up-to-date and extensive country data on hunger are urgently needed. Some efforts are underway to improve data on undernourishment and the distribution of food consumption. The Food and Agriculture Organization of the United Nations (FAO) is currently revising its methodology for estimating undernourishment in order to provide more timely data that integrates all relevant information, including findings of the large number of household surveys that have become available in recent years (FAO 2011b). Improvements in collecting high-quality data on hunger and food consumption will allow for a more complete and current assessment of the state of global hunger and, in turn, more effective steps to reduce hunger.

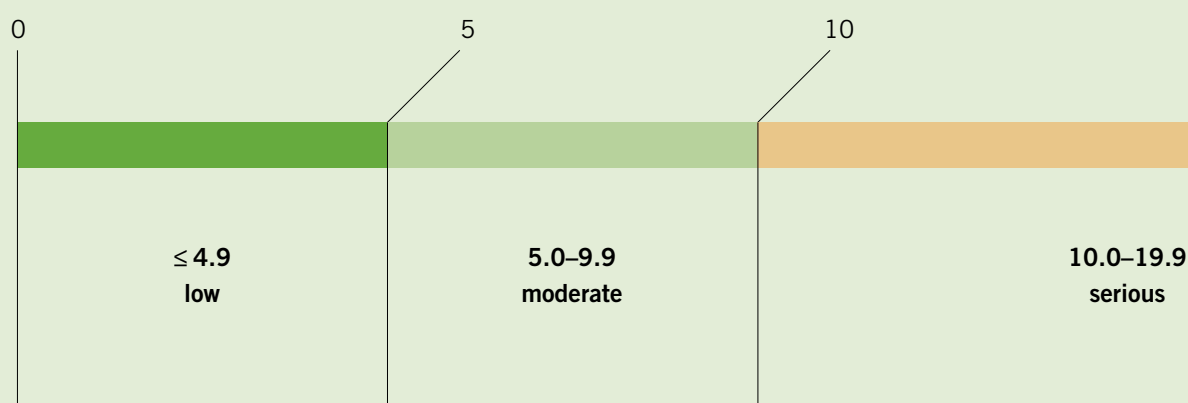
The GHI scores are based on source data that are continually revised by the United Nations agencies responsible for their compilation, and each year’s GHI report reflects these revisions. These revisions result in improvements in the data, but they also mean that the GHI scores from different years’ GHI reports are not comparable with one another. Like the 2011 GHI report, though, this year’s report has the advantage that it contains not only the most recent GHI, but also GHI scores for three other reference periods—1990, 1996, and 2001—that are, in fact, comparable with one another, allowing for in-depth analyses of trends.

¹ For background information on the concept, see Wiesmann (2004) and Wiesmann, von Braun, and Feldbrügge (2000).

² For a multidimensional measure of poverty, see the index developed by the Oxford Poverty and Human Development Initiative (OPHI) for the United Nations Development Programme (Alkire and Santos 2010).

³ FAO no longer publishes country-level estimates of undernourishment and dietary energy supply per capita for the Democratic Republic of Congo (FAO 2011a), which according to past reports had the largest relative and absolute increase in GHI scores since 1990. Similarly, no GHI could be calculated for Myanmar because of lack of data on undernourishment.

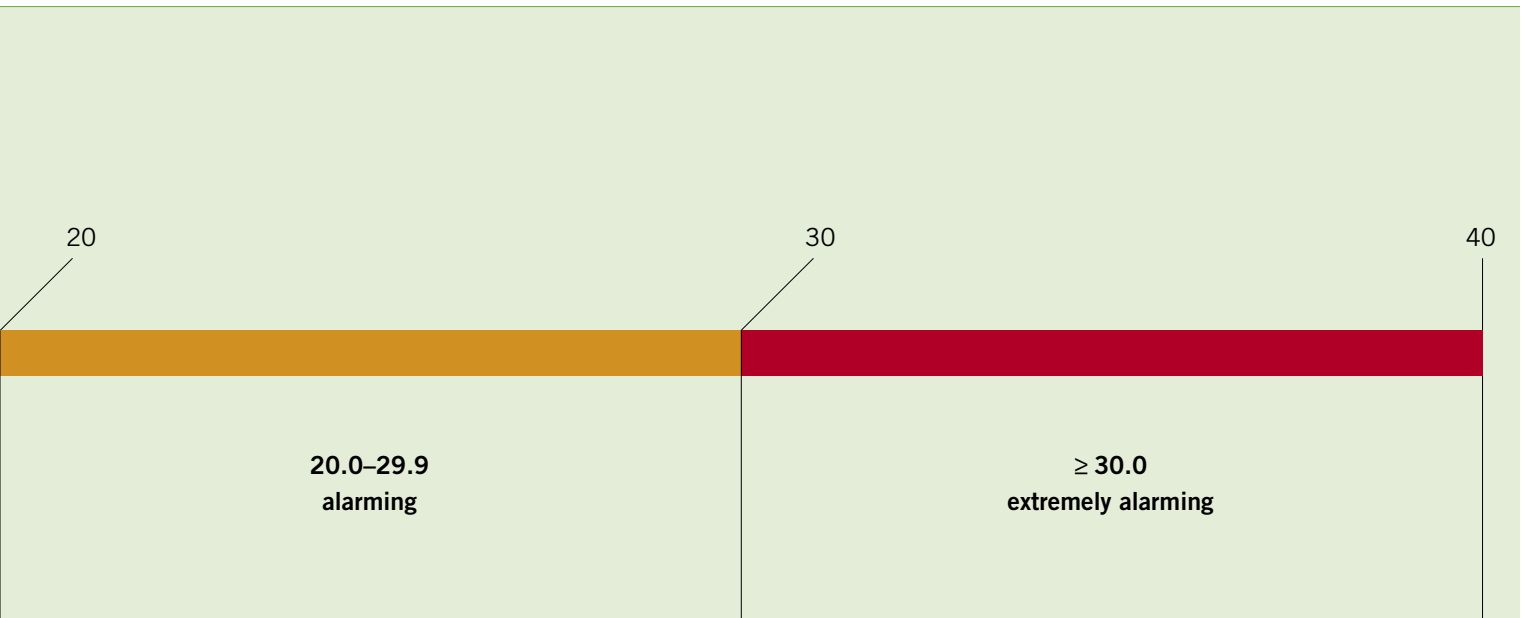
BOX 1.1 WHAT IS THE GLOBAL HUNGER INDEX?



CONSTRUCTING THE GHI: ABOUT THE DATA

The 1990, 1996, 2001, and 2012 GHI scores presented in this report reflect the latest revised data for the three components of the GHI.¹ Where original source data were not available, estimates were made for the GHI components based on the most recent data available. The “child mortality” and “undernourishment” components for the 1990, 1996, and 2001 GHI scores were revised using updated data from the United Nations Children’s Fund (UNICEF) and FAO, respectively. In addition, the 1990, 1996, 2001, and 2012 GHI scores use revised calorie data from FAO for “child underweight” estimates. The “child underweight” component of the four GHI scores includes the latest additions to the World Health Organization’s Global Database on Child Growth and Malnutrition, the most recent Demographic and Health Survey (DHS) and Multiple Indicator Cluster Survey (MICS) reports, and statistics from UNICEF (2012a). These enhancements in the underlying data improve the quality of the GHI.

Data for the 2012 GHI span the period 2005–10. The undernourishment data are for 2006–08 (FAO 2011a; authors’ estimates); data on child mortality are for 2010 (UNICEF 2012b); and data on child undernutrition are for the latest year for which data are available in the period 2005–10 (WHO 2012; UNICEF 2012a, c; MEASURE DHS 2012; authors’ estimates). See Appendix A for more detailed background information on the data sources for and calculations of the 1990, 1996, 2001, and 2012 GHI scores.



CONCEPTS OF HUNGER

The terminology used to refer to different concepts of hunger can be confusing. “Hunger” is usually understood to refer to the discomfort associated with lack of food. FAO defines food deprivation, or “undernourishment,” specifically as the consumption of fewer than about 1,800 kilocalories a day—the minimum that most people require to live a healthy and productive life.²

“Undernutrition” goes beyond calories and signifies deficiencies in any or all of the following: energy, protein, or essential vitamins and minerals. Undernutrition is the result of inadequate intake of food—in terms of either quantity or quality—poor utilization of nutrients due to infections or other illnesses, or a combination of these factors, which are in turn caused by household food insecurity; inadequate maternal health or child care practices; or inadequate access to health services, safe water, and sanitation. “Malnutrition” refers more broadly to both undernutrition (problems of deficiencies) and overnutrition (problems of unbalanced diets, such as consumption of too many calories in relation to requirements with or without low intake of micronutrient-rich foods).

In this report, “hunger” refers to the index based on the three indicators described on page 7.

¹ For previous GHI calculations, see von Grebmer et al. (2011); von Grebmer et al. (2010); von Grebmer et al. (2009); von Grebmer et al. (2008); IFPRI/Welthungerhilfe/Concern (2007); Wiesmann (2006a, b); and Wiesmann, Weingärtner, and Schöniger (2006).

² FAO considers the composition of a population by age and sex to calculate its average minimum energy requirement, which varies by country (from about 1,690 kilocalories per person per day in Eritrea to 2,000 kilocalories per person per day in the Netherlands for 2006–08). The country’s average minimum energy requirement is used to estimate undernourishment (FAO 2011a).

02

The need to **produce more with less** – and to do so more sustainably and in a manner that prioritizes the poor – will remain.



GLOBAL, REGIONAL, AND NATIONAL TRENDS

Improvements in global hunger since 1990 continue to be small. Although the *number* of undernourished people was on the rise from the mid-1990s until 2006–08, the *proportion* of undernourished people in the world declined in the same time period (FAO 2011a). Because the GHI measures relative hunger—that is, it refers to the proportion of people who suffer from hunger, broadly defined by the three component indicators—the index shows a positive trend. The 2012 world⁴ GHI fell by 26 percent from the 1990⁵ world GHI, from a score of 19.8 to 14.7 (Figure 2.1).

The three indicators contributed differently to the decline in the world GHI score since 1990. A decline in child underweight lowered the world GHI score by 2.7 points, whereas changes in the child mortality rate and the proportion of undernourished people in the population contributed reductions of 1.1 and 1.3 points, respectively.

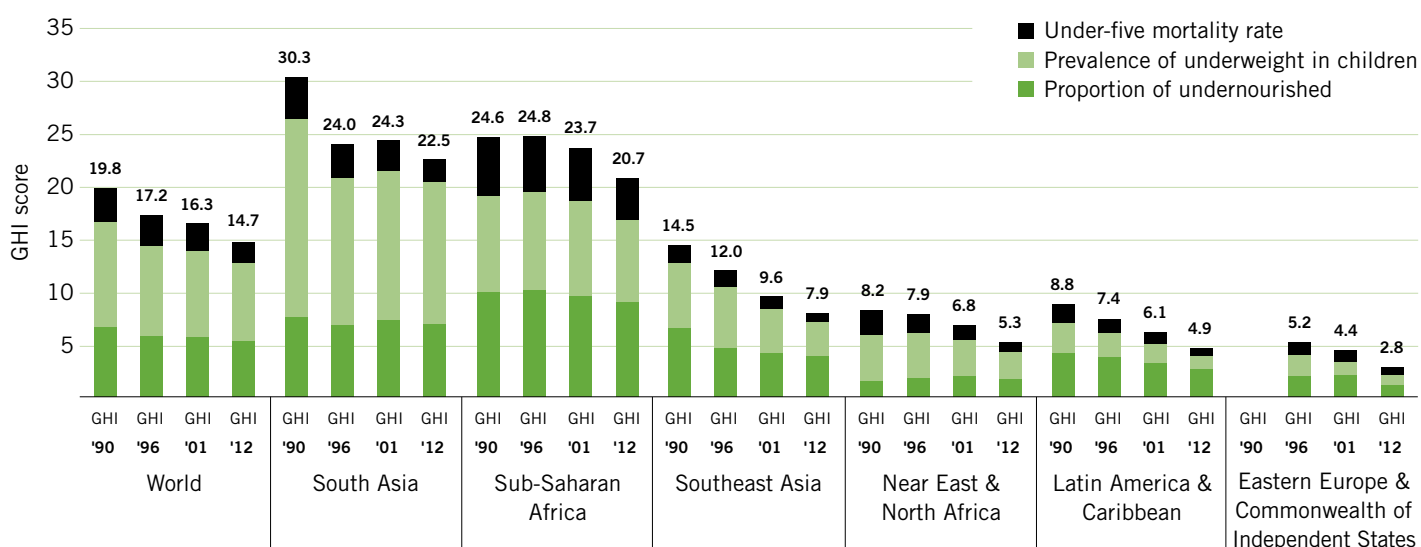
The world GHI declined most rapidly—by 2.6 points—between 1990 and 1996, and progress slowed thereafter. Undernourishment and underweight in children improved most between 1990 and 1996, whereas progress in reducing child mortality has accelerated since 2001. The proportion of undernourished people has remained almost constant at the global level since 1995–97, falling by just 1 percentage point. The index for hunger in the world, however, remains “serious.”

Large Regional and National Differences

These global averages mask dramatic differences among regions and countries. Compared with the 1990 score, the 2012 GHI score was 16 percent lower in Sub-Saharan Africa, 26 percent lower in South Asia, and 35 percent lower in the Near East and North Africa (Figure 2.1). Progress in Southeast Asia and Latin America and the Caribbean was particularly remarkable, with the GHI scores decreasing by 46 percent and 44 percent respectively (although the score was already low in the latter region). In Eastern Europe and the Commonwealth of Independent States, the 2012 GHI score was 46 percent lower than the 1996 score.⁶

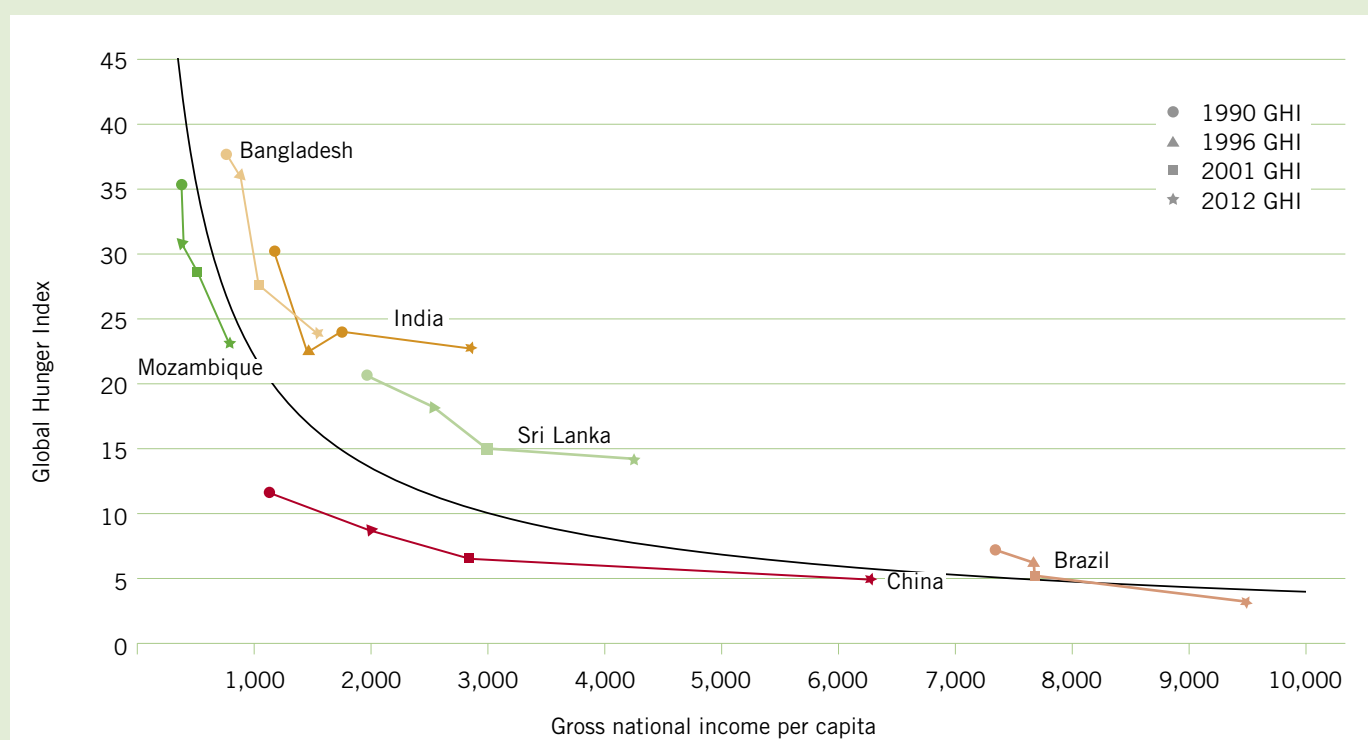
Southeast Asia and Latin America and the Caribbean have experienced a fairly consistent reduction in GHI scores since 1990. In the Near East and North Africa, the decrease of GHI scores has accelerated after a period of virtual stagnation between 1990 and 1996. In South Asia and Sub-Saharan Africa—the two regions with the highest GHI scores, at 24.5 and 20.7 respectively—the rates of progress have also been uneven.

FIGURE 2.1 CONTRIBUTION OF COMPONENTS TO 1990 GHI, 1996 GHI, 2001 GHI, AND 2012 GHI, BY REGION



Note: For the 1990 GHI, data on the proportion of undernourished are for 1990–92; data on child underweight are for the year closest to 1990 in the period 1988–92 for which data are available; and data on child mortality are for 1990. For the 1996 GHI, data on the proportion of undernourished are for 1995–97; data on child underweight are for the year closest to 1996 in the period 1994–98 for which data are available; and data on child mortality are for 1996. For the 2001 GHI, data on the proportion of undernourished are for 2000–02; data on child underweight are for the year closest to 2001 in the period 1999–2003 for which data are available; and data on child mortality are for 2001. For the 2012 GHI, data on the proportion of undernourished are for 2006–08, data on child underweight are for the latest year in the period 2005–10 for which data are available, and data on child mortality are for 2010.

BOX 2.1 GHI AND INCOME IN INDIA AND ELSEWHERE



Source: Based on data on per capita GNI from the World Bank (2012).

Note: Data on gross national income (GNI) per capita are based on purchasing power parity and expressed in constant 2005 international dollars. The black trend line was predicted from a regression of 1990, 1996, 2001, and 2012 country-level GHI scores on GNI per capita for all countries with available data. Data points for 1990 GHI, 1996 GHI, 2001 GHI, and 2012 GHI correspond with GNI per capita data for 1989–91, 1995–97, 2000–02, and 2008–10, respectively.

India has lagged behind in improving its GHI score despite strong economic growth. After a small increase between 1996 and 2001, India's GHI score fell only slightly, and the latest GHI returned to about the 1996 level, as the above graph shows. This stagnation in GHI scores occurred during a period when India's gross national income (GNI) per capita almost doubled, rising from about 1,460 to 2,850 constant 2005 international dollars between 1995–97 and 2008–10 (World Bank 2012).

When comparing GHI scores with GNI per capita, it must be emphasized that India's latest GHI score is based partly on outdated data: although it includes relatively recent child mortality data from 2010, FAO's most

recent data on undernourishment are for 2006–08, and India's latest available nationally representative data on child underweight were collected in 2005–06. Given that the Government of India has failed to monitor national trends in child undernutrition for more than six years, any recent progress in the fight against child undernutrition cannot be taken into account by the 2012 GHI.

Nonetheless, even bearing in mind that possible recent advances in the fight against child undernutrition are not yet visible in the latest GHI, India's track record is disappointing. Generally, higher incomes are associated with less hunger. This pattern is shown by the black line, which was predicted from a

regression of the GHI on GNI per capita for 117 countries with available data. India's data points fall consistently above the predicted line. This result means that given India's per capita income, it has higher GHI scores than would be expected. Between 1990 and 1996, India's trend line moved in parallel with the predicted line, indicating that its GHI score was falling commensurate with economic growth. After 1996, however, the disparity between economic development and progress in the fight against hunger widened, and India moved further away from the predicted line.¹

In two other South Asian countries—Bangladesh and Sri Lanka—GHI scores were also higher than expected but decreased almost

proportionally with GNI per capita growth (that is, largely in parallel with the predicted line). Compared with countries at a similar level of economic development, Sri Lanka achieved impressively high literacy and life expectancy through welfare-oriented policies, investment in public healthcare and education systems, and a commitment to gender equality (Samarage 2006). Bangladesh has benefited from broad-based social progress, and its vibrant NGO sector and public transfer programs helped reduce child undernutrition among the poorest. Bangladesh has also closed the gender gap in education through targeted public interventions and has overtaken India on a range of social indicators, including the level and rate of reduction of child mortality (UNICEF 2012b; World Bank 2005; Drèze 2004). The country is also committed to regular monitoring of children's nutritional status.

China has lower GHI scores than predicted from its level of economic development. It lowered its levels of hunger and undernutrition through a strong commitment to poverty reduction, nutrition and health interventions, and improved access to safe water, sanitation, and education. Brazil successfully implemented targeted social programs (von Braun, Ruel, and Gulati 2008). Since 1992, Mozambique has been recovering from a long-lasting civil war and has witnessed economic growth and poverty reduction (van den Boom 2011), coupled with hunger reduction: all three components of the GHI improved since 1990.

In India, 43.5 percent of children under five are underweight (WHO 2012, based on the 2005–06 National Family Health Survey [IIPS and Macro International 2007]): this rate accounts for almost two-thirds of the country's alarmingly high GHI score. According to the latest data on child undernutrition,

from 2005–10, India ranked second to last on child underweight out of 129 countries—below Ethiopia, Niger, Nepal, and Bangladesh. Only Timor-Leste had a higher rate of underweight children. By comparison, only 23 percent of children are underweight in Sub-Saharan Africa (although India has a lower proportion of undernourished in the population than Sub-Saharan Africa²).

It must be emphasized that child undernutrition is not simply the outcome of a lack of food in the household. There are many other potential causes, such as lack of essential vitamins and minerals in the diet, improper caring and feeding practices, or frequent infections, which often result from inadequate health services or unsanitary environments. Women's low status in India and other parts of South Asia contributes to children's poor nutritional outcomes in the region because children's development and mothers' well-being are closely linked: women's poor nutritional status, low education, and low social status undermine their ability to give birth to well-nourished babies and to adequately feed and care for their children (von Grebmer et al. 2010). According to surveys during 2000–06, 36 percent of Indian women of childbearing age were underweight, compared with only 16 percent in 23 Sub-Saharan African countries (Deaton and Drèze 2009).³

Research has shown that early nutritional deprivation causes lasting damage to children's physical and cognitive development, schooling outcomes, and economic productivity in later life (Victora et al. 2008). These findings underline the urgent need to address the issue of child undernutrition effectively, focusing particularly on the thousand days from conception to a child's second birthday. Whereas increases in food production and improved distribution of food may be neces-

sary to reduce child undernutrition, these measures alone are usually insufficient. The findings of a recent IFPRI study imply that in the absence of concurrent improvements in health and education, only modest impacts on child undernutrition in India are to be expected from income growth (Bhagowalia, Headey, and Kadiyala 2012). A multisectoral, well-coordinated approach is needed to successfully fight child undernutrition in India and elsewhere (Headey, Chiu, and Kadiyala 2011; von Braun, Ruel, and Gulati 2008; Bhutta et al. 2008).

India has moved on a number of fronts to improve food security and nutrition in past years and has recognized the need for multisectoral action (Kadiyala and Menon 2012). The government operates several large-scale, nutrition-relevant social programs, but poor design, low coverage, and insufficient monitoring are continual challenges. In the absence of up-to-date information on nutrition outcomes, program effectiveness remains uncertain. Home to the majority of the world's undernourished children, India is in dire need of monitoring systems for child undernutrition and related indicators that produce data at regular intervals, in order to improve program performance and scale up impact (Kadiyala et al. 2012).

¹ Unless child underweight was almost halved in India between 2005–06 and 2008–2010—which is extremely unlikely—this statement holds even if progress in reducing child underweight has recently accelerated. Recognizing the dearth of up-to-date information on child undernutrition in India, an alliance of civil society organizations conducted a nutrition survey in selected districts in 2011. The findings, while not nationally representative, indicate some improvement: child underweight fell from 53 to 42 percent in high-burden districts between 2002–04 and 2011, and the rate of reduction was lower in better-off districts (Naandi Foundation 2011).

² In 2006–08, 19 percent of the population was undernourished in India, and 27 percent in Sub-Saharan Africa (FAO 2011a).

³ This number is the population-weighted average for all these countries, which comprise roughly two-thirds of Sub-Saharan Africa's population.

Among the regions, South Asia has the highest 2012 GHI score. South Asia reduced its GHI score by more than 6 points between 1990 and 1996—mainly through a large 15-percentage-point decline in underweight in children—but this rapid progress could not be maintained. Stagnation followed, and the region has lowered its GHI score by only about 2 points since 2001 despite strong economic growth (see Box 2.1). The proportion of undernourished people did not decline between 1995–97 and 2006–08 and even showed a transient increase of about 2 percentage points around 2000–02. Social inequality and the low nutritional, educational, and social status of women are major causes of child undernutrition in this region and have impeded improvements in the GHI score.

Though Sub-Saharan Africa made less progress than South Asia in the 1990s, it has caught up since the turn of the millennium, with its 2012 GHI score falling below that of South Asia. However, South Asia's overall decline was greater because Sub-Saharan Africa

began with a lower GHI score in 1990. Sub-Saharan Africa's GHI score increased marginally between 1990 and 1996, fell slightly until 2001, and declined more markedly until the period reflected in the 2012 GHI score. The large-scale civil wars of the 1990s and 2000s ended, and former conflict countries became more politically stable. Economic growth resumed on the continent, and advances in the fight against HIV and AIDS contributed to a reduction in child mortality in the countries most affected by the epidemic.

Since 2001, child mortality rates—both for infants and for children under the age of five—have declined in Sub-Saharan Africa. While a range of factors may have played a role, a major reason seems to be the decrease in the prevalence of malaria, which coincided with the increased use of insecticide-treated bed nets and other antimalarial interventions (Demombynes and Trommlerová 2012). Other factors that may have contributed to reduced mortality rates include higher immunization rates and births in medical centers; improved

BOX 2.2 THE SAHEL: A SUDDEN CRISIS OR A SYSTEMIC PROBLEM?

In the spring of 2011, reports of an impending famine in the African Sahel region began to appear in the media. About 18 million people were estimated to be at risk of starvation, mainly because of poor harvests in several countries. The warning of the impending crisis was triggered by a large production shortfall in 2011—a 26 percent decline in the Sahelian countries—compared with 2010. That statistic alone, however, is somewhat misleading.

The year 2010 was a record production year, and, when compared with the average of the preceding five years, production in 2011 does not appear to be dramatically below recent trends, except in a few countries (see figure at right). Taken together, the eight Sahelian countries had an aggregate shortfall of just 3 percent compared with the preceding five-year average. In contrast, the eight neighboring coastal countries together produced 9 percent more than the preceding five-

year average. Taken together, the entire region of West Africa plus Chad produced 5 percent more than that average.

Moreover, domestic production is only one source of supplies to meet local demand for food. The other sources are commercial imports and food aid. When commercial imports are accounted for, supply levels for each country, as well as for the West African region as a whole, far exceed local demand. For the Sahelian countries, commercial imports bring the net excess supply to nearly 600,000 metric tons—not including food aid. The net surplus for the Economic Community of West African States (ECOWAS), without Nigeria and Guinea, exceeds 2 million metric tons. Niger has the second-highest GHI score in West Africa and is by far the most vulnerable country in the region. Yet even here, the production shortfall in 2011 was not exceptionally large by historical standards, nor were harvest levels in preceding years exceptionally poor. In fact, production has

increased steadily over the past few years, although the trends are highly variable. Here, too, domestic production and commercial imports have matched or exceeded aggregate demand every year, without even taking into consideration food aid and informal cross-border trade (Eilerts 2012).

The history of food prices in West Africa shows that the food balance situation in this region is actually more stable than in other regions of Africa. Prices have risen less than elsewhere on the continent.

So why the crisis? The real issue may not be sudden famine, but rather persistent, chronic vulnerability among certain segments of the population that is not being addressed in a systemic way. Operating in crisis mode, as is currently being done, leads to costly, blanket-style, short-term interventions, while the root of the problem remains. This “crisis approach” may be effective in raising funds, but it can disrupt the very policies that are needed to build resilience among the most vulnerable groups. Such policies require

antenatal care and access to clean water and sanitation facilities; and increasing levels of income, leading to better nutrition and access to medical care.

The recent crisis in the Horn of Africa, which intensified in 2011, is not reflected in the 2012 GHI. The crisis, and the current situation in the Sahel (see Box 2.2), demonstrates that, though the situation in Sub-Saharan Africa is improving, food security remains fragile in parts of the region and vulnerability to shocks is still high.

Best and Worst Country-Level Results

From the 1990 GHI to the 2012 GHI, 15 countries reduced their scores by 50 percent or more (Figure 2.2). Forty-four countries made modest progress, reducing their GHI scores by between 25 and 49.9 percent, and 21 countries decreased their GHI scores by less than 25 percent.⁷ Only one country in Sub-Saharan Africa—Ghana—is among the 10 best performers in improving their GHI score since

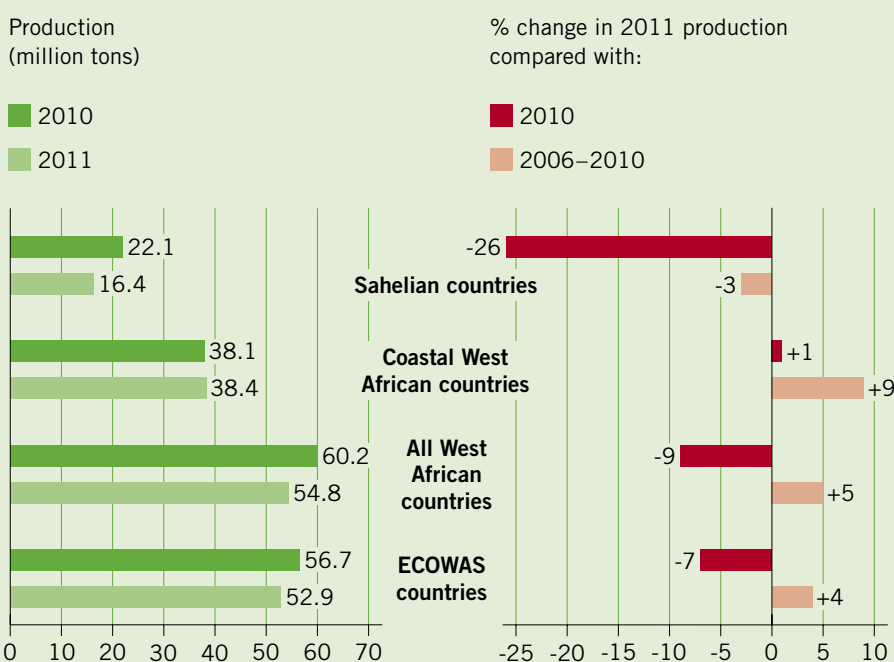
1990 (Figure 2.3). Turkey's notable progress since 1990 is due mainly to significant reductions in the prevalence of child underweight (which fell by almost 7 percentage points) and child mortality (which fell by about 6 percentage points), while undernourishment in the country remained very low. After 1996 Turkey's GHI score began to decline substantially, and between the 2001 GHI and the 2012 GHI, its score was halved. Kuwait's progress in reducing hunger is due mainly to its unusually high score in 1990, when Iraq invaded the country: its GHI score fell by more than 5 points (or 57 percent) until 1996, and has fallen by about 1 point since (see country trends in Appendix C).

With the exception of North Korea, all the countries in which the hunger situation worsened from the 1990 GHI to the 2012 GHI are in Sub-Saharan Africa. Increased hunger since 1990 in Burundi, Comoros, and Côte d'Ivoire can be attributed to prolonged conflict and political instability. In Comoros, the GHI score fell after a peak in 2001,

national governments to exercise leadership and to embrace (1) systemic and sustained efforts to raise productivity among the most vulnerable, (2) targeted safety-net programs and wider interventions that are consistent with and supportive of the goal of building long-term community resilience, and (3) concerted efforts to remove barriers to cross-border trade.

The region's strong agricultural and broader economic growth suggests that the chances for the first two measures to succeed are better now than at any time in the recent past. Moreover, the best argument for further opening up cross-border trade is the fact that the region as a whole is in a surplus situation while isolated areas of individual countries are suffering from the effects of localized production shortfalls. Alongside these efforts, a more unified and coherent approach to resilience, and more specifically to community resilience, is required of all stakeholders at national, international, and multilateral levels.

CHANGES IN CEREAL PRODUCTION AMONG SAHELIAN AND OTHER WEST AFRICAN COUNTRIES



Source: Based on CILSS/AGRHYMET (2012).
 Note: Sahelian countries are those that belong to the Comité permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel (CILSS); ECOWAS = Economic Community of West African States.

BOX 2.3 LATIN AMERICA AND THE CARIBBEAN: SHOCKS HIT A GROWING REGION

Since the late 1980s, almost all Latin American countries have adopted far-reaching economic reforms. The resulting increase in economic openness has gone hand in hand with large financial inflows—particularly in the first half of the 1990s—and brought new sources of economic growth. Although overall growth slowed after 1995, strong growth has resumed in the past five years. With the exception of a handful of countries, this economic growth has been accompanied by relatively modest inflation.

Despite these positive results, virtually all Latin American countries share similar problems: uneven economic growth, lagging agricultural growth, and, in certain cases, unacceptably high rates of poverty and malnutrition. More than 60 percent of the region's poor live in rural areas, where slow economic growth, unequal distribution of assets, inadequate public investment and public services, and vulnerability to natural and economic shocks are major policy issues. The 2007–08 and the 2010–11 food price crises exacerbated these problems. Although the region was considered relatively stable and capable of absorbing

external shocks, the food price crises significantly raised food inflation in most countries in Latin America and the Caribbean.

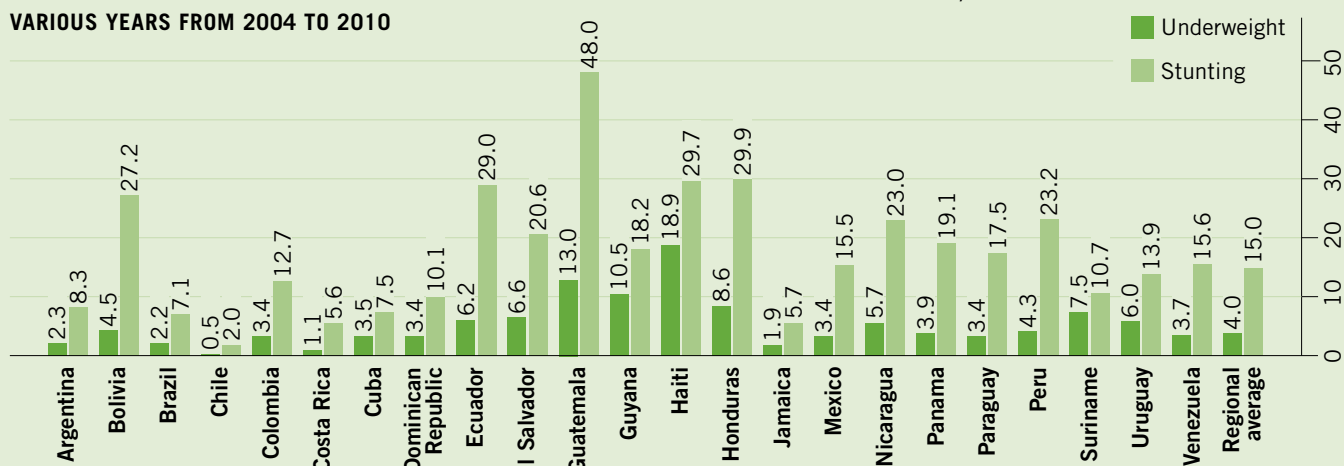
Before the crises, most countries in the region were on track to reach the Millennium Development Goal of halving the proportion of people who suffer from hunger by 2015; with the food crises, many countries experienced setbacks in their progress toward this goal. The impact has been greatest on net food-importing countries—specifically, Mexico and Central America—as well as on poor consumers in peri-urban and rural areas. When the food price crisis of 2007–08 hit El Salvador, for example, the food budget of a rural household bought only 56 percent of what it had bought 18 months before (WFP 2008). Such declines in food purchasing power are disproportionately felt by the poorest segment of the population.

The food price shocks hit a region where nutrition status is mixed. The average prevalence of child underweight in Latin America and the Caribbean is 4 percent, but in Guatemala and Haiti rates are 13 and about 19 percent, respectively. Rates of stunting

for children under five are even more worrisome. The prevalence of child stunting is only 2 percent in Chile, but it is more than 27 percent in Bolivia and Ecuador; nearly 30 percent in Haiti and Honduras; and 48 percent in Guatemala.

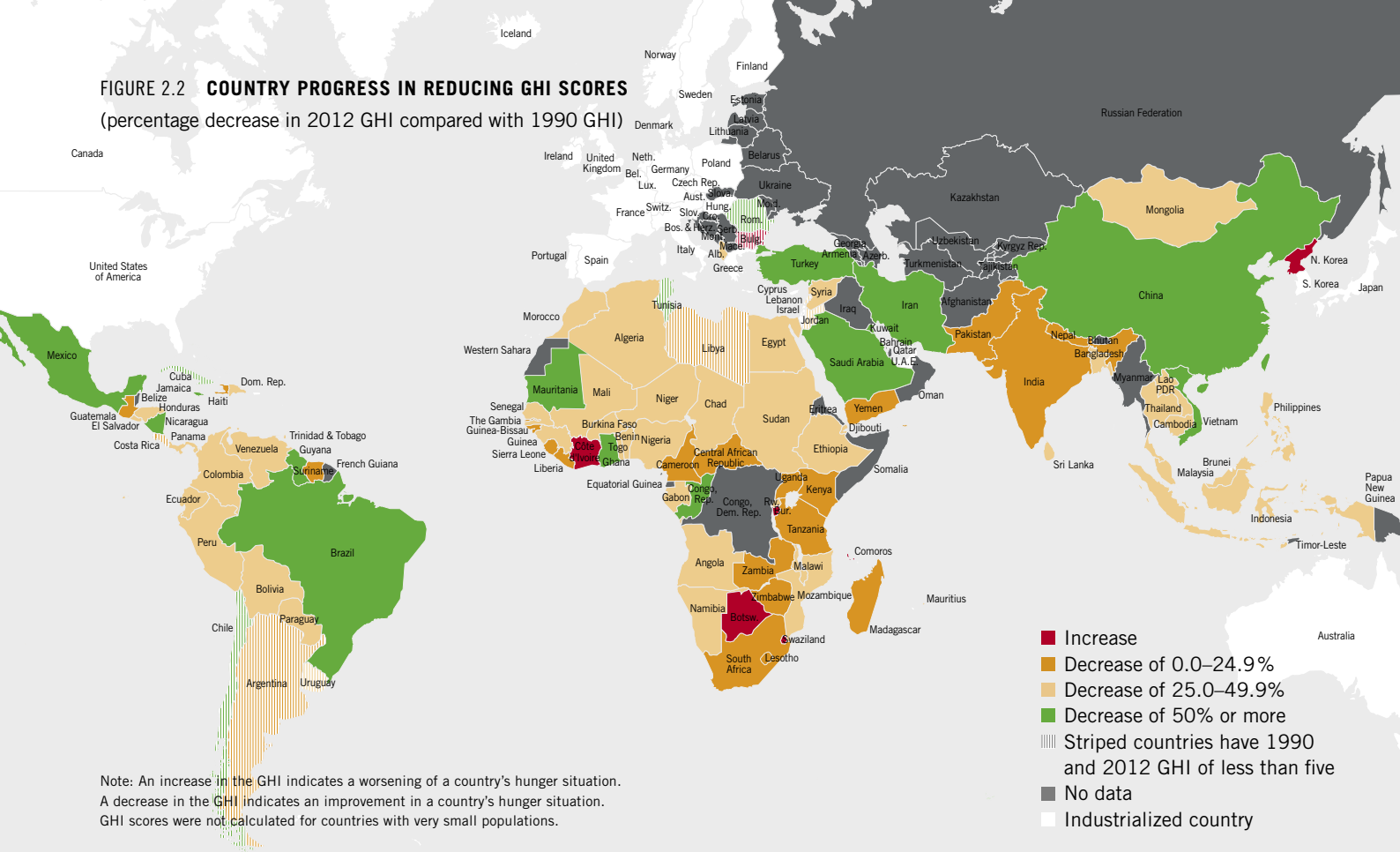
Haiti, the poorest and most food-insecure country in the Western hemisphere, is still feeling the effects of the January 2010 earthquake, which killed more than 300,000 people and affected 3 million—about one in three Haitians. More than 1 million people lost their homes, hospitals and other crucial infrastructure were destroyed, the health system was greatly weakened, and food availability declined (World Bank 2010; Rosen et al. 2012). As a consequence, from 2009 to 2010 child mortality in Haiti more than doubled, exceeding its 1990 level (IGME 2011). Lack of access to food, shelter, clean water, and health services increased the risk of child undernutrition (World Bank 2010). Two years after the disaster, more than half a million Haitians still lived in tents and under tarpaulins in hundreds of camps (Oxfam 2012).

PREVALENCE OF UNDERWEIGHT AND STUNTING IN CHILDREN YOUNGER THAN FIVE YEARS (%), VARIOUS YEARS FROM 2004 TO 2010



Source: WHO (2012); UNICEF (2012a); MEASURE DHS (2012).

FIGURE 2.2 COUNTRY PROGRESS IN REDUCING GHI SCORES
(percentage decrease in 2012 GHI compared with 1990 GHI)

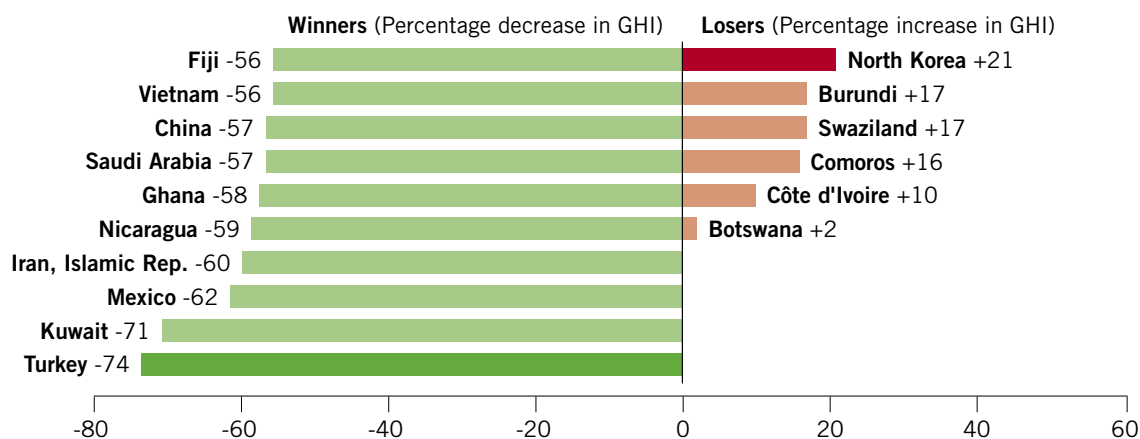


but it is not yet clear if this constitutes a reversal of past trends. Between 1990 and 2001, Burundi's GHI score increased steadily, but it has declined slightly since. With the transition to peace and political stability that started in 2003, the country began a slow recovery from decades of economic decline. However, its high level of undernourishment remains a serious issue: the proportion of undernourished people has been rising, although the rate of increase has now slowed. The prevalence of child underweight has declined since 2000, but it remains one of the highest in Sub-Saharan Africa. The country's child mortality rate has been improving, mainly since 2001 (see country trends in Appendix C).

In Côte d'Ivoire, the 1999 military coup and the 2002–07 civil war contributed significantly to the high level of hunger in the country. Since 2001, its GHI score has increased by 1.6 points (see country trends in Appendix C). Between 1999 and 2007, the prevalence of child underweight rose by 10 percentage points. Recent research examining the impact of the civil war on child health found that children residing in regions more affected by the conflict had significant health setbacks compared with children in less-affected regions (Minoiu and Shemyakina 2012).

For the Democratic Republic of Congo, another conflict-ridden country in Sub-Saharan Africa and by far the worst performer in terms of GHI scores in past GHI reports, data availability is no

FIGURE 2.3 GHI WINNERS AND LOSERS FROM 1990 GHI TO 2012 GHI



Note: Countries with both 1990 GHI and 2012 GHI scores of less than five are excluded.

longer sufficient to calculate the GHI (see note 3 on page 7). Renewed efforts should be made to collect high-quality data in order to fill current gaps.

In Swaziland, the HIV and AIDS epidemic, along with high income inequality, has severely undermined food security despite growth in national income. In 2009, Swaziland's adult HIV prevalence was estimated at 26 percent—the highest in the world (UNAIDS 2010). Although the country's GHI scores worsened throughout the 1990s, the negative trend has been partly reversed since 2001. Swaziland and several other African countries have made great strides in preventing mother-to-child transmission of HIV, and child mortality rates have dropped again after a peak around 2003 (UNAIDS 2010; IGME 2011). Botswana and Lesotho have also been heavily affected by HIV and AIDS and have benefited from advances in treatment and improved access to anti-retroviral drugs. The pattern in their GHI scores is similar to that of Swaziland, with peaks in 2001, caused partly by transient increases in undernourishment and partly by rises in child mortality up to 2001 (see country trends in Appendix C).

In North Korea, widespread starvation threatened in 1995 but was averted by large-scale food-aid deliveries (CIA 2012). The country's GHI rose sharply between 1990 and 1996 and has declined only slightly since, providing evidence of chronic food insecurity in spite of considerable international humanitarian assistance (see country trends in Appendix C). A weak economy, high military spending, weather-related crop failures, and systemic problems in the agriculture sector have hampered progress (CIA 2012).

Some countries achieved noteworthy absolute progress in improving their GHI scores. Between the 1990 GHI and the 2012 GHI, Angola, Bangladesh, Ethiopia, Malawi, Nicaragua, Niger, and Vietnam saw the largest improvements—by 13 points or more—in their scores. In Burundi and Comoros, however, the GHI rose by about 6 and 4 points, respectively.

Twenty countries still have levels of hunger that are “extremely alarming” or “alarming” (Figure 2.4). Most of the countries with alarming GHI scores are in Sub-Saharan Africa and South Asia. Two of the three countries with extremely alarming 2012 GHI scores—Burundi and Eritrea—are in Sub-Saharan Africa; the third country is Haiti. Haiti's GHI score fell by about one quarter from 1990 to 2001, but most of this improvement was reversed in subsequent years (see Box 2.3 and country trends in Appendix C). The devastating January 2010 earthquake, although not yet fully captured by the 2012 GHI because of insufficient availability of recent data, pushed Haiti back into the category of “extremely alarming.”

In terms of the GHI components, Burundi, Eritrea, and Haiti currently have the highest proportion of undernourished people—more than 50 percent of the population.⁸ Bangladesh, India, and Timor-Leste

have the highest prevalence of underweight in children under five—more than 40 percent in all three countries. Burkina Faso, Chad, Democratic Republic of Congo, Mali, Sierra Leone, and Somalia have the highest under-five mortality rate, ranging from 17 to 18 percent.

⁴ The “world” includes all developing countries for which the GHI has been calculated; it also includes Afghanistan, Democratic Republic of Congo, Iraq, Myanmar, Papua New Guinea, and Somalia, for which data on child underweight and child mortality are available or could be estimated and provisional estimates of undernourishment were provided by FAO only for the purpose of regional and global aggregation. Because much of the data for these countries is estimated or provisional, country GHI scores were not calculated. As noted earlier, data for some other countries are not available, and most high-income countries are excluded from the GHI calculation.

⁵ The year 1990 was chosen for comparison because it is the reference point for achieving the targets under the Millennium Development Goals.

⁶ For Eastern Europe and the Commonwealth of Independent States, the 1996 GHI score was used for comparison because data are not available to calculate the 1990 score.

⁷ The numbers in this sentence and the previous one refer to the 86 countries for which (1) data for the 1990 and 2012 GHI scores are available and (2) either or both of those scores is greater than 5.

⁸ The Democratic Republic of Congo and Somalia, which are likely to have high proportions of undernourished as well, could not be included in this comparison because of lack of data.

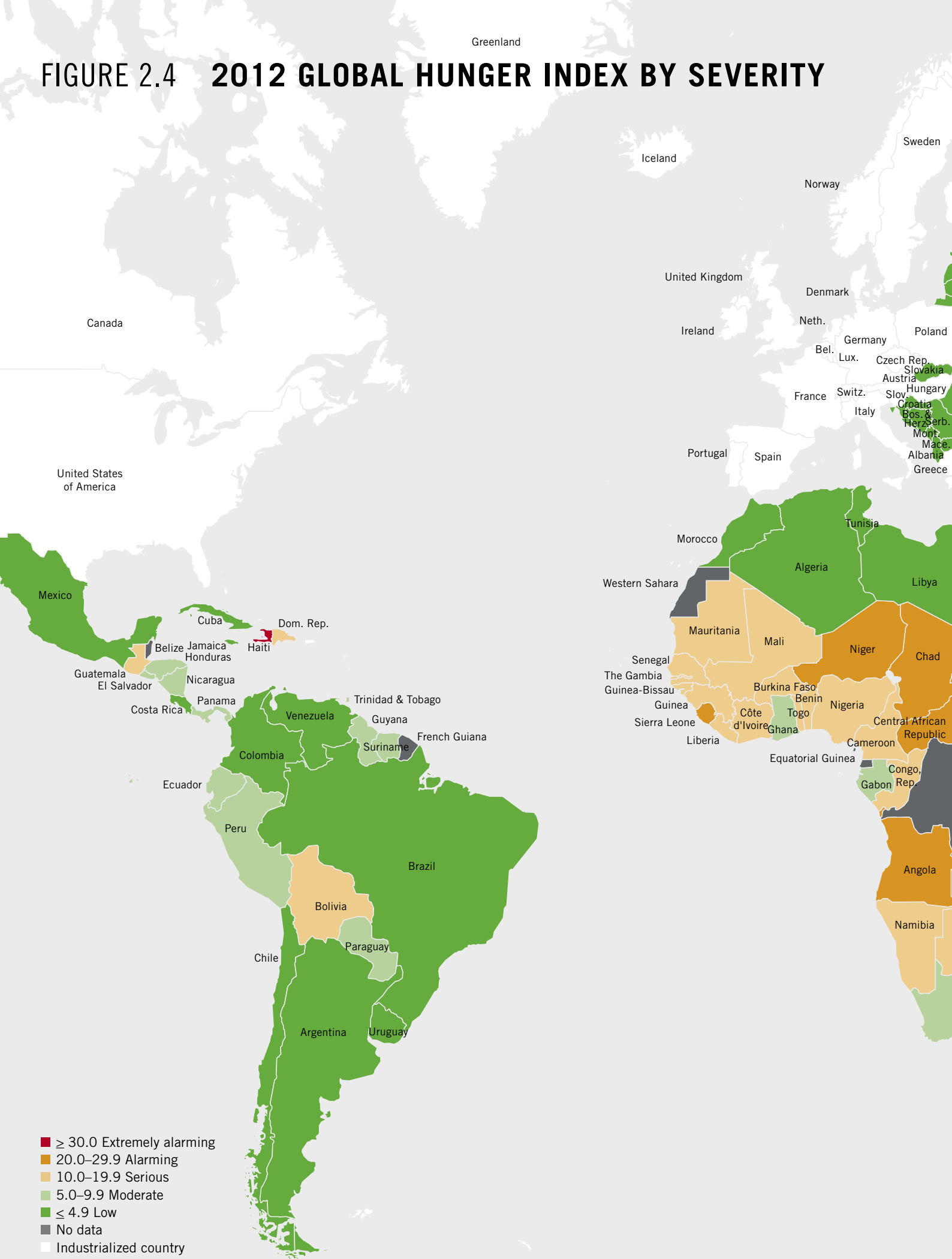
TABLE 2.1 COUNTRY GLOBAL HUNGER INDEX SCORES BY RANK, 1990 GHI, 1996 GHI, 2001 GHI, AND 2012 GHI

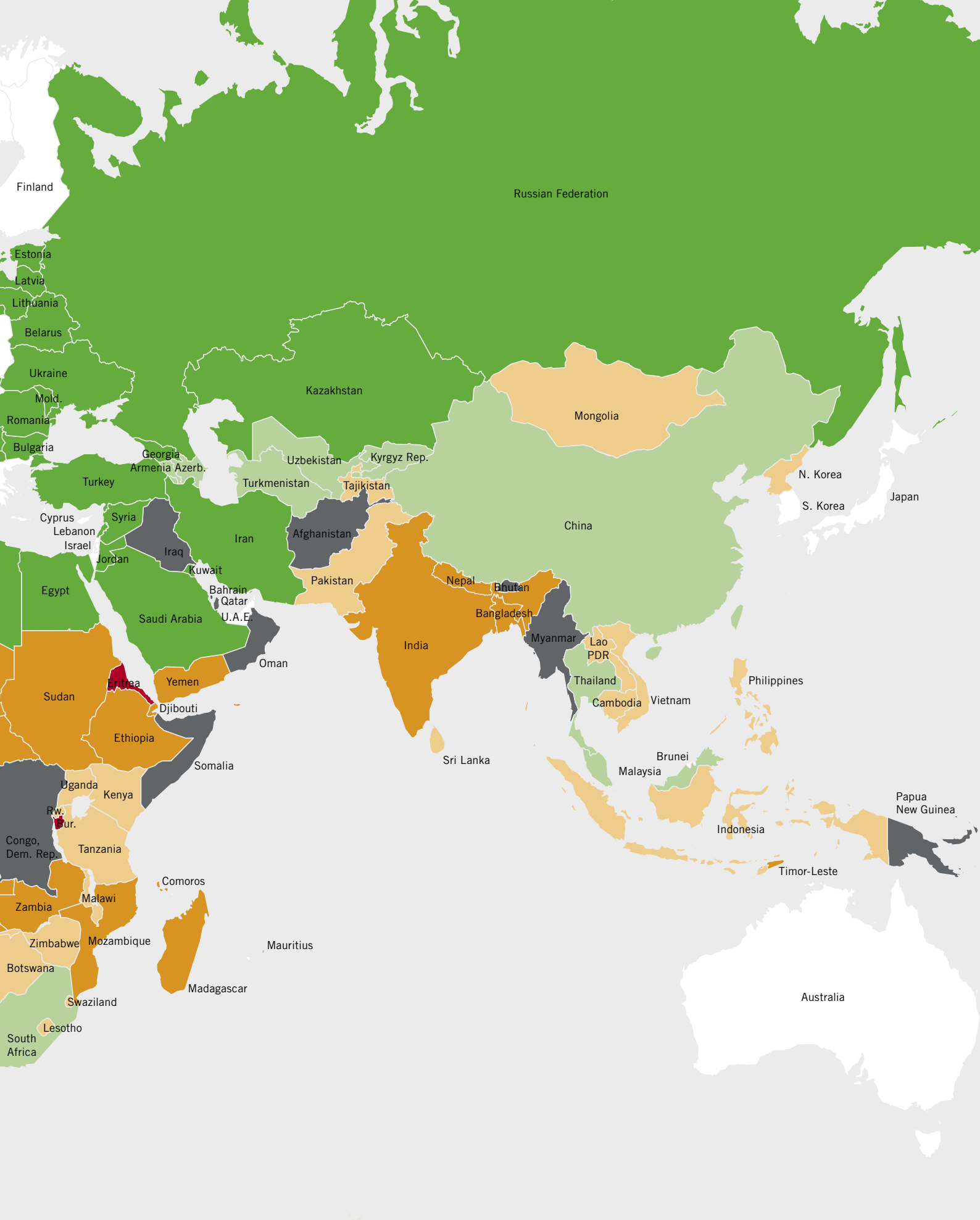
Rank	Country	1990	1996	2001	2012	Rank	Country	1990	1996	2001	2012
1	Azerbaijan	-	14.6	7.8	5.0	56	Cambodia	31.8	31.5	26.0	19.6
2	China	11.8	8.9	6.7	5.1	57	Lao PDR	28.6	25.2	23.6	19.7
3	Malaysia	9.0	6.7	6.6	5.2	57	Pakistan	25.5	21.8	21.7	19.7
4	Paraguay	7.9	5.8	5.4	5.3	57	Rwanda	28.2	32.7	25.6	19.7
4	Trinidad & Tobago	7.1	7.5	6.2	5.3	60	Nepal	26.9	24.4	23.0	20.3
6	Gabon	8.4	6.9	7.2	5.4	61	Sudan	28.7	24.5	25.9	21.5
6	Mauritius	8.0	7.4	6.0	5.4	62	Djibouti	30.8	25.7	25.3	21.7
8	El Salvador	10.1	8.7	5.4	5.7	63	Niger	36.4	35.9	30.5	22.3
9	Kyrgyz Republic	-	9.0	9.0	5.8	64	Madagascar	24.1	23.8	24.9	22.5
9	South Africa	6.9	6.5	7.4	5.8	65	India	30.3	22.6	24.2	22.9
11	Turkmenistan	-	10.0	8.9	6.9	66	Mozambique	35.5	30.7	28.8	23.3
11	Uzbekistan	-	9.0	10.8	6.9	66	Zambia	24.8	25.0	27.2	23.3
13	Panama	10.1	9.7	8.9	7.0	68	Bangladesh	37.9	36.1	27.8	24.0
14	Guyana	14.6	8.9	7.8	7.2	69	Angola	41.9	39.9	33.0	24.1
15	Peru	14.5	10.7	9.0	7.4	70	Yemen, Rep.	29.0	27.6	27.9	24.3
16	Ecuador	13.5	10.8	8.9	7.5	71	Sierra Leone	32.7	30.1	30.1	24.7
17	Honduras	13.5	13.2	10.0	7.7	72	Comoros	22.2	26.9	29.7	25.8
18	Thailand	15.1	11.8	9.2	8.1	73	Central African Rep.	27.4	28.4	27.4	27.3
19	Suriname	10.3	9.3	10.1	8.5	73	Timor-Leste	-	-	26.1	27.3
20	Ghana	21.4	16.3	12.8	8.9	75	Chad	39.3	35.6	30.4	28.3
21	Nicaragua	22.4	17.8	12.3	9.1	76	Ethiopia	42.2	38.6	34.5	28.7
22	Armenia	-	14.3	11.3	9.2	77	Haiti	33.9	32.2	25.8	30.8
23	Dominican Republic	14.2	11.8	10.9	10.0	78	Eritrea	-	37.8	37.8	34.4
24	Swaziland	9.3	12.6	12.9	10.9	79	Burundi	31.6	35.9	38.0	37.1
25	Mauritania	22.6	16.7	16.6	11.1						
26	Vietnam	25.6	21.4	15.5	11.2						
27	Congo, Rep.	23.6	24.1	15.7	11.4						
28	Mongolia	16.5	17.5	14.8	11.7						
29	Lesotho	12.6	13.6	13.9	11.9						
30	Indonesia	18.5	15.4	14.2	12.0						
31	Philippines	19.9	17.6	14.2	12.2						
32	Bolivia	16.9	14.3	12.3	12.3						
33	Guatemala	15.2	15.8	15.1	12.7						
34	Namibia	20.3	19.1	16.3	13.2						
35	Botswana	13.4	15.4	15.7	13.7						
35	Senegal	18.3	19.6	19.2	13.7						
37	Sri Lanka	20.8	18.4	15.2	14.4						
38	Benin	21.3	20.1	16.8	14.6						
39	Gambia, The	16.2	20.1	16.3	15.6						
40	Nigeria	24.1	20.9	18.2	15.7						
41	Tajikistan	-	24.1	24.6	15.8						
42	Uganda	18.7	20.3	17.3	16.1						
43	Mali	27.8	26.3	23.0	16.2						
44	Guinea	22.4	20.0	21.6	16.6						
45	Malawi	29.9	27.5	22.5	16.7						
46	Burkina Faso	23.5	22.4	21.8	17.2						
47	Zimbabwe	18.6	22.3	21.3	17.3						
48	Cameroon	21.6	22.2	19.0	17.4						
49	Côte d'Ivoire	16.5	17.8	16.6	18.2						
50	Guinea-Bissau	20.7	20.8	21.4	18.4						
51	Liberia	22.7	25.2	25.0	18.9						
52	North Korea	15.7	20.1	20.1	19.0						
52	Togo	26.4	22.0	23.3	19.0						
54	Kenya	20.7	20.8	20.4	19.3						
54	Tanzania	23.2	28.0	25.9	19.3						

COUNTRIES WITH 2012 GHI SCORES LESS THAN 5											
Country	'90	'96	'01	'12	Country	'90	'96	'01	'12		
Albania	8.5	5.2	8.2	<5	Latvia	-	<5	<5	<5		
Algeria	6.7	7.3	6.0	<5	Lebanon	<5	<5	<5	<5		
Argentina	<5	<5	<5	<5	Libya	<5	<5	<5	<5		
Belarus	-	<5	<5	<5	Lithuania	-	<5	<5	<5		
Bosnia & Herzegovina	-	<5	<5	<5	Macedonia, FYR	-	<5	<5	<5		
Brazil	7.4	6.4	5.4	<5	Mexico	7.9	5.4	<5	<5		
Bulgaria	<5	<5	<5	<5	Moldova	-	5.7	5.2	<5		
Chile	<5	<5	<5	<5	Montenegro	-			<5		
Colombia	9.2	6.8	5.8	<5	Morocco	7.6	6.8	6.2	<5		
Costa Rica	<5	<5	<5	<5	Romania	<5	<5	<5	<5		
Croatia	-	<5	<5	<5	Russian Federation	-	<5	<5	<5		
Cuba	<5	6.5	<5	<5	Saudi Arabia	6.3	6.2	<5	<5		
Egypt, Arab Rep.	8.0	6.7	5.3	<5	Serbia	-			<5		
Estonia	-	<5	<5	<5	Slovak Republic	-	<5	<5	<5		
Fiji	6.3	<5	<5	<5	Syrian Arab Republic	6.7	5.7	5.4	<5		
Georgia	-	8.7	6.0	<5	Tunisia	<5	<5	<5	<5		
Iran, Islamic Rep.	8.8	7.3	5.1	<5	Turkey	5.7	5.3	<5	<5		
Jamaica	6.7	5.0	<5	<5	Ukraine	-	<5	<5	<5		
Jordan	<5	<5	<5	<5	Uruguay	<5	<5	<5	<5		
Kazakhstan	-	<5	5.4	<5	Venezuela, RB	6.7	7.1	6.4	<5		
Kuwait	9.1	<5	<5	<5							

Note: Ranked according to 2012 GHI scores. Countries with a 2012 GHI score of less than five are not included in the ranking, and differences between their scores are minimal. Countries that have identical 2012 GHI scores are given the same ranking (for example, Paraguay and Trinidad & Tobago both rank fourth). The following countries could not be included owing to lack of data: Afghanistan, Bahrain, Bhutan, Democratic Republic of Congo, Iraq, Myanmar, Oman, Papua New Guinea, Qatar, and Somalia.

FIGURE 2.4 2012 GLOBAL HUNGER INDEX BY SEVERITY





Note: For the 2012 GHI, data on the proportion of undernourished are for 2006–08, data on child underweight are for the latest year in the period 2005–10 for which data are available, and data on child mortality are for 2010. GHI scores were not calculated for countries for which data were not available and for certain countries with very small populations.



“The tight interconnections between water, energy and land make clear that the management of each of them cannot be considered in isolation, but must be seen as part of an **integrated system**.”

SUSTAINABLE FOOD SECURITY UNDER LAND, WATER, AND ENERGY STRESSES

In the pursuit of agricultural and economic growth, natural resource scarcity and degradation have generally been afterthoughts. The rate of consumption growth, even more than population growth, has proven difficult to slow, testing our ability to meet the basic needs of the most vulnerable people (Ehrlich, Kareiva, and Daily 2012) by putting pressure on resources and pricing poor people out of access to these resources.

Recent developments in the land, water, and energy sectors have been wake-up calls. The stark reality is that we need to produce more with less while eliminating wasteful practices and policies. In other words, we need a new socioeconomic model that is sustainable and that prioritizes poor and marginalized people.

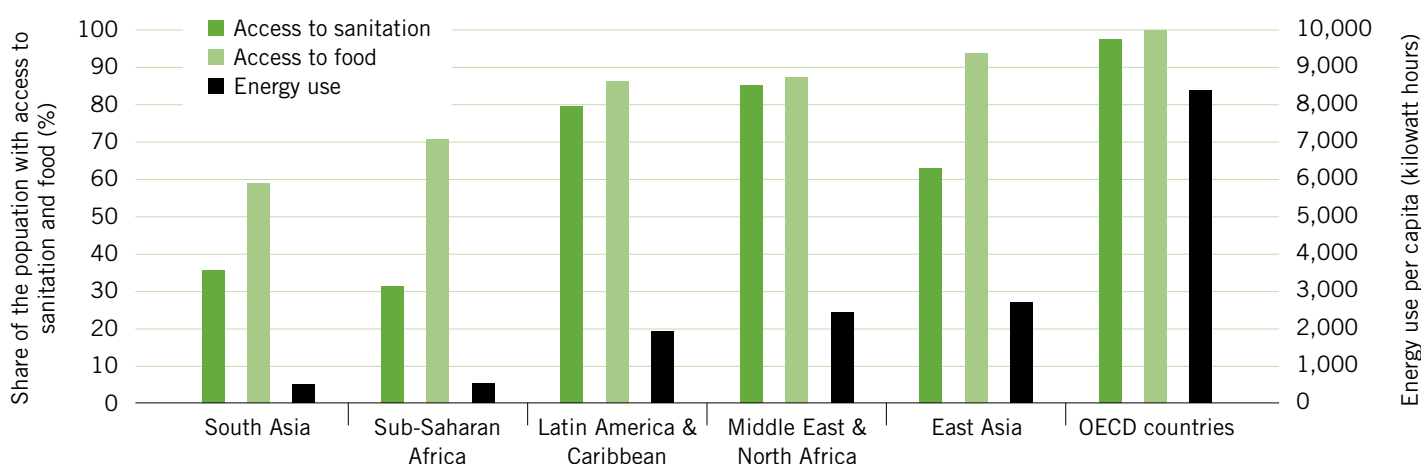
Higher food prices are one signal of the need for a new model. Prices rose by nearly 40 percent in 2007 and further increased in 2008, pushing 130–155 million people into extreme poverty. During this same period the number of children suffering permanent cognitive and physical injury due to malnutrition may have increased by 44 million (World Bank 2009). Food prices flared up again in 2011 as well as in 2012 and are unlikely to decline in the foreseeable future to the levels achieved in the early to mid-1990s. In addition to food price increases, food price volatility increasingly affects poor consumers and producers across the globe (von Grebmer et al. 2011).

The way we use land, water, and energy plays a significant role in the changing global food economy. Partly in response to the food price hikes, the number of international and national agricultural land deals has soared over the past 5–10 years (Anseeuw et al. 2012a, b). Many of the land leases and other agreements have targeted Sub-Saharan Africa, where land rents are cheaper and regula-

tory systems are weaker. Moreover, land deals are found more often in those countries with high GHI values. While demand for land is rising, continued land degradation is posing challenges. Soaring oil prices have also contributed to both higher food prices and the drive for land investments in developing countries, particularly for the production of first-generation biofuels (Anseeuw et al. 2012b). Rapid growth in domestic and industrial water demand—as a result of population and economic growth, increased urbanization, and associated, changing lifestyles—as well as changing climate, increased variability in rainfall patterns, and rapidly growing water pollution levels, have increased water scarcity across much of the developing world, especially in emerging countries (Rosegrant, Ringler, and Zhu 2009). Water pollution and poor access to sanitation, especially in Sub-Saharan Africa and South Asia, contribute to the contamination of food and drinking water and lead to diarrheal disease, a major source of childhood illness and death in the developing world. The need for increased investment to achieve water security has, for example, been recognized by China, which plans to invest an unprecedented US\$630 billion in water conservation over the next 10 years (Huang 2012).

As a result of economic and population growth, wealthier populations in the developed and increasingly the developing world are juxtaposed with nearly 1 billion food-insecure people and 2 billion people suffering from micronutrient deficiencies. High levels of hunger are generally found in those countries and regions where access and property rights to water and land are limited or contested and where modern energy sources and access to sanitation are underdeveloped (see Figure 3.1).

FIGURE 3.1 ENERGY USE AND ACCESS TO SANITATION AND FOOD BY REGION

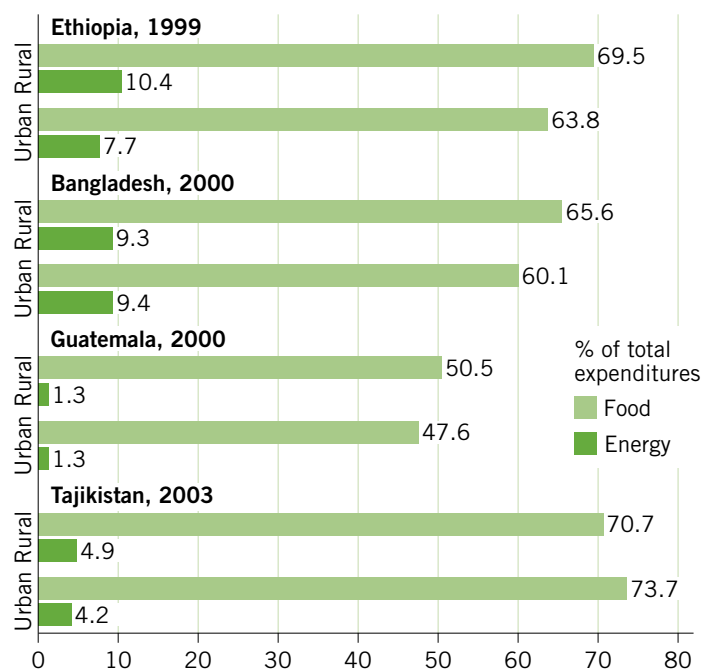


Sources: Access to food: based on child malnutrition levels calculated from IFPRI's International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) (Rosegrant et al. 2008b); access to sanitation and energy use: World Bank (2011b).

Energy use is particularly low in Sub-Saharan Africa and South Asia, where people still make heavy use of traditional biomass, such as fuelwood, cow dung, and crop residues. In Sub-Saharan Africa, almost 70 percent of people rely on wood (and its by-products) as their primary cooking fuel (Legros et al. 2009). Although the poorest people spend relatively little on energy (Figure 3.2), in part because of poor access, their use of traditional energy has other costs in terms of their time, health, and environment. Collection of fuelwood, for example, constitutes a major time burden for women and children, particularly in Sub-Saharan Africa. Indoor air pollution from the burning of biomass contributes to the death of nearly 2 million people annually, particularly women and children (Martin et al. 2011; von Braun 2007). Overall, according to the Foresight report, demand for energy is projected to increase by 45 percent between 2006 and 2030 and could double between now and 2050 (Foresight 2011).

As a result of increasing natural resource scarcity, sustainable food security is now inextricably linked to developments in the water, energy, and land sectors (Figure 3.3). Pressures on these sectors for nonfood uses, from biofuel mandates and urban and industrial development, as well as uncoordinated, injudicious use of these natural resources, will directly affect the food security of the poor and most vulnerable.

FIGURE 3.2 POOR PEOPLE'S SPENDING ON FOOD AND ENERGY



Source: von Braun (2007), based on Ahmed et al. (2007).
Notes: These data reflect spending by people living on less than US\$1.08 a day. Energy costs include cooking, lighting, and heating fuels.

FIGURE 3.3 HOW WATER, ENERGY, AND LAND POLICIES CAN THREATEN SUSTAINABLE FOOD SECURITY

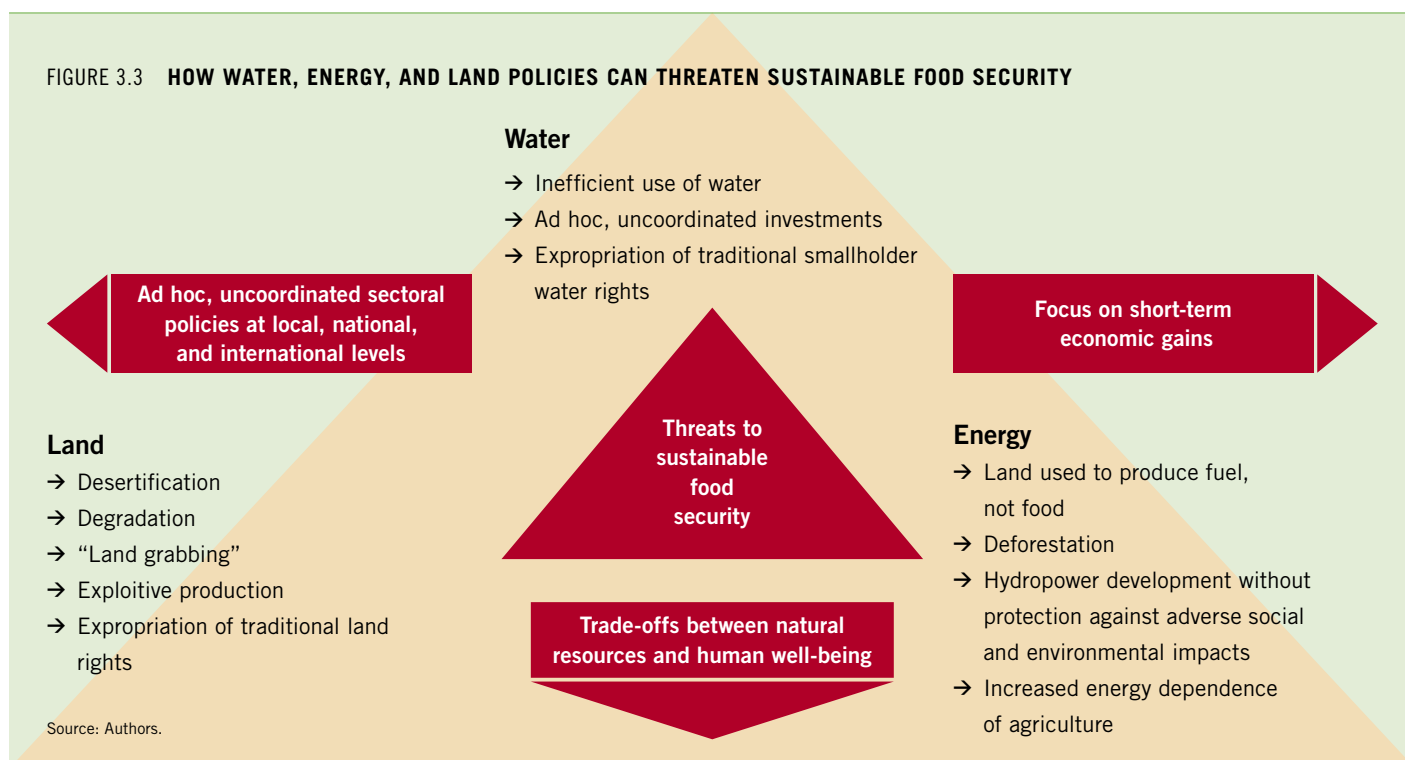
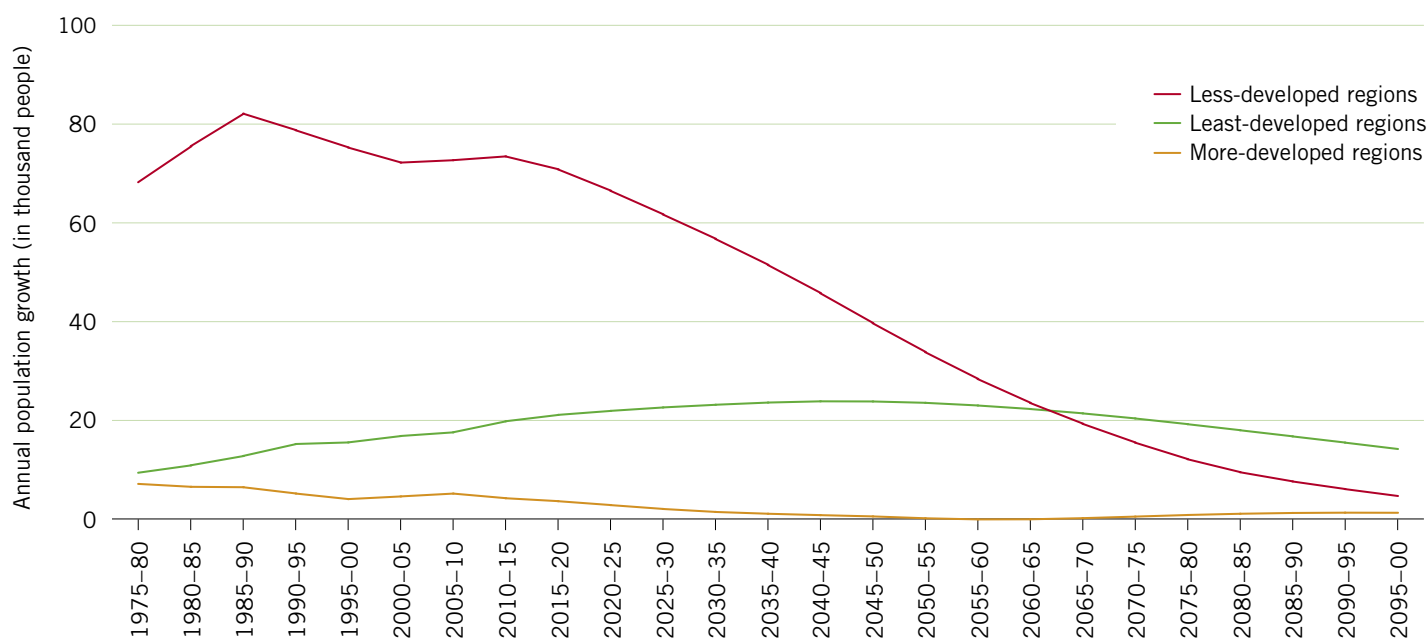


FIGURE 3.4 PAST AND PROJECTED POPULATION GROWTH, 1975–2100



Note: More-developed regions comprise Europe, North America, Australia/New Zealand, and Japan. Less-developed regions comprise all regions of Africa, Asia (excluding Japan), and Latin America and the Caribbean, plus Melanesia, Micronesia, and Polynesia. The least-developed countries include 33 countries in Africa, 9 in Asia, 5 in Oceania, and 1 in Latin America and the Caribbean. Source: Authors, based on UN (2011).

Contributors to Natural Resource Scarcity

DEMOGRAPHIC CHANGES. According to the United Nations medium variant⁹ scenario, the world’s population is expected to reach more than 8 billion by 2025 and more than 9 billion by 2050 (UN 2011). This increase occurs in the midst of major demographic changes. Fertility has declined rapidly in recent decades in most low- and middle-income countries. Total fertility rates are converging toward replacement level—that is, the rate at which population growth through reproduction will be approximately zero—except in 35 countries, mainly in Sub-Saharan Africa (World Bank 2007). In countries where fertility has declined significantly¹⁰ and mortality rates have fallen, population growth has slowed and the population has become older. However, countries where the population is still growing rapidly, mainly in Sub-Saharan Africa and parts of Asia, will face significant challenges because of expanding demand for public services, goods (such as food and clothing), and investments in education and health. Countries will need to increase such investments as the population increases, making it difficult for them to invest in other key sectors such as agriculture (World Bank 2007).

Almost all of the additional population will live in the group of “less-developed” countries (Figure 3.4). Strong income growth in many of these countries will drive the shift in diets toward more protein-rich and more resource-demanding commodities (such as meat and milk). Those countries with growing populations and limited ability to increase domestic production in line with growing demand, particularly in the Middle East and Africa, will experience an increase in demand for imported staples and high-value agricultural commodities.

In addition to population growth, migration from rural to urban areas in developing countries will have significant effects on food consumption patterns. About 52 percent of the world’s population currently lives in urban areas; by 2050, 67 percent will live in cities (UN 2011). When people move to urban areas, they tend to eat fewer basic staples and more fruits, livestock products, and cereals requiring less preparation. It will be a challenge to meet this demand in a sustainable manner (Tokgoz and Rosegrant 2011).

HIGHER INCOMES AND UNSUSTAINABLE RESOURCE CONSUMPTION. Rapid economic growth in some developing countries over the past several decades is supporting the emergence of a relatively wealthy, generally urban middle class, estimated at 2 billion people (Court and Narasimhan 2010). While economic progress is laudable, its impacts on natural resource use are substantial. Wealthier, more urbanized populations have transitioned toward more diversified diets, increasing their consumption of not only meat, but also vegetables and sugars—all of which require much more water and energy per unit of calorie produced. The lifestyles in industrialized countries are particularly characterized by overuse of both renewable and fossil resources.

Moreover, the benefits of economic growth have not reached everyone: even though global poverty levels have declined overall, the number of people living on between \$1.25 and \$2 a day nearly doubled between 1981 and 2008: from 648 million to 1.18 billion. The rate of growth in the number of people earning more than \$2 a day has slowed (Chen and Ravallion 2012). In some countries and regions, these poor are trapped in downward spirals of abject poverty, low prospects for economic activity, and unavailable or degraded natural resources.

POOR POLICIES AND WEAK INSTITUTIONS. Demographic change and economic growth are the fundamental drivers of natural resource scarcity, but the future of land, water, and energy security will be decided by agricultural, climate, energy, science, and trade policies and institutions (Ringler, Biswas, and Cline 2010). One policy area—biofuels—is briefly discussed to highlight the much broader issues behind this topic.

A number of factors have driven interest in biofuels as a renewable energy source. These include higher energy prices stemming from increased demand for energy, concerns about climate change, the desire to reduce dependence on imported energy sources, and the potential for rural growth and employment generation (Ewing et al. 2010; Kammen 2006). Biofuel policies have, however, resulted in increased pressure on land and water. Given that biofuels are not yet economically viable, biofuel policies typically include significant tax breaks for biofuel refineries combined with subsidies for feedstock and consumption targets or mandates for biofuels in the transportation sector. These mandates have resulted in large-scale investment in biofuels and expansion of crop area to produce biofuel crops. If these biofuel mandates were met through domestically grown feedstocks alone, they would require 30 percent of US agricultural area to be dedicated to produce fuel for transportation; in Europe, the share would be 72 percent (Ewing et al. 2010). The increased biofuel demand during 2000–2007, compared with previous rates of growth, is estimated to have accounted for 30 percent of the increase in weighted average grain prices during this period, resulting in a significant increase in the number of malnourished children (Rosegrant 2008; Rosegrant et al. 2008a). Moreover, the actu-

al net carbon savings of first-generation biofuels have been questioned, particularly when production-induced land use changes are considered (Searchinger et al. 2008), and impacts on both water quantity and quality, which can be significant, are growing (Moraes, Ringler, and Cai 2011).

Evidence of Natural Resource Scarcity

ENERGY. Global energy prices have increased significantly in recent years and are projected to continue to rise, albeit more slowly. If current policies continue, the International Energy Agency projects an increase in real crude oil prices from US\$78 a barrel in 2010 to US\$140 by 2035. This represents a 2.4 percent annual increase. If aggressive investments in alternative energy fuels were to be made, oil price increases would be somewhat lower (IEA 2011).

Rising energy prices affect agriculture in several ways. Higher energy prices make biofuels more profitable, increasing the demand for agricultural land to be converted to the production of biofuel crops. At the same time, rising energy prices raise farmers' costs, especially given that the agriculture sector has become more energy intensive. For example, farmers use diesel fuel and gasoline for tillage, planting, transportation, and harvesting. They use electricity, liquefied petroleum, gasoline, and natural gas to irrigate fields; operate livestock, poultry, and dairy facilities; and process and store perishable commodities (USDA 2006). Another important energy cost component is fertilizer use. According to Pimentel (2006), conventional agricultural production in the United States uses approximately 1,000 liters of fossil energy per hectare, divided approximately equally among petroleum-based fertilizers, mechanization, and other activities and inputs, such as pesticides. More broadly, the price of energy influences the prices of inputs, water, and transportation and marketing, all affecting agricultural production and food prices.

The share of energy in farmers' costs varies significantly within and between countries. Among the crops grown in the United States, the share of energy in total operating costs ranged from about 55 percent for wheat to about 20 percent for cotton in 2004 (USDA 2006). Energy accounts for a smaller share of farmers' costs in developing countries, but that share is rising as agricultural activities in those countries increase their use of technology and become more mechanized. In Vietnam, for example, energy accounted for 18 percent of total operating costs for maize in 2000 (IFPRI 2001). Newer estimates will likely show larger energy contributions to total production cost.

Because of rising energy costs, agriculture-intensive producers will see their cost of producing, transporting, and processing agricultural commodities rise. Higher energy prices will induce farmers to shift to less energy-intensive crops. At the same time, energy-saving agricultural practices such as conservation tillage, low-water-pressure and low-water-use irrigation, and improved fertilizer management will become more profitable.

Energy prices will also affect how water resources are used. It will become more expensive to extract and convey irrigation water—particularly using pump irrigation—and to desalinate seawater for drinking and household use. The higher cost of obtaining water will create incentives to develop more efficient mechanisms for allocating water and to reduce water losses, leaks, and runoff. Government subsidies for water and energy services and fertilizers will become increasingly expensive and may become fiscally unsustainable for many developing countries. This situation could provide incentives for reforming water policies and reducing subsidies. To date, however, there is little evidence of such reform. Higher energy prices also drive higher demand for hydroelectric power—often with positive impacts for domestic, industrial, and irrigation uses, but also with adverse social and ecological effects, such as resettlements and loss of fish and other freshwater ecosystem services.

LAND. Globally, agriculture occurs within a context of land scarcity, both because the world’s best arable land is already under cultivation and because agricultural practices have led to the degradation of significant amounts of farmland. At the same time, the rising demand for nonfood products (feed, fuel, and fiber) is putting additional pressure on agricultural production and on land use.

Cultivated systems¹¹ cover 25 percent of the globe’s terrestrial surface. A 10–20 percent increase in current crop area and pastureland may be needed to meet growing food demand. This increase would come mainly from grassland and forestland (Millennium Ecosystem Assessment 2005a, b). Demand for nonfood agricultural products could push the need for land significantly higher. Such an expansion will have both direct and indirect impacts on other ecosystems and particularly on biodiversity. Intensification—that is, practices that allow for greater output from a given amount of land—will be key to minimizing the conversion of natural land to cropland and thereby preserving terrestrial biodiversity. At the same time, if poorly managed, intensification can increase runoff of fertilizers and pesticides into water bodies, adversely affecting public health and inland and coastal aquatic ecosystems.

Unsustainable agricultural practices have already resulted in land degradation, including desertification, deforestation, salinization, and soil erosion. The causes underlying these forms of land degradation include high population density, poverty, lack of land tenure, and lack of access to extension services and other forms of knowledge, infrastructure, and markets (Nkonya et al. 2011). Distortionary trade policies, output price policies, and input subsidies, particularly for water and fertilizer, have also contributed to degradation.

One way of assessing land degradation is to measure the loss of net primary production—essentially, the decline in vegetative vigor.¹² Figure 3.5 shows the loss of net primary production from 1981 to



Tomnissoi Davlat

District Baljuvon, Tajikistan

“This year, I only harvested 500 kilograms of wheat per hectare. I sowed my seeds too late because fuel prices rose sharply at the beginning of spring.... Once I had enough money for fuel and plowing services, it was too late.”



Robert Mugabe

Kabarole District, Uganda

“I have no income. I only have a couple of acres to cultivate maize, cabbage, beans, tomatoes, and onions. At the same time I have to care for my mother and sister. So the increasing prices made it very stressful for me to buy paraffin and firewood. But I’m working hard and selling some of my products.... The most important thing is that we have enough to eat. So we are saving on energy. Instead of using four paraffin lamps to light the house, we now use only one.”

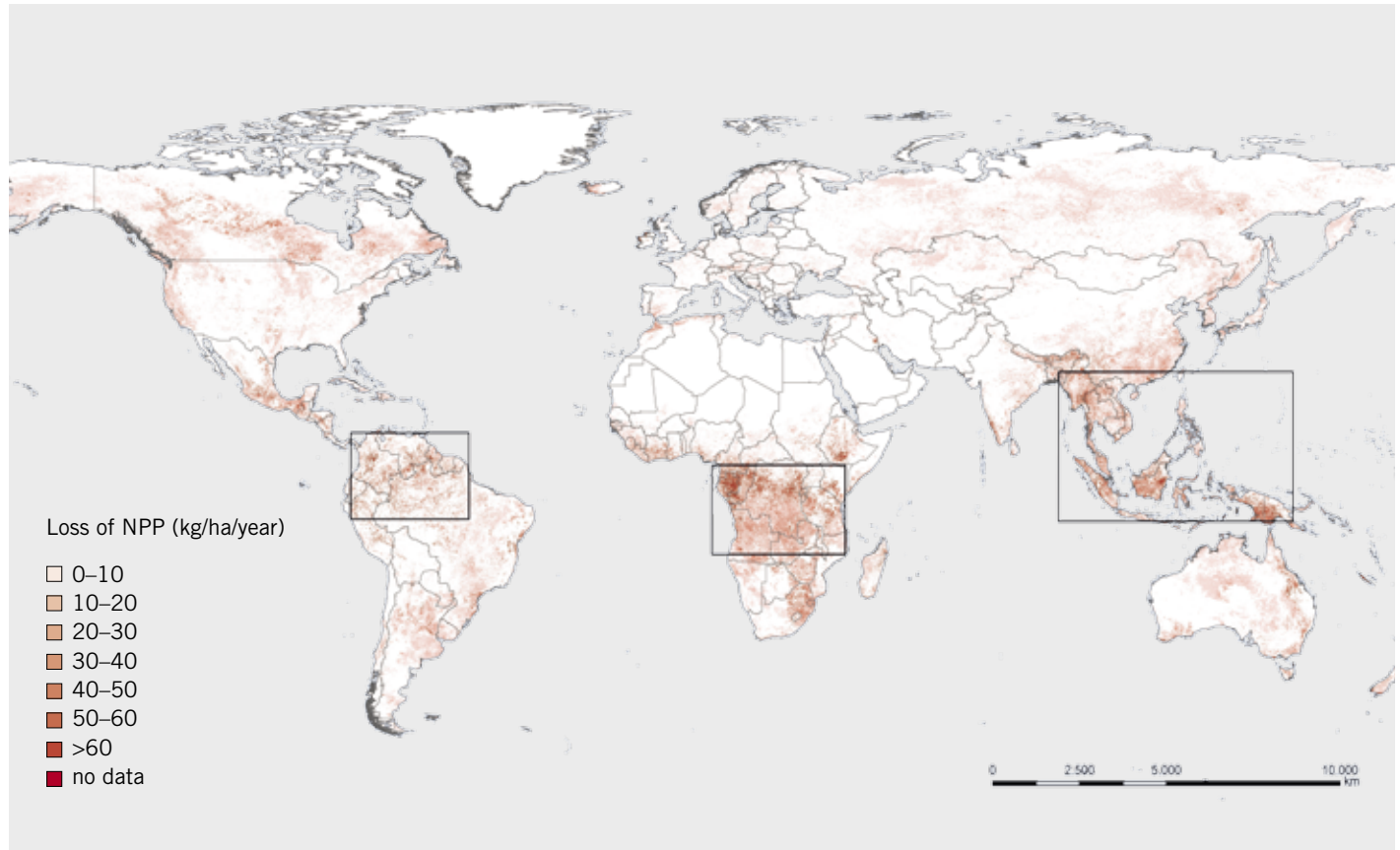


Fulmani Mandi

Jharkhand, India

“I am very worried about my children’s future. Now we have 2.5 acres of land. I have three sons. When they divide the land, each one of them will get only 0.8 acre, which is of no use. I don’t know how they will survive.”

FIGURE 3.5 LOSS OF ANNUAL NET PRIMARY PRODUCTION, 1981–2003



Source: Nkonya et al. (2011), based on data from Bai et al. (2008).
 Note: The boxes on the map outline key areas of land degradation.

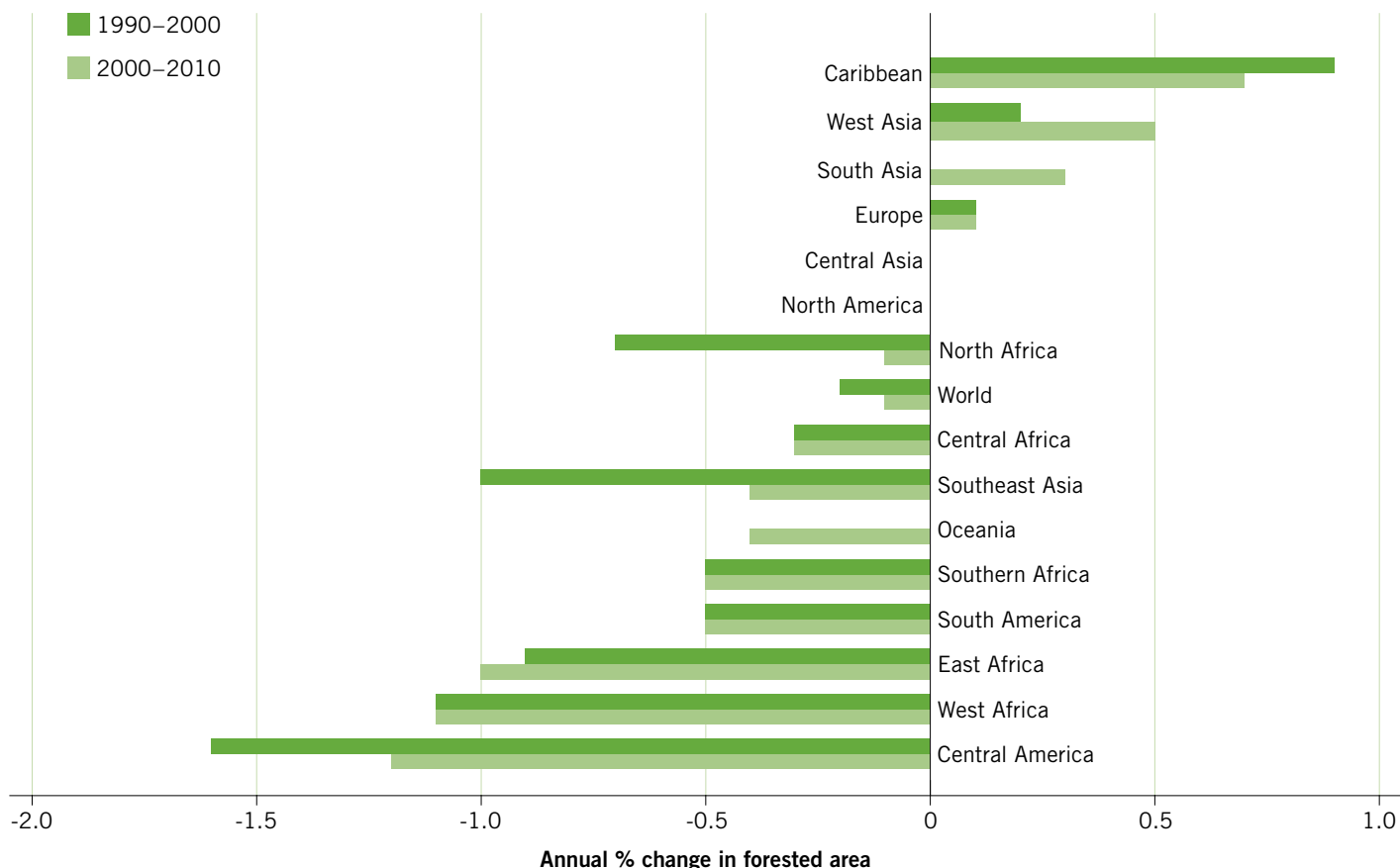
2003. Substantial degradation has occurred in most parts of the world. Past efforts to combat land degradation have often focused on drylands, where degradation causes desertification. However, the highest rate of degradation took place in humid and subhumid areas (marked by rectangles in Figure 3.5), which accounted for 78 percent of land degradation over this period (Nkonya et al. 2011). The immediate causes of land degradation include biophysical causes, including topography, which determines soil erosion hazard, and climatic conditions, such as rainfall, wind, and temperature. Unsustainable land management, such as deforestation, forest degradation, soil nutrient mining, and cultivation on steep slopes, also contributes directly to land degradation.

For agricultural producers, farm-level land degradation can lower crop yields and raise production costs because farmers need to apply more fertilizers and other inputs to offset yield losses. Degradation can also have off-site costs in the form of excessive runoff of fertilizers and pesticides, siltation of dams and irrigation systems,

eutrophication of lakes and oceans, and damage to mangrove swamps that support rich fisheries and provide many ecosystem services such as water filtration and prevention of erosion (Rosegrant, Nkonya, and Valmonte-Santos 2009).

Forests have important rainfall-regulating functions. Tropical forests can soak up storm water and then release it slowly, reducing flood and drought cycles. Water-regulating functions are particularly important in upper watersheds, where forests also help reduce soil erosion and thus prevent river sedimentation. Despite these and other important ecosystem functions, deforestation has also been significant in much of the world, as shown in Figure 3.6. The most serious deforestation has taken place in Africa and Central and South America. Some good news is also evident: reforestation is occurring in East, South, and West Asia and in the Caribbean. China has led the way in East Asia, with aggressive policies supporting reforestation. However, deforestation has accelerated in Southeast Asia.

FIGURE 3.6 CHANGE IN FORESTED AREA BY REGION, 1990–2010



Source: Computed by Ephraim Nkonya, IFPRI, based on FAO (2011c).

One outcome of the scarcity and degradation of farmland is the growing number of deals giving land-scarce or resource-demanding countries access to farmland in land-abundant countries. Of the approximately 1,000 international land deals (many of which are implemented with national partners) recorded as of May 2012, 46 percent targeted land in Sub-Saharan Africa and 37 percent land in Asia (International Land Coalition 2012). Among the 665 international land investments that report a specific crop, 55 percent relate to biofuel production, 19 percent to forestry products for wood and fiber and flowers, and the remainder to food production. Altogether, as of May 2012, the recorded deals affected 57 million hectares of agricultural land, or 1.2 percent of global agricultural area (International Land Coalition 2012). It is important to note that foreign investment in land also has important implications for local water availability and use (Anseeuw et al. 2012a).

Figure 3.7 presents the size of land deals as a share of agricultural area for 52 target countries, relative to the importance of agriculture in each country and its GHI score. Four countries where

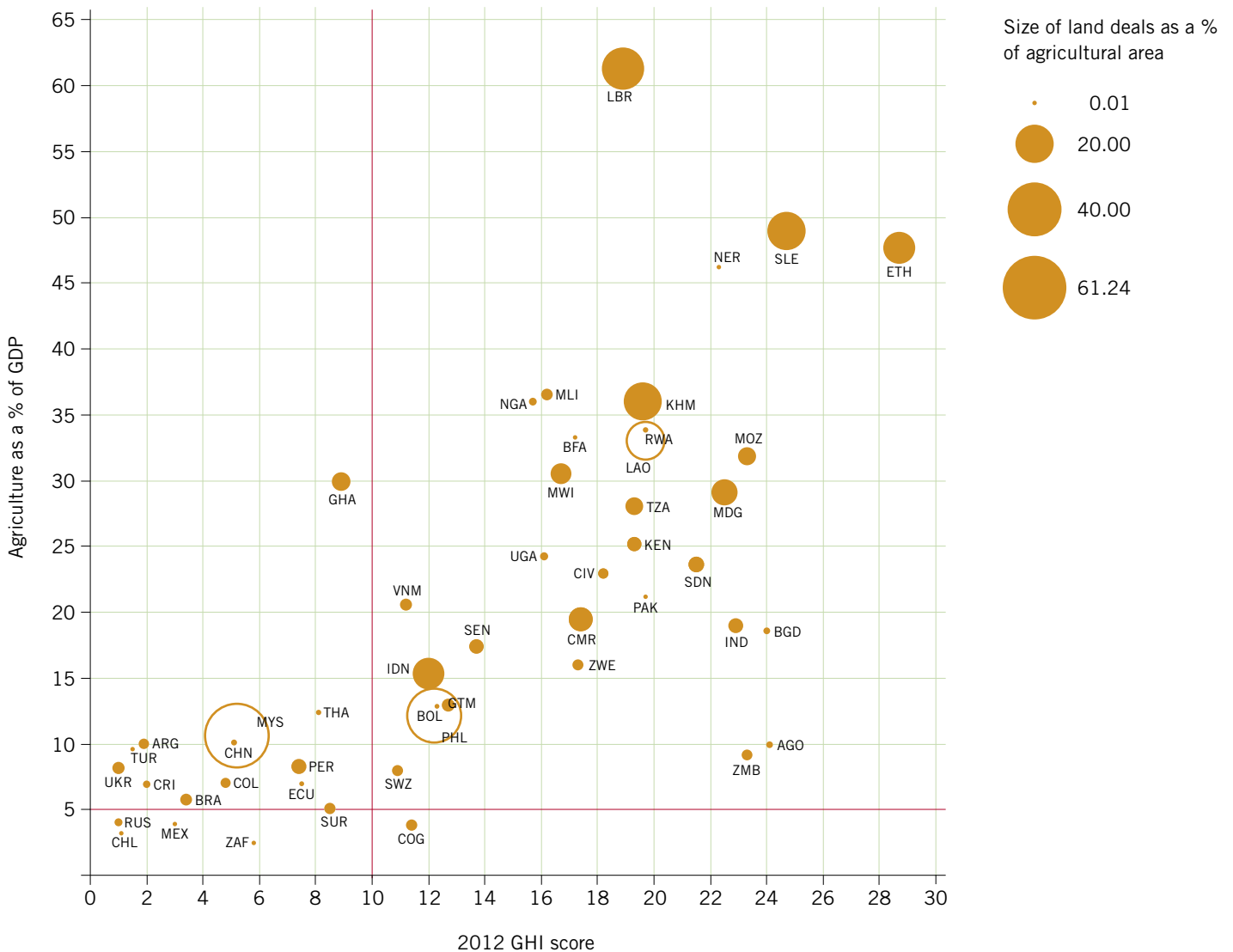
agriculture accounts for a small share of gross domestic product (GDP) (less than 5 percent) and where hunger is low or moderate (a GHI score of less than 10) received land investments affecting about 1.2 million hectares. In contrast, 32 countries where agriculture accounts for a higher share of GDP (more than 5 percent) and hunger is serious or alarming (a GHI score of more than 10) received investments affecting about 41 million hectares, accounting for the bulk of the total investment—73 percent. Thus, the majority of international land deals to date have occurred in those countries that experience higher levels of hunger and where the population and national incomes depend heavily on agriculture. In 17 of those, international land deals account for more than 5 percent of current agricultural area, and in 7 countries, land deals account for more than 10 percent of total agricultural area: Cambodia, Ethiopia, Indonesia, Lao PDR, Liberia, the Philippines, and Sierra Leone. Out of the 245 land deals in these seven countries where the commodity grown is known, 75 deals or 31 percent are for trees, including acacia, euca-

lyptus, rubber, and flowers; 112 deals or 46 percent of all investments with known crops relate to biofuels; and the remainder are for other agricultural commodities.

Research to date reveals high social and environmental risks of such investments, while the promised benefits often fail to materialize (see also case studies in Chapter 4). Both anecdotal and emerging case study evidence has shown that local and national land rights systems in most of these countries remain weak; as a result, local communities that once used some of the land acquired by foreign governments and companies have lost their traditional or customary rights.

One country, Republic of Congo, has a high GHI score, a low share of agricultural GDP (less than 5 percent) and limited international land investment (approximately 100,000 hectares); 13 countries have a low GHI score partnered with agricultural GDP greater than 5 percent, accounting for 25 percent of total land investment areas. This group includes such agricultural heavyweights as Argentina, Brazil, and China, as well as Malaysia, which accounts for the largest number of land deals as a share of national agricultural area. Other countries in this group with investments greater than 500,000 hectares include Ghana, Peru, and Ukraine.

FIGURE 3.7 TYPOLOGY OF LAND ACQUISITIONS ACCORDING TO 2012 GHI SCORE AND AGRICULTURAL GDP



Source: Anseeuw et al. (2012b).

WATER. Currently, 36 percent of the global population—approximately 2.4 billion people—live in water-scarce regions, and 22 percent of the world's GDP (US\$9.4 trillion at 2000 prices) is produced in water-scarce areas. Moreover, 39 percent of global grain production is unsustainable in terms of water use (Ringler et al. 2011), and 1.4 billion people live in areas with sinking groundwater levels (FAO 2009).

Water resources are distributed unequally across the globe, generally not in proportion to respective populations or land areas. For example, in 2005 per capita water availability in the most populous countries—China and India—was fairly low, at 1,691 and 1,101 cubic meters, respectively. In contrast, per capita water availability in Brazil (ranked fifth in terms of population) was 32,525 cubic meters and in Russia (ranked seventh in terms of population), 28,259 cubic meters. As a result of demographic changes in China and India, water availability is expected to further decline to 1,507 and 856 cubic meters per capita respectively by 2030, but subnational variations will be much larger.¹³ Falkenmark, Lundqvist and Widstrand (1989) suggest that per capita annual water availability of less than 1,000 cubic meters limits economic development and human health and well-being, and availability of less than 500 cubic meters, experienced in much of the Middle East and North Africa, constitutes a major constraint to life.

Agriculture consumes 80 percent of the world's "blue water" from rivers and aquifers, and is therefore both vulnerable to water scarcity and a contributor to it (Rosegrant, Cai, and Cline 2002). Water scarcity is exacerbated by climate change, especially in the driest areas of the world, which are home to more than 2 billion people and to half of all poor people. Moreover, increased flooding as a result of climate change and environmental degradation threatens agriculture in many parts of the world.

Besides population growth, other factors affect current and future global water use. Economic growth, for example, increases demand for water by households, industries, and farmers. Urbanization is associated with more water-intensive diets (meats, milk, vegetables, and sugars). Higher energy prices raise the cost of pumping water for irrigation and increase demand for hydropower. Climate change is raising temperatures and changing precipitation patterns, directly increasing demand and reducing availability of water for both rainfed and irrigated agriculture across the world.

Potential for growth in water supplies is limited, but domestic and industrial demand for water is growing rapidly. As a result, water is being transferred from agriculture to domestic and industrial uses (Rosegrant, Cai, and Cline 2002). This transfer will make irrigation water scarcer in rapidly growing, less-developed countries, and particularly in China and some countries in the Middle East and North Africa. By 2050 only 66 percent of irrigation water demands can likely be met, down from 78 percent in 2000. The decline will be much

steeper in water-scarce basins (Rosegrant, Ringler, and Zhu 2009). Thus, current levels of water productivity, under a scenario of medium economic growth, will not be sufficient to ensure sustainability and reduce risks to people, food systems, and economies. By 2050, it is projected that under "business as usual" 52 percent of the global population (4.8 billion people), 49 percent of global grain production, and 45 percent of total GDP (US\$63 trillion at 2000 prices) will be at risk due to water stress. This water stress will likely affect key investment decisions; increase operational costs in the water, energy, and food sectors; and affect the competitiveness of water-scarce regions (Ringler et al. 2011).

CLIMATE CHANGE. Agriculture, particularly rainfed systems in Africa and irrigated systems in Asia, is extremely vulnerable to the adverse impacts of climate change (ADB/IFPRI 2009; Nelson et al. 2009a; Nelson et al. 2010). FAO estimates that by 2085, climate change could result in the loss of 11 percent of arable land in developing countries. For Africa, the estimate is far higher (FAO 2012).

Higher temperatures reduce crop yields in much of the world while encouraging the proliferation of weeds, plant diseases, and pests. Changes in precipitation patterns shift growing seasons and increase the likelihood of crop failure in the short run and production declines in the long run. Although climate change could lead to gains in yields and cultivated area for some crops and in some regions, the overall impacts on agricultural production are projected to be highly negative, with increasing food prices intensifying the risk of hunger.

According to Parry et al. (2009), the number of people at risk of hunger is projected to increase by 10–20 percent by 2050 because of climate change. IFPRI IMPACT projections show increases in the number of malnourished children of up to 21 percent by 2050 as a



Kaseija Jailesi and Irene Kaseija

Kabarole District,
Uganda

“Already now it is difficult to reach the wells, as you have to cross people's land to reach them. That is prohibited though, and many landowners even fence in their land. With the worsening of the land situation, the water situation will become more difficult.”

result of climate change (Nelson et al. 2009a). Because the impact of climate change on child malnutrition is projected to be greatest in Sub-Saharan Africa, efforts to improve the various dimensions of the GHI need to be particularly strengthened there.

At the same time, agriculture contributes 9 percent to global greenhouse gas emissions. If land use change and deforestation, which are linked directly to agriculture, are added, the total contribution increases to 17 percent of global emissions (WRI 2010). Three-quarters of all agricultural emissions stem from developing countries. Thus, the task at hand will be to identify those interventions that reduce the adverse impacts of climate change on agriculture and at the same time reduce agriculture's carbon footprint.

ALTERNATIVE PATHWAYS UNDER GROWING NATURAL RESOURCE SCARCITY

Over the next four decades, agricultural production will need to increase substantially to meet the demands of a growing and increasingly wealthy population. With current levels of investment and economic development, however, projected production increases can be achieved only at much higher prices. An alternative vision or model for development would seek not only to increase future production, but also to achieve better outcomes for the poor and pay more attention to sustainability, reducing adverse environmental impacts. Future demand could be lowered somewhat by more resource-conserving lifestyle choices and a move away from first-generation technologies for large-scale production of biofuels, for example, but the need to produce more with less—and to do so more sustainably and in a manner that prioritizes the poor—will remain.

To assess the relative impact of two alternative development pathways in 2030 and 2050, IFPRI modeled the future world food system under two scenarios:

1. The Conventional World scenario (as shown in Figure 3.3 on page 24) reflects a continuation of recent trends in population and economic growth and other variables, including limited investment in agricultural research and thus in land, water, and energy efficiency. First-generation biofuel development continues following set mandates. Moreover, greenhouse gas emissions rapidly increase, water scarcity grows, and hunger and malnutrition remain serious problems in developing countries (Nelson et al. 2010; Rosegrant et al. 2008a).

2. The Sustainable World scenario (as shown in Figure 5.1 on page 47) focuses on increased agricultural research and development spending in developing countries, coupled with increased social investments and more judicious use of natural resources to sustainably improve rural livelihoods and incomes.¹⁴

The Sustainable World scenario postulates an increased focus on the conservation of water, land, and energy resources through more investment in technologies and more efficient resource use. It focuses on those investments that reduce hunger and malnutrition, such as enhanced crop yields and livestock growth and increased investments in sanitation and female secondary education. Other factors are also crucial for better outcomes for the poor and the environment, including improved governance, reduced inequality and greater inclusion of marginalized social groups.¹⁵ Compared with the Conventional World, this scenario includes both higher economic growth and lower population growth (using the UN low-variant projection of population growth) (see also Nelson et al. 2010). Moreover, the scenario projects rapid increases in water productivity and agricultural growth with increased efficiency in the use of research, among other things, as a result of spillover effects. As a result, by 2030, grain yields are 15 percent greater than in the Conventional World scenario, and by 2050, they are 35 percent larger. Livestock yields and herd size increase by 30 percent from 2015 to 2050 compared with the Conventional World Scenario. Moreover, there is a more aggressive move toward second-generation biofuel development. The Sustainable World scenario also meets a climate change target of no more than a 2°C rise in temperature. Increased investments help ensure that all girls have access to secondary schooling by 2030 and all people have access to safe drinking water by 2050.

These two development pathways have significantly different results for land and water. Under the Conventional World scenario, total harvested crop area is expected to grow globally at 0.23 percent a year, or 169 million hectares in total, during the period 2005–2050. The contractions in crop area in some industrial and Asian countries are more than offset by increases in Sub-Saharan Africa and Latin America. Much of the area expansion, however, will come from marginal and forest areas. In the Sustainable World scenario, important forest areas can be preserved as crop area contracts by 116 million hectares by 2030, and by 201 million hectares by 2050. Furthermore, total water withdrawals are 544 cubic kilometers lower by 2030, and 1,369 cubic kilometers below Conventional World levels by 2050. This scenario thus releases large resources for important domestic and environmental water needs.

The two scenarios also have divergent results for food prices and nutrition. As a result of very high agricultural productivity growth in the Sustainable World scenario, average cereal prices are 21 percent lower by 2030 and 39 percent lower by 2050 compared with the Conventional World scenario. Significantly lower food prices under the Sustainable World scenario boost affordability and thus access to food, increasing daily calorie availability in the developing world by 496 kilocalories per capita by 2030, and by 1,336 kilocalories per capita by 2050. Thanks to large new agricultural and social investments in developing countries, as well as more efficient use and preservation of natural resources, the Sustainable World

scenario results in 50 million malnourished children in 2050, compared with 115 million in the Conventional World scenario - a sharp decline of 57 percent. In India, for example, which is home to the largest number of malnourished children, the proportion of malnourished children would decline to 27 percent in the Sustainable World scenario by 2050, compared with 39 percent in the Conventional World scenario.

The calculations show that eradicating hunger in the near and medium term is a complex, multifaceted challenge. Significant achievements can be made through changes in investments and policies. Key factors that can make a difference for child malnutrition include accelerated growth in a diversity of crops, access to safe drinking water, and full female secondary school enrollment. Many of these changes both contribute to and will be driven by higher economic growth and slower population growth. The Sustainable World scenario assumes continued use of land and water resources for first-generation biofuel production following current mandates, but has a much larger focus on second-generation technologies. Removing current biofuel mandates would arguably have additional positive impacts for the eradication of child malnutrition, as well as water, land, and biodiversity conservation.

A sustainable vision for 2050 would mean that everyone in the world has access to, and is empowered to make use of, food, modern energy, and clean water while at the same time ecosystem degradation is halted or reversed. In the Sustainable World scenario, humankind makes large strides toward reducing hunger and improving water access but cannot entirely eliminate hunger and malnutrition by 2050. Achieving that goal would require additional targeted policies and institutional investments in key food crisis areas and other targeted, supporting measures (such as social support systems) for those suffering from chronic hunger (see also Runge et al. 2003).

⁹ The UN also projects low- and high-variant scenarios of population growth.

¹⁰ Determinants of fertility rate change are social, cultural, and economic variables, such as women's education level, employment status, urban-rural residence, household poverty, the cost of raising children, the cost of contraception, women's autonomy, and husband's occupation (World Bank 2007).

¹¹ Cultivated systems are defined as areas where at least 30 percent of the landscape is in croplands, shifting cultivation, confined livestock production, or freshwater aquaculture.

¹² Net primary production is the rate of carbon dioxide fixation by vegetation minus losses through respiration. It is a widely used indicator of land degradation for global and regional studies because it can be captured by satellite, making it relatively inexpensive to measure. Another major advantage is that long-term time-series data are available, allowing for comparison of land degradation over time.

¹³ These projections were calculated using IFPRI's International Model for Policy Analysis of Agricultural Commodities and Trade, or IMPACT.

¹⁴ A summary of these two scenarios is presented in Ozkaynak et al. (2012). The outcomes for these two scenarios were modeled using IFPRI's IMPACT model. IMPACT is designed to examine alternative futures for global food supply, demand, trade, prices, and food security. It covers 45 commodities, which account for virtually all of world food production and consumption. It is specified as a set of 115 country-level supply and demand equations where each country model is linked to the rest of the world through trade. To explore food security effects, IMPACT projects the percentage and number of malnourished preschool children (0 to 5 years old) in developing countries as a function of average per capita calorie availability, the share of females with secondary schooling, the ratio of female to male life expectancy at birth, and the percentage of the population with access to safe water. The model is integrated with a Water Simulation Module and a Global Hydrologic Model to assess the impacts of water supply and demand and climate change, respectively, on food outcomes. The model includes energy crops but not a full energy model.

¹⁵ Many of these factors, however, can only be assessed qualitatively; they are outside the reach of quantitative simulation models.



Ato Liben Boru Liben

Oromia Regional State, Ethiopia

“Pastoralists are migrating to urban areas because of high competition for water and pasture. However, only a few are successful in securing a job or engaging in income-generating activities, like opening small shops.”



Lespérance Fedner

Technical Coordinator

Welthungerhilfe, Jean Rabel, Haiti

“My expenses in terms of energy and water have increased sharply in recent years. Moreover, because of the problems of environmental degradation, water is increasingly scarce, and rare from the taps at home. I have to build a private tank to store water for household needs in periods of little water.”



Florence Akiiki Bamuturaki

Kabarole District, Uganda

“In the future, I am confident that there will be enough water and energy for our people as the country is developing.... I'm afraid the access to land is going to be a big problem in the nearer future. There will not be enough land for everyone. Our population is growing too fast, whereas land is a static resource which doesn't grow according to the population living on it.”



“Equitable access to land and natural resources is an essential element of the right to food for rural populations in general and for vulnerable and marginalized groups in particular.”

THE CENTRALITY OF LAND, WATER, AND ENERGY FOR SMALLHOLDERS

Smallholder farmers are among the poorest and most food-insecure people in the world. They live in the most ecologically and climatically vulnerable regions of the world and must draw their livelihoods from these same conditions. In the face of multiple challenges, it is small-scale farmers who feed the majority of the world, producing food for about 70 percent of the world's population (ETC Group 2009). For many of these farmers, scarcity scenarios are nothing new.

Because of the neglect of agricultural and rural development over past decades, secure land tenure and access to safe water and energy supplies have remained out of reach for many people, while national agricultural sectors have suffered structural deficits and low productivity.

The “triple-F” crises (food, fuel, and finance) and the emerging scarcity scenarios discussed in Chapter 3 have helped push agriculture to the top of the global policy agenda, forcing governments and international institutions to rethink the ways in which the world produces and distributes food. This is resulting in a renewed emphasis on the potential of agriculture, and governments in recent years have intensified efforts to commercialize their agricultural sectors.

Such initiatives can already be observed in Sierra Leone and Tanzania, where Welthungerhilfe, Concern Worldwide, and their partners cooperate with farmers in the areas of agriculture, rural development, and food security. The governments of both countries have adopted initiatives to accelerate agricultural growth through both the commercialization of smallholders and the promotion of large-scale corporate farming. As these initiatives gather pace, the situation in which smallholder producers find themselves is becoming increasingly precarious.

In Sierra Leone, local farmers have already lost land to large-scale investors. Civil society is organizing itself, demanding transparency, and challenging the dominant notion of “agricultural modernization,” which has already resulted in the acquisition of approximately 20 percent of the agricultural land available by foreign enterprises. In the case of Tanzania, Concern is supporting smallholders to secure land title and improve their access to water as the government advances a wider program to transform the agricultural sector.

How pressure for land transforms rural livelihoods in Sierra Leone

Since emerging from a civil war that lasted from 1991 to 2002, Sierra Leone has been working to overcome severe poverty and food insecurity. In spite of those efforts, the level of food insecurity remains alarming (the country's 2012 GHI score is 24.7). Domestic production of a range of food items falls short of local demand and—in con-

trast to the decades before the war—Sierra Leone is a net importer of food. At the same time, 50–60 percent of the population depends on farming for its livelihood. These are mostly small-scale, peasant farmers who rely on the bush fallow system, in which fields are cultivated for a few years until soil fertility is depleted and then left fallow for 10 to 15 years.

Vast Lands Available for Smallholders as well as for Large-scale Foreign Investment?

To deal with low productivity and food insecurity, the government of Sierra Leone is promoting agricultural modernization by means of mechanization and commercialization. In 2010, a five-year US\$400 million Smallholder Commercialisation Programme (SCP) was launched with the aim of linking smallholders to markets and commercial value chains.¹⁶ A new emphasis on large-scale, commercial agriculture has also emerged, with the government campaigning to attract foreign direct investment in agriculture. Investment delegations from China and elsewhere were received by the president; trade and investment forums were held in London and Freetown in 2009 and 2011 respectively; and the Sierra Leone Investment and Export Promotion Agency (SLIEPA), supported by the European Union and other donor funding, promises investors “easy access to land with smooth facilitation process” (SLIEPA 2012a).

SLIEPA argues that there are vast areas of available land with “only 15 percent of the country's 5.4 million hectares of cultivatable land being farmed as recently as 2003” (SLIEPA 2012b). These figures contrast with a study by the German Ministry of Economic Cooperation and Development (BMZ) indicating that much of the land is already overused and little room exists for agricultural expansion (Bald and Schroeder 2011).

The “Big Push”—For Whose Benefit?

Between 2008 and mid-2012, almost 1 million hectares of farmland across the country were leased or under negotiation for lease.¹⁷ Investors are predominantly interested in oil palm, sugarcane, and food crops such as rice—evidence of the extent to which land acquisitions are driven particularly by the food and fuel crises. Most of the projects are export oriented, and at least one investor—the Swiss-based Addax Bio-energy, leasing 44,000 hectares in the northern Bombali District of Sierra Leone for the production of sugarcane—aims to produce ethanol for export to the European Union and to sell electricity from the by-products in Sierra Leone (Anane and Abiwu 2011).

Although investors are looking to satisfy consumption needs in the global North, it is argued that large-scale foreign direct investment in agriculture can also have benefits for the local population (see, for example, World Bank 2011a). The following case study by Welthun-

gerhilfe and the Sierra Leonean nongovernmental organization Green Scenery takes a closer look at the reality behind the rhetoric and the impact of large-scale land investments on the food and livelihood security of the rural poor in Sierra Leone.¹⁸

Case Study: SAC investment in Malen Chiefdom, Pujehun District

Welthungerhilfe had been working in Pujehun District since 2007, engaging with smallholder farmers to rehabilitate rural infrastructure, increase incomes, and foster food security through efficient and environmentally safe use of available natural resources. In 2011 Socfin Agricultural Company Sierra Leone Ltd (SAC)—a subsidiary of the corpora-

tion Socfin registered in Luxemburg—leased 6,500 hectares of land in the area to grow oil palm and rubber for export. The lease covers approximately one-quarter of the area of Malen Chiefdom and includes 24 villages (see map on page 37). It is effective for 50 years, with the possibility of extension for another 21 years. As a direct result of this lease agreement, smallholder farmers no longer have access to agricultural land and forested areas, and most project activities that Welthungerhilfe had undertaken in partnership with local farmers have had to stop.

In this case, as in many others, there are two major concerns relating to the land deal: the way in which the acquisition is decided upon and the impact on local food and livelihood security (Anseeuw et al. 2012b).

BOX 4.1 TIMELINE OF THE INVESTMENT OF SOCFIN AGRICULTURAL COMPANY SIERRA LEONE LTD. (SAC) IN MALEN CHIEFDOM

2009

Feasibility study was conducted in the area (involving, for example, soil samples and surveying). The general population was not informed.

September 2010

At a chiefdom meeting in Sahn Malen, the paramount chief informed representatives of the local communities that a company would come and take over the former government plantation.

February 2011

At a chiefdom meeting in Sahn Malen, the paramount chief informed community representatives that all the land in the chiefdom would be taken over by SAC to plant oil palm and rubber. Malen landowners expressed unwillingness to lease land.

February/March 2011

Village chief of Semabu held meeting. The community expressed concern about what would happen to their plantations and food production. Paramount Chief (PC) said that all land would be taken by the company, with or without consent. When people asked where to get food, the PC said they should buy it using the money that they receive.

March 5, 2011

At a chiefdom meeting in Sahn Malen, the lease agreement was to be signed. Armed police were present. Village chiefs who signed got money to redistribute to the landowning families in their village. Villagers and village chiefs who did not want to sign kept away from the meeting. According to the lease agreement only five of the nine sections of Malen signed.

From April 2011 onward

Farmers' oil palm plantations were measured to determine compensation. Existing oil palm plantations were cleared. Operations in nursery started. Infrastructure was prepared.

May 30, 2011

At a stakeholder meeting in Pujehun, the conflicting parties reconciled and expressed their intention to work together for the well-being of the people.

June 4, 2011

At a chiefdom meeting in Sahn Malen, the contract was fully read publicly for the first time and partly translated into the local language Mende. The legality of the contract was questioned.

October 2011

Concerned landowners published a statement detailing their grievances (Malen Land Owners Association, "Grievances of Land Owners in Malen Chiefdom," letter to district officer of Pujehun District, October 2, 2011, accessible at www.greenscenery.org). More than 100 landowners blocked access to the area leased by SAC. Forty were arrested; 15 were charged on counts of riotous conduct, conspiracy, and threatening language.

Source: Melbach (2012).

“There was never a chance to say ‘no’ to the land deal; we felt coerced.”

Rural land in Sierra Leone is held by landowning families, with a chieftaincy structure that plays a significant administrative and custodial role. There exists a strong, pervasive notion of the fundamental inalienability of land from the landowning extended families and chiefdoms. Thus, traditionally land is not leased but allocated. Statutory law, however, provides a procedure for non natives to acquire leaseholds, requiring the consent of both the chiefdom and local councils. Investors can either lease land directly from the landowners or sublease from the government as the primary leaseholder.



Source: Welthungerhilfe/Green Scenery based on official maps.



S. J.

Sinjo village, Malen Chiefdom, Sierra Leone

“Today I have a quarter of what I used to have. The food situation is far worse than before because there is no more farming. We used to eat two times a day; now we eat only once a day and we have to buy everything. I paid 200,000 SLL to the Socfin [SAC] foreman for my four children to get employment. I told them [my children] I am going through challenges and that they have to work; four sons work now for the company. One son I have taken out of school to work in the plantations instead.”



Betty Sengeh

Sinjo village, Malen Chiefdom, Sierra Leone

“Sometimes our family has to take credit or a loan; currently our debts amount to 1,100,000 SLL. Out of this, 200,000 SLL are food debts. It is the first time that we have had food debts. For the past two months I have not been able to pay back any debt because my children who work with the company were inadequately paid. We expected annual payments for the plantations we owned, but this did not materialize.”

“I was employed by Socfin, but then I got sick and had to stop. Previously I used to work on our own farmland, now I am just sitting at home.... For the short term, I do not see any benefit in this development. For the long term, I don’t know. I have little understanding of what they want to achieve. If I do get that understanding, it may help me to determine whether there is future benefit. We don’t understand much, because we see how the chief, the company, and the authorities are more together than they are with us.”

In Malen Chiefdom, the SAC investment was presented as a far smaller deal than was actually the case. Local landowners and users were informed only after the decision had been made by the tribal authorities and were told to thumb print or sign without knowing or understanding the details of the agreement. Indeed, it was a full three months after the contract had been signed that it was fully read out publicly with ad hoc translation into the local language (see Box 4.1).

The land lease rent, amounting to US\$5 per acre (US\$12.50 per hectare) per year, was fixed by the government rather than negotiated with farmers. Landowners receive only 50 percent of the yearly lease payment, while the other half is divided between the different levels of government administration (the district and the chiefdom each receive 20 percent, and the national government receives 10 percent).

At the time the agreement was concluded, some villages, hoping for new employment and education opportunities, accepted the terms imposed. The anticipated opportunities, however, did not materialize. By August 2011, two more villages that had been more favourable toward the deal initially, had become critical.

“We used to have far more food.”

In times gone by, Malen Chiefdom was a farming society with a considerable degree of self-sufficiency. Today, it is a quasi-landless society dependent on uncertain and irregular demand for labor and suffering all the anxiety and uncertainty that comes with such dependency.

When SAC took over the land, farmers received a one-time payment amounting to 1 million leones (SLL) (approximately US\$220) for every acre of oil palm plantation lost. No compensation was offered for

TABLE 4.1 PRICES OF SELECTED FOODS IN PUJEHUN DISTRICT, SIERRA LEONE, 2011–12

Product	Unit	Prices (SLL) in May 2011				Prices (SLL) in May 2012				Average price change (%)
		Village market	Local market	Regional market	Average	Village market	Local market	Regional market	Average	
Local rice	Cup	1,000	n.a.	1,200	1,100	1,100	1,200	1,200	1,167	+6.1
Imported rice	Cup	1,000	1,000	1,000	1,000	1,000	1,000	933	978	-2.2
Raw cassava	Kg	500	n.a.	1,000	750	917	2,000	1,333	1,417	+88.9
Processed cassava (gari)	Cup	250	250	200	233	400	300	n.a.	350	+50.2
Local palm oil (dura variety)	Pint	1,000	1,000	1,200	1,067	1,400	1,500	1,433	1,444	+35.3
Masanke palm oil (tenera variety)	Pint	700–800	800	1,000	850	1,000	1,000	1,000	1,000	+17.7
Sweet potato	Pile	500	n.a.	1,000	750	917	1,000	1,333	1,083	+44.4
Flour	Cup	1,000	900	1,000	967	n.a.	1,100	1,500	1,300	+34.4
Salt	Cup	700	800	n.a.	750	1,000	500	500	667	-11.1
Sugar	Cup	2,000	2,200	2,000	2,067	2,000	2,000	2,500	2,167	+4.8

Note: n.a. = not available.

Source: Prices were recorded by Welthungerhilfe project staff. However, village-level prices were taken in different locations within the region affected by the lease in 2011 and 2012. The inflation rate of 2011 was 18.5 percent and is estimated to decline to 8.5 percent in 2012 (World Bank 2011a).

other crops. This amount is relatively small compared with the annual income farmers would otherwise have earned—income that many families used to pay to send their children to school.

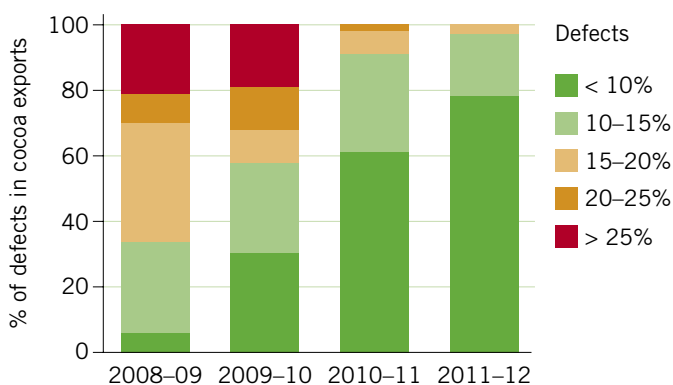
In the smallholder cultivation system, each family member contributed to the farm's success. Today, the large-scale plantation requires less labor, and former farm households must rely on the income of individual family members. Jobs are largely casual, and labor is recruited on a day-to-day basis. While the plantation attracts a lot of laborers from outside the area, no provision is made for the employment of those women and men who have leased their land.

Although payment levels at the plantations are in accordance with similar investment projects in Sierra Leone, a daily wage of US\$2.20 (SLL 10,000) is insufficient to cover the food needs of a family, especially in view of rising consumer prices. Between May 2011 and May 2012, market prices for food in the region affected by the large-scale land acquisitions have risen by 27 percent, on average (see Table 4.1).

As the level of self-sufficiency falls and the price of food rises, access to sufficient food is becoming an issue of concern for many. All those interviewed in May 2012 cited a fall in both the quantity and quality of food available to them since the SAC deal. In particular, interviewees said that they consume less meat since bush meat is much harder to find following the clearing of forested areas for the SAC plantation.

The conversion of former agricultural areas and bush land into plantations has had other serious consequences. People are increas-

FIGURE 4.1 **QUALITY OF COCOA EXPORTED BY THREE COOPERATIVES IN SIERRA LEONE, 2008–09 TO 2011–12**



Note: High-quality cocoa has less than 10 percent defects. The share of high-quality cocoa rose from less than 10 percent of country exports in 2008–09 to more than 75 percent in 2011–12. Source: Welthungerhilfe Project in cooperation with a distributor.



Sama Amara

Kortumahun village,
Malen Chiefdom, Sierra Leone

“The resources we had from the plantations are depleted. For example, cassava and rice were available all year round. I used to store palm oil and groundnuts throughout the year and would sell some whenever food was needed.... Today, our family consumes 8 cups of rice a day; previously we used to eat 20 cups. Still we try to eat two times a day.”



Memai Charles

Kortumahun village,
Malen Chiefdom, Sierra Leone

“There is no alternative to earn a living. If there were an alternative, I would not be working with Socfin [SAC]. When I was farming independently, I could decide how much I would eat and how much I would sell. This was good. Now, I am constricted with a small amount of money, and I have to buy everything.”

“It is pretty difficult now, because all things are being measured. When we did our farming there was no need to measure. And the cost of living is increasing.”

ingly concerned about the loss of firewood (the primary source of domestic energy, as in most of Sub-Saharan Africa; see Chapter 3, page 24) and more difficult access to herbal medicines.

Promoting dialogue about alternative forms of investment

National governments are responsible for respecting and protecting their citizens' right to adequate food. In many settings, however, the voices of those who caution against misguided developments that threaten food security are marginalized. It is essential in these cases to support the efforts of civil society organizations to engage their own government representatives in a dialogue about the observed consequences of policy decisions.

To collect evidence about the impacts of the SAC investment in Pujehun, Welthungerhilfe and Green Scenery have assisted in setting up a community-based monitoring system and are supporting the local population in Malen Chiefdom in assessing longer-term livelihood changes. At the time of writing, Green Scenery is setting up a database to register all large-scale land acquisitions in Sierra Leone as part of a larger initiative with other civil society organizations to increase transparency of large-scale investment deals. The information collected will be used to engage with national-level politicians and the national media about the consequences of large-scale land deals. This initiative and many more aim to raise awareness about the risks of large-scale foreign direct land investments and to promote alternative models of agricultural investment.

In eastern Sierra Leone, smallholder cocoa and coffee farmers face similar constraints as those observed in Pujehun and elsewhere in rural Sierra Leone. Yields are low because of the reliance on low-productivity varieties and techniques, as well as the advanced age of many trees. Because of poor quality, farmers are paid low prices by middlemen. They lack incentives to invest in proper harvesting, fermenting, drying, or marketing, and many are tied into a credit system that maintains the status quo.

While policies are clearly formulated at the national level, the role and functions of the local government in terms of rural development are not yet well understood or implemented. The introduction of farmer field schools under the Smallholder Commercialisation Programme, for example, has yet to reach the majority of households. The cocoa sector is neglected in terms of extension services, and cocoa exports have remained stagnant for many years, far below their pre-war levels.

Against this backdrop, the experiences of Welthungerhilfe in Sierra Leone show that—with adequate support—smallholder agriculture has commercial potential that goes beyond increasing food availability in local and regional markets.

Supported by the European Commission, Welthungerhilfe, the Agro Eco Louis Bok Institute, and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) have worked with three national coopera-

tives “to improve income and well-being of farm families through improved production and marketing of cocoa and coffee” in eastern Sierra Leone. This work, which began in 2007, has involved approximately 10,000 small-scale producers cultivating an average farm size of 2.4 hectares. It has shown that substantial improvements in both quantity and quality are possible, even in contexts where production is “atomized” among thousands of smallholders. Between 2007 and 2009, average household income from coffee and cocoa increased by 81 percent (US\$190), and 15 percent of this increase can be attributed directly to the project (comparing prices in project and nonproject villages). The quality of the cocoa exported through the three project cooperatives has also improved considerably (see Figure 4.1).

The above data demonstrates the economic potential of smallholders. With appropriate and adequate support and inexpensive training methods such as farmer field schools, small-scale producers can overcome constraints along the value chain while maintaining the diverse and sustainable structures of the cocoa agroforestry systems.

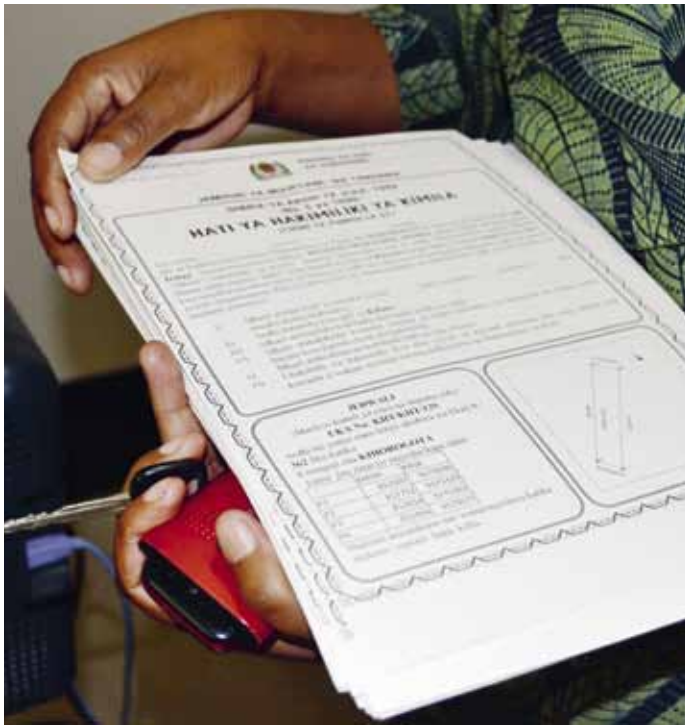
However, the up-scaling and sustainability of such successes rely to a large extent on the vision of “agricultural modernization” promoted by the government of Sierra Leone and the priority and support given to smallholders in that vision.

Land title and water in rural Tanzania: Protecting the livelihoods of poor farmers

Tanzania is a country of contrasts. In recent decades, it has experienced a healthy economic growth rate, with annual GDP growth between 2012 and 2016 set to exceed 7 percent. At the same time, it suffered from drought and food insecurity in 2009 and 2010. In addition, the year-on-year rate of food inflation remains unchanged at 25.3 percent, and the food component of the consumer price index, which accounts for 47.8 percent of the basket of goods used to measure inflation, has also seen an increase. In 2012, an estimated 1 million people are food insecure while 42 percent of households regularly have inadequate food. Tanzania ranks 54th in the 2012 GHI out of 79 countries.

Farming is the mainstay of Tanzanian life, with more than 80 percent of Tanzanians relying on agriculture for their livelihoods. Of the estimated 2.1 million hectares under production, 95 percent is cultivated by smallholder farmers with holdings of between 0.9 and 3.0 hectares. These farmers use traditional methods and produce primarily for subsistence.

These farmers face many challenges including low productivity, dependence on rainfed agriculture, underdeveloped support facilities, inappropriate technology, impediments to food market access, and low levels of public expenditure. But there is one underlying chal-



A completed certificate of customary right of occupancy

lence of which many are unaware. Although more than 90 percent of farmers claim ownership, the reality is that less than 10 percent of Tanzanians hold official title to their land.

Tanzania's 1999 Land Act No. 4 and Village Land Act No. 5 were established to allow smallholder farmers to formalize their land-ownership by acquiring a certificate of customary right of occupancy (CCRO). The acts recognize occupancy of land and seek to legally secure existing rights, especially the customary rights of smallholders. They give women the same rights as men to acquire, hold, use, and transfer land, either in their own name or jointly with men, regardless of customary and religious restrictions. Aside from securing land tenure, CCROs were also intended to be used as collateral, enabling farmers to purchase equipment and inputs in order to increase production, food security, and livelihood standards.

There have been challenges, however, in implementing the acts. Most occupancy rights have not been registered, and as CCROs are not recognized as instruments of mortgage, financial institutions are reluctant to recognize them as collateral. In addition, while the land laws recognize women's equal right to secure tenure, customary law and traditional practices can mean these provisions are not realized. Married women are not allowed to transact property without their husband's permission, and attitudes and behaviors can be such that women prefer not to be involved in land issues.



Sinaraha Adam Ng'omwa

Iringa District, Tanzania

“Today or tomorrow I might not be here, and neighbors could encroach if the boundaries are not clear.”



Mustafa Kibibi Balizila

Kibondo District, Tanzania

“Having the certificate is a security for the children so that if I die, they can keep the land. I also added my wife's name to the certificate, as she is my first wife. I included her because we have worked the land together since we were teenagers, so it is her right as well, and for her children. I think it is important to have her included.”



Ali Mtuli and Edna Mafunde

Pawaga Division, Tanzania

“When we have the money we would be interested in getting one [a CCRO] to ensure security of our land. Previously land was not valued, but demand is increasing now, and we hear on the news that people are beginning to grab land, so it is worth protecting.”

Given these difficulties, the government initiated a Strategic Plan for the Implementation of the Land Acts in 2006. The issuance of land title is also a pillar of Kilimo Kwanza, the national strategy that attempts to transform Tanzanian agriculture into a modern commercial sector. The challenges remain, but the need to accelerate the process grows as the government actively pursues initiatives to increase production and encourage commercial investment in the sector.

Concern's Work on Land Title and Irrigation

Concern Worldwide has been working in Tanzania since 1978, when it was invited by the first president, Julius Nyerere, to implement community development projects in Iringa.

Located in the southern highlands, this region was once the breadbasket of Tanzania. Over the past 20 years, however, Iringa has suffered persistent periods of drought. In 2011 alone, more than 43,000 of its population of 245,000 required food assistance.

Land remains of vital importance to the people of Iringa, with 90 percent of the population earning its living from agriculture and livestock production. Much of the potential remains untapped, however, and while 40 percent of its land is suitable for agriculture, just over 23.3 percent is actually cultivated.

Securing land title and irrigation are two core elements of Concern's work in this region and beyond. Since 2006, Concern's livelihoods programs have focused on the fulfilment of the right to an adequate standard of living for poor and vulnerable citizens in Iringa, Kilolo, and Mtwara districts. A key objective of its programs is to increase access to, and control over, land by formalizing ownership through acquisition of CCROs. These efforts have borne much fruit. Concern has supported the issuance of more than 9,500 CCROs, equal to approximately 16 percent of the total number issued across Tanzania since the Land Acts first came into force in 2001.

Since 2009, Iringa District has demarcated 103 of its 125 villages and issued village land certificates to each in preparation for demarcation and issuance of individual CCROs to households. Concern has supported the development of village land use plans in 12 villages and provided support for all other steps in the titling process with the exception of demarcation and survey of boundaries, for which the District Land and Village Council is responsible. More than 8,000 land titles have been issued in Iringa District, of which more than 6,000 were supported by Concern.



THE SOUTHERN AGRICULTURAL GROWTH CORRIDOR OF TANZANIA

- Southern Agricultural Growth Corridor of Tanzania (indicative)
- Concern's Program Areas
- Concern's Country Office

Source: Based on SAGCOT (2012).
 Note: The Southern Agricultural Growth Corridor covers approximately one-third of mainland Tanzania. It extends north and south of the central rail, road, and power "backbone" that runs from Dar es Salaam to the northern areas of Zambia and Malawi.

THE KEY STEPS IN THE CCRO PROCESS ARE AS FOLLOWS:

- Providing resources to district land officers, including GPS stations, computers, registry boxes, land seals, and software;
- Holding awareness-raising meetings on Village Land Act No. 5 of 1999 and Land Dispute Act No. 2 of 2002;
- Forming land tribunals and committees;
- Training tribunals and committees on their responsibilities;
- Preparing village land use plans in collaboration with the Village Council and Village Assembly;
- Demarcating and surveying village boundaries in collaboration with Village Land Committees;
- Preparing and issuing the certificates of villages;
- Carrying out land adjudication of individual land parcels within the village;
- Establishing village land registries and equipping registries with facilities such as seals, village land registers, and cabinets;
- Establishing a database of land-related information such as GPS coordinates for land parcels;
- Registering and issuing CCROs to individual owners; and
- Paying the cost per CCRO, per household, as set by the District Land Council of TSh50,000 (US\$31.60).

The Benefits of Land Titling

This collaboration has been among the most successful of its kind in Tanzania in terms of the number of land titles issued. For individual farmers, the overwhelming benefit is security. Land titles give farmers legal recognition. If land is appropriated thereafter, compensation must be paid. This is particularly important in light of a new government initiative launched at the World Economic Forum Africa Summit in 2010.

The Southern Agricultural Growth Corridor of Tanzania (SAGCOT) encompasses one-third of mainland Tanzania, stretching from Dar Es Salaam in the east to Morogoro, Iringa, Mbeya, and Sumbawanga in the west. It is a strategy designed to empower both smallholder and larger-scale farmers to make a commercial success of farming through partnership with government, businesses, and donors. Over time, this initiative is likely to have a significant impact on smallholder farmers as commercial enterprises look to invest in Tanzania. Ensuring that those farmers have secure tenure is an important step in strengthening their position in the future.

Access to loans, which enable farmers to invest and increase their yields, is a second tangible benefit of land titling. The process has also clarified the amount of land actually available. Many villages and local authorities have discovered there is not as much land as initially thought. According to the Assistant Commissioner for Land, Southern Zone, Msigwa Malaki, “When the land was demarcated, we thought there was enough; we thought there was idle land. But when it was surveyed, the villages found that they did not have enough land for inclusion under SAGCOT” (Msigwa Malaki, personal communication). Clearer boundaries and ownership of natural resources have reduced the opportunities for exploitation as well as the number of ongoing disputes.

The Challenge of Irrigation

Securing a land title is part of the solution. Water is also a major issue for the farmers of Iringa. With rainfall patterns becoming increasingly unpredictable, reliance on rainfed agriculture is becoming too risky. Less than 40 percent of the district has irrigation, and many farmers are unable to cultivate their land. For this reason, irrigation is a key component of Concern’s Integrated Livelihood Programme, which works with the District Ministry of Agriculture to improve irrigation infrastructure by supporting improvement of canals and construction of water gates. The introduction of drip irrigation has also become a key strategy for Concern.

In Luganga, for example, gates have been installed along the canal to help regulate the amount of water flowing to farmers. Concern has supported the strengthening and training of water user groups and their management committees—consisting of and elected by the villagers themselves—who are responsible for monitoring water usage, collecting fees, and overseeing maintenance of the canal. This canal provides irrigation to 300 farmers, who are able to cultivate their farms, increase their food security, and improve their livelihoods.

This progress is not without problems though. Loss of water through seepage along the canal has been a challenge that, if addressed, could enable a second harvest, improving food security and incomes. Water loss also affects the value of the land, which decreases as production falls. Conversely, the value of land increases with access to water. At the begin-



Hamidu N'gulali

Ruaha Village, Tanzania

“Growing onions is very demanding, and lack of labor has been a big constraint. It is not possible to prepare your farm and plant on your own. And despite cultivating the whole acre of rice this year, I was still only able to manage 10 bags as the rain stopped earlier this year.”



Safia Mohamed Kikwebe

Kibondo District, Tanzania

“I feel even if I die, I know the land is safe as I have written the names of four of my children on the certificate, two girls and two boys. (Four was the maximum number I could include.) I have 6.23 acres of land, and I grow maize, beans, potatoes, and cassava.”

“One of my sons is married, so I farm and my son helps me. We also exchange crops, so if either of us has a problem we share the harvest (cassava or maize). I eat two meals a day, lunch and dinner, as I go to farm very early.”

“I think the certificate is important. One advantage is that you can rent your farm out for money. I plan to do so if there is an emergency. I can rent the land out so I can still pay for the children to go to school.”

ning of 2012, a temporary connector was put in place to facilitate the flow of water to an additional 450 farms. Since its construction, the volume available to all farms has fallen, reducing the level of production.

Water-related tensions between pastoralists and farmers in the district are also becoming more common. Although pastoralists may have designated land, their land may not have a water source, leaving them at times with little choice but to encroach on farmland and accept that they will have to pay a fee to the relevant farmer to allow their animals' access to pasture and water.

Moving Forward with Land Titling

While benefits of the land titling process in Iringa are beginning to emerge, progress rolling out the Land Acts has been extremely slow since they first came into force in 2001. According to the Iringa District land officer, land has not been given priority in national budgets, and sectors such as health, education, and infrastructure have been prioritized instead. Iringa has a total district budget of TSh189 million. Of this total, TSh10 million have been allocated to come from the national government. The District Land Office estimates that in reality, they are likely to receive just one-third of what has been allocated. Furthermore, the amount for land administration in Iringa has been capped at TSh5.4 million (US\$3,412) for 2012/2013. Pressure on overall budgets and limits on the budget for land administration raise questions and concerns in relation to the priority being given to the issue of land title. More investment is required if more communities and farmers are to get titles.

Over the past 10 years, the government has made agricultural investment an increasing priority. With the high-level promotion of SAGCOT, it is particularly important that similar support, both technical and financial, be given to land and the land-titling process. People must be pro-

tected through land title before companies enter into areas that are being utilized already. Titles should precede determination of SAGCOT areas.

There is a need for more communication and information in relation to land titling on the part of both the community and local Village Councils too. There remains a great deal of uncertainty about the process and who has responsibility for instigating it. Official procedures call for farmers to apply to the Village Land Council and have their claim verified by the Village Land Tribunal; then a batch of applications is sent to the District Land Department. At times, though, Village Councils were waiting for the District Land Department to approach and notify them of their next visit to demarcate land.

Concern's experience with the titling process highlights the need for strong political will, alongside complementary policies and integrated programming initiatives, including supportive financial and extension services and water programs. Each of these elements is as important as the other. In the absence of any one, the overall impact will be diminished while together, they can sustain and strengthen the considerable investment in and impact of the land-titling process in Tanzania in the years to come.

Conclusion

The examples from both Sierra Leone and Tanzania show the particular vulnerabilities of smallholder producers given scarcity of resources and increased competition. Though national policies such as the Smallholder Commercialization Programme in Sierra Leone and the Land Acts in Tanzania may be in place, the actual benefit to small-scale family farmers appears limited. Findings suggest that such policies can reach their full potential and respond to the rights and needs of smallholder farmers only if they are accompanied by the appropriate resources and capacities and recognized as part of a wider vision of "agricultural modernization" that is explicitly and implicitly supportive of smallholder farmers.

Chapter 5 puts forward recommendations detailing the requisite policies and frameworks for responsible governance of natural resources. It presents technical advances and approaches that have successfully managed to address the interconnectedness of land, water, and energy policies, as well as the measures that should be taken to address the drivers of the rush for resources.



Kaleta Sharaba Kabika

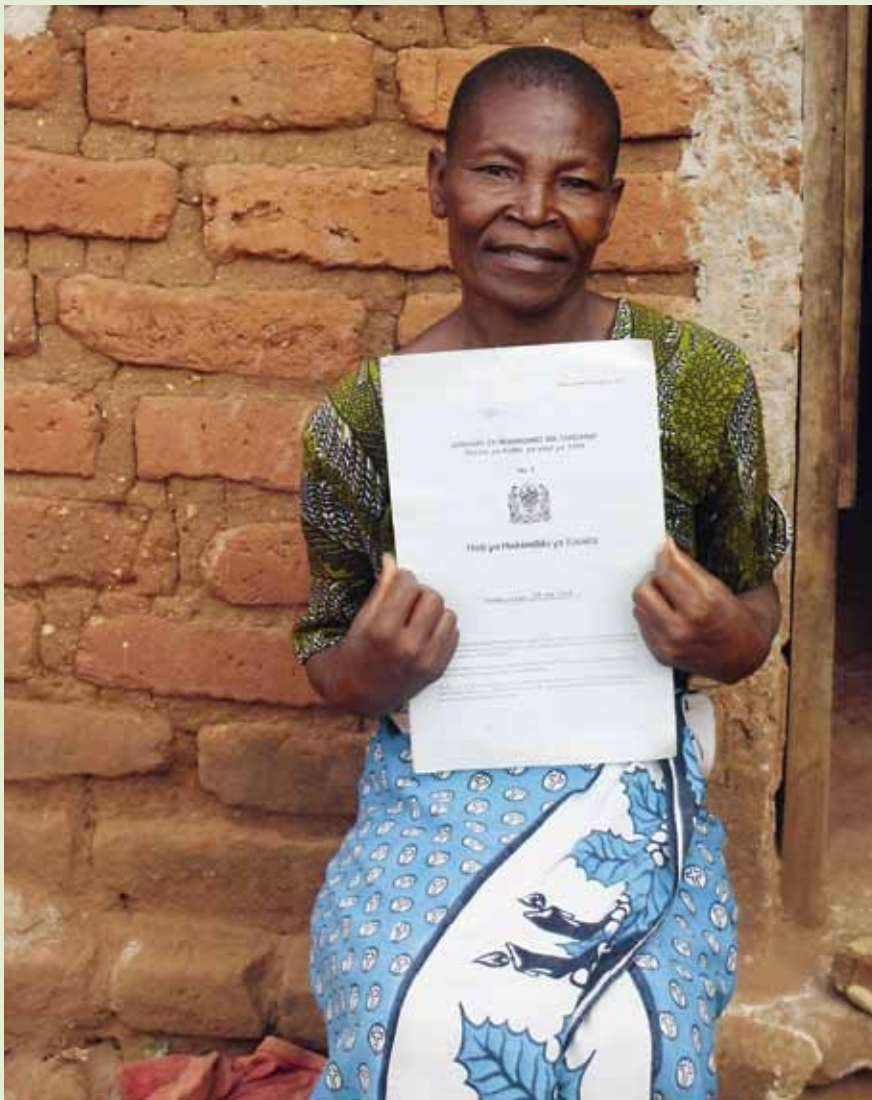
Kibondo District, Tanzania

“We own the land, cultivate it, and get food for our children. I would feel bad if my name was not on the certificate. If my husband died this would be a risk to me and my children. Another risk is that my husband could sell the land or rent it without my knowledge. Now because the certificate is in both our names, it has to be a joint decision if we wish to sell or rent it.”

¹⁶ The program has a planned budget of US\$403 million. However, as of July 2012 the SCP had been accorded US\$50 million from the multi-donor Global Agriculture and Food Security Program (GAFSP), administered by the World Bank. Furthermore, the Islamic Development Bank had announced a contribution of US\$20 million. A number of other programs, with a joint volume of US\$83 million, are understood as forming part of the SCP because they support some of the program's components (the World Bank's Rural Private Sector Program, the African Development Bank's Agricultural Rehabilitation Program, and the Rural Finance and Community Improvement Program and Community-Based Poverty Reduction Project of the International Fund for Agricultural Development).

¹⁷ These monitoring data are from the Sierra Leonean nongovernmental organization Green Scenery (www.greenscenery.org).

¹⁸ In August 2011 Welthungerhilfe commissioned an independent case study to get a better insight into the perspectives of local farmers on the deal and to understand the early impacts of the land acquisition. The full study can be accessed through Welthungerhilfe's webpage (Melbach 2012).



Anna Mdeka proudly holds up her certificate of customary right of occupancy (CCRO).

Anna Mdeka proudly holds up her CCRO. For her, this title represents important security and independence. Some years ago, Anna lost one of her legs, and her life changed in a number of ways. Whereas she used to engage in trade, she now relies solely on her farm for her livelihood. Concern Worldwide first started supporting the CCRO process in Luganga village, Pawaga Division, in 2006, working with the Village Council to raise awareness about the process and to survey and demarcate land. Anna's was among the first farms to be surveyed in 2008, and a year later, she was one of the first five people to receive an official CCRO.

"It was my son who first told me about the CCROs. He had been at a meeting where they were talking about it, and when he

came home he encouraged me to apply. He explained that the CCRO could be used to apply for credit, and I liked the thought of avoiding being harassed about my farm. As I am married, I had to approach my husband about the application. He has two other wives but agreed to give me two acres of land, and I applied for the CCRO in my name only."

Concern supported Anna through the process, covering the fee of TSh50,000 (US\$31.60) estimated by the Iringa District Land Office for demarcation and preparation of the title. For Anna, the main benefit of having a title is a feeling of security, as she knows those two acres belong to her and cannot be taken away. As one of three wives, Anna also now has more independence and protection over her own livelihood.

Although Anna has had her title for four years, she has not used it to obtain credit. But she knows exactly what she would do with a loan: "I would like to borrow TSh500,000 to buy pigs and grow more crops. I would like to diversify the crops that I grow and earn more money, but I am not sure how to go about getting a loan."

Uncertainty about using the titles to obtain credit is a common challenge in Iringa. So far only 21 of the more than 8,000 people with titles have been able to use their land titles as collateral. Furthermore, these farms were generally well developed, grew cash crops, and were more mechanized. Financial institutions look for these characteristics and thereby limit opportunities for smallholder producers.

In addition, the titles are not yet fully recognized as instruments of mortgage, and as a result financial institutions are reluctant or unwilling to accept them. While the Ministry of Land is currently working on getting titles included in the Land Registration Act, this will take time. In the meantime the benefit of the asset is being limited, given the lack of additional relevant information and complementary supportive policies.

Water is an additional challenge for Anna. "If I don't get enough water from the canal, weeds sprout on my land. The canal is not in good shape. If Concern had not been rehabilitating it over the last three years, we would not be able to farm in this village." Anna's plot is on the canal, and she can grow rice, harvesting between 26 and 30 bags of rice a season. Once the main harvest is over and the land becomes drier, she grows maize. On average she earns TSh600,000 (US\$380) a season. She also trades some of her rice for maize and meat.

Before leaving, Anna explains that her CCRO inspired her husband to look into the process, and he has since secured his own. Concern's support of the titling process is expanding, empowering many within the community to secure control over the land they have farmed for years. In 2011, a further 119 parcels of land were surveyed and demarcated in Anna's village.



“States can and must achieve a **reorientation of their agricultural systems** towards modes of production that contribute to the progressive realization of the human right to adequate food.”

Olivier De Schutter, United Nations Special Rapporteur on the Right to Food

POLICY RECOMMENDATIONS

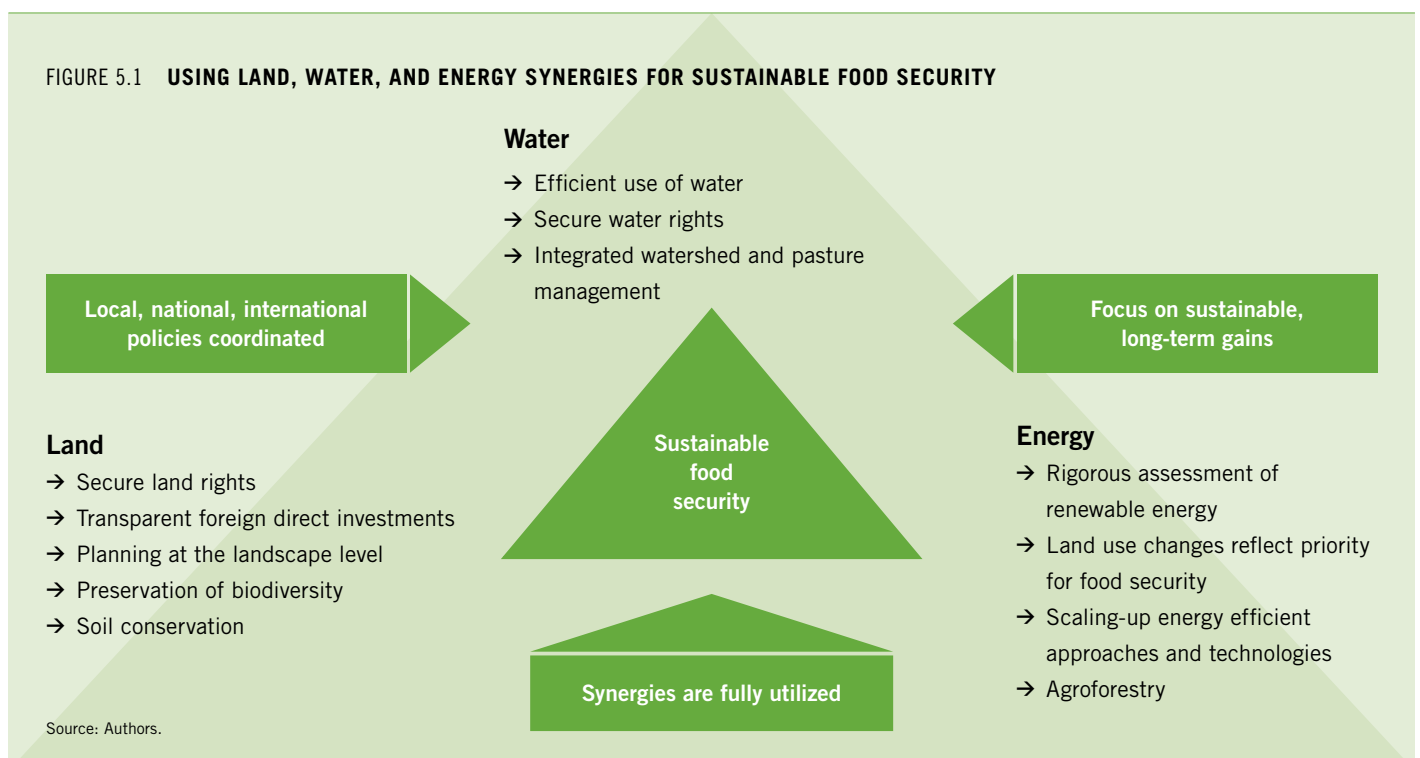
In the coming decades food security will be increasingly challenged by water, land, and energy scarcity. If progress and improvements to the well-being and nutritional status of the poor are to be realized, we will need to make a diverse range of foods more available and accessible, identify and address wasteful practices and policies, and assure local communities of greater control over and access to productive resources.

As a result of growing food price volatility and food price spikes, in part driven by land, water, and energy scarcity, many countries have started to rethink agriculture and food security strategies. This rethinking provides an opportunity to ensure that food security strategies are aligned with plans in relation to land, water, and energy. More holistic strategies for dealing with land, water, energy, and food can reduce the adverse impacts of policy incoherence across these areas and promote the sharing of successful innovation.

Greater collaboration is needed among government ministries as well as with communities, civil society, and the private sector in policy design, implementation, and monitoring. It is crucial to monitor both the human and the environmental outcomes of developments in the land, water, and energy sectors and of alternative agricultural and food and nutrition strategies.

Against this backdrop, there are three overall areas in which action is needed:

- 1. Responsible governance of natural resources:** getting the policy frameworks right
 - a. Secure land and water rights
 - b. Phase out subsidies
 - c. Create a macroeconomic enabling environment
- 2. Scaling up technical approaches:** addressing the nexus
 - a. Invest in agricultural production technologies that support increased land, water, and energy efficiency
 - b. Foster approaches resulting in more efficient land, water, and energy use along the value chain
 - c. Prevent resource depletion by monitoring and evaluating strategies in water, land, energy, and agricultural systems
- 3. Addressing the drivers of natural resource scarcity:** managing the risks
 - a. Address demographic change, women's access to education, and reproductive health
 - b. Raise incomes, lower inequality, and promote sustainable lifestyles
 - c. Mitigate and adapt to climate change through agriculture



Akello Grace Acyanga

Lira, Uganda



“Land is the only wealth people are left with in the village, and people think if they sell it, they have sold everything they have.”

“I think my children will not have sufficient fuelwood for cooking and heating in the future because the current generations are cutting down trees for fuelwood and they are not replacing them.”

Immaculate Nakee

Nakapiripirit District, Uganda



“To increase water and energy supplies and access to land, the communities should be sensitized, elderly people should launch a campaign to educate the actors to stop excessive cutting of big trees, more boreholes should be drilled where there are new settlements, and rainwater ponds should be constructed for animals and domestic use.”

Responsible Governance of Natural Resources: Getting the Policy Frameworks Right

Secure Land and Water Rights

As natural resources become scarcer, how land and water rights are allocated will have increasing implications for the social and economic development of states and their citizens, and particular impacts on the livelihoods of the poor.

Though most regions of the world have some form of rights system, many are underdeveloped and underfinanced and neither grounded in statutory law nor respectful of customary arrangements. In these contexts, rights holders are vulnerable to expropriation. The recent increase in the number of land deals within and between countries has amplified these challenges and raised important questions about how rights to local resources should be handled in such cases.

In May 2012 the Committee on World Food Security adopted Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries, and Forests in the Context of National Food Security (see Box 5.1). These guidelines allow government authorities, the private sector, civil society, and citizens to judge whether their proposed actions and the actions of others constitute acceptable practices and are geared toward protecting smallholder land and water rights. Moreover, the Committee on World Food Security is currently debating principles for responsible agricultural investment that will become available in 2013. Preliminary studies on cases of land acquisition have shown that the rights of small farmers and marginalized groups have so far not sufficiently been taken into account. Therefore, requests by farmers' organizations and other stakeholders to stop large-scale land acquisitions need to be examined in the light of these guidelines and principles.

Phase Out Subsidies

To ensure more sustainable and efficient use of water, land, and energy resources, direct subsidies for fuels and fertilizer should be phased out. Instead, countries should provide limited, carefully targeted direct payments to support poor farmers and consumers. Subsidies on water and energy lead to the overuse of these scarce resources, put pressure on tight government budgets, and often fail to reach the poorest producers and consumers. Nonetheless, many countries subsidize water and energy, both directly (through fuel or electricity subsidies and free delivery of irrigation water) and indirectly (by subsidizing fertilizers) in order to provide income support for farmers and boost production. The International Energy Agency suggests that global fossil fuel subsidies may rise to US\$660 billion in 2020 from US\$409 billion in 2010. In contrast, renewable energy subsidies totaled US\$66 billion in 2010. These fossil fuel

subsidies do not necessarily help the poorest people. In 2010 the poorest 20 percent of the population received approximately 8 percent of the US\$409 billion (IEA 2011), and the more than 1 billion people without access to modern forms of energy were fully excluded from this support.

In South Asia, increased national spending on energy subsidies is raising pressure on groundwater resources (because energy is used to pump water for irrigation) and energy supplies. For example, partly as a result of energy subsidies, up to 60 percent of India's food production now stems from groundwater resources, which are often exploited at unsustainable levels.

To reduce dependence on fossil fuels, some countries increasingly focus on sources of renewable energy. So far, however, these renewable energy strategies continue to depend heavily on first-generation biofuels. Although biofuel development can be beneficial to the economies of some countries, such as Brazil, the biofuel mandates instituted by the United States, the European Union, and a handful of other countries have contributed to reducing both the quantity and quality of water and land available for growing food, hence contributing to higher food prices and to increased competition for land. This competition has major risks for small-holder farmers in countries where land is being leased (see Chapter 4).

Create a Macroeconomic Enabling Framework

Market solutions, which encourage behavior through market signals rather than through explicit directives, can provide payments to farmers who conserve water, land, and associated ecosystem services (Stavins 2005). For example, the formal and informal water markets that have developed in water-scarce, agriculture-dependent countries have been shown to significantly increase the efficiency of water and energy use (Easter, Rosegrant, and Dinar 1998). Payments for ecosystem services, for example, from downstream reservoirs to upstream farmers and foresters who reduce erosion in watersheds is another way to promote efficient use of resources and avoid the negative impacts of poor resource use, but this approach depends on identifying downstream entities that can and want to pay for these services.

Enhanced regional and international trade can help make production more efficient and ensure that agricultural products are produced in those countries where inputs are most abundant or cheaply available. To ensure that trade generates full and equitable benefits, continued development of domestic and regional institutions and pro-poor policies to manage globalization is important. In particular, there is a need for reform of fiscal and financial policies and institutions; property and contract laws that foster modern commerce; flexible and efficient markets for products, labor, and capital; and development of technology and human capital.

Enhanced trade of agricultural commodities is also relevant to help offset the negative effects of climate change on agricultural productivity (Nelson et al. 2009b). Through its effects on temperature and pre-

cipitation, climate change is projected to reduce crop productivity in developing countries and thus to substantially increase their imports of major grains. Trade can partially compensate for the projected loss of productivity and thus help spread the risks associated with climate change, increasing the resilience of individual countries that might be hard hit by climatic events in particular seasons or years.

Farmers should be encouraged to move up the value chain by assuming increased roles in processing, packaging, and marketing their products. By promoting economies of scale, cooperatives can make it easier for farmers to add value (see case study on Sierra Leone in Chapter 4), help them gain a stronger market position, and open avenues for trade.

Scaling Up Technical Approaches

Invest in Agricultural Production Technologies That Support Increased Land, Water, and Energy Efficiency

Although private investment is rising, few developing-country governments have increased their investments in agricultural research, development, or extension, which have benefits for poor people's food security and income. In the 2003 Maputo Declaration on Agriculture and Food Security, African governments committed themselves to allocate at least 10 percent of national budgetary resources to agriculture and rural development policy within five years. As of 2008, only eight countries had met this goal. Nine countries reported rates between 5 and 10 percent, and 28 others reported rates of less than 5 percent (Omilola et al. 2010).

However, not only the quantity, but also the quality of investment must adjust to maximize water, land, and energy security for better food and nutrition outcomes. Most past efforts have focused on improving seeds and ensuring that farmers are provided with a set of inputs that can increase yields. This approach replicates an industrial process, in which external inputs serve to produce outputs in a linear model of production. Instead, smart, site-specific agroecological approaches that increase production, conserve natural resources, and are tailored to specific human and environmental conditions should be favored. Such approaches include integrated soil fertility management, alternate wetting and drying of rice land and direct seeding of rice, on-time water delivery and microirrigation, and increased fertilizer use efficiency.

For example, integrated soil fertility management involves applying both organic and inorganic fertilizers to the soil while also practicing reduced tillage and increasing the reuse of crop residues—practices that help protect the soil and add nutrients. Many studies in Sub-Saharan Africa have shown that integrated soil fertility management increases the soil moisture content, improves energy efficiency, and raises farmers' crop yields. It also increases soil organic carbon, which is particularly crucial

BOX 5.1 NEW GUIDELINES ON GOVERNING LAND, FISHERIES, AND FORESTS

New Guidelines on Governing Land, Fisheries, and Forests

In May 2012 the United Nations Committee on World Food Security adopted a set of voluntary guidelines to help countries establish laws and policies to better govern land, fishery, and forest tenure rights, with the ultimate aim of supporting food security and sustainable development. Over the course of almost three years, 96 national governments, civil society organizations, private sector entities, international organizations, and academics participated in developing the guidelines.

Though the guidelines have been discussed predominantly in connection with large-scale land acquisitions (“land grabbing”), they actually address a wide range of issues including:

- recognition and protection of legitimate tenure rights, also under informal systems
- best practices for registering and transferring tenure rights (including making tenure administrative systems accessible and affordable)
- management of expropriations and restitution of land to people who were forcibly evicted in the past
- approaches to ensuring that investment in agricultural lands occurs responsibly and transparently, including consideration of investment models that do not result in the large-scale transfer of tenure rights
- mechanisms for resolving disputes over tenure rights
- good practices and policies for land consolidation and redistributive reforms, where required
- transparent and participatory implementation of regulated spatial planning

The adoption of the voluntary guidelines is only a first step. The FAO, with partners, is now developing a series of technical handbooks designed to help countries adapt the guidelines to their local context and put them into play. To the same end, the FAO will also provide targeted technical assistance to governments. Equally if not more important will be support to civil society. Funds and training should be made available to allow civil society to use the voluntary guidelines as a tool to monitor government policies and to increase government accountability—especially in those countries where the secure use of and access to natural resources provides for the livelihood of large parts of the population.

in this region (see, for example, Bryan et al. 2011; Bationo et al. 2007; Marenya et al. 2012). Alternate wetting and drying of rice fields, direct seeding of rice, and dryland rice cultivation are all technologies that can, under appropriate conditions, reduce water use, energy use, and greenhouse gas emissions while maintaining or increasing crop yields. Several of these technologies are now being adopted for their labor-saving rather than their natural resource-conserving properties. For example, direct seeding of rice, which helps conserve labor (Pandey and Velasco 2005), has been adopted on almost half of all rice area in Vietnam (Farooq et al. 2011). There are, however, no general solutions. The best approach for each set of conditions must be determined on a case by case basis.

Foster Approaches That Lead to More Efficient Land, Water, and Energy Use along the Value Chain

To ensure that food and nutrition objectives for poor, food-insecure communities and households can be met, it is important to go beyond agricultural production to assess the implications of water, land, and energy policies along the entire value chain. Water and energy efficiency should be increased in the processing and retail sectors as well; and transportation, transaction, and trade costs of the final product should be factored into land intensification plans as well as new land development.

Some recent studies suggest there is significant potential for reducing postharvest losses along the value chain from the farm to the consumer in both the developing and developed world (see, for example, Gustavsson, Cederberg, and Sonesson 2011). If postharvest losses of agricultural commodities in developing countries account for 10–40 percent of total production, depending on the commodity, and if a significant share of these losses could be reduced, pressure on energy, water, and land resources could be considerably lowered.

Other studies, however, have found that developing-country postharvest losses might be much lower (see, for example, Greeley 1982; Reardon, Chen, and Minten, forthcoming), and the economics of loss recovery has yet to be established (see, for example, Rosegrant, Tokgoz, and Bhandary 2012). To better understand the potential benefits of reducing postharvest losses and food waste, researchers must better assess the recoverable losses along the value chain for key commodities and analyze the cost of reducing those losses through specific interventions in developing and developed countries.

Prevent Resource Depletion by Monitoring and Evaluating Strategies in Water, Land, Energy, and Agricultural Systems

The long-term availability of natural resources is crucial for food security. The increasing demand for agricultural products needs to be addressed in a sustainable way to prevent resource depletion. To fully reflect the value of natural resources and set appropriate incentives to help manage them sustainably, decisionmakers should take into account the full cost

of environmental degradation as well as the full range of benefits and services that ecosystems provide. To do so, however, they need information on which technologies and development pathways can optimally promote food security, poverty alleviation, and environmental sustainability.

The links between water, land, energy, and food mean that we need better ways to track, monitor, and evaluate the impacts of policies supporting the sustainable use of natural resources. In the case of food, agriculture, and bioenergy, new metrics are necessary to assess, for example, the nutrition and health implications of natural resource strategies as well as the effects on food security strategies. Once established, the best approaches can be developed into monitoring systems to generate evidence for sound policies.

In recent years, several initiatives have started to monitor the socioeconomic and environmental impacts of agricultural systems. It is important that these initiatives develop a wide range of indicators encompassing water, energy, land use, food, nutrition, and health outcomes. Moreover, indicators need to be simple and affordable to collect, including by developing-country government agencies and farmers themselves. Most important, such monitoring systems must be transparent, and data must be provided in a timely manner, allowing governments, the private sector, and civil society to make appropriate adjustments in response to indicator values. To integrate modern science with local knowledge, monitoring and research should be conducted with local farmers, particularly small-scale producers. Their participation will ensure that solutions are not one-size-fits-all, but fitted to the specific circumstances and responsive to actual needs.

Addressing the Drivers of Natural Resource Scarcity

Address Demographic Change, Women's Access to Education, and Reproductive Health

Economists, demographers, and policymakers have long debated the relationships between reproductive health, population change, and economic well-being. In recent years, however, a growing number of studies across disciplines have shown that declines in fertility affect the structure of a country's population (see, for example, World Bank 2007; Joshi 2012).

The emerging age structure has a lower dependency ratio (fewer young and older people per working-age adult), which creates a window of opportunity for economic development. Studies have also shown that access to family-planning services contributes to a reduction in fertility, which frees up household resources and allows women to make more investments in education. Better access to education, particularly by women, will in turn lead to positive food and nutrition security outcomes: the 2009 Global Hunger Index report suggests that there is



Jean Vea Dieudonné

Jacmel, Haiti

“In 10 years the prices for land have tripled, and a tendency has developed to pay in US dollars.”

“We must rather say that things have changed but not in the right direction. The water does not suffice for the population; neither does the electricity. All the land on the outskirts of the city has become slums.”

“What should be done to improve the situation is better management of the natural resources we have and better control of the distribution of these resources.”



U Khwin Thein

Pauk Township, Myanmar

“I know that the forest around our village was badly denuded. When I was young, perhaps 20 years of age, the forest between Pauk and our village was very dense. Nobody could dare to pass through it even during daytime.”

“In fact, perhaps the situation could be improved with the introduction of alternative fuel sources other than wood and perhaps by using fuel-efficient stoves. I had once such a stove made out of clay. I kept it for a long time to show it to others and encourage them to use it. But myself, I could never use it because I did not manage to persuade my wife....”

U Ye Myint

Pauk Township, Myanmar



“As my village is located in the lowlands near the Yaw River, it is easy to drill wells and find water. We suffer from too much instead of too little water, especially in the latter part of the rainy season. Water is pouring on the village from uphill and endangering houses. Therefore we want to reforest these 5 acres on top of the hill in order to reduce the water flow.”

Lespérance Fedner

Technical Coordinator, Welthungerhilfe,
Jean Rabel, Haiti



“During recent years, land prices have increased dramatically.... The pressure on land leads to the urbanization of areas which are actually reserved for agriculture.”

“The population must be conscious, motivated, and aware of the problem of availability of resources for the future needs of our children.”

a particularly strong relationship between education and hunger. Educated women have better nutritional status themselves, are better cared for, and provide higher-quality care for their children. To help address the challenge of providing adequate family-planning services, a recent summit on family planning led to pledges toward halving the number of women in developing countries who want, but lack access to, modern contraception (DFID 2012).

Raise Incomes, Lower Inequality, and Promote Sustainable Lifestyles

Rising income levels, with corresponding changes in lifestyle and consumption patterns, are likely to increase demand for a wide range of goods and services. Developing countries will have valuable opportunities to realize the wealth-creating potential of water, energy, and land resources, but they also face the risk of using these resources in ways that exacerbate economic inequality and environmental degradation.

Natural resources are often the principal source of income for the world's poorest people. In countries with weak governance of natural resources, civil society and the international community need to help strengthen governance systems by monitoring the natural resource base and ensuring that it is not expropriated at the expense of marginalized parts of society. Programs and initiatives such as those described in Chapter 4 can help strengthen the capacity of civil society groups to support poor and marginalized people in securing their rights and sustaining their livelihoods.

At the same time, economic growth in many developing countries is associated with more resource-intensive lifestyles that have proven to be unsustainable. Rising incomes should therefore be used as an opportunity to leapfrog unsustainable natural resource use and demonstrate the potential of lifestyles that are consistent with sustainable global development. Such lifestyles must not only be environmentally sustainable, but also allow poorer countries to catch up with the industrial countries in terms of human well-being. The largest onus of adjusting resource-intensive lifestyles, however, will remain with the industrial countries, in the interest of both sustainability and equality.

Moreover, broader action is needed to address the growing gap between the rich and the poor. While the exact dimensions of inequality vary from country to country, depending on the ethnic, regional, and religious situation, a systematic picture of inequality between rural and urban populations, between social or ethnic groups, and between the poorest and the rich is evident for almost all regions of the globe. In view of the growing inequities outlined in the Conventional World scenario in Chapter 3, increased investments in agriculture, rural infrastructure, health, education, and social protection¹⁹ are urgently needed in low-income developing countries to close the gaps between the rich and the poor and promote a model of development that is both socially and environmentally more sustainable. The industrial countries need to recon-

sider their lifestyles and consumption patterns and demonstrate that responsible use of natural resources benefits everyone in society.

Mitigate and Adapt to Climate Change through Agriculture

Sustainable practices are critical for helping agriculture adapt to climate change. At the same time, agriculture has been shown to significantly contribute to climate change, primarily by producing and releasing greenhouse gases and altering land cover and land use. Consequently, it will be necessary not only to reduce the adverse impacts of climate change on agriculture and the rural poor but also to minimize agriculture's impact on the climate. Developing countries will require funding for both agricultural adaptation and mitigation, and this financial and technical assistance should be additional to other aid commitments. It should also be targeted to those countries and regions most vulnerable to climate change, particularly in Sub-Saharan Africa and South Asia.

Critical adaptation measures include targeted investments in agricultural research and extension, rural infrastructure, and strengthened social protection programs. The goal should be to develop crops and livestock that are resilient in a range of production environments. Within countries, extension programs can help farmers adapt through new technologies, build farmers' knowledge and skills, and encourage them to form networks for sharing information and developing community-based adaptation options, such as farmer-managed irrigation systems and tree nurseries. Understanding the interactions between agriculture and climate well enough to support adaptation and mitigation activities requires major improvements in data collection, dissemination, and analysis.

In addition, greenhouse gas mitigation in the agricultural sector should be addressed through policy reforms. To date, agriculture has played a relatively minor role in greenhouse gas mitigation. Because of the large number of smallholder farmers that need to participate in mitigation projects to achieve significant savings in greenhouse gases, the administrative cost of agricultural mitigation is higher than in other sectors. In addition, more research is needed to establish the greenhouse gas savings from a number of specific agricultural practices. Carbon market schemes for agriculture could help reduce carbon emissions, although so far they have proven effective only for large-scale farmers. If the transaction costs for small-scale projects can be reduced, they might be an important source of income for small-scale farmers in the future. Most, if not all, agricultural practices that have been shown to reduce emissions also increase productivity and reduce other environmental impacts. Examples are agroecological approaches, such as integrated soil fertility management, which can be adapted to specific conditions.

¹⁹ Social protection includes benefits provided by governments to individuals or households to reduce hunger, poverty, and other forms of deprivation. These benefits include safety nets, such as public works schemes or cash welfare payments; drought, illness, and unemployment insurance; and other social sector policies including direct nutrition interventions and free primary education.



Ebwongu Edison

Kaberamaido district, Uganda

“I foresee my children not having sufficient water in the future. This is because currently we are already facing a safe water shortage (something that never used to happen in our village). Additionally, with the rapidly increasing population, there will be continuously growing contamination of the underground water wells due to human activities. This will render most of the water sources unfit for human consumption.”

“To counteract the scarcity of land, there is a need to sensitize the community to practice family planning to check the rapidly growing population.”



Daw Thaug Kyi

Pauk Township, Myanmar

“When I was young my parents' main earnings were from charcoal burning. I became to know that is a main cause for the lack of forest nowadays. And if there are no trees, rain may be lacking. I would like to plant some trees to get good timber in order to construct a house. And I also have great interest in installing a solar plate in order to get electric light.”

Data Sources and Calculation of the 1990, 1996, 2001, and 2012 Global Hunger Index Scores

All three index components are expressed in percentages and weighted equally. Higher GHI values indicate more hunger. The index varies between a minimum of 0 and a maximum of 100, but these extremes do not occur in practice. The maximum value of 100 would be reached only if all children died before their fifth birthday, the whole population was undernourished, and all children under five were underweight. The minimum value of zero would mean that a country had no undernourished people in the population, no children under five who were underweight, and no children who died before their fifth birthday. The table below provides an overview of the data sources for the Global Hunger Index.

THE GLOBAL HUNGER INDEX IS CALCULATED AS FOLLOWS:

$$\text{GHI} = (\text{PUN} + \text{CUW} + \text{CM})/3$$

with **GHI:** Global Hunger Index

PUN: proportion of the population that is undernourished (in %)

CUW: prevalence of underweight in children younger than five (in %)

CM: proportion of children dying before the age of five (in %)

GLOBAL HUNGER INDEX COMPONENTS, 1990 GHI, 1996 GHI, 2001 GHI, AND 2012 GHI

GHI	Number of countries with GHI	Indicators	Reference years	Data sources
1990	97	Percentage of undernourished in the population ^a	1990–92 ^b	FAO 2011a and authors' estimates
		Percentage of underweight in children under five	1988–92 ^c	WHO 2012 and authors' estimates
		Under-five mortality	1990	UNICEF 2012b
1996	117	Percentage of undernourished in the population ^a	1995–97 ^b	FAO 2011a and authors' estimates
		Percentage of underweight in children under five	1994–98 ^d	WHO 2012; UNICEF 2012a; and authors' estimates
		Under-five mortality	1996	IGME 2011
2001	118	Percentage of undernourished in the population ^a	2000–02 ^b	FAO 2011a and authors' estimates
		Percentage of underweight in children under five	1999–03 ^e	WHO 2012 and authors' estimates
		Under-five mortality	2001	IGME 2011
2012	120	Percentage of undernourished in the population ^a	2006–08 ^b	FAO 2011a and authors' estimates
		Percentage of underweight in children under five	2005–10 ^f	WHO 2012; UNICEF 2012a, c; MEASURE DHS 2012; ^g and authors' estimates
		Under-five mortality	2010	UNICEF 2012b

^a Proportion of the population with calorie deficiency.

^b Average over a three-year period.

^c Data collected from the year closest to 1990; where data for 1988 and 1992, or 1989 and 1991, were available, an average was used. The authors' estimates are for 1990.

^d Data collected from the year closest to 1996; where data for 1994 and 1998, or 1995 and 1997, were available, an average was used. The authors' estimates are for 1996.

^e Data collected from the year closest to 2001; where data for 1999 and 2003, or 2000 and 2002, were available, an average was used. The authors' estimates are for 2001.

^f The latest data gathered in this period.

^g WHO (2012) data are the primary data source, and UNICEF (2012a, c) and MEASURE DHS (2012) are secondary data sources.

DATA UNDERLYING THE CALCULATION OF THE 1990, 1996, 2001, AND 2012 GLOBAL HUNGER INDEX SCORES

Country	Proportion of undernourished in the population (%)				Prevalence of underweight in children under five years (%)				Under-five mortality rate (%)				GHI			
	90-92	95-97	00-02	06-08	88-92	94-98	99-03	05-10	1990	1996	2001	2010	1990 (with data from 88-92)	1996 (with data from 94-98)	2001 (with data from 99-03)	2012 (with data from 05-10)
Afghanistan	-	-	-	-	44.9	33.6 *	28.4 *		20.9	15.3	15.0	14.9	-	-	-	-
Albania	11 *	5 *	5 *	5 *	10.4 *	7.1	17.0	6.3	4.1	3.4	2.7	1.8	8.5	5.2	8.2	<5
Algeria	4 *	5	5	4 *	9.2	11.3	8.3	3.0	6.8	5.6	4.7	3.6	6.7	7.3	6.0	<5
Angola	67	61	52	41	34.4 *	37.0	27.5	15.1	24.3	21.7	19.5	16.1	41.9	39.9	33.0	24.1
Argentina	1 *	1 *	1 *	2 *	3.4 *	4.7	2.4 *	2.3	2.7	2.2	1.9	1.4	<5	<5	<5	<5
Armenia	-	36	28	21	5.4 *	2.7	2.6	4.7	5.5	4.1	3.2	2.0	-	14.3	11.3	9.2
Azerbaijan	-	27	11	2 *	11.8 *	8.8	5.9	8.4	9.3	7.9	6.5	4.6	-	14.6	7.8	5.0
Bahrain	-	-	-	-	6.3	7.6	6.7 *	5.8 *	1.7	1.4	1.2	1.0	-	-	-	-
Bangladesh	38	41	30	26	61.5	56.7	45.4	41.3	14.3	10.7	8.1	4.8	37.9	36.1	27.8	24.0
Belarus	-	1 *	2 *	1 *	2.3 *	1.7 *	1.2 *	1.3	1.7	1.7	1.3	0.6	-	<5	<5	<5
Benin	20	18	15	12	26.0 *	26.8	21.5	20.2	17.8	15.6	14.0	11.5	21.3	20.1	16.8	14.6
Bhutan	-	-	-	-	34.0	24.8 *	14.1	12.7	13.9	10.7	8.5	5.6	-	-	-	-
Bolivia	29	24	22	27	9.7	9.3	7.0 *	4.5	12.1	9.7	7.9	5.4	16.9	14.3	12.3	12.3
Bosnia & Herzegovina	-	4 *	4 *	2 *	4.7 *	4.3 *	4.2	1.6	1.9	1.2	0.9	0.8	-	<5	<5	<5
Botswana	19	23	27	25	15.2 *	15.1	10.7	11.2	5.9	8.2	9.5	4.8	13.4	15.4	15.7	13.7
Brazil	11	10	9	6	5.3	4.5	3.7	2.2	5.9	4.6	3.4	1.9	7.4	6.4	5.4	<5
Bulgaria	4 *	9 *	9 *	10 *	2.6 *	2.8 *	2.4 *	2.1 *	2.2	2.3	2.0	1.3	<5	<5	<5	<5
Burkina Faso	14	12	12	8	35.9 *	35.4 *	34.5	26.0	20.5	19.7	18.9	17.6	23.5	22.4	21.8	17.2
Burundi	44	56	59	62	32.6 *	34.4 *	38.9	35.2	18.3	17.3	16.2	14.2	31.6	35.9	38.0	37.1
Cambodia	38	40	29	25	45.4 *	42.6	39.5	28.8	12.1	12.0	9.6	5.1	31.8	31.5	26.0	19.6
Cameroon	33	34	26	22	18.0	17.8	16.3 *	16.6	13.7	14.8	14.7	13.6	16.3	22.2	19.0	17.4
Central African Rep.	44	47	43	40	21.6 *	20.4	21.8	26.1	16.5	17.7	17.5	15.9	27.4	28.4	27.4	27.3
Chad	60	53	43	39	37.3 *	34.3	29.4	28.7 *	20.7	19.6	18.8	17.3	39.3	35.6	30.4	28.3
Chile	7	4 *	3 *	2 *	1.0 *	0.7	0.7	0.5	1.9	1.3	1.0	0.9	<5	<5	<5	<5
China	18	12	10	10	12.6	10.7	7.1	3.4	4.8	4.1	3.1	1.8	11.8	8.9	6.7	5.1
Colombia	15	11	10	9	8.8	6.3	4.9	3.4	3.7	3.1	2.6	1.9	9.2	6.8	5.8	<5
Comoros	38	47	54	47	16.2	22.3	25.0	21.8 *	12.5	11.3	10.2	8.6	22.2	26.9	29.7	25.8
Congo. Dem. Rep.	-	-	-	-	23.6 *	30.7	33.6	24.2	18.1	18.1	18.1	17.0	-	-	-	-
Congo. Rep.	42	41	20	13	17.3 *	20.5 *	16.7 *	11.8	11.6	10.9	10.3	9.3	23.6	24.1	15.7	11.4
Costa Rica	3 *	4 *	4 *	4 *	2.5	1.9	1.5 *	1.1	1.7	1.5	1.2	1.0	<5	<5	<5	<5
Croatia	-	13 *	9 *	3 *	0.6 *	0.5	0.4 *	0.4 *	1.3	1.0	0.8	0.6	-	<5	<5	<5
Cuba	6	14	2 *	1 *	3.6 *	4.6 *	3.4	3.5	1.3	1.0	0.8	0.6	<5	6.5	<5	<5
Côte d'Ivoire	15	17	17	14	19.5 *	20.9	18.2	28.2	15.1	15.4	14.5	12.3	16.5	17.8	16.6	18.2
Djibouti	60	50	40	26	20.2	16.0	25.4	30.1	12.3	11.2	10.4	9.1	30.8	25.7	25.3	21.7
Dominican Republic	28	26	25	24	8.4	4.7	3.9	3.4	6.2	4.8	3.9	2.7	14.2	11.8	10.9	10.0
Ecuador	23	16	17	15	12.2 *	12.5	6.6 *	5.5 *	5.2	3.9	3.1	2.0	13.5	10.8	8.9	7.5
Egypt. Arab Rep.	4 *	3 *	3 *	4 *	10.5	10.8	8.7	6.8	9.4	6.3	4.3	2.2	8.0	6.7	5.3	<5
El Salvador	13	12	7	9	11.1	9.6	6.1	6.6	6.2	4.5	3.2	1.6	10.1	8.7	5.4	5.7
Eritrea	-	64	70	65	-	38.3	34.5	32.2 *	14.1	11.0	8.9	6.1	-	37.8	37.8	34.4
Estonia	-	5	5	4 *	2.9 *	1.1 *	1.1 *	0.8 *	2.1	1.7	1.2	0.5	-	<5	<5	<5
Ethiopia	69	62	48	41	39.2	38.1 *	42.0	34.6	18.4	15.7	13.6	10.6	42.2	38.6	34.5	28.7
Fiji	8	5	3 *	3 *	7.8 *	6.2 *	5.1 *	3.6 *	3.0	2.5	2.2	1.7	6.3	<5	<5	<5
Gabon	6	5 *	4 *	4 *	10.0 *	6.7 *	8.8	4.9 *	9.3	8.9	8.7	7.4	8.4	6.9	7.2	5.4
Gambia. The	14	23	21	19	18.0 *	23.2	15.4	18.1	16.5	14.1	12.4	9.8	16.2	20.1	16.3	15.6
Georgia	-	19	12	6	2.2 *	3.2 *	2.7	1.1	4.7	3.9	3.2	2.2	-	8.7	6.0	<5
Ghana	28	13	9	5	24.0	25.1	19.6	14.3	12.2	10.9	9.7	7.4	21.4	16.3	12.8	8.9
Guatemala	15	20	22	22	22.7 *	21.7	18.7	13.0	7.8	5.7	4.7	3.2	15.2	15.8	15.1	12.7
Guinea	20	19	20	16	24.4 *	21.2	27.9	20.8	22.9	19.7	17.0	13.0	22.4	20.0	21.6	16.6
Guinea-Bissau	22	26	25	22	19.0 *	17.4 *	21.9	18.1	21.0	18.9	17.4	15.0	20.7	20.8	21.4	18.4
Guyana	20	11	7	8	17.2 *	10.3	11.9	10.5	6.6	5.5	4.5	3.0	14.6	8.9	7.8	7.2
Haiti	63	60	53	57	23.7	24.0	13.9	18.9	15.1	12.5	10.6	16.5	33.9	32.2	25.8	30.8
Honduras	19	16	14	12	15.8	19.2	12.5	8.6	5.8	4.5	3.6	2.4	13.5	13.2	10.0	7.7
India	20	17	20	19	59.5	41.1	44.4	43.5	11.5	9.7	8.3	6.3	30.3	22.6	24.2	22.9
Indonesia	16	11	15	13	31.0	28.9	22.5	19.6	8.5	6.4	5.2	3.5	18.5	15.4	14.2	12.0
Iran. Islamic Rep.	3 *	3 *	4 *	4 *	16.9 *	13.8	7.1 *	3.8 *	6.5	5.0	4.1	2.6	8.8	7.3	5.1	<5
Iraq	-	-	-	-	10.4	-	12.9	7.1	4.6	4.4	4.2	3.9	-	-	-	-
Jamaica	11	6	5	5	5.2	5.6	4.1	1.9	3.8	3.3	3.0	2.4	6.7	5.0	<5	<5
Jordan	3 *	5	5	3 *	4.8	3.8	3.6	1.9	3.8	3.3	2.8	2.2	<5	<5	<5	<5
Kazakhstan	-	1 *	8	0 *	6.0 *	6.7	3.8	4.9	5.7	4.9	4.3	3.3	-	<5	5.4	<5
Kenya	33	32	33	33	19.3 *	18.7	17.5	16.4	9.9	11.6	10.8	8.5	20.7	20.8	20.4	19.3
Kuwait	20	5	6	5	5.7 *	5.4	2.2	1.7	1.5	1.4	1.2	1.1	9.1	<5	<5	<5
Kyrgyz Republic	-	13	17	11	5.3 *	8.2	4.9 *	2.7	7.2	5.9	5.0	3.8	-	9.0	9.0	5.8
Lao PDR	31	29	26	22	40.3 *	35.9	36.4	31.6	14.5	10.8	8.4	5.4	28.6	25.2	23.6	19.7
Latvia	-	3 *	4 *	3 *	3.0 *	1.1 *	1.2 *	0.7 *	2.1	2.2	1.6	1.0	-	<5	<5	<5
Lebanon	3 *	3 *	3 *	3 *	6.1 *	3.5	3.8 *	2.7 *	3.8	3.3	2.8	2.2	<5	<5	<5	<5

Note: * indicates IFPRI estimates.

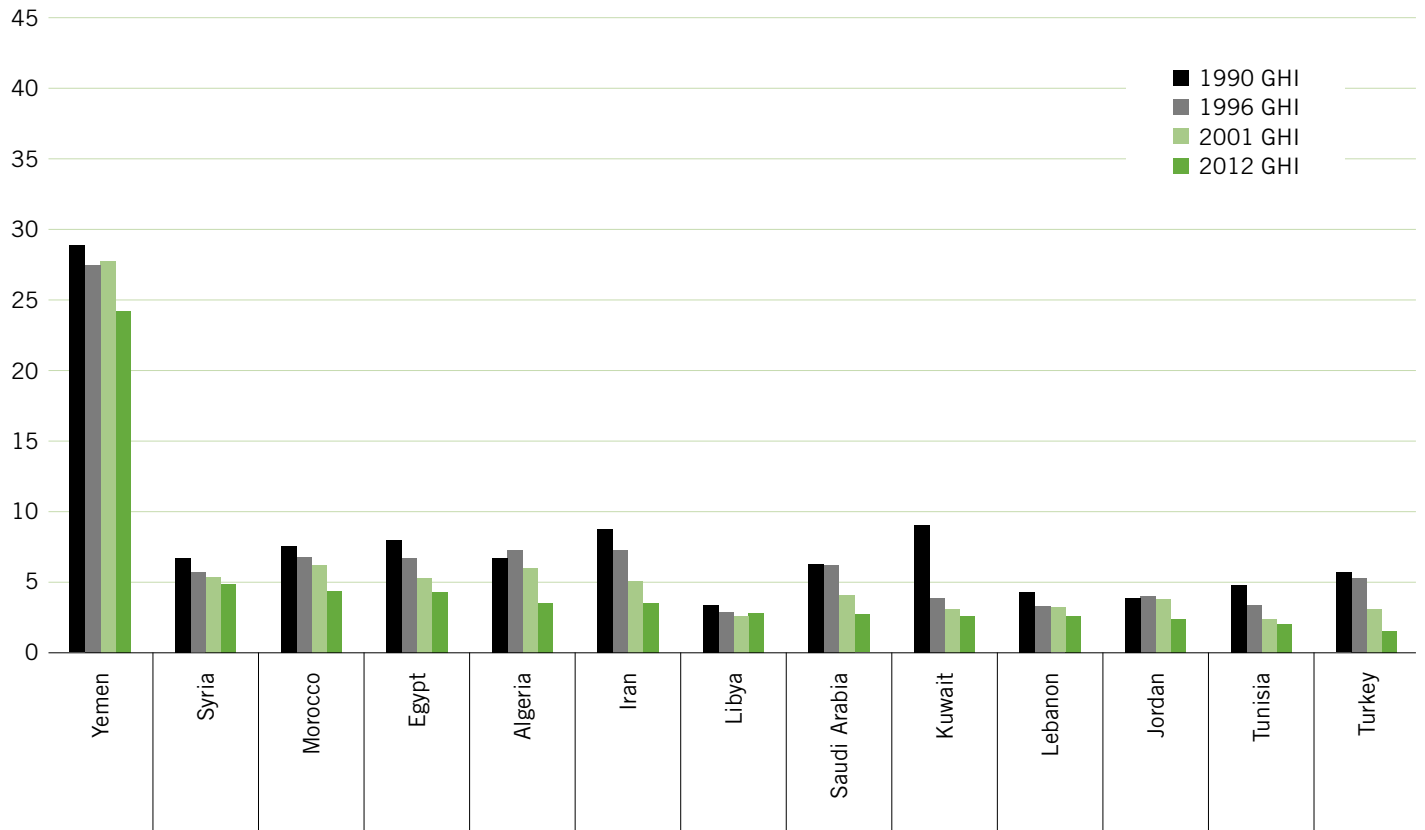
DATA UNDERLYING THE CALCULATION OF THE 1990, 1996, 2001, AND 2012 GLOBAL HUNGER INDEX SCORES

Country	Proportion of undernourished in the population (%)				Prevalence of underweight in children under five years (%)				Under-five mortality rate (%)				GHI			
	90-92	95-97	00-02	06-08	88-92	94-98	99-03	05-10	1990	1996	2001	2010	1990 (with data from 88-92)	1996 (with data from 94-98)	2001 (with data from 99-03)	2012 (with data from 05-10)
Lesotho	15	16	14	14	13.8	14.0	15.0	13.2	8.9	10.7	12.7	8.5	12.6	13.6	13.9	11.9
Liberia	30	32	36	32	15.3 *	23.4 *	22.8	14.4	22.7	20.2	16.1	10.3	22.7	25.2	25.0	18.9
Libya	1 *	1 *	1 *	1 *	4.8 *	4.3	4.3 *	5.6	4.5	3.3	2.6	1.7	<5	<5	<5	<5
Lithuania	-	2 *	1 *	1 *	3.2 *	1.4 *	1.0 *	0.6 *	1.7	1.5	1.1	0.7	-	<5	<5	<5
Macedonia, FYR	-	9 *	6 *	3 *	2.9 *	2.9 *	1.9	2.0	3.9	2.2	1.5	1.2	-	<5	<5	<5
Madagascar	21	26	28	25	35.5	33.0	37.0 *	36.3 *	15.9	12.3	9.7	6.2	24.1	23.8	24.9	22.5
Malawi	43	36	30	27	24.4	26.5	21.5	13.8	22.2	19.9	15.9	9.2	29.9	27.5	22.5	16.7
Malaysia	3 *	1 *	2 *	2 *	22.1	17.7	16.7	12.9	1.8	1.3	1.0	0.6	9.0	6.7	6.6	5.2
Mali	27	25	18	12	30.9 *	31.0	30.1	18.9	25.5	22.9	21.0	17.8	27.8	26.3	23.0	16.2
Mauritania	12	9	8	8	43.3	29.3 *	30.4	14.2	12.4	11.8	11.5	11.1	22.6	16.7	16.6	11.1
Mauritius	7	7	5	5	14.6 *	13.0	11.3 *	9.7 *	2.4	2.2	1.8	1.5	8.0	7.4	6.0	5.4
Mexico	5 *	5 *	4 *	4 *	13.9	7.7 *	6.0	3.4	4.9	3.6	2.8	1.7	7.9	5.4	<5	<5
Moldova	-	9 *	9 *	6 *	4.5 *	5.0 *	4.1 *	3.2	3.7	3.0	2.6	1.9	-	5.7	5.2	<5
Mongolia	28	33	27	27	10.8	11.5 *	11.6	5.0	10.7	7.9	5.7	3.2	16.5	17.5	14.8	11.7
Montenegro	-	-	-	8 *	-	-	-	2.2	1.8	1.5	1.2	0.8	-	-	-	<5
Morocco	6	6	6	4 *	8.1	7.7	7.3 *	5.5 *	8.6	6.6	5.3	3.6	7.6	6.8	6.2	<5
Mozambique	59	47	46	38	25.5 *	26.0	23.0	18.3	21.9	19.1	17.3	13.5	35.5	30.7	28.8	23.3
Myanmar	-	-	-	-	28.8	31.9	30.1	23.0	11.2	9.6	8.5	6.6	-	-	-	-
Namibia	32	30	21	18	21.5	20.3 *	20.3	17.5	7.3	6.9	7.5	4.0	20.3	19.1	16.3	13.2
Nepal	21	20	18	17	45.5 *	42.9	43.0	38.8	14.1	10.4	8.0	5.0	26.9	24.4	23.0	20.3
Nicaragua	50	38	25	19	10.4 *	10.2	7.8	5.7	6.8	5.1	4.1	2.7	22.4	17.8	12.3	9.1
Niger	37	37	27	16	41.0	45.0	43.6	36.6	31.1	25.7	20.9	14.3	36.4	35.9	30.5	22.3
Nigeria	16	10	9	6	35.1	32.4 *	27.3	26.7	21.3	20.4	18.2	14.3	24.1	20.9	18.2	15.7
North Korea	21	30	34	35	21.5 *	22.4 *	21.3	18.8	4.5	7.8	4.9	3.3	15.7	20.1	20.1	19.0
Oman	-	-	-	-	19.2	10.0	11.3	8.6	4.7	3.0	2.0	0.9	-	-	-	-
Pakistan	25	20	24	25	39.0	34.2	31.3	25.4 *	12.4	11.1	9.9	8.7	25.5	21.8	21.7	19.7
Panama	18	20	19	15	9.0 *	6.3	5.1	3.9	3.3	2.8	2.5	2.0	10.1	9.7	8.9	7.0
Papua New Guinea	-	-	-	-	19.3 *	17.7 *	18.0 *	18.0	9.0	8.0	7.2	6.1	-	-	-	-
Paraguay	16	10	10	10	2.8	3.3 *	2.8 *	3.4	5.0	4.1	3.4	2.5	7.9	5.8	5.4	5.3
Peru	27	21	18	16	8.8	5.7	5.2	4.3	7.8	5.5	3.8	1.9	14.5	10.7	9.0	7.4
Philippines	24	20	18	13	29.9	28.3	20.7	20.7	5.9	4.6	3.9	2.9	19.9	17.6	14.2	12.2
Qatar	-	-	-	-	-	4.8	-	-	2.1	1.5	1.2	0.8	-	-	-	-
Romania	2 *	2 *	1 *	0 *	5.0	4.6 *	3.8	3.0 *	3.7	3.1	2.6	1.4	<5	<5	<5	<5
Russian Federation	-	4 *	3 *	1 *	2.7 *	2.6	1.0 *	0.7 *	2.7	2.6	2.2	1.2	-	<5	<5	<5
Rwanda	44	53	38	32	24.3	24.2	22.2	18.0	16.3	20.9	16.6	9.1	28.2	32.7	25.6	19.7
Saudi Arabia	2 *	2 *	1 *	1 *	12.4 *	13.5	8.8 *	5.3	4.5	3.2	2.5	1.8	6.3	6.2	<5	<5
Senegal	22	26	26	19	19.0	19.6	20.3	14.5	13.9	13.3	11.4	7.5	18.3	19.6	19.2	13.7
Serbia	-	-	-	8 *	-	-	-	1.6	2.9	1.7	1.2	0.7	-	-	-	<5
Sierra Leone	45	39	43	35	25.4	25.1 *	24.7	21.7	27.6	26.3	22.6	17.4	32.7	30.1	30.1	24.7
Slovak Republic	-	3 *	5 *	4 *	4.0 *	1.5 *	1.3 *	0.9 *	1.8	1.4	1.1	0.8	-	<5	<5	<5
Somalia	-	-	-	-	-	-	22.8	32.8	18.0	18.0	18.0	18.0	-	-	-	-
South Africa	4 *	5 *	4 *	3 *	10.8 *	8.0	10.1	8.7	6.0	6.4	8.1	5.7	6.9	6.5	7.4	5.8
Sri Lanka	28	25	20	20	31.3 *	27.5	23.3	21.6	3.2	2.6	2.2	1.7	20.8	18.4	15.2	14.4
Sudan	39	29	28	22	34.7 *	32.8 *	38.4	32.2	12.5	11.8	11.3	10.3	28.7	24.5	25.9	21.5
Suriname	14	13	15	15	11.7 *	10.6 *	11.4	7.5	5.2	4.4	3.9	3.1	10.3	9.3	10.1	8.5
Swaziland	12	21	18	19	6.4 *	6.8 *	9.1	5.8	9.6	10.0	11.6	7.8	9.3	12.6	12.9	10.9
Syrian Arab Republic	4 *	3 *	3 *	3 *	12.3 *	11.3	11.1	10.1	3.8	2.7	2.2	1.6	6.7	5.7	5.4	<5
Tajikistan	-	42	46	26	13.5 *	19.5 *	18.7 *	15.0	11.6	10.8	9.0	6.3	-	24.1	24.6	15.8
Tanzania	29	42	40	34	25.1	26.9	25.3	16.2	15.5	15.2	12.5	7.6	23.2	28.0	25.9	19.3
Thailand	26	18	18	16	16.1 *	15.4	8.0 *	7.0	3.2	2.0	1.7	1.3	15.1	11.8	9.2	8.1
Timor-Leste	39	32	28	31	-	-	40.6	45.3	16.9	13.1	9.7	5.5	-	-	26.1	27.3
Togo	43	36	36	30	21.5	16.7	21.6 *	16.6	14.7	13.2	12.2	10.3	26.4	22.0	23.3	19.0
Trinidad & Tobago	11	14	11	11	6.7 *	5.0 *	4.4	2.3 *	3.7	3.4	3.1	2.7	7.1	7.5	6.2	5.3
Tunisia	1 *	1 *	1 *	1 *	8.5	5.7	3.5	3.3	4.9	3.6	2.7	1.6	<5	<5	<5	<5
Turkey	1 *	1 *	1 *	1 *	8.2 *	9.0	4.5 *	1.7	8.0	5.9	3.9	1.8	5.7	5.3	<5	<5
Turkmenistan	-	9	9	7	10.3 *	12.8 *	10.5	8.0	9.8	8.3	7.2	5.6	-	10.0	8.9	6.9
Uganda	19	23	19	22	19.7	21.5	19.0	16.4	17.5	16.4	13.9	9.9	18.7	20.3	17.3	16.1
Ukraine	-	4 *	2 *	1 *	2.2 *	2.3 *	2.5	0.8 *	2.1	1.9	1.7	1.3	-	<5	<5	<5
Uruguay	5	4 *	3 *	3 *	6.4 *	5.1 *	5.4	4.5 *	2.3	2.0	1.7	1.1	<5	<5	<5	<5
Uzbekistan	-	5	19	11	9.6 *	15.3	7.1	4.4	7.7	6.8	6.2	5.2	-	9.0	10.8	6.9
Venezuela, RB	10	14	13	7	6.7	4.4	3.9	3.7	3.3	2.8	2.4	1.8	6.7	7.1	6.4	<5
Vietnam	31	22	17	11	40.7	38.2	26.2	20.2	5.1	4.1	3.4	2.3	25.6	21.4	15.5	11.2
Yemen, Rep.	30	31	31	30	44.3 *	40.9	43.1	35.3 *	12.8	11.0	9.7	7.7	29.0	27.6	27.9	24.3
Zambia	35	38	43	44	21.2	19.6	23.3	14.9	18.3	17.4	15.3	11.1	24.8	25.0	27.2	23.3
Zimbabwe	40	44	41	30	8.0	11.7	11.5	14.0	7.8	11.1	11.3	8.0	18.6	22.3	21.3	17.3

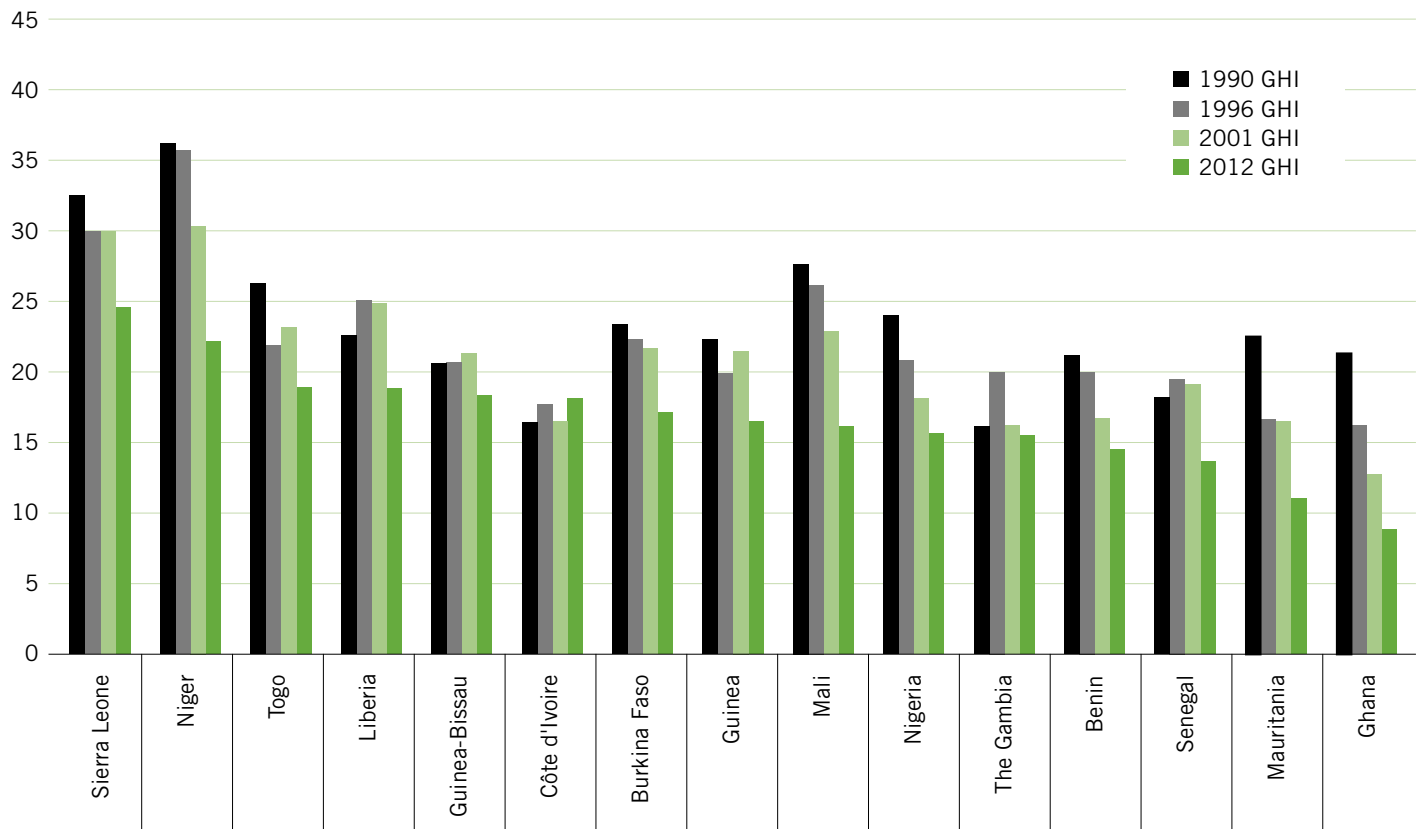
Note: * indicates IFPRI estimates.

COUNTRY TRENDS FOR THE 1990, 1996, 2001, AND 2012 GLOBAL HUNGER INDEX SCORES

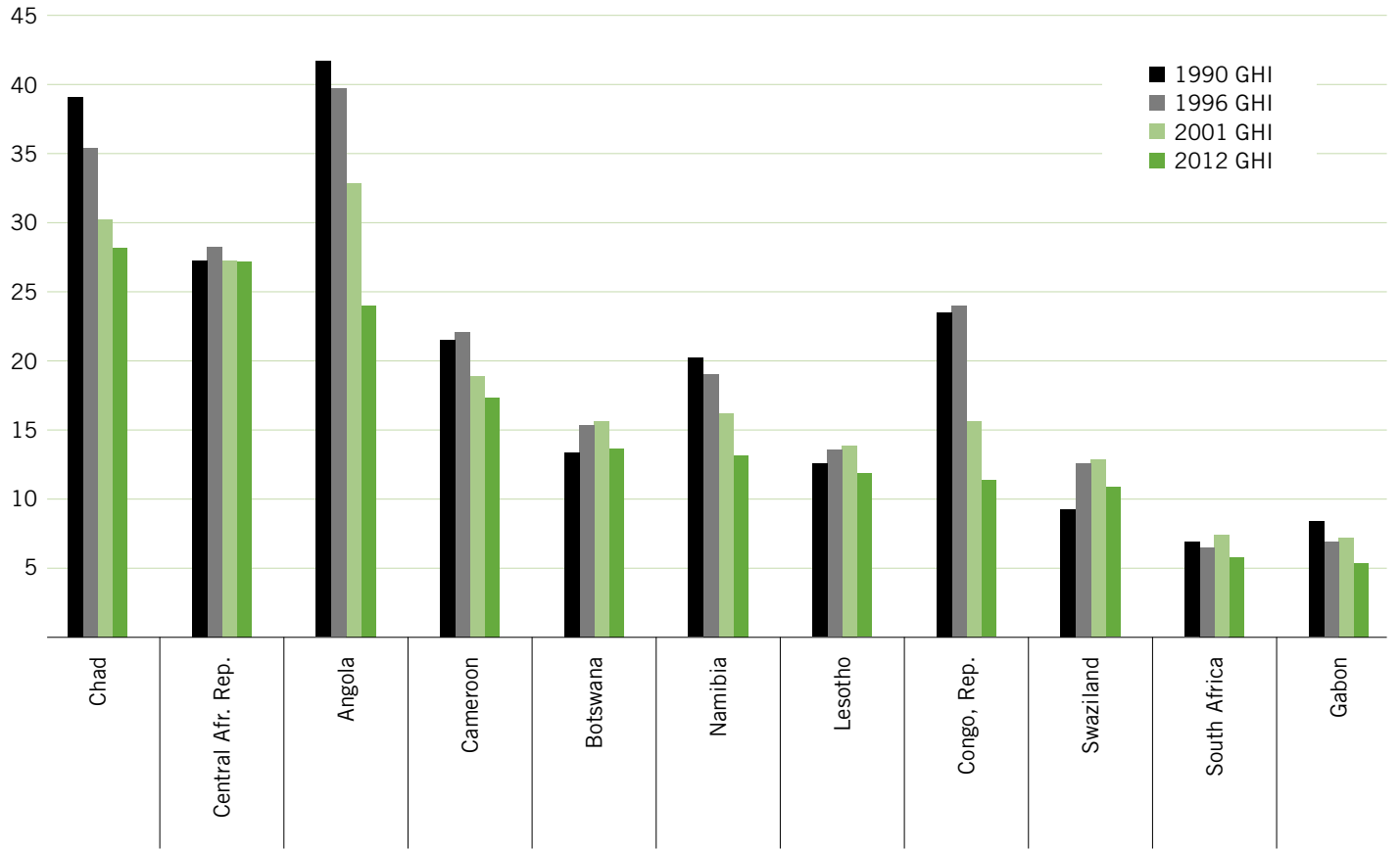
NEAR EAST AND NORTH AFRICA



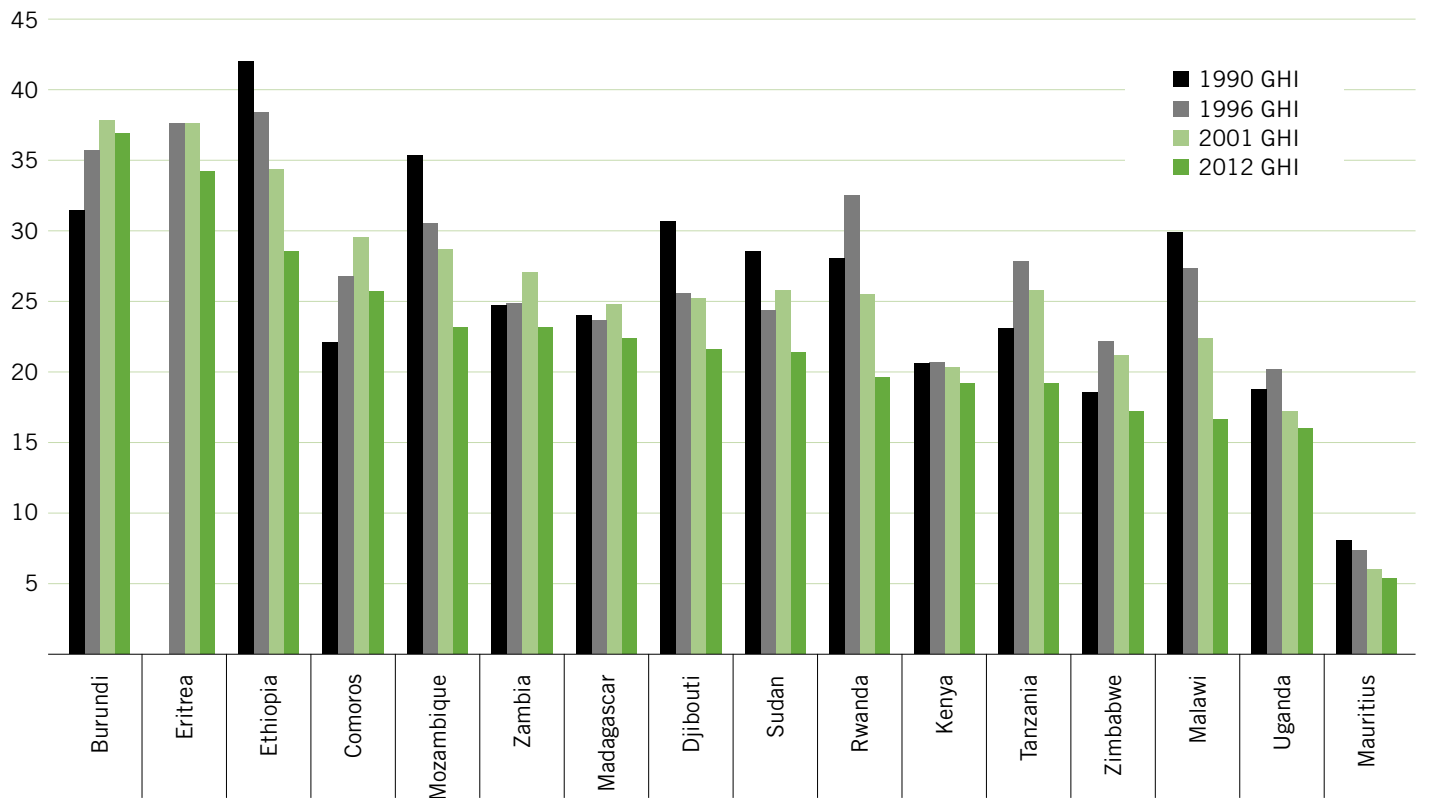
WEST AFRICA



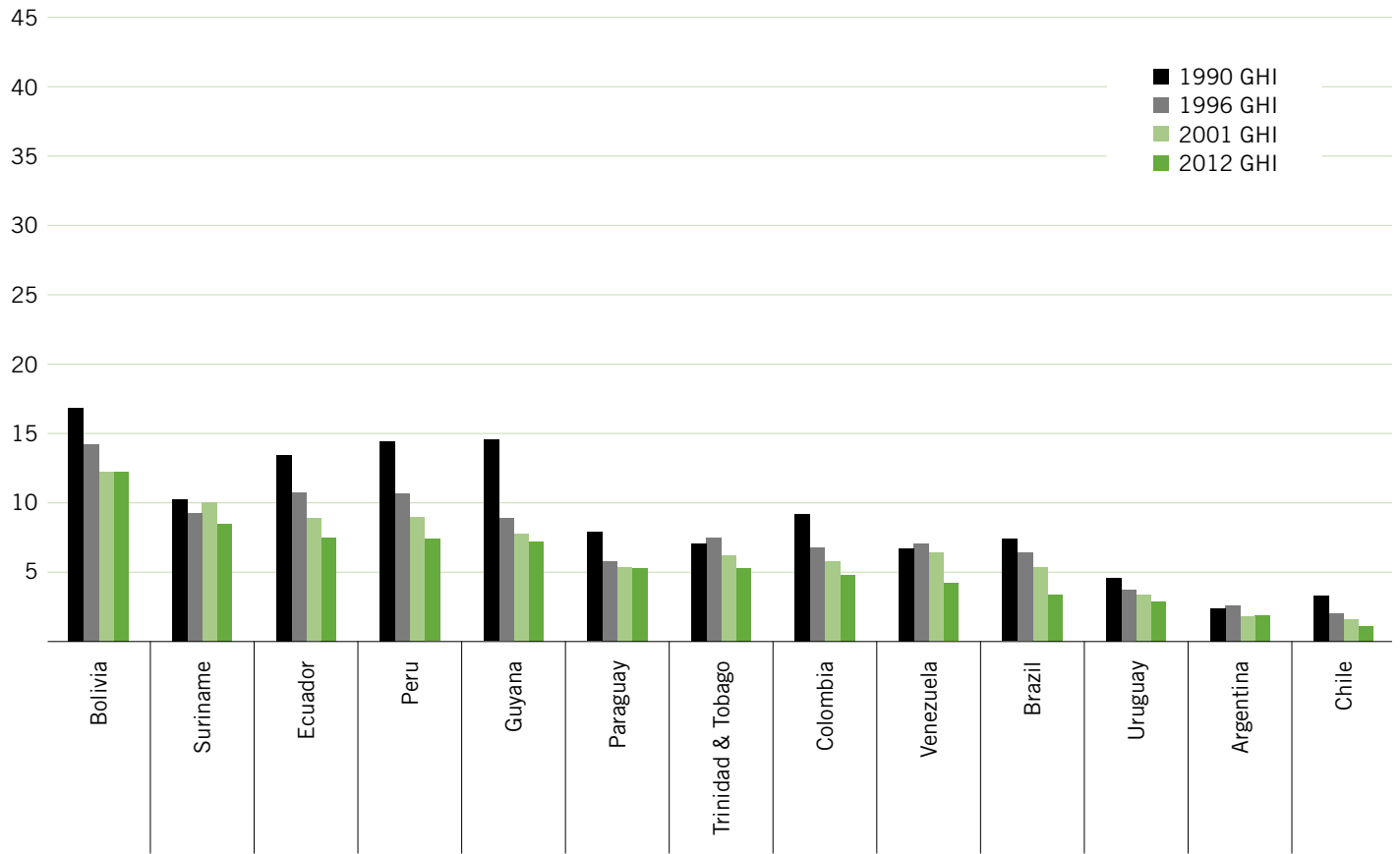
CENTRAL AND SOUTHERN AFRICA



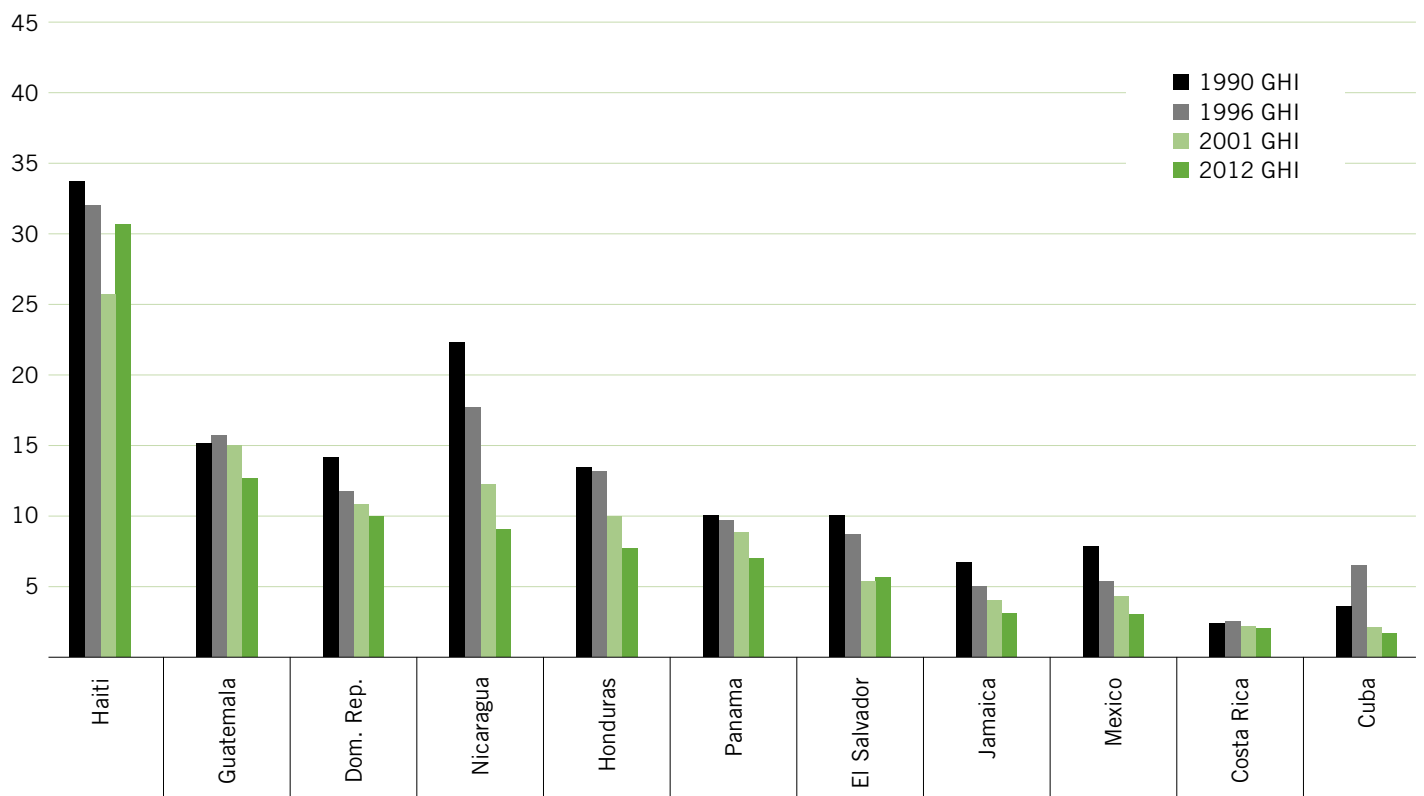
EAST AFRICA



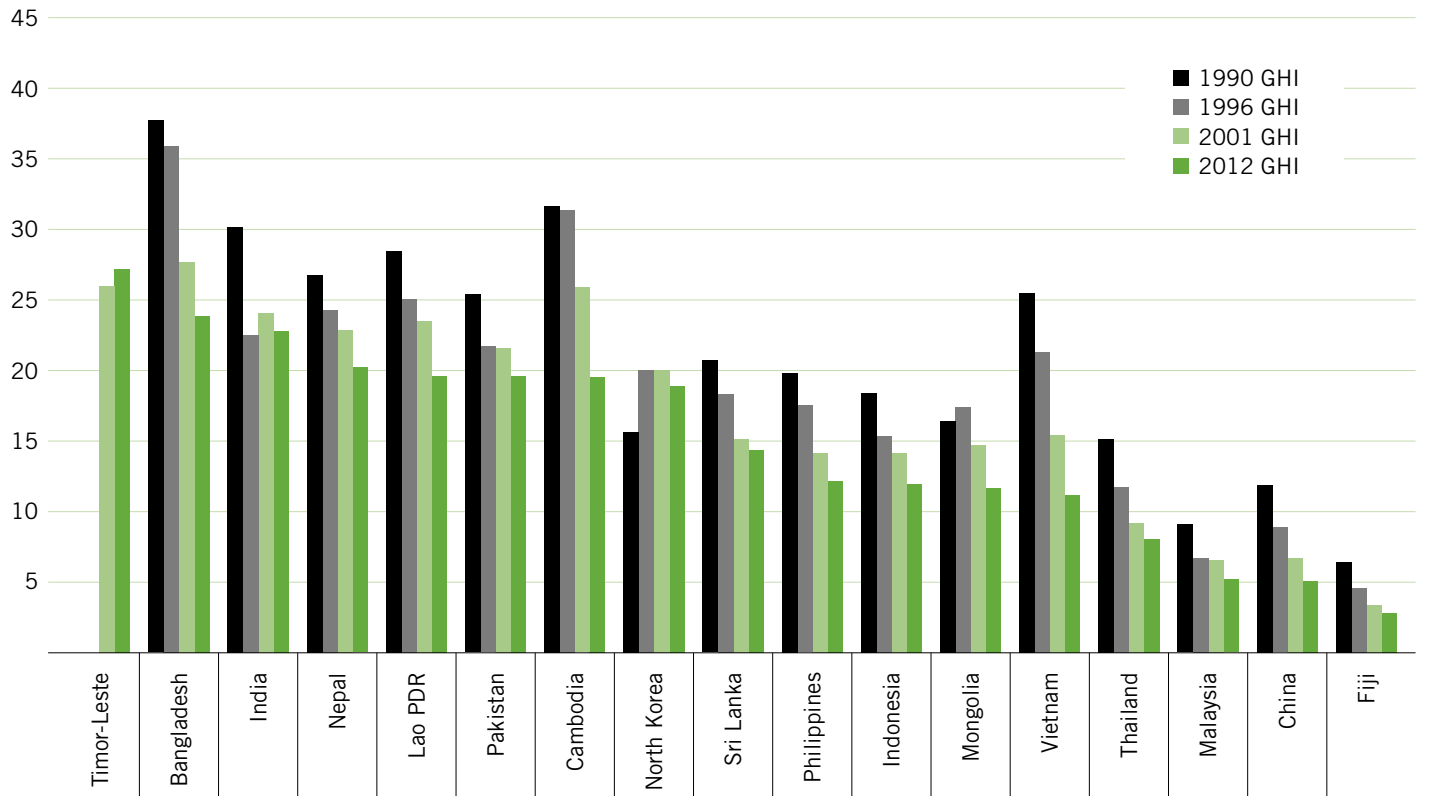
SOUTH AMERICA



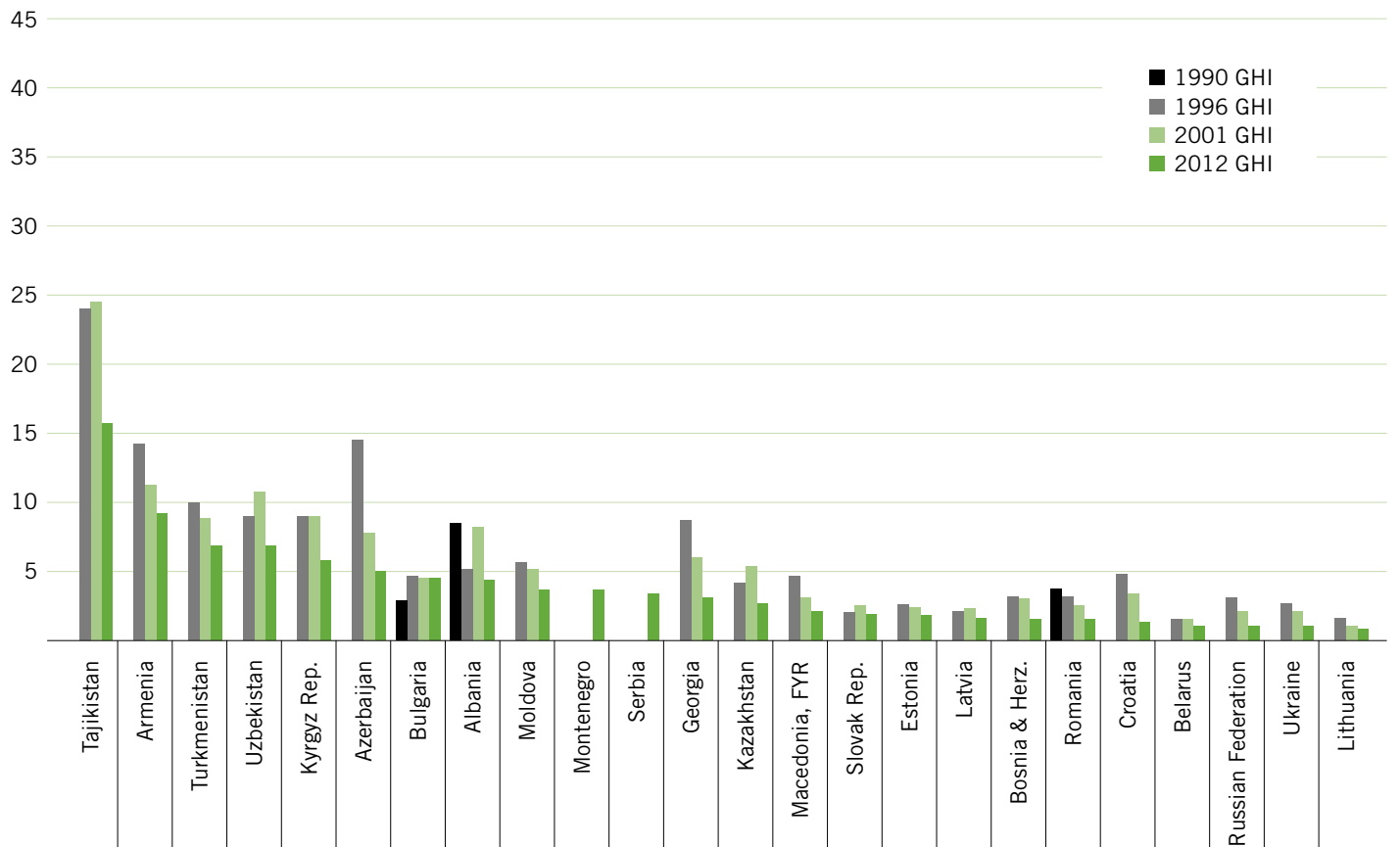
CENTRAL AMERICA AND CARIBBEAN



SOUTH, EAST, AND SOUTHEAST ASIA



EASTERN EUROPE AND COMMONWEALTH OF INDEPENDENT STATES



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PARTNERS



About IFPRI

The International Food Policy Research Institute (IFPRI®) was established in 1975 to identify and analyze alternative national and international strategies and

policies for meeting food needs of the developing world on a sustainable basis, with particular emphasis on low-income countries and on the poorer groups in those countries. While the research effort is geared to the precise objective of contributing to the reduction of hunger and malnutrition, the factors involved are many and wide-ranging, requiring analysis of underlying processes and extending beyond a narrowly defined food sector. The Institute's research program reflects worldwide collaboration with governments and private and public institutions interested in increasing food production and improving the equity of its distribution. Research results are disseminated to policymakers, opinion formers, administrators, policy analysts, researchers, and others concerned with national and international food and agricultural policy.

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towards the ultimate elimination of extreme poverty. We work in 25 of the world's poorest countries and have over 3,100 committed and talented staff.

Our mission – what we do

Our mission is to help people living in extreme poverty achieve major improvements in their lives which last and spread without ongoing support from Concern Worldwide. To this end, Concern Worldwide will work with the poor themselves, and with local and international partners who share our vision, to create just and peaceful societies where the poor can exercise their fundamental rights. To achieve this mission we engage in long-term development work, respond to emergency situations, and seek to address the root causes of poverty through our development education and advocacy work.

Our vision – for change

A world where no-one lives in poverty, fear or oppression; where all have access to a decent standard of living and the opportunities and choices essential to a long, healthy and creative life; a world where everyone is treated with dignity and respect.



Our vision: A world in which all people can exercise their right to lead a self-determined life in dignity and justice, free from hunger and poverty.

Who we are

Welthungerhilfe was formed in 1962 as part of a ground-breaking global campaign – the “Freedom from Hunger Campaign”. Established under the umbrella of the UN Food and Agriculture Organisation (FAO), we are now one of Germany's largest private aid agencies. We are an independent organisation and firmly rooted in German society through our member organisations, donors and supporters. We stand for courage, a passion for life and humanity as part of our mission.

What we want

We promote food security for all people, rural development and the preservation of natural resources. We believe in the power of dreams because dreams drive people forward. For this reason, we have increasingly been linking our partners in Germany and the project countries to a dynamic global network and are making development cooperation a reality.

What we do

We help people in developing countries to provide for themselves now and in the future. As a large German aid agency with 50 years of international experience, we have been chalking up success stories in Africa, Asia and Latin America. As part of our political activities, we fight to change the conditions that lead to hunger and poverty. In Germany, we mobilise people to support and help implement our vision.

How we work

We pursue a holistic, quality- and impact-oriented concept ranging from immediate disaster aid and reconstruction to long-term development projects. In this context, we work with the affected people on equal terms – offering competence, reliability and transparency. We support partner organisations in the project countries thereby ensuring that structures are reinforced from the bottom up and that successful project work can be secured for the long term.

IMPRINT

Deutsche Welthungerhilfe e. V.

Friedrich-Ebert-Str. 1
53173 Bonn, Germany
Tel. +49 228-2288-0
Fax +49 228-2288-333
www.welthungerhilfe.de

Secretary General and Chairperson:

Dr. Wolfgang Jamann

International Food Policy Research Institute (IFPRI)

2033 K Street, NW
Washington, DC 20006-1002, USA
Tel. +1 202-862-5600
Fax +1 202-467-4439
www.ifpri.org

Director General:

Dr. Shenggen Fan

Concern Worldwide

52-55 Lower Camden Street
Dublin 2, Ireland
Tel. +353 1 417 7700
Fax +353 1 475 7362
www.concern.net

Chief Executive:

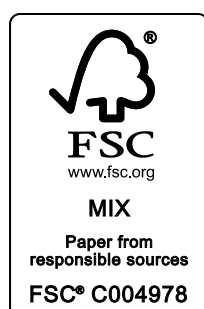
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Authors:

IFPRI: Klaus von Grebmer (Senior Research Fellow and Strategic Advisor), Claudia Ringler (Deputy Director, Environment and Production Technology Division), Mark W. Rosegrant (Director, Environment and Production Technology Division), Tolulope Olofinbiyi (Research Analyst), Doris Wiesmann (Independent Consultant), Heidi Fritschel (Editor), Ousmane Badiane (Director, Africa), Maximo Torero (Director, Markets, Trade, and Institutions Division), and Yisehac Yohannes (Research Analyst)
Concern Worldwide: Jennifer Thompson (Advocacy Officer for Hunger)
Welthungerhilfe: Constanze von Oppeln (Food Aid and Food Security Policy)
Green Scenery: Joseph Rahall (Director)

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Deutsche Welthungerhilfe e. V.

Friedrich-Ebert-Str. 1
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Tel. +49 228-22 88-0
Fax +49 228-22 88-333
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Fax +353 1-475-7362
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