Chapter 10

No Free Lunch: Agribusiness and Risks to Food Security

The agricultural sector and with it, the **agribusiness industry**, has **particularly high levels of disaster risk**. Disasters in this sector are not only disasters for businesses, large or small, but **also significantly affect rural societies**, urban households, national **and global commodity markets and food security**.

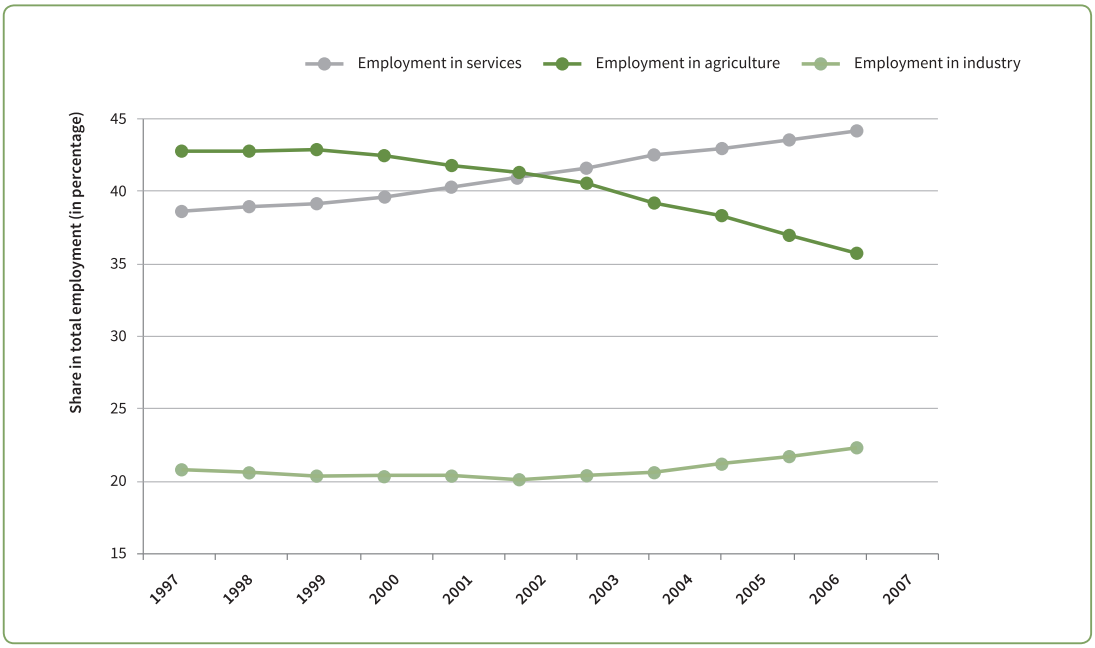
In the localities and regions where these investments are being made, already **limited access to fertile land by smallholder farmers** may be further reduced. In a context of increasingly **constrained global food markets**, the spread of agribusiness investments into regions with high but poorly understood agricultural drought and other hazards generates **risks of future and more severe food price spikes**. This poses a greater threat to the food security of households in low income areas than drought itself.

But **new practices are emerging** that match **investment opportunities** for private companies with infrastructure and service **gaps in under-developed markets**, particularly in Africa. Partnerships are developed that aim to **increase the productivity and resilience of smallholder farmers**, contributing to local and national food security.

Agriculture remains a key sector in the global economy even as industrial and service sector growth continues. Moreover, in several regions, agricultural production increases at a staggering rate—for example, in Latin America, it increased 50 percent from 2000 to 2012, and in sub-Saharan Africa, more than 40 percent (FAO, 2012a). In fact, urbanisation is giving a boost to the role of the agribusiness industry in mediating food production, distribution and consumption.

Many low and middle-income countries significantly depend on food exports. And agribusiness' role in creating income and employment opportu-

Figure 10.1 Contribution of agriculture to global employment (1997–2007)



(Source: ILO, 2012)

nities, particularly in those countries, is undeniable (FAO and UNIDO, 2009; ILO, 2012; World Bank, 2008b). For example, in sub-Saharan Africa, although agriculture contributes about one-fifth of GDP growth, the sector provides more than one-half of all employment and remains the largest employer in the region (IMF, 2012). Even globally, although total employment in agriculture is declining, it still provides more than one-third of total employment (Figure 10.1).

Thus, disasters in the agricultural sector are not only disasters for agribusinesses, large or small, but they also affect rural societies, urban households, national and global commodity markets and food security. And yet, only 14 percent of the 94 countries reporting on progress in implementing the HFA (see Chapter 14 and Annex 3) undertake disaster risk assessments prior to investment in agriculture. The risks associated with agribusiness investments become costs shared with all who purchase and consume food and agricultural commodities throughout the world. Therefore, decisions taken by agribusiness in factoring disaster risk considerations into its investments will play a crucial role in global food security.

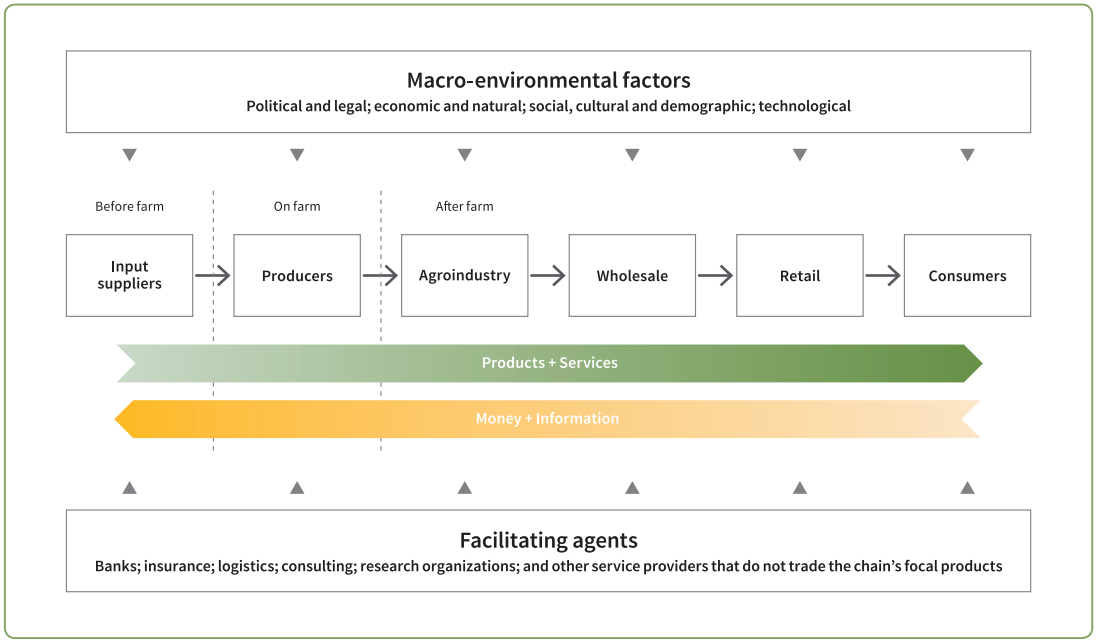
10.1 The agricultural value chain

The complexity of value chains in the agribusiness sector means that interruptions at critical points or nodes can ripple through the entire supply chain.

The agribusiness sector is organised around a complex value chain—input suppliers, producers, intermediaries, processors, marketers and consumers, mediated by a range of facilitating agents and macroenvironmental factors (Figure 10.2).

Along this value chain, size and form of businesses vary immensely; from large fertiliser companies to individual farm households that sell surplus production to local buyers at the farm gate; from local grain mill cooperatives to medium-sized processing plants; from small urban traders to multinational food chains.

Figure 10.2 Framework of a typical agribusiness production chain



(Source: Fava Neves and Alves Pinto, 2012)

However, the myriad of agricultural producers and those that rely on the sector for their livelihood all experience different types of vulnerabilities and exposures along the value chain.

At every step of the chain, transport and associated infrastructure can be at risk of direct damage from hazard events, meaning that interruptions at critical points or nodes can ripple through the supply chain. Those investing in agricultural production, processing and trade, therefore, have a vested interest in the uninterrupted functioning of this infrastructure and in reducing damage owing to disasters.

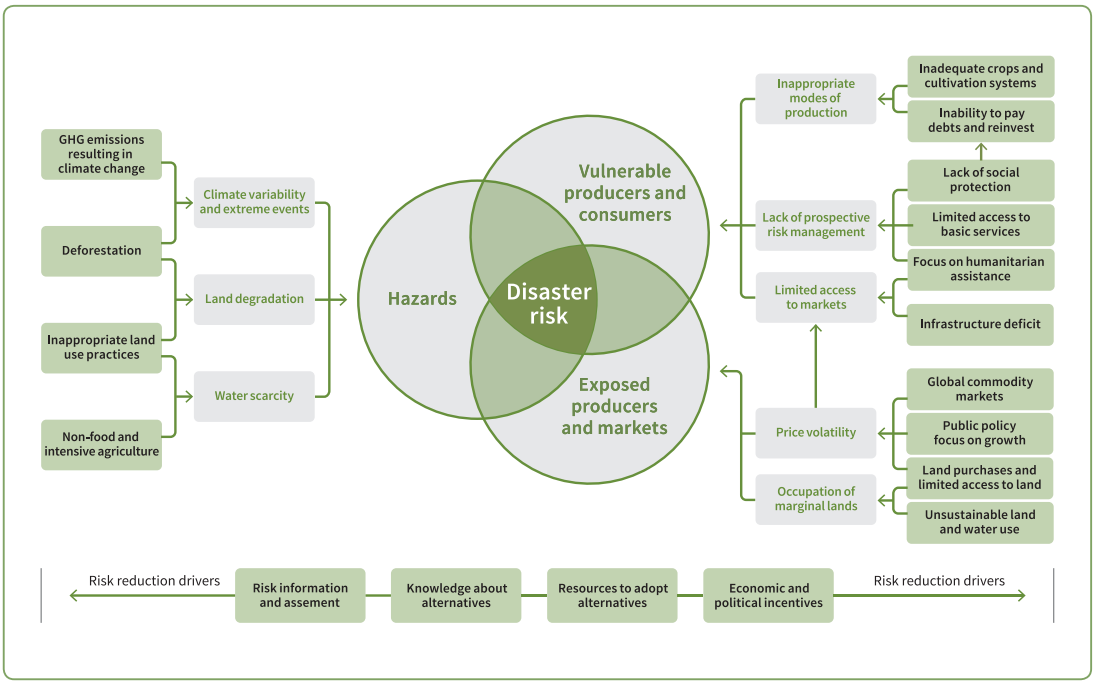
Nevertheless, producers are usually in the supply chain's most vulnerable position. In other sectors, producers are better able to estimate accurately output volume in relation to a desired level of production and a given set of inputs. In farming, however, production is subject to highly unpredictable and uncontrollable conditions, including weather-related hazards and pest and diseases in crop and livestock. Additionally, there is a large time gap between the moment farmers make decisions regarding what crops to produce and when they are able to harvest and sell their production. During this gap, in addition to other hazards, farmers face risks related to price volatility that are greater than in most other sectors (Fava Neves and Alves Pinto, 2012). Figure 10.3 shows how, in the agribusiness sector, disaster risk lies at the junction of a broad spectrum of hazards, vulnerabilities and exposures.

10.2 Drivers of production and price: local and global vulnerabilities

Dynamic global food markets and volatile prices are affected by disasters but also act as an important driver of food insecurity and disaster risk.

Despite inherent uncertainty and risk in the sector, constant hikes in global prices for agricultural commodities since 2000, including exceptional food price spikes towards the end of the last decade (Figure

Figure 10.3 The multiple dimensions of disaster risk in agriculture

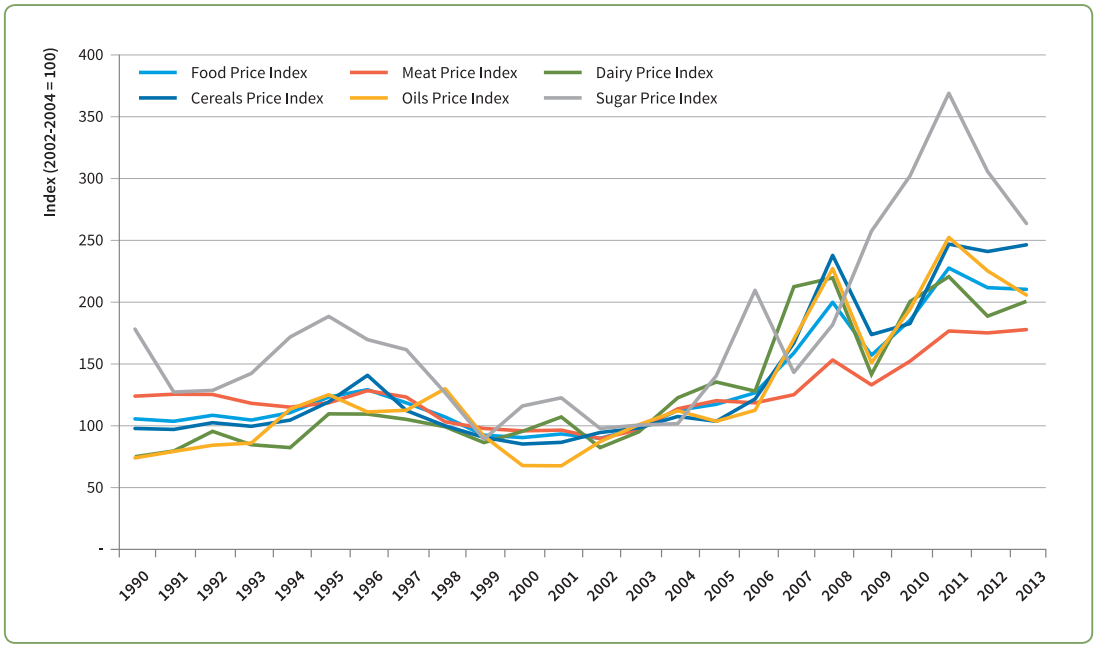


(Source: UNISDR, adapted from Fava Neves and Alves Pinto, 2012)

10.4), have stimulated major new investments in the agricultural sector and in global food production.

Growth estimates for the cereal market, for example, project that by 2021, world wheat production will increase by 12 percent from the base period 2009–2011 (reaching 761 million tonnes (Mt)); world coarse grain production will increase by 20 percent (1,359 Mt); and world rice production by 16 percent (542 Mt) (OECD and FAO, 2012) (see Figure 10.5).

Figure 10.4 Rising food prices since 2000 (as observed January 2000–August 2012, not adjusted against inflation)



(Source: FAO, 2012c)

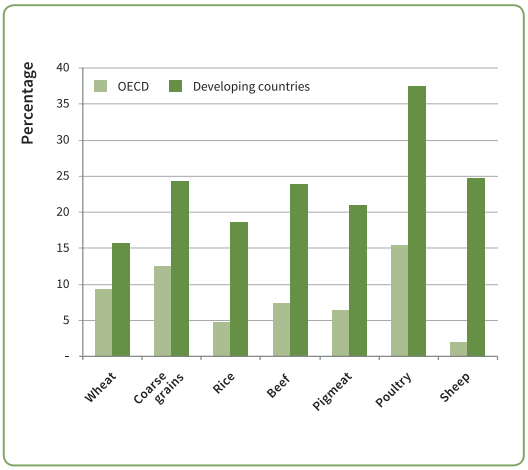
Figure 10.5 Observed and expected price and production of wheat, coarse grain and rice, 2000–2021

(Source: UNISDR based on OECD and FAO, 2012)

Countries expected to contribute to this growth include Kazakhstan, Russian Federation and Ukraine for wheat; and Argentina, Brazil as well as several Sub-Saharan countries for coarse grain.

Rising global food prices are being driven by several factors. These include rising demand for food owing to population growth, urbanisation and changing food consumption patterns, particularly in rapidly growing low and middle-income countries; high crude oil prices; use of agricultural commodities for the production of biofuels; and lower global stocks (FAO, 2012c; OECD and FAO, 2012; FAO et al., 2011; World Bank, 2008b). For example, although consumption is expected to increase for all products in all regions, meat consumption in low-income countries in particular is expected to increase to double that in high-income countries; the reason for the strong demand is increasing per capita income and population growth, especially with large growing middle classes (Figure 10.6).

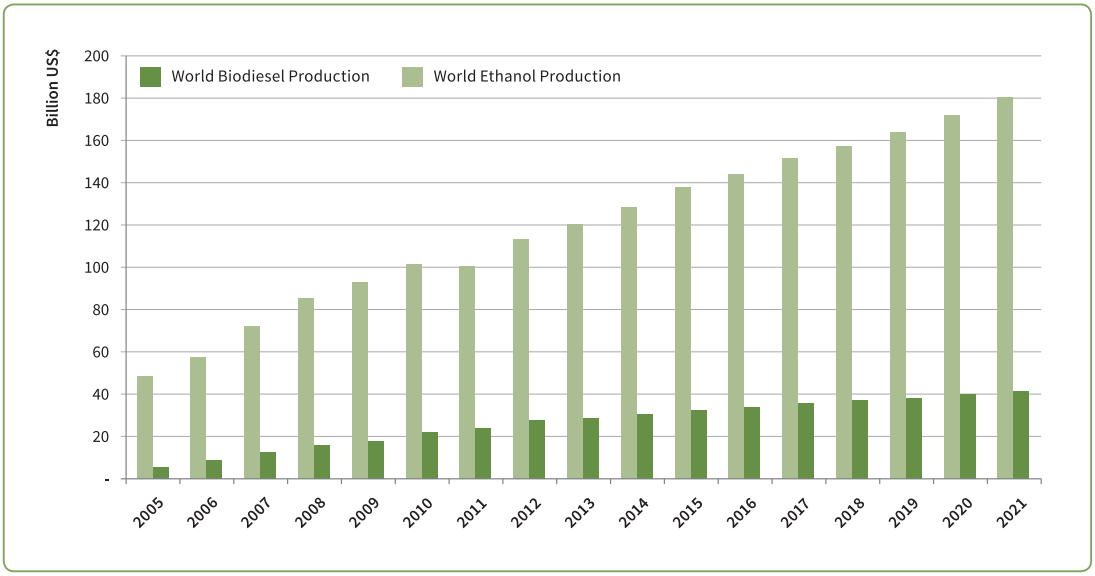
Figure 10.6 Expected increase in the consumption of crops and livestock in developing countries[i] (percent change in consumption: 2021 relative to average 2009–2011)



(Source: UNISDR based on OECD and FAO, 2012)

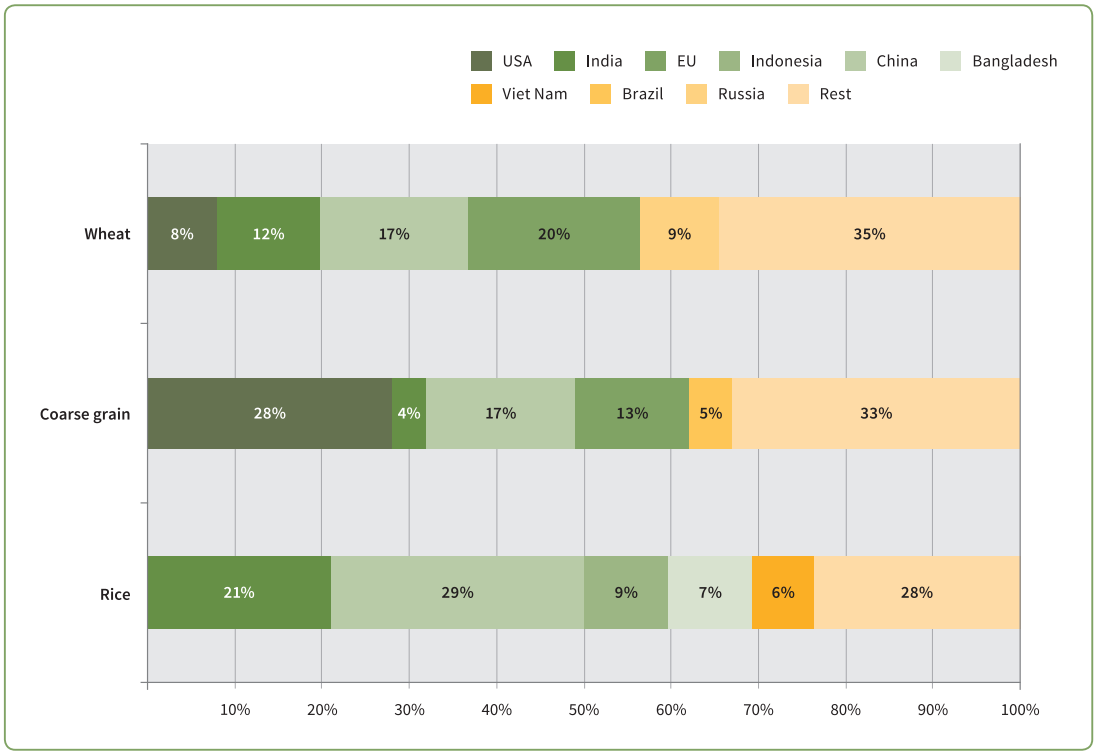
The balance of supply and demand, however, does not directly translate into prices in the agricultural commodity market. National food security policies, such as export restrictions and hoarding, can prevent produced commodities from being traded in the global market. Price volatility and international price spikes are further catalysed by factors such as the concentration of production in a few hazard-exposed regions, declining stocks, the role of commodity markets and weather and climate related disasters. Despite this, global market projections for

Figure 10.7 Global production and prices of ethanol and biodiesel, 2005–2021



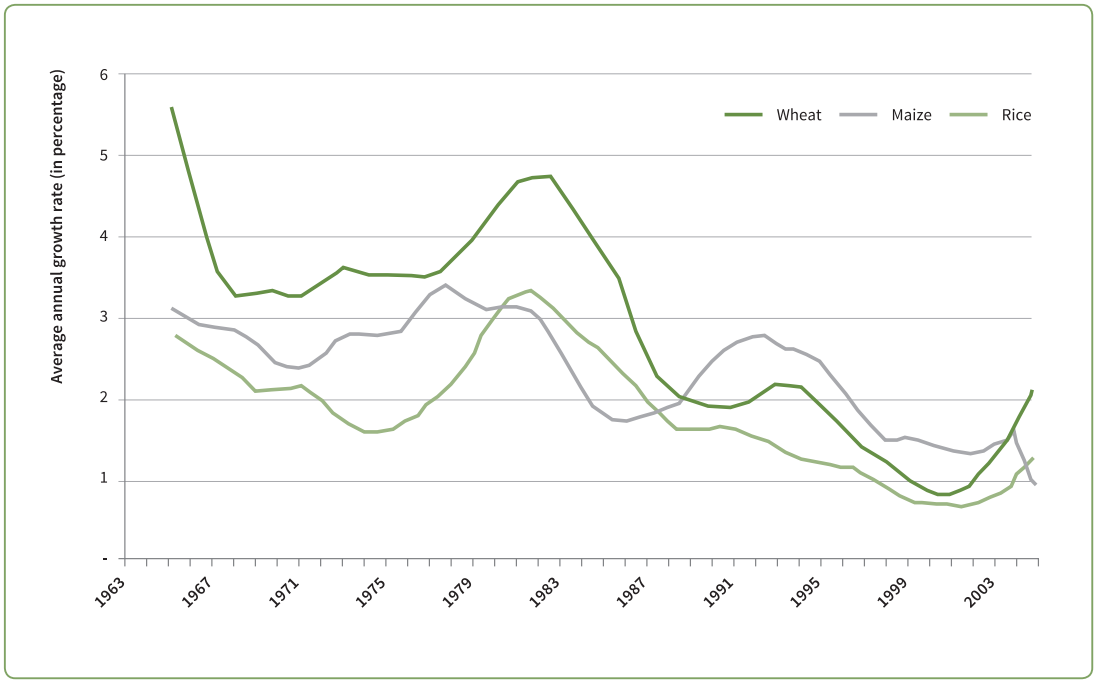
(Source: UNISDR based on OECD and FAO. 2012)

Figure 10.8 World production of wheat, coarse grain and rice by country, 2011



(Source: UNISDR based on OECD and FAO, 2012)

Figure 10.9 Growth rates of yields for major cereals in low-income countries



(Source: World Bank, 2008b)

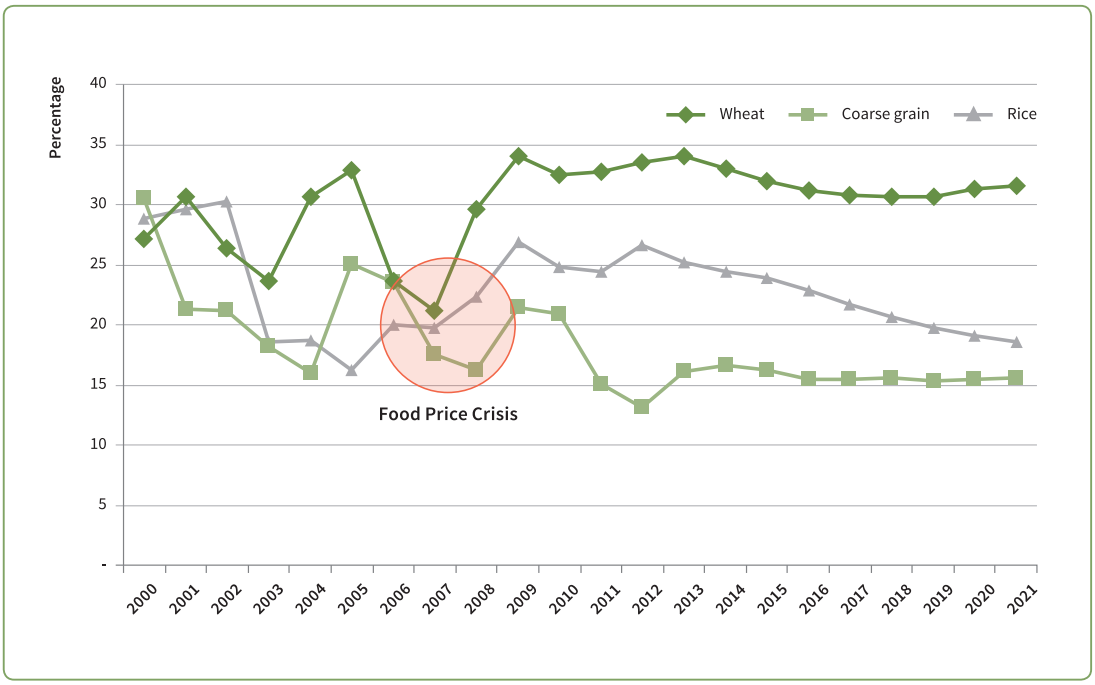
crops, livestock and fisheries products often still presume "normal weather conditions" as part of "a plausible view on the evolution of the global agricultural markets over the next decade" (OECD and FAO, 2012), and continue to discount for disaster risk in growth projections.

Increasing global demand for biofuels, triggered by higher oil prices, has significantly underpinned price hikes (Matondi et al., 2012; Fava Neves, 2011; Ambali et al. 2011). Currently, about 65 percent of EU vegetable oil, 50 percent of Brazilian sugarcane and about 40 percent of US corn production is used as feedstock for biofuel production (OECD and FAO, 2012). By 2021, global ethanol and biodiesel production are projected to rise by 373 percent and 779 percent, respectively, compared with production levels of 2005 (Figure 10.7), and related crop production increasing correspondingly. Also by 2021, 14 percent of global coarse grain production, 34 percent of global sugarcane production and 16 percent of global vegetable oil production are expected to be used to produce biofuel (Ibid.)

The production of major food crops is concentrated in selected countries that are exposed to frequent hazards. For example, as Figure 10.8 shows, in 2011, the United States of America grew 28 percent of the world's coarse grain and 8 percent of wheat, whereas China produced 17 percent of wheat and coarse grain and 29 percent of rice. Another hazard-prone country—India—also produced 21 percent of rice, 12 percent of wheat and 4 percent of coarse grain. Rice production especially is heavily concentrated in hazard-prone regions, with more than 70 percent of production concentrated in five hazard-prone Asian countries (OECD and FAO, 2012).

Higher costs of inputs, such as fertilisers owing to high oil prices, and growing constraints from water and land degradation, tend to slow yield and productivity growth, lessening the pace of production and contributing to lower stocks (OECD and FAO, 2012). For example, growth in yield rates for major cereals in low-income countries has been declining consistently since the 1980s, as shown in Figure 10.9.

Figure 10.10 Global stock in relation to domestic demand for wheat, coarse grain and rice, 2001–2021



(Source: UNISDR, based on OECD and FAO, 2012[ii])

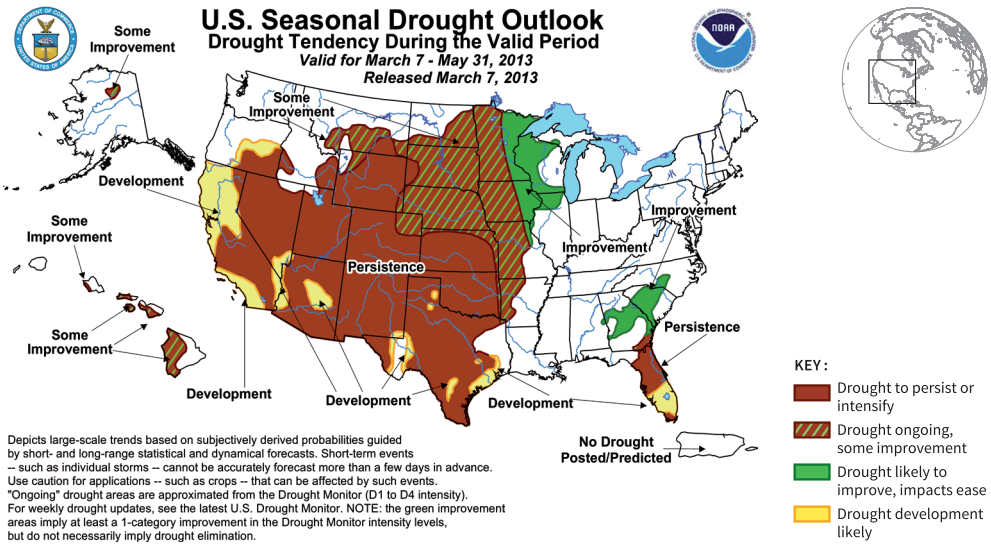
Box 10.1 The 2012 drought in the United States of America

In 2012, the most severe and extensive agricultural drought in at least 25 years was affecting agriculture in the United States of America and parts of Canada and Mexico, with impacts on livestock and crops. 2012 production deviated significantly from expectations early in the growing season. In the first weekly rating of the corn crop reported by United States Department of Agriculture's National Agricultural Statistics Service (NASS) on 20 May, more than 75 percent was rated as good-to-excellent, whereas only 3 percent was in the poor or very poor category. By 30 September, only 25 percent of the crop was rated good-to-excellent with 50 percent rated poor or very poor. Sharp declines in soybean crop ratings also occurred, with only 35 percent of the crop rated good-to-excellent as of 7 October compared with 65 percent in first 2012 weekly soybean rating on 3 June.

By November 2012, production estimates for corn and soybean were down by 13 percent and 4 percent, respectively, from 2011. This represented the lowest corn production in the United States of America since 2006. The drought also affected the transport of harvest within the country. Millions of tonnes of grain travel each month on the Mississippi River, but when water levels dropped to a historic low, barge traffic was severely hampered, and costs for alternative transport increased.

The Food and Agriculture Organization of the United Nations (FAO) calculated that global cereal production in 2012 was 2 percent lower than in 2011owing to severe droughts in the United States of America and across part of Europe and central Asia. Stocks are expected to decline even further as the 2013 outlook for the United States of America continues to be unfavourable with severe drought conditions continuing to plague the southern Plains (Figure 10.11). This will have direct impacts on global food prices.

Figure 10.11 Agricultural drought in the United States of America



(Source: NOAA)

The US midwest represents a key node for worldwide agricultural production with implications for global commodity supply chains. When analysts' predictions for a record harvest collapsed, in futures markets, "prices for corn, soybeans, soy meal and rapeseed [...] exploded to record highs".[iv] International wheat quotations also surged 19 percent amid worsened production prospects in the Russian Federation for 2012 and expectations of firm demand for wheat as feed because of limited maize supplies. Combined with the drought forecasts in the US this year, this means that importing countries across Asia, Africa, Europe and Latin America will continue to face uncertainty over supply and significant food price spikes, with global knock-on effects, as farmers elsewhere switch to wheat for animal feed, thereby driving up prices for another staple.

(Source: NOAA, FAO, USDA and Cornell University[v] ; Clements-Hunt, 2012)

Decreased stocks weaken the agribusiness sector's resilience to shocks, including to hazards such as drought. Low stocks and uncertainty about stock levels in some parts of the world contributed to the 2007–2008 price hikes (Figure 10.10). In fact, even expectations of depleted stock may lead to price hikes (FAO et al., 2011).

High price volatility results partly from speculative trading with futures contracts in global commodity exchanges—the volumes of which have risen significantly over the last years (Fava Neves and Alves Pinto, 2012; UNCTAD, 2011). In turn, the volatility of food prices may well have encouraged speculative trading as profits to be gained in price fluctuations usually attract traders (see also Chapter 12).

The deregulation of futures markets in the United States of America and the European Union has resulted in a further increase of pure speculation in commodity futures (Clements-Hunt, 2012). Excessive speculation, combined with regulatory failures for certain financial transactions in the commodities markets, have meant that from 2004 onward, dealers have used US$173 billion of institutional investment to trade in main commodities (Masters and White, 2011). To absorb this new money, commodities futures markets expanded, leading to a dramatic rise of futures prices, including for major agricultural products (Ibid.). In fact, traders in commodity and futures markets can benefit directly from agricultural droughts and temperature spikes as these create the conditions for dynamic markets with higher returns (Clements-Hunt, 2012; IATP, 2009).

The correlation of commodity and equity markets and herd behaviour by investors make the market very sensitive to even small shocks (UNCTAD, 2011). For example, as commodities such as cereals become increasingly securitized, a perceived risk of crop failure, owing to drought or flood, may be magnified via speculative market behaviour, dramatically increasing global food prices as a result (FAO, 2010).

Speculative investment in futures contracts—for example, from index funds—can stimulate price spikes that magnify actual production shortfalls (Masters and White, 2011; IATP, 2009). In 2011, the indexation of commodity markets attracted large investors, such as pension funds and insurance reserves, increasing the volume of speculative trading from 30 percent to 80 percent of commodity futures trading (Ibid.). Index funds currently hold about one-fourth of all agricultural futures contracts, and their participation is growing. Between March 2006 and December 2011, for example, the volume of commodity index funds trading in corn increased by 157 percent on the Chicago Board of Trade (IFPRI, 2011).

All these factors influence the impact that hazards—such as drought—may have on food prices. International food price spikes, for example, as occurred in 2008, 2010 and 2012, are often said to be triggered by production shortfalls in major producing countries, such as Australia, Russian Federation and the United States of America.[iii] As Box 10.1 shows, the severe drought that affected the US Midwest in 2012 had a significant effect on global food prices. With the failure of the US corn and soya bean harvest in 2012, importing countries across Africa, Asia, Europe and Latin America face uncertainty over supply and significant food price spikes. The rapid rise in US corn prices has knock-on effects globally, as farmers elsewhere, for example, switch to wheat for animal feed, thereby driving up prices for another staple.

10.3 Enter the dragon: new agribusiness investments in low-income countries

Investment in agribusiness in low-income countries, particularly in Africa, is rapidly increasing, resulting in increased land pressure and potentially increased disaster risk.

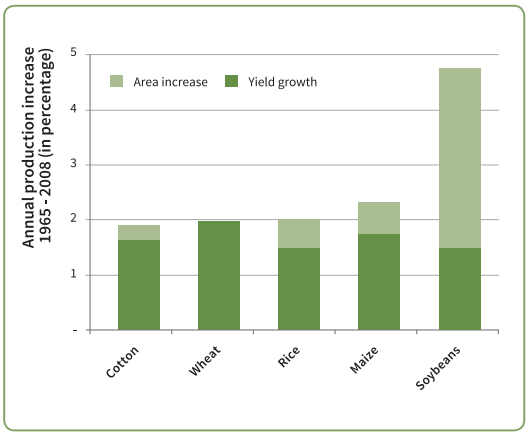
Until 2008, increase in agricultural production was driven by increasing the cultivated areas as well as from significant growth in yields (Figure 10.12).

Yield increases are projected to account for up to 90 percent of future growth in agricultural production (FAO, 2009), but the expansion of arable land, particularly in low and middle-income countries, is still significant. It is expected that by 2021, low and middle-income countries will put into production about 10–12 percent of global arable land (Nellemann et al., 2009). This corresponds to 107–120 million hectares of land in sub-Saharan Africa and Latin America (FAO, 2012a; Nellemann et al., 2009). This presents a huge business opportunity for agricultural investors and companies.

Recognising this opportunity, large businesses are buying productive, arable land and investing in export-oriented commercial agriculture, particularly in sub-Saharan Africa. Globally, 13 of the top 20 target countries for international investment in agricultural land acquisitions are in Africa (Figure 10.13). Most of these countries have a high share of agricultural GDP and also high levels of food insecurity (Anseeuw et al., 2012).

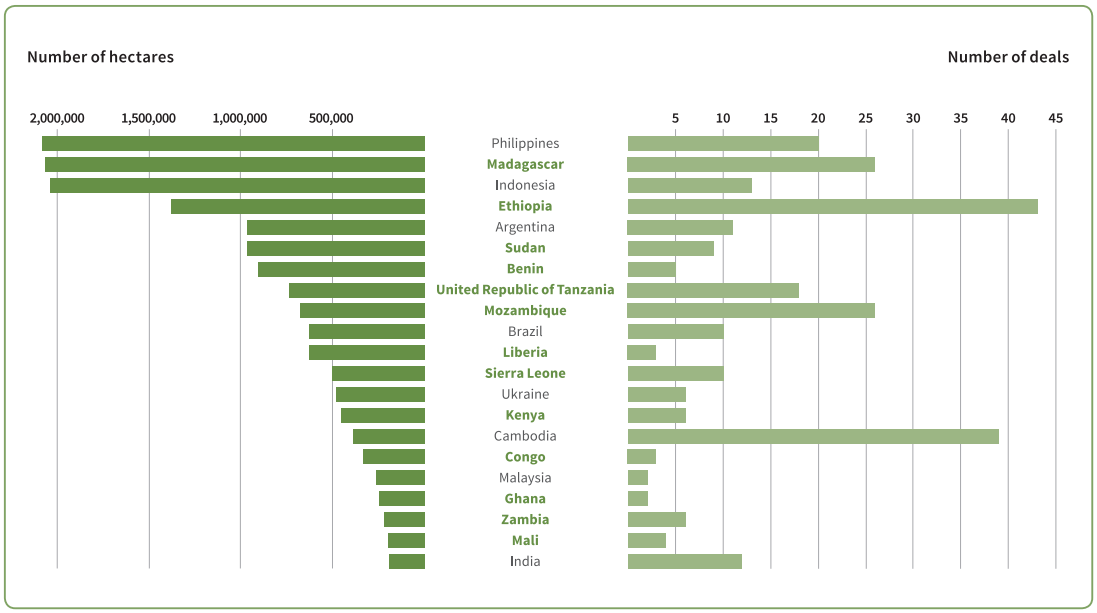
Although there is little reliable information on these deals, inventories carried out in Ethiopia, Ghana, Madagascar and Mali (Cotula et al., 2009) confirm land acquisitions of some 2 million hectares in the four countries. International investment accounts for about three-fourths of this land area (Ibid.). Another study—based on FAO data—shows that land acquired in seven countries in sub-Saharan Africa (Ethiopia, Ghana, Liberia, Madagascar, Mozambique, South Sudan and Zambia) comprises more

Figure 10.12 Increase of crop production owing to growth in yield and area (1965–2008)



(Source: World Bank data cited in Nellemann et al., 2009)

Figure 10.13 Foreign investments in land acquisitions in selected countries according to size of total reported acquisitions



(Source: UNISDR, based on Land Matrix data.)[vi]

than 65 percent of total area acquired on the continent (Schoneveld, 2011).

Thus, some countries with relatively small areas of productive land, such as Congo, Ghana and Liberia, have become key targets, mainly driven by the acquisition of farmland for biofuel feedstock production (Ibid.). An increasing number of national inventories of land deals are being developed, highlighting the unprecedented scale of land acquisitions, particularly in Africa (IIED, 2012b).

Governments are leasing land through many forms of public–private partnerships (PPPs)—through sovereign wealth funds, state-owned enterprises and involvement of private enterprises. Opportunities for broader public benefits in host countries are rare, and provisions for risk management and distribution of benefits in contracts are limited (IIED, FAO and IFAD, 2011). However, for several low-income countries, such as Madagascar or Ethiopia, it is unlikely that agricultural productivity could be increased without this investment.

As with other sectors examined in this report, investments in the agribusiness sector involve trade-offs. From an investor's perspective, agribusiness is an increasingly profitable and attractive sector owing to high food prices and growing future food shortages. Investments also increase the productivity of agricultural production over large areas and thus contribute to increased global food production.

Many governments sell or lease land, which is a means of increasing their wealth using their natural capital. Agribusiness is one of the few sectors where governments can have comparative advantages to attract investment. This investment creates opportunities to capitalize on the agricultural sector, increase employment and volume of exports and achieve economic growth.

However, as with investment in urban development and tourism, these investments may increase disaster risks if hazards associated with droughts, floods and other events are not identified, estimated and taken into account. As Chapter 6 of this report highlights, compared with other risks, the mapping and estimation of agricultural drought risk is still incipient in most low and middle-income countries. It is likely then that risk levels are not being adequately considered in investment decisions, let alone the shared social and environmental costs.

10.4 The externalised cost of agribusiness investment

Business investment in agriculture that does not take into account the risk of drought, floods and other hazards may face high losses and result in high external environmental and social costs.

As Chapter 6 highlighted many countries where investments are being made have high levels of agricultural drought risk and land degradation, which may be increasing owing to climate change. Globally, according to the OECD and FAO (2012), approximately 25 percent of the world's agricultural land areas are highly degraded. Degraded soils are more vulnerable to temperature extremes, droughts and floods.

Without reliable information, it is unclear to what extent businesses in the sector are assessing these and other weather-related risks before making investments. However, if drought and other risks are not being adequately factored into agribusiness investment decisions, businesses may face higher-than-expected losses, which can have negative repercussions on the price and availability of agricultural commodities.

The cost of increasing an area of intensive agriculture is usually justified through expected increases in production and yields (Yumkella et al., 2011). This assessment of costs and benefits, however, rarely includes the potential increase in direct losses owing to agricultural droughts and longer-term loss of

natural capital, for example, through land degradation; nor does it address the question of who owns these risks and pays the price.

Lack of accurate drought risk information may encourage investment in inappropriate agricultural practices, which in turn can further increase risks owing to overexploitation of finite water resources and through land degradation. For example, mono-cropping increases the risk of loss of biodiversity, competition for water in rain-fed agriculture and the possibility of introducing alien invasive species (Ambali et al., 2011).

Agribusiness companies will also face new risks, as underlying risk drivers such as climate change, land degradation and dwindling water resources increase agricultural drought risk. Cases of increasing agricultural drought, driven by changing microclimates and potentially climate change, are affecting agribusiness across the world.

For example, the global agribusiness and food company Bunge suffered a loss of US$56 million in its sugar and bioenergy segments in the fourth quarter of 2010 only, owing to agricultural drought in its main growing areas in Brazil.[vii] In fact, Bunge reported that the overall impact from droughts in various regions exceeded US$70 million for this one quarter. The company was affected not only by lower production that resulted in lower sales and gross margins, but also by increased cost absorption from its fixed costs, charges related to writing-off damaged cane and replanting and costs related to the settlement of their hedge positions on global commodities markets.[viii]

The agribusiness sector has particularly high external social and environmental costs. It is estimated, for example, that currently the costs externalised by the agribusiness sector outweigh the earnings of the entire sector (KPMG, 2012). This clearly presents an opportunity for reassessment of current value creation within the industry from both business and society perspectives. A few select businesses in the sector are beginning to recognise a number of risks that may impact their performance in the medium to long term should they not begin to think about shared rather than just shareholder value.

In a context of increasingly constrained global food markets, the spread of agribusiness investments into regions with high but poorly understood agricultural drought and other hazards generates risks of future and more severe food price spikes. As will be highlighted in section 10.6 of this chapter this poses a greater threat to the food security of low-income rural and urban households than drought itself.

10.5 Water risks

Agriculture is the biggest water consumer, with around 70 percent of all water withdrawn globally. Increasing demands on water resources by agricultural production, including biofuel production, are driving water scarcity, also contributing to trans-boundary conflict.

The World Economic Forum's Global Risks 2012 report identifies water supply crises, food shortage crises, extreme volatility in energy and agricultural commodity prices, and rising greenhouse gas emissions among its top global risks over the next 10 years.[ix] Demand for food, water and energy is expected to grow by 35 percent, 40 percent and 50 percent, respectively, by 2030 (National Intelligence Council, 2012), and because of their interdependence, problems pertaining to one resource will be linked to supply and demand for the others.

High demands of water by agricultural production, coupled with declining rainfall in some areas, can lead to a dramatic depletion of non-renewable water sources. Agriculture, including crop and livestock production, remains the biggest global water consumer—about 70 percent of all water with-

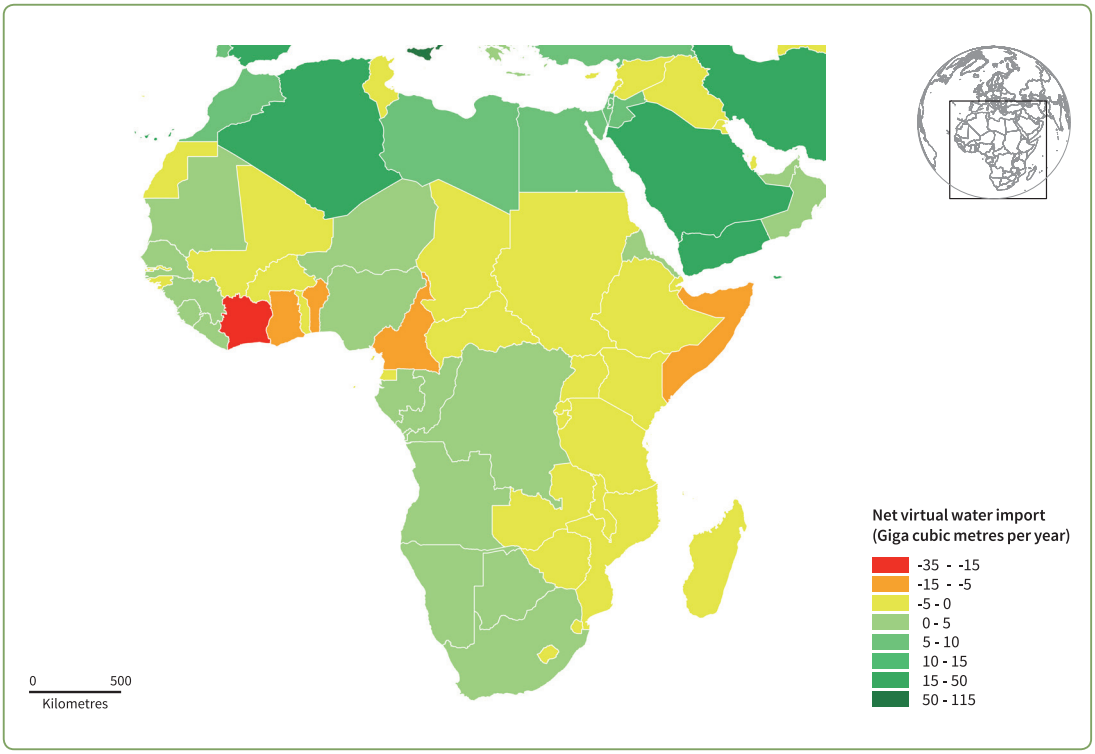
drawn (FAO[x]; Hoekstra and Chapagain, 2008; OECD and FAO, 2012). This percentage includes water consumption for animal feed production.

Biofuel production—depending on what crop is grown and in which region—potentially causes significant pressure on existing water resources (National Academy of Sciences, 2007). But perhaps more important is that water used in biofuel refineries can create a significant local footprint; for example, a refinery that produces 100 million gallons of ethanol per year uses an equal amount of water as does a town of 5,000 people (Ibid.).

The impact of decades of overconsumption of water can be felt in the agribusiness sector worldwide. In several countries, such as India and Egypt, electricity for pumping groundwater and the water itself are free if used for agricultural production. This clearly affects levels of water use and abuse, resulting in unsustainable water practices; for example, 85–95 percent of all water use in India and Egypt is used for agriculture irrigation (Saeijs and van Berkel, 1995). On a global scale, about 15–35 percent of all water use for irrigation is considered unsustainable (WBCSD, 2005).

When water price is undervalued or water is free of charge, the price of water consumption is not added to the cost of the final product and trade, which means that exporting countries trade their precious water resources for free. Through exporting products, be it raw material, flowers, tea or industrial goods, water utilised in the process must also be considered as exported. In drought-affected countries, such as the Sahel belt and the Horn of Africa, 5–15 billion m3 of virtual water[xi] a year are being exported (see Figure 10.14), probably unaccounted for (Mekkonen and Hoekstra, 2011) and leaving local farmers, pastoralists and agribusinesses increasingly vulnerable to water scarcity and droughts.

Figure 10.14 Virtual water balance in Africa in terms of import (+) or export (-)



(Source: adapted from Mekkonen and Hoekstra, 2011)

The growing demand for freshwater is posing several issues related to water availability and sourcing.

The overextraction of groundwater is irreversibly undermining water quality. Furthermore, this practice ultimately leads to land subsidence, which increases risk from river and coastal flooding. In Bangkok, Thailand, it was estimated that the land has subsided up to 10 cm/year, mainly owing to excessive water extraction (Lorphensri et al., 2011). This phenomenon contributed substantially to the 2011 floods (Aon Benfield, 2012a).

Increasing demand towards finite water resources also heightens trans-boundary conflicts. In Africa alone, there are 59 trans-boundary river basins, accounting for 80 percent of the continent's surface water resources. In Arab countries, about 65 percent of annually renewable resources, including water, originate outside the boundaries of the Arab region, which makes these countries particularly vulnerable to water-related disputes (Erian et al., 2012). Similarly, Egypt relies virtually exclusively on run-off from the Nile's headwaters in the Ethiopian and Equatorial Highlands several thousands of kilometres south (Calvert, Ceres and Oxfam, 2010). The construction of the Renaissance Dam in Ethiopia may have positive outcomes for Ethiopia, but is likely to affect water availability and security in Egypt (Vella, 2012; Erian et al., 2012).

Climate change is likely to add more constraint on water availability. Because of climate change, annual discharge in the Euphrates River is expected to decrease by 29–73 percent by 2070 (compared with its flow in 2000) (Erian et al., 2012).

10.6 Risk transferred to smallholders and pastoralists

Food insecurity and crises are linked more strongly to the accessibility rather than the availability of food. This means that increases in agricultural production will not necessarily result in increased food security, particularly for low-income households.

Agribusiness investments may transfer risks and costs to already vulnerable local communities. In the localities and regions where these investments are being made, already limited access to fertile land by smallholder farmers may be further reduced. Over the past 40 years, per capita availability of farmland in Africa has halved and its distribution is highly unequal (Yumkella et al., 2011). Host communities may lose access to productive land, grazing areas or transhumance routes, and are dispossessed of land and water resources under customary tenure (Anseeuw et al., 2011).

Agricultural drought is already a major challenge to smallholder farmers and pastoralists in Africa, particularly in areas of low productivity where a high percentage of the population lives from subsistence agriculture and livestock production in marginal areas with low and irregular rainfall. In these environments, even a small shift in seasonal precipitation can lead to major crop and livestock losses (UNISDR, 2009).

However, the relationship between crop and livestock losses from agricultural droughts and food insecurity is far less simple. In fact, there is no simple linear correlation between crop production and food security (Sen, 1981; Dreze and Sen, 1989; Bouis and Welsh, 2010; Burchi et al., 2011).

As Box 10.2 highlights, studies of household economies in sub-Saharan Africa repeatedly reveal that subsistence agricultural production provides only a small part of food requirements (Ruel et al., 1998;

Louw et al., 2007; Baiphethi and Jacobs, 2009). Most food consumed in households is purchased or comes from food aid and assistance, which in turn is also often sold.

This study, with a similar study conducted in Niger (Holt et al., 2009), also highlighted the importance of livestock as a source of household wealth, and explains why food crises often occur even during good harvests. Households sell the food they produce on the market to buy staple cereals. Food price spikes can drastically alter the terms of exchange; in other words, households cannot buy enough food with what they are able to sell.

Food price spikes particularly affect low and middle-income countries, where households spend a far higher proportion of their income on food than in high-income countries. For example, in Indonesia, 46 percent of household expenditure goes to food, compared with only 6 percent in the United States of America (IFPRI, 2011). National food markets are closely correlated with global markets. Rising and volatile global food prices therefore impact directly on food security and vulnerability in low-income countries. During the 2005 food crisis in Niger, for example, malnutrition was highest in areas with abundant production and was driven largely by a spike in the price of millet—driven by the dynamics of the export market to Nigeria.

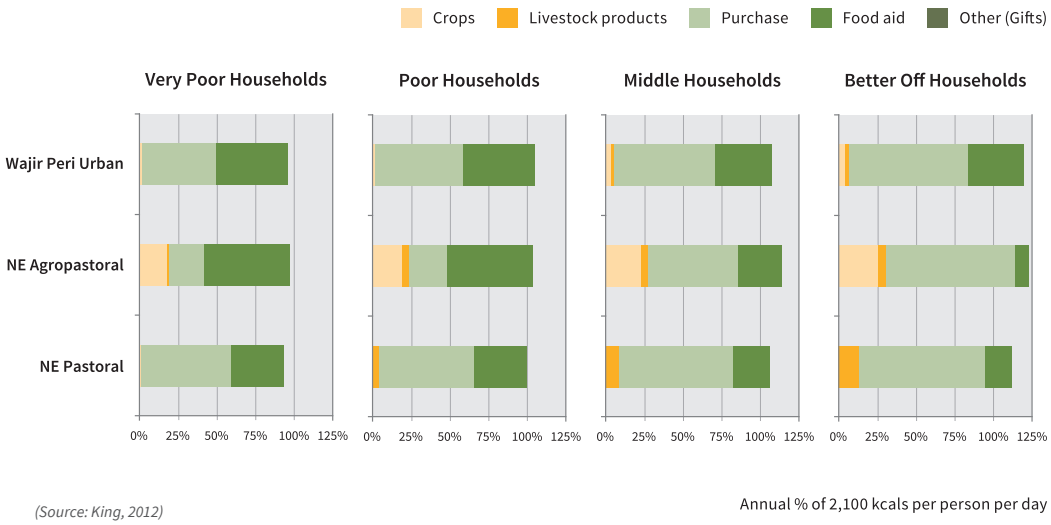
Similarly, an estimated 18.4 million inhabitants in the Sahel faced a food crisis in 2012. However, cereal production in the region in 2011 was only 3

Box 10.2 Understanding the underlying causes of food insecurity and malnutrition

The Household Economy Analysis (HEA) tool is a livelihoods-based survey designed to provide a clear and accurate representation of household economies. The analysis is conducted at different levels of a wealth continuum, in different livelihood zones across a region of a country, assessing the cost of diet (COD), energetically and nutritionally.

An analysis (below) carried out in October 2012 in the most drought-affected areas in Kenya shows a high dependency of households on purchased goods and food aid; illustrates the resilience deficit; and explains the slow recovery after the 2011 food crisis (Fig 10.15).

Figure 10.15 Source of food per livelihood zone and wealth group in northeast Kenya



(Source: King, 2012)

(Source: Save the Children International)

percent lower than the average of the previous five years, and 2010 had seen a bumper harvest (Gubbels, 2012). As Box 10.3 highlights, food crises can occur even in growing economies.

By increasing farmers' income and assets, improving agricultural production contributes to reducing hunger in rural areas. However, data from the Sahel and the Horn of Africa show that child malnutrition rates are not related to general food availability (Burchi et al., 2011). Despite this recognition, there is a tendency in food security policies to focus on food production as a main solution (Bouis and Welch, 2010).

The root causes of food insecurity in regions such as Africa are therefore less related to agricultural drought as to chronic vulnerability and the underlying development deficit (Gubbels, 2012). For example, during the 2010 Sahel crisis, the case-load of severe acute malnutrition (or SAM) in Niger, the epicentre, was 320,000 children (IASC, 2012). A year later, in 2011, Niger had exceptional rains and a record agricultural harvest. However, the case-load of SAM dropped only slightly, to 307,000 children (Ibid.).

Because households depend so heavily on purchases or aid, food markets heavily mediate food crises. Rising retail food prices are a particular problem for low-income countries and low-income households, more generally. When examining annual food price inflation rates over the past 10 years, one can conclude that they have been both higher and more variable in low-income countries than in OECD countries (OECD and FAO, 2012). This is caused partly by the greater weight of basic food in the consumer food basket in low-income countries.

In some countries, such as Kenya, overall food production has been increasing owing to higher productivity and despite increasing agricultural drought (Erian et al., 2012). In other countries, such as Niger, production has increased through developing new cultivated areas and owing to improved rainfall, relative to the 1980s (Ibid.). However, many African countries are heavily dependent on imports for the main staple foods (Mkumbwa, 2011). As Figure 10.16 shows, national production is increasingly surpassed by consumer demand, with projected unmet consumer needs in East African countries by 2020 potentially increasing by 75 percent.

Between the early 1970s and early 2000s, East Africa's import dependency ratio for cereal food commodities grew from 6 percent to 20 percent (Mkumbwa, 2011), leaving consumers—in particular low-income groups—vulnerable to price hikes of staple cereals (see also Box 10.3). A key challenge for countries in today's globalised food system is that increases in food production at the national level are no longer directly linked to food security. At best, the relationship is indirect; at worst, it does not exist at all.

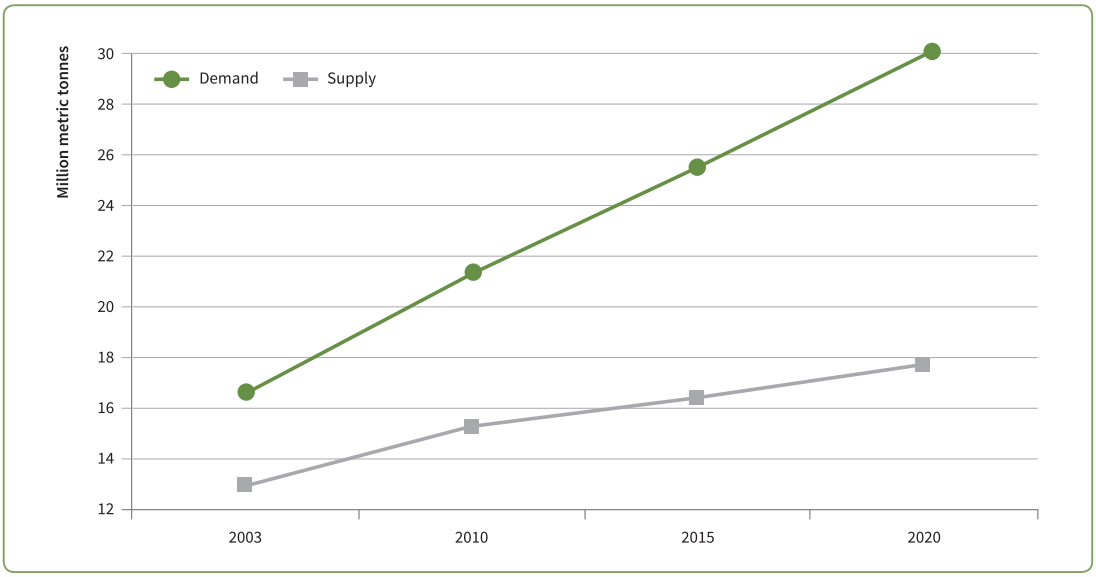
The import and trading of cereal crops is determined not only by national production deficits, but also and importantly by government food and trade policies, such as import protection and domestic agriculture support policies, and export taxed or bans. National food supply deficits are often subject to adjustments of regional and international trade imbalances. For example, Malawi in 2012, de-

Box 10.3 Price increases and food insecurity in Ethiopia

Ethiopia is one of the fastest growing non-oil producing economies in Africa (African Development Bank, 2012); in 2011, the economy grew at 11.4 percent, marking the eighth consecutive year of rapid growth. In 2012, the country witnessed significant rises in food prices, e.g. wheat by 20 percent and maize, the main staple food, by 80 percent (FAO, 2012a). As a result, and despite its strong economic performance in agricultural production for export (coffee), the same year saw 3.2 million people registered in need of humanitarian assistance (FAO, 2012b).

(Source: UNISDR)

Figure 10.16 Future supply and demand for East African Countries



(Source: Mkumbwa, 2011)

spite a bumper harvest of 3.2 million tonnes of maize compared with a national consumption of 2.4 million tonnes, announced an export ban to rebuildi the national reserve. This narrowed the options of countries with a food deficit, such as Kenya, to secure maize imports at the reduced 25 percent import tariff within the Common Market for Eastern and Southern Africa (COMESA) as opposed to a 50 percent tariff on imports from non-COMESA members.[xii]

10.7 A way forward? Another approach to agribusiness investment

Policy and practice that continues to prioritise humanitarian assistance over long-term investment in increasing smallholder productivity and access to markets is becoming increasingly unviable. New partnerships between farmers, governments and agribusiness companies are emerging that may more effectively strengthen the resilience of local producers and markets.

For decades, existing policies and practices in Africa seem to have been focused, on the one hand, on promoting export-oriented, commercial production in more favourable areas that have access to more reliable rainfall, inputs, roads and markets. They still rely today, on the other hand, on international humanitarian assistance to buffer food insecurity among smallholder farmers and pastoralists. Given the internal and external risks posed by large agribusiness investments, on the one hand, and continued food insecurity, despite decades of massive investment in humanitarian assistance, on the other hand, a new approach is urgently required. National and regional efforts, such as the Ethiopian Government's Productive Safety Net Programme described in GAR11, aim to address this challenge, but remain exceptions to an overall trend of stagnant policies and investments.

There is a massive disproportion of spending on reducing disaster risks and strengthening resilience, which over the last decade (2000–2009) accounted for only 1 percent of total overseas development assistance (ODA) in the 40 countries receiving the highest humanitarian aid (Kellet and Sparks, 2012). Humanitarian assistance has been continuously high over the last decades (see Figure 10.17), but is increasingly unsustainable and has become part of

the continuation of disaster risk and food insecurity rather than part of the solution.

FAO (2011a) estimates that roughly one-third of food produced for human consumption alone (not counting animal feeds that take 37 percent of grain production) is wasted. Another study shows that potentially 30–50 percent of all food produced never reaches a human stomach (IMECHE, 2012). The causes of food losses in low-income countries are mainly connected to financial, managerial and technical limitations in harvesting techniques, storage and cooling facilities, infrastructure and packaging and marketing (FAO, 2011a). In medium and high-income countries, which contribute more to food waste than low-income countries, food loss tends to occur at the consumption stage.

Given the dependence of food-insecure households on purchased food, investments in global logistics to reduce food waste and efforts to change consumption patterns, coupled with improving access to food for low-income households, may do more to increase global food security than any further investments in the intensification of production (Fava Neves, 2011; Maxwell and Slater, 2003; Webb et al., 2006).

Investments to address infrastructure deficits may also contribute to increased food security. In Africa, for example, a persistent infrastructure deficit is a key determinant of low productivity and trade. Less than 4 percent of sub-Saharan Africa's arable land is irrigated—a much lower proportion compared with South Asia (almost 39 percent) or Latin America and the Caribbean (11 percent) (Yumkella et al., 2011). Supplemental irrigation, which allows earlier planting in appropriate time, would dramatically increase yields in those areas.

And as Table 10.1 shows, Africa's infrastructure networks consistently lag behind those of other low-income countries. In such contexts, damage to infrastructure from even small and localised disaster events, such as floods, can have severe implications for the resilience of smallholder farmers as well as

Figure 10.17 Overseas development aid flows for food aid and food security

(Source: UNISDR, based on data from OECD Creditor Reporting System[xiii])

big companies owing to major disruptions in market access.

Agriculture promotion policies should be carefully designed. For example, instruments—such as input or insurance subsidies—can, on the one hand, reduce vulnerability of producers and other actors in the agricultural value chain, but, on the other hand, may increase overall vulnerability of the local agricultural system by facilitating production on marginal lands and possibly increasing drought exposure (Hazell and Hess, 2010).

New partnerships between smallholders, local and national governments and large agribusiness companies may pave the way for a longer-term strategy that effectively strengthens the resilience of smallholder farmers. More and more companies are recognising the business opportunities inherent in addressing existing agricultural challenges (see Box 10.4).

Owing to rising agricultural commodity prices, some multinational agribusiness corporations are now seeing opportunities to invest in improving the productivity and strengthening the resilience of smallholder farmers.

As Box 10.5 highlights, although still controversial, commercial initiatives are providing technology and outreach to smallholder farmers for food production in regions with high potential and where limited gaps in infrastructure, markets and production deficits may relatively cost-effectively relieve some risks to natural and human capital. At the same time, investments by major global corporations raise new concerns regarding the use of genetically modified

Table 10.1 Infrastructure deficit of Africa's low-income countries

Normalised Units	Sub-Saharan Africa low-income countries	Other low-income countries
Paved road density	31	134
Mainline (telephone density)	137	211
Generation capacity	37	326
Electricity coverage	16	41
Mobile density	55	76

(Source: adapted from Foster and Briceno-Gardena, 2010)

Box 10.4 Creating shared value in agriculture in India

In India, Jain Irrigation Systems, the largest manufacturer of irrigation systems and a leading fruit and vegetable processing business, developed a micro-irrigation system based on the principle of drip irrigation that was appropriate for smallholder farmers and that reduced water usage by 30 percent compared with commonly used flood irrigation systems (Borgonovi et al., 2011). Targeting small farmers with less than 1 hectare of land, the company has developed a significant new market and claims to have grown at a compounded annual growth rate of 41 percent from 2005 to 2010 (Borgonovi et al., 2011).

Another example from the subcontinent is a public-private partnership (PPP) that seeks to address farmers' vulnerability to volatile commodities markets. Gramin Suvidha Kendra (GSK) has established partnerships with a variety of private companies, non-governmental organisations and government institutions, such as the state postal departments, to provide farmers with agricultural inputs and expert advice as well as information on storage, financing and futures prices; the latter via the Multi Commodity Exchange of India Limited (MCX), a founding partner of GSK. First surveys of participating farmers indicate real success, with 57 percent of farmers reporting the successful use of MCX futures prices for their cropping decisions and 66 percent claiming productivity increases owing to access to improved seeds and fertilisers.

(Source: UNISDR)

seeds and the creation of monopolistic dependence. This is despite growing recognition that in future, new developments in biotechnology for plant breeding to address the challenges of an increasingly changing climate will be required.

The 2008 World Development Report on Agriculture reported strong synergies between agribusiness, agriculture performance and poverty alleviation (World Bank, 2008b). Strong links between agribusiness and smallholders via effective government policy can reduce rural poverty and increase resiliency if they are successful in promoting components critical for small farm production as well as commercial agriculture (Figure 10.19). Agribusiness companies usually seek to do this via a combination of partnerships to increase opportunities for technology transfer, contract farming and hybrid schemes of small and large-scale farming.

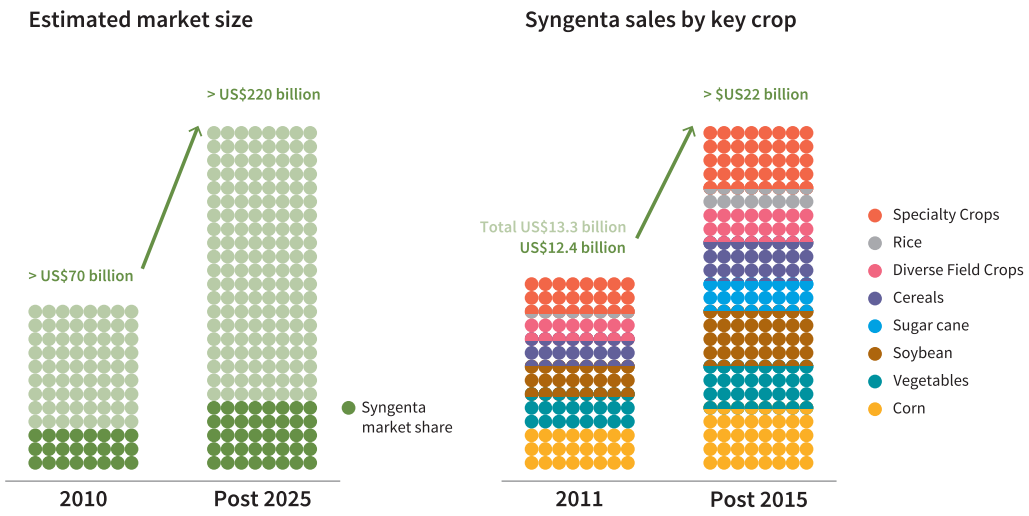
Many of the elements in this approach are already well known and have been successfully demonstrated to produce results: agro-ecological approaches to agriculture, which can increase productivity, strengthen resilience and conserve natural capital (Pretty, 2006; Altieri, 1987); decentralised natural resource management (Sekar, 2000); investments in infrastructure and development of markets that link smallholders to modern national and international supply chains (Le Courtois et al.,

Box 10.5 Agribusiness investing in smallholders

Syngenta —a world leader in crop protection—recognises the productive regions of sub-Sahara as a market that is vast and virtually untapped. In 2012, its CEO announced plans for a significant investment in smallholders across Africa.[xiv]

More than 75 percent of maize production is currently provided by small farmers in the region (FAO, 2011b). By treating smallholders as individual firms, Syngenta has committed to enter into partnership agreements with them, providing the full package of required inputs, technical services, insurance and knowledge to create viable smallholders. As smallholders get access to key inputs for increased productivity, Syngenta will invest to increasing the size of the market and with it, its overall market share (Figure 10.18), possibly creating shared value for both groups.

Figure 10.18 Syngenta estimated global market size and crop sales



(Source: Syngenta)

2010); social protection, through conditional cash transfers and temporary employment programmes (Farrington et al., 2008; Devereux, 2003; UNISDR, 2011); and parametric crop insurance schemes (see example in Box 10.6).

But for approaches like these to be viable, an enabling policy environment will be required, involving all institutions engaged in property and land-holding registration, environmental protection and land-use departments as well as business regulators (Fava Neves and Alves Pinto, 2012; Hill and Pittman, 2012).

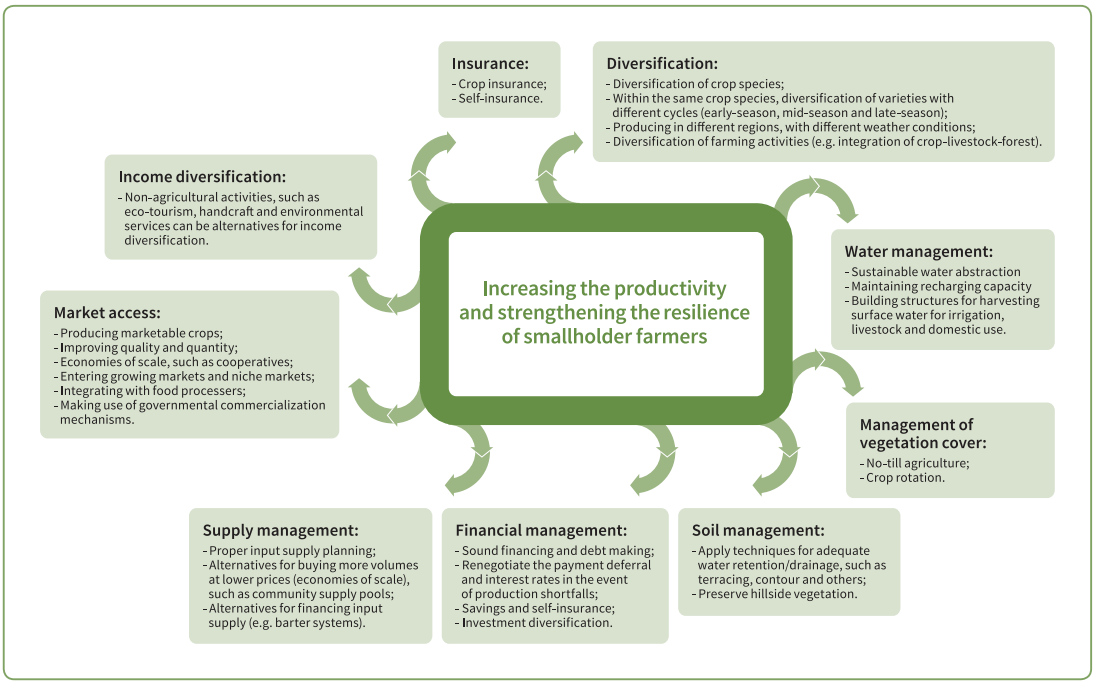
In Brazil, for example, the government has been successful in promoting substantial private investment into food and non-food agricultural production by creating incentives through a mixture of infrastructure improvements and policy instruments (Box 10.7).

For government departments concerned with increasing growth and investment, the challenge is to present an approach as a competitive advantage in the context of stimulus packages for agribusiness investments, such as the provision of local infrastructure; the regulation of environmental protection as well as human resources; taxation policies; and research and development (Fava Neves, 2011). Although Brazil was successful in attracting significant investment in agribusiness, the opening up of lands to national and foreign investors, for example in the Amazon region, has also resulted in large-scale deforestation (Cattaneo, 2002).

As highlighted in Chapter 6, improved modelling of agricultural drought and other hazards, together with down-scaled climate scenarios can provide an evidence base that would encourage informed investments by the agribusiness sector and more relevant and effective public policy decisions by governments.

Increasing agricultural productivity and resilience alone will not eliminate food insecurity for highly vulnerable rural households who rely on purchased food and aid. However, by increasing the value and quantity of crops smallholder farmers are able to

Figure 10.19 Components for improving the resilience of smallholder farmers



(Source: UNISDR, based on Fava Neves and Alves Pinto, 2012)

Box 10.6 The future of index-based insurance—the R4 Rural Resilience Initiative

The challenge of how insurance of property and assets can be relevant and affordable to low-income communities has triggered a number of micro-insurance initiatives over the last two decades (UNISDR, 2009 and 2011). Some of these instruments, such as index-based crop insurance schemes, have enjoyed remarkable success across the globe. However, even these targeted programmes rarely reached the most vulnerable of low-income populations—those with no land or productive assets to insure.

An innovative partnership between Swiss Re., a major global reinsurance company, the UN World Food Programme, and Oxfam, a large international development organisation, is testing and developing a new set of integrated tools to reach some of the most vulnerable populations in Africa. Building on the success of HARITA, the first micro-insurance scheme to offer poor farmers to pay for crop insurance with their own labour, the R4 Rural Resilience Initiative seeks to improve approaches to targeting and financing to mature the programme into a commercially viable option that is accessible to the poorest. Success will depend on a number of factors, not least the functioning of the partnership between public and private actors in this scheme. To date, although these innovations have shown promising results in reaching farmers for which normal insurance schemes are out of reach, such programmes have had to rely on heavily subsidised premiums and have not yet been scaled up to a level that would prove their viability and sustainability.

(Source: Spiegel and Satterthwaite, in Orie and Stahel, 2012)

Box 10.7 Like moths to a flame—attracting private investment in agriculture through electricity

Secure energy supply is crucial for some agribusiness activities, as energy is necessary to operate pumps in irrigation systems, ventilators in poultry farms, cooling systems for the storage of some fresh food such as milk and meat, etc.

In 2000, about 10 million or 80 percent of smallholder farmers in Brazil had no access to public power supply (Government of Brazil, 2010). From 2003 to 2010, the government invested heavily to change this, and by 2010, the budget for this initiative had reached R$20 billion (Ibid.). By September 2011, 14.2 million people had been reached.[xv] Hand-in-hand with this investment, a new policy on the creation of Production Community Centres, in which private investment was sought and supported, was established.

(Source: UNISDR)

sell and by reducing the risks of crop loss and yield reduction, it is possible to increase income, which in turn will allow farmers to purchase more food and increase reserves for lean periods, building theirs and society's resilience to disasters.

Notes

i Category of 'Developing countries' as used in OECD and FAO, 2012.

ii OECD and FAO (2012) explain that the decrease of stock ratio in rice is mainly caused by a contraction in China and India from the extraordinarily high inventory levels of recent years.

iii Years based on the FAO Food Price Index: http://www.fao.org/worldfoodsituation/wfs-home/foodpricesindex/en/

iv "Stuck on dry land," Financial Times (Analysis), 31 July 2012.

v http://www.cpc.ncep.noaa.gov/products/expert_assessment/seasonal_drought.pdf ; http://US$a01.library.cornell.edu/US$a/current/CropProd/CropProd-11-09-2012.pdf ; http://www.fao.org/worldfoodsituation/wfs-home/csdb/en/ ; http://www.fao.org/worldfoodsituation/wfs-home/foodpricesindex/en/ ; http://www.ers.US$a.gov/topics/in-the-news/us-drought-2012-farm-and-food-impacts.aspx ; http://www.US$a.gov/oce/commodity/wasde/latest.pdf.

vi http://landportal.info/landmatrix; accessed 18 February 2013 only using land deals in relation to agricultural production.

vii http://www.morningstar.com/earnings/21927995-bunge-ltd-bgq4-2010.aspx?pindex=2 (accessed 21 February 2013).

viii http://www.morningstar.com/earnings/21927995-bunge-ltd-bgq4-2010.aspx?pindex=3 (accessed 21 February 2013).

ix http://reports.weforum.org/global-risks-2012.

x FAO Aquastat, www.fao.org/nr/water/aquastat/water_use/index.stm.

xi 'Virtual water' refers to the amount of water that is used by one country by consuming goods produced somewhere else. At country level, this water is neither accounted for in the population's consumption nor in the country's water demand. In the countries were the goods are produced, this 'virtual water' is subtracted to the local consumption. As this 'virtual water' is often not accounted for, the water balance for these producing countries might not capture correctly the sources of shortages.

xii COMESA = Common Market for Eastern and Southern Africa. Source of data: Agritrade, 12 February 2012 http://agritrade.cta.int.

xiii http://stats.oecd.org/index.aspx?r=543569.

xiv Verbal communication during Naivasha Drought Experts meeting, October 2012.

xv http://www.brasil.gov.br/energia-en/light-for-all-program-1/what-it-is/br_infografico?set_language=en.