

SUSTAINABLE AGRICULTURE AND  
**FOOD SECURITY**  
IN ASIA AND THE PACIFIC





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## FOREWORD



The sixty-fourth session of the Economic and Social Commission for Asia and the Pacific took place at a time when rocketing prices of both food and oil were causing serious hardship. In response, the Commission decided that the theme topic for the sixty-fifth session in 2009 should be on food security and sustainable agriculture. Since then, the picture has been transformed. The global economy has sunk into recession – and prices for food, oil and other commodities have fallen back sharply.

From this, you might conclude that the food emergency has passed – that we should concentrate only on the financial and economic crises. In fact, however, the economic crisis makes it even more urgent that we tackle food insecurity now. For millions of people across the Asia-Pacific region, the economic crisis will also be a food crisis. The prices they pay may have fallen, but their incomes have fallen further still.

As governments face up to the current economic storms, they must ensure that everyone, everywhere, has enough to eat. This is a clear humanitarian and development priority, but it is also a political imperative; food insecure people make angry citizens. The first priority, therefore, is to check the resilience of social safety nets – and, if necessary, bolster them to meet the immediate crisis. But the region also needs to look to the future. As this study emphasizes, the world's food system has become increasingly fragile. Food prices have dipped, but they will surely surge again when the global economy and the demand for food starts to recover.

On present trends, the region will be hard pressed to meet that demand. Food security is being threatened from many directions, not least from unsustainable forms of agriculture that are degrading the soil, water and biological diversity – problems that will be exacerbated by climate change.

Time to turn again, therefore, to sustainable agriculture – ensuring that farmers, and particularly small producers, have the support they need to grow nutritious food in ways that meet human needs today, while protecting vital environmental resources for future generations. Time also to capitalize on our efforts in regional cooperation – ensuring that we avoid food protectionism and, instead, use our regional strengths to build flexible and resilient systems of food security.

A handwritten signature in black ink, appearing to read 'Noeleen Heyzer'.

Noeleen Heyzer  
Under-Secretary-General of the United Nations  
Executive Secretary of ESCAP

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# ABBREVIATIONS

AIDS	Acquired immune deficiency syndrome
ASEAN	Association of Southeast Asian Nations
COMTRADE	United Nations Commodity Trade Statistics Database
ERS	Economic Research Service
ESCAP	Economic and Social Commission for Asia and the Pacific
FAO	Food and Agriculture Organization of the United Nations
GDP	gross domestic product
GHI	global hunger index
GM	genetically modified
HIV	human immunodeficiency virus
ICT	information and communications technology
IMF	International Monetary Fund
IPR	intellectual property rights
MASIPAG	Magsasaka at Siyentipiko para sa Pag-unlad ng Agrikultura (Farmer-Scientist Partnership for Development, Incorporated)
MDG	Millennium Development Goal
MFN	most favoured nation
NCHS	National Centre for Health Statistics
NGO	non-governmental organization
OECD	Organisation for Economic Co-operation and Development
PPP	purchasing power parity
UNICEF	United Nations Children's Fund
SAARC	South Asian Association for Regional Cooperation
SEWA	Self-Employed Women's Association
SITC	Standard International Trade Classification
USDA	United States Department of Agriculture
TRAINS	Trade Analysis and Information System
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
VAT	value added tax
WFP	World Food Programme
WHO	World Health Organization
WITS	World Integrated Trade Solution
WTO	World Trade Organization

*Photo: Marie Ange Sylvain-Holmgren*





## OVERVIEW

**It seems surprising that a region that has in many ways been so successful should still have serious problems with something as basic as food. This is partly because most governments have been neglecting agriculture, but also because many people cannot afford the food they need for an active and healthy life.**

### Hunger hotspots in Asia and the Pacific

In Asia and the Pacific, people who are food insecure are largely hidden. Occasionally, food shortages will hit the national headlines. But outside immediate emergencies, food has a much lower public profile. This is largely because achieving 'food security' means not just ensuring that sufficient food is produced, but also that everyone has access to it – and failures of access to food, particularly for the most marginal communities, are largely hidden from the public view.

### *Monitoring progress*

The simplest way of monitoring food security is to look at outcomes – to count how many people are hungry. For this, there are two principal measures. The first addresses consumption, typically by estimating the proportion of the population whose food intake falls below the minimum dietary energy requirement of 1,800 calories per day (the minimum standard often used by FAO). On this basis, in 2005–2006, on average some 16 per cent of the region's population, 542 million people, were going hungry – and in 2007, as a result of sudden price rises, that number is thought to have increased to 582 million. The greatest problems are in South and South-West Asia where 21 per cent of the population are undernourished. The country with

the most acute problems is Afghanistan – where the proportion is more than one third. But, levels of undernourishment are also high – between 20 and 34 per cent – in a number of other countries, including (in descending order of the proportion undernourished) Tajikistan, the Democratic People's Republic of Korea, Mongolia, Bangladesh, Cambodia, Pakistan, Armenia, Sri Lanka, India and the Solomon Islands.

### *Children underweight*

The second principal way of monitoring food security is by weighing a sample of children to arrive at the proportion who are underweight for their age. Again, the problems are most severe in South and South-West Asia where on average 42 per cent of children are underweight – with the highest figures in Bangladesh, at 47 per cent, and India, at 46 per cent. However, even in South-East Asia, the majority of countries in the subregion have more than one quarter of their children undernourished. For children, the consequences are potentially fatal because poorly nourished children have low resistance to infection and disease. Across Asia and the Pacific, around 3.8 million children die each year before reaching the age of five, and around half these deaths, over 1.9 million, are from causes related to malnutrition, poor hygiene and lack of access to safe water and adequate sanitation. This is the equivalent of 10 jumbo jets, full of children, crashing every day and killing all on board.

### *The global hunger index*

Another way of tracking food insecurity is through the 'global hunger index', which is based on a simple average of three indicators: the percentage of the population undernourished; the percentage of under-five children underweight; and the under-five mortality rate. Of the Asia-Pacific countries listed in this index, Afghanistan again has the worst score, over 40 per cent, as a consequence of high levels on all three indicators, with Tajikistan second at 26 per cent, with a high score primarily on undernourishment.

These indicators help build up a picture of malnutrition across the region by country. However, since most food insecure people are usually found in specific provinces or states, it is usually better to consider data at the sub-national level. In Indonesia, for example, rates of child undernutrition range across provinces from 15 to 42 per cent; in India across states they range from 36 to 60 per cent. In addition to mapping in-country food insecurity by region or state, it is also possible to identify food-insecure subgroups. One is rural children – who are twice as likely to be undernourished as those living in urban areas. Another is women: in some countries there is a persistent gender bias, as a result of maldistribution within households, which causes women to be at greater risk of undernourishment than men. Other vulnerable groups include migrant workers, tribal peoples as well as people living with HIV and AIDS.

Households that come under pressure, as a result of rising prices or falling food supplies, have a range of coping responses. Typically, they react first by eating less food, or cheaper food. But, if high prices persist, the poorest households will be driven to borrowing money or selling some of their assets. Just as poverty makes people food insecure, so food insecurity increases the risk of falling into poverty.

### **The roots of food insecurity and price shocks**

Although the principal cause of food insecurity is poverty, there are also many other contributing factors, linked to the balance of supply and demand. This study traces the Asia-Pacific experience starting with food production.

Since the mid-1960s, Asia and the Pacific has benefited from a remarkable boost in agricultural output as a result of the Green Revolution, using new varieties of rice and wheat, along with the application of fertilizer and irrigation. The result was a striking increase in cereal yields.

To some extent, especially in its initial stages, the Green Revolution benefited the rural poor. This was partly because the new technology could also be used on small farms, and because the new farming systems, which often involved double or triple cropping, proved to be quite labour intensive – thus generating more work for the landless. Nevertheless, the Green Revolution displaced many smaller farmers, particularly women, as production was consolidated into larger and more integrated farming systems.

#### *Increasing demand*

While the supply of food was increasing in Asia and the Pacific, so was the demand. This was not just because rising populations resulted in more mouths to feed, but also because higher incomes enabled consumers to buy more and better food. The poorest people typically have to buy the cheapest available carbohydrates. But, with more money, they can buy more fruits and vegetables, along with meat, dairy goods, and eggs. As a result, much of the region has been changing from a traditional diet based on carbohydrates and vegetables to one richer in fat and protein.

#### *Security through trade*

While some countries grow most of the food that they need, most rely to some extent on international trade. In the Asia-Pacific region, 25 countries are net food importers. Some of these have, at times, aimed for national food self-

sufficiency. However, a more realistic objective is ‘food self-reliance’ – which means being able to earn sufficient foreign exchange from other exports, such as manufactured goods, so as to be able to import food. Countries following this strategy will, however, need to be concerned about the terms of trade. As food prices rise, food self-reliant countries will need to export more manufactured and other goods to be able to import sufficient food.

### *Food policies of the developed countries*

The international trade in food is also profoundly affected by the policies of the developed countries which have generally protected and subsidized their local farmers – encouraging over-production. This may have supported local agriculture, but it harmed farmers around the world when the flood of subsidized crops into international markets resulted in surges of imports into developing countries. The consequences can be severe. Fiji, for example, in 1986 was 75 per cent self-sufficient in rice but, due to deregulation and the influx of cheaper imports, that proportion is now down to 15 per cent.

### *Market-based food insecurity*

Even when food is available, from local production or imports, people may not have physical access to the food. People may not have economic access to food – they may not have the cash to buy food. For large numbers of people, the primary source of food security is their income – either from producing non-food goods or from selling their labour. Under these circumstances, much depends on the national terms of trade – on the balance between the prices of food and those of other goods. The problem of food insecurity, like that of poverty, is thus frequently traceable to macroeconomic conditions and market failures. Farming communities and others can also suffer from food insecurity because of the actions of exploitative intermediaries, including landowners, moneylenders and traders. One of the most severe problems is the shortage of affordable credit. In some cases, farmers can pay interest rates of 25 per cent per 100 days. Desperate for cash, small

and marginal farmers, for example, are forced to sell their crops immediately after the harvest to middlemen or their creditors, only to have to repurchase some of this food later, at a higher price.

### *Food absorption and utilization*

Even when food is available in the household, some family members may not be able to take advantage of it – hampered by inadequate water supplies and poor standards of sanitation which reduce the quality of their food or make it hazardous. Without reliable water supplies or basic sanitation, children especially are constantly exposed to infections and diseases that not only threaten their lives directly, but also prevent their absorption of many essential nutrients. Both children and adults need safe food. For babies, this is best assured by exclusive breast feeding for the first six months of their lives. Older children and adults also have to be concerned about the ever-present dangers of food contamination – which can arise, for example, through the use of chemical products in food production, as well as from failures in the ways in which food is transported, stored and served.

### *The 2008 food price crisis*

The downward trend in food prices of the 1980s and 1990s reversed in the early 2000s, after world stocks of wheat, maize and rice dropped to 30-year lows. The drop in stocks, which resulted from production lagging significantly behind consumption, caused food prices to rise sharply. The price increase accelerated from 9 per cent in 2006 to 23 per cent in 2007 and 51 per cent between January-June 2007 and January-June 2008.

### *The impact of high oil prices*

Another major factor in the food price rises was the steep hikes in oil prices. Food prices are increasingly linked with those for oil and gas, partly because natural gas is the principal input for fertilizers. But agriculture itself has also consumed more fuel, as it has become more

energy intensive. In addition, some land has been taken for the production of biofuels.

### *Decelerating productivity*

While the demand for grain has been rising, productivity has failed to keep pace. This is largely the consequence of a neglect of investment in agriculture. Moreover, when prices were low, farmers had few incentives to step up production. Extreme climatic events also played their part in disrupting agriculture and food output. One of the main contributing factors to the 2007-2009 increases, for example, was six years of drought in Australia.

### *Speculation*

While speculation is not a driver of commodity prices, it can nevertheless accelerate and amplify price movements driven by fundamental supply and demand factors. Given how steeply food prices increased and how fast they fell in 2008, it is likely that the growing presence of financial investors in commodity markets made prices over-react to new market information and deviate from fundamentals.

### *Respite*

With the onset of a global recession, prices started to fall again and, by early 2009, were back in real terms at around 2006 levels. This is a temporary respite. Once the industrial economies recover from the recession, both oil and food prices will start to rise again – partly because of resurgent demand, but also because the world faces threats to sustainable agriculture.

## **Threats to sustainable agriculture**

In future, farmers will find things steadily more difficult – faced with environmental degradation, climate change, and a series of other threats. Unless they can produce food not just efficiently, but also in ways that respect the environment, the food security outlook will be bleak. Sustainable agriculture integrates the goals of environmental

health, economic profitability, and social and economic equity. The overriding principle is to meet current food needs without compromising the rights of future generations.

### *Expanding deserts*

One of the most critical threats to sustainable agriculture is land degradation. Vast areas of cropland, grassland, woodland and forest in Asia and the Pacific have already been lost, and many more are threatened. In many countries, including China, the implications of land degradation are grave as deserts expand across the territory. Over the next 50 years, crop output in north-eastern China could fall by as much as 40 per cent.

Much of the land degradation results from over-intensive cultivation. In order to meet their basic food needs, smallholders and the rural poor have been pushed into using ecologically fragile areas, forced to crop intensively on steep slopes that are vulnerable to erosion. Land degradation has also resulted from excessive use of mineral fertilizers and over-intensive livestock-keeping.

### *Shrinking forests*

Forests provide critical ecosystem services to the agricultural sector, including pollination and watershed protection, and support to fisheries. Millions of poor people and small-scale enterprises across the region depend on forests for food, fibre, fodder and other materials, but are finding this increasingly hard as the natural forests shrink. Some of the deforestation is a consequence of high prices for other fuels, driving the poorest people to take more wood from forests. But, in many cases, trees are falling as a result of a rapacious timber industry. At particular risk are mangrove forests. The Asia-Pacific region has around half the world's total area of mangroves. These are under severe strain as a result of the extraction of timber and coastal development, including for the production of environmentally damaging, export-oriented cultivation of shrimps.

### *Competing for water*

The region's main staple food, rice, requires two or three times more water for cultivation than other cereals. As a result, across Asia and the Pacific, agriculture is still the principal user of water, accounting for around 70 per cent of total withdrawals. Producing each calorie of food requires approximately one litre of water. On that basis, to provide each consumer with 1,800 calories per day, Asia and the Pacific would by 2050 need an additional 2.4 billion cubic metres of water per day.

Some of this overuse reflects government policy. Many governments have subsidized the construction of inefficient irrigation systems, along with fuel and electricity supplies. This has weakened price signals, tempting farmers to withdraw too much water from rivers, over-pump groundwater and generally waste freshwater resources. In addition, intensive agriculture and industrial effluents are creating high levels of pollution.

All water users – domestic, industrial and agricultural – have together been withdrawing more water than the renewable capacity of the natural hydrological cycle. Many countries are already facing water stress, and heightened competition for this precious resource is leading to water conflicts, which are emerging as new threats to social stability.

### *Displaced by biofuels*

Food also has to compete with biofuels for land. Some countries have been subsidizing the production of biofuels as a way of bolstering fuel security. Biofuels have, however, become increasingly controversial. Many people are concerned about their environmental impact, pointing out that their production will increase carbon dioxide emissions. Expanding the area devoted to biofuels could also accelerate the switch to industrial agriculture, at the expense of small farmers growing food crops, or of people living from forests. There are also major worries about food security. If crops are grown for biofuels, they

displace those that could have been used for food, causing shortages and driving up food prices.

In Asia and the Pacific, biofuels may not yet have had a large impact on domestic food markets – especially since the major staple is rice whose production has not been affected. But this situation could change, particularly if countries like China produce more corn for biofuels.

### *Genetically modified crops*

Critics argue that genetically modified (GM) crops threaten human health and the environment and will allow large corporations to tighten their grip over agricultural production and thus widen socio-economic disparities. Currently, GM crops are used to a fairly limited extent, so it is difficult to assess their impact. At present, most GM crops are grown as high-priced animal feedstock to supply rich nations with meat, rather than to meet the immediate food security needs of local households. The benefits of GM crops are far from certain. There is, for example, little consistent evidence of higher yields. Moreover, little is known about the risks, since there has been relatively little biosafety research on their health, environmental and socio-economic effects.

### *Climate change*

Food security is also being threatened by climate change which will have many complex effects – bringing advantages in some places, but disadvantages in others. Higher concentrations of atmospheric carbon dioxide could, for example, increase photosynthesis in several crops, such as wheat and rice, thereby boosting yields. However, this potential gain could easily be outstripped by the effects of higher temperatures and more variable rainfall. In addition, there are likely to be more extreme weather conditions: more intense and frequent floods, droughts and storms will create significant uncertainties for agricultural production. One major impact will arise from the melting of the Himalayan glaciers.

## **Governments step in**

Surges in food prices in recent years have shaken many countries, propelling governments to take immediate action – from blocking food exports to introducing special measures for social protection. Some of these responses have been counterproductive, but others show greater promise for strengthening food security, both in the short and longer terms.

### *Agriculture that lasts*

The main priorities in food-producing countries should be to promote sustainable agriculture – so as to optimize food production, boost the incomes of farmers and maintain vibrant rural economies. This would constitute a shift in emphasis. In the past, many countries have been less concerned about sustainability – placing greater reliance on new technology. But they did not achieve food security for all, since many of the benefits were reaped by the richer farmers, and long-term sustainability was threatened by the overuse of fertilizers and other inputs.

In practice, the barriers facing agriculture are not just technical, but also social and political. Many countries still face severe structural constraints, such as inequitable or inefficient land ownership. Agriculture, like many other forms of development, is further constrained by low levels of human capacity. Farmers often lack the education, training or the necessary health standards to make the best use of available resources and have found it more difficult to get extension services. While some farmers now have cell phone access to market prices, many still neither have access to such information nor to markets. They have also been held back by government policy, which until recently at least, has tended to tax agriculture at the expense of urban consumers.

### *Trade policies*

National food availability is also strongly affected by government policy on trade. Indeed, when global food prices start to skyrocket, one of the first responses from exporting countries may be

to restrict exports or impose quotas or export taxes. This may help domestic consumers, but it will harm domestic producers and may encourage smuggling. It will also hurt consumers in importing countries. The overall effect of trade restrictions is thus to undermine national, regional and global food security.

Trade measures can also be taken by food-importing countries. When world food prices have been low, some countries have aimed for food self-sufficiency by combining efforts to boost local production with restrictions on cereal imports. On the other hand, when international prices are high, the importing countries will want to reduce tariffs; however, since these are already low, this is unlikely to make much difference to retail prices.

### *Fiscal policy*

In addition to adjusting trade policies, governments have influenced prices through fiscal measures. One option is to reduce domestic taxes, such as value added tax, on basic food commodities. Many countries have also introduced price controls and consumer subsidies. While benefiting consumers these measures do, however, reduce government revenue and increase government expenditure.

### *Stocks and reserves*

Most governments in Asia and the Pacific hold national stocks of rice or other staple foods. These can serve as buffers at times of volatile prices, since purchases from farmers to build the stocks can ensure that they receive minimum prices. At times of shortage, this food can then be released to consumers. However, building and managing national food stocks can be complex and expensive.

### *Food transfers*

Food from reserves and elsewhere can be released into national food markets. Typically, this has been through ‘food-for-work’ programmes, such as building roads, which are ‘self targeting’ on

the assumption that only the poorest would be prepared to do this work for the type of food on offer. Other types of conditional programmes include ‘food-for-education’ – whereby food may be distributed through schools to encourage attendance.

Food aid has helped achieve many humanitarian and development goals, but it has also been criticized for damaging local markets, fostering dependency, and for being susceptible to corruption.

### *Cash transfers*

An alternative form of support to food-insecure communities is to offer lump sum payments to vulnerable groups. These too are usually conditional – such as the Primary Education Scholarship Programme in Bangladesh and the Rural Employment Guarantee Scheme in India. Many programmes target women on the grounds that, compared with men, they are more likely to allocate incremental food or cash to their families, especially their children. But the conditions applied also represent extra demands on over-worked mothers.

### *Insurance systems*

A further way to offer greater security to farmers is through insurance mechanisms. One of the most promising options is weather insurance based on a local index, say, of rainfall shortage or days of hailstorm or snow or frost.

### *Activist administrations*

The looming threats to food production will require Governments in Asia and the Pacific to take active measures to protect their poorest people.

## **Resilient communities**

Communities that are food insecure face different kinds of shocks. To protect themselves, they have established many systems of mutual support, through cooperatives, for example, or microcredit schemes to deal with financial risks. They can also take measures to improve food security through more resilient forms of agriculture.

### *Everything together*

Farmers who rely on one or two crops can be at considerable risk if these fail, or market prices fall. In response, many farmers have evolved complex integrated farming systems. In Kazakhstan, for example, some farmers have developed a form of two-track agriculture combining livestock and food production that tides them over during the severe winter months. In China, farmers have developed integrated agriculture centred on fish ponds, combined with cultivating silkworms, along with raising chickens, ducks and other animals – a system that uses almost all waste as nutrient resources. Farmers in Japan have similarly made use of complex ecosystems, for example, by rearing ducks in rice fields.

### *Building banks*

Farmers can provide a degree of security for themselves by using common resources, such as grain or seed banks. This type of mutual support is promoted, for example, by the Self-employed Women’s Association, a trade union based in Gujarat in India, which has used banks for grain, seeds, fodder and tools to help build food security. In some cases, grain banks have been combined with other activities to build the equivalent of public distribution systems.

### *Sharing water*

Asia has many community-based water delivery systems, which serve one third or more of the total irrigated area. Generally, these have been developed in mountainous or hilly territory, based on the diversion of small and medium streams, especially in the Himalayan regions, China, the Lao People’s Democratic Republic, Japan, the

Philippines and Thailand. In the Ilocos provinces of the northern Philippines, for example, irrigation systems are run by small societies which have run successfully for centuries. In Indonesia, rice farmers in Bali have irrigation systems coordinated through temples and that use common planting cycles based on a ritual calendar.

### *Common property resources*

The poorest households often rely for food security on common resources – lands, forests, wildlife, fisheries and waterways – which they use as primary or secondary sources of food and fodder. As well as offering extra quantities of food, these can also add to the nutritional quality of their diets.

### *Food storage and protection*

One of the best ways of boosting food security is to reduce the amount of food that is lost during storage and transmission. Poor communities in rural areas, however, lacking in modern methods of storage, have had to devise some of their own. In the Himalayan regions of India, for example, food grains like maize, wheat and rice are stored in special bamboo containers that inhibit the entry of insects and larvae. For protecting crops, people also use indigenous materials, such as leaves from the neem tree.

Community-based responses generally rely on informal but well-informed contracts of mutual support. But they may exclude certain groups – women, for example, religious and ethnic minorities, persons with disabilities, and those at the bottom of the pyramid. They are also hampered by limited resources, both human and financial, and so cannot usually address covariate risks – particularly in the wake of disasters. In these circumstances, they work best in combination with official safety nets.

## **An agenda for food security**

Food security depends on interlinked short-, medium- and long-term measures.

### **Short-term measure: improving access to food**

For large numbers of people in Asia-Pacific, food security depends as much on income as on food availability. People who have sufficient money will always have enough economic access to food. Government action to promote the long-term availability of food on a sustainable basis must be complemented by measures to ensure economic and social, and physical access to food, especially with regard to the poor and vulnerable communities of the Asia-Pacific region.

### *Economic and social access*

Certain groups must have the protection of the State for food security on an equitable basis. Thus, it will be important to identify groups in need of special attention (such as small and marginal farmers, women and children in poor households, people living with HIV and AIDS, ethnic minorities, older persons, people who have been internally displaced and people with disabilities) and to provide special schemes for their food security.

### *Social protection against shocks*

Whole communities may experience food insecurity associated with ‘covariate’ shocks. In many cases, people face food insecurity because of ‘idiosyncratic’ shocks of various kinds that force them to sell their only productive assets. To prevent downward spiralling due to such shocks, governments need to consider strengthening systems of social protection. These will include new forms of insurance, as well as more traditional forms of transfer, such as food- or cash-for-work. Women and girl children face multiple food insecurities, resulting from the multiple inequalities that they face. Governments need to eliminate gender-based food insecurities through social, economic and legislative measures.



*Social protection for food production* – The most effective strategy for ensuring that the poorest people have food supplies in hand is to aim for sustainable increases of agricultural productivity on their land holdings. A key component of such a strategy is sustainable home (or kitchen) gardening of indigenous food plants, in which women play a central role, integrated with health and nutrition education. This strategy will reduce long-term dependence on budgetary resources and emergency actions. Other schemes targeting smallholders and the rural poor and that ensure minimum levels of income from agricultural activities can significantly boost smallholder food production. This would include a combination of *insurance* schemes, such as for micro-insurance, weather index insurance and community-based health insurance. It would also include robust *common property resource management systems* with joint stakeholder responsibility for management, and enactment and enforcement of legislation recognizing and protecting people’s usufructuary rights to these resources; *productivity-related schemes*, such as government-supported micro-credit and community banks of agricultural inputs, working capital, facilities, services, tools and draught animals; and *strengthening the governance, accountability and administration of social protection schemes*.

#### ***Physical access: transport and logistics***

Governments also need to be concerned about the way food is transported, stored, marketed and distributed. For perishable foods, it will be important to define and implement operational standards for packaging, handling, storage and transport, bearing in mind the need to incorporate high-efficiency technologies. To enhance access to food, current logistics, storage and marketing institutions and practices need to be streamlined, with improvements in the corresponding infrastructure and services. Especially important in areas prone to disasters are improvements to transport and logistics infrastructure and decentralized food storage facilities for emergency food distribution.

#### ***Improving choice and utilization of food***

Measures are needed to enable people to make informed choices about the food that is available to them and to have access to health-promoting food and nutrition education. Measures are also needed to ensure the physical capacity to absorb and utilize the nutritious value of food that is consumed. For this, public health measures for health promotion and environmental hygiene will significantly reduce vulnerability to water-borne and other diseases that prevent food absorption.

#### **Medium-term measure: sustainable agriculture**

The Governments of the region stand at a crossroads: business as usual, continuing with short-term profits for the few through chemically cultivated, irrigation- and energy-intensive monoculture, with the burden of long-term costs shouldered by the many; or, a new, long-term commitment to ecologically balanced, socially just and economically equitable agriculture to ensure food security for all.

*Revitalizing small-scale sustainable food production* – Long-term food security in the Asia-Pacific region requires active State support for the participation of small farmers in a new green food revolution that gives high priority to revitalizing small-scale food production based on ecologically viable systems. A shift to such systems will provide the poor with *in situ* sources of food security and livelihood. Future agricultural development will need to focus more on conservation farming, ensuring that the soils retain vital nutrients and that farmers and others protect biodiversity. A significant part of smallholder food production should increasingly be biodiverse, as insurance against various kinds of shocks to which agriculture is perpetually vulnerable, and based on integrated agro-ecosystems for greater resilience and productivity. Phasing out of agro-chemicals and inorganic fertilizer, complemented by cash incentives for biofertilizers as part of targeted government policy towards rejuvenating and converting national cultivable land for sustainable food production. Smallholder farming should increasingly be based on multiple, multilayer and mixed cropping

for providing insurance against various kinds of shocks to which agriculture is perpetually vulnerable.

*Rain-fed agriculture* – While it will be necessary to develop sustainable irrigation systems, it will be even more important to reap greater benefits from rain-fed agriculture.

*Better water management* – Farmers will need to make smarter use of both soil moisture storage (green water) and irrigation. But governments will also need to give greater attention to watershed and river basin development and management. Governments shall need to achieve more optimal and equitable use of water resources. Governments may also consider offering incentives for upstream watershed management and by providing tax breaks to encourage water storage and harvesting. Furthermore, governments could consider introducing a differential, incremental pricing mechanism for higher per capita/per hectare levels of consumption of surface or ground water in excess of a minimum allotment for irrigation of food crops, especially those grown by small and marginal farmers.

*Village knowledge and technology centres* – To strengthen sustainable agriculture for food security, governments can help establish ICT-networked knowledge centres, including at the village level. With good external ICT connections, preferably through the internet, community radio or cell phones, these can disseminate timely knowledge on experiences and options concerning seed and plant varieties, soil conservation and rejuvenation techniques, improvements in technology, attendant long- and short-term risks, costs and benefits, levels of regulation, as well as market trends and price fluctuations.

### **Long-term measure: adaptation to climate change**

Climate change holds the potential to radically alter agro-eco systems in the coming decades. Adaptation to climate change should include strengthening regional and national mechanisms for scientific assessment, forecasting and

information sharing, while building national and local capacities for greater ecological literacy, monitoring agro-eco systems and for assessing and managing risks. The concept of building the resilience of communities to tackle the impact of climate change in the context of changes in socio-economic and environmental conditions has to be rapidly developed and widely promoted. Measures include rehabilitating degraded grasslands, as well as improving crop and grazing land use and management.

### **Trans-boundary and other support measures**

#### *Harnessing trade*

For food, most countries in the region rely, to some extent, on trade. It is generally vital to avoid raising trade barriers. Furthermore, the promotion of food security with economic, social and ecological sustainability requires the removal of trade-distorting barriers. Food trade can be promoted through regional cooperation on harmonizing sanitary and phytosanitary certification, and simplifying and increasing the transparency of administrative procedures and documents. There is also scope for increasing the trade in perishable food products.

#### *Strengthening regional cooperation*

*Map food insecurity hotspots in Asia-Pacific* – There is scope for regional cooperation to help build national systems and technical capacity for identifying food insecurity hotspots and food insecure groups, as well as tracking, collecting, analysing and disseminating statistics at national and local levels.

*Establish an Asia-Pacific food security coalition* – The coalition could track progress in improving food security and suggest appropriate pre-emptive and remedial action. It could also incorporate an Asia-Pacific early warning and response system for rapid sharing of information, technology and mitigation expertise.

*Build a knowledge hub* – ESCAP, together with other regional development agencies, could

work closely with FAO in forming a regional information and knowledge hub on food, to support an Asia-Pacific food security coalition which could, *inter alia*, include hosting a regional database on food security. Special information modules on the logic of chemical and organic agriculture could be developed and made widely accessible via the internet for communities to exercise their right to make informed choices.

*Establish a network of IT providers* - Countries that have abundant software capabilities and those with extensive hardware capabilities, could help other countries in the region introduce e-governance in the development of sustainable agriculture and food production.

*Networking ESCAP regional institutions to support Asia-Pacific food security* - Under the auspices of ESCAP, the five regional institutions could, in their respective areas, support sustainable agriculture and food security through strengthening South-South cooperation, including on indigenous agricultural knowledge and practices, science, technology transfer, innovation and capacity building.

*Role of CAPSA* - A strengthened CAPSA has a key role in improving the food security and livelihood of communities in fragile eco-regions. There is a historic opportunity for CAPSA to change the decades-old perception of “secondary” crops to twenty-first century understanding that, for very poor communities, these are “primary” crops. CAPSA may thereby take forward the agenda for food security in Asia-Pacific by opening up a new research and policy action paradigm on sustainable agriculture in food insecure eco-regions, focusing on enabling communities to get out of poverty.

*Role of UNAPCAEM* - UNAPCAEM could pursue, along with FAO, the ESCAP secretariat and other concerned stakeholders, three broad areas as part of ESCAP’s connectivity role: bridge knowledge sharing in the Asia-Pacific region; contribute to secretariat services for an Asia-

Pacific food security coalition; initiate linkages among the five regional institutions for revitalizing small-scale sustainable food production for Asia-Pacific food security.

### **A window of opportunity**

The food price crisis of 2008 was a shock to the global food system. The prices may subsequently have subsided, but the underlying problems persist. Governments of the region should regard that crisis as a warning of things to come, and seize this window of opportunity to establish a robust system of equitable, pro-poor, green food security based on sound principles of sustainable agriculture.

*Photo: Marie Ange Sylvaïn-Holmgren*



## HUNGER HOTSPOTS IN ASIA AND THE PACIFIC

**Despite remarkable success in reducing poverty, the Asia-Pacific region still suffers from high levels of food insecurity. Millions of people are food insecure and children are dying every day from malnutrition. This chapter assesses the extent and impact of food insecurity across the region, identifying hotspots and vulnerable groups.**

Asia and the Pacific is one of the world's most dynamic regions – indeed for the past two decades or so, it has been one of the principal engines of the global economy, and through trade surpluses has accumulated more than \$4 trillion in financial reserves. Across the region, rapid economic growth has contributed steadily to improving levels of human development and, in most countries, children have been growing up taller than their parents and better educated. Between 1990 and 2004, more than 350 million people escaped from poverty.<sup>1</sup>

It seems surprising that a region that has in many ways been so successful should still have serious problems with something as basic as food. Across Asia and the Pacific, millions of people are still food insecure and children are dying every minute of every day from causes related to malnutrition. India alone has more food insecure people – 231 million – than the whole of sub-Saharan Africa.<sup>2</sup> But, in Asia and the Pacific, food insecure people are rarely visible. They neither feature on the world's television screens amid shocking images of famine, nor are they crowded into refugee camps. They usually live far from centres of power and simply struggle on their own to feed their families. Many are scattered in isolated rural communities, though others may go hungry, even living alongside the condominiums of the region's rich and powerful.

Occasionally, food shortages will hit the national headlines. Public discontent at high prices may even erupt into 'food riots', especially when sudden price hikes hit the pockets of urban consumers – scenes played out most recently in 2007 and 2008 when global food prices suddenly soared to previously unimagined levels. But, outside such emergencies, food has a much lower public profile. This is largely because what is termed 'food security' is a complex multi-faceted issue, concerning not just agriculture, technology and trade, but is also overlaid with multiple political and social considerations.

Nevertheless, the key food security question is simple. Can people in Asia and the Pacific reliably get the nutrition they need to live healthy and productive lives? This study responds to that question by addressing the multiple dimensions of food security, while maintaining that the objective is not to achieve an abstract or theoretical aggregate level of regional food availability, but to ensure that everyone, no matter where each lives, can rely on having enough to eat.

### **What is food security?**

Over time, the world has taken a steadily more comprehensive view of food and nutrition. From the 1960s onwards, most of the emphasis was on food supply, and the 1974 World Food

Conference, held at a time of an earlier global food crisis, aimed to make food available at stable prices in both national and international markets. Many developing countries then seemed to achieve this objective through the Green Revolution – using improved seeds, fertilizers and irrigation to grow much more food. Even so, towards the late 1970s and early 1980s, this boost in production did not appear to be benefiting everyone – and it was certainly not eliminating hunger and malnutrition.

The most powerful critique of the supply-driven approach came from Amartya Sen, who stressed that the output of food per se was not sufficient, that people needed access to that food – to gain their ‘entitlement’. Amartya Sen pointed out that people could be food insecure even when there was no general food shortage. Bangladesh, for example, suffered a famine in 1974, even though that was a year of peak food production. The problem was that, although there was plenty of food available, millions of people, particularly agricultural labourers who had lost wages because

of severe flooding, could not afford to buy food and so suddenly faced starvation.<sup>3</sup>

As a result of these and other analyses, the concept of food security was widened to: “ensuring that all people at all times have both physical and economic access to the basic food that they need” – a change in emphasis from availability to access.<sup>4</sup> Later, the concept was broadened further to take into account such factors as the nutritional value of food and people’s social and cultural preferences.

This more comprehensive concept was encapsulated in the definition of food security presented at the World Food Summit in 1996: “Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life.” This indicates that food security has four key elements: availability, access, utilization and stability (Box I-1).

#### Box I-1 – Elements of food security

FAO identifies four main elements of food security:

- *Food availability* – The availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports, including food aid.
- *Food access* – Access by individuals to adequate resources – entitlements -- for acquiring appropriate foods for a nutritious diet. Entitlements are defined as the set of all commodity bundles over which a person can establish command, given the legal, political, economic and social arrangements of the community in which s/he lives, including traditional rights such as access to common resources.
- *Utilization* – Utilization of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met.
- *Stability* – To be food secure, a population, household or individual must have access to adequate food at all times. They should not risk losing access as a consequence of sudden shocks, such as economic or climatic crises, or cyclical events such as agricultural seasons. Stability is thus needed in both availability and access.

## Monitoring progress

This broader concept of food security is much more relevant to everyday needs and particularly those of the poorest people. It is, however, more difficult to assess than a narrower concept based only on food availability. In practice, the best way of monitoring food security is to look at outcomes – to count how many people are going hungry. For this there are two principal measures, which are also used as the food targets for the first Millennium Development Goal (Box I-2).

The picture for children underweight is in many ways more troubling. Although it is not possible to produce aggregate data for the region as a whole, in many countries more than one quarter of children under five are malnourished. More than half the world's underweight children, around 79.5 million, live in South and South-West Asia alone.<sup>6</sup>

It should be emphasized, however, that this is an incomplete picture. The statistical information is often weak, especially for highly food insecure areas. In the case of underweight children, for

### Box I-2 – The MDG nutrition indicators

The Millennium Development Goals use two indicators for nutrition:

- Proportion of population undernourished – The proportion of the population consuming less than the minimum level of dietary energy requirement. FAO estimates this for each country using three key parameters: the minimum number of calories required for an average person, the average amount of food available per person for human consumption, and the level of inequality in access to that food, based on income.
- Prevalence of underweight children – The proportion of children aged 0-59 months who fall below the median weight for age of the NCHS/WHO standard reference population by more than three standard deviations. In a normally distributed population, only 0.13 per cent of children would be expected to fall below this standard.

The first measure addresses consumption, typically by assessing the proportion of the population whose food intake falls below the minimum dietary energy requirement. The second involves physical 'anthropometric' measurements to assess the nutritional status of children under five, to arrive at the proportion who are underweight – who weigh less than they should do for their age.

On either of these measures, the Asia-Pacific region presents a disturbing picture. The most comprehensive data on undernourishment are available only up to 2005-2006, and thus prior to the most recent food crisis, but even these showed 16 per cent of the region's total population, 542 million people, were consuming less than the dietary minimum.<sup>5</sup>

example, data are missing for all Pacific island States, except Fiji and the Federated States of Micronesia. Furthermore, FAO's core database, FAOSTAT, covering cereals, oils and meats available for human consumption, has complete data only up to 2005.

However it is measured, poor nutrition is a serious problem for adults, undermining their health and reducing their capacity to live and work to their full potential. For children, the consequences are even more serious and potentially fatal. This is because poorly nourished children are far more susceptible to the many health dangers that assault them in the first few years of life – and have less resistance to infection and disease. Across Asia and the Pacific, around 3.8 million children die each year before reaching the age of five,<sup>7</sup> and around half these deaths, over 1.9

million, are from causes related to malnutrition, poor hygiene and lack of access to safe water and adequate sanitation.<sup>8</sup> This is the equivalent of 10 jumbo jets, full of children, crashing every day and killing all on board.

### The extent of undernourishment

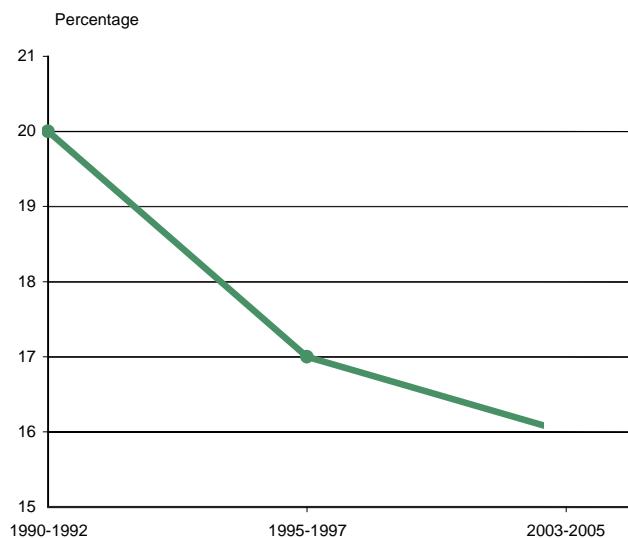
The following sections of this chapter look at the current situation more closely, starting with undernourishment. The global standard for adequate nourishment – the average dietary minimum requirement – is 1,800 calories per day.<sup>9</sup> In fact, this is not generally assessed at a national level by aggregating the actual consumption of households, but rather by considering how much food is available in each country, either from local production or from imports, and then using data on income distribution to estimate what proportion of the population will have been able to afford 1,800 calories per day. This is thus a rather indirect measure, and arguably unlikely to reflect real consumption very accurately. Many countries do not have very reliable data on food

availability, or on inequality, and a relatively small variation in just one of these parameters makes a big difference in a country's estimated level of food insecurity. Nevertheless, this does give a useful overall picture for inter-country comparisons.

The resulting data are indicated in Figure I-1. This confirms that, on average in 2003-2005, some 16 per cent of the region's population were consuming less than the dietary minimum. However, as this figure also shows, that proportion has been coming down – having fallen from 20 per cent in 1990-1992.

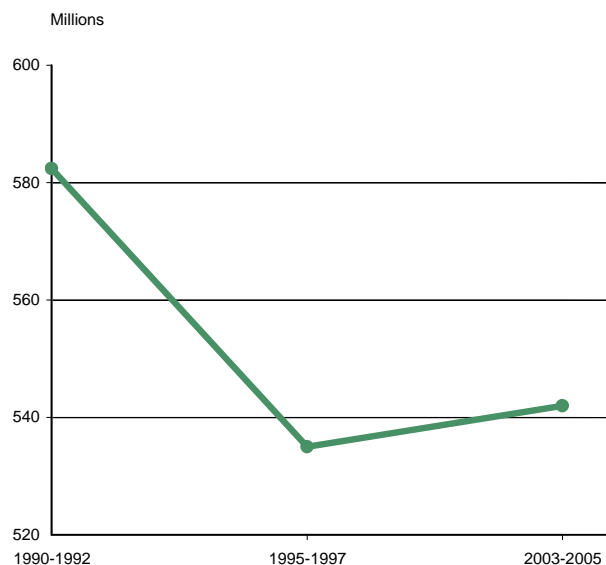
The trend is less consistent, however, when it comes to the total number of people who are undernourished, as shown in Figure I-2. This too had been falling, but it then increased after 1995-1997, from 535 to 542 million – as improvements in food availability were offset by population growth. Moreover, FAO estimated that, for 2007, as a result of sudden price rises in that year, the number had further increased to 582 million.<sup>10</sup>

**Figure I-1 – Proportion of undernourished people in Asia and the Pacific, 1990-1992 to 2003-2005**



Source: FAO (2008). *The State of Food Insecurity in the World 2008: High food prices and food security – threats and opportunities* (Rome, FAO).

**Figure I-2 – Numbers of undernourished people in Asia and the Pacific, 1990-1992 to 2003-2005**



Source: FAO (2008). *The State of Food Insecurity in the World 2008: High food prices and food security – threats and opportunities* (Rome, FAO).



While the overall proportion of undernourished people remains high, it should also be emphasized that there are considerable variations across the Asia-Pacific region. This is detailed by subregion in Table I-1. Clearly, the greatest problems are in South and South-West Asia where during 2003–2005 some 21 per cent of the population were undernourished. Indeed, South Asia alone is thought to have more than one third of the food insecure people in the developing countries of the world.<sup>11</sup>

However, countries where the level is between 10 and 19 per cent should also be considered as having significant problems. These include (in descending order of the proportion undernourished) Myanmar, the Lao People’s Democratic Republic, Thailand, Indonesia, the Philippines, Nepal, Viet Nam, Uzbekistan, Georgia, Papua New Guinea, Azerbaijan, Vanuatu, the Maldives and New Caledonia. Even China, at 9 per cent, approaches this threshold, and, because it is the region’s most populous country, it accounts for

**Table I-1 – Population undernourished by country grouping, region and subregion**

	Proportion of the population undernourished (average, %)			Number of people undernourished (average, thousands)		
	1990-1992 <sup>1</sup>	1995-1997 <sup>2</sup>	2003-2005 <sup>3</sup>	1990-1992 <sup>1</sup>	1995-1997 <sup>2</sup>	2003-2005 <sup>3</sup>
East & North-East Asia	15	12	10	183,500	152,000	131,800
South-East Asia	24	18	16	105,600	88,600	86,900
South & South-West Asia	25	22	21	282,500	284,800	313,600
North & Central Asia	8	9	11	4,000	4,700	6,500
Pacific	15	14	12	862	909	881
Asia-Pacific total	20	17	16	582,400	535,000	541,900
Developing countries	20	18	16	776,600	774,700	798,500
Sub-Saharan Africa	31	36	32	131,900	192,100	201,400
World	16	14	13	841,900	831,800	848,000

Notes: <sup>1</sup> 1990-1992 average for all countries, except those in Central Asia, where this observation indicates the average for 1993–1995. For the compositions of the subregions, see Table I-2 <sup>2</sup> 1995-1997 average. <sup>3</sup> 2003-2005 average.

Source: FAO (2008). *The State of Food Insecurity in the World 2008: High food prices and food security – threats and opportunities* (Rome, FAO). United Nations (2008). Millennium Development Goals Indicators. The official United Nations site for the MDG Indicators, <<http://mdgs.un.org/unsd/mdg/Data.aspx>>. For Brunei Darussalam, Maldives and Pacific island States, the population undernourished is calculated from ESCAP (2007). *Statistical Yearbook for Asia and the Pacific 2007* (United Nations publication, Sales No. B.08.II.F1).

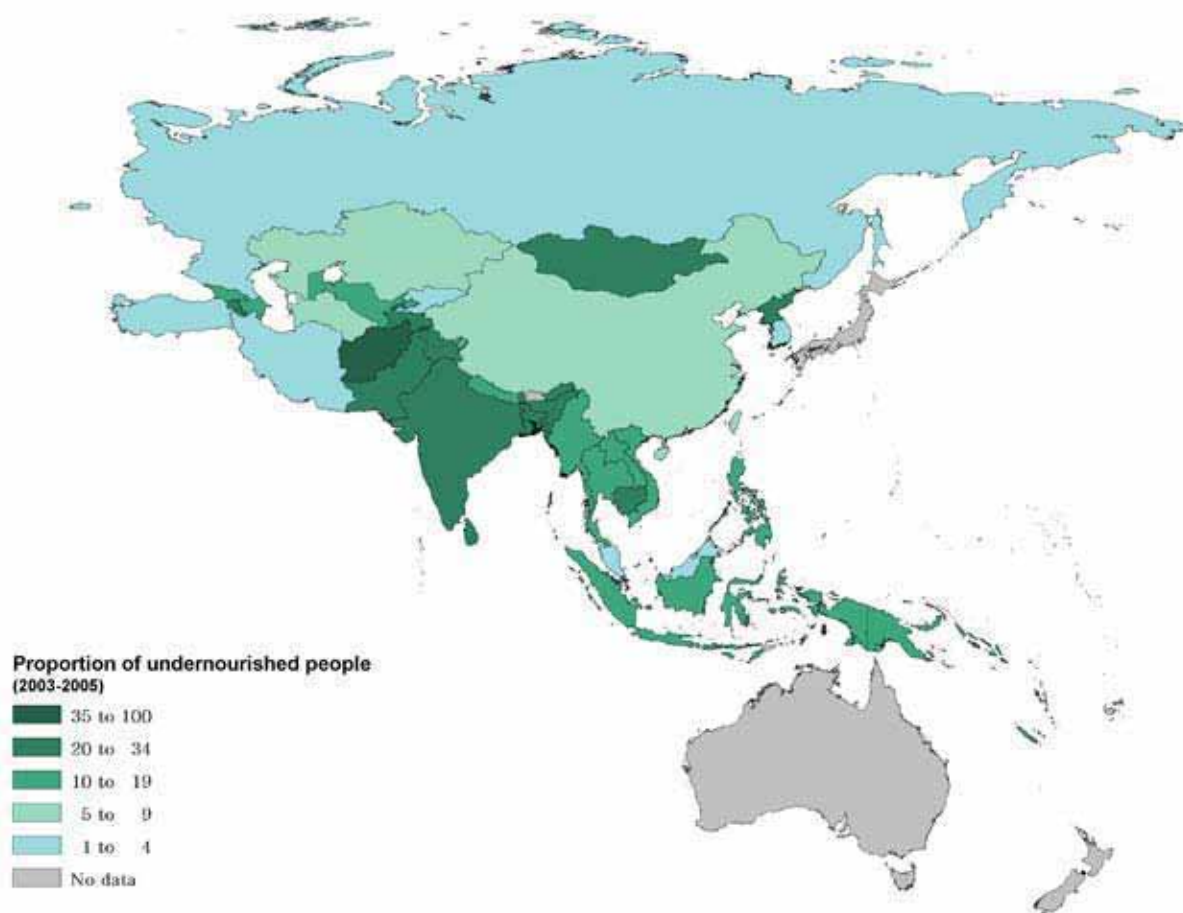
A more detailed national-level perspective can be seen in Figure I-3 which indicates that the most acute problems are in Afghanistan – where more than one third of the population are undernourished, a consequence not just of drought or bad weather, but also of the ongoing civil war. Both Figure I-3 and Table I-2 indicate that the levels are also high – between 20 and 34 per cent – in a number of other countries, including (in descending order of the proportion undernourished), Tajikistan, the Democratic People’s Republic of Korea, Mongolia, Bangladesh, Cambodia, Pakistan, Armenia, Sri Lanka, India and the Solomon Islands.

a significant proportion – 23 per cent – of the region’s undernourished.

### Children underweight

The second main way of assessing standards of nutrition is by weighing a sample of children to arrive at the proportion who are underweight for their age. It can also be supplemented by other assessments. Generally the children’s height will also be measured, which enables an estimate of stunting, too short for their age, or wasting, too light for their height. These measures can also be difficult to arrive at and there may be doubts

**Figure I-3 – Proportion of people undernourished, by country, Asia and the Pacific, 2003-2005**



Disclaimer: The boundaries used in this map do not imply official endorsement or acceptance by the United Nations.

The dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

Source: ESCAP mapping on the basis of the data from FAO (2008). *The State of Food Insecurity in the World 2008: High food prices and food security – threats and opportunities* (Rome, FAO).

about their accuracy, but these ‘anthropometric’ measures do at least have the advantage of being more direct.

The results for Asia and the Pacific are shown in Table I-3. As with the proportion undernourished, the problems are most severe in South and South-West Asia where, on average, 42 per cent of children are underweight – with the highest figures in Bangladesh at 47 per cent and in India at 46 per cent. However, even in South-East Asia, the overall proportions remain disturbingly high, at 26 per cent, with the highest numbers in Timor-Leste at 46 per cent and in

the Lao People’s Democratic Republic at 40 per cent. In fact the majority of countries in the subregion have more than one quarter of their children undernourished. The proportions are generally lower in East and North-East Asia and in North and Central Asia, as well as in the Pacific, though in the latter case few countries can provide adequate data.

These high rates also mean that many countries are unlikely to meet the corresponding MDG target, which is, between 1990 and 2015, to have reduced the proportion by half. Countries off-track on this basis include Cambodia, the Democratic People’s

**Table I-2 – Population undernourished, by subregion and country**

	Proportion of population undernourished (%)				Number of people undernourished (thousands)			
	1990-1992 <sup>1</sup>	1995-1997 <sup>2</sup>	2001-2003 <sup>3</sup>	2003-2005 <sup>*</sup>	1990-1992 <sup>1</sup>	1995-1997 <sup>2</sup>	2001-2003 <sup>3</sup>	2003-2005 <sup>*</sup>
<b>North and North-East Asia</b>								
China <sup>4</sup>	16	12	12	9	193,600	145,600	150,000	122,700
Democratic People's Republic of Korea	18	34	35	32	3,600	7,300	7,900	7,600
Mongolia	34	45	28	29	800	1,100	700	800
Republic of Korea	<2.5	<2.5	<2.5	<2.5	800	800	800	
<b>South-East Asia<sup>5</sup></b>								
Brunei Darussalam	4	3	3	3	10	9	10	10
Cambodia	43	46	33	26	4,400	5,400	4,600	3,600
Indonesia	19	13		17	34,500	26,700		37,100
Lao People's Democratic Republic	29	28	21	19	1,200	1,300	1,200	1,100
Malaysia	3	<2.5	3	<2.5	500	400	600	
Myanmar	44	34		19	18,100	14,800		8,800
Philippines	21	18	19	16	13,300	12,800	15,200	13,300
Thailand	30	23	21	17	16,800	13,700	13,400	10,900
Timor-Leste	11	9	8		100	100	100	
Viet Nam	31	23	17	14	20,600	16,700	13,800	11,500
<b>South and South-West Asia<sup>6</sup></b>								
Bangladesh	35	40	30	27	39,200	50,400	43,100	40,100
India	25	21	20	21	214,800	201,800	212,000	230,500
Iran (Islamic Republic of)	4	3	4	4	2,100	2,200	2,700	2,700
Maldives	17	15	11	11	37	37	30	30
Nepal	20	26	17	15	3,900	5,600	4,100	4,000
Pakistan	24	19	23	23	27,800	24,800	35,200	35,000
Sri Lanka	28	26	22	21	4,800	4,600	4,100	4,000
Turkey	<2.5	<2.5	3	3	1,000	1,500	2,000	
Armenia	52		29	21	1,800		900	600
<b>North and Central Asia</b>								
Azerbaijan	34		10	12	2,600		800	1,000
Georgia	44		13	13	2,400		700	600
Kazakhstan	<2.5		8	8	200		1,200	1,200
Kyrgyzstan	21		4	4	1,000		200	200
Russian Federation	4		3	3	6,400		4,100	4,100
Tajikistan	34	42		34	1,200			2,200
Turkmenistan	12		8	6	500		400	300
Uzbekistan	8			14	1,700			3,600
<b>Pacific<sup>7</sup></b>								
Fiji	10	7	4		72	54	32	
French Polynesia	4	4	4		8	9	9	
Kiribati	9	7	6		6	5	5	
New Caledonia	10	10	10		17	19	22	
Papua New Guinea	15	15	13		620	706	700	
Samoa	11	11	4		18	19	7	
Solomon Islands	33	21	20		103	76	83	
Vanuatu	12	12	12		18	21	23	

Notes: <sup>1</sup> 1990-1992 average for all countries, except those in Central Asia, where this observation indicates average for 1993-1995. <sup>2</sup> 1995-1997 average. <sup>3</sup> 2001-2003 average. <sup>4</sup> Includes China (mainland); Taiwan Province of China; Hong Kong, China; Macao, China. <sup>5</sup> No observations for Singapore. <sup>6</sup> No observations for Afghanistan and Bhutan. <sup>7</sup> No observations for American Samoa, Cook Islands, Guam, Marshall Islands, Micronesia (Federated States of), Nauru, Niue, Northern Mariana Islands, Palau, Tonga and Tuvalu. \* Data from FAO (2008). *The State of Food Insecurity in the World 2008: High food prices and food security – threats and opportunities* (Rome, FAO).

Sources: FAO (2008). *The State of Food Insecurity in the World 2008: High food prices and food security – threats and opportunities* (Rome, FAO); United Nations (2008). Millennium Development Goals Indicators. The official United Nations site for the MDG Indicators, <<http://mdgs.un.org/unsd/mdg/Data.aspx>>. For Brunei Darussalam, Maldives and Pacific island States, the population undernourished is calculated from ESCAP (2007), *Statistical Yearbook for Asia and the Pacific 2007* (United Nations publication, Sales No. B.08.II.F1).

**Table I-3 – Children underweight, Asia and the Pacific**

Country	Proportion of children underweight (%)		Number of children underweight (thousands)	
	(oldest observation since 1990)	(most recent observation)	(oldest observation since 1990)	(most recent observation)
<b>East &amp; North-East Asia<sup>1</sup></b>	<b>19.8</b>	<b>7.2</b>	<b>23,951</b>	<b>6,288</b>
China	19.1 <sup>k (90)</sup>	6.9 <sup>k (05)</sup>	22,703	5,885
Democratic People's Republic of Korea	60.0 <sup>q (98)</sup>	23.4 <sup>m (04)</sup>	1,205	389
Mongolia	12.3 <sup>j (92)</sup>	6.3 <sup>k (05)</sup>	44	15
<b>South-East Asia<sup>2</sup></b>	<b>34.1</b>	<b>25.7</b>	<b>19,009</b>	<b>14,156</b>
Cambodia	39.8 <sup>d, k (93)</sup>	35.6 <sup>k (05)</sup>	770	598
Indonesia	34.0 <sup>k (95)</sup>	28.2 <sup>k (03)</sup>	7,338	6,135
Lao People's Democratic Republic	44.0 <sup>k (93)</sup>	40.0 <sup>k (00)</sup>	357	312
Malaysia	23.3 <sup>k (93)</sup>	8.1 <sup>k (05)</sup>	616	223
Myanmar	32.4 <sup>h (90)</sup>	31.8 <sup>k (03)</sup>	1,625	1,327
Philippines	33.5 <sup>a, k (90)</sup>	27.6 <sup>k (03)</sup>	3,072	3,015
Singapore		3.4 <sup>k (00)</sup>		9
Thailand	18.6 <sup>k (93)</sup>	9.3 <sup>k (05)</sup>	939	420
Timor-Leste	42.6 <sup>k (02)</sup>	45.8 <sup>k (03)</sup>	70	83
Viet Nam	44.9 <sup>k (94)</sup>	25.2 <sup>k (05)</sup>	4,222	2,033
<b>South &amp; South-West Asia</b>	<b>49.7</b>	<b>42.1</b>	<b>93,782</b>	<b>79,580</b>
Afghanistan	48.0 <sup>o (97)</sup>	39.3 <sup>f, q (04)</sup>	1,691	1,830
Bangladesh	67.4 <sup>q (92)</sup>	47.5 <sup>k (04)</sup>	11,569	8,985
Bhutan		18.7 <sup>q (99)</sup>		13
India	53.4 <sup>c, i (93)</sup>	45.9 <sup>g (05)</sup>	67,775	58,244
Iran (Islamic Republic of)	15.7 <sup>k (95)</sup>	10.9 <sup>k (98)</sup>	1,308	649
Maldives	38.9 <sup>l (94)</sup>	30.4 <sup>k (01)</sup>	15	10
Nepal	48.7 <sup>p (95)</sup>	38.6 <sup>k (06)</sup>	1,695	1,394
Pakistan	40.4 <sup>b, k (91)</sup>	37.8 <sup>e, k (02)</sup>	8,337	7,720
Sri Lanka	37.7 <sup>n (93)</sup>	29.4 <sup>n (00)</sup>	662	475
Turkey	10.4 <sup>k (93)</sup>	3.9 <sup>k (03)</sup>	730	259
<b>North &amp; Central Asia</b>	<b>13.9</b>	<b>4.8</b>	<b>965</b>	<b>717</b>
Armenia	3.9 <sup>k (98)</sup>	4.0 <sup>k (05)</sup>	8	7
Azerbaijan	10.1 <sup>q (96)</sup>	6.8 <sup>n (01)</sup>	91	47
Georgia		3.1 <sup>k (99)</sup>		8
Kazakhstan	8.3 <sup>g (95)</sup>	4.0 <sup>k (06)</sup>	121	48
Kyrgyzstan	11.0 <sup>g (97)</sup>	3.4 <sup>k (06)</sup>	66	17
Russian Federation		3.0 <sup>k (95)</sup>		242
Tajikistan		17.4 <sup>k (05)</sup>		150
Turkmenistan	12.0 <sup>k (00)</sup>	11.0 <sup>k (05)</sup>	58	54
Uzbekistan	18.8 <sup>g (96)</sup>	5.1 <sup>k (06)</sup>	622	145
<b>Pacific<sup>3</sup></b>				
Cook Islands		10.0 <sup>k (97)</sup>		
Fiji		7.9 <sup>k (93)</sup>		8
Kiribati		13.0 <sup>k (99)</sup>		
Micronesia (Fed. States of)		15.0 <sup>k (97)</sup>		2

Notes: <sup>1</sup> No estimates available for Japan; Hong Kong, China; Macao, China; and the Republic of Korea. <sup>2</sup> No estimates for Brunei Darussalam. <sup>3</sup> No estimates available for any other Pacific member and associate members.

<sup>a</sup>. Data refer to 1989-1990. <sup>b</sup>. Data refer to 1990-1991. <sup>c</sup>. Data refer to 1992-1993. <sup>d</sup>. Data refer to 1993-1994. <sup>e</sup>. Data refer to 2001-2002. <sup>f</sup>. Data refer to 2003-2004. <sup>g</sup>. Age group is 0-35 months. <sup>h</sup>. Age group is 0-36 months. <sup>i</sup>. Age group is 0-47 months. <sup>l</sup>. Age group is 0-48 months. <sup>k</sup>. Age group is 0-59 months. <sup>l</sup>. Age group is 0-60 months. <sup>m</sup>. Age group is 0-71 months. <sup>n</sup>. Age group is 3-59 months. <sup>o</sup>. Age group is 6-35 months. <sup>p</sup>. Age group is 6-36 months. <sup>q</sup>. Age group is 6-59 months.

Sources: Proportion of children underweight from United Nations (2008). Millennium Development Goals Indicators. The official United Nations site for the MDG Indicators <<http://mdgs.un.org/unsd/mdg/Data.aspx>>. Number of children aged 0-4 years, from United Nations (2007). *World Population Prospects: The 2006 Revision. Population Database* <<http://esa.un.org/unpp/index.asp?panel=2>>.

Republic of Korea and Indonesia, where the proportion has not fallen since 1990, and others which are making progress, but too slowly to meet the target, including Bangladesh, India, the Lao People's Democratic Republic, Myanmar, Pakistan and the Philippines.

### The global hunger index

As the previous sections have indicated, countries that perform worst in terms of undernourishment also do badly in terms of children underweight. But the correspondence is by no means exact. Mongolia, for example, which has one of the higher levels of undernourishment, seems to do better when it comes to feeding its children. An overall picture of nutrition should therefore take both measures into account. One attempt to do this has been offered by the global hunger index (GHI), first presented in 2006 by the International Food Policy Research Institute and Deutsche Welthungerhilfe. The GHI is based on a simple

average of three indicators: the percentage of the population undernourished; the percentage of under-five children underweight; and the under-five mortality rate.

There is an element of redundancy in the GHI, since the infant mortality rate is to some extent correlated with child underweight. But combining the two has the merit of taking into account the quality of food, since many of the deaths related to malnutrition will also be linked not just to underweight but to other forms of malnutrition, including deficiencies in micro nutrients (Box I-3). Globally, deficiencies in three key micronutrients – iron, vitamin A and zinc – are thought to each cause an additional 750,000 to 850,000 deaths.<sup>12</sup> Since countries generally have few data on these deficiencies, the infant mortality rate can partially serve as a proxy. However, when expressed as a percentage, the infant mortality rate is generally far lower than the other two figures, so it effectively has a lower weight in the overall rankings.

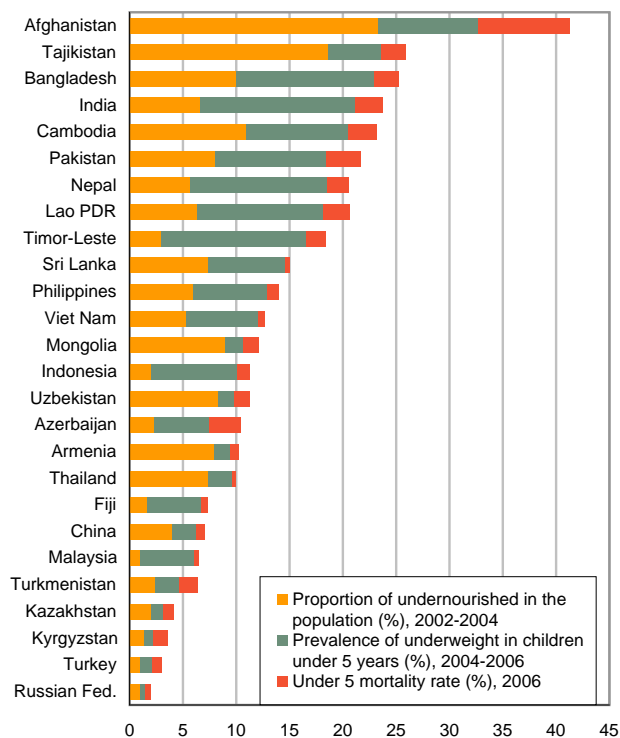
#### Box I-3 – Micronutrient deficiencies

Micronutrients are vitamins and trace minerals that are essential for chemical processes that ensure the survival, growth, and functioning of vital human systems. People in low- and middle-income countries in Asia and the Pacific often lack three key micronutrients: iron, vitamin A and zinc. As a result they are at greater risk of illness or death from infectious diseases and may not develop to their full physical or mental potential. Children will find it more difficult to learn in school and adults will have less capacity to work. Countries can lose an estimated 1 per cent of their gross domestic product from widespread micronutrient deficiencies, though they could reverse these deficiencies by spending only a small fraction of this.<sup>13</sup>

The picture offered by the composite GHI index is shown in Figure I-4. This does not cover all countries in the region, since it excludes the better-off economies such as Singapore and the Republic of Korea, as well as others, many in the Pacific, for which there are insufficient data, or some where the data are unreliable.

The overall index is arrived at by adding the three components and dividing by three. Averaging in this simple way also makes it easy to appreciate the contribution of each component of the index. Of the Asia-Pacific countries listed in the GHI, Afghanistan has the most disturbing score, over 40 per cent, as a consequence of high scores on all three indicators, with Tajikistan second at 26 per cent, with a high score primarily on undernourishment. Further down the list, however, child malnutrition starts to play a more dominant role.

**Figure I-4 – Global hunger index in Asia and the Pacific**

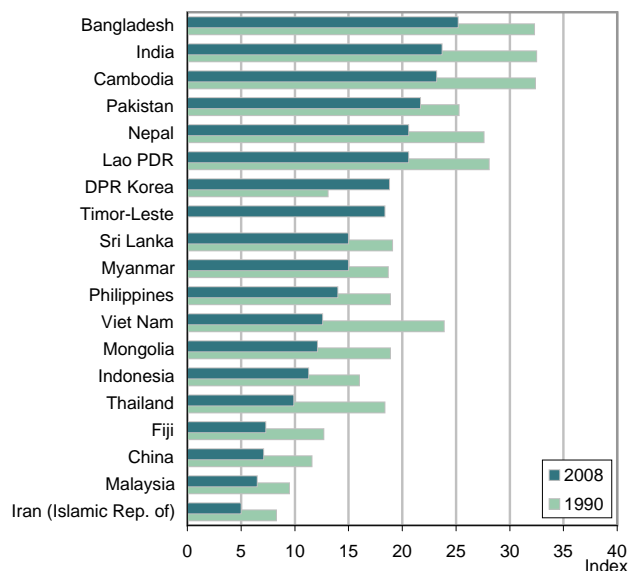


Note: The GHI is the sum of the components divided by three, so the percentage for each component indicated in this figure is also one third of its value.

Source: von Grebmer, K. and others (2008). *Global Hunger Index. The Challenge of Hunger 2008* (Bonn, Washington, D.C. and Dublin, Deutsche Welthungerhilfe, International Food Policy Research Institute, Concern Worldwide).

It is reassuring to note that the GHI, even if it remains relatively high, fell in most countries between 1990 and 2008, as in Viet Nam, for example, and India, though there was also significant progress in Thailand and Indonesia.

**Figure I-5 – Global hunger index, 1990 and 2008**



Source: von Grebmer, K. and others (2008). *Global Hunger Index. The Challenge of Hunger 2008* (Bonn, Washington, D.C. and Dublin, Deutsche Welthungerhilfe, International Food Policy Research Institute, Concern Worldwide).

### Hunger hotspots

These indicators help build up a picture of malnutrition across the Asia-Pacific region – and identify the countries that should be considered food insecurity hotspots. Using the GHI criteria, for example, a cut-off point might be 10 per cent, which would include the 18 countries down to Thailand (Figure I-4). However, this misses out other countries not covered by the GHI. Another option would be to consider as hotspots countries where undernourishment was greater than 10 per cent – which, on the basis of Table I-2, would be 25 countries. Another would be to include countries where child undernutrition was greater than 20 per cent which, on the basis of Table I-3, would add a twenty-sixth country, Timor-Leste. The resulting full list is shown in Table I-4.

**Table I-4 – Food insecurity in Asia and the Pacific, country hotspots**

Afghanistan	Nepal
Armenia	New Caledonia
Azerbaijan	Pakistan
Bangladesh	Papua New Guinea
Cambodia	Philippines
Democratic People's Republic of Korea	Solomon Islands
Georgia	Sri Lanka
India	Tajikistan
Indonesia	Thailand
Lao People's Democratic Republic	Timor-Leste
Maldives	Uzbekistan
Mongolia	Vanuatu
Myanmar	Viet Nam

Note: These countries, listed in alphabetical order, have rates of undernourishment above 10 per cent, or child underweight rates above 20 per cent, or both.

The total population of these countries is more than 2.2 billion, which is 53.8 per cent of the region's population. With food insecurity so generalized across the Asia-Pacific region, it may not be very useful, therefore, to consider countries as hotspots; vast countries like India and Indonesia can hardly be considered as 'spots'.

### *In-country regions and provinces*

It is probably better, therefore, to consider data at the sub-national level since the most food insecure are usually found in specific provinces or states, and within these in particular subregions or villages. This may be to do with the nature of the terrain, which might be considered on the 'arable margin', such as drought-prone areas in western China and north-eastern Thailand; high-altitude settings in the Himalayas and in the mountains that divide China from its southern neighbours; as well as in coastal regions that are highly susceptible to typhoons, for example in the central Philippines and central Viet Nam. For deficit areas such as these, food insecurity may be

measured in terms of the number of months a population can feed itself from one year's output of rice. This statistic is often reported, from the household level all the way up to the national level, since rice is the staple cereal for most Asians and on average accounts for over 40 per cent of daily caloric intake.<sup>14</sup>

Not all countries collect sufficient data to be able to track food insecurity at the local level. In the case of undernourishment, for example, using the same methodology applied at the national level would require data on food availability and income distribution at lower levels of administration, which can be difficult to obtain.

The data on child nutrition, however, are usually more available at provincial or lower levels, particularly in the larger countries, where they are gathered regularly in household surveys. Indonesia, for example, has data on child nutrition not just for 31 of its 33 provinces, but also for more than 400 districts. The hotspots at the provincial level are shown in Figure I-6. This indicates levels ranging from 15 per cent in Yogyakarta to 42 per cent in Gorontalo. Indonesia thus has hunger hotspots across the archipelago, but they are fewer on the rich island of Java in the west and more common in the poorer provinces in the centre and east.

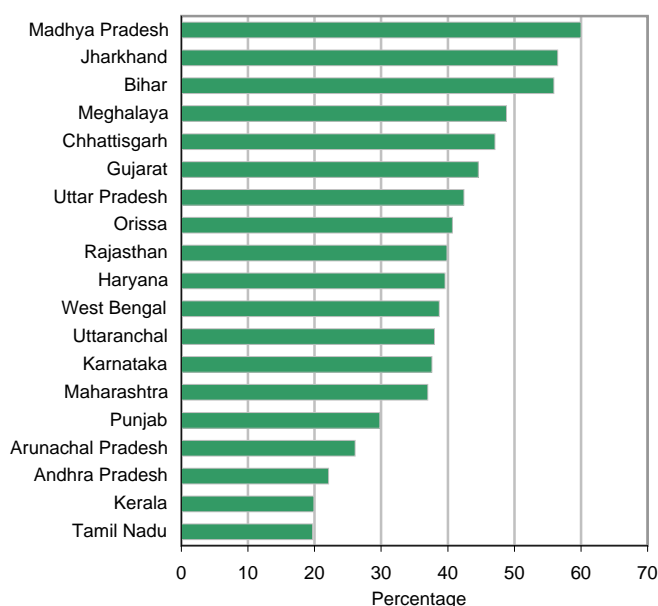
**Figure I-6 – Food insecurity hotspots, by province, in Indonesia**



Source: Millennium Development Report Indonesia, 2007, available at <[http://www.undp.or.id/mdg/Documents/id\\_mdgr2007\\_bahasa\\_131207.pdf](http://www.undp.or.id/mdg/Documents/id_mdgr2007_bahasa_131207.pdf)>

Figure I-7 presents a similar picture for India, by state. Here the greatest problems are in the poorer northern states. Madhya Pradesh has the highest proportion of underweight children, at

**Figure I-7 – Food insecurity hotspots in selected states in India**



Source: International Institute for Population Sciences (IIPS) and Macro International (2007). *National Family Health Survey (NFHS-3) 2005-2006: India*, vol. I (Mumbai, India, IIPS).

60 per cent. Jharkhand and Bihar where poverty levels are high also have rates of over 50 per cent. Southern India has fewer problems, though it still has many underweight children, particularly among peasant families that have migrated to the cities in search of work.<sup>15</sup> Even the most apparently food secure states, such as the Punjab, could have problems in the longer term, as a result of environmental degradation.<sup>16</sup>

Using additional measures, some countries have also collected even more detailed information on food insecurity. For India, a 2002 study which used 19 indicators ranked Jharkhand and Bihar the most food insecure states – followed by Madhya Pradesh, Chhattisgarh, Gujarat, Uttar Pradesh, Orissa, Rajasthan and Uttaranchal.<sup>17</sup>

The region’s other large country, China, has overall much lower proportions of children underweight, around 6.9 per cent. Nevertheless, it still has 6 million children underweight – with higher than average levels in Ningxia, Yunnan, Tibet and Guizhou – parts of China with relatively poor transport infrastructure and access to markets.<sup>18</sup>



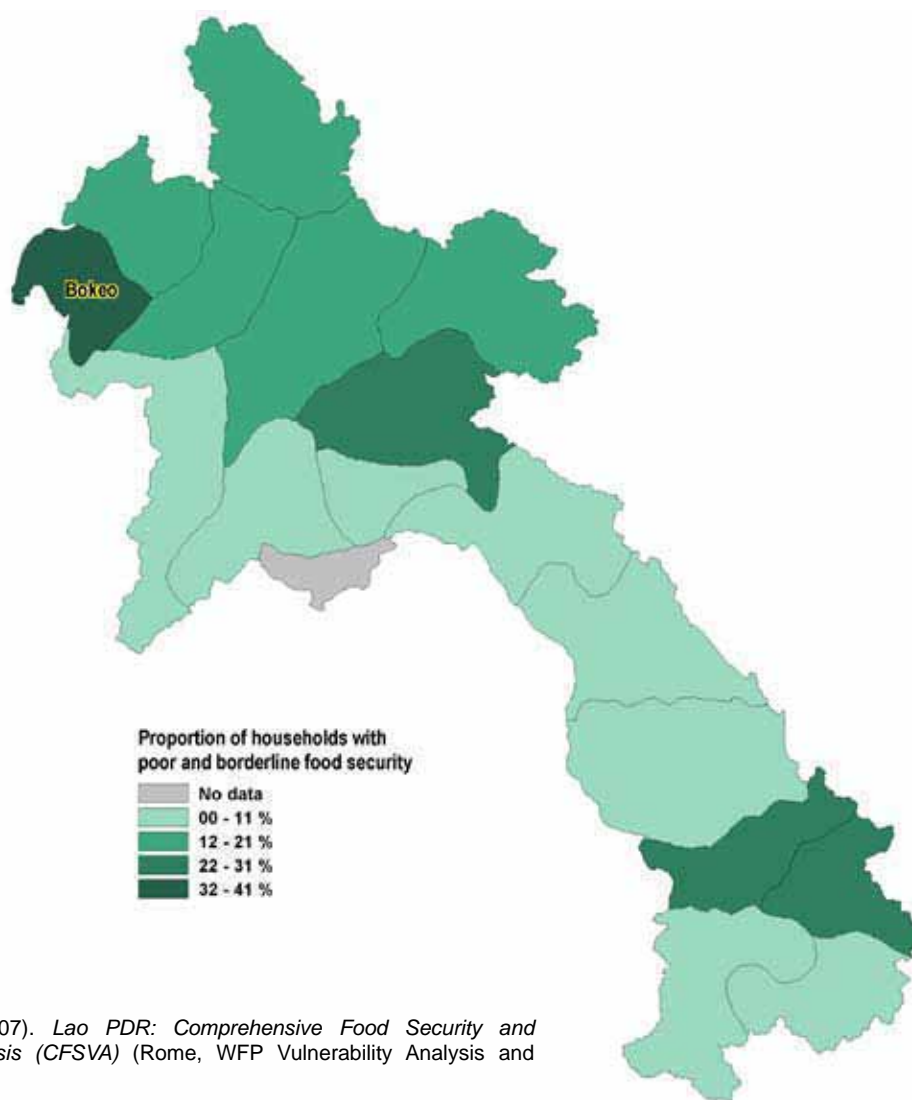
Of the smaller countries, a notable case is the Lao People's Democratic Republic, with which the World Food Programme has carried out a Comprehensive Food Security and Vulnerability Analysis down to the household level. The Third Expenditure and Consumption Survey conducted in 2002–2003 went into considerable detail, logging the actual food consumed by each household, and classifying it according to food group. This was then used to find which households had poor or borderline food consumption by international standards.

The result was that, overall, 23 per cent of households, 84,000, were consuming less than they should – 17 per cent of those in urban areas

and 25 per cent of those in rural areas. The most food insecure households were typically the largest – composed of eight people or more – and where the head of household tended to be older.<sup>19</sup> In the Lao People's Democratic Republic, many people consume calorie-dense foods that are low in bioavailable protein and micronutrients.<sup>20</sup>

The pattern across the country is mapped in Figure I-8. This highlights much greater food insecurity in the mountainous regions. In Bokeo, for example, more than one third of households suffered from poor or borderline food security. Insecurity was much lower in the south, in the Vientiane Plain and the Mekong Corridor – the main rice-growing regions.

**Figure I-8 – Food insecurity in the Lao People's Democratic Republic**



Source: WFP (2007). *Lao PDR: Comprehensive Food Security and Vulnerability Analysis (CFSVA)* (Rome, WFP Vulnerability Analysis and Mapping Branch).

## Vulnerable groups

In addition to regional mapping of hotspots, it is also possible to identify particular population subgroups that are at greatest risk, whether based on location, or social group, or a number of other characteristics, including HIV status (Box I-4).

households. One study in India, for example, documented the practice of ‘maternal buffering’ – as mothers deliberately eat less to allow men, particularly younger men, and children in their households get enough to eat.<sup>26</sup>

### Box I-4 – Food security and the AIDS epidemic

The Asia-Pacific region is home to some 6 million people living with HIV and AIDS.<sup>21</sup> The AIDS epidemic and food and nutrition insecurity form a vicious cycle. Malnutrition heightens susceptibility to HIV infection, while HIV in turn undermines food security.

People living with HIV have higher than normal nutritional requirements, needing up to 50 per cent more protein and up to 15 per cent more calories; they also need a variety of vitamins and minerals.<sup>22</sup> In addition, people living with HIV are likely to suffer from loss of appetite and anorexia, which could reduce their dietary intake just when their nutritional requirements are greatest. Malnutrition, in turn, expedites the onset of AIDS, and ultimately death.

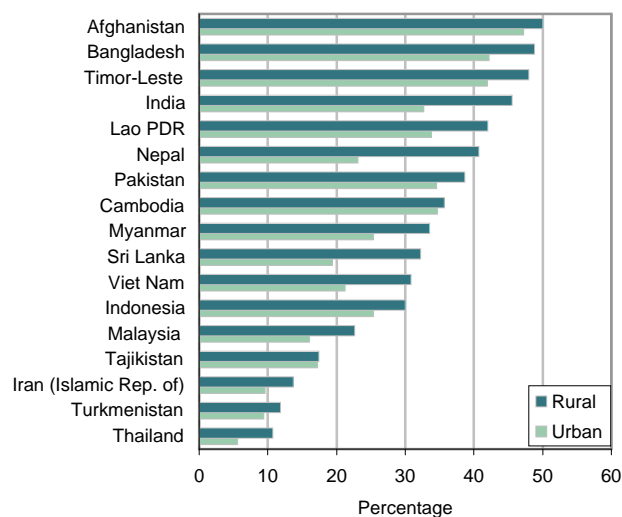
HIV mostly affects sexually active young adults who are among those who are most economically productive. As a consequence, when HIV affects an individual there are likely to be repercussions for the food supply of other family members and even the community.<sup>23</sup>

Women are biologically, socio-economically, and socio-culturally more at risk of HIV infection than men. They also tend to be economically dependent on men and have unequal access to resources, opportunities and assets, including land, which can place them at even higher risk.<sup>24</sup> In addition, women have disproportionately more responsibility as care givers of people living with AIDS.

UNICEF estimates that in East Asia and the Pacific, children living in rural areas are more than twice as likely to be underweight as compared with children in urban areas. The proportions for selected Asia-Pacific countries are shown in Figure I-9.<sup>25</sup> Although in percentage point terms the greatest contrast is in Nepal, there are also strikingly wide gaps in other countries, including India, Sri Lanka and Viet Nam.

Another important overall distinction is by sex. For children in most countries, the rates of underweight are the same for both sexes, except in South Asia where for boys the rate is 44 per cent while for girls it is 47 per cent. But, for adults, there are indications in some countries that women are more likely to be undernourished than men because of maldistribution within

Figure I-9 – Proportion of underweight children in urban and rural areas, selected countries



Note: Data are from the most recent year, over the period 1998-2006

Source: UNICEF. Childinfo: Monitoring the Situation of Children and Women. Statistics by Area: Child Nutrition <[http://www.childinfo.org/undernutrition\\_weightbackground.php](http://www.childinfo.org/undernutrition_weightbackground.php)> (accessed on 9 October 2008).

However, women also suffer as wage earners since their wages are consistently lower than those of men for the same work. This has serious implications for the food security of households that depend on female earners. In Bangladesh, for example, the female wage rate is so low that a day's wage cannot maintain a family of three, even if the female worker is employed full time.

The situation is bleakest for rural women. They are often the main food producers – contributing about 65 per cent of total food production.<sup>27</sup> Yet, rural women find it more difficult to get access to a range of resources such as credit, land, agricultural inputs and extension services and employment, both within the community and the household. Such discrimination has an obvious bearing on food for women, in terms of both availability and access, particularly if the men have migrated or stopped working in agriculture.

Another group vulnerable to food insecurity are migrant workers. In fact, many migrants set off precisely because of hunger. Garhwa, for example, is a district in India with a high proportion of poor and landless families. As a result of recurrent droughts and shortages of food, many people have migrated to the neighbouring states of Bihar, Uttar Pradesh and Chattisgarh. During the course of a year, an entire family may migrate to different states.<sup>28</sup> In many countries, the landless poor have migrated to cities. In China, for example, official statistics put the number of internal migrants at over 130 million.<sup>29</sup> Once in the cities, they are more vulnerable to fluctuations in food prices. In 2009, as a result of the recession, many of these workers have lost their jobs.

Also vulnerable are tribal groups, many of whom have lost access to their traditional land and forests and other common property resources on which they depended for food and livelihood. The Asian and Pacific region is home to 70 per cent of the world's indigenous populations – in countries such as Bangladesh, China, India, Nepal, Pakistan, Papua New Guinea and the Philippines. In South Asia, there is also discrimination against the lower caste groups, the Dalits. In India, these

comprise 16 per cent of the population, 167 million people<sup>30</sup> and in Nepal, 13 per cent, more than 3 million people.<sup>31</sup>

### **The impact of food insecurity**

The most general impact of food insecurity, and particularly rising prices, is an increase in poverty. In Indonesia, for example, each 10 per cent increase in the price of rice has been estimated to reduce the spending power of the poorest tenth of the population by 2 per cent.<sup>32</sup> The effects are thus likely to be similar to those of any increase in poverty – causing people to mortgage or sell assets, migrate elsewhere in search of work, or remove their children from school so that they can work to contribute to the household income. Parents may even give up children for adoption, or marry off their daughters early to reduce the number of mouths to feed.

But, when households come under immediate pressure, as a result of rising prices or falling food supplies, the first response is usually to change how they eat, consuming less or different food. Examples from around the region show the range of responses.

#### ● *China*

High prices generally cause people to eat cheaper food, which usually involves less protein. Consumers in China, for example, faced a 23 per cent increase between February 2007 and February 2008, with the steepest rises for meat, oil and vegetables. As a result, poor farmers in Fujian Province, for example, were estimated to have reduced their consumption of pork by 15 per cent and of eggs by 20 per cent.<sup>33</sup>

#### ● *Bangladesh*

A study of the impact of food price rise during 2007 and 2008, in rural and urban slum areas, identified seven major coping strategies: (1) reducing savings; (2) selling assets; (3) mortgaging assets and land; (4) taking loans; (5) reducing non-food expenditure; (6) reducing food intake; and

(7) marrying daughters early. In one rural district, as many as 85 per cent of surveyed households resorted to taking loans. However, more people were also limiting their food intake and, as a result, a high proportion of children faced health-related problems.<sup>34</sup>

● *Nepal*

The World Food Programme carried out a study in 2006 and 2007 in nine districts. This found that the main responses were to switch to less expensive food and reduce spending on non-food items (Figure I-10).

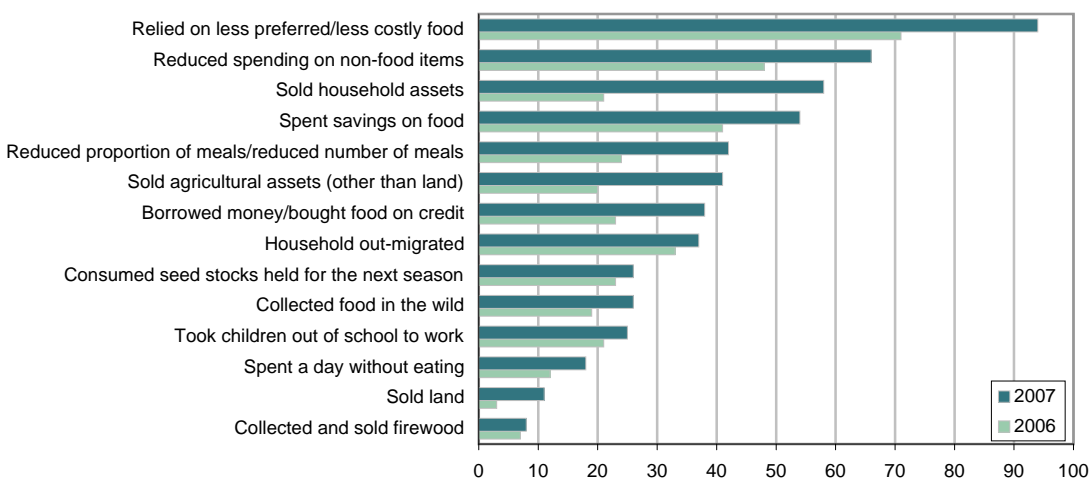
● *Niue*

Niue's Acting Premier, Pokotoa Sipeli, has reported that higher prices are forcing poor islanders to reduce food consumption or buy cheaper food of poorer quality and lower nutritional value.<sup>35</sup>

● *Sri Lanka*

Early in 2008, when food prices more than doubled, some estimates suggested that half the population could no longer afford to buy sufficient food. Poor rural people responded by reducing the number of times they ate and altering the amount and type of food.<sup>36</sup>

**Figure I-10 – Coping with food price increases in poor households in Nepal, percentage of households, 2006 and 2007**



Source: WFP (2008). *Food Security Bulletin – 20* (Rome, WFP).

**Hidden food insecurity**

Asia and the Pacific thus has disturbingly high levels of food insecurity, both in overall terms for particular areas or social groups – and, at times of high food prices, diets deteriorate. Why is this happening in a region that should be able to feed everyone? This is the subject of the next chapter.



*Photo: Stockxchange*

## THE ROOTS OF FOOD INSECURITY AND PRICE SHOCKS

**The Green Revolution appeared to offer the solution to hunger in Asia and the Pacific. And for many years it did generate striking increases in output. But by the early 1990s, progress appeared to stall, eventually contributing to shortages that were suddenly exposed by soaring food prices in 2007 and 2008. This chapter explores some of the main factors that contribute to the region's food insecurity.**

Why are people food insecure? Why are 16 per cent of the population of Asia and the Pacific undernourished? Why are 25 per cent or more of under-five children in many countries underweight? The answers to these questions will inevitably be similar to queries about the persistence of poverty – since poverty and food insecurity are closely interlinked. The poorest and most food insecure people are those who lack decent work, who have low levels of health and education, and who generally have few economic

opportunities (Box II-1). This chapter focuses more specifically, however, on issues related directly to food, starting with production.

### Food production

Since the mid-1960s, Asia and the Pacific has benefitted from a remarkable boost in agricultural output. The main way of increasing output is to increase productivity, either of land or labour, whichever is in shorter supply. In Australia, for

#### Box II-1 – Poverty and food security – a community well-being ranking, Pakistan

Communities define food security and poverty in their own ways – and along many dimensions, and the criteria will change markedly from one place to another. A participatory poverty assessment in 2003 in the Federally Administered Tribal Areas (FATA) in Pakistan, for example, indicated four general categories.

Well-off	Better-off	Poor	Very poor
Good physique	Some land	Drinks black tea	Hungry
Land	50 sheep	Often hungry	Physically weak
Crops	Good health	Many dependants	Landless
100-150 sheep	Enough food grain and bread	Bad health	No livestock
Surplus food (meat, butter, milk)	Eats 2 meals / day	Very little land	No food
		1-2 head(s) of livestock	Low quality food
		Insufficient food	Eats dry bread
			Depends on donations
			Begs

Based on Table 2: Characteristics of well-being categories compiled from well-being analysis across the Federally Administered Tribal Areas (FATA) Participatory Poverty Assessment (PPA) sites.

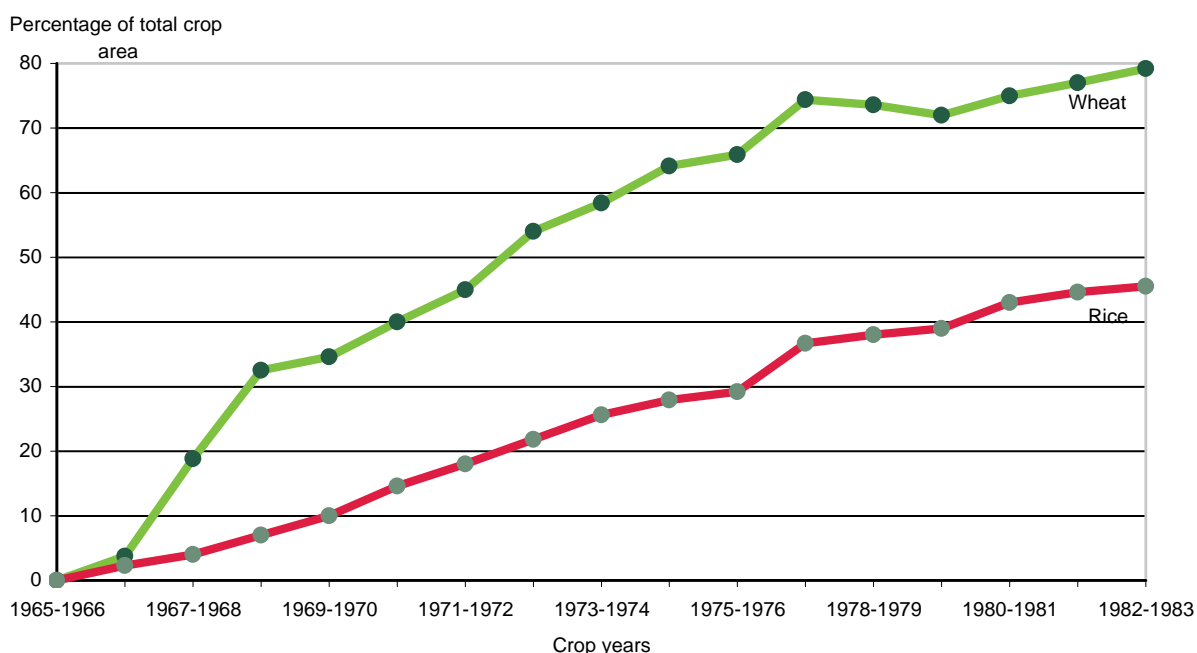
example, the greater constraint is labour, so one of the main priorities has been mechanization. In most of tropical Asia, on the other hand, the major constraint is land. The priority, therefore, has been to raise the productivity of land – through biological improvement, irrigation, and more intensive use of fertilizers.<sup>37</sup> This was the basis of the Green Revolution, which got under way in many parts of Asia in the mid-1960s. Intensive research, in Asia and elsewhere, had developed new varieties of rice and wheat, which, with the application of fertilizer and irrigation, produced more grain than traditional strains.<sup>38</sup> As indicated in Figure II-1, improved varieties of rice and wheat were adopted very quickly in South and South-East Asia.

fertilizers grew at an average of 3.2 per cent annually, compared to the global average of 2.1 per cent. The leading users are the Republic of Korea, New Zealand and Japan. In the region’s developing countries, nutrient use per hectare in 2006 was highest in Viet Nam, Bangladesh, Malaysia and Pakistan.<sup>39</sup>

The result, in Asia and elsewhere, has been a striking increase in cereal yields. This continued fairly consistently, even in the years following the Green Revolution.

Between 1980 and 2000, production per hectare generally rose – in China by 60 per cent, in India by 81 per cent, and in Viet Nam by 114 per cent. The main exceptions were Malaysia and

**Figure II-1 – Adoption of high-yielding strains of rice and wheat in South and South-East Asia, 1965-1983**

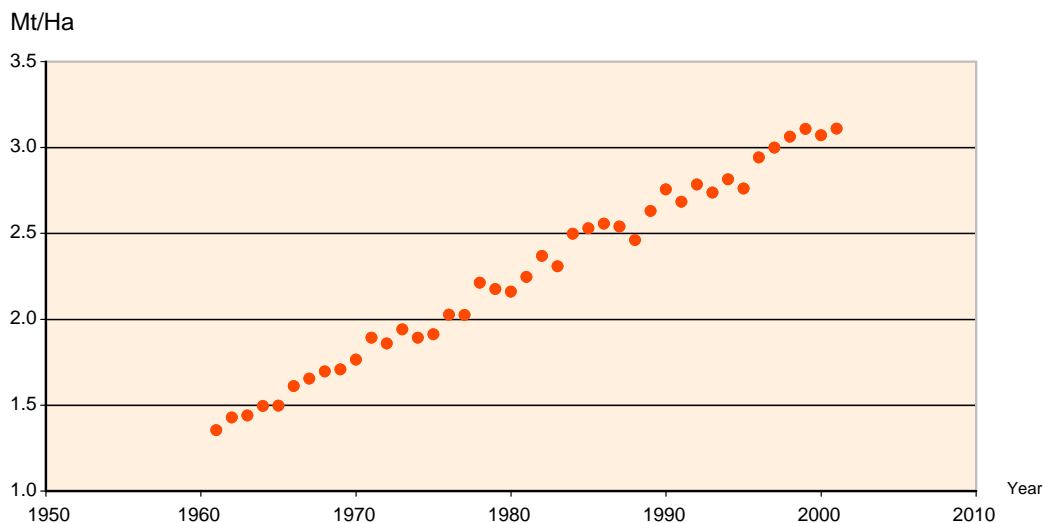


Source: Dalrymple, D (1985). “The Development and Adoption of High-Yielding Varieties of Wheat and Rice in Developing Countries”, in *American Journal of Agricultural Economics*, 1985, vol. 67, pp. 1067-1073.

As a result, countries in the Asia-Pacific region are among the world’s most intensive users of mineral fertilizers. Consumption per hectare is more than twice that in the rest of the world, and it continues to increase. Over the period 1996-2006, the region’s consumption of mineral

Sri Lanka, which had already achieved high yields, and Thailand which, despite being the world’s leading exporter of rice, does not have strikingly high usage of fertilizers or irrigation.



**Figure II-2 – Average global cereal yield, 1961-2001**

Source: Southgate, D., D. Graham and L. Tweeten (2007). *The World Food Economy* (Malden, Blackwell Publishing).

**Table II-1 – The Green Revolution in selected Asia-Pacific countries, 1980 and 2000**

Countries listed in descending order of per capita income	Rural population density in 2001 (persons/km <sup>2</sup> of arable land)	Fertilizer use (kg/ha)		Irrigation (% of arable land)		Cereal yield (kg/ha)	
		1980	2000	1980	2000	1980	2000
Malaysia	554	427	670	6.7	4.8	2,828	3,132
Thailand	326	18	112	16.4	27.1	1,911	2,654
Philippines	564	64	134	12.8	14.6	1,611	2,692
China	561	149	256	45.1	36.3	3,027	4,845
Sri Lanka	1,607	180	277	28.3	33.6	2,462	3,520
Indonesia	591	65	124	16.2	14.4	2,837	4,141
India	460	35	107	22.8	32.2	1,324	2,390
Viet Nam	923	30	341	25.6	37.6	2,049	4,375
Pakistan	438	53	136	72.7	81.6	1,608	2,266
Mongolia	87	8	3	6.7	4.8	573	751
Bangladesh	1,228	46	166	17.1	49.6	1,938	3,312
Lao People's Democratic Republic	495	4	11	13.1	18.2	1,402	3,140
Cambodia	274	5	0	5.8	7.1	1,615	2,178
Nepal	668	10	26	22.5	36.2	2,521	3,453

Source: World Bank (2008). *World Development Indicators 2008* <<http://ddp-ext.worldbank.org/ext/DDPQQ>> (accessed in October 2008).

This enabled many countries in the region to shift from extensive to intensive farming and production systems, and to move from harvesting stocks of fish or timber in the wild to more organized aquaculture and plantation forestry.

Another important structural change is from horizontal to vertical integration.<sup>40</sup> Poultry production, for example, has developed from a simple farm operation to a complex vertical operation of linked industries and enterprises – from farms growing animal feeds, to feed mills, to slaughterhouses, to processing plants to food stores.<sup>41</sup> However, despite the clear shift towards commercial farming, this process is difficult to track. There are surprisingly few data to demonstrate what proportion of total food production in Asia and the Pacific can actually be attributed to industrial agriculture and how much is actually produced by small rural producers.

### **The impact on the poor**

To some extent and in its initial stages, the Green Revolution also benefited the rural poor. First, the new technology could be used not just on large farms, but also on small ones.<sup>42</sup> Second, the then new farming systems, which often involved double and triple cropping, proved to be quite labour intensive – thus offering more work for the landless. Nevertheless, the Green Revolution also displaced many smaller operators, as production was consolidated into more efficient systems to feed large-scale processing operations and provide a steady supply to the markets – especially in countries where tenure rights were not well established. Even the smaller operators that were able to sell crops under contract to large-scale food producers often found that they earned relatively little.

Industrial agriculture and export-focused production have also marginalized women. Worldwide, rural women are the mainstay of agriculture and of food systems. In Asia, they are responsible for more than half of the tasks in rice cultivation. In South-East Asia and the Pacific, for example, their home gardens are among some

of the world's most complex agricultural systems. Women also provide most of the labour for, and make decisions on, a wide range of post-harvest operations, including storage, handling and marketing. As countries have moved towards cash crops, however, and commercial farming has become more mechanized, women have steadily been displaced as farmers and reduced to being agricultural workers.<sup>43</sup> It may be noted that agricultural workers are twice as likely to die at work than workers in other sectors.<sup>44</sup> They suffer severe poisoning from hazardous pesticides that they are forced to use, including work-related cancers and reproductive impairments. Women agricultural workers tend to be the weakest links in the global value chains.

### **Increasing demand**

While the supply of food was increasing in Asia and the Pacific, so too was the demand. To a large extent, this increasing appetite was due to population growth. In 1950, Asia's population was 1.3 billion; over the next quarter century, it increased by 2.1 per cent per annum, reaching 2.3 billion by 1975. Subsequently, the growth slackened – over the next 25 years, annual growth averaged 1.7 per cent, though by 2000 the total population of the region had reached 3.5 billion. Even with slower growth, however, Asia's share of the world population rose; between 1950 and 2000, it increased from 54 to 57 per cent.<sup>45</sup>

This slowing of the population growth was largely because of a drop in fertility. In China, for example, between 1980 and 2006, total fertility fell from 2.5 to 1.8 births per woman.<sup>46</sup> But, fertility was to also decline across the region, often to below replacement levels, particularly in countries where per capita income equalled or exceeded \$3,000 in purchasing power parity. In India, total fertility fell from 5.0 to 2.5.<sup>47</sup>

Food production thus had to keep pace with an increasing number of people. At the same time, while populations were growing, so too were their incomes which meant that these larger numbers of people were also in a position to buy

more food. The relationship between population growth, increased incomes and the demand for food is traced for a number of Asian countries in Table II-2. This is based on estimates for each country of the ‘income elasticity of food demand’, which is the average proportion of any increased income which will be spent on food. Thus in Viet Nam in 2007, the population grew by 1.22 per cent and per capita income increased by 7.17 per cent. On the assumption that 0.73 per cent of the additional income in that year would be spent on food, then the demand for food would increase by 6.45 per cent.

of the Asian diet.<sup>49</sup> Over the period, 1995-2005, per capita rice production fell while per capita wheat production increased. Much of this is now going to supermarkets, a process linked to rapid urbanization and the increasing number of women in the urban labour force who try to save time by using packaged food products.<sup>50</sup>

On the whole, during the last three decades of the twentieth century, production managed to keep pace with this changing pattern of demand. This is summarized in Table II-3 and Table II-4.

**Table II-2 – Growth in population, average income, and food demand in selected Asian and Pacific countries in 2007**

Country (ranked by average income)	Population growth (%)	Growth in per capita income (%)	Income elasticity of food demand	Demand growth (%) *
Malaysia	1.66	3.97	-	-
Thailand	0.61	4.12	0.65	3.29
Philippines	1.87	5.34	0.66	5.39
China	0.62	11.20	-	-
Sri Lanka	0.30	6.47	0.70	4.83
Indonesia	1.15	5.10	0.69	4.67
India	1.21	7.72	-	-
Viet Nam	1.22	7.17	0.73	6.45
Pakistan	2.11	4.16	0.72	5.11
Mongolia	1.06	8.70	0.77	7.76
Bangladesh	1.64	4.78	0.73	5.13
Lao People's Democratic Republic	1.73	5.25	-	-
Cambodia	1.74	8.43	-	-
Nepal	1.67	0.80	0.75	2.27

Sources: World Bank (2008). *World Development Indicators 2008* <<http://ddp-ext.worldbank.org/ext/DDPQQ>> (accessed in November 2008 for population and income growth). Economic Research Service of the United States Department of Agriculture (ERS-USDA). *International Food Consumption Patterns 2003* <<http://www.ers.usda.gov/data/InternationalFoodDemand/>> (accessed in November 2008 for income elasticities).

A further consequence of this increased income was that people could buy different, better quality food. The poorest people generally buy the cheapest available carbohydrates. But with more money, they can buy more fruits and vegetables, along with meat, dairy goods, and eggs. To meet this demand, farmers have to feed more corn and other grains to cattle, poultry and other livestock.

As a result, Asia has been changing from the traditional carbohydrate- and vegetable-dominated diet to one richer in fat and protein<sup>48</sup> – a process that has been called the westernization

In South Asia, for example, the area devoted to millet and sorghum fell, while more land was planted with fruits and vegetables. In South and South-East Asia, the pattern was similar, with a fall in the area of land devoted to ‘other cereals’. As a result, there was a substantial growth in the production of fruit, though more because of an increase in planting than of an increase in yields. On the other hand, cereals like rice, wheat and corn also showed solid increases, in this case largely due to higher yields. Rice production across Asia and the Pacific increased by an average of 0.9 per cent annually between 1996 and 2006, despite a minimal increase in rice areas.<sup>51</sup>

**Table II-3 – East and South-East Asia, arable land use, crop yields, and output, 1970 to 2000**

Crop	Production in 2000 (million tons)	Average annual growth of arable land devoted to the crop (%)	Average annual yield growth (%)	Average annual output growth (%)
Rice	344	0.4	1.8	2.2
Vegetables	313	4.4	1.5	6.0
Roots and tubers	239	0.1	1.2	1.3
Corn	127	1.0	2.7	3.8
Fruits	105	4.7	1.2	5.9
Wheat	100	0.1	4.0	4.1
Oil crops	41	2.2	3.7	5.8
Other Cereals	15	-3.5	1.4	-2.2

Source: J. Dixon and A. Gulliver with D. Gibbon (2001). *Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World* (Rome, FAO).

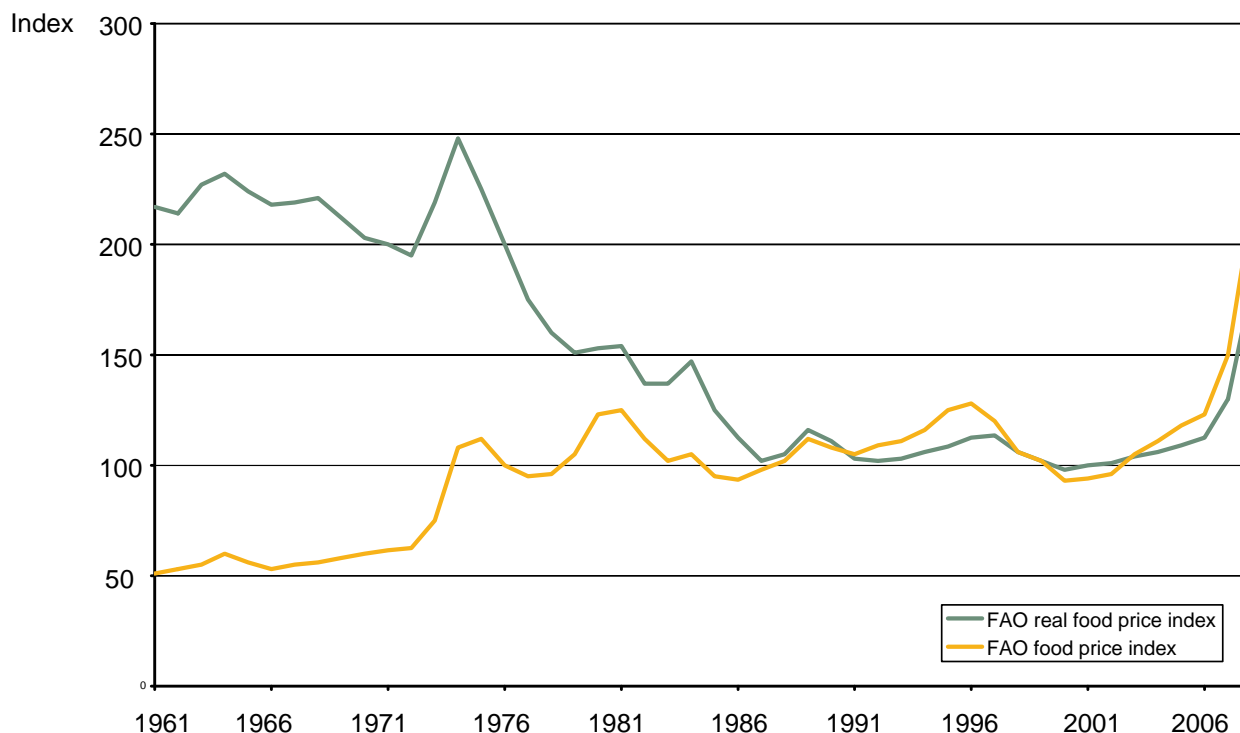
**Table II-4 – South Asia, arable land use, crop yields, and output, 1970 to 2000**

Crop	Production in 2000, (million tons)	Average annual growth of arable land devoted to the crop (%)	Average annual yield growth (%)	Average annual output growth (%)
Rice	184	0.5	2.0	2.5
Wheat	98	1.4	2.8	4.3
Vegetables	71	1.7	1.2	3.0
Fruits	40	3.0	1.2	4.3
Pulses	15	0.3	0.2	0.5
Corn	14	0.4	1.0	1.6
Millet	10	-1.7	0.7	-1.0
Oil crops	10	1.3	1.4	2.6
Sorghum	10	-1.6	0.7	0.5

Source: J. Dixon and A. Gulliver with D. Gibbon (2001). *Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World* (Rome, FAO).

In contrast to the sluggish growth in cereal production, from 1996 to 2006, overall meat production rose by 40 per cent, growing at an average of 5 per cent per year. Milk production also grew by one third over this period, at an average rate of 3.8 per cent annually. And there was a phenomenal increase in egg output – by 19 per cent per year. Egg production over the decade increased especially rapidly in South Asia (India, Pakistan, Nepal and Sri Lanka) and Central Asia (Tajikistan and Uzbekistan) – for both subregions at about twice the regional average.<sup>52</sup>

With yields and output going up, real food prices fell. Between the early 1960s and the mid-1980s the FAO global real food price index roughly halved (Figure II-3). This represents, on average, a very substantial improvement in purchasing power for households that typically spend between one-third and two-thirds of total earnings on basic food items. Subsequently, however, progress seemed to stall, and real food prices remained at similar levels for several years.

**Figure II-3 – FAO index of real food prices, 1961 to 2008**

Source: FAO (2008). *The State of Food Insecurity in the World 2008: High food prices and food security – threats and opportunities* (Rome, FAO).

### Security through trade

Food availability depends not just on production, however, but also on international trade. A number of countries have at times aimed for national food self-sufficiency. However, in many cases, a more realistic objective is what is termed food self-reliance – which means being able to earn sufficient foreign exchange from other exports so as to be able to import food.

The Asia-Pacific region has 25 net food-importing countries; six are low-income and 11 are lower middle-income countries (Table II-5). Much of this trade takes place within the region. Viet Nam, for example, is a major exporter of rice to the Philippines and Malaysia, while Thailand is a major exporter to China and Singapore. China, for its part is a major source of meat and fruit (Table II-6).

**Table II-5 – Net food importers and exporters in Asia and the Pacific**

	Low-income	Lower middle-income	Upper middle-income	High-income	Total
Importers	Bangladesh Cambodia Kyrgyzstan Nepal Pakistan Tajikistan	Armenia Azerbaijan Georgia Islamic Republic of Iran Kiribati Maldives Mongolia Philippines Samoa Turkmenistan Vanuatu	Kazakhstan Russian Federation	Hong Kong, China Japan Macao, China New Caledonia Republic of Korea Singapore	<b>25</b>
Exporters	Papua New Guinea Viet Nam	China India Indonesia Sri Lanka Thailand	Fiji Malaysia Turkey	Australia New Zealand	<b>12</b>

Note: Income status is based on the World Bank Atlas classification (2007).

Sources: The net food trade position is calculated based on the simple average of 2004-2006 or 2007 (when available) food import and export data. Food is defined as SITC (Rev 3) 0+1+22+4 categories. Trade flows data are COMTRADE data downloaded from using WITS (October 2008).

**Table II-6 – Selected products exported and imported by Asia-Pacific developing countries**

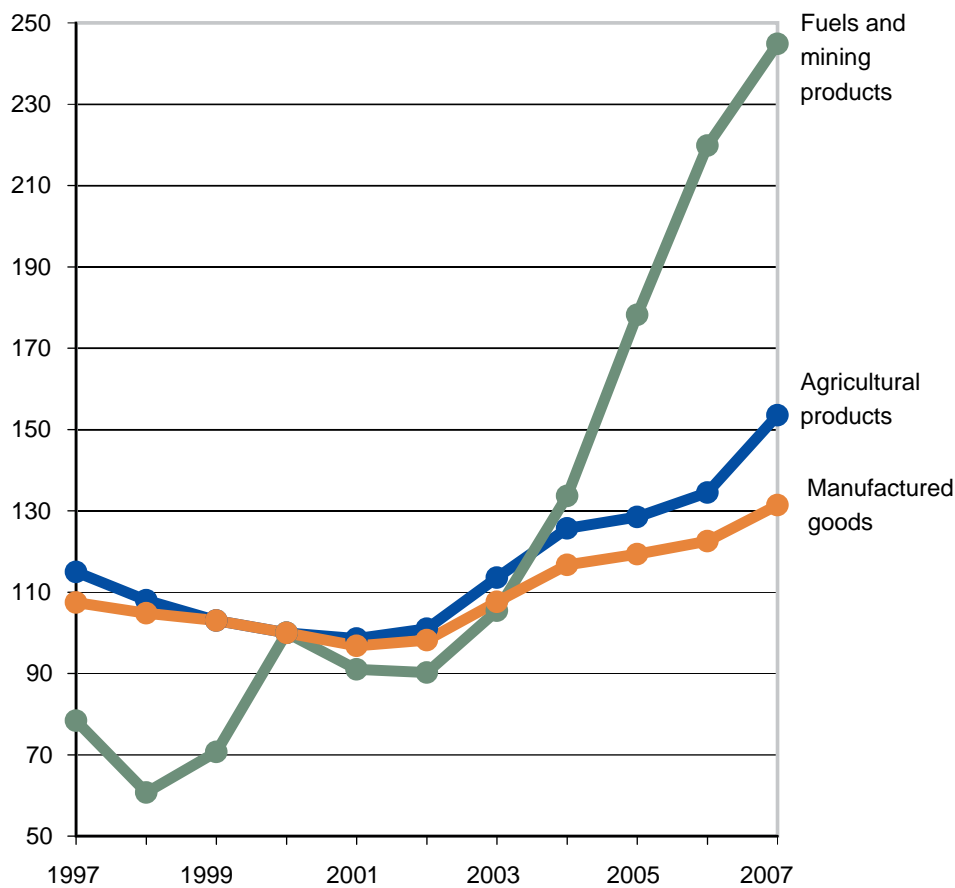
	Exporters	Importers
Rice	Viet Nam	Philippines, Malaysia
	Pakistan	Islamic Republic of Iran
	India	Saudi Arabia
	Thailand	China; Hong Kong, China; Malaysia; Singapore
Maize	China	Republic of Korea, Malaysia
Frozen beef	India	Malaysia, Philippines
Frozen pork	China	Hong Kong, China; Singapore
Bananas	Philippines	Republic of Korea, China
Apples	China	Indonesia, Thailand, Singapore, Philippines, Hong Kong, China; Malaysia
Black fermented tea	Sri Lanka	Islamic Republic of Iran; Pakistan; Hong Kong, China
Crude palm oil	Indonesia	India, Malaysia
	Malaysia	India, Pakistan, China
Palm oil and its fractions	Indonesia	China, Pakistan, India
	Malaysia	China, Pakistan, Turkey
Cocoa beans	Indonesia	Malaysia, Singapore, China

Source: Stevens, C., J. Kennan and M. Meyn (2007). "South-South Trade in Special Products", ICSTD Issue Paper No. 8, June 2007.

Countries which aim to deliver food security through self-reliance – by exchanging their exports for a sufficient amount of food – need to be concerned about the terms of trade – the ratio of export-to-import prices. In the past, the region’s successful exporters of manufactured goods might have presumed they had little to worry about. However, recent price shocks and the potential for future food price volatility now make some of these self-reliance strategies less secure. Figure II-4 shows, for example, that since 2000 there has been a widening gap between the unit values of manufactured goods and agricultural products – implying that more manufactured goods will have to be exported to import sufficient food.

Moving food and agricultural produce from place of production to consumers often involves crossing national borders. In order to do so, in addition to dealing with transportation issues, traders must pay appropriate trade taxes and prove that goods crossing the border meet all required health and other standards and comply with other trade procedures. Frequently, this process requires submission of multiple documents, takes a long time and increases costs of food for consumers which has the effect of reducing the economic access of people to food, while reducing its nutritional quality. Many countries in the region could gain much more from the international trade in food if their logistics could be improved (Box II-2).

**Figure II-4 – Export unit values, for fuels, manufactured goods and agricultural products**



Source: World Trade Organization (2008). *International Trade Statistics 2008* (Geneva, WTO).

## Box II-2 – Better logistics can open up new food markets

The supply chain for perishable foods, such as fruits and vegetables, is very complex because it is time- and temperature-sensitive. As a result, most of the global exports of fruits and vegetables originate from relatively few countries that can offer efficient storage and handling facilities and swift customs clearance procedures. Delays in India mean that it has a relatively small share of international markets. India produces 11 per cent of the world's vegetables and 15 per cent of the fruit but has only 1 per cent of global exports.<sup>53</sup>

A large portion of delays and additional costs are associated with the preparation of trade and customs documents and inspections due to the lack of standardized documents. A single complete consignment transaction, from seller to buyer, can comprise up to 150 documents with duplicated information and data to be re-entered 42 times.<sup>54</sup> At the India-Bangladesh border, a consignment needs at least 22 different documents and over 55 signatures and at least 116 copies for the final approval.<sup>55</sup> Each country requires different sets, including customs declarations, certificates of origin, and cargo manifests, which exporters have to prepare on each side of the border before actual shipping of goods. In addition, more procedures in terms of sanitary and phytosanitary certification are required on agricultural products to verify that the exported products meet the health and other standards of the importing country.

Simplifying the complex and myriad trade and customs formalities, procedures and associated documentary requirements will be critical for developing countries in the region to make inroads in this lucrative market. Once trade procedures and documents are simplified, the introduction of standards-driven electronic trade documentation can significantly reduce paperwork and multiple permit procedures. The benefits can increase, if the standards-driven electronic trade documentation is used within a single window environment that allows parties to lodge standardized information and documents with a single entry point. If information is electronic, then individual data elements need only be submitted once.<sup>56</sup>

Thailand, for example, is introducing a national single window e-logistics system that will be fully operational in 2012 and is expected to cut by half the time for document preparation and clearance. The overall cost savings with this new system are estimated to be around \$1.5 billion per annum.<sup>57</sup>

## Food policies of the developed countries

Food availability in developing countries is also affected of course by the policies of the developed countries. The multilateral rules on trade in agriculture are summarized in Box II-3.



### Box II-3 – Multinational governance of trade in agricultural and food products

Multilateral trade governance in the area of agriculture and food products is still weak. Before 1995, most developed countries, excluding Australia and New Zealand, took advantage of opportunities to offer protection and subsidies to their own food producers, leading to over production, while most developing countries, influenced by the structural adjustment policies of the IMF and the World Bank, generally neglected agriculture, leading to underproduction.<sup>58</sup>

The establishment of the World Trade Organization (WTO) was accompanied by the Agreement on Agriculture whose main focus was to deal with overproduction, rather than to promote agriculture in developing countries.<sup>59</sup> This agreement, among other things, introduced disciplines in three areas:

*Import protection* – Rules were simplified and rationalized, so as to reduce import protection and enable cheaper imported foodstuffs. In countries like Indonesia and the Philippines, the reduction of import protection, combined with other domestic policies, caused their transformation from net rice exporters to net rice importers.

*Export subsidies* – These had to be defined in the country's schedules, and existing ones were to be reduced, both in terms of expenditure and quantity of exports covered.

*Domestic support for agriculture* – Policies were divided into those that distorted trade because they linked support payments to price of production (Amber box), and those that provided support with no such distortions (Green box). Another category of policies linked to supply control was later added as a Blue box.

The rules were negotiated at a time when governments of developing countries were focused on how to react to low-price competition from developed countries. Thus, no strong export restriction rules, which are needed when prices are high, were considered. The negotiation under the Doha Development Agenda Round, while still dominantly focused on the removal of distorting policies identified in the Uruguay Round, needs to use this opportunity to add rules on export restrictions. Furthermore, it needs to enlarge development policy space for developing countries through special products and special safeguard measures.

Relevant to food trade is another agreement from 1995 that concerns sanitary and phytosanitary measures -- the basic rules for food safety and animal and plant health standards needed to protect human, animal or plant life or health. These were not meant as a means of protection, though some developing countries are finding them a barrier to accessing international markets for high-value food products – fruit, vegetables, fish, meat, nuts and spices. However, there are also benefits for developing countries, if they adopt safer and more sustainable production practices.

The most controversial of the WTO agreements however, is the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), which has predominantly served the interests of developed countries in three areas: plant variety right protection, patenting and geographical indications. There has been criticism concerning compliance with the terms of TRIPS in these and other areas in developing countries. Box II-4 provides a telling account of the impact of TRIPS on small farmers in Asia.

The developed countries, with the notable exceptions of Australia and New Zealand, have generally taken advantage of a fairly lax regime to protect their local farmers. Available data on tariff and non-tariff protection show that agricultural imports in the OECD countries receive much more protection than non-agricultural imports

– from 3 times as much in the United States to almost 40 times as much in Norway.<sup>60</sup> Agricultural products remain the most protected product group in any type of trade arrangements of the OECD countries. This may have had the advantage of benefiting farmers in the richer countries, but it has harmed those in developing countries (Box II-4).

#### Box II-4 – A farmer's perspective on TRIPS

“I farm a 2.6 hectare area where I grow rice, corn, various vegetables, fruit trees and root crops. I am one of the 34 practising rice breeders in Magsasaka at Siyentipiko Para sa Pag-unlad ng Agrikultura (MASIPAG), and my farm is my laboratory. It is also here where I do on-the-job coaching for other farmers who want to learn how to do systematic breeding. It was during a meeting in MASIPAG in 1998 that I first came to hear about the Trade-Related Aspects of Intellectual Property Rights (TRIPS). After three months of educating and consulting with other grassroots members in Negros, we organized a mass mobilization against TRIPS in which 7,000 farmers and their support groups participated. As a farmer-breeder, the impact of putting these intellectual property systems in place can be summarized in four points:

Privatization of genetic resources – TRIPS enforces the private ownership of genetic resources. This will restrict access to seeds for planting and breeding materials, a factor which is sure to affect crop improvement, both in the big institutions and on farms. TRIPS means monopoly control and ownership which is contrary to the free sharing that we farmers have been practicing for generations. Scientists will not be willing to exchange materials freely anymore and farmer-breeders like me, will lose the most.

Promotion of the wrong agricultural agenda – TRIPS will push agricultural research into the wrong direction: towards corporate agendas in public research, high value export crops rather than poor people's food crops, and uniformity in the field rather than diversity. In addition, our governments' research priorities are currently shifted to modern biotechnology at the expense of research and development for sustainable agriculture which is more useful to the majority of our farmers who are small.

Restriction to saving, exchanging and selling of seeds – Taking care of the seed is essential for small farmers to survive. But now with TRIPs, the act of saving, exchanging and selling seeds is being prohibited. For example, in the proposed Philippine Bill on Plant Variety Protection, it states that farmers are only allowed to save, exchange, and sell seeds if it is for non-commercial purposes and done in their own landholdings. But the reality is, 1.2 million farming families in the country are landless. This favours big resource-rich farms while putting aside the interest of resource-poor farmers.

Undermining farmers' rights – TRIPS tramples on our inherent rights as farmers, which have been established for thousands of years. How can someone suddenly claim ownership over genetic resources? And make farmers pay royalties on them! We Filipino farmers have been prey to this... scientists took the credit for the *burdagol* rice variety, which was in fact, developed by a farmer. Although there was no intellectual property right involved in this case, we can draw from this experience: how much worse it would be when the TRIPS regime is established.

We will not submit ourselves to such a regime, and continue to uphold our rights as farmers to do whatever is necessary to protect, conserve and improve our seeds which belong to all of us collectively, and to no one privately.”

(Excerpted from *Masipag News & Views*, Saturday, 22 September 2001)

Note on MASIPAG: In the Philippines, the failure of the Green Revolution pushed farmers and progressive scientists in 1985 to form an alternative agricultural research programme that would respond to the needs of poor farmers for an appropriate diversity of seeds and low-cost technology to fight the infertile soils, degraded farm environments and higher incidence of pest infestation associated with the Green Revolution.

MASIPAG trial farms, with a diversity of crop varieties and demonstration of yields (comparable to those of the prevalent Green Revolution high-yielding variety crops) is a powerful educational tool for the present generation of farmers, many of whom have almost lost the knowledge of traditional farming.

Changed from their previous high-yielding variety mono-cropping and chemical based farming, most MASIPAG farmers have increased their own food security and food production capacity, and gained control over diverse seeds. They have also recovered their dignity as farmers and paid off their debts, freeing income for social benefits.

Source: *MASIPAG farmers: Beyond putting food on the table* <<http://www.masipag.org/news>>

Some Asia-Pacific developing countries have seen regular import surges of food crops. For example, between 1982 and 2003, Indonesia, Mongolia, Papua New Guinea, Philippines, Sri Lanka and Tuvalu all had more than 120 import surges, with Sri Lanka recording the highest number at 170.<sup>61</sup> These have involved, for example, palm and soybean oil, bovine and poultry meats and coarse grains, along with sugar and eggs.<sup>62</sup> Of course some of these surges may be beneficial, helping countries overcome shortfalls in domestic supplies due to natural disasters. However, they are often a consequence of subsidized exports in richer countries which deprive local producers in poorer countries of opportunities to capture a market share for themselves. Every unit which is not produced --- but which could be produced --- represents a potential opportunity lost for creating

employment and income and for strengthening food security.

With cheap subsidized food pouring into international markets, developing countries that had been self-sufficient, or even net exporters for a number of food items, became net importers. Fiji, for example, in 1986 was 75 per cent self-sufficient in rice but, due to deregulation and the influx of cheaper imports, that proportion is now down to 15 per cent.<sup>63</sup> Moreover, across the Pacific islands, imported rice and wheat have been displacing traditional foods and have contributed to the rise in heart diseases, obesity, diabetes and other health complications. Some of the blame for weak agricultural performance, however, also lies with the developing countries, which have neglected agriculture and particularly the potential of smallholder food producers.

## Market-based food insecurity

Even when food is available, from local production or imports, people may not have physical access to the food (Box II-5).

determine who will be food insecure and for how long. Importantly, markets transmit the effects of macroeconomic growth. The problem of food insecurity, like that of poverty, is thus frequently traceable not to chronic structural deficits, but to macroeconomic conditions and market failures.

### Box II-5 – Transport and physical access to food

Where households do not produce sufficient food for their own needs, the challenge is to make food continuously available at local outlets. In the mountainous regions of China, India and Nepal, for example, people have to walk miles through rugged terrain to buy food – a severe problem for millions of people, especially those with disabilities, older persons, the frail and the sick.

A study of rural roads in Indonesia, Philippines and Sri Lanka found that a large part of each community was affected by lack of food at critical points of the year. Overall, 74 per cent of all survey respondents reported facing some food shortages.<sup>64</sup>

The provision of rural transport infrastructure and services assists people in remote areas not only in gaining easier physical access to food, but also easier access to potable water. The carrying of water by women and children is extensively practised in rural areas. In this respect, improvement of rural roads, tracks and paths can reduce the burden and time taken, as well as facilitate the use of vehicles, motorized and non-motorized.

Furthermore, people may not have economic access to food, that is, they may not have the cash to be able to buy food. Households may not be able to afford food. These physical and economic access issues are problems faced by both the rural and urban poor.

Even in the region's food-exporting countries, many rural households are net purchasers of food. Viet Nam, for example, is the world's second largest exporter of rice. Yet even in the country's "rice basket" areas, nearly half the population sells more rice than it buys: 47 per cent in the Mekong Delta and 45 per cent in the Red River Delta.<sup>65</sup>

Indeed for large numbers of people, the primary source of food security is their income – either from producing non-food goods or selling their labour. Under these circumstances, much depends on the terms of trade in markets – and the institutions and policies which influence their operations and help

During China's last famine, between 1958 and 1961, millions died from causes related to food insecurity, while the country was in a position to sell grain on the international market.<sup>66</sup>

Food may also fail to reach the poor because of the operations of exploitative intermediaries.<sup>67</sup> Landowners, for example, exploit sharecroppers and tenants, robbing them of their produce. But among the worst offenders are the moneylenders. Farmers all over the world usually need credit. But, if they are smallholders with little collateral, they can be charged exorbitant interest rates, in some cases borrowing from money lenders at 25 per cent per 100 days.<sup>68</sup> In India, farmers with no way of escaping their debts have been driven to suicide. Others effectively become bonded labourers. People who cannot repay are compelled to work for their creditors – but the interest rates are so high and the wages so low that the debt just keeps piling up.<sup>69</sup>

Farmers can also be exploited by traders. Desperate for cash, small and marginal farmers are forced to sell their crops immediately after the harvest to middlemen, when the prices are lowest, to meet pressing needs and often to repay loans taken for the very same agricultural operation. Then the same farmers have to buy back some of their agricultural produce at a much higher price – while also devoting much of their energies and resources to debt servicing.

Most of the worst forms of exploitation take place in the private sector, but some occur in the public sector. Government banks and agencies whose task is to protect the poor may themselves practise forms of exploitation. This may be through the imposition of heavy levies.<sup>70</sup>

Added to formal charges are the costs of corruption which acts as an informal system of taxation. Several Asian countries head Transparency International's Corruption Perceptions Index of 2008.

### **Food absorption and utilization**

Even when food is available in the household, some family members may not be able to take advantage of it – hampered by inadequate water supplies and poor standards of sanitation which reduce the quality of their food or make it hazardous.

For water supplies, there have been some improvements. Many more people across the region – on average 88 per cent – now have access to improved drinking water sources. The proportion is, however, lower in the least developed countries and landlocked developing countries which have access rates of only around 70 per cent, while the Pacific developing economies are even further behind, at 49 per cent. Progress has been slower for sanitation. Only around 55 per cent of people in the region have access to improved sanitation facilities – such as household toilets or latrines connected to piped sewerage systems or ventilated improved pit latrines.<sup>71</sup> Without reliable water supplies and basic sanitation, children especially

are constantly exposed to infections and diseases that not only threaten their lives directly, but also prevent their absorption of many essential nutrients.

In fact, many children start their lives undernourished as low birthweight babies. Low birthweight is a serious problem in South Asia.<sup>72</sup> Around one-third of children in India and Bangladesh are born underweight. Low birthweight babies tend to have persistent health problems and their development is impaired. Children are likely to be born underweight if their mothers are undernourished, before and after pregnancy. Another risk factor is short stature in the mother, which itself is often a legacy of undernutrition in her own childhood – thus perpetuating an intergenerational cycle of malnutrition.

### *Quality and safety*

Both children and adults need safe food. For babies, this is best assured by exclusive breast feeding for the first six months of their lives, since breast milk provides all the energy and nutrients that infants need and promotes sensory and cognitive development, as well as protection against infectious and chronic diseases.<sup>73</sup> Subsequently, this should be complemented with foods that are sufficiently dense in calories and nutrients.<sup>74</sup>

Older children and adults also have to be concerned about food contamination. This is partly because of the increasing use of chemical products in food production, but also as a result of transportation to cities – which is often in open vans or motorbikes subjected to air pollution. There are also risks in the way that food is conserved, with the addition of chemical agents and hazardous colourings – as well as the dangers of breaks in the cold chain. With many people eating outside the home, it is also vital to ensure strict control over the ways that street vendors and restaurants prepare, display and store food.

## The 2008 food price crisis

Since the 1970s, the demand for food had thus been rising. Production initially rose even faster, so prices fell. Eventually, however, the downward trend in food prices of the 1980s and 1990s reversed in the early 2000s, after world stocks of wheat, maize and rice dropped to 30-year lows. The drop in stocks, which resulted from production lagging significantly behind consumption, caused food prices to rise sharply. The price increase accelerated from 9 per cent in 2006 to 23 per cent in 2007 and 51 per cent between January-June 2007 and January-June 2008.

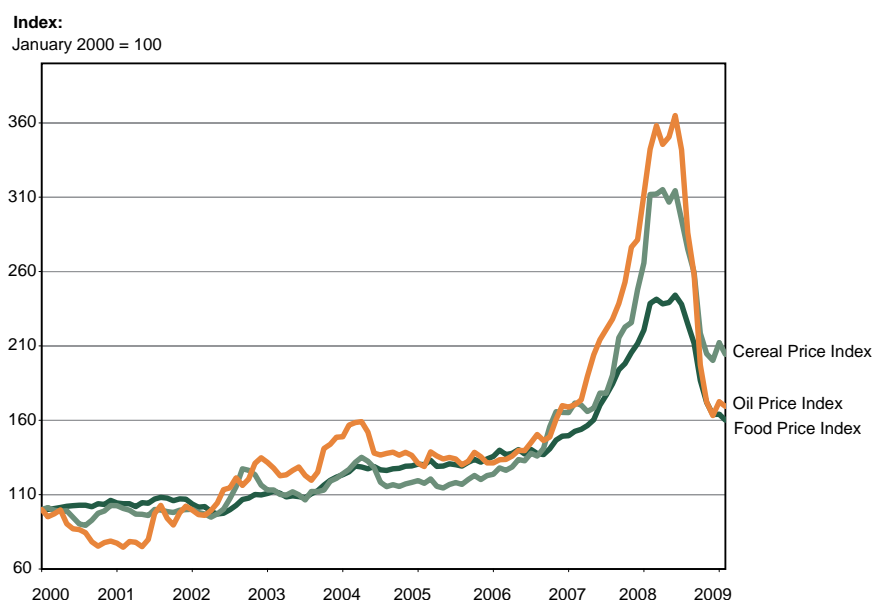
In sympathy with global prices, national prices rose too. Domestic wheat prices, for example, increased by 36 to 100 per cent in Bangladesh, Mongolia, Pakistan, Kyrgyzstan, Tajikistan and Sri Lanka.<sup>75</sup> Rice prices also rose steeply. For example, between 2006 and 2007, the price of rice doubled in Bangladesh.<sup>76</sup> The increase in domestic rice prices was particularly steep in the first half of 2008. Between January and July of 2008, the retail price of rice increased by 76 per cent in Ulaan Baatar, 65 per cent in Hanoi and 54 per cent in Karachi.<sup>77</sup> Not surprisingly,

among Asian countries, Mongolia and Viet Nam experienced the fastest increases in food prices in early 2008.<sup>78</sup>

To some extent, price rises are beneficial. They boost the incomes of rural producers, and in China, in particular, have helped reduce rural poverty. They also improve the trade balances of net food exporters. And, in the longer term, higher prices should in principle stimulate investment in agriculture – for example by bringing new areas under irrigation. But high prices hurt many marginalized groups, especially the rural landless and the urban poor, who tend to spend half or more of their family budgets on food. The high prices are thus felt more sharply in the region's poorer countries – indeed the latest food crisis resulted in social turbulence or even food riots in over 30 countries from Bangladesh to Indonesia and contributed to the fall of at least one elected government.<sup>79</sup>

To see why, one can look more closely at the causes of the sudden spikes in 2007 and 2008. As indicated in Figure II-5, much of this spike was driven by the rise in the price of cereals, so the following discussion will focus on wheat, corn and rice.

**Figure II-5 – FAO nominal price indices for oil, food and cereals, 2000-2009**



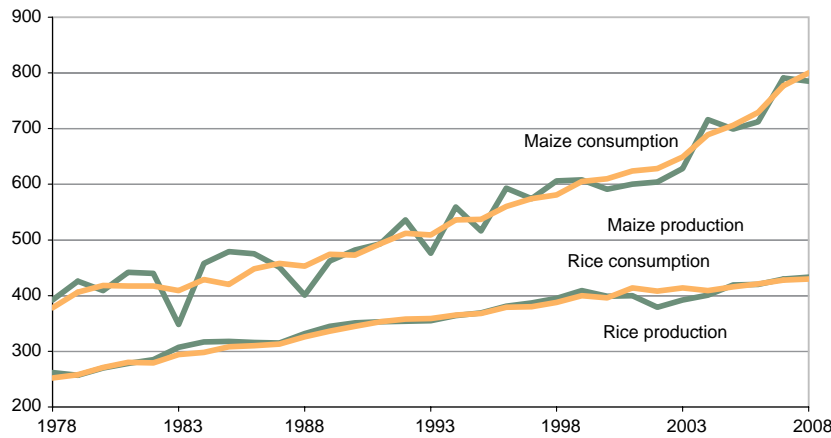
As shown in Figure II-6, in the early 2000s world production of maize and rice lagged significantly behind consumption for four years. These episodes, which resulted in large drops in cereals stocks, are not unusual. Over the past 30 years or so, production of maize and wheat has on occasion fallen substantially below consumption, usually as the result of major crop failures in important production areas, but production has usually recovered briskly the following year.

Stocks fell basically because demand was increasing while global production, though also rising, failed to keep pace.

*Increases in demand*

Why has demand for cereals continued to surge? One factor has been the growth of the middle class throughout the world, including the Asia-Pacific region. This is not because they are consuming more grains directly but because they are eating more meat, which comes largely from grain-fed livestock. On a world average, each kilo of beef requires eight kilos of grain.<sup>80</sup>

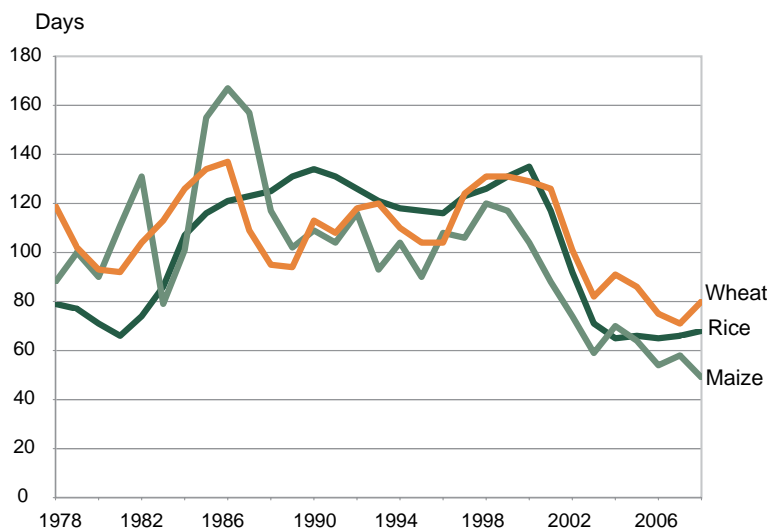
**Figure II-6 – Multi-year episodes of cereal production falling behind consumption between 1978 and 2008**



As a result of such shortfalls, since their peaks in the late 1990s to 2008, the world stocks of these three cereals dropped markedly: wheat by 31 per cent, maize by 59 per cent and rice by 50 per cent – reaching their lowest levels in 30 years (Figure II-7).

Over the past decade, Chinese domestic consumption of milk and dairy has risen by more than 500 per cent. But the demand for food in China should not be overplayed. China has not just consumed more, it has also produced more

**Figure II-7 – World grain stocks, in days of consumption, 1978-2008**



– indeed it can provide more than 95 per cent of its needs in wheat, maize and rice. Nevertheless, China does import substantial quantities of food commodities, particularly soybean, mostly for animal feed, for which it imports 40 per cent<sup>81</sup> of global production. Greater consumption in China has certainly affected world prices.

In order to assess the roles of China and India in pushing up global food demand, Table II-7 breaks down the increase in the world's consumption of maize, rice, and wheat over 1999–2008 by selected countries and regions. China and India clearly boosted demand of some cereals. In the case of maize, for example, world demand increased by 197 million tons, of which 21 per cent was in China and 2 per cent was in India. India also accounted for 35 per cent of the increase in rice demand and 12 per cent of the increase for wheat. On the other hand, China, as it consumed more meat and dairy products, actually consumed less rice and wheat. In fact, as Table II-7 makes clear, most of the increase in global demand came from elsewhere, primarily from the United States and the European Union. Taking into account that China and India represent around 27 per cent of the world population, their joint contribution to the increase in the demand for cereals between 1999 and 2008 was significant but unremarkable.

### *The impact of high oil prices*

Another major factor in the recent food price rises has been the steep hikes in oil prices. The correlation between the two is clear from Figure II-5, as nominal food and cereal prices seemed to move in lock-step. This is confirmed by regression analyses of the IMF food price index and the oil price index: for the period 1990–1999, the correlation was relatively weak (an  $R^2$  of only 0.06) while for the period 1998–2000 the correlation was much stronger (an  $R^2$  of 0.91).<sup>82</sup>

The correlation grew tighter partly because of the increase in the cost of fertilizers. The main fossil fuel input for fertilizer is actually natural gas, but since for many uses gas can be substituted for oil, a rise in oil prices is transmitted to gas prices, thus pushing up fertilizer costs.

Rising oil prices also assumed greater significance, as agriculture became more energy intensive. Farmers nowadays are using much more electricity or diesel to run pump sets for irrigation, especially in the Green Revolution areas that plant high-yielding seeds. In addition, more food is being traded internationally over greater distances, adding to the transport costs of 'food miles'.

**Table II-7 – China and India's contribution to the global increase in cereal demand**

**Increase in cereals domestic consumption between 1999 and 2008 (tons '000)**

	Maize		Rice		Wheat	
	Tons (millions)	Percent of World	Tons (millions)	Percent of World	Tons (millions)	Percent of World
World	197.3	100%	31.2	100%	72.5	100%
United States	78.9	40%	0.2	1%	0.1	0%
EU-27	3.4	2%	0.2	1%	18.3	25%
China	40.7	21%	-6.6	-21%	-2.3	-3%
India	4.8	2%	10.9	35%	8.8	12%
Rest of the world	69.6	35%	26.5	85%	47.6	66%

Note: Domestic consumption includes all possible uses of the commodity: food, feed, seed, industrial processing, and waste.

Source: ESCAP, based on USDA. Foreign Agricultural Service (FAS) Production, Supply and Distribution Datasets <<http://www.fas.usda.gov/psdonline/psdDownload.aspx>> (accessed on 24 October 2008).



A third way in which the prices for oil and food have become more closely linked is through biofuels. Partly as a result of massive subsidies, land has rapidly been diverted from grain and oilseeds into production of biofuels – creating a shock in the already unstable international agricultural market.<sup>83</sup>

### *Decelerating food productivity*

While the demand for grain has been rising, productivity has failed to keep pace. Between 1970-1990 and 1990-2005, the global average annual rate of growth in grain yield (production per unit of land per season) dropped from 2.7 to 1.2 per cent.<sup>84</sup> During the same period, the global average annual rate of growth in land area also dropped significantly, from 0.7 to 0.2 per cent.

The decline in yield growth is largely the consequence of a neglect of investment in agriculture over the last decade or so.<sup>85</sup> Governments have added to these problems through policies that have discriminated against agriculture. Agriculture, in many parts of the region, continues to be hampered by structural constraints, such as inequality in land ownership, inadequate rural infrastructure and low levels of education and health in the workforce.<sup>86</sup>

Nor have governments offered sufficient rural credit or put enough weight behind research and development and extension services. While food was cheap, governments felt less need to invest in agriculture. In fact, most of the investment recently has been in biotechnology in the United States and a few other affluent nations. The governments of some developing nations – notably Brazil, China and India – also provide substantial support for research and development, including biotechnology. But elsewhere in the developing world, this support has dwindled to very low levels.<sup>87</sup> This has also been reflected in weaker support for the international agricultural research centres. For example, the International Rice Research Institute, which was the source of most of the breakthrough gains of the Green Revolution in tropical Asia during the 1960s and

1970s, saw its budget fall in inflation-adjusted terms from \$55 million per year in 1992 to under \$30 million by 2004.<sup>88</sup> Added to this, there has been little progress in rural development generally which has suffered from declining official development assistance.<sup>89</sup>

United Nations Secretary-General Ban Ki-moon has called for this trend to be reversed, for a renewed commitment to research and development. The “overall price tag for national governments and international donors,” the Secretary-General states, “could exceed \$15 to \$20 billion annually, over a number of years.”<sup>90</sup>

Thus far, however, farmers have had few incentives to step up production. The outcome is evident in Figure II-6. Some of this lag in production may well have been because a buoyant world economy offered better-paying job opportunities in the cities. But farmers will also have been responding to low prices. It is noticeable that these multi-year episodes of lagging cereal production followed dramatic drops in cereal prices – more than 50 per cent – between May 1996 and August 2000.

### *Climate change and disasters*

Agriculture and food output have always been disrupted by extreme climatic events, and over the past 20 years, probably as a result of climate change, they seem to have become more frequent and intense. One of the main contributing factors to the 2007-2009 increases, for example, was six years of drought in Australia which reduced the country’s rice crop by 98 per cent and contributed to a doubling of rice prices in the first four months of 2008.<sup>91</sup>

### *Speculation*

The factors listed earlier led to a dramatic drop in grain stocks which made it much more difficult for governments to intervene by distributing grain from national stocks. While speculation is not a driver of commodity prices, it can nevertheless accelerate and amplify price movements driven by fundamental supply and demand factors.

Given how steeply food prices increased and how fast they fell in 2008, it is likely that the growing presence of financial investors in commodity markets made prices over-react to new market information and deviate from fundamentals. Low reserves invite speculative attacks because the time taken to replenish stocks encourages speculators to bet that prices will continue going up.<sup>92</sup>

Investors have certainly become much more interested in trading in commodity futures. Between end 2005 and March 2008, commodity futures contracts more than doubled – to \$400 billion.<sup>93</sup> These investors, including those for index funds and hedge funds, were looking to diversify from stocks and bonds, and were attracted to commodities, often in the mistaken belief that commodity markets were experiencing a ‘super cycle’ – a long-term trend that would drive prices higher for years to come.<sup>94</sup>

In principle, speculators can play a useful role in commodity markets, providing liquidity and facilitating price discovery. But they seem to be changing in character. In the past, speculators have tended to move in and out of commodity markets in response to supply and demand factors. But the new breed of speculators was different. They were less concerned with short-term changes in fundamentals, and many tended to bet only that commodity prices would rise.<sup>95</sup>

This in itself should push up prices – at least in the short-term. The arrival of speculators at times of short supply will make prices more volatile. But whether they affect longer-term prices, over a period of a year or more, is less certain. Futures contracts are largely electronic transactions that are typically wound up long before any physical goods change hands. The only way in which futures prices can affect cash prices is if they signal to sellers that they should hoard grains. Whether this actually happened on a large scale is difficult to discern, since the data on overall food inventories do not seem to indicate any hoarding.<sup>96</sup> Nevertheless, hoarding may take place over shorter periods than would be reflected in the inventory data. In India and the Philippines, for

example, in the first four months of 2008, large warehouses were thought to be hoarding rice.<sup>97</sup>

Futures speculation may thus influence cash prices to some extent, but it is generally more likely to accelerate or amplify price movements that are driven by fundamental factors of supply and demand.<sup>98</sup> Financial investors are thus likely to heighten volatility, as they respond to new market information, causing prices to change more quickly or to overshoot.<sup>99</sup>

## Respite

The year 2008 was understandably seen as a year of food crisis. But then, even more suddenly, with the onset of a global recession prices started to fall again, and by early 2009 were back in real terms at around 2006 levels. Does this mean that the food crisis too has melted away? No. This has been a temporary respite. While forecasting future prices is particularly difficult in the present circumstances, once the industrial economies recover from the recession, both oil and food prices will probably start to rise again.<sup>100</sup> According to the International Energy Agency,<sup>101</sup> over the period 2008–2015 the price of crude oil will average \$100 per barrel at constant 2007 prices, and rise to \$120 in 2030. Food prices will rise again too. This will be partly because of resurgent demand, but also because the world faces threats to sustainable agriculture. These are the subject of the next chapter.





*Photo: Eric Roeder*

## THREATS TO SUSTAINABLE AGRICULTURE

**One of the keys to food security is sustainable agriculture. Farmers in Asia and the Pacific have, in many respects, been very successful. They have increased output and just about kept pace with demand. But in future they will find things steadily more difficult – faced with environmental degradation, climate change, and a series of other threats. Unless farmers, across Asia and the Pacific and elsewhere, can produce food not just efficiently but in ways that respect the environment, the food security outlook will be bleak.**

In some cases, people go short of food because of market shortages. But more often it is because they cannot buy the food that is available, or cannot make best use of it. These other causes of food insecurity are all too familiar: poverty, landlessness and multiple forms of discrimination against vulnerable groups that deny them access to food. But, it is now becoming clear that even food production itself could fall short – that the years of plentiful production are coming to an end. This chapter looks therefore at some of the future threats to sustainable agriculture.

In contrast to food security, there is no internationally agreed definition of sustainable agriculture. But, in short, sustainable agriculture can be considered as food production that integrates the goals of environmental health, economic profitability, and social and economic equity. The overriding principle is to meet the food needs of the present generation without compromising the rights of future generations (Box III-1).

### Box III-1 – What is sustainable agriculture?

Sustainable agriculture implies an integrated system of plant and animal production practices which over the long term:

- Satisfies human needs for food and fibre;
- Enhances environmental quality and the natural resource base;
- Uses non-renewable resources and on-farm resources efficiently;
- Integrates natural biological cycles and controls;
- Sustains the economic viability of farm operations;
- Enhances the quality of life for farmers and society as a whole.

Source: United States (1990). *Food, Agriculture, Conservation, and Trade Act of 1990* (Washington, D.C., Government Printing Office).

Sustainable agriculture involves stewardship of both natural and human resources. Stewardship of natural resources involves maintaining, regenerating or enhancing the natural environment to leave the food production base unimpaired. Stewardship of human resources entails ensuring the health of producers, and offering them sufficient income and decent working conditions, while also ensuring the health of consumers, by providing food that is safe and nutritious.

### **Expanding deserts**

One of the most critical threats to sustainable agriculture is land degradation. Vast areas of cropland, grassland, woodland and forest in Asia and the Pacific have already been lost, and many more are threatened. In South and South-East Asia, around 74 per cent of agricultural lands have been severely affected by erosion, by wind or water or chemical pollution.<sup>102</sup> In the worst cases, particularly in dry-land ecosystems, farmland can turn to desert. The problems are particularly severe in Central Asia. In Kazakhstan alone, around 66 per cent of the total land area is desertified.<sup>103</sup>

The Islamic Republic of Iran, too, has been losing its battle with the desert. In 2002, its Anti-Desertification Organization reported that sand storms had buried 124 villages in the south-eastern province of Sistan-Baluchestan. Drifting sands had covered grazing areas, starving livestock and depriving villagers of their livelihood. Neighbouring Afghanistan faces a similar situation. The Registan Desert is migrating westward, encroaching on agricultural areas. Sand dunes are moving onto agricultural land in the upper reaches of the Amu Darya Basin, their path cleared by the loss of stabilizing vegetation from firewood gathering and overgrazing. Dust storms carry away topsoil. Sand dunes 15 meters high have been blocking roads, forcing residents to establish new routes.

In many countries, including China, the implications of land degradation are grave. According to China's Ministry of Water Resources, the country's eroded land now extends

to more than 3.5 million square kilometres – 1.6 million of which have been lost as a result of erosion by water and 1.9 million by wind. If this process continues at its current rate over the next 50 years, crop output in north-eastern China could fall by as much as 40 per cent. In south-western China over the next 35 years, about 100 million people will risk losing their land. This has huge economic implications. In 2000, land degradation was thought to have cost 200 billion yuan (\$29 billion) – reducing China's GDP by 2.25 per cent.<sup>104</sup> Yet little is being done to reverse the processes – in 2004, the investment was just 1.63 billion yuan, 0.012 per cent of GDP.<sup>105</sup>

Across the region, much of the land degradation results from over-intensive cultivation. In order to meet their basic food needs, smallholders and the rural poor, growing annual food crops such as maize, have been pushed into using ecologically fragile areas, forced to crop intensively on steep slopes that are vulnerable to erosion. In China, the areas affected by land erosion are occupied by about three quarters of the country's poorest people.<sup>106</sup> The situation is similar in other countries, including mountainous areas of the Philippines and Thailand. In addition, farmers have been reducing the length of fallow periods, and ploughing up land previously reserved for grazing. Even crops like cassava that are well adapted to marginal lands can, if cropped over-intensively, rapidly deplete soil nutrients.

Much of the region's land degradation has also resulted from the over-use of mineral fertilizers. Over the period 1992 to 2002, countries such as India, the Lao People's Democratic Republic, Myanmar, the Philippines, Sri Lanka, Thailand and Viet Nam increased their use of mineral fertilizers by as much as 90 per cent – with detrimental effects on the structure and nutrient balance of the soil.<sup>107</sup>

Over-intensive livestock-keeping has also put pressure on range land. Herding communities prefer to maintain large herds as a form of insurance, so they have sufficient animals to rebuild their stock in the event of a drought. In

the past, overstocking has to some extent been contained by communal supervision of land, but population increases and encroachment by powerful factions have resulted in a breakdown in traditional systems of range management.

### Shrinking forests

Forests provide critical ecosystem services to the agricultural sector, including pollination and watershed protection, and support to fisheries. Millions of poor people and small-scale enterprises across the region depend on forests for food, fibre, fodder and other materials, but are finding this increasingly hard as the natural forests shrink.<sup>108</sup> A number of countries are experiencing rapid deforestation. Between 1990–2000 and 2000–2005, deforestation accelerated in Cambodia, Papua New Guinea, the Russian Federation and Viet Nam.<sup>109</sup> Some of this was a consequence of high fossil fuel prices that drove the poorest people to take more wood from forests. But, in many countries, deforestation is

principally caused by a rapacious timber industry. A significant proportion of this timber extraction is illegal – an estimated 20 per cent of that in the Russian Federation,<sup>110</sup> for example, and 30 per cent of that in Indonesia.<sup>111</sup>

At particular risk are mangrove forests. The Asia-Pacific region has around half the world's total area of mangroves, of which most are in South-East Asia.<sup>112</sup> These are under severe strain. In Bangladesh, India, Indonesia and Thailand, mangrove forests are being destroyed as a result of the extraction of timber and the discharge of domestic and industrial waste. But one of the greatest threats to mangrove ecosystems is export-oriented shrimp cultivation – which is degrading water supplies, reducing biodiversity and damaging the common fish stocks on which many communities rely for food and income. Moreover, shrimp cultivation is no longer confined to coastal zones; many inland areas are threatened by the blight of badly managed farms (Box III-2).

#### Box III-2 – The shrimp farm blight

Shrimp farms, which need large volumes of brackish water, were previously confined to relatively narrow bands of coastal land. Farmers have discovered, however, that it is both feasible and profitable to grow tiger shrimp inland by mixing hyper-saline water with freshwater drawn from irrigation canals or natural streams. Small-scale tiger shrimp farms are now common in traditional rice-growing areas in Thailand and India.

Shrimp ponds, both coastal and inland, have severe environmental impact. They use copious amounts of artificial feed, pesticides, chemical additives and antibiotics. When the wastewater, which also has shrimp excrement and is high in organic matter, is pumped into the surrounding environment it pollutes coastal waterways and groundwater, poisoning native flora and fauna and making alternative cropping nearly impossible.

The lifespan of an intensive shrimp farm is between five and 10 years, though some are forced to shut down within two years after choking on their own pollution. Once the farm is abandoned, it is expensive and difficult to rehabilitate the land. Indeed, the bottom soil of an abandoned shrimp pond is often too saline ever to be used for agriculture again.

Source: Lester R. Brown (2008). *PLAN B 3.0 Mobilizing to Save Civilization* (New York, Earth Policy Institute).

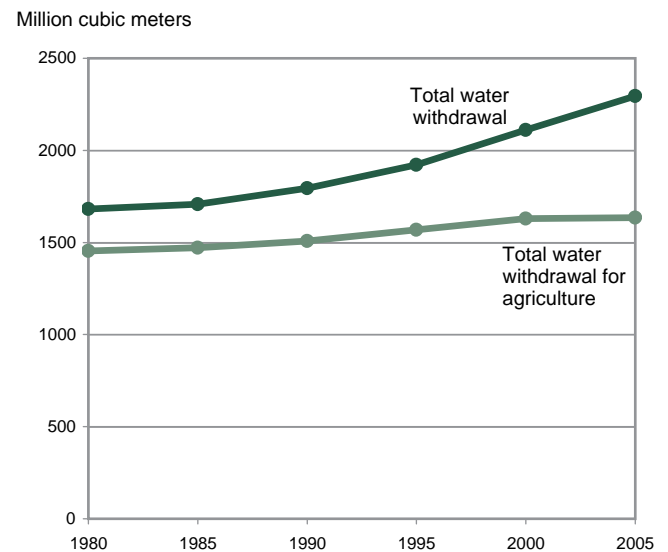
## Competing for water

The Green Revolution in Asia and the Pacific was based on more intensive use of a number of inputs, but particularly water. Today, almost 40 per cent of world food production comes from irrigated land. Ample water is critical for the region's main staple food, rice, which requires two or three times more water than other cereals, including millets and sorghum which belong to the category known as secondary crops.<sup>113</sup> Around 90 per cent of world rice production is under 'ponded' water culture.

Nevertheless, in recent years most of the increase in water withdrawal (Figure III-1) has come not from agriculture but from rising domestic consumption and increasingly thirsty industrial processes. Agriculture's share has fallen—especially in North-East Asia. In China, Japan, the Republic of Korea and Mongolia, between 1990 and 2005, the proportion of water withdrawn for agriculture fell from 84 to 53 per cent.

There is some economic logic to this since industry creates greater economic value per litre of water. It has been estimated, for example, that while it takes 1,300 litres of water to produce a kilo of rice, it takes only 363 litres to produce a kilo of car. Consequently, per litre of embedded water, the car is in economic terms more than 130 times more valuable.<sup>114</sup>

**Figure III-1 – Water withdrawal since 1980 in Asia and the Pacific**



Source: FAOSTAT data <<http://faostat.fao.org/>> (accessed in October 2008).

In aggregate, all users whether domestic, industrial or agricultural have been consistently withdrawing more water than the natural hydrological cycle's renewable capacity. Agriculture must take its share of the blame. In many countries, irrigation systems, along with fuel and electricity supplies, have been subsidized. This has weakened price signals, tempting farmers to take too much water from rivers, over-pump groundwater and generally waste freshwater resources. In India, for example, during the last 40 years, the Governments of Rajasthan, Haryana and Punjab have supported irrigation agriculture by subsidizing diesel and electricity. As a result, groundwater levels have dropped dramatically and in some parts of Rajasthan, wells have dried up completely.<sup>115</sup> Farmers usually lack the financial resources and information to invest in more expensive water-saving technologies, like drip irrigation infrastructure or storage.

Even greater flows of water will be needed as populations get richer. With more money at their disposal, households are seeking healthier and better balanced diets, and consumers want more fresh vegetables and fruits, which are often produced under intensive farming methods, using



irrigation for year-round production.<sup>116</sup> Diets are also changing to include more dairy and meat products which, compared with cereals, have a high proportion of embedded water. Producing one kilogram of wheat requires one cubic metre of water; producing one kilogram of beef requires 15 times as much.

Globally, 15 to 35 per cent of total water withdrawals for irrigated agriculture are estimated to be unsustainable – that is, the use of water exceeds the renewable supply.<sup>117</sup> In Asia and the Pacific, this intensive withdrawal has depleted aquifers, particularly in South Asia and China. It has also reduced the flow of major rivers like the Ganges, the Yellow River, the Amu Darya, the Syr Darya and the Chao Phraya.<sup>118</sup> One of the most frequently cited examples is the water extraction which has been drying up the Aral Sea in Central Asia. If food prices increase, this situation may worsen, as even schemes previously considered uneconomic become more necessary.

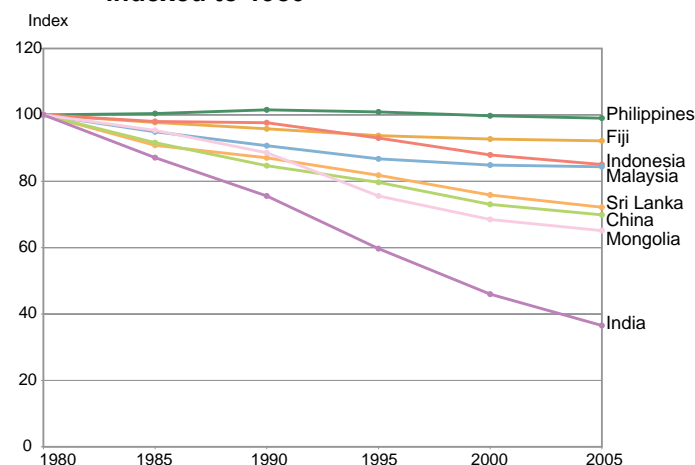
Over-extraction is a threat not just to the quantity of available water but also its quality. Particularly in coastal aquifers, the extraction of fresh water and the consequent sinking of the water table have allowed the intrusion of saline water. Today, nearly 40 per cent of irrigated land in dry areas of Asia is thought to be affected by salinization which reduces crop productivity.<sup>119</sup> There are also many other forms of contamination. Fertilizers and pesticides, for example, have contaminated aquifers and waterways with nitrogen, phosphorous and highly toxic heavy metals such as copper and zinc.<sup>120</sup> Animal wastes too have been polluting waterways. In the 1990s China, Viet Nam and Thailand, for example, almost doubled their production of pigs and poultry, and in coastal areas of the South China Sea these operations have become the major source of nutrient pollution.<sup>121</sup>

Another major contributor to water degradation is urbanization, particularly from smaller cities of fewer than 500,000 people which are often poor at managing waste water. On current trends, water

pollution, particularly from households in mid-size and smaller cities, will increase fivefold.<sup>122</sup> This has serious consequences for farming communities downstream whose surface and ground water becomes unsuitable for agriculture, as well as those relying on river fishing.

As a result of both over extraction and pollution, many countries are already facing water stress. This can be assessed using the ‘index of water available for development’, calculated per capita as the country’s internal renewable water resources minus total water used. Figure III-2 shows the trend for selected countries in the region since 1980, indicating steep declines, notably in India, in the water available for human, economic and ecological use.

**Figure III-2 – Index of water available for development, selected countries, indexed to 1980**



Source: FAOSTAT data <<http://faostat.fao.org/>> (accessed in October 2008).

Water shortfalls on this scale heighten competition for a precious resource and frequently lead to conflicts, which are emerging as new threats to social stability. During the 1990s, China alone is thought to have had over 120,000 disputes related to water. India too has many water conflicts – such as the disputes between the states of Tamilnadu and Karnataka over their shares of water from the river Krishna. In the autumn of 2004, four people were killed and 30 more injured in protests by farmers over allocations of water from the Indira

Gandhi Canal in the Sriganganagar District of Rajasthan.<sup>123</sup>

Food security is also threatened by water withdrawal for factories. Industries can afford more powerful pumps and withdraw a larger share of water than farmers, who may be relying on the same source for irrigation. In November 2007, some 30,000 farmers stormed the Hirakud reservoir on Mahanadi River in Sambalpur in Orissa, India, because water from the reservoir, originally meant for irrigation, was being increasingly given to industries.<sup>124</sup>

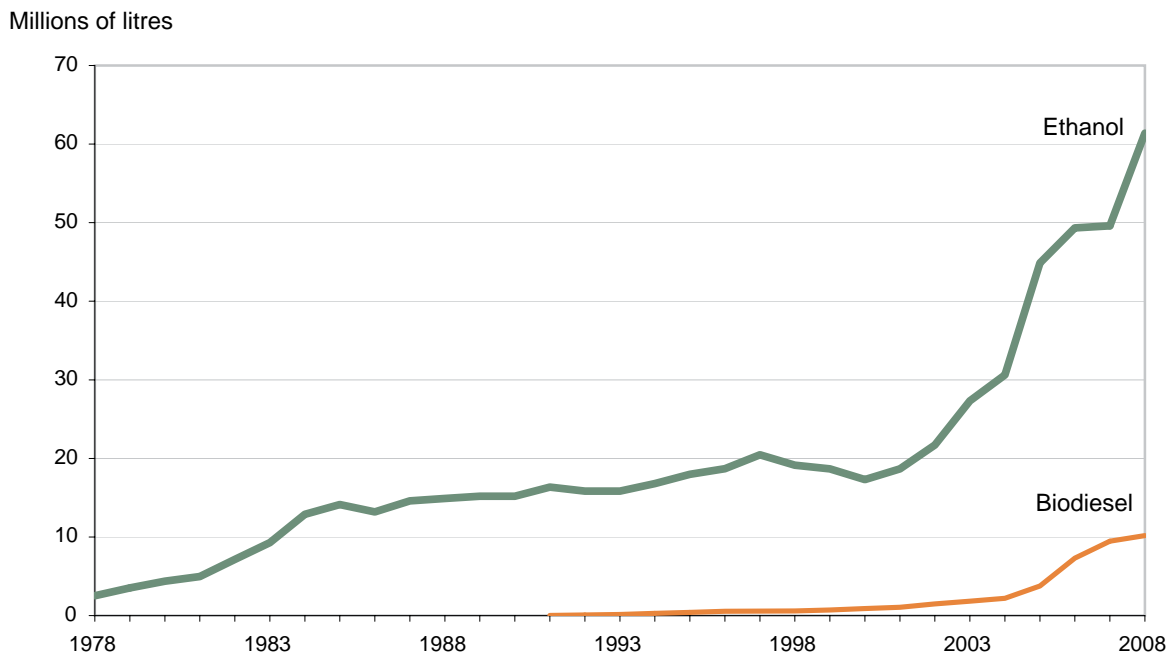
Using today's technologies and agricultural practices, producing each calorie of food requires approximately one litre of water. On that basis, to provide each consumer with 1,800 calories per day (the minimum standard often used by FAO), Asia and the Pacific would by 2050 need an additional 2.4 billion cubic metres of water per day.<sup>125</sup> If things continue in this way, by 2025

a shortage of water for irrigation would cause global losses of 350 million metric tons of food production.<sup>126</sup>

### Displaced by biofuels

Food production has been competing with industry for water; now it is starting to compete with biofuels for land. Previously, with low oil prices, it was uneconomic in many countries to power vehicles with biofuels. But as oil prices started to rise, biofuels became commercially more viable, and a number of countries, some in Asia and the Pacific, started to subsidize production, seeing biofuels as a way of bolstering fuel security. As a result, after 2002, the global output of biofuels started to rise steeply (Figure III-3). In 2007, worldwide output was close to 62 billion litres; roughly 52 billion litres of fuel ethanol and 10 billion litres of biodiesel.<sup>127</sup> Over the next 10 to 15 years, biofuels could provide as much as 25 per cent of the world's energy needs.<sup>128</sup>

**Figure III-3 – World production of ethanol and biodiesel, millions of gallons**

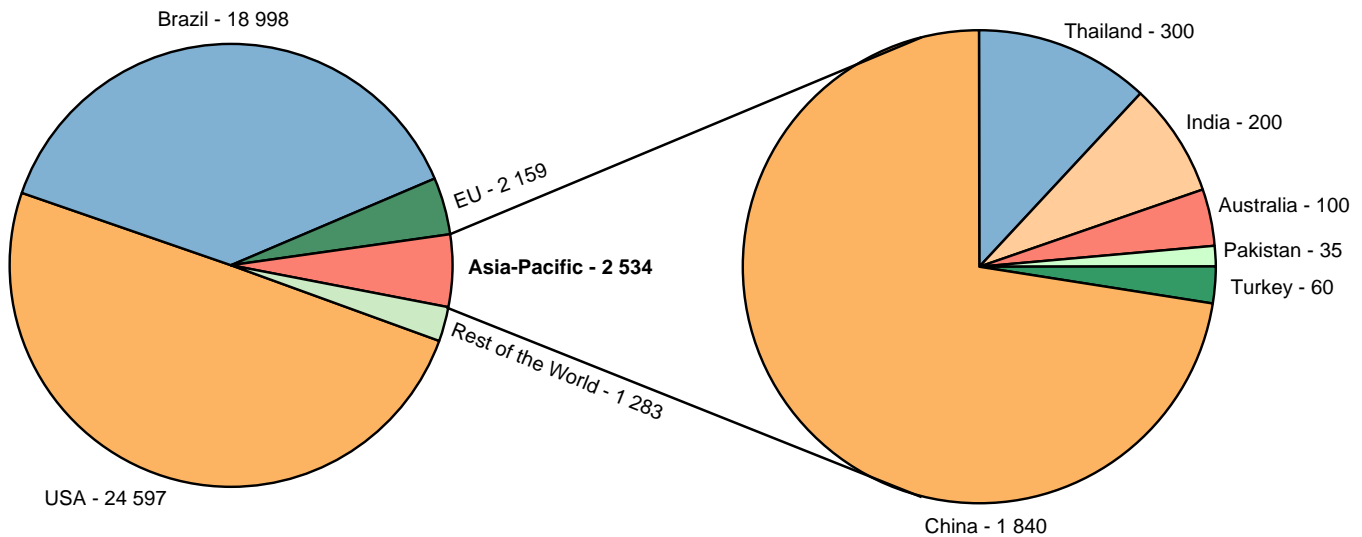


Source: Birur, D.K., T.W. Hertel and W.E. Tyner (2007). "The Biofuels Boom: Implications for World Food Markets", paper presented at the Food Economy Conference, The Hague, 18-19 October 2007.

Currently, around 85 per cent of these fuels are in the form of ethanol, most of which comes from the United States, where it is produced from maize, and from Brazil, where it is made from sugarcane.<sup>129</sup> As yet, the Asia-Pacific region is still a minor player, producing around 2.5 billion litres of fuel ethanol each year, five per cent of global output. Of this, three quarters originate from China, processed from maize, and most of the rest from Thailand and India where it is produced mostly from sugarcane (Figure III-4). The region is also expanding its output of biodiesel. Malaysia and Indonesia have constructed their first plants to manufacture biodiesel from palm oil and together could produce 22 billion litres annually, with the Philippines and Thailand adding a potential 1.6 billion litres.

Biofuels have become increasingly controversial. This is due in part to their potential environmental impact, and in particular concerns that their production will increase the volume of greenhouse gases. This occurs first during the process of land conversion. Converting peatlands in Indonesia to palm oil, for example, releases large amounts of carbon dioxide, creating a 'carbon debt' that it will take many years to repay.<sup>130</sup> One study by the University of Minnesota and Nature Conservancy concluded that the conversion of the rainforests, grasslands and savannahs of South-East Asia to biofuel crops will contribute to increased greenhouse gas emissions for many centuries. Then there are indications that the fertilizer used will release into the atmosphere large amounts of an even more powerful greenhouse gas, nitrous oxide.<sup>131</sup>

**Figure III-4 – Major fuel ethanol producers, 2007, millions of litres**



Source: Renewable Fuels Association - Ethanol Industry Statistics, taken from F.O. Licht's "2007 World Fuel Ethanol Production" <<http://www.ethanolrfa.org/industry/statistics/>> (accessed in April 2009).

Expanding the area devoted to biofuels can also accelerate the switch to industrial agriculture, at the expense of small farmers growing food crops, or of the people living from any forested land being cleared. According to the United Nations Permanent Forum on Indigenous Issues, the expansion of palm-oil plantations in parts of the region has already led to the displacement of indigenous peoples and rural farmers.<sup>132</sup>

There are also major worries about food security. If crops are grown as biofuel feedstock, they displace those that could have been used for food, causing shortages and driving up food prices. This can be presented most starkly as a conflict of interest between consumers of food and fuel. Feeding one person for one year with maize could take around 240 kilograms. The same quantity could be converted to 100 litres of ethanol – enough to fill the tank of an SUV and run it for perhaps a week.<sup>133</sup>

Many people argue that this has already happened, and that the surge in food prices in 2007 and 2008 was a consequence largely of biofuel production in the United States, Brazil and the European Union.<sup>134</sup> Oxfam, for example, attributed around 30 per cent of the rise to the diversion of cropland to biofuels.<sup>135</sup> This process could well continue. The International Food Policy Research Institute estimates that current investments in biofuel production capacity will push the price of maize to 26 per cent above its baseline forecast by 2020, while doubling this production capacity will push it to 72 per cent.<sup>136</sup>

Jean Ziegler, the former United Nations Special Rapporteur on the Right to Food, concluded that biofuel production “is a crime against humanity” and has called for a five-year moratorium.<sup>137</sup>

Proponents of biofuels disagree. They point out, for example, that rice and wheat, two of the commodities commonly associated with the food crisis, are not major sources of biofuel production and do not compete with food crops. Moreover, the area that is being used for biofuels remains relatively small. According to the International

Energy Authority, in 2004 biofuel crops took around 14 million hectares of the world’s arable land – about one per cent – though that share might go up to 3.8 per cent by 2030.<sup>138</sup> Moreover, some of the more promising biofuel crops, such as jatropha, can be grown on marginal land or on abandoned agricultural land – including territory in Australia, China, India and the Russian Federation.<sup>139</sup> Second-generation biofuels, produced from waste products in particular and that avoid land use change, may offer significant environmental and social benefits.

In Asia and the Pacific, biofuels have probably not yet had a large impact on domestic food markets – especially since the region’s major staple is rice whose production has not been affected. However, the situation could change, particularly if countries like China produce more corn for biofuels. Even though several countries in the region have pursued biodiesel production from palm oil at the height of oil prices, concerns have been raised regarding converting additional forests into palm oil plantations. For example, Malaysia had in the past converted forests into palm oil plantations for producing biofuels, but is now making more efforts to balance land utilization and taking a more precautionary measure to protect its forests. Clearly, the benefits from biofuels have to be weighed against the potential costs of rising food prices, though the balance could change along with technological advances in biofuel and crop production.

### **Genetically modified crops**

During the recent food crisis, there were renewed calls for more priority to be placed on developing genetically modified (GM) crops. Advocates say this will help increase yields and reduce the need for pesticides. Critics argue that GM crops threaten human health and the environment and will allow large corporations to tighten their grip over agricultural production and thus widen socio-economic disparities.

Currently, GM crops are used to a fairly limited extent. In 2007, the global area of approved

GM crops was 114 million hectares which is 8 per cent of arable land worldwide.<sup>140</sup> Generally they are confined to the main traded agricultural crops. The principal GM crop is soya, which in 2007 occupied 51 per cent of global GM crop area, followed by maize with 31 per cent, cotton with 13 per cent and canola with 5 per cent.<sup>141</sup> By far the largest user of GM crops is the United States with around 50 per cent of the global GM crop area, followed by Argentina with 19 per cent, Brazil with 15 per cent, Canada with 7 per cent and India with 6 per cent.<sup>142</sup> After India, the only other Asia-Pacific countries that plant significant amounts of GM crops are China, the Philippines and Australia. The main crops are cotton in India, China and Australia, and maize in the Philippines.

Given the limited use of GM crops, it is difficult to weigh the benefits and risks. Even the benefits are far from certain. There is, for example, little consistent evidence of higher yields. Some reports indicate highly variable, 10 to 33 per cent, yield gains in some places, but declines in others.<sup>143</sup> Often the evidence is contradictory on whether GM crops will produce more food.<sup>144</sup>

In fact, GM crops have not been designed primarily for higher yields but to have greater tolerance of herbicides and stronger resistance to insects. If successful, this would reduce the cost of inputs. On this issue too, however, the data are scant and the evidence is ambiguous. A recent report of the International Assessment on Agricultural Knowledge, Science and Technology for Development could not come to a firm conclusion that GM crops offered a path to more sustainable production increases, increased yields or higher revenue.<sup>145</sup>

At present, most GM crops are grown as high-priced animal feedstock to supply rich nations with meat, rather than to meet the immediate food security needs of local households. Poor and subsistence farmers will be reluctant to gamble on GM crops – given the higher upfront costs for GM seeds.<sup>146</sup> They could, however, suffer if the technological improvement did boost production

on other farms and lower the market prices.<sup>147</sup>

### *Unknown risks*

The other issue concerns the risks. On this issue, there is again much uncertainty, with relatively little biosafety research to assess the health, environmental and socio-economic risks.<sup>148</sup> On the health front, there is little evidence either way in peer-reviewed journals.<sup>149</sup> In 2003, for example, a review of possible health consequences of GM food and feed found only 10 *in vivo* studies.<sup>150</sup> Worryingly, those studies conducted by the GM industry found no physiological or pathological differences, while those by independent researchers showed differences that merited immediate follow-up. This left many questions unanswered.<sup>151</sup> There is also scant evidence on the environmental risks.<sup>152</sup> There has been some work on the transfer of genes from GM to other crops in Mexico, but it is clearly vital to have much more work conducted on the economic, political, social and scientific context of GM crops to their place of adoption.<sup>153</sup>

To address these issues, the Conference of the Parties to the Convention on Biological Diversity has developed the Cartagena Protocol on Biosafety. This seeks to protect biological diversity from any risks from genetically modified organisms. This is based on the precautionary principle, and allows countries to ban imports of organisms on which they do not consider there is sufficient evidence of safety, and requires exporters to label GM shipments. Thirty-nine ESCAP member countries and one associate member have signed the Protocol.

One side effect of the optimism for GM crops and the massive investments in the new technology has been the neglect of other more promising but less glamorous areas such as organic agriculture.<sup>154</sup> Research in ecology and natural resource management is trailing far behind.<sup>155</sup> This imbalance arises because GM research is largely concentrated in the private sector. Other agricultural areas are usually the preserve of public research and extension institutions,

and public seed companies – which have often been dismantled.<sup>156</sup> GM research is also biased towards products that offer patent protection and open up profit-related commercial possibilities for integrating chemical and seed businesses.<sup>157</sup>

In China, for example, Huazhong Agriculture University's GM work involves at least 12 patents held by such companies as Monsanto, Rhone Poulenc Agrochimie/Bayer Crops and Novartis/Syngenta.<sup>158</sup> As a result, public sector research faces thickets of intellectual property rights. In developing countries especially, these drive up costs and restrict experimentation by farmers or public researchers, while also undermining local practices that enhance food security and economic sustainability.<sup>159</sup>

Thus, research is driven not by the needs for food security but by market forces. The world's top 10 transnational bioscience corporations spend about \$3 billion per year on agricultural biotechnology research and development.<sup>160</sup> Some argue that the solution is for the public sector to do more work in this area. But others call for more resources and research towards alternative and proven approaches such as sustainable or organic agriculture, or agro-ecological farming which could strengthen food security for the poor.<sup>161</sup> Clearly, many of the poorer countries in the region lack the scientific or technological capacity to deal with the challenges posed by GM crops. Most are still developing national frameworks and there is relatively little public knowledge on this issue.

## Climate change

Food security is also being threatened by climate change. The effects will be many and complex: with advantages and disadvantages; winners and losers. One of the benefits could come from higher concentrations of carbon dioxide in the atmosphere, which will increase photosynthesis in several crops such as wheat and rice, thereby boosting yields. However, this potential gain could easily be outstripped by the effects of higher temperatures and more variable rainfall.

Temperature changes alone will alter the timing and length of growing seasons and force farmers to change crops. Changes in rainfall and overall meteorological conditions will also seriously affect water supplies and other ecological conditions. In addition, there are likely to be more extreme weather conditions: changes in the intensity and frequency of floods, along with droughts and storms, will create significant uncertainties for agricultural production.

The global warming effect comes from three major greenhouse gases in the atmosphere: carbon dioxide (CO<sub>2</sub>), 63 per cent; methane (CH<sub>4</sub>), 19 per cent; and nitrous oxide (N<sub>2</sub>O), 6 per cent. Around 12 per cent of GHG emissions come from agriculture itself. Agriculture is largely neutral in the case of carbon dioxide, but is responsible for about 60 per cent of total nitrous oxide emissions, from fertilizers for example, and for about 50 per cent of methane emissions, much of which comes from livestock.<sup>162</sup> Asia-Pacific is responsible for around 39.7 per cent of global agricultural emissions.<sup>163</sup>

According to the 2007 Intergovernmental Panel on Climate Change (IPCC) fourth assessment report, over the period 1906-2005, the global temperature rose by 0.74°C. This rise has accelerated in recent years and in future the rate of increase could be two to seven times higher than the previous trend. The key changes in Asia and the Pacific are summarized in Table III-1. Annual mean rainfall has fallen, for example, in the Russian Federation, North-East and North China, in the coastal belts and arid plains of Pakistan, and in parts of North-East India, Indonesia, the Philippines and some areas in Japan. On the other hand, rainfall has increased in western China, the Changjiang Valley and along the south-eastern coast of China, the Arabian Peninsula, Bangladesh and along the western coasts of the Philippines.

**Table III-1 – Key climate trends and variability in Asia and the Pacific**

Region	Country	Change in temperature	Change in precipitation
North Asia	Russian Federation	2°C to 3°C rise in past 90 years, more pronounced in spring and winter	Highly variable, decrease during 1951 to 1995, increase in last decade
	Mongolia	1.8°C rise in last 60 years, most pronounced in winter	7.5% decrease in summer and 9% increase in winter
Central Asia	Regional mean	1°C to 2°C rise in temperature per country	No clear trend during 1900 to 1996
	North-West China	0.7°C increase in mean annual temperature from 1961 to 2000	Between 22% and 33% increase in rainfall
Tibetan Plateau	Regional mean	0.16°C and 0.32°C per decade increase in annual and winter temperatures, respectively	Generally increasing in north-east region
West Asia (Middle East)	Iran (Islamic Republic of)	During 1951 to 2003 several stations in different climatological zones of the Islamic Republic of Iran reported significant decrease in frost days due to rise in surface temperature	Some stations show a decreasing trend in precipitation (Anzali, Tabriz, Zahedan), while others (Mashad, Shiraz) have reported increasing trends
East Asia	China	Warming during last 50 years, more pronounced in winter than summer, rate of increase more pronounced in minimum than maximum temperature	Annual rain declined in past decade in North-East and North China, increase in western China, Changjiang River and along the south-east coast
	Japan	About 1.0°C rise in 20th century, 2°C to 3°C rise in large cities	No significant trend in the twentieth century, although fluctuations increased
	Republic of Korea	0.23°C rise in annual mean temperature per decade, increase in diurnal range	More frequent heavy rain in recent years
South Asia	India	0.68°C increase per century, increasing trends in annual mean temperature, warming more pronounced during post- monsoon and winter	Increase in extreme rains in the north-west during the summer monsoon in recent decades, lower number of rainy days along the east coast
	Nepal	0.09°C rise per year in the Himalayas and 0.04°C rise in the <i>Terai</i> region, more in winter	No distinct long-term trends in precipitation records for 1948 to 1994
	Pakistan	0.6°C to 1.0°C rise in mean temperature in coastal areas since the early 1900s	10% to 15% decrease in coastal belt and hyper arid plains, increase in summer and winter precipitation over the last 40 years in northern Pakistan
	Bangladesh	An increase trend of about 1°C in May and 0.5°C in November during the 14-year period from 1985 to 1998	Decadal rain anomalies above long-term averages since 1960s
	Sri Lanka	0.016°C increase per year between 1961 to 1990 over the entire country, 2°C increase per year in central highlands	Increase trend in February and decrease trend in June
South-East Asia	General	0.1°C to 0.3°C increase per decade reported between 1951 to 2000	Decreasing trend between 1961 and 1998. Number of rainy days have declined throughout South-East Asia
	Indonesia	Homogeneous temperature data were not available	Decline in rainfall in southern region and increase in northern region
	Philippines	Increase in mean annual, maximum and minimum temperatures by 0.14°C between 1971 to 2000	Increase in annual mean rainfall since the 1980s and in number of rainy days since the 1900s, increase in inter-annual variability of onset of rainfall

Source: Intergovernmental Panel on Climate Change(2007). *Fourth Assessment Report: Climate Change*.

Other major impacts include the melting of the Himalayan glaciers, some retreating by 74 metres a year. These feed Asia's seven major rivers – the Brahmaputra, Ganges, Indus, Salween, Mekong, Huang He and Yangzi Jiang – which run across the region's most populated lands (Box III-3). There will also be more extreme meteorological events. Cyclones originating from the Pacific have already become more frequent and intense.

Food from oceans, seas, rivers and lakes constitute an irreplaceable part of the dietary preferences in many Asian and Pacific cultures, including those of their poorest peoples. Overfishing and habitat destruction of breeding grounds are rapidly contributing to future food crises and demand urgent attention.

But the greatest effects of climate change are likely to be on production and thus availability. One channel will be through higher levels of

### Box III-3 – Turning off the tap from Asia's water tank

The vast Qinghai-Tibetan Plateau is the roof of the world. With an elevation of over 4,500 meters, and an area of 2.5 million square kilometres, this is the highest and largest plateau on earth. It is also Asia's water tank. Glaciers and wetlands on the plateau serve as head waters for several important rivers and play pivotal roles in agricultural productivity, water donation, and storage.

Currently, as a result of climate change, the plateau is undergoing rapid transformation. The Gangotri glacier, for example, which supplies 70 per cent of the ice melt that feeds the Ganges River during the dry season, could disappear entirely in a matter of decades – leading to hunger and starvation on an unimaginable scale. Asian food security would take a second hit because the melting of glaciers would also contribute to rising global sea levels, inundating many rice-growing river deltas and flood plains. A sea level rise of only one metre would inundate half of the rice-land in Bangladesh. A one-metre rise in sea level will not happen overnight, but if ice melting continues at today's rates, at some point, such a rise in sea level will no longer be preventable. In 2007, reports from Greenland indicated that the flow of glaciers into the sea had accelerated beyond anything glaciologists had thought possible.

Sources: AMBIO (2008). "The headwater loss of the Western Plateau exacerbates China's long thirst", in *A Journal of the Human Environment*, pp. 271–272; and Brown, Lester R. (2008). *PLAN B 3.0 Mobilizing to Save Civilization* (New York and London, Earth Policy Institute), pp. 65-66.

Temperatures will also be higher – well above the global mean in Central Asia, the Tibetan Plateau, and northern Asia. Rainfall patterns will change: summer precipitation, for example, is likely to increase in northern Asia, East and South Asia and most of South-East Asia, but it is likely to decrease in Central Asia. East, South-East and South Asia will see an increase in extreme rainfall and winds associated with tropical cyclones.

#### *The impact on food security*

Climate change will affect the four main elements of food security – availability, stability, utilization and access.

atmospheric carbon dioxide which will increase photosynthesis in several crops such as wheat and rice, thereby increasing biomass accumulation and the final yield. However, for some cereal and forage crops, higher carbon dioxide could reduce the protein content and thus the nutritional value.<sup>164</sup>

Climate change also affects food production directly through changes in agro-ecological conditions.

Rising water stress and aridity increase the vulnerability of the rural poor, especially landless and peasant communities who eke out



a living in marginal areas that are food insecure hotspots, heightening the urgency of improving their livelihoods and food supplies. For these communities, the so-called ‘secondary’ crops are actually major contributors to the food supply that they themselves, particularly women, produce. Such crops are indigenous and well-adapted over centuries to local agro-ecosystems; they are primary sources of nutrition for women and children in these communities. They have very high nutritional value, the poor as producer-consumer can have direct access to them, or otherwise through their affordability, and they are less water-intensive. However, modernization has cast such crops in a negative light, associated as they are with the very poor and with that which is traditional and indigenous.

In temperate latitudes, higher temperatures are

expected to be beneficial, extending potential croplands and growing seasons. In some humid and temperate grasslands, a moderate increase in temperature may increase pasture productivity. But gains at higher latitudes, such as in the Russian Federation and Central Asia, could be offset by a corresponding decline of potential cropland at lower latitudes in temperate regions and in semi-arid and arid pasture regions, rendering them unsuitable for cropping.<sup>165</sup> A warmer climate will also expand the range of agricultural pests and enable them to survive the winter and thus affect spring crops.

According to the IPCC, mid-twenty-first century cereal crop yields could increase up to 20 per cent in East and South-East Asia, but decrease up to 30 per cent in Central and South Asia. By the end of the twenty-first century, rice production

**Table III-2 – Adaptation options and supporting policies**

Adaptation Options	Supporting Policies (some examples)
<i>Short-term</i>	
Crop insurance for risk coverage	Improve access, risk management, revision of pricing incentives
Crop/livestock diversification to increase productivity and protect against diseases	Provide extension services, financial support
Adjust timing of farm operations to reduce risks of crop damage	Provide extension services, pricing policies
Change cropping intensity	Improve extension services, pricing policy adjustments
Livestock management to adjust to new climate conditions	Provide extension services
Change tillage practices	Provide extension of services to support activities, pricing incentives
Temporary mitigation for risk diversification to withstand climate shocks	Employment/training opportunities
Food reserve and storage as temporary relief	
Changing crop mix	Improve access and affordability, revise prices
Modernize farm operations	Promote adoption of technologies
Permanent migration to diversify income opportunities	Education and training
Define land use and tenure rights for investment	Legal reform and enforcement
<i>Both short- and long-term</i>	
Develop crop and livestock technology adapted to climate change stress: e.g., drought and heat tolerance	Agricultural research (crop and livestock trait development), agricultural extension services
Develop market efficiency	Investment in rural infrastructure, remove market barriers, ensure property rights
Irrigation and water storage expansion	Investment by public and private sectors
Efficient water use	Water pricing reforms, clearly defined property rights
Promote international trade	Pricing and exchange rate policies
Improve forecasting mechanisms	Information dissemination across all sectors
Institutional strengthening and decision-making structure	Reform existing institutions on agriculture

Source: Kurukulasuriya, P. and S. Rosenthal (2003). “Climate Change and Agriculture: A Review of Impacts and Adaptation”, Agriculture and Rural Development Department Paper No. 91 (Washington D.C., World Bank).

in Asia could decline by 3.8 per cent.<sup>166</sup> In North Asia, grain production could fall by 26 per cent and fodder production by 9 per cent.<sup>167</sup> In China, a 2°C increase in mean air temperature could decrease rain-fed rice yield by 5 to 12 per cent.<sup>168</sup>

In South Asia, under the most conservative climate change scenario, net cereal production by the end of this century is projected to decline by between 4 and 10 per cent.<sup>169</sup> In Bangladesh, for example, by 2050, production of rice might drop by 8 per cent and wheat by 32 per cent.<sup>170</sup> In India, a temperature rise of 0.5°C to 1.5°C could produce a 2 to 5 per cent decrease in the yield potential of wheat and maize.<sup>171</sup>

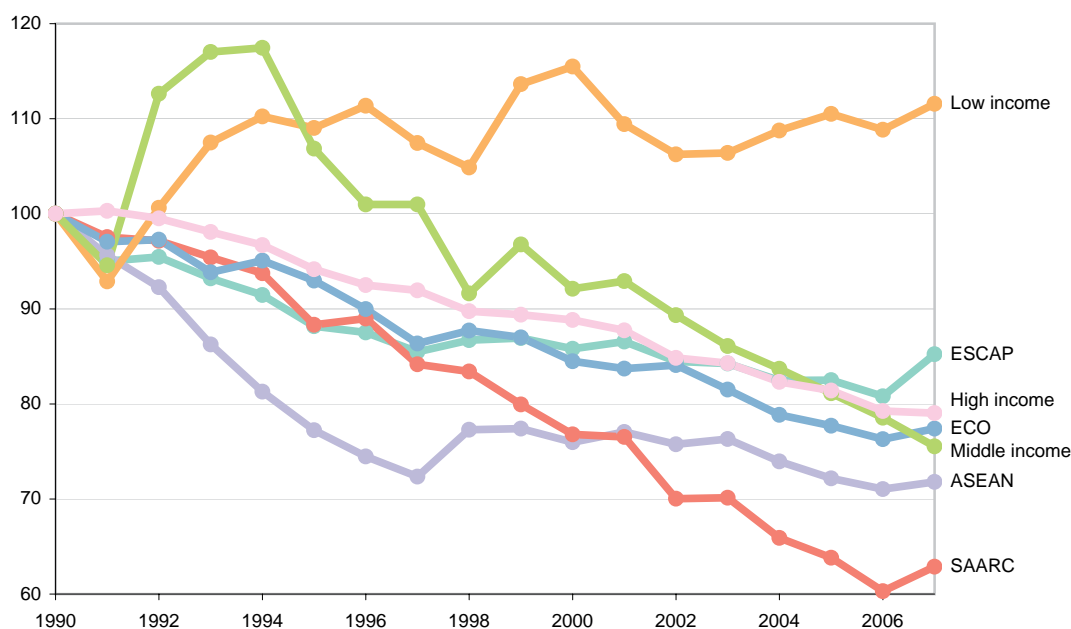
Small island States could suffer extended periods of drought, interspersed with heavy rainfall, which could degrade the land and reduce soil fertility, though in high-latitude islands, the effects could well be beneficial.<sup>172</sup> Table III-2 lists the options for adaptation.

## An uncertain future

Sustainable agriculture is thus under serious threat – as a result of disappearing arable land and forests, intense competition for water, the development of biofuels, and the spread of GM crops – as well as by the overarching phenomenon of climate change. While food prices may again be low, they will probably start rising again soon.

This may in itself encourage greater production. Thailand, for example, whose economy has long been driven by manufacturing exports, could again consider putting more investment in agriculture – prompted by an unprecedented and simultaneous rise in the prices of five major crops – rice, sugar cane, tapioca, rubber and palm oil.<sup>173</sup> And, there are already signs that in a number of countries, agriculture is making a stronger contribution to GDP (Figure III-5). Nevertheless, the immediate prospect is of greater food insecurity. How have governments been responding to this prospect? That is the subject of the next chapter.

**Figure III-5 – Changes in agricultural contribution to GDP**







*Photo: ILO*

## GOVERNMENTS STEP IN

**Surges and food prices have shaken many countries, causing governments to take immediate action – from blocking food exports and relaxing import tariffs on food imports to introducing special measures for social protection. Some of these responses are counter productive. But there are others which show greater promise, for strengthening food security both in the short and longer terms.**

The international community and individual governments have been taking urgent steps to make food more available. In response to rapidly rising prices, in April 2008, the Chief Executives Board of the United Nations, for example, established a High-Level Task Force on the Global Food Crisis which produced a Comprehensive Framework for Action. For immediate action, it considered such options as: providing emergency food assistance and safety nets; boosting smallholder farmer production; and adjusting trade and tax policies. For the long term, it argued for: expanding social protection; sustaining production in small farms; improving international food markets; and developing an internationally accepted consensus on biofuel production.

Then in June 2008, the Food and Agriculture Organization of the United Nations held a High-Level Conference – World Food Security: The Challenges of Climate Change and Bioenergy – which called, among other things, for greater food production, liberalizing food trade, and more research on the contentious issue of biofuels. It also underlined the importance of investing in sustainable agriculture. At the conference, United Nations Secretary-General Ban Ki-Moon predicted that as much as \$20 billion a year might be needed to increase food production. The countries of Asia and the Pacific have also held a number of meetings on food, at both the regional and subregional levels (Box IV-1).

### Box IV-1 – Regional and sub-regional consultations on food security

Governments across the Asia-Pacific region have recognized the importance of concerted action.

*Asia and the Pacific* – In December 2008, ESCAP and the Government of Indonesia convened a High-Level Policy Dialogue – The Food-Fuel Crises and Climate Change: Reshaping the Development Agenda. Over 100 policy makers from across the region discussed ways of preventing this triple crisis from becoming a development emergency. Among other things, the meeting urged regional cooperation to support countries facing difficulties with their balance of payments.

*ASEAN* – In August 2008 in Chiang Mai, Thailand, Ministers of Agriculture of the Association of South-East Asian Nations discussed an ASEAN Integrated Food Security Framework which specified policy responses in four areas: strengthening food security arrangements, promoting better food markets and trade, strengthening integrated food security information systems and agricultural innovation.

*Pacific Islands Forum* – The Second Regional Conference of Ministers of Agriculture and Forestry in September 2008 held a high-level meeting on food security. This stressed the importance of boosting production and maintaining open markets, as well as expanding intra-country trade in locally-grown Pacific food commodities.

*SAARC* – The 15th Summit of the South Asian Association for Regional Cooperation (SAARC), issued in August 2008 the “Colombo Declaration on Food Security”. Among other things, this called for a road map for agriculture development and food security and the drawing up of a SAARC Agriculture Perspective 2020. It also directed that SAARC operationalize a two million-ton SAARC Food Bank – to provide a reserve for use during food shortages and emergencies and offer support to national food security efforts.

## **Agriculture that lasts**

The main priorities in food-producing countries should be to promote sustainable agriculture – so as to optimize food production, boost the incomes of farmers and maintain vibrant rural economies. This would constitute a shift in emphasis. In the past, many countries were less concerned about sustainability and placed greater reliance on new technology and the Green Revolution, using agriculture to boost food production. But they did not achieve food security for all, since many of the benefits were reaped by the richer farmers, and long-term sustainability was threatened by the overuse of fertilizers and other inputs.<sup>174</sup>

India, for example, made considerable gains with the Green Revolution from the mid- 1960s to the late 1980s. Since then, however, productivity gains have been slower – partly because of a neglect of investment in roads and rural development. There have also been serious environmental consequences, since the government provided heavy subsidies for electricity which, apart from diverting funds from other priorities, encouraged overpumping of ground water, resulting in water logging and falling water tables.<sup>175</sup>

Governments still want to raise levels of technology but are turning their attention to genetically modified crops and biotechnology. Here too, however, the consequences for food security are uncertain since these crops too require additional investment and the use of patented seeds that keep control of production in the grip of multinational companies.<sup>176</sup>

In practice, the barriers facing agriculture are not just technical, but also social and political. Many countries still face severe structural constraints, such as inequitable or inefficient land ownership. In the region, the most significant developments in land tenure have been in China. From 1979 to 1984, the Government established the Household Responsibility System through which land which had been farmed collectively was contracted to individual households. Initially the land use right was contracted for 15 years, but later for 30 years (Box IV-2). In October 2008, the Government passed further legislation to permit contract holders to transfer their land use rights or to lease the land.<sup>177</sup>

**Box IV-2 – Household responsibility in Xiaogang, the village where it all began**

Like other villages, Xiaogang, in Anhui province, China, went under collective ownership in 1956, later becoming a people's commune. Everyone earned from 1 to 10 work points – worth a maximum of 1 fen, around half of one US cent. They lived in desperate poverty and could probably get more by begging.<sup>178</sup> In the 1960s, people were dying of starvation. In 1978, 18 famished farmers decided to do away with the collective farming that had suppressed grain production and left them hungry for years. Recalling that fateful night in December 1978, when Mr. Guan Youjiang, now aged 62 and one of the 18 men who pressed their red-inked thumbs onto a crumpled piece of paper to do away with collective farming, said: "Many of us could not even understand all the words on that piece of paper. But we knew we just had to do it. We had to fill our stomachs, feed our families."<sup>179</sup>

The starving farmers began parcelling out their hitherto communal land, cattle and farming tools to individual family units. This was to become known as the household responsibility system (dabaogan). Productivity and grain production rose dramatically, as the farmers found new incentives to work hard to better their own lot. Though local officials in Xiaogang initially disapproved, they later won support from a provincial leader, and ultimately from the country's leader, Deng Xiaoping, who hailed the new system as "a great creation of Chinese farmers".<sup>180</sup>

That desperate pact by Xiaogang's villagers was to spur a tectonic shift in the Chinese countryside – and also become the first chapter in China's recent dramatic chronicle of economic growth and prosperity. Unknown to the Xiaogang villagers, the winds of change were also blowing in Beijing, with a watershed meeting of the Chinese Communist Party that same month opting for 'socialist modernization'.

By the end of 1982, more than 90 per cent of China's agricultural households had returned to some sort of family farming. In 1984, China had a bumper harvest of 407 million tons of food, and for the first time in years the country had enough to feed itself. China this year expects a harvest of 528.2 million tons of grain.<sup>181</sup>

Land distribution and tenure are also major issues in many other countries – often with gender implications, since despite women being responsible for much of the food production, the land titles are typically granted to men.<sup>182</sup>

Agriculture, like many other forms of development, is further constrained by low levels of human capacity. Farmers often lack the education, training or the necessary health standards to make best use of the available resources, and have found it more difficult to get trade or extension services. They have also been held back by government policy which has tended to tax agriculture at the expense of urban consumers, though in recent years the reversal of this trend has started.<sup>183</sup>

### Trade policies

National food availability is also strongly affected, not just by local production, but also by policy on trade. Indeed, when global food prices start to skyrocket, one of the first responses from exporting countries may be to raise trade barriers. Faced with street protests against expensive food, governments may not immediately be able to stimulate greater production, but they can at least attempt to hold prices down and conserve national supplies by restricting or banning exports or imposing quotas or export taxes. In 2008, these and other measures were taken in a number of Asia-Pacific countries, including Bangladesh, Cambodia, China, India, Indonesia, Kazakhstan, Pakistan and Viet Nam.

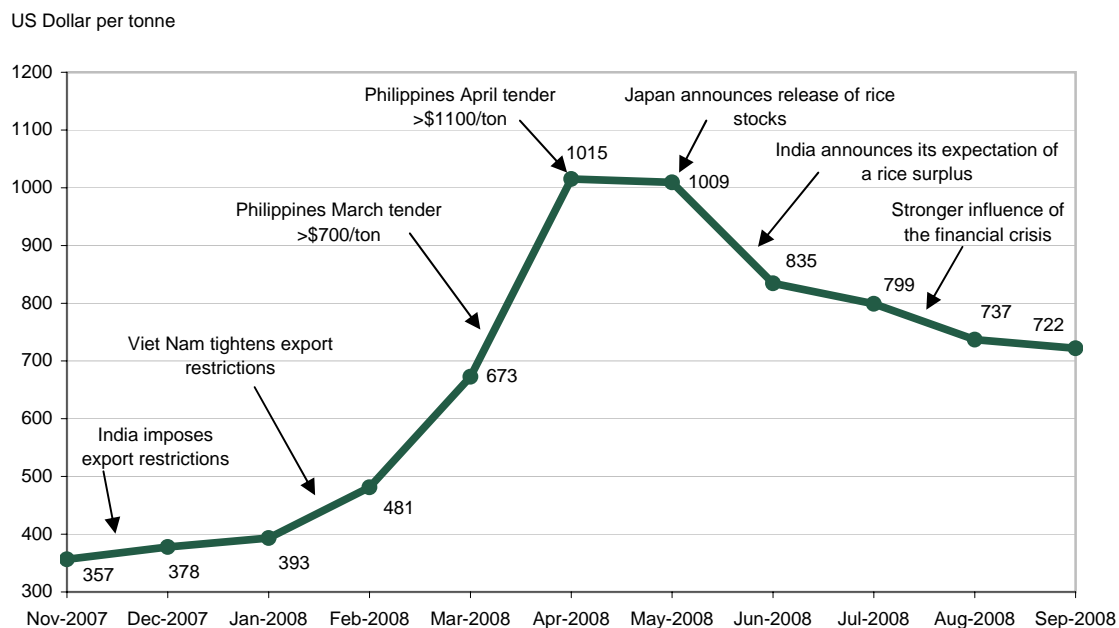
These measures affect international prices. This is easiest seen in the case of rice. The market in rice is relatively ‘thin’. Only 7 to 9 per cent of the rice produced is traded internationally, so interventions are felt more quickly than in ‘thicker’ markets, such as those for wheat or corn.<sup>184</sup> Figure IV-1 traces the price of rice through 2007-2008 showing the influence of export restrictions by India and Viet Nam, as well as the effects of purchases by a major importer, the Philippines. After the peak, the price fell partly because another importer, Japan, released rice stocks, and India and Thailand announced record rice harvests. Subsequently, the international financial crisis also started to reverberate through many commodity markets, including those for food, further depressing prices.

Countries with a larger share of the world market have also considered forming export cartels. In 2008, Thailand proposed such a cartel for rice – involving Thailand, Viet Nam, India, Pakistan and Cambodia. But the proposal did not go through, since it became clear that this would harm poor rice-importing countries.

### Importer action

Trade measures can also be taken by food-importing countries – either to boost national production or to facilitate imports. The two largest rice importers in Asia and the Pacific are the Philippines and Indonesia. When food prices have been low, they have at times attempted, and failed, to combine measures to boost local

**Figure IV-1 – Trade and the price of rice, 2007-2008**



Sources: Data on rice prices based on IMF Primary Commodity Prices Database and downloaded from <<http://www.indexmundi.com/commodities/?commodity=rice&months=12>>. Information on export restrictions from T. Slayton and C.P. Timmer (2008). “Japan, China and Thailand Can Solve the Rice Crisis – But U.S. Leadership is needed”, Center for Global Development Notes, May 2008; and from C.P. Timmer (2008). “Causes of high food prices” in *Asian Development Outlook 2008, Update* (Manila, Asian Development Bank).

Restricting exports may help domestic consumers, but it will also harm domestic producers as well as consumers in other countries, thus undermining regional and global food security. It can also encourage the smuggling of food, with implications for national food security.

production with restrictions on cereal imports.<sup>185</sup> More recently, China, which has its own history of failed interventions in domestic food production and trade, has taken actions that suggest a similar motivation. In recent years, national authorities,



equating food security and self-sufficiency, decreed the preservation of 120 million hectares of farmland.<sup>186</sup>

In fact, keeping food prices high may actually undermine efforts to achieve food security in the long run. This is because such measures distort producer incentives and undermine the operation of local markets. They can also prove extremely expensive for consumers when the country has the option of cheaper imports.

On the other hand, when international prices are high, the importing countries will want to reduce tariffs. In response to the price surge of 2007 and 2008, a number of countries opted to reduce import tariffs and other import surcharges, along with domestic taxes, on selected food crops, including rice, maize, wheat and soybean. This happened, for example, in Azerbaijan, Bangladesh, India, Indonesia, the Philippines, the Republic of Korea, Solomon Islands, Timor-Leste and Turkey. But this may not achieve a great deal. On the whole, food tariffs are already relatively low, and they have generally been coming down further – now averaging around 10 per cent (Figure IV-2). Most low-income net food importers in Asia and the Pacific, such as Kyrgyzstan, Tajikistan and Nepal, already have low applied tariffs on basic food; so even if they remove tariffs altogether, this is unlikely to make much difference to retail prices.

## Fiscal policy

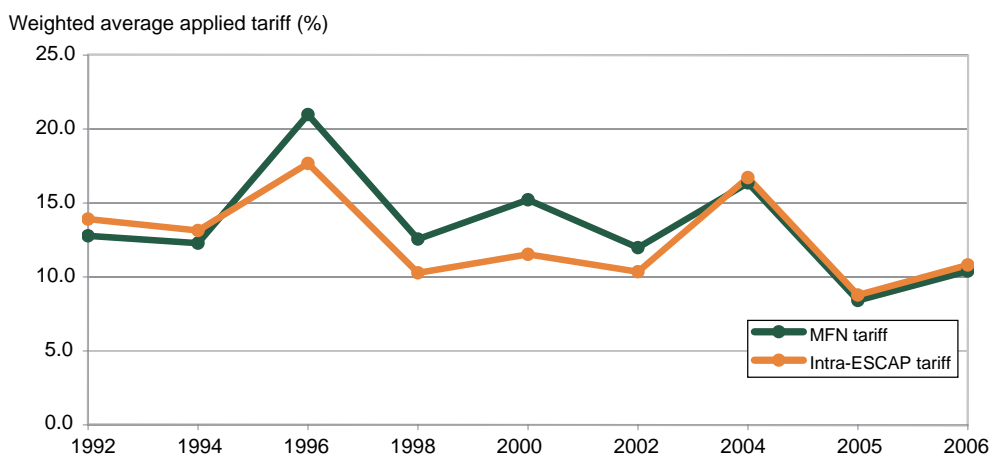
In addition to adjusting trade policies, governments in the region have influenced prices in other ways. In the past, they were more concerned about low prices and set minimum prices, particularly for rice to offer some protection to farmers and reduce uncertainty.<sup>187</sup> More recently, however, they have been faced at times with volatile and rapidly rising prices which they have tried to stabilize.

One option is to reduce domestic taxes, such as Value Added Tax (VAT), on basic food commodities. A number of governments have responded in this way, including Afghanistan, Azerbaijan, Bangladesh, Bhutan, China, Fiji, India, Indonesia, Kazakhstan, Kyrgyzstan, Maldives, Mongolia, Pakistan, and Sri Lanka.<sup>188</sup> Fiji, for example, introduced zero-rating for VAT on locally-produced eggs.

While benefiting consumers this does, however, reduce government revenue. This can be quite significant: losses averaged 0.15% of GDP in Bangladesh, India, and Indonesia, for example, though in some cases larger – 0.6% of GDP in the Solomon Islands, for example.<sup>189</sup>

Many countries have also introduced price controls and consumer subsidies (Box IV-3). Price controls and consumer subsidies also have budgetary implications.

**Figure IV-2 – Trade and tariffs for food and beverages, Asia and the Pacific, 1992-2006**



Source: Calculated based on COMTRADE (trade flows) and TRAINS (Tariffs) data downloaded from WITS.

The Government of Indonesia has vast experience not only with social safety nets to assist the hungry poor, but also with fiscal policy on various basic needs items. Policies and programmes implemented by the Government of Indonesia have included safety nets, such as health insurance for the poor, a school operational assistance programme, free elementary and junior high school education, and financial support for the poor, including subsidies on fuel, rice and cooking oil.<sup>190</sup> In 2008, Indonesia implemented non-targeted price controls and consumer subsidies, reduced import duties and VAT on basic food commodities, and increased domestic supply using food grain stocks.<sup>191</sup> More specifically, this includes:

- Increased rice subsidies
- Introduced subsidies on cooking oil for poor households
- Introduced price subsidies for small-scale producers of processed soybeans
- Removed import tariffs on flour and soybeans
- Increased the export tax on palm oil
- Exempted cooking oil from VAT
- Increased the supply of rice from Government stocks

In Azerbaijan, Bangladesh, Malaysia and Pakistan, subsidies over the period 2006-2008 resulted in increased government expenditure equivalent to between 0.1 and 0.35 per cent of GDP. On the other hand, over the same period, food subsidies decreased in India, Indonesia and Turkmenistan.<sup>192</sup>

Governments have also offered subsidies on fuel. However, these also benefit many richer households. Subsidies on food, by comparison, tend to be more pro-poor and also less expensive. Governments with limited budgets that wish to improve the food security of their people would therefore be better off using food subsidies.

### **Stocks and reserves**

Most Governments in Asia and the Pacific hold national stocks of rice or another staple food. These can serve as buffers at times of volatile prices, since purchases from farmers to build the stocks can ensure that they receive minimum prices. At times of shortage, this food can then be released to consumers. However, building and managing national food stocks can be complex and expensive.

The recent Comprehensive Framework for Action, produced by the United Nations High-Level Task Force on the Global Food Crisis, urges countries to use national stocks of food to stabilize prices in the short term at times of price volatility. But it suggests that rather than holding national stocks it would be better to develop regional stocks or make food reserve agreements, though in this case there is the risk that the food held in reserve by one country may not be culturally appropriate in another.<sup>193</sup>

In 1979, the Association of Southeast Asian Nations (ASEAN) for example, established the ASEAN Food Security Reserve and in March 2004 the ASEAN + 3 – which includes China, Japan and the Republic of Korea – expanded this as the East Asia Emergency Rice Reserve.<sup>194</sup> This consists of 87,000 metric tons from ASEAN, plus 250,000 tons from Japan, and may be used to respond to disasters in any of the 13 countries. Member countries can also use it as part of their national emergency rice stocks. This reserve has been used to provide relief in disasters – to victims of floods in Indonesia and Cambodia, of volcanic eruptions and mud slides in the Philippines and of Cyclone Nargis in Myanmar.<sup>195</sup>

In 1988, SAARC also established a food security reserve, consisting of 241,580 tons of food grains, including rice and wheat. Despite a number of crises, this had not been drawn upon by 2004, partly because in order to draw upon it Governments would have to declare a national food emergency which they were reluctant to do. At a SAARC Summit in 2004, therefore, government representatives recommended that the reserve be re-established as a more flexible regional food bank. Each country would contribute a certain amount to this bank, which it could draw upon as needed, but it could also borrow from food held in storage in a neighbouring country. The borrowing country would not be charged for this, but would need to replace the stock when in a position to do so.

Governments that use food stocks will generally be combining these with trade and other measures. All can have different effects for producers and consumers, some positive, some negative. For some, it can be difficult to gauge the net impact. The possible outcomes of these and other measures are summarized in Table IV-1.

### Food transfers

Food from reserves and elsewhere can be released into national food markets – sold by the government to traders. But this food, along with food purchased locally or internationally, can also be distributed to those in need (Box IV-4). In some cases, this food may be given unconditionally, as has happened in Bangladesh, Fiji, India, Indonesia, the Philippines, Pakistan and Sri Lanka. Pakistan recently reintroduced subsidized wheat through a ration card system.<sup>196</sup>

**Table IV-1 – Interaction of trade and other policies that affect local prices**

	Domestic consumer price level	Domestic farmers' income level	Domestic production	Volatility of international prices	Government revenue	Urban food security	Rural food security
Reduction of import tariffs for food	↓	↓	↓	↓	↓	↑	↓
Reduction of domestic tax on consumption	↓	–	–	?	↓	↑	↑ or –
Increase of export taxes	↓	↓	↓	↑	↑	↑	↓
Introduce export quotas	↓	↓	↓	↑	–	↑	↓
Export license / export ban	↓	↓	↓	↑	– or ↑	↑	↓
Administration of local prices for all consumers	↓	↓	↓	–	– or ↑	↑	↓
Input subsidies to producers	– or ↓	↑	↑	?	↓	↑	↑
Subsidies to consumers / vouchers	–	–	–	–	↓	↑	↑
Use of reserves / buffer stocks	↓	↓	↓	↓	↓	↑	↓

Note: This table indicates the impact of measures listed in the first column on the factors listed in the first row. – indicates no impact.

Source: World Bank (2008). "Double Jeopardy: Responding to High Food and Fuel Prices", G8 Hokkaido-Toyako Summit, 2 July 2008 (Washington D.C., World Bank).

*Social protection* – A broad concept describing all interventions from public, private and voluntary organizations and social networks, which support communities, households and individuals in their efforts to prevent, manage and overcome vulnerability. Social protection can include employment guarantees, unemployment benefits, training programmes and public assistance schemes.

*Social assistance* – Also known as social transfers, this is a component of social protection that directly addresses poverty and vulnerability, through transfers, in cash or kind, to poor households. Transfers can be unconditional, as with most pensions and disability or child grants, or conditional on certain behaviour, such as regular attendance at school or local health centres, to be eligible for mid-day meals, or participation in public works, like food-for-work, programmes.

*Social insurance* – Measures taken to manage future shocks. Social insurance is a public insurance programme that provides protection against various economic shocks (such as loss of income due to crop failure, sickness, disability and old age); participation in the programme is compulsory. Social insurance is considered to be a type of social security; in fact, both terms are sometimes used interchangeably.

India's food distribution system is the largest in the world, reaching 600 million people.<sup>197</sup> This is based on locally-procured food which is distributed in various ways. Households below the poverty line can purchase 35 kilograms per month at 48 per cent of the cost to the Government. Households above the poverty line are obliged to pay 70 per cent of the cost.

For these programmes, one of the most important considerations is targeting – since distributing food to large numbers of people can be prohibitively expensive. Sri Lanka, for example, started a food subsidy programme more than 60 years ago during the Second World War when the government subsidized a rationed amount of rice to all consumers. Under financial pressure, however, successive governments had to reduce the costs, which by 1970 were swallowing up 23 per cent of government expenditure. Gradually, the subsidies were targeted more precisely: by 1978 this measure had reduced the proportion to 19 per cent and by 1984 to 4 per cent.<sup>198</sup>

An alternative to selecting recipients based on income is to introduce a form of self-targeting.

This is commonly through food-for-work programmes, such as building roads, on the assumption that only the poorest would be prepared to do this work for the type of food on offer. Afghanistan, Bangladesh, Cambodia, India and Nepal have been using self-targeted food-for-work programmes; the Bangladesh programme was expanded in early 2008 to respond to disasters and the increased price of food.

Food-for-work can be considered a conditional food programme. Other types of conditional programme include food-for-education. Some countries distribute food through schools to encourage school attendance. In this case, the food not only provides school meals, but also offers rations for the rest of the family. Cambodia, China, Bhutan, India, Maldives, Pakistan and Sri Lanka have used school feeding programmes.<sup>199</sup> Other conditions may relate to training. In Bangladesh, the Income Generation for Vulnerable Group Development Programme provides nearly 300,000 rural women with 30 kilograms of wheat per month, as long as they participate in savings groups and receive training for entrepreneurial skills and enterprise development.<sup>200</sup>

These food distribution schemes need to be carefully designed so as not to distort local food markets. On the one hand, if the food is brought in from outside, for example, it may drive down prices to the detriment of local producers. On the other hand, if it is procured locally, this may drive up prices and hurt poor consumers.

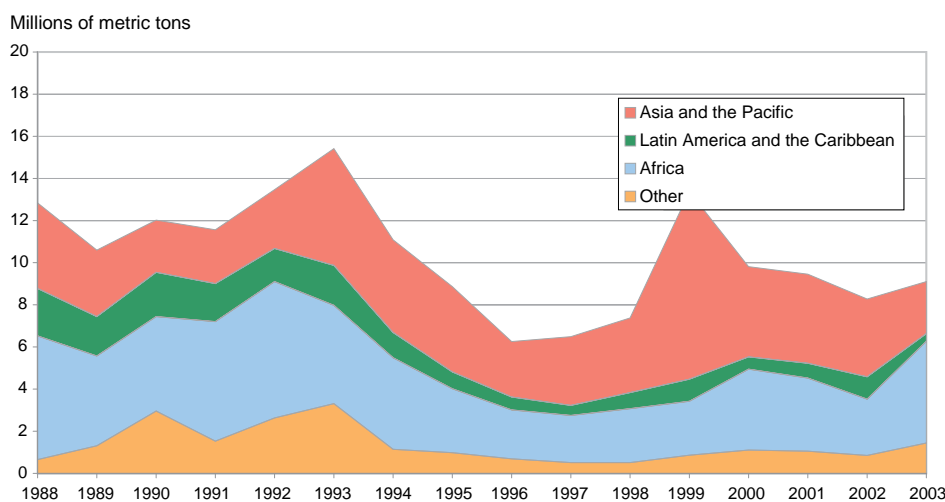
In many cases, it is better to procure the food locally but to target the distribution to those who are already priced out of the market.<sup>201</sup> This should not affect prices, as when food-for-education programmes offer a greater variety of food, including vegetables, meat, eggs and dairy products, as well as non-staple cereals such as wheat. In Bangladesh, for example, biscuits provided on the school feeding programme opened a new market opportunity for local wheat farmers.<sup>202</sup>

## International food aid

The question of the impact on local food prices also arises with international food aid. Although the World Food Programme and major donors now source some of their food locally, nationally or in other countries in the region, they still get much of it from the United States and other countries which, as a result of subsidies, have generated food surpluses.

Food aid flows globally reach between 125 and 250 million people.<sup>204</sup> Around half of the food goes to Africa, but around one third to countries in Asia and the Pacific (Figure IV-3). In 2007, the region's top five recipients were, in descending order: the Democratic People's Republic of Korea, 752,352 metric tons; Afghanistan, 224,237; Bangladesh, 220,988; India, 118,586; and the Philippines, 110,204 metric tons.<sup>205</sup>

**Figure IV-3 – Distribution of food aid, by global region, 1988-2003**

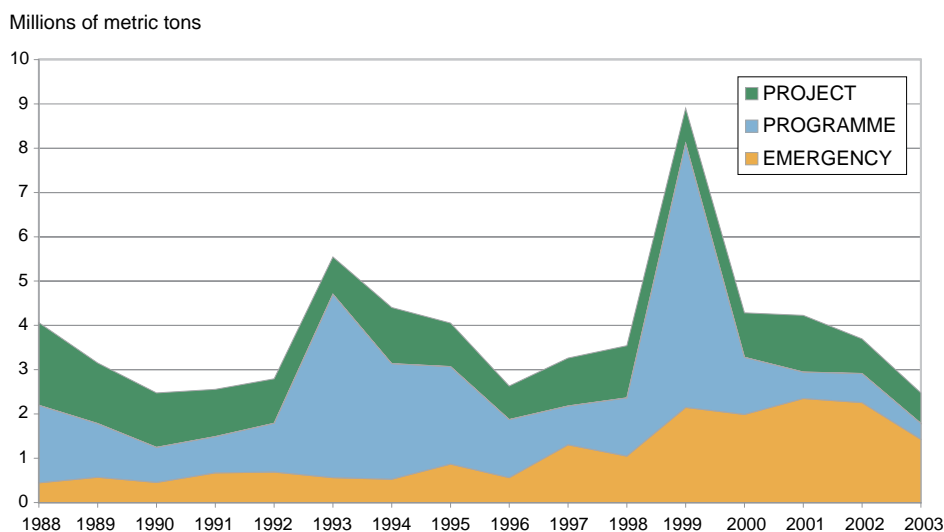


Source: Compiled using Interfais data from WFP

During the economic crisis in the 1990s, the Government of Indonesia initiated a country-wide school feeding scheme, but deliberately excluded the local staple, in this case partly to avoid meal substitution at home. It also stipulated that the programme could use only locally-grown commodities. Meals were prepared by local women organized through local women's associations. In a survey, 72 per cent of farmers said that the school feeding scheme had given them more opportunities to sell produce from their fields and vegetable gardens.<sup>203</sup>

Of the aid flowing to Asia and the Pacific, more than half is used for emergency purposes. Around 20 per cent is used for projects such as food-for-work or school feeding. The rest is programme food aid, through which a donor government sells food at a discount to a recipient government which can then sell it and use the revenue for any number of purposes (Figure IV-4).

**Figure IV-4 – Forms of cereal food aid to Asia and the Pacific, 1988-2003**



Source: Compiled using Interfaiss data from WFP

Food aid has helped achieve many humanitarian and development goals, but it has also been criticized for damaging local markets, fostering dependency, and for being susceptible to corruption. In some ways, food aid is an outmoded form of assistance and it is surprising to see that the region still receives more than 2 million tons a year. Most of this continues to be shipped long distances, which can be slow and inefficient and may not deliver food that is culturally appropriate.<sup>206</sup>

### Cash transfers

An alternative form of support to food-insecure communities is through cash transfers in the form of lump sum payments to vulnerable groups. Such transfers not only give the recipients greater freedom in how to use the transfers, but they also offer greater benefits than even locally-sourced food in stimulating the local economy through multiplier effects when the recipients spend them on goods and services, thus generating further income and employment.

This will be true even if the grants go to those who are not economically active – through social pensions or child support grants. But transfers will have even more benefits for food security if they go to poor farmers who spend at least a part of their incremental income on producing

more food.<sup>207</sup> Timely cash transfers also help prevent small producers from falling into debt, or resorting to other measures, such as removing children from school, and instead allow them to accumulate productive assets.<sup>208</sup>

As with food transfers, cash transfers may be unconditional or conditional. Unconditional cash transfers have the disadvantage that they are difficult to target, so there can be considerable leakage to the non-poor. However, there have been examples in the region, including the Di Bao programme in China which gave cash to 22 million urban poor, and an Indonesian social safety net programme which gave \$10 per month to 19 million poor households.<sup>209</sup>

Governments more commonly offer conditional cash transfers, and have expanded such schemes in response to the recent food crisis – as in Bhutan, China, Maldives, Pakistan, Singapore and Sri Lanka.<sup>210</sup> One large-scale conditional transfer scheme is the Primary Education Scholarship Programme in Bangladesh which reaches more than 5 million people, conditional on children's attendance at primary school.<sup>211</sup> Another, and probably the world's largest, is the Rural Employment Guarantee Scheme of the Government of India. The Scheme has an annual budget of over \$4 billion and guarantees households 100 days employment.<sup>212</sup> Typically,

the beneficiaries work on improving the rural environment by building roads and engaging in many activities related to water, including water harvesting, drought proofing, flood control and irrigation.<sup>213</sup> One risk with these public works schemes is that they may divert small-holders from vital farming activities, such as weeding, especially if they are offered participation during periods of high agricultural activity, which are also the food-insecure periods.<sup>214</sup>

These and other social protection programmes can have both intended and unintended gender implications. Many programmes target women, on the grounds that, compared with men, they are more likely to allocate incremental food or cash to their families, especially their children.<sup>215</sup> But the conditions applied also represent extra demands on over-worked mothers who have to ensure that children attend school and clinics. Apart from reinforcing traditional gender roles, these conditions can displace women from farming or income-generating activities. Similarly, efforts to target women in public works projects by setting gender quotas can lead to perverse outcomes, if women who are already over burdened and “time poor” have to do even more work.<sup>216</sup>

Some argue that, in certain cases, it may be better to target men. A programme that transfers draught bullocks could target men who are usually responsible for ploughing and who control land and other assets. This would mean accepting inequities, pending the vesting in women of ownership rights over productive resources.

### **Insurance systems**

A further way to offer greater security to farmers is through insurance mechanisms. Few smallholders have access to crop insurance, so a harvest failure can have disastrous consequences. Thus far, however, systems of crop insurance for smallholders have largely failed, for a number of reasons: high transaction costs, moral hazard, adverse selection, covariate risk and delayed payouts.<sup>217</sup>

Instead of crop insurance, it may be better to offer weather-based insurance. In this case, the insurance is based on a local index, say, of rainfall shortage or days of hailstorm or snow or frost. Farmers are compensated, if the index reaches a trigger level, regardless of their crop losses. Without the need to check on the situation of each farmer, payments can be made rapidly, so farmers need not resort to selling their assets in the event of a bad harvest. In addition, farmers covered by weather-indexed insurance should also be more credit worthy and thus able to invest in greater productivity.<sup>218</sup> On the other hand, an insured farmer may suffer a loss, yet not receive a payout.

The main challenge to the widespread adoption of weather-indexed insurance is the relatively high cost: the premiums may be too high for smallholders, which suggests that this is better addressed through public systems of social protection.

### **Activist administrations**

The looming threats to food production will require Governments in Asia and the Pacific to take active measures to protect their poorest people. Most already have considerable experience in this area, but could also learn from the approaches taken in other countries. Nevertheless, most of the efforts to achieve greater food security take place at the local level – as illustrated by examples in the next chapter.



*Photo: Marie Ange Sylvaain-Holmgren*



## RESILIENT COMMUNITIES

**While governments can take many measures to promote food security – creating the best conditions for production and access, what are people, as individuals, as families and as communities, doing to survive? How are they using community resources and networks?**

**Communities that are food insecure face different kinds of shocks. Some affect everyone simultaneously, such as national economic crises, droughts or other disasters. These ‘covariate’ shocks may be too difficult for households or communities to deal with themselves, so they will also need assistance from outside, from the State or institutions of civil society.**

Other shocks may be limited to a particular household, caused by illness in the family, or the head of the household losing his or her source of livelihood. In rural Asia-Pacific, these ‘idiosyncratic’ shocks may be at least as significant as covariate ones. But, they are also easier to address at the community level. All over the region, people have established many systems of mutual support, through cooperatives, for example, or microcredit schemes to deal with financial risks. Or, they work together as networks, communicating early warning, about imminent

typhoons perhaps, or other emergencies. This chapter is concerned primarily with responses that relate more specifically to food security – for which it offers a series of examples from across the region.

### Everything together

Farmers who rely on one or two crops can be at considerable risk if these fail, or market prices fall. In response, many farmers have developed complex integrated systems mixing crops, livestock and other sources of income. Box V-1 outlines the elements of an integrated cropping system for sustainable agriculture.

#### Box V-1 – An integrated cropping system

An integrated cropping system for sustainable agriculture combines the following:

- *Multiple cropping*: growing different crops in the same field and in the same period which would be harvested at different times.
- *Multilayer cropping or forest gardening*.<sup>219</sup> growing, with proper spacing in the same area and at the same time, tall and medium-sized fruit trees, shrubs, climbing vines and leafy plants, along with cereals, vegetables and tubers; the layered structure permits the variety of plants to capture maximum sunlight for growth, thereby reducing weeds, keeping the soil healthy and effectively expanding the cultivable area.
- *Mixed cropping*: traditional farming system growing a diversity of crops, to extend the harvesting period and help alleviate seasonal food shortages, thus stabilizing household food access.

### *Multiple layers in Kazakhstan*

In Karatal, a village in Almaty, Kazakhstan, farmers have developed a two-track agricultural system. The first track is based on crops, the second on livestock. Both involve multiple layers. In crop production, the layers are on three levels. Under the ground, they grow tubers: ginger, onions, carrots, turnips and potatoes. On top of the ground, they grow cereals and vegetables like cabbage. Then further above the ground, they cultivate fruits and nuts. Livestock has four layers – consisting in this case of poultry, sheep, cows and horses which between them provide eggs, meat and milk.

Both crops and livestock allow the farmers to tide themselves over during the severe winter months. They can store the crops underground, and dry the fruit, while keeping their meat and milk as live animals. In this way, they can eat much the same thing all year round – though the proportions vary according to the season. Using this integrated system, a household needs only half an acre to feed itself around the year – though the three layers add up to one and a half acres. Significantly, the land belongs to the State. The farmers only have a right to cultivate it. In other circumstances, this might inhibit investment, but not here, since the farmers never expect to be evicted.

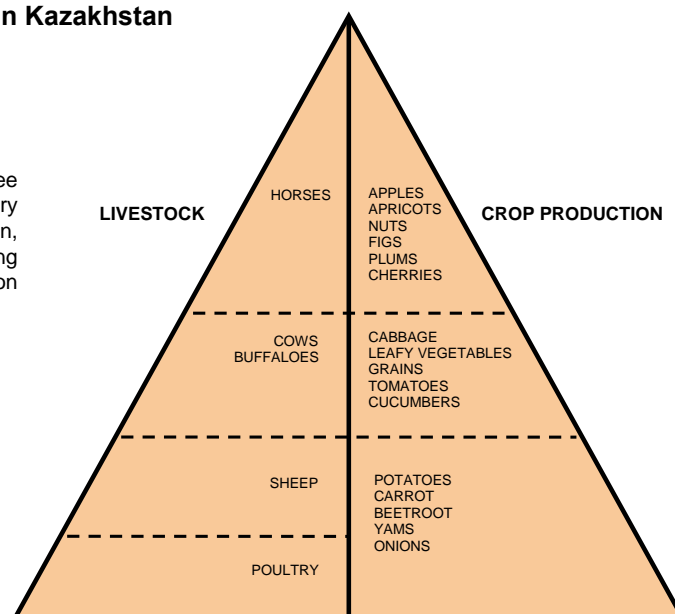
### *Productive ponds in China*

Farmers in the Pearl River Delta region of China have developed one of the classic forms of integrated agriculture, centred on fish ponds. The farmers dig out the ponds – to an area of around half a hectare and two to three metres deep. They use the excavated soil to build the surrounding dykes which are up to one metre high and six to 10 metres wide. Then they stock the ponds with various species of carp, each of which lives at different pond depths and has a distinctive feeding habit.

The farmers use the dykes in several ways. Generally, they plant them with mulberry trees whose leaves they feed to silkworms whose wastes they scatter in the pond to encourage the growth of the plankton that feed the fish. On the dykes, they also raise chickens, ducks and other livestock, whose wastes they also tip into the pond and, at the same time, they cultivate elephant grass that can be fed directly to the fish. The farmers drain the pond two or three times a year, dredging out the mud. In winter, which is the off-season for silkworms, they spread the mud on the floor of the silkworm shed and cultivate mushrooms. After the final crop of mushrooms, they use the mud bed to grow vegetables, fruit trees and grasses.

**Figure V-1 – Layers of farming in Kazakhstan**

Source: Field Notes of Amitava Mukherjee and Eugene Gherman, ESCAP advisory mission (5-13 June 2008) to Almaty region, Kazakhstan, on participatory planning for income and employment generation programmes at the local-level.



The largest source of income is the fish, but this system, which recycles all “wastes” into nutrient resources, also produces many other harvests. More than 99 per cent of the energy used is sunlight.

### *Ducking and diving in Japanese rice fields*

Farmers in Japan also combine different activities in a complex ecosystem, in this case, rearing ducks in rice fields. Soon after they have planted rice seedlings, they release ducklings, about 20 per tenth of a hectare, into the rice fields. The ducks perform many useful tasks. They eat insects and pests, such as the golden snail and the seedlings of weeds, but they cannot eat the seedlings of rice which have too much silica. As they paddle between the rows of seedlings, occasionally dipping into the water, they oxygenate it, encouraging the growth of the rice roots, and stimulating the rice plants, making them grow thicker and stronger.

This is the *aigamo* organic farming system – named after the breed of duck – a mixture of traditional farming practices and the

experimentation of the Furano family in Fukuoka. As well as rice, the farmers also introduce a nitrate-fixing species of aquatic fern, azolla, onto the surface of the water. This provides more food for the ducks, both directly and by attracting insects. The farmers also stock the rice fields with fish, including loach, which can hide from the ducks under the azolla, while feeding on duck droppings, or on daphnia and other worms. Both ducks and fish fertilize the rice plants. When the rice plants form ears of grain, the farmers remove the ducks, to stop them eating the rice, and confine them to a shed where they feed on waste grain. When they have sufficiently fattened up the ducks, which also provide eggs, they can sell them for their meat. All in all, a complex, well-balanced, self-maintaining and self-propagating ecosystem.

Box V-2 illustrates an organic agriculture movement initiated by civil society, which Government has adopted as part of a national development plan.

### **Box V-2 – Sustainable and organic agriculture in Thailand**

The organic agriculture movement in Thailand gained momentum largely as a result of the work of civil society entities that, in the 1980s, began to promote organic agriculture in Chiang Mai and other provinces. The Alternative Agriculture Network was established in 1984 and it serves as the main discussion forum for issues related to sustainable agriculture, including organic agriculture.<sup>220</sup>

In 1993, producers and consumers wishing to support environmentally and socially responsible farming established Green Net, an NGO that was the first organic fresh produce wholesaler in Thailand; it continues to be the largest to date. Green Net’s goal is “to serve as a marketing channel for small-scale organic farmers with fair trade principles in its marketing activities.” Green Net farmers sell in local markets and for home consumption. In 2002, Green Net was certified by Fairtrade Labelling Organisations International and it now also exports fair trade rice to Europe, with fair prices for producers and buyers and reflecting principles of environmental safety, conservation and social responsibility.

Green Net founded a national organic certification body, Organic Agriculture Certification Thailand (ACT), which certifies produce as organic for domestic and for export sale.<sup>221</sup> There now exists a network of sales outlets and efforts are in progress on the branding of Thai organic food. Green Net focuses on bringing the values of 'fairtrade' into farming groups: capacity building, gender equality, transparency, sustainability and respect. In 2000, it founded Earth Net Foundation to consolidate its work in the research and development of organic products and the promotion of community enterprises. Earth Net services to farmers include forums, quality assurance, farmer field schools and organic farming technology, as well as consumer awareness promotion.

Government support for sustainable agriculture reached a turning point when the Government adopted sustainable agriculture as part of its 8<sup>th</sup> National Economic and Social Development Plan (1997 – 2001) and a pilot project on sustainable agriculture was funded in 34 provinces throughout the country. In January 2005, the Government adopted a policy on organic agriculture. The policy aims to improve food safety and environmental conservation, reduce importation of chemical inputs into agriculture, and increase opportunities for Thai exporters to enter the world market.<sup>222</sup>

There is a view that the Government's policy toward organic produce has focused heavily on certification, accreditation and development of national standards, which some feel have, in its present form, constraining effects and may not be in the areas most in need of attention. It has been suggested that a more effective use of government resources might be to focus on improving extension services so that they reach more small-scale farmers, developing post-harvest technology, building domestic markets and strengthening private and public sector collaboration.<sup>223</sup>

The major organic crops in Thailand are rice, vegetables, herbs and fruit. Coffee and tea are also grown organically. A study of organic, as compared to conventional, agriculture in Chiang Mai province indicated, as did other studies, that the yields from organic agriculture were lower and the costs higher than for conventional agriculture. However, given the higher revenues accruing to organic agriculture, the profits from organic agriculture exceeded that for conventional agriculture.<sup>224</sup>

### **Building up banks in India**

Farmers can provide a degree of security for themselves by using common resources, such as grain or seed banks. This type of mutual support is promoted by the Self-employed Women's Association (SEWA), a trade union based in Gujarat in India. SEWA has used banks for grain, seeds, fodder and tools to help build food security for 40,000 small and marginal farmers in 400 villages in the desert districts of Kutch, Patan and Surendranagar.

*Grain banks* – The region has a long history of grain banks, some government-supported, some informal. They take contributions in cash or kind from community members to build up a store of

grain which households can draw upon during difficult times. The grain can be taken on loan or bought at cost price. This community distribution acts as a supplement to the public food distribution system which may fail to deliver food on time.

*Seed banks* – These store good quality high-yielding seeds, certified by the Gujarat State Seed Corporation, which farmers can borrow at low rates of interest and return over several seasons. For example, in 2007 in one village, 200 farmers each borrowed eight kilograms of cumin seeds.

*Fodder banks* – Fodder is scarce in the dry and semi-arid districts of Gujarat, and is becoming scarcer as farmers shift to cash crops. Poor people who rely on raising livestock regularly run short

of fodder during the dry season. SEWA has therefore helped members of dairy cooperatives to establish fodder banks. Each member initially deposits 200 rupees which is used to purchase fodder which can be distributed during lean periods. For example, in 2003, over 500 metric tons of fodder worth about Rs. 1.9 million was distributed to members, including green fodder, dry fodder and cattle feed.

*Tool banks* – Many poor farmers cannot afford to buy the equipment they need. To tackle the problem, SEWA has started a tools and equipment ‘library’. Managed by local women’s cooperatives, this houses agricultural equipment such as ploughs, masonry tools, water lifting machines and tractors. The tools and equipment ‘library’ is self-sustaining, since farmers pay a nominal membership fee which is then used to buy and maintain the equipment.

### Sharing water

Community-based water delivery systems are very common in Asia-Pacific, serving a third or more of the total irrigated area. Generally, these have been developed in mountainous or hilly areas, based on the diversion of small and medium streams, especially in the Himalayas, China, the Lao People’s Democratic Republic, Japan the Philippines and Thailand.

#### *Zanjeras in the Philippines*

In the Ilocos provinces of the northern Philippines, irrigation systems are run by *zanjeras*, small societies which have run successfully for centuries. Land is allocated among the farmers in parcels of equal size, the holdings being dispersed between upstream and downstream areas. This system has survived several State interventions. In 1976, for example, the State Water Code, asserted State ownership of water sources, requiring everyone who diverted water to have a permit. This left intact the traditional, informal systems and in some cases it even provided new opportunities for coordination among different *zanjeras* along the same river system. There have, however, been

some conflicts between registered and unregistered users and some powerful individuals have been able to seize control of water resources.<sup>225</sup>

#### *The temple is the kingpin in Bali, Indonesia*

In Bali, rice farmers have well coordinated irrigation systems that cover wide areas without requiring any central control. The systems are based on water diverted from rivers into small dams and thence into the canals and aqueducts, which carry it to the fields. The farmers who share the water are organized into associations, *subaks*, which coordinate their planting schedules in a distinctive fashion.

Each dam is associated with a temple, dedicated to the worship of the water goddess and various agricultural deities. The temple hosts annual meetings where farmers decide on a common planting cycle based on the temple's ritual calendar. Coordination among users of weirs along the same river is achieved via regular exchange of delegates among temples, in fulfilment of obligations associated with ritual ties among the deities to which the temples are dedicated. This system is finely tuned to local conditions and allows yields to be maintained in the face of crises, such as low rainfall or large increases in pest populations.<sup>226</sup>

There are now between 1,200 and 1,800 such self-organizing groups in Bali, each controlling an irrigated field complex of from 4 to 800 hectares, overseeing 18 per cent of the island’s area. Nowadays, *subaks* are also found on other Indonesian islands where sizeable migrant communities of Balinese agriculturists have settled.

### Alternative public distribution systems

In some cases, grain banks have been combined with other activities to build the equivalent of a public distribution system. The Deccan Development Society, for example, a non-governmental organization in the subdistrict of Zaheerabad in Andhra Pradesh, India, has created a system based on a community grain fund for

whose procurement, storage and distribution are managed entirely by women.

Most of the members in the 11 villages it covers are marginal and small farmers and are organized into self-help groups, or *sanghams*. The farmers were given loans fixed at Rs. 4,200 (\$88) per acre to allow them to bring fallow lands into production over a three-year period. They repaid the loans in grain over a five-year period at pre-fixed prices. Some of this was used for food distribution to poor households who were identified by the villagers themselves, using a five-point poverty scale that they evolved through participatory wealth ranking. The poor households were issued a sorghum card entitling them to a fixed quantity of grain at a Rs. 3.50 per kilogram – one rupee less than the procurement price. The money was deposited in a bank account from which the interest payments helped bridge the gap between the procurement and subsidized prices.

Women committee members were responsible for timely implementation of all seasonal agricultural activities and for disbursing the loans. This programme has ensured that more

food is produced from the fallow lands and has also increased biodiversity by helping revive several varieties of crops, cereals, legumes, pulses and oilseeds, providing a more nutritious range of food.

### Common property resources

For food security, the poorest households often rely on common property resources – land, forest, waterways, wildlife and fish which they use as sources of food and fodder for both consumption and trade. In arid and semi-arid areas in India, for example, food from common property resources constitutes around one third of the food consumed by the poor.<sup>227</sup> In Tangail, Bangladesh, people take from 40 to 90 per cent of their food from what they call “uncultivated sources”.<sup>228</sup> As well as offering extra quantities of food, these can also add to the nutritional quality of the diet. Examples of non-timber forest produce gathered in the Lao People’s Democratic Republic are shown in Table V-1.

In some cases, the rights to use common

**Table V-1 – Diverse food from forests in the Lao People’s Democratic Republic**

	No. of products	Examples
<b>Fruits, seeds</b>	87	Sugar palm fruits, Baccaurea berries, Irvingia nuts
<b>Leaves</b>	86	Barringtonia, Lasia, Azadirachta, Centella
<b>Shoots</b>	23	Bamboo shoots, rattan shoots, palm hearts
<b>Tuber, roots</b>	22	Yam tubers (Dioscorea), Ganga roots
<b>Mushrooms</b>	16	Ear mushrooms, Shiitake, termite mushrooms
<b>Flowers</b>	4	Sesbania, Butea
<b>All Plants</b>	238	
<b>Fish</b>	300	Cyprinidae, Pangasiidae, Siluridae, Notopteridae
<b>Birds</b>	63	Dove, partridge, pheasant, bulbuls, Estrilda
<b>Mammals</b>	54	Squirrels, wild boar, rats, civet cats, mouse deer
<b>Reptiles, Amphibians</b>	41	Frogs, monitor lizards, snakes, turtles
<b>Molluscus</b>	7	Freshwater shrimps, crabs, snails, shells
<b>Insects</b>	5	Red ant eggs, bamboo grub, dung beetles
<b>All Animals</b>	470	
<b>Total</b>	<b>708</b>	

Source: Foppes, J. and S. Ketphanh (2004). “NTFP use and household food security in Lao PDR”, paper prepared for the NAFRI/FAO EM-1093 Symposium on Biodiversity for Food Security, Vientiane, 14 October 2004.

properties rotate. For example, in a fishing community in Sri Lanka, the size of the catch depends on the location and the time of the day. Access is therefore allotted on a strict schedule, so as to equalize catches between households.<sup>229</sup> In another example, the warabandi system of water distribution in rural Pakistan, canal water is distributed to farmers on a rotational basis at pre-specified times during the course of the week.<sup>230</sup> These traditional rules help households to smooth consumption over time, thereby reducing the risk of seasonal food insecurity.

Although some people use common resources as their main source of food, many will use them as secondary sources, particularly when their main crops such as rice, potatoes or pulses prove insufficient. A longitudinal study in a village in West Bengal, India, for example, showed how people would use secondary sources from which to collect or hunt for food.<sup>231</sup> They also used the

land of richer farmers, by picking vegetables that remained unharvested because they had been damaged by pests or bad weather. Similarly, in coastal areas during the flooding season, when there are fewer job opportunities, many landless households try to secure their living by fishing on rivers and canals and in flooded areas.

There are comparable examples of common property resources in urban areas.<sup>232</sup> In this case, people often scavenge for food from leftovers in markets – food which can be accessed by anybody. Urban residents also grow food on scraps of land along roads or railway tracks. This is common in many parts of South Asia, Cambodia, the Lao People’s Democratic Republic and Viet Nam. Generally those gleaning food in this way are women (Box V-3), and people from the poorest groups, ‘untouchables’ in Nepal for example, or ethnic minority groups in Bangladesh.

### Box V-3 – Women’s access to common property resources

Land rights can make a notable difference to women’s bargaining power within the home and community, enhance their confidence and sense of self-worth, as well as enable them to negotiate better deals in the wage labour market, increase the respect they command within the community, and facilitate their participation in village decision-making bodies. Empowerment in one or more of these forms has emerged wherever social movements or civil society entities have helped women gain access to land. Consider, too, women’s own perceptions; in the Bodhgaya movement in Bihar, India, women graphically contrasted their earlier voicelessness with their situation upon receiving land in two villages: “Now that we have the land, we have the strength to speak and walk.”

While women’s ownership of land is very important, women’s right to common property resources (forests, grazing lands, bodies of water, river beds, and natural resources collectively called “micro-environment”) is equally important. These provide vital resources: fuel, fodder, shelter, medicines and, above all, water and food. Since women are traditionally the ones who gather and collect fuel, fodder, water and food, as also process and serve them, recognizing women’s right to use common property resources is central to enhancement of their general well-being. Enabling women to fulfil this right helps women strengthen their “fall back position”; it tides them over crises of seasonality and calamity that regularly visit poor households. Furthermore, proper recognition of women’s right to use common property resources is also an insurance against misuse and overuse of these vital resources and mismanagement of biodiversity and ecology.

*Principal sources:* Agarwal, B. (1994). *A Field of One’s Own: Gender and Land Rights in South Asia* (Cambridge, Cambridge University Press); and Agarwal, B. (2003). “Gender and Land Rights Revisited: Exploring New Prospects via the State, family and Markets”, in *Journal of Agrarian Change*, vol. 3, nos. 1 and 2, 2003, pp. 184-224.

## Food storage and protection

One of the best ways of boosting food security is to reduce the amount of food that is lost during storage and transmission. In Bangladesh, for example, up to 20 per cent of food is lost in this way<sup>233</sup> and, in Sri Lanka, up to 40 per cent.<sup>234</sup> Urban and peri-urban areas generally have fairly modern food storage facilities that can minimize losses and deterioration in quality and nutritional value. Poor communities in rural areas, however, lacking modern methods, have had to devise some of their own – which vary according to the crop or the agro-climatic zone.

In the Himalayan regions of India, for example, food grains like maize, wheat and rice are stored in special bamboo containers called *peri*.<sup>235</sup> The farmers plaster the *peri* on the inside with a mixture of cow dung and clay, place them in a separate room on the ground floor, and subsequently fill them with grain from a hole in the roof. The bamboo allows air to flow through the grain store, and keeping the *peri* on the ground floor ensures cooler temperatures. Storing the food away from the main living space also protects the grain from potential fire hazards. The grain is unloaded via an opening on the bottom of each *peri*.

In other parts of the Himalayan region, grain is also stored in structures known as *darauntha* which are made of deodar wood which inhibits the entry of insects and larvae. The *darauntha* are kept in wooden buildings away from the living quarters, to prevent the entry of rodents and pests. Elsewhere, farmers keep grain in special earthen buildings that offer cool storage, though poor household may use bamboo – both cases built away from family units to avoid fire hazards.

## Food protection

While storing food, farmers also look for other ways to protect them from insects, mildew and dampness. For this purpose, they use indigenous and locally available material such as leaves from trees that have anti-microbial and pesticidal properties. One of the best-known examples is the neem, a tropical tree that grows in semi-arid climates. Due to the presence of the active compound, azadirachtin, the neem is almost completely free from insects and pests. In rural Bangladesh, India and Pakistan, farmers protect stored grains by mixing them with dried neem leaves (Box V-4).

### Box V-4 – The neem, the United Nations “tree of the 21<sup>st</sup> Century”

The United Nations has declared the neem as the "tree of the 21st century", since it offers a natural form of pesticide. It has been planted in many parts of the region, including Bangladesh, Cambodia, India, Indonesia, Islamic Republic of Iran, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand and Viet Nam, and has recently been introduced into Hainan Island, China.

Since the 1930s, farmers have applied neem cake to rice and sugarcane fields to protect them from stem borers and white ants. In some parts of India and Pakistan, farmers still put green neem twigs and leaves in rice nursery beds to produce robust seedlings and simultaneously ward-off attacks by early pests --- leafhoppers, plant-hoppers and whorl maggots. They have also improved storage of grains by mixing them with dried neem leaves.

In the 1960s, Indian scientists reported that the neem could be used to combat the desert locust and subsequently isolated several bioactive ingredients, particularly meliantriol and azadirachtin, from various parts of the tree. These findings aroused worldwide interest in the bioactivity of the neem tree. In 1994, the European Patent Office granted the US corporation W.R. Grace a patent on the neem as a method for controlling fungi on plants.<sup>236</sup>

Source: <<http://agroextracts.com/default.htm>>



### *Adaptation to climate variability*

Climate change will require major efforts at adaptation. Most of these will have to be carried out by communities – who may have to move, or change their mix of crops. In Nepal, some communities, with the support of national and international institutions, are also considering what species of crops will best suit their local circumstances.

Farmers have already noticed delays in the monsoon season, changes in rainfall intensity and duration, changing vegetation composition, more soil erosion, and reduced agricultural productivity. In response, Local Initiatives for Biodiversity, Research and Development, the National Agriculture Research Council and Biodiversity International, have begun a project in Begnas Village in western Nepal, using participatory plant breeding to improve the quality and traits

of local varieties. Farmers made an inventory of 69 local rice varieties and selected eight that had beneficial traits, such as the ability to cope with low rainfall or long droughts. There was then a cross-breeding programme, in which they selected the plants after each generation. After nine generations, a new variety called Mansara-5 emerged, which was well adapted to the local microclimate. Today, the villagers are continuing with participatory plant breeding activities. They are documenting local climate change impact and have recently initiated a community seed bank to conserve the gene pool of local varieties.<sup>237</sup>

As oil becomes more expensive and scarce, the agricultural and fishery sectors would have to search for alternative fuel sources. Already, there are efforts being made to address the potential fuel shortage problems by introducing renewable energy, including solar, biomass wastes, biogas, wind and hydro power (Box V-5).

#### **Box V-5 – Alternative fuels for agriculture**

**Solar** – One of the principle sources should be the sun. Asia-Pacific as a whole is estimated to have 30 to 35 per cent of the world's solar energy potential. Solar systems are useful in remote locations on farms, ranches and agricultural lands not connected to a power grid. Photovoltaic systems can provide electrification and heated hot water can be used for cleaning livestock pens and processing crops. Water pumps powered by solar-generated electricity can be used for food cleaning, livestock watering and crop irrigation.

**Biomass** – Another major form of decentralized energy uses biomass to power farm machinery and sugar and rice mills. In Indonesia and Thailand, many agricultural factories use excess residues – including rice husk, oil palm shell, bagasse, and corn cobs – to fuel cogeneration systems.<sup>238</sup> These systems also allow for local plants to sell their excess electricity to the power grid and use the profit gained to operate agricultural processing equipment.

**Biogas** – Produced from manure, biomass, sewage and energy crops, through anaerobic digestion, biogas is typically used for domestic heating and cooking fuel. But biogas can also be applied to agricultural production – integrated systems which are self-sufficient and self-contained, based solely on animal and agricultural wastes.<sup>239</sup> Not only do biogas plants generate feed for livestock via feed mills, the electricity generated provides power to lights, engines, pumps, dryers, burners, cooking and refrigeration. The animal wastes are further used for algae cultivation, mushroom growing and as feed for fish in the ponds for aquaculture.

*Wind power* – This can provide electricity in select locations. Wind power is generally known for powering homes, but small-scale wind turbines are alternatives to diesel and electricity pumps for irrigation. The ESCAP region possesses 12 to 18 per cent of the world’s total wind energy potential.<sup>240</sup>

*Hydropower* – Large and small-scale hydropower can provide additional energy for grain milling, sawmills and other activities related to farming. Small and micro-hydropower set-ups are suitable for more remote areas. The ESCAP region accounts for 41 per cent of the world’s total hydroelectric potential, contributing to an average 14 per cent of the region’s electricity production, and therefore holds much promise for the future.<sup>241</sup>

### **The strength of community responses**

Community-based responses to improve food security have a number of advantages over State systems. The main one is that they rely on informal but well-informed contracts of mutual support. People acting within communities know that if they cheat or renege on their obligations, any short-term benefits will be off-set by the long-term costs. Community-based responses thus have low information and enforcement costs.<sup>242</sup>

But community systems also have their problems. One is that they may exclude certain groups – women, for example, religious and ethnic minorities, persons with disabilities, and those at the bottom of the pyramid. A second limitation is that they are small and have limited resources, both human and financial, so cannot usually address covariate risks – particularly in the wake of disasters. In these circumstances they work best in combination with social protection programmes. Indeed, public schemes are much more effective when they involve beneficiaries, NGOs and community organizations, which can ensure that they are better targeted and more effective.<sup>243</sup>





*Photo: Stockexchange*

## AN AGENDA FOR FOOD SECURITY

**The food and fuel crises of 2008 were signals of what could lie ahead. When the world emerges from economic recession, the same issues are likely to surge again – perhaps with even greater ferocity. How can the countries of the region avoid the worst of these crises, ensuring that everyone has access to food, and that sufficient food is available at all times, while also protecting their citizens from shocks and emergencies?**

Food security depends on interlinked short-, medium- and long-term measures involving several sectors. For the Asia-Pacific region with almost thrice the number of undernourished children and adults as live in sub-Saharan Africa, ensuring food security for all its peoples is of immediate urgency. This will continue to be of importance in the long term as well. The imminent danger of large parts of the region facing severe water scarcity needs immediate attention. Sustainable food production to reinforce access measures is just as critical. Given the severity of problems in the agriculture sector, the promotion of sustainable agriculture must also begin immediately. The long-term consequences of climate change have to be effectively countered and adaptation initiatives must begin simultaneously with short- and medium-term measures for food security.

### **Short-term measure: improving access to food**

For large numbers of people in Asia-Pacific, food security depends as much on income as on food availability. People who have sufficient money will always have enough economic access to food. Thus, effective efforts to eliminate poverty and enhance the purchasing power of the poor and other vulnerable groups will also serve to build food security. The measures outlined below,

however, are those related specifically to food access and availability, especially with regard to the poor and vulnerable communities of the Asia-Pacific region.

Government action to promote the long-term availability of food on a sustainable basis must be complemented by measures to ensure economic and social, and physical access to food, particularly by poor and vulnerable groups. This includes ensuring that these groups have some form of protection against shocks, for example, through food provisioning to enhance the capacity of poor households to store a few weeks or months of grain supply, thereby ensuring that they would not live in a continuous hand-to-mouth existence.

### *Economic and social access*

Certain groups must have the protection of the State for food security to be assured on an equitable basis; these include groups who are marginalized and face discrimination on the grounds of one or more of these factors: gender, economic status, vulnerability as single parents or widows heading households, religion, ethnicity, caste, disability and illness, especially living with communicable diseases. Particular attention needs to be given to addressing the multiple food insecurities that women and girl children face. This may require, among other measures, review and amendment

of legislation and practices to ensure gender equality concerning inheritance and ownership of productive resources, so that women's equal right to food is explicitly protected.

There is a need to establish and strengthen public distribution systems that target food support at poor households, particularly those whose members are infirm or sick and whose care givers are thus unable to earn daily wages. Public distribution systems should offer a wide variety of locally-produced foods and include secondary crops such as corn, millets and sorghum. Governments could consider having such food distribution systems managed by civil society groups or local enterprises formed by groups of small farmers.

Social assistance programmes, such as food and cash transfers, which already exist in several countries of the region, provide a measure of protection against drops in food consumption caused by shocks. In addition, in the context of food security, a comprehensive social protection system can also play a vital role in supporting food production.

Guaranteed employment for food insecure groups is a major means of ensuring economic access to food. Public employment guarantee schemes, such as food-for-work or cash-for-work schemes, not only ensure minimum levels of food consumption, but also help people avoid resorting to damaging coping mechanisms that involve asset sales and indebtedness. Such schemes could employ large numbers in forest conservation, land contouring and integrated watershed development.<sup>244</sup> School feeding programmes are critical to providing basic nutrition to children, while encouraging attendance; and the use of solar steam cooking could reduce programme costs significantly. The effective functioning of these schemes requires attention to stopping leakages and more effective targeting of landless agricultural workers, small and marginal farmers, nomadic communities, people who have been internally displaced, women in women-headed households, people living with HIV and AIDS, and people with disabilities.

If, however, adequate food is produced at the household level, income-related public works expenditures should start to become secondary. Public works schemes would then become necessary to the extent that they would provide additional sources of income during breaks in the agricultural cycle. Furthermore, if Governments embark on the promotion of stable agro-industrial processing as a policy measure for providing green employment at local levels, rural labour would no longer need to resort to distress migration due to the smallest shock or disturbance.

### *Social protection against shocks*

Whole communities may experience food insecurity associated with 'covariate' shocks. In many cases, people face food insecurity because of 'idiosyncratic' shocks of various kinds such as family illness requiring payment of medical bills or sudden loss of income, for example, through crop failure due to a pest attack or job loss. In such circumstances, and as a coping strategy of last resort, people are often forced to sell their only productive assets. To prevent downward spiralling due to such shocks, governments need to consider strengthening systems of social protection, including through involving local banks in preventing the exploitation of the poor by private money lenders.

*Social protection for food production* – The most effective strategy for ensuring that the poorest people have food supplies in hand is to aim for sustainable increases of agricultural productivity on their land holdings. A key component of such a strategy is to support the central role of women in household-level food security through promoting, with health and nutrition education, sustainable home (or kitchen) gardens of indigenous food plants.<sup>245</sup> This strategy will reduce long-term dependence on budgetary resources and emergency actions. Other schemes targeting smallholders and the rural poor and that ensure minimum levels of income from agricultural activities can significantly boost smallholder food production. This would include a combination of the following:

- *Insurance* schemes, such as for micro-insurance, weather index insurance and community-based health insurance, which Governments can support at low premium rates affordable by poor communities. In the case of insurance schemes that aim to boost the capacity of vulnerable groups to cope with and survive ‘covariate’ shocks such as disasters that affect whole communities, more flexible financing and implementation arrangements are required.
- *Common property resource management systems*, including building institutions of stakeholders with joint responsibility for the management of these resources, and enactment and enforcement of legislation recognizing and protecting people’s usufructuary rights to these resources – land, forests, bodies of water and their biodiversity – which provide vital nutrients, supplementary foods, and insurance against fluctuations in food security.
- *Productivity-related schemes*, such as government-supported microcredit for the acquisition of non-fossil organic agricultural inputs. Governments could support small and marginal farmers in forming enterprises that meet their needs for community banks of grain, seeds, biomass, fodder, humus, working capital, processing, packing, storage and marketing facilities, tools and draught animals. Such measures, especially if available in a one-stop, farmer-friendly facility, would strengthen farmer capacity for holding surplus produce till prices are more remunerative and to enable the processing of raw produce, thereby adding value and reducing the farmers’ vulnerability to market volatility. Combining farmer-friendly facilities with improving domestic farm-gate prices and access to markets for this group of farmers would constitute a serious effort to better their livelihoods. Governments now need to seriously consider strong support for food producer groups to protect them from vicious cycle debt entrapment by commercial sources that control seed and agricultural input

monopolies. Low-interest loans, concessions and easier credit access, commensurate with the incentives long extended to industry, are other necessary government measures to protect the productivity of small farmers.

- *Strengthening the governance, accountability and administration of social protection schemes* through measures such as deregulation to protect farmers’ free access to biodiverse seed, plant, livestock and fish varieties, and decentralization to local-level elected bodies, building local institutions for social protection, undertaking social auditing, and making the right to information on social protection programmes a statutory right.

#### *Physical access: transport and logistics*

Proactive government support for transportation, primary processing and marketing infrastructure to shorten the supply chain between farmers, retail outlets and consumers would lower the costs of food and enhance access.

Governments also need to be concerned about the way food is transported, stored, marketed and distributed – whether it comes from national production or from imports. This will mean making domestic and international logistics systems more efficient, for example, by developing dry ports and inter-modal transfer points for consolidation, sorting, storage, processing and distribution. Increasingly, it is important to reduce emissions from ‘food miles’ in food transportation and minimize the carbon foot print and dependency on oil.

For perishable foods, it will be important to define and implement operational standards for the packaging, handling, storage and transport of fresh agricultural produce along the cold chain, bearing in mind that cold chains are energy-intensive and need to incorporate high-efficiency technologies.

To enhance access to food, current logistics, storage and marketing institutions and practices

need to be streamlined, with improvements in the corresponding infrastructure and services.

Especially important in areas prone to disasters are improvements to transport and logistics infrastructure and decentralized food storage facilities. Measures can include realigning roads away from unstable slopes, protecting and raising river banks in flood-prone areas, as well as stockpiling food in strategic locations for quick deployment and ensuring the availability of a range of transport options for emergency food distribution.

### *Improving choice and utilization of food*

Chronic diseases are increasing, partly due to poor nutrition, poor food quality and poor food safety. Measures are needed to enable people to have access to health-promoting foods and to nutrition education that recognizes food patterns and preferences. People have a right to make informed choices about the food that is available to them. The introduction of transparency in the certification and labelling of food, with due attention to the constraints and needs of small-scale food producers, would enable consumers in general to understand what they are eating and how it was produced.

Measures are also needed to ensure the physical capacity to absorb and utilize the nutritious value of food that is consumed. For this, there is need for strong multisectoral policy and programme coordination among all systems across the food chain on monitoring, reducing, controlling and treating infectious diseases. For example, public health measures providing constant access to potable water, promoting hand washing with soap at appropriate times, consumption of safe drinking water, and use of proper sanitation facilities are part of health promotion and environmental hygiene to significantly reduce vulnerability to water-borne and other diseases that prevent food absorption.

Mandatory treatment and recycling of solid and liquid wastes reduce food and water contamination

and improve food utilization through, among others, elimination of water-borne and microbial diseases. Community-based organizations could engage in these measures, some of which could be turned into remunerative activities.

### **Medium-term measure: sustainable agriculture**

The Governments of the region stand at a cross-roads: business as usual, continuing with short-term profits for the few through chemically cultivated, irrigation- and energy-intensive monoculture, with the burden of long-term costs shouldered by the many; or, a new, long-term commitment<sup>246</sup> to ecologically balanced, socially just and economically equitable agriculture to ensure food security for all.<sup>247</sup>

### *Revitalizing small-scale sustainable food production*

Much of the food produced in the Asia-Pacific region is produced by individual farmers, the majority of whom are small farmers. For long-term food security in the Asia-Pacific region, Governments may consider providing active State support for the participation of small-scale food producers in a new green food revolution that gives high priority to revitalizing small-scale food production based on ecologically viable systems. A shift to such systems will provide the poor with *in situ* sources of food security and livelihood. Such agriculture, being labour-intensive, presents opportunities for green employment; it could reduce distress migration and generate rural incomes, especially with rising consumer demand for organic food and recent declines in urban job opportunities.

The next stages in agricultural development will need to be much more about conserving natural resources, recycling carbon and ensuring that soils retain vital nutrients. It will also have to ensure that farmers and others protect biodiversity, conserve grasslands, wetlands and local forests in their watersheds and regenerate natural resources of soil and water. Options include integrated



pest management and zero tillage technology. In offering subsidies, governments will need to achieve a balanced combination of minerals, green manures and organic and inorganic fertilizers, bearing in mind that inorganic fertilisers are based on fossil fuel materials which may be constrained in future due to both the energy and climate crises. In the initial stages, Governments could promote the dissemination of good practices by linking farmers with at least three years of demonstrated, exemplary success in sustainable agriculture with agricultural education and research institutions, scientists and extension workers. This would support an enriching interaction between formal and indigenous systems of knowledge and practice, documentation and dissemination of sustainable agricultural practices for food security.

Governments may consider phasing out, through 20 to 25 per cent annual reductions over a time-bound period of, for example, five to 10 years, subsidies on soil-depleting agro-chemicals and inorganic nitrogenous fertilizer whose excessive use is incrementally destroying the vital biological quality of soil, contributing to global warming, and impoverishing farmers. Subsidies thus saved could instead be used as cash incentives to support farmers in offsetting initial risks (two to three years) associated with the local generation of biofertilizers, and to build up national agricultural capital of soil and water for sustainable agricultural productivity. Such phasing out, complemented by subsidies for biofertilizers, could be a part of targeted government policy towards rejuvenating and converting national cultivable land to ecologically sound, economically viable and sustainable food production.

Polyculture should be promoted in agriculture. A significant part of smallholder food production should increasingly be biodiverse, as insurance against various kinds of shocks to which agriculture is perpetually vulnerable, and based on integrated agroecosystems for greater resilience and productivity:<sup>248</sup> multiple cropping; multilayer cropping or forest gardening; and mixed cropping.

### *Rain-fed agriculture*

While it will be necessary to develop sustainable irrigation systems, it will be even more important to reap greater benefits from rain-fed agriculture. This will mean, for example, developing varieties of seeds that are resistant to drought and pests, water-logging and salinity, and creating market opportunities for dry-land farm products, such as pulses, oilseeds, millets, as well as vegetables, fruit, milk and meat.

### *Better water management*

Farmers will need to make smarter use of both soil moisture storage (green water) and irrigation, using indicator plants to assess soil moisture and schedule water flows. But governments will also need to give greater attention to watershed and river basin development and management. Governments shall need to achieve more optimal and equitable use of water resources, for example, by establishing common property rights over water, regulating rural water delivery through local bodies controlled by resident farmers, subsidizing small farm ponds and ground water recharge by farmers for immediate on-farm water availability, and promoting increased biomass and mulch to enhance ground water recharge to increase 'plant-available' water, as well as diminish the risk of run-offs and floods.

Governments may also consider offering incentives for upstream watershed management, through downstream 'payments for ecosystem services', and by providing tax breaks to encourage water storage and harvesting. At the same time, they should set limits on water withdrawals from rivers and groundwater sources, encourage environmentally sustainable water consumption, and promote the use of water-saving practices and technologies for increasing water efficiency and productivity.

Furthermore, governments could consider introducing a differential, incremental pricing mechanism for higher per capita/per hectare levels of consumption of surface or ground water in excess of a minimum allotment for irrigation

of food crops, especially those grown by small and marginal farmers. There is an emerging crisis of ground water in drier areas of the region, which feeds into the energy crisis by increasing the energy requirements for pumping ground water – this issue needs to be addressed with urgency.

### *Village knowledge and technology centres*

To strengthen sustainable agriculture for food security, governments can help establish ICT-networked knowledge centres, including at the village level. With good external connections, preferably through the internet, community radio or cell phones, these can disseminate ICT knowledge on experiences and options concerning seed and plant varieties, soil conservation and rejuvenation techniques, improvements in technology, attendant long- and short-term risks, costs and benefits, levels of regulation, as well as market trends, price fluctuations, weather forecasting and early warning. They could also cover all other aspects of rural life --- commerce, weather, health and education and be combined with women- and child-centred development and nutrition support programmes.

### **Long-term measure: adaptation to climate change**

Climate change holds the potential to radically alter agroecosystems in the coming decades and there is already evidence of devastating crop failures. Predictions concerning food production vary. However, even if overall production were to remain high, declines in certain parts of the region may be expected.<sup>249</sup> Governments have to encourage adaptation to climate change. This should include strengthening regional and national mechanisms for scientific assessment, forecasting and information sharing, while building national and local capacities for greater ecological literacy, monitoring agroecosystems and for assessing and managing risks.

The concept of building the resilience of communities to tackle the impact of climate change in the context of changes in socio-

economic and environmental conditions has to be rapidly developed and widely promoted. Integrating local knowledge and practices in adaptation and risk management strategies would enable local differences in meteorological dynamics associated with cultivation conditions to be taken into account.

Grasslands are under increasing stress due to global warming. The hundreds of millions of livestock that grasslands support add substantial depth to the food security and livelihoods of the poor. Governments must protect these sources of food security and livelihoods that are being endangered. Measures include rehabilitating degraded grasslands, as well as improving crop and grazing land use and management; and livestock and manure management.

To foster the resilience of the agricultural sector and its likely impact on food production, countries could develop five codes, based on the same logic as the Famine Codes developed in nineteenth century India. First, a *good weather* code – using the good years to prepare for the bad ones, for example, by developing drought-resistant seeds and raising appropriate trees in nurseries, so that in years of good rainfall, trees can be planted in arid areas to stabilize sand dunes. Second, a *drought* code that establishes changes in cropping patterns according to moisture availability. Third, a *flood* code with measures, such as developing seeds that are flood-resistant, as well as mulching and zero tillage, to mitigate soil erosion from heavy rainfall. Fourth, a *disaster* code for dealing with situations when disasters strike such as through the rehabilitation of irrigation sources, disposal of debris and waste from crop lands, distribution of seeds that are quick growing, and salt-resistant, as may be required, as well as the restoration of ecosystems and habitats. Fifth, an *adaptation* code for adapting to the effects of climate change and which outlines, among others, an incentive system for undertaking adaptation measures in the agricultural sector. In the emerging context of climate change and disturbed hydrological cycles, the privatization of water resources represents a threat to the long-term sustainability of Asia-

Pacific food production and that needs to be carefully reviewed.

## **Trans-boundary and other support measures**

### *Harnessing trade*

For food, most countries in the region rely, to some extent, on trade. In some short-term, emergency situations, Governments may feel compelled to raise import or export barriers to food trade. However, it is generally vital to avoid raising trade barriers. Furthermore, the promotion of food security with economic, social and ecological sustainability requires the removal of trade-distorting barriers.

Food trade can be promoted through regional cooperation on harmonizing sanitary and phytosanitary certification, and simplifying and increasing the transparency of administrative procedures and documents, by aligning them to international standards and introducing electronic certification, to facilitate exports by small farmers, and small- and medium-sized food production enterprises. Farmers could be supported to encourage the production of high market value, toxin-free food, if governments could, among other measures, provide small farmers' groups with free certification of organic food, as well as introduce compulsory labelling of chemically cultivated food.

There is scope for increasing the trade in high-value perishable food products, particularly from developing countries that produce such food but lack export capacity, though such export carries with it an energy burden. This can be supported by well-targeted trade policies and facilitation measures and orienting 'aid-for-trade' to build the capacity of small-scale developing country food producers and agroenterprises.

Within the framework of WTO compliance, Governments need to design their trade and intellectual property right policies in a manner that will support the development of sustainable, local food production and protect the rights

of Asia-Pacific developing country farmers to agricultural diversity, especially seeds and a broad gene base for their food production, while respecting their traditional, local knowledge and food production methods. Strategies for self-reliance in food and agriculture will, in the long run, build food security. Asia-Pacific countries need to cooperate more closely on food security-related trade issues, to support the development of a common position for negotiation towards the reformulation of trade-distorting policies in the agricultural sector and renegotiation of the TRIPS agreement for protecting the rights and livelihoods of farmers of the Asia-Pacific region.

### *Strengthening regional cooperation*

The bedrock of any food security system has to be built at the national level. But there are also opportunities for regional cooperation, including food aid. Food can serve as a bridge to help build better relations between nations.

### *Map food insecurity hotspots in Asia-Pacific -*

There is scope for regional cooperation to help build national systems and technical capacity for identifying food insecurity hotspots and food insecure groups, as well as tracking, collecting, analysing and disseminating statistics at national and local levels. These systems should include vulnerability mapping that combines information on food security statistics with other socio-economic data. They should also form the bases of early warning mechanisms for food security, including better weather forecasting and timely notifications of impending disasters.

### *Establish an Asia-Pacific food security coalition -*

This coalition could be composed of those that have a role in Asia-Pacific sustainable agriculture and food security: member States, academic and civil society institutions, farmers' and women's associations, as well as the mass media and bilateral and multilateral agencies. The coalition could:

- Develop indicators to guide decision-making and to track progress in improving food

security, at the national, subregional and regional levels, and suggest appropriate pre-emptive and remedial action.

- Incorporate an Asia-Pacific early warning and response system for timely prediction of major food shortages, as well as rapid sharing of information, technology and mitigation expertise.

*Build a knowledge hub* - ESCAP, together with other regional development agencies, could work closely with FAO in forming a regional information and knowledge hub on food security, to support an Asia-Pacific food security coalition which could, *inter alia*, include hosting a regional database on food security. Furthermore, for important food crops, special information modules on the logic of chemical and organic agriculture could be developed and made widely accessible via the internet for communities to exercise their right to make informed choices.

*Establish a network of IT providers* - Countries, such as India and the Republic of Korea, that have abundant software capabilities and those, such as China, with extensive hardware capabilities, could help other countries in the region introduce e-governance in the development of sustainable agriculture and food production.

*Networking ESCAP regional institutions to support Asia-Pacific food security* - Under the auspices of ESCAP, there are five regional institutions: Asian and Pacific Centre for Transfer of Technology (APCTT); Asian and Pacific Centre for Information and Communication Technology for Development (APCICT); Centre for Alleviation of Poverty through Secondary Crops Development in Asia and the Pacific (CAPSA); Statistical Institute for Asia and the Pacific (SIAP); United Nations Asia-Pacific Centre for Agricultural Engineering and Machinery (UNAPCAEM).

The five regional institutions could, in their respective areas, support sustainable agriculture

and food security through strengthening South-South cooperation, including on indigenous agricultural knowledge and practices, agricultural science, technology transfer, innovation and capacity building.

Furthermore, the regional institutions and the ESCAP secretariat could work with FAO and other stakeholders in assisting member States in developing, for regional consideration, a draft regional framework or guidelines on Asia-Pacific "plant variety protection" and "access and benefit sharing" regimes, to ensure effective fulfilment of "farmers' rights over farmers' varieties", as well as IPR-protected varieties, so as to bring into implementation effective domestic (*sui generis*) regimes to safeguard farmers from the onslaught of IPRs, taking into account the provisions of the Convention on Biological Diversity, the International Treaty on Plant Genetic Resources for Food and Agriculture, and the special and differential treatment of least developed countries in WTO.

In addition, CAPSA and UNAPCAEM, the two ESCAP regional institutions that are directly concerned with the agriculture sector, could play specific, complementary roles in supporting poor communities:

- CAPSA's role: reducing poverty and food insecurity of communities dependent on 'secondary' crops;
- UNAPCAEM's role: promoting transfer of technology, to enhance the productivity and sustainability of food production and post-harvest agro-processing by poor communities.

*Role of CAPSA* - A strengthened CAPSA, in cooperation with other regional and national agricultural research institutions and civil society groups, has a key role in improving the food security and livelihood of communities in fragile eco-regions by capturing across Asia-Pacific the ecological knowledge and practices that

farmers possess with respect to ‘secondary’ crops and promoting these as a regional resource for supporting poor communities.

In the context of climate change, there is a historic opportunity for CAPSA to overturn the decades-old prejudice against ‘secondary’ crops and promote twenty-first century understanding that, for very poor communities, these are ‘primary’ crops for their poverty reduction and food security.

CAPSA may thereby take forward the agenda for food security in Asia-Pacific by opening up a new research and policy action paradigm on sustainable agriculture in food insecure eco-regions, focusing on enabling communities to get out of poverty. In this regard and subject to consideration and approval by its Governing Council, CAPSA could pursue actions that include the following:

1. Undertake comprehensive spatial mapping of food insecure poor communities and the ‘secondary’ crops that are best suited to the various eco-regions in Asia-Pacific.
2. Improve, at the peasant household level, food productivity and nutritional support and build food provisioning capability by:
  - (a) Strengthening research on the cultivars that are indigenous to dry- and upland eco-regions, as well as the associated traditional farming knowledge and practices of small-scale food producers;
  - (b) Developing and deploying cultivars adaptable to site-specific conditions<sup>250</sup> and constraints, especially to preserve indigenous varieties of seeds, and enhancing sustainable use of land, water and biological resources;
  - (c) Supporting poor households in diversifying their food base and improving their dietary balance and nutrition, including during the lean season, by promoting a major policy initiative on sustainable home gardening.
3. Promote regional participatory, collaborative linkages among knowledge networks of poor communities that are ‘secondary crop’ smallholders, as well as national agricultural research systems, and civil society and academic stakeholders, to generate the evidence base for updating the curricula in agricultural science universities and extension training institutions.
4. Support and promote understanding of how indigenous cultivars grown by poor communities in biodiverse agro-ecosystems and associated knowledge systems contribute to all-year-round food provisioning and requirements for balanced nutrition and medicinal plants, so that Governments of the region may phase in a long-term policy and institutional shift that recognizes the primary importance, to poor communities, of indigenous cultivars that have traditionally been for them an important source of foods and medicinal plants.
5. Augment the economic and social status of communities in food insecure hotspots through:
  - (a) Advocating the inclusion of ‘secondary’ crop cereals in public distribution systems in the region and in food aid;
  - (b) Promoting, in collaboration with other regional institutions of ESCAP, labour-saving, small-scale, post-harvest drying, preservation, agro-processing and marketing of ‘secondary’ crops, including those using renewable energy, and building on indigenous approaches; aside from potential income benefits from value addition and contribution to year-round availability of foods in local markets, appropriate drying and preservation would enable poor communities to conserve nutrients in food supplies for use in lean periods;
  - (c) Participating in intra- and interregional South-South cooperation initiatives to support poor communities in their

adaptation of knowledge and practices to the specific conditions of the respective food insecure eco-regions.

for improving agricultural productivity and post-harvest processing in a sustainable manner.

*Role of UNAPCAEM* – Subject to consideration and approval by its Governing Council, UNAPCAEM could pursue, along with FAO, the ESCAP secretariat and other concerned stakeholders, three broad areas as part of ESCAP's connectivity role; UNAPCAEM could:

1. Bridge knowledge sharing in the Asia-Pacific region by:
  - (a) Serving as a node for regional promotion of sustainable agriculture, by developing strong linkages with national agricultural institutions and regional centres of excellence;
  - (b) Helping member States in developing the five codes (good weather, drought, flood and adaptation) to address climate change and its impact on food production.
2. Contribute substantive secretariat and technical services to support the initiation and operation of an Asia-Pacific food security coalition.
3. Initiate linkages among the five regional institutions for revitalizing small-scale sustainable food production for Asia-Pacific food security through effectively employing comprehensive outreach to the 62 members and associate members of ESCAP/UNAPCAEM, to support:
  - (a) Technology transfer;
  - (b) Evidence-based advocacy;
  - (c) ICT-supported knowledge sharing, e-certification and e-governance;
  - (d) Food-related trade and transport facilitation;
  - (e) Creation of an Asia-Pacific pool of extension experts;
  - (f) Development of appropriate technology

## **A window of opportunity**

The food price crisis of 2008 was a shock to the global food system. The prices may subsequently have subsided, but the underlying problems persist. And indications are that they would worsen. Rather than turning their attention away from food security, Governments of the region should regard that crisis as a warning of things to come, and seize this window of opportunity to establish a robust system of equitable, pro-poor, green food security, based on sound principles of sustainable agriculture. The time for decisive action is now.

## ENDNOTES

- 1 ESCAP, ADB and UNDP (2008). *A Future within Reach 2008* (United Nations publication, Sales No. E.08.II.F.15).
- 2 FAO (2008). *The State of Food Insecurity in the World 2008: High food prices and food security – threats and opportunities* (Rome, FAO).
- 3 Sen, A. (1999). *Development as Freedom* (New York, Alfred A. Knopf).
- 4 FAO (1983). *World Food Security: A Reappraisal of the Concepts and Approaches* (Rome, FAO).
- 5 FAO (2001). “Mobilizing resources to fight hunger”, Committee on World Food Security, Twenty-seventh Session, Rome, 28 May – 1 June 2001.
- 6 United Nations (2008). Millennium Development Goals Indicators - The official United Nations site for the MDG indicators <<http://mdgs.un.org/unsd/mdg/Data.aspx>> (accessed in November 2008).
- 7 UNICEF <<http://www.childinfo.org>> (accessed in March 2009).
- 8 ESCAP calculation based on information in *Young child survival and development* <<http://www.unicef.org/childsurvival/index.html>> (accessed in March 2009).
- 9 FAO (2001). *Ibid.*
- 10 FAO (2008). *Ibid.*
- 11 von Braun, J. (2007). *The World Food Situation: New Driving Forces and Required Actions* (Washington D.C., International Food Policy Research Institute).
- 12 FAO (2004). *The State of Food Insecurity in the World 2004: Monitoring Progress towards the World Food Summit and Millennium Development Goals* (Rome, FAO).
- 13 United Nations University (2007). “Vitamin and mineral deficiencies technical situation analysis: a report for the Ten Year Strategy for the Reduction of Vitamin and Mineral Deficiencies”, in *Food and Nutrition Bulletin*, vol. 28, no. 1 (supplement) (Tokyo, United Nations University Press).
- 14 Pandey, S. (2008). “The true price of rice”, in *Rice Today*, January-March 2008, pp. 36-37 <[www.irri.org](http://www.irri.org)> (accessed in November 2008).
- 15 Zeigler, M.M. (2003). “Hunger hotspots 2003”, in Bread for the World Institute (2003). *Agriculture in the Global Economy, Hunger 2003, 13th Annual Report on the State of World Hunger* (Washington D.C., Bread for the World).
- 16 M.S. Swaminathan Research Foundation and WFP (2002). *Food Insecurity Atlas of Rural India* (Chennai, M.S. Swaminathan Research Foundation).
- 17 M.S. Swaminathan Research Foundation and WFP (2002). *Ibid.*
- 18 UNDP (2002). *China Human Development Report 2002: Making Green Development a Choice* (Hong Kong, China, Oxford University Press).

- <sup>19</sup> Committee for Planning and Investment National Statistics Centre. “Summary report: Food insecurity assessment based on food consumption statistics derived from the 2002/2003 Lao PDR Expenditure and Consumption Survey” <[http://www.fao.org/faostat/foodsecurity/files/FoodInsecurityAssessmentReport\\_LaoPDR\\_2002-03.pdf](http://www.fao.org/faostat/foodsecurity/files/FoodInsecurityAssessmentReport_LaoPDR_2002-03.pdf)> (accessed in December 2008).
- <sup>20</sup> Smith, L.C. and A. Subandoro (2007). *Measuring Food Security Using Household Expenditure Surveys. Food Security in Practice No. 3, Technical Guide Series* (Washington, D.C., International Food Policy Research Institute).
- <sup>21</sup> UNAIDS and WHO (2007). *AIDS Epidemic Update: December 2007* (Geneva, UNAIDS and WHO).
- <sup>22</sup> Piwoz, E. and E. Preble (2000). *HIV/AIDS and Nutrition. A Review of the Literature and Recommendations for Nutritional Care and Support in Sub-Saharan Africa SARA Project* (Washington D.C., US Agency for International Development).
- <sup>23</sup> Bellin-Sesay, F. (2003). “Overview on Current HIV/AIDS in Asia: Some Implications for food and nutrition security”, in *Malaysian Journal of Nutrition*, vol. 9, no. 2, pp. 75-84.
- <sup>24</sup> Gillespie, S. and S. Kadiyala (2005). *HIV/AIDS and Food and Nutrition Security: From Evidence to Action* (Washington, D.C., International Food Policy Research Institute).
- <sup>25</sup> Childinfo (2008). “Monitoring the situation of children and women. Statistics by area: Child nutrition” <[http://www.childinfo.org/undernutrition\\_weightbackground.php](http://www.childinfo.org/undernutrition_weightbackground.php)> (accessed in October 2008).
- <sup>26</sup> Praxis (1998). *Participatory Poverty Profiling Study, Bolangir District, Orissa* (Patna, Praxis).
- <sup>27</sup> Inter-Press Service (2008). “Q&A: Women do most, with least assistance: Interview with Lennart Båge, President of the International Fund for Agricultural Development”, 14 August 2008 <<http://ipsnews.net/news.asp?idnews=43554>> (accessed in November 2008).
- <sup>28</sup> Alternative for India Development. “Food security and migration” <[http://www.aidindia.org.uk/nl\\_mig\\_nov06/mig\\_oct01.htm](http://www.aidindia.org.uk/nl_mig_nov06/mig_oct01.htm) on 15 January 2009> (accessed in November 2008).
- <sup>29</sup> Tan, Y. and D. Xin (2009). “20 million migrants lost jobs: Survey”, in *China Daily*, 3 February 2009, p. 1 <[http://www.chinadaily.com.cn/china/2009-02/03/content\\_7440106.htm](http://www.chinadaily.com.cn/china/2009-02/03/content_7440106.htm)> (accessed in February 2009).
- <sup>30</sup> Navasranjan. “Who are dalits?” <<http://navasranjan.org/navasranjan/dalits/whoaredalits>> (accessed in February 2009).
- <sup>31</sup> Shrestha, A. (2003). “Dalits in Nepal: Story of discrimination” <[http://www.hurights.or.jp/asia-pacific/no\\_30/04.htm](http://www.hurights.or.jp/asia-pacific/no_30/04.htm)> (accessed in February 2009).
- <sup>32</sup> World Bank (2006). *Making the New Indonesia Work for the Poor* (Washington, D.C., World Bank).
- <sup>33</sup> Sun, Y. (2008). “Poor Chinese farmers sell and buy less in response to rising food prices”, in *IFAD, Making a Difference in Asia and the Pacific*, issue 21, June-July 2008.
- <sup>34</sup> Raihan, S. (2008). “Impact of food price rise on school enrolment and dropout in the poor and vulnerable households in selected areas of Bangladesh”, in *Bangladesh Economic Outlook*, vol. 2 no. 1, September.



- <sup>35</sup> Reliefweb. “Urgent support needed for Pacific farmers and food consumers” <<http://www.reliefweb.int/rw/rwb.nsf/db900SID/KKAA-7JR87>> (accessed in December 2008).
- <sup>36</sup> Herath, A. (2008). “Higher food prices, fewer meals in Sri Lanka” in *IFAD: Making a Difference in Asia and the Pacific*, issue 21, June-July 2008.
- <sup>37</sup> Hayami, Y. and V. Ruttan (1985). *Agricultural Development: An International Perspective* (Baltimore, Johns Hopkins University Press).
- <sup>38</sup> Dalrymple, D. (1985). “The development and adoption of high-yielding varieties of wheat and rice in developing countries”, in *American Journal of Agricultural Economics*, vol. 67, pp. 1067-1073.
- <sup>39</sup> FAO (2007). *Selected Indicators of Food and Agricultural Development in the Asia-Pacific Region 1996-2006* (RAP 2007/15) (Bangkok, FAO Regional Office for Asia and the Pacific) <<http://www.fao.org/docrep/010/ah994e/ah994e00.htm>> (accessed in January 2009).
- <sup>40</sup> FAO Regional Office for Asia and the Pacific (2008). *The State of Food and Agriculture in Asia and the Pacific Region* (RAP Publication 2008/03) (Bangkok, FAO Regional Office for Asia and the Pacific).
- <sup>41</sup> McCullough, E., P. Pingali and K. Stamoulis (2008). *The Transformation of Agri-food Systems: Globalization, Supply Chains and Smallholder Farmers* (Rome, FAO).
- <sup>42</sup> David, C. C. and K. Otsuka (eds.) (1993). *Modern Rice Technology and Income Distribution in Asia* (Boulder, Lynne Rienner).
- <sup>43</sup> FAO Regional Office for Asia and the Pacific (2005). *Rural Women and Food Security in Asia and the Pacific: Prospects and Paradoxes* (Bangkok, FAO RAP).
- <sup>44</sup> United Nations Environment Programme (September 2008). *Green Jobs: Towards decent work in a sustainable, low-carbon world*, pp. 231-232 <[www.unep.org/civil\\_society/Publications/index.asp](http://www.unep.org/civil_society/Publications/index.asp)> (accessed in March 2009).
- <sup>45</sup> United Nations Development Programme (2002). *Human Development Report 2002* (New York, Oxford University Press).
- <sup>46</sup> World Bank. World Development Indicators Online <<http://ddp-ext.worldbank.org/ext/DDPQQ>> (accessed in October 2008).
- <sup>47</sup> World Bank. World Development Indicators Online. *Ibid.*
- <sup>48</sup> FAO Regional Office for Asia and the Pacific (2008). *Ibid.*
- <sup>49</sup> Pingali, P., C. Marquez, A. Rola and F. Palis (1995). “The Impact of Long-Term Pesticide Exposure on Farmer Health: A Medical and Economic Analysis in the Philippines”, in Pingali, P. and P. Roger (eds.) (1995). *Impact of Pesticides on Farmer Health and the Rice Environment* (Boston, Kluwer Academic Publishers).
- <sup>50</sup> McCullough, E., P. Pingali and K. Stamoulis (2008). *Ibid.*; Pingali, P., C. Marquez, A. Rola and F. Palis (eds.) (1995). *Ibid.*
- <sup>51</sup> FAO Regional Office for Asia and the Pacific (2007). *Ibid.*
- <sup>52</sup> FAO Regional Office for Asia and the Pacific (2007). *Ibid.*

- <sup>53</sup> World Bank (2008). *Trade and Transport Facilitation Systems in South Asia: Systems in Transition* (Washington D.C., World Bank).
- <sup>54</sup> SITPRO (2008). *The Cost of Paper in the Supply Chain: "Project Hermes", Perishable Foods Sector Research Report* (London, SITPRO).
- <sup>55</sup> Research and Information System for the Non-Aligned and Other Developing Countries (2004). *South Asia Development and Cooperation Report 2004* (New Delhi, RIS).
- <sup>56</sup> United Nations Economic Commission for Europe/United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) (2005). "Recommendation and Guidelines on establishing a Single Window to enhance the efficient exchange of information between trade and government, Recommendation 33" <[http://www.unece.org/cefact/recommendations/rec33/rec33\\_trd352e.pdf](http://www.unece.org/cefact/recommendations/rec33/rec33_trd352e.pdf)> (New York and Geneva, United Nations).
- <sup>57</sup> Kasetsart University, Institute for Information Technology Innovation (2007). "Study and analysis for the development of Thailand single window e-logistics systems: Final report", commissioned by the Ministry of Information and Communication Technology, Government of Thailand, Bangkok.
- <sup>58</sup> ESCAP (2008a). *Economic and Social Survey of Asia and the Pacific 2008* (United Nations publication, Sales No. E08.II.F.7).
- <sup>59</sup> Sharma, R. and P. Konandreas (2008). "WTO provisions in the context of responding to soaring food prices", in FAO Commodity and Trade Policy Research Working Paper No. 25 (Rome, FAO).
- <sup>60</sup> World Bank (2008). World Trade Indicators Database <<http://go.worldbank.org/3Q2ER38J50>> (accessed in November 2008).
- <sup>61</sup> FAO Briefs on Import Surges (2006). "Import Surges: What is their frequency and which are the countries and commodities most affected?", issue no. 2 (Rome, FAO) <<ftp://ftp.fao.org/docrep/fao/009/j8675e/j8675e00.pdf>> (accessed in November 2008).
- <sup>62</sup> FAO (2006). *Ibid.*
- <sup>63</sup> Fiji, Ministry of Finance (2009). "Fiji's economic response to the food crisis" – case study prepared by S. Torrance, Senior Economic Planning Officer, as a contribution for the preparation of the ESCAP theme study on sustainable agriculture and food security in Asia and the Pacific.
- <sup>64</sup> Hettige, H. (2006). *When do Rural Roads Benefit the Poor and How? An in-depth Analysis Based on Case Studies* (Manila, ADB).
- <sup>65</sup> Glewwe, P. and V. Linh (2008). "Impacts of rising food prices on poverty and welfare in Vietnam", Midwest Conference on International Development Economics, Madison, Wisconsin, 1-2 May 2008.
- <sup>66</sup> Short, P. (1999). *Mao: A Life* (New York, Henry Holt).
- <sup>67</sup> Jazairy, I., M. Alamgir and T. Panuccio (1992). *The State of World Rural Poverty: An Inquiry into Its Causes and Consequences* (London, Intermediate Technology Press for International Fund for Agricultural Development).
- <sup>68</sup> Ecumenical Church Loan Fund International (2008). "Micro-loans to 56 rice farmers in the Philippines" <<http://www.globalgiving.com/pr/1200/proj1101a.html#progressReports>> (accessed in December 2008).

- <sup>69</sup> Child Workers in Asia Association (2007). *Understanding Bonded Child Labour in Asia: An Introduction to the Nature of the Problem and How to Address It* (Bangkok, Child Workers in Asia Foundation).
- <sup>70</sup> “Plight of Chinese farmer”, in *The Strait Times*, 5 September 2004 <<http://www.hartford-hwp.com/archives/55/333/html>> (accessed in October 2008).
- <sup>71</sup> ESCAP (2007). *Statistical Yearbook for Asia and the Pacific 2007* (United Nations Publication, Sales No. B.08.II.F.1).
- <sup>72</sup> United Nations Children’s Fund/ World Health Organization (2004). *Low Birthweight - Country, Regional and Global Estimates* (New York, UNICEF).
- <sup>73</sup> World Health Organization. “Exclusive Breastfeeding” <[http://www.who.int/nutrition/topics/exclusive\\_breastfeeding/en/](http://www.who.int/nutrition/topics/exclusive_breastfeeding/en/)> (accessed in November 2008).
- <sup>74</sup> UNICEF (2006). *UNICEF joint health and nutrition strategy for 2006–2015* (United Nations Economic and Social Council.E/ICEF/2006/8)
- <sup>75</sup> ADB (2008). *Food Prices and Inflation in Developing Asia: Is Poverty Reduction Coming to an End? Special Report* <[www.adb.org](http://www.adb.org)> (accessed in May 2008).
- <sup>76</sup> Tolentino, B. and T. Norbu (2008). “Soaring world food prices exacerbate challenges across Asia, especially in the Philippines”, in *The Asia Foundation*, March 2008.
- <sup>77</sup> Food and Agriculture Organization, Global Information and Early Warning System on Food and Agriculture (GIEWS). Data and Analysis Tool <<http://www.fao.org/giews/pricetool/>> (accessed March 2009).
- <sup>78</sup> Brahmabhatt, M. and L. Christuaensen (2008). *Rising Food Prices in East Asia: Challenges and Policy Options* (Washington D.C., World Bank).
- <sup>79</sup> He, C. (2008). “Twin crises of finance and food”, in *China Daily*, Thursday, 20 November 2008, p. 9.
- <sup>80</sup> “The end of cheap food,” in *The Economist*, 6 December 2007.
- <sup>81</sup> Song, B. (2007). “Market power and competitive analysis of China’s soybean import market”, paper presentation contributed to the International Agricultural Trade Research Consortium (IATRC), 8-9 July 2007, Beijing.
- <sup>82</sup> ESCAP (2009). *Economic and Social Survey of Asia and the Pacific 2009* (United Nations publication, Sales No. E.09.II.F.11).
- <sup>83</sup> Grunwald, M. (2007). “The clean energy scam”, in *Time*, 7 April 2007.
- <sup>84</sup> Hossain, M. (2007). “A balancing act”, in *Rice Today*, April-June 2007.
- <sup>85</sup> ESCAP (2008b). *Energy Security and Sustainable Development in Asia and the Pacific* (New York, United Nations).
- <sup>86</sup> Liu, W. (2008). “Slow growth of agricultural productivity”, background paper contributed for the preparation of the ESCAP theme study on sustainable agriculture and food security in Asia and the Pacific.
- <sup>87</sup> Pardey, P. and N. Beintema (2001). *Slow Magic: Agricultural R&D a Century after Mendel*. (Washington D.C., International Food Policy Research Institute).

- <sup>88</sup> Otsuka, K. “The green revolution in Asia and its sustainability” <<http://www.fasid.or.jp/daigakuin/sien/kaisetsu/051125report.pdf>> (accessed in November 2008).
- <sup>89</sup> ESCAP (2008a). *Ibid.*
- <sup>90</sup> Ban, K. (2008). “Address by the Secretary-General to the High-Level Conference on World Food Security”, 3 June 2008 (Rome, FAO).
- <sup>91</sup> Bradsher, K. (2008). “A drought in Australia, a global shortage of rice”, in *The New York Times*, 17 April 2008 <<http://www.nytimes.com/2008/04/17/business/worldbusiness/17warm.html>> (accessed in May 2008).
- <sup>92</sup> Graziano, J. “The global food crisis” <[http://www.ukwatch.net?article/the\\_global\\_food](http://www.ukwatch.net?article/the_global_food)> (accessed in July 2008).
- <sup>93</sup> International Food Policy Research Institute (2008). “Speculation and world food markets”, in *IFPRI Forum*, July 2008.
- <sup>94</sup> Macwhirter, I. (2008). “The trading frenzy that sent prices soaring”, in *The New Statesman*, 17 April 2008.
- <sup>95</sup> International Food Policy Research Institute (2008). *Ibid.*
- <sup>96</sup> Krugman, P. (2008). “Running out of planet to exploit”, in *The New York Times*, 21 April 2008.
- <sup>97</sup> International Food Policy Research Institute (2008). *Ibid.*
- <sup>98</sup> Burkhard, J. (2008). “The price of oil: A reflection of the world”, Testimony before the Committee on Energy and Natural Resources, United States Senate, 3 April 2008 (Washington D.C., Cambridge Energy Research Associates); International Monetary Fund (2006). *World Economic Outlook* (Washington, D.C., IMF).
- <sup>99</sup> UNCTAD (2007). “The development role of commodity exchanges”, TD/B/COM.1/EM.33/2 (Geneva, UNCTAD).
- <sup>100</sup> OECD-FAO (2008). *Agricultural Outlook: 2008-2017* (Paris, OECD) <<http://www.oecd.org/dataoecd/54/15/40715381.pdf>> (accessed in December 2008)
- <sup>101</sup> International Energy Agency (2008). *World Energy Outlook 2008* (Paris, IEA).
- <sup>102</sup> Woods, S., K. Sebastian and S.J. Scherr (2000). *Pilot Analysis of Global Ecosystem: Agroecosystems* (Washington D.C., World Resources Institute) <<http://www.ifpri.org/pubs/books/page.htm>> (accessed in March 2006).
- <sup>103</sup> ESCAP (2005). *State of the Environment in Asia and the Pacific 2005* (United Nations publication, Sales No. E.06.II.F.30).
- <sup>104</sup> Xie, Y. (2008). “Land erosion ‘threat to food supply’”, in *China Daily*, 22-23 November 2008.
- <sup>105</sup> Xie, Y. (2008). *Ibid.*
- <sup>106</sup> Xie, Y. (2008). *Ibid.*
- <sup>107</sup> ESCAP (2005). *Ibid.*

- <sup>108</sup> Mazhar, F. and others (2007). *Food Sovereignty and Uncultivated Biodiversity in South Asia* (New Delhi, Academic Foundation and International Development Research Centre).
- <sup>109</sup> FAO (2005). *Global Forest Resources Assessment 2005* (Rome, FAO).
- <sup>110</sup> United Nations Economic Commission for Europe and Food and Agriculture Organization (2005). *Forest Products Annual Market Review 2004-2005* (ECE/TIM/BULL/2005/3) (Geneva, United Nations).
- <sup>111</sup> ESCAP (2005). *Ibid.*
- <sup>112</sup> FAO (2003). *State of the World's Forests 2003* (Rome, FAO).
- <sup>113</sup> FAO Regional Office for Asia and the Pacific (2007). *The Future of Large Rice-based Irrigation Systems in South-East Asia: Proceedings of the Regional Workshop on the Future of Large Rice-based Irrigation Systems in South-East Asia, Ho Chi Minh City, 26-28 October 2005* (RAP publication 2007/28) (Bangkok, FAO Regional office for Asia and the Pacific).
- <sup>114</sup> Liu, J. and H.H.G. Savenije. "Food consumption patterns and their effect on water requirement in China", in *Hydrology and Earth Systems Sciences*, vol. 12, pp. 887-898 <<http://www.hydrol-earth-syst-sci.net/12/887/2008/hess-12-887-2008.html>> (accessed in November 2008).
- <sup>115</sup> United Nations Convention to Combat Desertification and the International Fund for Agricultural Development (2007). *Women Pastoralists: Preserving Traditional Knowledge, Facing Modern Challenges* (Bonn, UNCCD).
- <sup>116</sup> Lopez-Gunn, E. and M.R. Llamas (2008). "Re-thinking water scarcity: Can science and technology solve the global water crisis?", in *Natural Resources Forum*, vol. 32, no. 3. (August 2008), pp. 228-238.
- <sup>117</sup> The International Bank for Reconstruction and Development and the World Bank (2007). *World Development Report 2008: Agriculture for Development* (Washington, D.C., World Bank).
- <sup>118</sup> The International Bank for Reconstruction and Development and the World Bank (2007). *Ibid.*
- <sup>119</sup> World Resources Institute (2005). *Millennium Ecosystem Assessment, Ecosystems and Human Well-Being: Wetlands and Water Synthesis* (Washington D.C., World Resources Institute).
- <sup>120</sup> FAO. Aquastat <<http://www.fao.org/nr/water/aquastat/main/index.stm>> (accessed in September 2008).
- <sup>121</sup> FAO Regional Office for Asia and the Pacific (2008). *Ibid.*
- <sup>122</sup> Devan, J., S. Negri and J.R. Woetzel. "Meeting the challenges of China's growing cities", *The McKinsey Quarterly* <[http://www.mckinseyquarterly.com/Economic\\_Studies/Country\\_Reports/Meeting\\_the\\_challenges\\_of\\_Chinas\\_growing\\_cities\\_2152](http://www.mckinseyquarterly.com/Economic_Studies/Country_Reports/Meeting_the_challenges_of_Chinas_growing_cities_2152)> (accessed in July 2008)
- <sup>123</sup> Gleick, P. (2006). *Water Conflict Chronology* <<http://www.worldwater.org/conflictchronology.pdf>> (accessed in August 2008).
- <sup>124</sup> Panda, R.K. (2008). "A new dimension of water conflict in Orissa: Industry vs. agriculture" *Society for the Study of Peace and Conflict*, Article no. 140, 15 February 2008. <[http://www.sspconline.org/article\\_details.asp?artid=art153](http://www.sspconline.org/article_details.asp?artid=art153)> (accessed in September 2008).

- <sup>125</sup> International Water Management Institute (2007). *Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture* (London, Earthscan).
- <sup>126</sup> Rosegrant, M.W., X. Cai and S. Cline (2002). *World Water and Food to 2025: Dealing with Scarcity* (Washington D.C., IFPRI).
- <sup>127</sup> FAO (2008). *Ibid.*
- <sup>128</sup> FAO (2006). “FAO sees major shift to bioenergy” <<http://www.fao.org/Newsroom/en/news/2006/1000282/index.html>> (accessed in November 2008).
- <sup>129</sup> Renewable Fuels Association - Industry - Statistics <<http://www.ethanolrfa.org/>> (accessed in April 2009).
- <sup>130</sup> Morrison, D. (2008). “Converting pristine lands to biofuel farms worsens global warming” <[http://www1.umn.edu/umnnews/Feature\\_Stories/Converting\\_pristine\\_lands.html](http://www1.umn.edu/umnnews/Feature_Stories/Converting_pristine_lands.html)> (accessed in November 2008).
- <sup>131</sup> Crutzen, P. (2007). “Biofuels may raise GHG emissions, says Nobel Laureate”, news item dated 17 October 2007 <<http://prismwebcastnews.com/2007/10/17/biofuels-may-raise-ghg-emissions-says-nobel-laureate-paul-crutzen/>> (accessed in November 2008).
- <sup>132</sup> Checkbiotech (2007). “Biofuel crops threaten indigenous people”, news item dated 15 May 2007 <[http://bioenergy.checkbiotech.org/news/2007-05-15/Biofuel\\_crops\\_threaten\\_Indigenous\\_people/](http://bioenergy.checkbiotech.org/news/2007-05-15/Biofuel_crops_threaten_Indigenous_people/)> (accessed in October 2008).
- <sup>133</sup> World Bank (2008). “Biofuels: The promise and the risks”, in *Agriculture for Development Policy Brief, World Development Report 2008*.
- <sup>134</sup> World Bank (2008). *Ibid.*
- <sup>135</sup> Oxfam. “Biofuels” <[http://www.oxfam.org.uk/oxfam\\_in\\_action/issues/biofuels.html](http://www.oxfam.org.uk/oxfam_in_action/issues/biofuels.html)> (accessed in January 2009).
- <sup>136</sup> von Braun, J. (2008). *Food Prices, Biofuels and Climate Change* <<http://www.ifpri.org/presentations/200802jvbbiofuels.pdf>> (accessed in February 2008).
- <sup>137</sup> Lederer, E.M. “Production of biofuels ‘is a crime’”, in *The Independent*, 27 October 2007 <<http://www.independent.co.uk/environment/green-living/production-of-biofuels-is-a-crime-398066.html>> (accessed in October 2008).
- <sup>138</sup> International Energy Agency (2006). *World Energy Outlook 2006* (Paris, IEA).
- <sup>139</sup> Bergeron, L. (2008). “Feeding and fueling the future: the bioenergy potential of reviving abandoned agricultural land”, in *Stanford Report*, 24 June 2008 <<http://news-service.stanford.edu/pr/2008/pr-biofuel-070908.html>> (accessed in October 2008).
- <sup>140</sup> James, C. (2007). “Global Status of Commercialized Biotech/GM Crops: 2007”, in *ISAAA Briefs No. 37-2007. Executive Summary* <<http://www.isaaa.org/resources/publications/briefs/37/executivesummary/default.html>> (accessed in October 2008).
- <sup>141</sup> James, C. (2007). *Ibid.*
- <sup>142</sup> James, C. (2007). *Ibid.*

- <sup>143</sup> FAO and others (2008). “International Assessment on Agricultural Knowledge, Science and Technology for Development: Executive Summary of the Synthesis Report” <[http://w.w.w.agassessment.org/docs/SR\\_Exec\\_Sum\\_280508\\_English.htm](http://w.w.w.agassessment.org/docs/SR_Exec_Sum_280508_English.htm)> and Global Summary for Decision Makers <[http://w.w.w.agassessment.org/docs/Global\\_SDM\\_060608\\_English.htm](http://w.w.w.agassessment.org/docs/Global_SDM_060608_English.htm)> (accessed in October 2008).
- <sup>144</sup> Heinemann, J.A. (2009). *Hope not Hype: The Future of Agriculture Guided by the International Assessment of Agricultural Knowledge, Science and Technology for Development* (Penang, Third World Network).
- <sup>145</sup> FAO and others (2008). *Ibid.*
- <sup>146</sup> Heinemann, J.A. (2009). *Ibid.*
- <sup>147</sup> Santaniello, V. (2003). “Agricultural biotechnology: Implications for food security”, in *Proceedings of the 25th International Conference of Agricultural Economists, 18–22 August 2003* (Durban, IAAE).
- <sup>148</sup> Myhr, A.I. and T. Traavik (2002). “The precautionary principle: Scientific uncertainty and omitted research in the context of GMO use and release”, in *Journal of Agricultural and Environmental Ethics* (2002), vol. 15, pp. 73–86.
- <sup>149</sup> Domingo, J.L. (2000). “Health risks of genetically modified foods: many opinions but few data”, in *Science* (2000), vol. 288, pp. 1748–1749; Domingo, J.L. (2007). “Toxicity studies of genetically modified plants: A review of the published literature”, in *Critical Reviews in Food Science and Nutrition* (2007), 47 (8): 721–733.
- <sup>150</sup> Pryme, I.F. and R. Lembcke (2003). “*In vivo* studies on possible health consequences of genetically modified food and feed – with particular regard to ingredients consisting of genetically modified plant materials”, in *Nutrition and Health* (2003), vol. 17, pp. 1–8.
- <sup>151</sup> Pusztai, A. and S. Bardocz (2005). “GMO in animal nutrition: potential benefits and risks”, in Mosenthin, R., J. Zentek and T. Zebrowska (eds.) *Biology of Nutrition in Growing Animals*. (Amsterdam, Elsevier Limited), pp. 513–540; Pusztai, A., S. Bardocz and S.W.B. Ewen (2003). “Genetically modified foods: Potential human health effects”, in D’Mello, J.P.F. (ed.) (2003). *Food Safety: Contaminants and Toxins* (London, CABI), pp. 347–372; Traavik, T. and J. Heinemann (2007). *Genetic Engineering and Omitted Health Research: Still No Answers to Ageing Questions, TWN Biotechnology & Biosafety Series 7* (Penang, Third World Network); Wilson, A.K., J.R. Latham and R.A. Steinbrecher (2006). “Transformation-induced mutations in transgenic plants: analysis and biosafety implications”, in *Biotechnology and Genetic Engineering Reviews* (2006), vol. 23, pp. 209–234.
- <sup>152</sup> Snow, A.A. and others (2003). “Genetically engineered organisms and the environment: Current status and recommendations”, in Ecological Society of America position paper <[http://www.esa.org/pao/esaPositions/Papers/geo\\_position.htm#top](http://www.esa.org/pao/esaPositions/Papers/geo_position.htm#top)> (accessed in November 2008); Wolfenbarger, L.L. and P.R. Phifer (2000). “The ecological risks and benefits of genetically engineered plants”, in *Science* (2000), vol. 290, pp. 2088–2093.
- <sup>153</sup> Myhr, A.I. and T. Traavik (2002). *Ibid.*
- <sup>154</sup> Jordan, C.F. (2002). “Genetic engineering, the farm crisis and world hunger”, in *BioScience* (2002), vol. 52, pp. 523–529.
- <sup>155</sup> FAO (2003). *World Agriculture: Towards 2015/2030. An FAO perspective*. Bruinsma, J. (ed.).

(London, Sterling: Earthscan Publications Ltd.).

- 156 Santaniello, V. (2003). *Ibid.*
- 157 Falcon, W.P. and C. Fowler (2002). “Carving up the commons – emergence of a new international regime for germplasm development and transfer”, in *Food Policy* (2002), vol. 27, pp.197-222.
- 158 Greenpeace China and Third World Network (2008). “*Chinese*” *Genetically Engineered Rice in Foreign Patent Trap?* (Beijing, Greenpeace 2008).
- 159 Commission on Intellectual Property Rights (2002). *Integrating Intellectual Property Rights and Development Policy* (London, CIPR); FAO and others (2008). *Ibid.*
- 160 FAO (2004). *The State of Food and Agriculture, 2003–2004. Agricultural Biotechnology: Meeting the needs of the poor?* (Rome, FAO).
- 161 Heinemann J.A. (2009). *Ibid.*; FAO and others (2008). *Ibid.*; Jordan, C.F. (2002). “Genetic engineering, the farm crisis and world hunger”, in *BioScience* (2002), vol. 52, pp. 523-529; Parrott, N. and T. Marsden (2005). *The real Green Revolution: Organic and agroecological farming in the South* (London, Greenpeace Environmental Trust); Rosset, P. (2005). “Transgenic crops to address Third World hunger? A critical analysis”, in *Bulletin of Science, Technology & Society* (2005), vol. 25, pp. 306-313.
- 162 International Federation of Agricultural Producers, and World Meteorological Organization (2008). “Climate change: Impacts on global agriculture”, *Issue Brief*.
- 163 Rosegrant, M. and others (2008). *Climate Change and Agriculture* (Berlin, GTZ).
- 164 Aggarwal, P.K. (2003). “Impact of climate change on Indian agriculture”, in *Journal of Plant Biology* (2003), vol. 30, pp.189-198.
- 165 Fischer, G., M. Shah and H. van Velthuizen (2002). “Climate change and agricultural vulnerability”, a special report prepared as a contribution to the World Summit on Sustainable Development 2002.
- 166 Murdiyarsa, D. (2000). “Adaptation to climatic variability and change: Asian perspectives on agriculture and food security”, in *Environmental Monitoring and Assessment*, vol. 61, pp. 123-131.
- 167 Izrael, Y.A (2002). “Scientific aspects of environmental problems in Russia”, All-Russia Conference, Nauka, Moscow <<http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter10.pdf>> (accessed in November 2008).
- 168 Lin, E.D. and others (2004). “Possible adaptation decisions from investigating the impacts of future climate change on food and water supply in China”, paper presented at the 2nd AIACC Regional Workshop for Asia and the Pacific, 2-5 November 2004, Manila <[http://www.aiaccproject.org/meetings/Manila\\_04/Day2/erda\\_nov3.doc](http://www.aiaccproject.org/meetings/Manila_04/Day2/erda_nov3.doc)> (accessed in October 2008).
- 169 Lal, M. (2007). *Implications of Climate Change on Agricultural Productivity and Food Security in South Asia: Key Vulnerable Regions and Climate Change – Identifying Thresholds for Impacts and Adaptation in Relation to Article 2 of the UNFCCC* (Dordrecht, Springer).
- 170 Faisal, I.M. and S. Parveen (2004). “Food security in the face of climate change, population growth and resource constraints: Implications for Bangladesh”, in *Environmental Management* (2004), vol. 34, pp. 487-498.



- 171 Aggarwal, P.K. (2003). *Ibid.*
- 172 Intergovernmental Panel on Climate Change (2007). *Fourth Assessment Report: Climate Change.*
- 173 “Pridiyathorn: Agricultural sector set to drive growth”, in *Bangkok Post*, 26 July 2008.
- 174 FAO Regional Office for Asia and the Pacific (2006). *Rapid Growth of Selected Asian Economies. Lessons and Implications for Agriculture and Food Security: China and India* (Bangkok, FAO Regional Office for Asia and the Pacific); ESCAP (2001). *Reducing Disparities: Balanced Development of Urban and Rural Areas and Regions within the Countries of Asia and the Pacific.* (Bangkok, United Nations); Conway, G. (1997). *The Doubly Green Revolution: Food for All in the Twenty-First Century* (London, Penguin Books).
- 175 FAO Regional Office for Asia and the Pacific (2006). *Ibid.*
- 176 Southgate, D., D.H. Graham and L. Tweeten (2007). *The World Food Economy.* First edition (Malden, Oxford and Carlton Blackwell Publishing Ltd.).
- 177 Government of China (2008). “China liberalizes farmers’ land use right to boost rural development”, press release 19 October 2008 <[www.gov.cn](http://www.gov.cn)> (accessed in October 2008).
- 178 Li, H. (2009). “Land of opportunity”, in *China Daily*, 13 January 2009, p. 18.
- 179 Sim, C. Y. (2008). “The village where it all began”, in *The Straits Times*, 6 December 2008.
- 180 “Enlighten policies, spread the wealth”, in *China Daily*, 13 January 2009, p. 18.
- 181 “Bumper harvests lift farm income”, in *China Daily*, 29 December 2008, p.1.
- 182 Agarwal, B. (2003). “Gender and land rights revisited: Exploring new prospects via the State, family and market”, in *Journal of Agrarian Change*, vol. 3, pp. 184-224.
- 183 Anderson, K. (2008). “Distorted agricultural incentives and economic development: Asia’s experience”, CEPR Discussion Paper No. DP6914, July 2008 <<http://ssrn.com/abstract=1240224>> (accessed in September 2008).
- 184 Slayton, T. and C.P. Timmer (2008). “Japan, China and Thailand can solve the rice crisis – But U.S. leadership is needed”, in *Center for Global Development Notes*, May 2008.
- 185 FAO (2005). *The State of Food and Agriculture – Agricultural trade and poverty: Can trade work for the poor?* (Rome, FAO) <<http://www.fao.org/docrep/008/a0050e/a0050e00.htm>> (accessed in November 2008).
- 186 He, S. (2007). “Government holds fast to arable land”, in *China.Org.Cn*, 16 August, 2007 <<http://www.china.org.cn/english/government/221140.htm>> (accessed in February 2009).
- 187 Timmer, C.P. and D. Dawe (2007). “Managing food price instability in Asia: A macro food security perspective”, in *Asian Economic Journal* (2007), vol. 21, no. 1, pp. 1-18.
- 188 World Bank (2008). “Rising food prices: Policy options and World Bank response” <[http://sitere-sources.worldbank.org/NEWS/Resources/risingfoodprices\\_backgroundnote\\_apr08.pdf](http://sitere-sources.worldbank.org/NEWS/Resources/risingfoodprices_backgroundnote_apr08.pdf)> (accessed in April 2008)
- 189 IMF. “Food and fuel prices – Recent developments, macroeconomic impact and policy responses” <<http://www.imf.org/external/np/pp/eng/2008/091908.pdf>> (accessed in July 2008).

- <sup>190</sup> ESCAP (2008c). Statements made at the sixty-fourth Commission session, Bangkok, 28 April 2008.
- <sup>191</sup> World Bank (2008). “Rising food prices”, *Ibid.*
- <sup>192</sup> World Bank (2008). “Rising food prices”, *Ibid.*
- <sup>193</sup> United Nations (2008). “Comprehensive Framework for Action”, July 2008. (New York, United Nations).
- <sup>194</sup> “East Asia emergency rice reserve (EAERR), What is EAERR?” <<http://www.eaerr.com/>> (accessed in September 2008).
- <sup>195</sup> World Food Programme (WFP). INTERFAIS data <<http://wfp.org/>> (accessed in September 2008).
- <sup>196</sup> World Bank (2008). “Rising food prices”, *Ibid.*
- <sup>197</sup> del Ninno, C., P.A. Dorosh and K. Subbarao (2005). “Food Aid and Food Security in the Short and Long Run: Country Experience from Asia and Sub-Saharan Africa”, Social Protection Discussion Paper Series 0538. (Washington D.C., World Bank).
- <sup>198</sup> Foster, P. and H.D. Leathers (1999). *The World Food Problem*. Second edition (Boulder and London, Lynne Rienner Publishers).
- <sup>199</sup> World Bank (2008). “Rising food prices”, *Ibid.*
- <sup>200</sup> Ahmed, S.S. (2005). “Delivery mechanisms of cash transfer programs to the poor in Bangladesh”, Working Paper 32751, Social Protection Discussion Paper Series 0520 (Washington D.C., World Bank).
- <sup>201</sup> Barrett, C.B. and D.G. Maxwell (2005). *Food Aid After Fifty Years: Recasting its Role* (New York, Routledge).
- <sup>202</sup> Caldes, N. and A. Ahmed (2004). *Food for Education: A review of program impacts* (Washington, D.C., International Food Policy Research Institute).
- <sup>203</sup> Studdert, L., K. Soekirman and J. Habicht (2004). “Community-based school feeding during Indonesia’s economic crisis: Implementation, benefits and sustainability”, in *Food and Nutrition Bulletin* (2004), vol. 25, no. 2, pp. 156-165.
- <sup>204</sup> Lowder, S. and T. Raney (2008). “Food Aid: A Primer”, FAO Working Paper <<http://www.fao.org/>> (accessed in September 2008).
- <sup>205</sup> World Food Programme (WFP). INTERFAIS data *Ibid.*
- <sup>206</sup> Barrett, C.B. and D.G. Maxwell (2005). *Ibid.*; FAO (2006). *The State of Food and Agriculture: Food Aid for Food Security?* (Rome, FAO).
- <sup>207</sup> Martinez, S. (2004). *Pensions, Poverty and Household Investments in Bolivia* (Berkeley, University of California at Berkeley).
- <sup>208</sup> Coady, D., M. Grosh and J. Hoddinott (2004). *Targeting of Transfer in Developing countries: Review of Lessons and Experience* (Washington D.C., World Bank); Harvey, P. (2007). *Cash-based Responses in Emergencies, HPG Report 24* (London, Overseas Development Institute).

- <sup>209</sup> Ta, P. and M. Patel (2008). “Rising food prices in East Asia and the Pacific: Assessing its impacts and reviewing policies to protect the vulnerable”, unpublished Regional Social Policy Working Paper produced for the UNICEF East Asia and the Pacific Regional Office.
- <sup>210</sup> World Bank (2006). Country Program Profiles. Prepared for the Third International Conference on Conditional Cash Transfers held in Istanbul, Turkey, June 26-30, 2006; World Bank (2008). Rising food prices. *Ibid.*; ADB. “Food prices and inflation in developing Asia: Is poverty reduction coming to an end? Special report” <[www.adb.org](http://www.adb.org)> (accessed in May 2008).
- <sup>211</sup> Ahmed, S.S. (2005). “Delivery mechanisms of cash transfer programs to the poor in Bangladesh”, Working Paper 32751, Social Protection Discussion Paper Series 0520 (Washington D.C., World Bank).
- <sup>212</sup> “Needed: A new revolution: How bad policies crimp exporters”, in *The Economist*, 27 March 2008; Ministry of Rural Development, National Rural Employment Guarantee Act of 2005 <<http://nrega.nic.in/>> (accessed in November 2008).
- <sup>213</sup> Vandenberg, P. (2008). “Is Asia adopting flexicurity? A survey of employment policy in six countries,” An Economic and Labour Market Paper (Geneva, International Labour Organization) <<http://www.ilo.org/public/english/employment/download/elm/elm08-4.pdf>> (accessed in November 2008).
- <sup>214</sup> McCord, A. (2005). “Win-win or lose-lose? An examination of the use of public works as a social protection instrument in situations of chronic poverty”, paper for presentation at the Conference on Social Protection for Chronic Poverty, Institute for Development Policy and Management, University of Manchester, Manchester.
- <sup>215</sup> Haddad, L. and others in L. Haddad, J. Hoddinott and H. Alderman (eds.) (1997). *Intrahousehold Resource Allocation: Methods, Models and Policy* (Baltimore, Maryland, Johns Hopkins University Press).
- <sup>216</sup> Devereux, S. and others (2005). “Making cash count: Lessons from cash transfer schemes in east and southern Africa for supporting the most vulnerable children and households” (London and Brighton, Save the Children UK and the Institute of Development Studies).
- <sup>217</sup> Alderman, H. and T. Haque (2007). “Insurance against covariate shocks: The role of index-based insurance in social protection in low-income countries of Asia-Pacific region”, in Asia-Pacific Region Human Development Working Paper No. 95 (Washington, D.C., World Bank).
- <sup>218</sup> Mechler, R., J. Linnerooth-Bayer and D. Peppiatt (2006). *Disaster Insurance for the Poor? A Review of Microinsurance for Natural Disaster Risks in Developing Countries, How to keep Premiums Low Yet Ensure Financial Sustainability of Microinsurance Providers?* (Geneva, ProVention Consortium).
- <sup>219</sup> FAO Corporate Document Depository: Agriculture and Consumer Protection. “Livelihoods grow in gardens” <<http://www.fao.org/docrep/006/y5112e/y5112e05.htm>> (accessed in March 2009).
- <sup>220</sup> Panyakul, V. (2003). “Organic agriculture in Thailand”, presentation made at the Seminar on the Production and Exports of Organic Fruits and Vegetables in Asia, 3-5 November 2003, Bangkok.
- <sup>221</sup> Fairtrade Foundation (2008). “Boonjira Tanruang, Green Net Co-operative, Thailand” <[http://www.fairtrade.org.uk/producers/rice/boonjira\\_tanruang.aspx](http://www.fairtrade.org.uk/producers/rice/boonjira_tanruang.aspx)> (accessed in March 2009).

- <sup>222</sup> Pattanapant, A. and G.P. Shivakoti (forthcoming). “Opportunities and Constraints of Organic Agriculture in Chiang Mai Province, Thailand”, *Asia-Pacific Development Journal*.
- <sup>223</sup> Panyakul, V. (2003). *Ibid*.
- <sup>224</sup> Panyakul, V. (2003). *Ibid*.
- <sup>225</sup> Cruz, M.C.J. (1989). “Water as common property: the case of irrigation water rights in the Philippines”, in Berkes, F. and C. Folke (eds.) (1989). *Linking Social and Ecological Systems* (Cambridge, Cambridge University Press).
- <sup>226</sup> Lansing, J.S. (1991). *Priests and Programmers: Technologies of Power in the Engineered Landscape of Bali* (New Jersey, Princeton University Press); Lansing, J.S. and J.N. Kremer (1993). “Emergent properties of Balinese water temple networks: co-adaptation on a rugged fitness landscape”, in *American Anthropologist* (1993), vol. 95, no. 1, pp. 97-114.
- <sup>227</sup> Jodha, N.S. (1986). “Common property resources and rural poor in dry regions of India”, in *Economic and Political Weekly* (1986), vol. 21, no. 27.
- <sup>228</sup> Mazhar, F. and others (2007). *Ibid*.
- <sup>229</sup> Bhattamishra, R. and C.B. Barrett (2007). “Community-based risk management arrangements: An overview and implications for social fund program design” Cornell University Working Draft, 1 October 2007.
- <sup>230</sup> Murgai, R. and others (2002). “Localized and incomplete mutual insurance”, in *Journal of Development Economics* (2002), vol. 67, no. 2, pp. 245-274.
- <sup>231</sup> Mukherjee, A. and N. Mukherjee (2008). “Consolidated reply: MS Swaminathan’s query on hunger, Asia-Pacific Millennium Development Goals, community of practice” <<http://cop.mdgasiapacific.org/page/consolidated-reply-ms-swaminathans-query-on-hunger> (accessed in December 2008).
- <sup>232</sup> Brocklesby, M.A. and E. Hinshelwood (2001). *Poverty and the Environment: What the Poor Say – An Assessment of Poverty – Environment Linkages in Participatory Poverty Assessment* (Swansea, Wales, Centre for Development Studies, University of Wales).
- <sup>233</sup> Rahman, A. (2008). Information provided during deliberations at the “South Asian Civil Society Forum on Responding to Food Insecurity in South Asia”, held in Kathmandu, 23-24 October 2008, and organized by the South Asia Watch on Trade, Economics & Environment (SAWTEE), Nepal; Consumer Unity & Trust Society (CUTS)-International, India; and Oxfam (novib), the Netherlands.
- <sup>234</sup> Somaratne, W.G. (2008). Information provided during deliberations at the “South Asian Civil Society Forum on Responding to Food Insecurity in South Asia”, held in Kathmandu, 23-24 October 2008, and organized by the South Asia Watch on Trade, Economics & Environment (SAWTEE), Nepal; Consumer Unity & Trust Society (CUTS)-International, India; and Oxfam (novib), the Netherlands.
- <sup>235</sup> Verma, L.R. and others (1998). *Indigenous technology knowledge for watershed management in upper north-west Himalayas of India* (Kathmandu, Participatory Watershed Management Training in Asia Program).

- <sup>236</sup> Downes, Gerard (2003). “Implications of TRIPS for Food Security in the Majority World”, prepared for Comhlámh Action Network, Dublin, October 2003.
- <sup>237</sup> International Institute for Environment and Development and Stockholm Environment Institute (2008). “Community action in Nepal”, in *Tiempo*, issue no. 68, July, pp. 11-14.
- <sup>238</sup> Gonzales, A.D.C. (2007). *Situation Analysis on Biomass Utilization and Trade in South-East Asia with Particular Focus on Indonesia and Thailand* (Bangkok, Full Advantage Co. Ltd.).
- <sup>239</sup> Ho, M.-W. and Lim L. C. (2008). *Mitigating Climate Change through Organic Agriculture and Localized Food Systems, ISIS Report 31/1/08* (London, The Institute of Science in Society); Ho, M.-W., S. Burcher, Lim L.C. and others (2008). *ISIS-TWN Report, Sustainable World 2nd Report, Food Futures Now \*Organic \*Sustainable \*Fossil Fuel Free* (London, The Institute of Science in Society).
- <sup>240</sup> ESCAP (2008b). *Ibid.*
- <sup>241</sup> ESCAP (2008b). *Ibid.*
- <sup>242</sup> Coate, S. and M. Ravallion(1993). “Reciprocity without commitment: characterization and performance of informal insurance arrangements”, in *Journal of Development Economics*, vol. 40, pp. 1-24.
- <sup>243</sup> Subbarao, K. and others (1997). *Safety Net Programs and Poverty Reduction: Lessons from Cross-country Experience* (Washington D.C., World Bank).
- <sup>244</sup> United Nations Environment Programme (September 2008). *Ibid.*
- <sup>245</sup> FAO Corporate Document Repository. Improving nutrition through home gardening and “Chapter 5 – Promotion of food and dietary diversification strategies to enhance and sustain household food security” in *Agriculture, food and nutrition for Africa* <<http://www.fao.org/DOCREP/>> (accessed in March 2009).
- <sup>246</sup> FAO and others (2008). *Ibid.*
- <sup>247</sup> Save, B. (2008). *The Great Agricultural Challenge* (Transcribed by B. Mansata) (Kolkata, India, Earth-care Books).
- <sup>248</sup> Save, B. (2008). *Ibid.*
- <sup>249</sup> Borrón, S. (2006). “Building resilience for an unpredictable future: how organic agriculture can help farmers adapt to climate change” (Rome, FAO, Sustainable Development Department) <<ftp://ftp.fao.org/docrep/fao/009/ah617e/ah617e.pdf>> (accessed in March 2009).
- <sup>250</sup> FAO and others (2008). *Ibid.*

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