

## 6. Impacts on poverty and food security

For the poorest households, food accounts for a major part of their expenditures, and food prices directly affect their food security. As a commonly accepted definition, food insecurity exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active, healthy life. Already, the recent increase in staple food prices has triggered demonstrations and riots in a number of countries. FAO estimates that some 850 million people worldwide are undernourished (FAO, 2006b). Given the potential scale of the biofuel market, the uncertainty relating to long-term price developments and the large number of poor households, the question of what impact expanding biofuel production will have on the food security of the poor should be high on the political agenda.

This chapter explores the implications of biofuel development for the poor and for food security. Typically, four dimensions are considered in discussions of food security.

- **Availability of food** is determined by domestic production, import capacity, existence of food stocks and food aid.
- **Access to food** depends on levels of poverty, purchasing power of households, prices and the existence of transport and market infrastructure and food distribution systems.
- **Stability** of supply and access may be affected by weather, price fluctuations, human-induced disasters and a variety of political and economic factors.
- **Safe and healthy food utilization** depends on care and feeding, food safety and quality, access to clean water, health and sanitation.

Although expanding demand for biofuels is only one of many factors underlying the recent price increases (see Chapter 4, page 41) the rapid growth in biofuel production will affect food security at the national and household levels mainly through its impact on food prices and

incomes. In terms of the four dimensions, the discussion focuses on the impacts of higher food prices on availability and access at the national level, as well as the household level. At both levels, the initial focus is on short-term impacts, before moving on to address the longer-term impacts. In the medium-to-longer term, higher agricultural prices offer the potential for a supply response and for strengthening and revitalizing the role of agriculture as an engine of growth in developing countries.<sup>12</sup>

### Food-security impacts at the national level

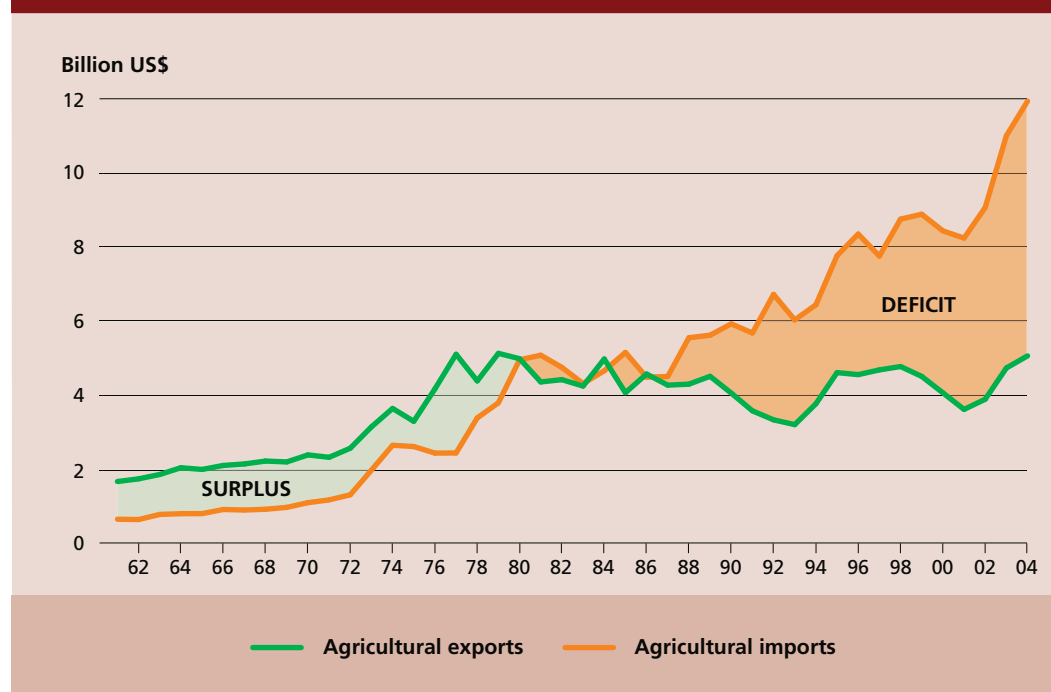
Chapter 3 discussed the strengthened linkages between energy and agricultural commodity prices resulting from the growth in demand for biofuels and Chapter 4 considered the implications for agricultural commodity prices. How individual countries will be affected by higher prices will depend on whether they are net agricultural commodity importers or net exporters. Some countries will benefit from higher prices, but the least-developed countries,<sup>13</sup> which have been experiencing a widening agricultural trade deficit over the last two decades (Figure 27), are expected to be considerably worse off.

Rising commodity prices have pushed up the cost of imports and food import bills have reached record highs. Based on FAO's latest analysis, global expenditures on

<sup>12</sup> The dynamics of the rapid rise in commodity prices are covered in greater detail in *The State of Agricultural Commodity Markets 2008* (FAO, forthcoming, 2008c), while the impacts of soaring food prices on the poor are the subject of *The State of Food Insecurity in the World* (FAO, forthcoming, 2008d).

<sup>13</sup> Least-developed countries are classified as such on the basis of: (a) a low-income criterion (a three-year average estimate of per capita gross national income of below US\$750); (b) a human-resource weakness criterion; and (c) an economic vulnerability criterion. For more detail and a list of least-developed countries see UN-OHRLS (2008).

**FIGURE 27**  
Agricultural trade balance of least-developed countries



Source: FAO.

imported foodstuffs in 2007 rose by about 29 percent above the record of the previous year (FAO, 2008a) (Table 11). The bulk of the increase was accounted for by rising prices of imported cereals and vegetable oils – commodity groups that feature heavily

in biofuel production. More expensive feed ingredients lead to higher prices for meat and dairy products, raising the expenditures on imports of those commodities. The rise of international freight rates to new highs also affected the import value of all

**TABLE 11**  
Import bills of total food and major food commodities for 2007 and their percentage increase over 2006

COMMODITY	WORLD		DEVELOPING COUNTRIES		LDCs <sup>1</sup>		LIFDCs <sup>2</sup>	
	2007 (US\$ million)	Increase over 2006 (Percentage)	2007 (US\$ million)	Increase over 2006 (Percentage)	2007 (US\$ million)	Increase over 2006 (Percentage)	2007 (US\$ million)	Increase over 2006 (Percentage)
<b>Cereals</b>	268 300	44	100 441	35	8 031	32	41 709	33
<b>Vegetable oils</b>	114 077	61	55 658	60	3 188	64	38 330	67
<b>Meat</b>	89 712	14	20 119	18	1 079	24	8 241	31
<b>Dairy</b>	86 393	90	25 691	89	1 516	84	9 586	89
<b>Sugar</b>	22 993	-30	11 904	-14	1 320	-25	4 782	-37
<b>Total food</b>	<b>812 743</b>	<b>29</b>	<b>253 626</b>	<b>33</b>	<b>17 699</b>	<b>28</b>	<b>119 207</b>	<b>35</b>

<sup>1</sup> Least-developed countries (see footnote 13).

<sup>2</sup> Low-income food-deficit countries. FAO classifies countries as low-income food-deficit on the basis of three criteria: their per-capita income; their net food trade position; and a "persistence of position", which postpones the "exit" of an LIFDC from the list, despite the country not meeting the LIFDC income criterion or the food-deficit criterion, until the change in its status is verified for three consecutive years.

For a detailed description of the criteria and a list of LIFDC countries, see: <http://www.fao.org/countryprofiles/lifdc.asp>.  
Source: FAO, 2008a.

**TABLE 12**  
**Net importers of petroleum products and major cereals, ranked by prevalence of undernourishment**

COUNTRY	PETROLEUM IMPORTED	MAJOR CEREALS IMPORTED	PREVALENCE OF UNDERNOURISHMENT
	(Percentage of consumption)	(Percentage of domestic production)	(Percentage of population)
Eritrea	100	88	75
Burundi	100	12	66
Comoros	100	80	60
Tajikistan	99	43	56
Sierra Leone	100	53	51
Liberia	100	62	50
Zimbabwe	100	2	47
Ethiopia	100	22	46
Haiti	100	72	46
Zambia	100	4	46
Central African Republic	100	25	44
Mozambique	100	20	44
United Republic of Tanzania	100	14	44
Guinea-Bissau	100	55	39
Madagascar	100	14	38
Malawi	100	7	35
Cambodia	100	5	33
Democratic People's Republic of Korea	98	45	33
Rwanda	100	29	33
Botswana	100	76	32
Niger	100	82	32
Kenya	100	20	31

Source: FAO, 2008a.

commodities, placing additional pressure on the ability of countries to cover their food import bills. Although growing demand for biofuels accounts for only part of the recent sharp price increases, the table nevertheless illustrates the significant impact higher agricultural commodity prices can have, especially on the low-income food-deficit countries (LIFDCs).

High food prices have been accompanied by rising fuel prices, which further threaten macroeconomic stability and overall growth, especially of low-income

net energy-importing countries. Table 12 lists 22 countries considered especially vulnerable owing to a combination of high levels of chronic hunger (above 30 percent undernourishment), high dependency on imports of petroleum products (100 percent in most countries) and, in many cases, high dependency on imports of major cereals (rice, wheat and maize) for domestic consumption. Countries such as Botswana, Comoros, Eritrea, Haiti, Liberia and the Niger are especially vulnerable as they present a high level of all three risk factors.

## Food-security impacts at the household level – short-run effects<sup>14</sup>

### Access to food

At the household level, a critical factor for food security is access to food. Access to food refers to the ability of households to produce or purchase sufficient food for their needs. Two key indicators can help assess the impact of biofuel developments on food security: food prices and household incomes. The more income a household or individual has, the more food (and of better quality) can be purchased. The precise effects of food prices on household food security are more complex. Higher food prices are expected to make net food-buying households in both urban and rural areas worse off, while better-endowed rural households, who are net sellers of food, stand to gain from the increased incomes resulting from the higher prices.

Higher world food prices do not necessarily affect household food security: the impact will depend on the extent to which international prices pass through to domestic markets. The depreciation of the United States dollar against many currencies (for example the euro and the CFA [Communauté financière africaine] franc) and government policies designed to avoid large domestic price shocks tend to reduce the transmission of world market prices to domestic markets.<sup>15</sup> Sharma (2002), in a study of eight Asian countries in the 1990s, found that price transmission was strongest for maize, followed by wheat, and least for rice, which is the staple food for most of Asia's poor. The degree of transmission is always stronger over the longer term.

In many Asian countries rice is designated as a special, or sensitive, commodity for food security, and FAO (2008f) found that transmission varies significantly from country to country, depending on the instruments, if any, that are used to insulate

the domestic economy from price increases on international markets. For example, India and the Philippines make use of government storage, procurement and distribution as well as restrictions on international trade. Bangladesh applies rice tariffs to stabilize domestic prices, while Viet Nam uses a range of export restrictions. On the other hand, countries such as China and Thailand have allowed most of the changes in world prices to pass through to domestic markets. Maize is a feedgrain in Asia and subject to much less price intervention. FAO (2004b) found that price transmission is generally weaker in Africa than in Asian countries. Domestic price policies can help stabilize prices but they do require fiscal resources. In the longer run they may also impede or slow down an effective supply response to higher prices.

### Impacts on net food buyers and net food sellers

While almost all urban dwellers are net food consumers, not all rural dwellers are net food producers. Many smallholders and agricultural labourers are net purchasers of food, as they do not own sufficient land to produce enough food for their families. Empirical evidence from a number of sub-Saharan African countries, compiled in Barrett (forthcoming) in no case finds a majority of farmers or rural households (depending on the survey definition) to be net food sellers.

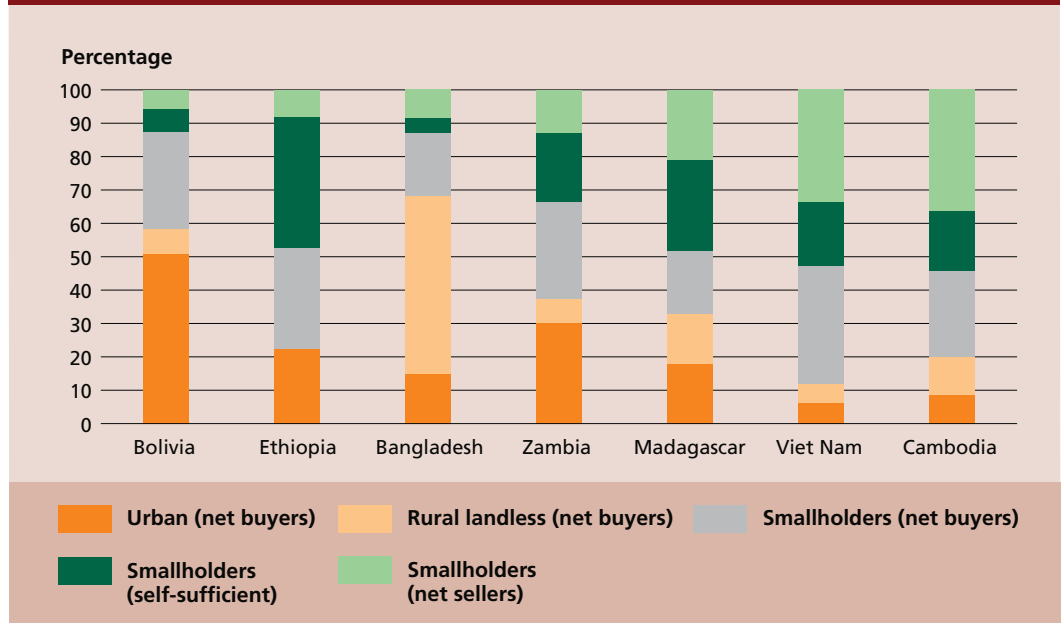
Empirical evidence prepared by FAO (2008a) confirms this pattern, as illustrated in Table 13, which shows the share of net staple food-selling households among urban and rural households, respectively, for a series of countries. Only in two instances does the share of net selling households exceed 50 percent.

Even in rural areas, where agriculture and staple food production is an important occupation for the majority of the poor, a vast share of the poor are net food buyers (Figure 28) and thus stand to lose, or at least not gain, from an increase in the price of tradable staple foods. The proportion of poor smallholders that are also net sellers never exceeds 37 percent and for four of the seven countries is 13 percent or less. The proportion of poor that are net buyers ranges from 45.7 percent in Cambodia to over 87 percent in Bolivia, and for

<sup>14</sup> A comprehensive assessment of the food-security impacts of higher food prices can be found in FAO (2008a).

<sup>15</sup> Recent work by FAO (2008a) confirms that country-level impacts require case-by-case analysis as different countries have experienced different exchange-rate movements and employ different commodity market policies.

**FIGURE 28**  
**Distribution of poor net buyers and sellers of food staples<sup>1</sup>**



<sup>1</sup> Percentage of poor population buying or selling internationally traded staples (rice, wheat, maize, beans).

Source: World Bank, 2007.

five of the seven countries the proportion is over 50 percent.

#### *Poverty impacts of higher food prices*

For the poorest households, food typically accounts for half, and often more, of their total expenditure. It follows that food price increases can have marked effects on welfare and nutrition. As an example, Block *et al.* (2004) found that when rice prices increased in Indonesia in the late 1990s, mothers in poor families responded by reducing their caloric intake in order to feed their children better, leading to an increase in maternal wasting. Furthermore, purchases of more nutritious foods were reduced in order to afford the more expensive rice. This led to a measurable decline in blood haemoglobin levels in young children (and in their mothers), increasing the probability of developmental damage.

Farmers who are net food sellers and will benefit from higher prices will typically be those with more land, who will also tend to be better off than farmers with only little land. Moreover, farmers with more surplus production to sell will benefit from high prices more than farmers with only a small surplus to sell. In any case, poorer farmers are

unlikely to receive the bulk of the benefits from higher food prices and are the most likely to be negatively affected.

Estimates of the short-term welfare impact on rural and urban households of a 10 percent increase in price of the main staple food are shown in Figure 29 for seven of the countries listed in Table 13. These estimates do not allow for household responses in production and consumption decisions and thus they represent an upper bound of the likely impact. However, in the very short run, the potential for adjustments in crop production is limited, and on the consumption side the very poor are likely to have only minimal substitution possibilities.

What Figure 29 highlights is that the poorest expenditure quintiles are worst affected in both urban and rural areas – they experience either the largest decline or the smallest increase in welfare. Even in some of the countries where rural households gain on average, for example Pakistan and Viet Nam, the poorest quintiles in the rural areas still face a negative change in welfare as a result of the staple price increase. Unsurprisingly, all urban households are expected to lose in all countries, but to varying degrees, with the poorest experiencing the largest decline.

**TABLE 13**  
Share of net staple food-seller households among urban, rural and total households

COUNTRY/YEAR	SHARE OF HOUSEHOLDS		
	Urban (Percentage)	Rural (Percentage)	All (Percentage)
<b>Bangladesh, 2000</b>	3.3	18.9	15.7
<b>Bolivia, 2002</b>	1.2	24.6	10.0
<b>Cambodia, 1999</b>	15.1	43.8	39.6
<b>Ethiopia, 2000</b>	6.3	27.3	23.1
<b>Ghana, 1998</b>	13.8	43.5	32.6
<b>Guatemala, 2000</b>	3.5	15.2	10.1
<b>Madagascar, 2001</b>	14.4	59.2	50.8
<b>Malawi, 2004</b>	7.8	12.4	11.8
<b>Pakistan, 2001</b>	2.8	27.5	20.3
<b>Peru, 2003</b>	2.9	15.5	6.7
<b>Viet Nam, 1998</b>	7.1	50.6	40.1
<b>Zambia, 1998</b>	2.8	29.6	19.1
<b>Maximum</b>	<b>15.1</b>	<b>59.2</b>	<b>50.8</b>
<b>Minimum</b>	<b>1.2</b>	<b>12.4</b>	<b>6.7</b>
<b>Unweighted average</b>	<b>6.8</b>	<b>30.7</b>	<b>23.3</b>

Source: FAO, 2008a.

FAO's analysis of the welfare impacts of staple food price increases also indicated that female-headed households in most urban, rural and national samples typically fare worse than male-headed households, in that they face either greater welfare losses or smaller welfare gains. This strong result emerged even though female-headed households are not systematically overrepresented among the poor in all, or even most, of the countries. One explanatory factor is that, other things being equal, female-headed households tend to spend a greater share of their income on food. Moreover, in rural contexts, they generally have less access to land and participate less in agricultural income-generating activities and thus cannot share in the benefits of food price increases (FAO, 2008a).

While higher food prices will tend to have a negative impact on the purchasing power of the rural poor, there is also the potential for benefits to this group as a result of increased demand for agricultural labour,

which is a prime source of income for the poor. Indeed, poor and landless families typically rely disproportionately on unskilled wage labour for their income (World Bank, 2007). Higher agricultural prices, by stimulating the demand for unskilled labour in rural areas, can lead to a long-run increase in rural wages, thereby benefiting wage-labour households as well as self-employed farmers. Ravallion (1990), using a dynamic econometric model of wage determination and data from the 1950s to the 1970s, concluded that the average poor landless household in Bangladesh loses in the short run from an increase in rice prices (because of higher consumption expenditures) but gains slightly in the longer run (after five years or more). Indeed, in the long run, as wages adjust, the increase in household income (dominated by unskilled wage labour) becomes large enough to exceed the increase in household expenditures on rice. However, this study used relatively old data, compiled when rice

**FIGURE 29**  
Average welfare gain/loss from a 10 percent increase in the price of the main staple, by income (expenditure) quintile for rural and urban households



Source: FAO, 2008a.

farming was a larger sector of the economy and thus had a more profound impact on labour markets. Rashid (2002) found that rice prices in Bangladesh ceased to have a significant effect on agricultural wages after the mid-1970s. If higher rice prices no longer induce higher rural wages in Bangladesh, where agriculture represents a larger

share of the economy and rice dominates the agriculture sector to a greater extent than in most other Asian countries, it seems unlikely that higher cereal prices will provide a significant stimulus to the rural labour market in economies with a more diversified range of employment opportunities.

Higher food prices may also have second-round multiplier effects, as the higher incomes of farmers create demand for other goods and services, many of which will be locally produced. However, if this additional income simply represents a transfer from the rural landless and urban poor, these new multiplier effects will be counterbalanced by negative multiplier effects generated by the reduced incomes of the poor, who will have less money to spend on non-food items as their food bills increase. The net multiplier effects will depend on the change in income distribution and the different spending patterns of the winners and losers from the new set of relative prices.

On balance, at the global level, the immediate net effect of higher food prices on food security is likely to be negative. For example, Senauer and Sur (2001) estimated that a 20 percent increase in food prices in 2025 relative to a baseline will lead to an increase of 440 million in the number of undernourished people in the world (195 million of whom live in sub-Saharan Africa and 158 million in South and East Asia). The International Food Policy Research Institute (IFPRI) estimated that biofuel expansion based on actual national expansion plans would raise the prices of maize, oilseeds, cassava and wheat by 26, 18, 11 and 8 percent, respectively, leading to a decrease in calorie intake of between 2 and 5 percent and an increase in child malnutrition of 4 percent, on average (Msangi, 2008). These, however, are global figures, and the outcome will vary across countries and regions within countries.

Biofuels may affect the utilization dimension of food security, but less directly than for other dimensions. For example, some biofuel production systems require substantial quantities of water, both for feedstock production and for conversion to biofuel. This demand could reduce the availability of water for household use, threatening the health status and thus the food-security status of affected individuals. On the other hand, if bioenergy replaces more polluting energy sources or expands the availability of energy services to the rural poor, it could make cooking both cheaper and cleaner, with positive implications for health status and food utilization.

## **Biofuel crop production as an impetus for agricultural growth**

### **Biofuels and agriculture as engines of growth**

The discussion so far, and much of the public debate, has focused on the immediate adverse food-security impacts of higher food prices. Over the medium-to-longer term, however, there could be a positive supply response not only from smallholders who are net sellers but also from those on the margin and those who are net buyers who are able to react to the price incentives. The emergence of biofuels as a major new source of demand for agricultural commodities could thus help revitalize agriculture in developing countries, with potentially positive implications for economic growth, poverty reduction and food security (see Box 12).

Many of the world's poorest countries are well placed, in agro-ecological terms, to become major producers of biomass for liquid biofuel production – or to respond in general to higher agricultural prices. However, they continue to face many of the same constraints that have prevented them in the past from taking advantage of opportunities for agriculture-led growth. Their ability to take advantage of the new opportunities offered by biofuels – either directly as biofuel feedstock producers or indirectly as producers of agricultural commodities for which prices have gone up – will depend on how these old constraints (and a few new ones) are addressed.

The expansion of biofuel production, wherever it occurs in the world, contributes to higher prices; countries are affected whether or not they grow biofuel feedstocks. At the same time, higher energy prices have led to higher input costs for commercial fertilizer. Increased farm productivity will be fundamental in preventing long-term increases in food prices and excessive pressure for expansion of cultivated area, together with the associated negative environmental effects (including increased greenhouse gas emissions). While, historically, on-farm innovations helped drive productivity gains in Europe and the United States of America, the considerable



## BOX 12

**Agricultural growth and poverty reduction**

Agriculture, due to its size and its linkages with the rest of the economy – which remain strong and significant in many of today's developing countries – has long been seen by agricultural economists as an engine of growth in the earlier stages of development (see, for example, Johnston and Mellor, 1961; Hazell and Haggblade, 1993). Starting with Ahluwalia's (1978) work on India, many studies have attempted to quantify the impact of agricultural growth on poverty. Seminal work by Ravallion and Datt (1996) and Datt and Ravallion (1998) showed that rural growth, stimulated by agricultural growth, not only reduced poverty but also had a stronger effect on poverty reduction than growth in other sectors such as manufacturing and services. Furthermore, rural growth had a significant poverty-reduction impact also in urban areas.

Cross-country econometric evidence indicates that GDP growth generated in agriculture is at least twice as effective in reducing poverty as growth generated by other sectors, controlling for the sector's size (World Bank, 2007). Even in studies that do not find agriculture to be the sector contributing most to poverty reduction, growth in the primary sector is still found to have a sizeable impact on the living standards of the poor – well beyond that suggested by its role in the economy (Timmer, 2002; Bravo-Ortega and Lederman, 2005).

The extent to which agricultural growth contributes to poverty reduction, depends, however, on the degree of inequality in a country (Timmer, 2002)

and on the share of agriculture in the economy and in employment. Most agricultural growth, over the long term, stems from technical change (Timmer, 1988). A vast body of literature on the Green Revolution illustrates the strong poverty-reducing impact of productivity-enhancing technological innovation. Such innovation in agriculture has lifted millions of people out of poverty by generating rural income opportunities – not only for farmers, but also for farm labourers and other rural providers of goods and services – and by reducing prices for consumers (FAO, 2004c). Studies on China and India have shown that, dollar for dollar, agricultural research has historically been one of the most effective means for poverty reduction through government spending (Fan, Zhang and Zhang, 2000; Fan, 2002). Subsequent work in Uganda has shown similar results (Fan, Zhang and Rao, 2004).

An FAO study on the roles of agriculture outlined four main channels through which agricultural growth can alleviate poverty (FAO, 2004d; FAO, 2007d): (i) by directly raising incomes; (ii) by reducing food prices; (iii) by raising employment; and (iv) through higher real wages. For the first of these channels, the distribution of land is important: a more equitable land distribution provides a more equal distribution of the benefits of agricultural growth (Lopez, 2007). Similarly, the wage and employment channels are more effective when urban and rural labour markets are better integrated (Anríquez and López, 2007).

resources required to carry out research on modern agricultural technology means that publicly funded research is essential. Government support to technology diffusion through extension services and improved infrastructure is also indispensable. Biofuels strengthen the case for considerably enhanced investments in agricultural productivity growth in developing countries.

**Biofuels, commercialization and agriculture-sector growth**

Crops cultivated for biofuels, at least from the farmer's perspective, are no different from other commercial crops and can be instrumental in transforming agriculture from semi-subsistence, low-input and low-productivity farming systems, which characterize many parts of the developing world. Experience has shown that cash-crop

## BOX 13

## Cotton in the Sahel

Over the past 50 years, and particularly in the past two decades, cotton has become a key export crop for many Sahelian countries. Although cotton is a plantation crop in the European Union and the United States of America, in the Sahel it is grown almost exclusively on small farms. Moreover, this success has not been achieved at the expense of foregone cereal production. Cotton production has contributed to higher incomes, improved livelihoods and better access to social services such as education and health.

Mali is one of the largest cotton producers in the region, and indeed in all of sub-Saharan Africa. In 2006, roughly 200 000 Malian smallholder farmers produced cotton for sale on the international market. Over the past 45 years, cotton production has increased by more than 8 percent per year, providing an average income of US\$200 per household for over 25 percent of Malian rural households.

Mali's cotton farmers traditionally cultivate cotton in rotation with coarse grains, particularly maize and sorghum. Contrary to popular fears that cash crops may have a negative effect on food-crop production and household food security, cotton production has actually boosted coarse grain production in Mali. Unlike coarse grains produced outside the cotton zone, cereals grown by cotton farmers benefit from greater access to fertilizer and from the residual effects of cotton fertilizers procured and financed through the region's cotton-based input/credit system. Cereal fields also benefit from improved farming practices made possible through the use of animal traction equipment financed by cotton income. Farmers with animal traction equipment

obtain higher yields in both cotton and coarse grains than the semi-equipped and manual producers (Dioné, 1989; Raymond and Fok 1995; Kébé, Diakite and Diawara, 1998). Well-equipped cotton farmers, likewise, are more able to satisfy the demanding husbandry requirements of maize production, including timely planting, frequent ploughing and regular weeding (Boughton and de Frahan, 1994). They also tend to sell more cereals to the markets. In general, farmers using animal traction account for the majority of cereal sales, primarily because of their higher per capita production.

Historically, an important factor in the success of cotton farmers with both cotton and cereals has been the extension support provided by the Compagnie Malienne de Développement des Textiles (CMDT). The CMDT's construction and maintenance of regional feeder roads has also facilitated the collection and transport of seed cotton. This benefits food-crop marketing by helping to lower marketing costs and improve market integration in the zone. The Malian cotton experience highlights the importance of investing in agriculture if biofuels are to become an engine of agricultural growth.

Cotton also illustrates the impact of OECD countries' subsidies to production and exports and tariffs on imports of farm-based commodities. Anderson and Valenzuela (2007) estimate that the removal of current distortions affecting cotton markets would boost global economic welfare by US\$283 million per year and raise the price of cotton by about 13 percent. Moreover, West African cotton farmer's incomes would rise by 40 percent.

*Source:* based on Tefft (forthcoming).

development by smallholders need not come at the expense of food-crop production or food security in general (see Box 13), although this has occurred in some instances (Binswanger and von Braun, 1991; von Braun, 1994).

Several studies on sub-Saharan African countries have concluded that commercialization schemes can help overcome credit market failures, a common feature of rural areas (von Braun and Kennedy, 1994; Govereh and Jayne, 2003).

In addition, the introduction of cash crops to a region may stimulate private investment in distribution, retail, market infrastructure and human capital, which ultimately also benefits food-crop production and other farm activities. Where farmers have timely access to credit and inputs, and to extension services and equipment, they are able not only to boost their incomes, but also to intensify food production on their lands. Conversely, poor agro-ecological conditions, weak input and infrastructural support and poor organization of smallholder cash-cropping schemes can lead to failure (Strasberg *et al.*, 1999).

In terms of the employment effects, net job creation is more likely to occur if biofuel feedstock production does not displace other agricultural activities or if the displaced activities are less labour-intensive. The outcome will vary, depending on a country's endowments in land and labour, on the crop used as feedstock and on the crops that were grown previously. Even within a single country and for one individual crop, labour intensity can vary substantially; in Brazil, for example, sugar-cane production uses three times as much labour in the northeast as it does in the centre-south (Kojima and Johnson, 2005).

Research by von Braun and Kennedy (1994) found that the employment effects of commercial crops for poor households were generally significant. In Brazil, the biofuel sector accounted for about 1 million jobs in 2001 (Moreira, 2006). These jobs were in rural areas and mostly for unskilled labour. The indirect creation of employment in manufacturing and other sectors was estimated at about another 300 000 jobs.

#### Promoting smallholder participation in biofuel crop production

Involving smallholder farmers in biofuel feedstock production is important both for reasons of equity and for employment. Are biofuel crops more likely to be produced on plantations or by small farmers? Hayami (2002) points out that smallholders have certain advantages over plantations in that they can avoid problems related to supervision and monitoring and can be more flexible. Indeed, many plantation crops are also grown successfully by smallholders

somewhere in the world. In Thailand, for example, where smallholders are generally prominent in terms of numbers and production, they compare favourably, in efficiency terms, with large- and medium-sized sugar farms in Australia, France and the United States of America (Larson and Borrell, 2001). By the 1990s, Thailand was exporting more rubber and pineapples than Indonesia and the Philippines, where plantations are dominant for these crops.

However, when processing and marketing become more complex and centralized, plantations represent a solution to the need for vertical integration of production with other processes – as is the case for palm oil, tea, bananas and sisal. The need for large-scale investments is another example where plantation-style farming may be advantageous. If investors have to build supporting infrastructure such as irrigation, roads and docking, the scale of the operation necessary to offset the costs will be even larger. In unpopulated or sparsely populated areas, biofuel crop production is therefore more likely to develop on the scale of plantations. This is one key reason why sugar cane in the Philippines is produced by smallholders in old settled areas of Luzon while plantations dominate in areas of Negros that were settled more recently (Hayami, Quisumbing and Adriano, 1990).

Smallholder productivity and profitability are often held back by poorly working commodity markets, lack of access to financial markets, poorly performing producer organizations and significant input market failures, especially for seed and fertilizer in sub-Saharan Africa. Government policy can promote smallholder farming. Key areas for policy intervention are:

- investment in public goods such as infrastructure, irrigation, extension and research;
- the sponsoring of innovative approaches to rural finance;
- the creation of market information systems;
- improvements in output and input markets in rural areas so that small farms are not at a disadvantage relative to larger farms;
- the enforcement of contracts.

Producer organizations that foster collective action can also help reduce transaction costs and achieve market power to the benefit of smallholder competitiveness (World Bank, 2007). The experience of the Green Revolution shows how responsive small-farmer productivity and output supply can be to public investment in research, irrigation and input supply.

At least in the early years, when biofuel crop production is gaining momentum, investors ready to inject the necessary capital are likely to look for some security of supply. One way to achieve this is by establishing a plantation of the crop on which production is based. However, smallholder participation in the form of contract farming (also referred to as “outgrower schemes”) is perhaps the most obvious approach to building the necessary market while safeguarding staple-food production and ensuring pro-poor growth. Contract farming implies the availability of credit, timely supply of inputs, knowledge transfer, provision of extension services and access to a ready market. From the contractors’ perspective, this type of arrangement can improve acceptability to stakeholders and overcome land constraints.

In many countries, contract farming is encouraged by governments as a means for enabling rural farming households and communities to share in the benefits of commercial agriculture while maintaining some independence (FAO, 2001). Contract/outgrower schemes are more likely to succeed if they are based on proven technology and an enabling policy and legal environment. Default by contract farmers can be a major problem in the operation of such schemes. A weak legal system, weak insurance services and the associated high transaction costs lead to considerable risk for companies (Coulter *et al.*, 1999).

Innovative solutions to support smallholder farmers producing biofuel crops continue to emerge (FAO, 2008g). In Brazil, the government created the Social Fuel Stamp programme to encourage biodiesel producers to purchase feedstocks from small family farms in poorer regions of the country. Companies that join the scheme benefit from partial or total federal tax exemption. By the end of 2007, some 400 000 small farmers had joined the programme, selling mainly palm

oil, soybeans and/or castor beans to refining companies.

### **Biofuel crop development: equity and gender concerns**

Important risks associated with the development of biofuels relate to worsening income distribution and a deterioration of women’s status. The distributional impact of developing biofuel crops will depend on initial conditions and on government policies. The consensus with regard to the impact of cash crops on inequality appears to lean towards greater inequality (Maxwell and Fernando, 1989). However, evidence from the Green Revolution suggests that adoption was much less uneven than was first supposed. Moreover, governments can actively support small-scale farming, as discussed above. The impact on inequality will depend on the crop and technology employed, with a scale-neutral technology favouring equal distribution of benefits. Other important factors are: the distribution of land with secure ownership or tenancy rights; the degree of access by farmers to input and output markets and to credit; and a level playing field in terms of policies.

Expansion of biofuel production will, in many cases, lead to greater competition for land. For smallholder farmers, women farmers and/or pastoralists, who may have weak land-tenure rights, this could lead to displacement. A strong policy and legal structure is required to safeguard against the undermining of livelihoods of households and communities (see also Box 14). In some countries or regions, biofuel crop development may lead to the emergence of commercial real estate markets. At the same time, land rental values are likely to rise and poor farmers may not be in a position to secure land through buying or renting. Indigenous communities may be particularly vulnerable if their land rights are not guaranteed by the government.

Bouis and Haddad (1994) found that the introduction of sugar cane in the southern Bukidnon province of the Philippines led to a worsening of the land-tenure situation, with many households losing their access to land. The establishment of large sugar

## BOX 14

**Biofuel crops and the land issue in the United Republic of Tanzania**

While the Tanzanian Government is encouraging investors to consider the United Republic of Tanzania for ethanol and biodiesel production, it is also trying to grapple with a number of uncertainties and constraints. First and foremost are the interrelated questions of land availability and food security. Requests for land for bioenergy crops (mainly sugar cane, oil palm and jatropha) are in the order of 50–100 000 hectares at a time. Although there will be a considerable time lag before such large-scale plans are transformed into planted fields – developments currently being implemented are in the 5–25 000 hectare range – the short- to long-term implications for food security are being studied as a matter of urgency.

For many households in the United Republic of Tanzania, their food security depends on access to land. There are concerns that the amount of land being requested cannot be met without displacing households from their land. Because suitable farming land mostly belongs to villages, some argue that no free land is available. Others, however, argue that only a small percentage of cultivable land is actually being used for crop production. Large amounts of land are under the control of government institutions such as the Prisons Service and the National Service, and while village land may indeed be used by farming communities, much unused land remains available according to the Tanzania Investment Centre and the Sugar Board of Tanzania. However, investors are looking for land close to existing infrastructure and reasonably close to ports and are not interested in the vast areas that are not currently serviced by adequate infrastructure. Over the longer term, poor infrastructure, weak extension services, the near-complete lack of credit and low yields are obstacles that will continue to inhibit transformation of the country's agriculture sector.

Access to land is complex in the United Republic of Tanzania. All land is classified

as either village land or national land. The procedure for renting village land is both complicated and time-consuming as the potential investor must obtain consent at the village, district, regional and then ministry levels. Presidential consent may even be required, depending on the size of land area requested. At the end of the process, the village land is reclassified as national land with the land deed held by the Tanzania Investment Centre, which then leases the land to the investor for up to 99 years. This process, which involves the payment of compensation to farm households, can take up to two years. Leasing national land is a much shorter process. A more effective mechanism for locating appropriate land, assessing food-security implications and coordinating information flows among the various ministries, agencies and investors involved is needed in order to create the necessary investor-friendly environment while safeguarding the welfare of the affected populations.

In part, the land issue highlights the lack of a bioenergy policy and the legal framework required to support government and investor decisions. Indeed, both investors and government officials frequently state that the absence of bioenergy policy is the single most pressing problem facing the development of the sector.

---

*Sources:* based on or informed by the authors' discussions with officials at the Ministry of Agriculture, Food and Cooperatives, Ministry of Energy, Tanzania Investment Centre, Sugar Board of Tanzania, United Nations Industrial Development Organization (UNIDO), United Nations Development Programme (UNDP) and United Nations Children's Fund (UNICEF); with representatives from InfEnergy, Sun Biofuels, British Petroleum, Diligent Energy Systems, SEKAB, Deutsche Gesellschaft für Technische Zusammenarbeit GmbH (GTZ) and Tanzania Traditional Energy Development and Environment Organisation (TaTEDO); and with researchers from the Microbiology Unit at the University of Dar es Salaam.

haciendas without a net increase in demand for labour meant that income inequality also deteriorated. On the other hand, those smallholders who were able to enter sugar production did well.

FAO (2008h) suggests that female farmers may be at a distinct disadvantage *vis-à-vis* male farmers in terms of benefiting from biofuel crop development. To start with, there are often significant gender disparities with regard to access to land, water, credit and other inputs. Although women are often responsible for carrying out much of the agricultural work, in particular in sub-Saharan Africa, they typically own little of the land (UNICEF, 2007). In Cameroon, women provide three-quarters of agricultural labour but own less than 10 percent of the land; in Brazil, they own 11 percent of the land while in Peru they own slightly more than 13 percent. Unequal rights to land create an uneven playing field for men and women, making it more difficult for women and female-headed households to benefit from biofuel crop production (FAO, 2008h).

The emphasis on exploiting marginal lands for biofuel crop production may also work against female farmers. For example, in India, these marginal lands, or so-called “wastelands”, are frequently classified as common property resources and are often of crucial importance to the poor. Evidence from India shows that gathering and use of common property resources are largely women’s and children’s work – a division of labour that is also often found in West Africa (Beck and Nesmith, 2000). However, women are rarely involved in the management of these resources.

In a study by von Braun and Kennedy (1994), it was found that in “none of the case studies they analysed did women play a significant role as decision-makers and operators of the more commercialized crop, even when typical ‘women’s crops’ were promoted”. Dey (1981), in her review of rice development projects in the Gambia, also highlighted the importance of incorporating information about women’s role in agriculture when designing commercialization schemes so as to generate a better outcome in terms of equity, nutritional outcomes and even overall performance.

As has emerged from the discussion above, the development of biofuel production may bring to the forefront a series of equity- and gender-related issues, such as labour conditions on plantations, constraints faced by smallholders and the disadvantaged position of female farmers. These are critical and fundamental issues that largely derive from existing institutional and political realities in many countries and that must be addressed in parallel with the prospects for biofuel development in a specific context. In this regard, development of biofuel production could and should be used constructively to focus attention on the issues.

### Key messages of the chapter

- Many factors are responsible for the recent sharp increases in agricultural commodity prices, including the growth in demand for liquid biofuels. Biofuels will continue to exert upward pressure on commodity prices, which will have implications for food security and poverty levels in developing countries.
- At the country level, higher commodity prices will have negative consequences for net food-importing developing countries. Especially for the low-income food-deficit countries, higher import prices can severely strain their food import bills.
- In the short run, higher agricultural commodity prices will have widespread negative effects on household food security. Particularly at risk are poor urban consumers and poor net food buyers in rural areas, who tend also to be the majority of the rural poor. There is a strong need for establishing appropriate safety nets to ensure access to food by the poor and vulnerable.
- In the longer run, growing demand for biofuels and the resulting rise in agricultural commodity prices can present an opportunity for promoting agricultural growth and rural development in developing countries. They strengthen the case for focusing on agriculture as an engine of growth for poverty alleviation. This requires strong government commitment to enhancing

agricultural productivity, for which public investments are crucial. Support must focus particularly on enabling poor small producers to expand their production and gain access to markets.

- Production of biofuel feedstocks may offer income-generating opportunities for farmers in developing countries. Experience shows that cash-crop production for markets does not necessarily come at the expense of food crops and that it may contribute to improving food security.
- Promoting smallholder participation in biofuel crop production requires active government policies and support. Crucial areas are investment in public goods (infrastructure, research extension, etc.), rural finance, market information, market institutions and legal systems.
- In many cases, private investors interested in developing biofuel feedstock production in developing countries will look to the establishment of plantations to ensure security of supply. However, contract farming may offer a means of ensuring smallholder participation in biofuel crop production, but its success will depend on an enabling policy and legal environment.
- Development of biofuel feedstock production may present equity- and gender-related risks concerning issues such as labour conditions on plantations, access to land, constraints faced by smallholders and the disadvantaged position of women. Generally, these risks derive from existing institutional and political realities in the countries and call for attention irrespective of developments related to biofuels.
- Governments need to establish clear criteria for determining “productive use” requirements and legal definitions for what constitutes “idle” land. Effective application of land-tenure policies that aim to protect vulnerable communities is no less important.