1
Global trends in agriculture and food systems

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Summary

Increasing globalisation affects agricultural production and trade and has consequences for the sustainability of both conventional and organic agriculture.

During the last decades, agricultural production and yields have been increasing along with global fertiliser and pesticide consumption. This development has been especially pronounced in the industrialised countries and some developing countries such as China, where cereal yields have increased a remarkable 2-fold and 4.5-fold respectively since 1961. In those countries, food security has increased, a greater variety of food has been offered and diets have changed towards a greater share of meat and dairy products. However, this development has lead to a growing disparity among agricultural systems and population, where especially developing countries in Africa have seen very few improvements in food security and production. The vast majority of rural households in developing countries lack the ecological resources or financial means to shift into intensive modern agricultural practices as well as being integrated into the global markets. At the same time, agricultural development

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has contributed to environmental problems such as and global warming, reductions in biodiversity and soil degradation. Furthermore, pollution of surface and groundwater with nitrates and pesticides remains a problem of most industrialised countries and will presumably become a growing problem of developing countries. Nitrate pollution is now serious in parts of China and India. The growing global trade with agricultural products and the access to pesticides and fertilisers have changed agricultural systems. Easier transportation and communication has enabled farms to buy their inputs and sell their products further away and in larger quantities and given rise to regions with specialised livestock production and virtual monocultures of e.g. Roundup Ready soybeans in Argentina. Since 1996, the Argentinean area devoted to soybeans have increased remarkably from 6 to 14 million hectares, covering approximately 50 percent of the land devoted to major crops in 2003. Since 1997, Brazilian Amazon has seen a deforestation of more than 17.000 km^2 each year with medium or large-scale cattle rangers presumably being the key driving force.

Organic farming offers a potentially more sustainable production but has likewise been affected by globalisation. Organic farming is practiced in approximately 100 countries of the world and the area is increasing. European countries have the highest percentage of land under organic management, but vast areas under organic management exist in e.g. Australia and Argentina. Europe and North America represents the major markets for certified organic products, accounting for roughly 97 percent of global revenues. The international trade with organic products have two major strands; a) trade between European and other Western countries (U.S., Australia, New Zealand) and b) South-North trade, involving production sites, most importantly in Latin America, which ship to major Northern organic markets. The recent development holds the risk of pushing organic farming towards the conventional farming model, with specialisation and enlargement of farms, increasing capital intensification and marketing becoming export-oriented rather than local. Furthermore, as the organic products are being processed and packaged to a higher degree and transported long-distance, the environmental effects needs to be addressed. Organic farming might offer good prospects for marginalised smallholders to improve their production without relying on external capital and inputs, either in the form of uncertified production for local consumption or certified export to Northern markets. However, in order to create a sustainable trade with organic products focus should be given to issues like trade and economics (Chapter 4 & 5), certification obstacles, and ecological justice and fair trade (Chapter 2 & 3). Furthermore, the implications of certified and non-certified organic farming in developing countries need to be addressed (Chapter 6 & 9) including issues on soil fertility (Chapter 8) and nutrient cycles (Chapter 7) and the contribution to food security (Chapter 10).

Introduction

Increasing globalisation has been one of the major trends in the latest decades, as a consequence of the dominating technological and social development. Globalisation is here understood as "the erosion of the barriers of time and space that constrain human activity across the earth *and* the increasing social awareness of these changes" (Byrne & Glover, 2002). The increasing globalisation has consequences for the way that we produce and trade agricultural products and thereby also environmental consequences for the climate, biodiversity, and land resources among other things. Globalisation has implications for conventional agriculture but contains also specific opportunities and problems for organic farming – related to e.g. trade with organic certified products from developing countries. The idea of "Sustainable development" has been another key concept in the latest decades and can be seen as reaction to the dominating development. Sustainability is a concept that can have different meanings (Jacobs, 1995; Rigby & Cáceres, 2001). The definitions of sustainability include both the interpretation related to "functional integrity", where man is seen as an integrated part of nature (Thompson, 1996) and the "resource sufficiency", which addresses the rate of resource consumption linked to production. In the following, recent trends in agriculture in relation to globalisation and sustainability will be presented. Focus will be given to issues that are relevant for the discussion of the role and conditions for further development of organic farming in a global context.

The overall aim with this chapter is to:

- Show global trends in agriculture and food systems related to globalisation and their environmental and socio-economic impacts.
- Show global trends in organic farming related to globalisation – and indicate potentials and challenges in global organic agriculture related to environmental and socio-economic issues.

World agriculture - trends and impacts

Agriculture and food systems have changed very much over the last 50 years. Agricultural development has seen a rapid advance of agricultural technology in industrialised countries with the green revolution in the 1960s being counteracted by an increasing public awareness of environmental protection and sustainable development that evolved in the 1980's (FAO, 2000). In the 1990s an increasing globalisation occurred that has continued into the 21st century. The current wave of globalisation was made possible by technological breakthroughs in transportation and communication technologies (notably the Internet, mobile telephone technology and just-in-time systems) and affordable fuel in tandem with various efforts to liberalise international trade and investment flows (FAO, 2003). Increases in long-distance food trade, global concentration in food processing and retail industries and diet change are signs of the globalisation of the food system (von Braun, 2003).

In the following, major trends in agricultural production and food systems in relation to globalisation will be shown along with environmental and socio-economic impacts. The conceptual model in figure 1.1 shows the structure in section 1.2 and illustrates possible connections in the development of the global agricultural and food systems. The figure is not intended to cover all aspects on global food systems sustainability, but to illustrate possible problematic situations.

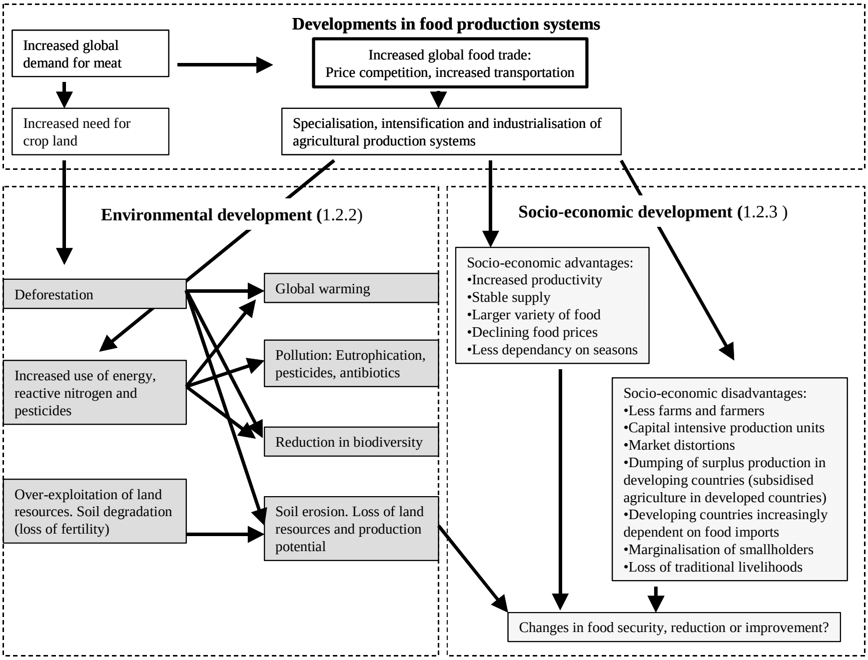

Figure 1.1. Illustration of possible problematic aspects in global food systems sustainability, environmentally and socio-economically. The arrows indicate possible effects.

Trends in agricultural production

Agricultural production has increased greatly over the last decades and in most continents the food production has been able to surpass the population growth. According to FAO (2000), the increase in production is among other attributable to the following factors:

- the spread in developed countries of the modern agricultural revolution (involving large-scale mechanisation, biological selection, use of chemicals, specialisation),
- a modern agricultural revolution in some developing countries that is not dependent on heavy motorised mechanisation but instead involves the use of chemicals and the selection of varieties,
- the expansion of irrigated surfaces, from about 80 million ha in 1950 to about 270 million ha in 2000,
- the expansion of arable land and land under permanent crops, from some 1 330 million ha in 1950 to 1 500 million ha in 2000,
- the development of mixed farming systems using high levels of available biomass (combining crop, arboriculture, livestock and, sometimes, fish farming) in the most densely populated areas that lack new land for clearing or irrigation.

The average yields of a milking cow and crop yields per ha and per worker has been increasing over the last 50 years (FAO, 2000). In the past four decades, increasing yields accounted for about 70 percent of the increase in crop production, compared to expanding the land area or increasing the cropping frequency (often through irrigation). However, yield increases have been most profound in industrial countries and e.g. China, whereas the yield increases in e.g. developing countries in Africa have been very limited (Figure 1.2).

The considerable advances in agriculture cannot hide the fact that most of the world's farmers use inefficient manual tools and their plants and domestic animals have benefited very little from selection. The progress in agricultural production hides a growing disparity among agricultural systems and populations. The gap between the most productive and least productive farming systems has increased twenty fold in the last 50 years (FAO, 2000). The agricultural revolution with all its attributes and especially its motorised mechanisation has not extended far beyond the developed countries, with the exception of small portions of Latin America, North Africa, South Africa and Asia, where it has only been adopted by large national or foreign farms that have the necessary capital (FAO, 2000).

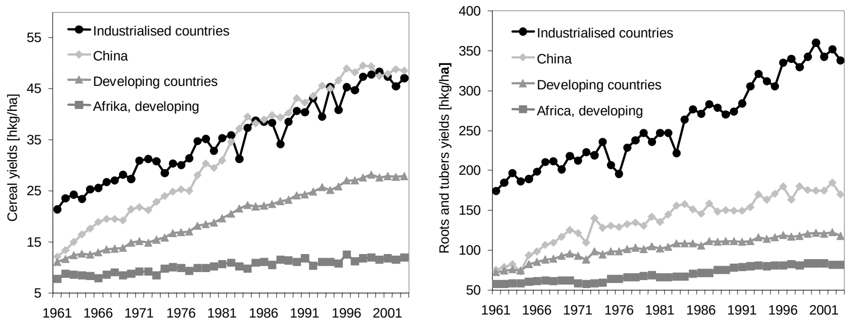

Figure 1.2. Yields of cereals plus roots and tubers in industrialised and developing countries plus in China and Africa, developing from 1961-2003 (hkg/ha) (FAOSTAT data, 2005)

Agricultural intensification

The agricultural revolution and globalisation have had an enormous impact on agriculture and food systems in the developed countries. Developments in industry, biotechnology, transport and communication have affected agriculture in different ways.

Industrial developments have provided the means for motorisation and large-scale mechanisation, mineral fertilisation, treatment of pests and diseases (pesticides, veterinary drugs etc.) and the conservation and processing of vegetable and animal products in developed countries. Developments in biotechnology supplied through selection, high yielding plant varieties and animal breeds have been adapted to the new means of production (FAO, 2000). The latest biotechnological developments are the genetically modified crops, grown primarily in USA, Canada and Argentina (see case from Argentina in Box 1.1).

The increase in fertiliser use and the use of improved varieties, though selection, have been among the important factors for the increased food production. A third of the increase in world cereal production in the 1970s and 1980s has been attributed to increased fertiliser use (FAO, 2003). World fertiliser consumption grew rapidly in the 1960s, 1970s and 1980s (Figure 1.3). The fertiliser uses in Europe have slowed down since the 1980's mainly due to reduced government support for agriculture and increased concern over the environmental impact. Fertiliser use in Asia, especially China, has been increasing (FAO, 2003; Figure 1.3), but the level of fertiliser use varies enormously between regions. North America, Western Europe and South East Asia accounted for four-fifths of world fertiliser use in 1997-99 (FAO, 2003).

The highest rates are applied in East Asia, especially in China, followed by the industrial countries. At the other end of the scale, farmers in sub-Saharan Africa apply much less (FAO, 2003; Figure 1.3). The average fertiliser consumption is predicted to increase in developing countries (FAO, 2003). However, the average figure masks that for many (especially small) farmers the purchase of manufactured fertilisers and pesticides is and will continue to be constrained by their high costs relative to output prices and risks or simply by unavailability (FAO, 2003).

The global uses of pesticides have increased considerably during the second part of the 20th century (Figure 1.4). Some of the problems with diseases and insects have increased with the increased use of nitrogen fertilisers due to a higher susceptibility of the crop to attack at higher nitrogen input (Olesen et al., 2003). Some countries in Western Europe have seen a reduction in pesticide consumption in recent years, primarily due to policies that promote or enforce management strategies with reduced pesticide use (Stoate et al., 2001). Future pesticide consumption is likely to grow more rapidly in developing countries than in developed ones (FAO, 2003). The treatment of pests and diseases, in both plants and livestock, has become more important to safeguard investments in farm output.

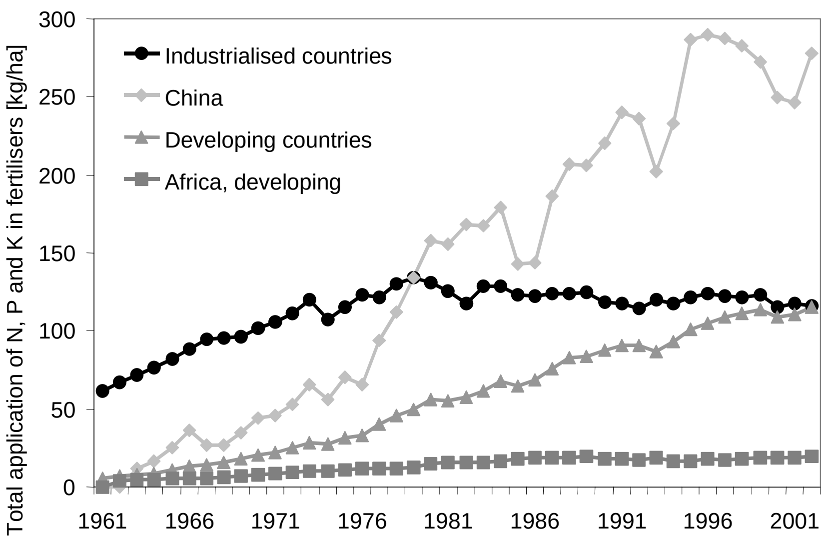

Figure 1.3. Total fertiliser application of N, P and K in industrialised and developing countries plus China and Africa, developing from 1961 to 2002 (kg/ha) (FAOSTAT data, 2005)

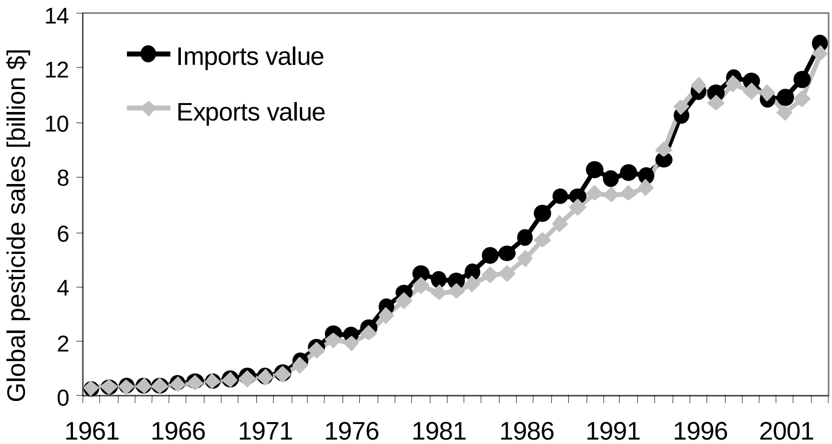

Figure 1.4. Imports and exports value of global pesticide sales from 1961 to 2003 (FAOSTAT data, 2005)

The more expensively bred and fed animal and the larger and more concentrated the animal production, the higher the risks. A great part of the antibiotics produced today are used as treatments against infectious diseases or as growth promoters in animal production, especially for pigs and poultry. Mellon et al. (2001) estimated that 70 percent of all antibiotics used in the United States are used for non-therapeutic livestock use. JETACAR (1999) found that approximately one-third of the antibiotics imported to Australia is for humans and two-thirds for animals. Denmark became the first country with a significant livestock industry to curtail the use of antibiotic growth-promoters in pig and poultry production in 1998. Approximately 70 percent of the antimicrobials used in Denmark are for therapeutic veterinary use (Heuer & Larsen, 2003).

Agricultural systems have changed with the introduction of mineral fertiliser, pesticides etc. With the use of mineral fertiliser cash crop production no longer rely on soil fertility building or use of manure. Furthermore with the introduction of mechanisation, agriculture has also been freed from the need to produce forage for draught animals. Consequently, agricultural holdings suited for mechanised crop production have been able to abandon fodder and livestock production and specialise in cash crop production while other agricultural holdings have specialised in livestock production, often without sufficient land for manure application (FAO, 2000). Furthermore, the use of agricultural chemicals and GMO crops has partly released agricultural holdings from former crop rotation systems used to control weeds, insects and diseases. As a result cropping systems have been simplified and further specialised, culminating in monocropping or quasi-monocropping.

There has been a trend towards a narrower genetic base used for plant and animal production. Of the 270.000 known species of higher plants only three species (wheat, rice and maize) provide half of the world's plants derived energy intake (Cromwell et al, 1999; FAO, 1997). At a national and regional level, only a few varieties are used over large-scale areas and the same trend can be seen in livestock genetic resources (CBD, 2001). The latest development in this aspect is the rapid spread of GMO crops, where a few (pesticide resistant) varieties of e.g. maize and soybean now cover large areas of land (see case from Argentina in Box 1.1).

Developments in transportation and communication has opened up the farms and agricultural regions and enabled them to procure their fertiliser, feed and other inputs from further away and in larger quantities. It also allowed for the sale of their products in increased amounts and wider areas. An increased globalisation has freed agricultural holdings even more from comprehensive localised self-supply and made them able to focus on the most profitable product (or simplified combination of products). Virtual monocultures of soybean, maize, wheat, cotton, vineyards, vegetables, fruit and flowers and specialised productions of pig and poultry have thus spread over entire regions giving rise to new specialised regional agricultural systems (FAO, 2000).

Dietary changes

Just as world average calorie intakes have increased, so have also people's diets changed. Patterns of food consumption are becoming more similar throughout the world, incorporating higher-quality and more expensive foods such as meat and dairy products.

This diet change is partly due to simple preferences by populations. Partly, too, it is due to increased international trade in foods, to the global spread of fast food chains, and to exposure to North American and European dietary habits. Convenience also plays a part, for example the portability and ease of preparation of ready-made bread or pizza, versus root vegetables. Changes in diet closely follow rises in incomes and occur almost irrespective of geography, history, culture or religion (FAO, 2003).

These changes in diet have had an impact on the global demand for agricultural products and will continue to do so. Meat consumption in developing countries, for example, has risen from only 10 kg per person per year in 1964-66 to 26 in 1997-99. It is projected to rise still further, to 37 kg per person per year in 2030. Milk and dairy products have also seen a rapid growth, from 28 kg per person per year in 1964-66 to 45 kg in 1997-99, and with the expected consumption of 66 kg by 2030 in developing countries. The intake of calories derived from sugar and vegetable oils is furthermore expected to increase. However, average human consumption of cereals, pulses, roots and tubers is expected to level off (FAO, 2003).

Environmental impacts

Human activities and in particular the provision of foods for the growing world population put increasing demands on the natural resources of the earth. These effects are seen in several ways (Figure 1.1). In some areas of the world, agricultural land use increases at the expense of forests and other natural terrestrial ecosystems. In other parts of the world there is an overexploitation of the land resources leading to soil degradation and loss of soil fertility. However, the major way used to satisfy the need for food is through intensification of the agricultural production, primarily through the use of fertilisers and pesticides (see "Trends in agricultural production"). All of these pathways have their own effects on the environment.

Four major indicators of environmental sustainability (EEA, 2005) are considered here as illustrated in figure 1.1:

- Loss of land resources by soil erosion and soil degradation. Eroded soils are often lost for productive agricultural use for a very long time, whereas soils that are degraded through loss of soil organic matter, soil compaction, nutrient mining or salinisation may be restored through proper agricultural management techniques. Loss of land resources has secondary negative effects on biodiversity and global warming.
- Loss of biodiversity involves a reduction in the number of living species on the earth and thus a loss of genetic resources (CBD, 2001) and a loss of ecosystem services in both natural and managed ecosystems (Costanza et al., 1997). Both effects have negative long-term consequences for the interaction between the human population and the environment. Biodiversity are reduced by a number of agricultural activities, such as deforestation, reduction of field margins and hedgerows, drainage of wetlands, genetic uniformity in crop land, pesticides etc (FAO, 2003).
- Global warming is a consequence of increasing emissions of greenhouse gases (primarily CO_2, CH_4, N_2O and CFCs) to the atmosphere. The global emissions of CO_2 in 1996 (23 900 million tonnes) were nearly four times the 1950 total (UNEP, 1999). The use of fossil fuels is the primary cause of these emissions. However, agricultural production contributes about 39 % of the methane and 60 % of the nitrous oxide emissions released in OECD countries (OECD, 2000 cf. OECD, 2001b). Methane emissions from agriculture are mainly produced from ruminant animals and the handling of manure, while the main source of nitrous oxide emissions is nitrogen fertilisers (OECD, 2001b). In addition, CO_2 from deforestation, soil degradation and soil erosion also have major contributions to the global greenhouse gas emissions. Furthermore, the use of fertiliser is associated with high energy requirements for their production resulting in CO_2 emissions (Dalgaard et al., 2000).

- The use of fertiliser in high amounts per hectares and the large amounts of manure concentrated in specific geographical areas has increased the emission of ammonia and nitrate, which creates eutrophication and acidification in sensitive aquatic and terrestrial environments and pollution of ground and surface water (EEA, 2003), see more below. With increasing load of phosphorus in agricultural soils in particular with intensive livestock farming, there is also a risk of phosphorus losses to sensitive aquatic environments (Novotny, 2005).

Most of the environmental problems have increased considerably in recent decades. These problems are usually externalised, being greater for the society as a whole than for the farms on which they operate, and direct incentives from the farmers to correct them are therefore largely lacking (Stoate et al., 2001). Impacts on biodiversity and global warming are trans-boundary or global in their nature, and efforts to deal with these therefore require international collaboration.

In the following, the effects on the above mentioned environmental indicators caused by 1) agricultural land use and by agricultural intensification through 2) the global nitrogen cycle and 3) pesticides will be discussed.

Agricultural land use

The worlds land area comprises 130.7 million km^2. However, less than half of this land area is suitable for agriculture, including grazing (Kindall & Pimentel, 1994). Nearly all of the world's productive land is already exploited. Thus, only a small increase in agricultural area has been seen over the past 40 years. Most of the unexploited land is too steep, too wet, too dry or too cold for agriculture. For arable crops, soils also limit land use, because many soils are unsuitable for tillage or depleted in nutrients.

Expansion of the cropland has to come at the expense of forest and grassland, which also have essential uses. The net gain in agricultural area comes from adding land through deforestation and loss of land from land degradation and reforestation. It has been estimated that 70-80 % of deforestation is associated with agricultural uses (Kindall & Pimentel, 1994). There are several environmental problems associated with deforestation, of which loss of biodiversity and CO_2 emissions are the major ones. It has thus been estimated that CO_2 emissions from land use changes amount to 20 % of the emissions associated with fossil energy use (Houghton et al., 2001).

Degradation of existing agricultural land involves loss of productive land. According to some analysts, land degradation is a major threat to food security and it is getting worse (Pimentel at al., 1995; UNEP, 1999; Bremen et al., 2001). Others believe that the seriousness of the situation has been overestimated at the global and local level (Crosson, 1997; Scherr, 1999; Lindert, 2000; Mazzucato & Niemeijer, 2001). Brown (1984) estimated that about 10 million ha of agricultural land was lost by soil erosion every year, corresponding to 0.7 % of global cropland area. Others argue that the area of cropland going out of use because of degradation is in the order of 5-6 million hectares every year (UNEP, 1997). It is estimated that soil degradation is severely affecting 15 % of the earth's cropland area, and in Europe alone 16 % of the soils are prone to soil degradation (Holland, 2004). UNEP (1999) estimated that 500 million hectares of land in Africa have been affected by soil degradation since about 1950, including as much as 65 percent of agricultural land.

The degradation and loss of agricultural land arises mainly from soil erosion, salinisation, waterlogging, and urbanisation. In addition nutrient depletion, overcultivation, overgrazing, and soil compaction contributes to the deterioration of soil fertility. Many of these processes are caused by agricultural management practices. Soil erosion is considered the single most serious cause of arable land degradation, and the major cause is poor agricultural practices that leave the soil without vegetative cover or mulch to protect it against water and wind erosion. In developing countries, the degradation is worsened by low inputs, partly due to lack of credits and partly because available crop residues and dung are used for fuel. This reduces soil nutrients and intensifies soil erosion.

The global nitrogen cycle

Nitrogen is one of the most abundant chemical elements in the atmosphere and biosphere. However, more than 99 % of the nitrogen is present as molecular nitrogen, which is not available to most organisms. Only a small proportion of the nitrogen is thus present as reactive nitrogen, which includes inorganic forms (NH_3, N_2O, NO, NO_2 and NO_3) and organic compounds (urea, amines, proteins and nucleic acids).

In the pre-industrial world, creation of reactive nitrogen occurred primarily from lightning and biological nitrogen fixation, and the denitrification process balanced the input of reactive nitrogen. However, in the industrialised world reactive nitrogen is accumulating in the environment at all spatial scales (Galloway et al., 2003). During the past few decades, reactive nitrogen has been accumulating in the environment (Figure 1.5), primarily due to the industrialised production of fertiliser nitrogen by the Haber-Bosch process, which converts non-reactive N_2 to reactive NH_3.

The remarkable change in the global N cycle caused by the higher inputs of reactive N has had both positive and negative consequences for people and ecosystems. A large proportion of the global population is sustained because reactive nitrogen is provided as fertiliser nitrogen or by cultivation introduced biological nitrogen fixation (Smil, 2002). However, nitrogen is accumulating in the environment, because the rate of input is much larger than the removal by denitrification, and this accumulation is projected to continue to increase as human population increases and per capita resource use increases. The accumulation of reactive nitrogen in the environment contributes to a number of local and global environmental problems (Galloway et al., 2003):

- Increases in reactive nitrogen in the atmosphere leads to production of tropospheric ozone and aerosols that induce respiratory disease, cancer and cardiac disease in humans (Wolfe and Patz, 2002).
- Increases in nitrate contents of groundwater, which have potential health effects (Jenkinson, 2001).
- Productivity of terrestrial systems (e.g. grasslands and forests) is affected with loss of biodiversity in oligotrophic ecosystems.
- Reactive nitrogen contributes to acidification and biodiversity loss in lakes and streams in many parts of the world (Vitousek et al., 1997). There are several examples of streams and lakes, where recent reductions in fertiliser inputs have led to reduced N concentrations (Iital et al., 2005).
- Reactive nitrogen is responsible for eutrophication, hypoxia, biodiversity loss and habitat degradation in coastal ecosystems (Howarth et al., 2000). This environmental problem appears to be increasing globally (Burkhart and James, 1999; EEA, 2003).
- Reactive nitrogen contributes to global climate change and stratospheric ozone depletion, both of which have impacts on human and ecosystem health (Mosier, 2002).

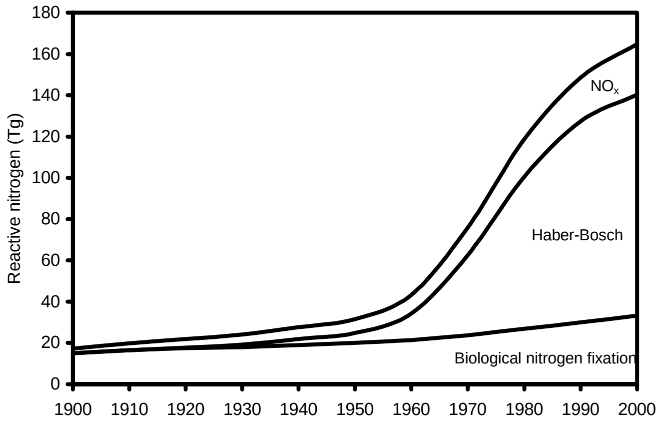

Figure 1.5. Global input for reactive nitrogen through biological nitrogen fixation, the industrial Haber-Bosch process and NOx (based on Galloway et al., 2003)

Intensively managed agroecosystems are the primary drivers of the changes that have occurred in the global nitrogen cycle. About 75 % of the reactive nitrogen generated globally by humans is added to agroecosystems to sustain production food and fibre. About 70 % of this input comes from the Haber-Bosch process and about 30 % from biological nitrogen fixation. There is only a small net residence of nitrogen in the agroecosystem, and most of the reactive nitrogen that is input to the system in a given year is lost again, either through consumption by humans or as losses to the environment.

On a global basis, about 120 Tg (1 Tg = 10^{12} grams = 10^6 tons) N from new reactive N (fertiliser and biologically fixed N) and about 50 Tg N from previously created N (manure, crop residues etc.) is added annually to global agroecosystems (Figure 1.6). Only about a third of this N input is converted into crop yield, whereas the rest is lost, primarily to the environment (Raun and Johnson, 1999). Animals consume about 33 Tg N per year of crop produce and humans consume about 15 Tg per year. Of the nitrogen input consumed by animals, only about 15 % is converted to food used by humans. Of the 120 Tg N per year in new reactive nitrogen, only 21 Tg N per year converted to food for humans (Figure 1.6). Since the change is soil nitrogen storage is very small, the rest is lost to the environment. On a global basis 6 to 12 % of the added active nitrogen is denitrified to N_2 (Smil, 2002). The remaining losses of nitrogen occur as NO_3, NO_x, NH_3 and N_2O, and all of these emissions can cascade through natural ecosystems, where they alter their dynamics and in many cases reduce ecosystem services.

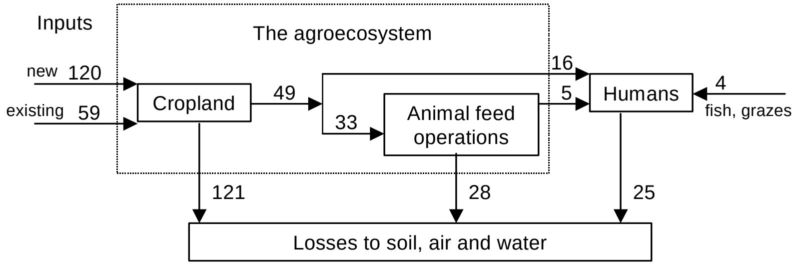

Figure 1.6. Major reactive nitrogen flows in crop and animal production components of the global agroecosystem (Tg N). Inputs represent new reactive nitrogen created through the Haber-Bosch process and through biological nitrogen fixation, and existing reactive nitrogen in crop residues, manure, atmospheric deposition, irrigation water and seeds. Portions of the lost reactive nitrogen may be reintroduced into the cropland component (Modified after Galloway et al., 2003 who refer to Smil, 2002)

Since the 1970s extensive leaching of nitrate from soils into surface and groundwater has become an issue in almost all industrial countries (OECD, 2001b). OECD (2001a) estimated that agriculture accounts for around two-thirds of nitrogen emissions into surface and marine waters and about one-third for phosphorous. In the EU countries, there is a large nitrogen surplus in the agricultural soils that can potentially pollute both surface and groundwater (Nixon et al., 2003). Nitrate concentrations in rivers are highest in those Western European countries where agriculture is most intensive, but has during the 1990s been stabilised (Nixon et al., 2003). Nitrate drinking water limit values (50 mg per litre) have been exceeded in around one third of the ground water bodies in EU (EEA, 2003). In general, there has been no substantial improvement in the nitrate situation in European groundwater and hence nitrate pollution of groundwater remains a significant problem (EEA, 2003). Total nitrogen loading to the environment (air, soil and water) from livestock production in OECD regions is expected to increase by about 30 % between 1995 and 2020 with particular large increases in Central and Eastern Europe and levels in Western Europe actually declining (OECD, 2001b). The problem of nitrate pollution of groundwater is now also serious in parts of China and India and a number of other developing countries and will presumably get worse (Zhang et al., 1996). Nitrogen and phosphate enrichment of lakes, reservoirs and ponds can lead to eutrophication, resulting in high fish mortality and algae blooms, which may in the future be potentially more serious in warmer developing countries with more intense sunshine (FAO, 2003; Gross, 1998).

Pesticides

In most industrialised countries pesticides with serious toxic effects of vertebrates have been at least partially phased out. However, globally serious intoxications and incidences due to misuse of organophosphorous pesticides continue to be a problem (Satoh and Hosokawa, 2000). Both the intoxication rates and the fatality rates are highest in developing countries. UNEP (1999) estimated that global pesticide use results in 3.5 -5 million acute poisonings each year.

Pesticides enter surface and groundwater from point source contamination following spillage events and from diffuse sources following their application to crops. They can be toxic to aquatic organisms and some are potentially carcinogenic (Cartwright et al., 1991). In aquatic environments the leaching of pesticides into rivers, lakes and coastal waters is known to cause damage to aquatic biodiversity (OECD, 2001a).

Direct measurements of pesticides in surface or groundwater are not widely available across OECD countries, mainly because of the high costs of chemical analysis. Furthermore, many pesticides are not found in water bodies simply because they are not searched for, although when they are looked for they are frequently detected (OECD, 2001a). While the use of pesticides have fallen in many OECD countries since the mid 1980s the long time lag between use and their detection in groundwater means that, as with nitrates, the situation could deteriorate before it starts to improve (OECD, 2001b). According to a survey of pesticide pollution of waters in the United States, in agricultural areas more than 80 percent of sampled rivers and fish, contained one, or more often, several pesticides. Pesticides found in rivers were primarily those that are currently used, whereas in fish, organochlorine insecticides, such as DDT (now prohibited), which were used decades ago, were detected (USGS, 1999). The US survey also revealed that nearly 60 percent of wells sampled in agricultural areas contained one or more pesticides. The results of pesticide sampling in groundwater across a number of European Union countries, found a considerable number of site with pesticide concentrations >0.1 microgram per litre, which is the maximum admissible concentration of pesticides specified in the EU Drinking Water Directive (EEA, 1998). Finally, a French study found excessive quantities in the water environment, with surface waters being most affected where only 3 percent of the monitoring points showed no pesticides were present and groundwater being better protected with 52 percent of all monitoring points considered to be unaffected (IFEN, 1998 cf. OECD, 2001a). Pesticide pollution is now appearing in developing countries as well and is likely to grow more rapidly than in developed countries (FAO, 2003)

The use of pesticides also affects terrestrial flora and fauna (OECD, 2001a). Herbicides are known to give rise to a decline in the flora of arable cropping systems (Andreasen, 1996). The floras of farming systems are particularly diverse along the field margins, where herbicide uses also reduce biodiversity by removing or reducing the first step (plants) in the food web for e.g. birds and mammals (Chiverton and Sotherton, 1991). Farmland bird populations in the EU countries have fallen substantially in recent decades (EEA, 2004). The herbicide uses have been reported to have direct and knock-on effects on invertebrate abundance and species diversity (Moreby et al., 1994). Broad-spectrum insecticides can cause substantial damage to populations of beneficial invertebrates and honeybees (Grieg-Smith et al., 1995). Hence loss of biodiversity is not limited to the land clearing stage, but continues long afterwards.

Socio-economic impacts

Developments in agriculture and food systems such as industrialisation and globalisation have had socio-economic impacts all over the world, both for the millions who are engaged in farming and for the urban populations, as illustrated in Figure 1.1. More details on socio-economic impacts are discussed in the following.

The present phase of globalisation, characterized chiefly by the proliferation of wireless communications, satellite television and the Internet, may be seen as the final outcome of a process that began in the mid-19th century with the first network technologies; the railroads and the telegraph. Beginning with these two early agents of mass transport and mass communication, the 20th century could well be characterised as the coming into being of a global mass society. Social, economic and political life has become increasingly dominated by the rise and spread of technologies of mass production and mass transport that are highly intensive in the use of energy, minerals and capital. With the accompanying trends of urbanisation and rapid population growth, the impacts on agriculture and rural communities have been enormous worldwide (The Ecologist, 1993).

Industrialised countries

Agricultural modernisation in the 20th century has brought major changes in socio-economic conditions in the industrialised countries of Western Europe, Oceania and North America. Along with the increases in agricultural production (see "Trends in agricultural production"), smaller farms have been consolidated into larger ones and there have been a dramatic decline in the percentage of the population engaged in agricultural activities (FAO, 2000). Thus, in the United States, the number of farms has shrunk from about 6 million in 1950, to about 2 million today (Pretty, 2002). With the shift of agriculture, from small- and medium-scale farms serving local needs to a mass-production industry aiming at global markets, has come the growth of international competition for selling surplus agricultural produce, and the constant pressures to lower costs. Agricultural modernisation has thus resulted in an abundance of raw and processed foods in national and international markets, with declining food prices (FAO, 2003). Cheaper food allows consumers in industrialised countries to spend only a small percentage of their household disposable income on food (10 % for American consumers in 2003). Furthermore, a larger variety of food, especially fruit and vegetables, independent of season, can presumably be beneficial for public health and may help to revive the cultivation of some marginalised crops, such as certain millets and legumes. Despite the falling commodity prices of agricultural produce such as maize and soybean, the price of food has continued to rise with inflation (FAO, 2003), an increase attributed to the marketing costs of agribusiness and food companies, such as transportation, packaging etc. Declining real prices of agricultural produce also implies that governments in the industrialised countries have had to constantly prop up their small rural populations engaged in high external inputs agriculture with large subsidies and other incentives. These farms, in turn, have been forced to consolidate into ever larger operations and enter into contracts with large agribusiness corporations in order to remain economically viable. Thus, in the United States, about 60 to 90 % of all wheat, maize and rice are marketed by only six trans-national companies; and about 90 % of poultry production is controlled by just 10 companies (Pretty, 2002). Trends in Western Europe have been similar over the past few decades (see e.g. Mies, 1999).

Developing countries

Farm sizes in many developing countries are typically small (often less than one or two hectares). In addition there is often a substantial rural population of landless households. Therefore, on-farm mechanisation of agricultural activities has not occurred to the same extent as in industrialised countries. However, many trends of modern agriculture (often hailed by many agricultural scientists, governments and international donor agencies as the "Green Revolution") have also been witnessed by most developing countries over the past three decades. With their large rural populations and small land-holdings, the arrival of high-input agriculture has brought sweeping socio-economic impacts upon tens of millions of families in Asia, Latin America and, lately, Africa as well. Certainly, some parts of the rural population have benefited greatly from better irrigation facilities and access to subsidised diesel and electricity for pumping water from canals or deep aquifers. But, the vast majority of rural households in developing countries, especially Sub-Saharan Africa (SSA), lack the ecological resources or the financial means to shift to intensive modern agricultural practices.

Integration into the global markets can be a two-edged sword for farmers in developing countries (FAO, 2000). With declining real prices of agricultural produce, farmers in developing countries tend to focus on cash crops such as cotton, paddy, sugarcane and groundnuts to take advantage of the widening access to external trade, and are forced to adopt many modern practices such as the increased use of chemical fertilisers and pesticides. This entails significant increase in the costs of agricultural inputs such as high-yielding seeds, chemical fertilisers and pesticides. The socio-economic impacts of this have become plainly visible in South Asia, with its large population of small farmers and landless labourers (Shiva, 1991). Lacking sufficient access to financial institutions (e.g. microfinance and rural credit), small farmers and labourers tend to borrow from local moneylenders at exorbitant rates of interest, which they are often unable to repay due to the vagaries of weather or unfavourable market conditions. This results in a deepening of the economic problems for small farmers in developing countries (see e.g. Sainath, 1996). The farmers are thus obliged to concentrate their efforts on short-term returns and to neglect the maintenance of the cultivated ecosystem leading to fertility decline (FAO, 2000). This process of impoverishment and exclusion is affecting primarily the most deprived, small farmers who are especially numerous in resource-poor regions and constituting the bulk density (three quarters) of the undernourished people in the world (FAO, 2000).

Focusing on cash crops leads furthermore to a decline in local food production and increased dependency of food imports (FAO, 2000). Developing countries have become increasingly dependent on agricultural imports. A rapid growth in imports of temperate-zone commodities (especially meat) have been seen and are expected to continue far into the 21st century (FAO, 2003). Some regions have remained sheltered for a long time from the cheap imports of cereals and other staple foods from the more advantaged regions and countries, being able to maintain their production systems longer than others. However, as soon as these regions are penetrated by the advance of motorised transport and commerce, they also find themselves caught up in interregional trade, exposed to low-cost imports of cereals and other food commodities (FAO, 2000).

Food security

For the past few decades, global food production has generally been adequate to meet human nutritional demands, and has kept pace with the rapid growth in human population. Food security has been substantially increased for some developing countries over the last decades, whereas other countries such as Sub-Saharan Africa have seen no improvements. With the socio-economic disparities and political asymmetries that continue to exist, nearly 800 million people remain undernourished (see Chapter 10), where the vast majority of this undernourished population lives in rural areas and urban shanties of South Asia and sub-Saharan Africa (FAO, 2000). Thus on one hand, increases in agricultural productivity and falling real prices of produce benefit global food buyers and even raise the economic status of the urban poor in developing countries, helping to reduce food insecurity for many. On the other hand, a combination of specialisation, industrialisation and increased price competition, accompanied by negative environmental externalities, holds the risk of marginalizing a large number of small agricultural producers in developing countries. Exacerbating this problem is the underdevelopment of regional food storage and distribution systems linking small producers to local and regional markets. Even where such systems exist (such as the public distribution system in India), small producers in developing countries are often unable to take advantage of them due to socio-economic inequities and political imbalances that exist in many rural areas.

On balance, the socio-economic implications of agricultural trends and the larger impacts of globalisation are twofold. Based on the problems described above and the principles of organic farming it is interesting to discuss the potential of organic farming for contributing to a solution to some of the issues. These opportunities, if utilized well, may reverse some of the ill-effects of modern agriculture witnessed in the 20th century as discussed in the (following) sections. This includes both the environmental problems in intensive agriculture and the problem that there does not appear to be sufficient safeguards and policies to ensure that small producers in developing countries can benefit from the present phase of globalisation. A broad range of initiatives to foster sustainable land, energy and water use practices, and social equity policies at the regional, national and international levels will be required if global trends toward organic agriculture and renewable energy, for example, are to prove beneficial to small agricultural producers in developing countries. Additionally, the role of non-governmental organizations (regional, national and international) in helping address issues of smallholder farms can be critical if these producers are to benefit from the global trends toward organic agriculture.

Box 1.1. Case on increasing Roundup Ready soybean export from Argentina

Increasing Roundup Ready soybean export from Argentina
by Walter Pengue

The soybean production area in Argentina has shown a remarkable increase within the last decade caused by an increasing global demand for soybeans for the pig and poultry industry, an open market and a strong campaign of technological change to Roundup Ready (RR) soybeans among other things. Concurrently with the expansion of the RR soybean production in Argentina, the use of glyphosate has showed a remarkable increase too. However, excessive reliance on a single agricultural technology, like RR soybeans and glyphosate, can set the stage for pest and environmental problems that can erode systems performance and profitability. In the following a case on the expanding soybean production in Argentina will be presented, focusing on the agricultural and environmental sustainability.

Expanding soybean export from Argentina
Over the last decade, soybean has become the most important crop in Argentina. The majority of the expanding soybean production in Argentina is exported to world markets for animal protein supplement and vegetable oil (Benbrook, 2005). Increasing demand for meat has increased the demand for fodder for e.g. the pig and poultry industry in Europe. At the same time globalisation has expanded global markets for agricultural commodities and enabled production to be separated from consumption in geographical terms.

Argentina is the world's leading exporter of cake of soybeans, followed by Brazil (FAO, 2005a). Since 1997, the export of cake of soybean from Argentina has increased dramatically from 8 million MT to 18.5 million MT in 2003 (FAO, 2005a). The importing countries are primarily European countries, such as Spain, Italy, The Netherlands and Denmark (Figure 1.7). The majority (82 %) of the cake of soybean imported to Denmark in 2003 came from Argentina (FAO, 2005a). Denmark is the world's leading exporter of pig meat and the cake of soybean is primarily used for the pig production (FAO, 2005b).

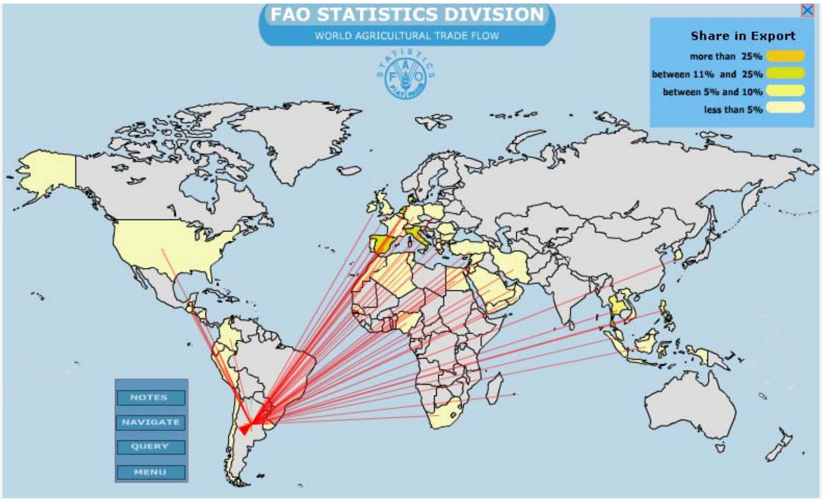

Figure 1.7. Export of cake of soybeans from Argentina in 2003 (18.476.000 MT) (FAO, 2005a). The lines show the export of cake of soybeans to different countries, where Spain, The Netherlands, Italy and Denmark are the major importers of cake of soybean from Argentina

Rapid adoption of RR soybeans and expanding soybean areas

The dramatic growth of the soybean industry in Argentina was made possible by the combination of two technologies – no tillage system and transgenic Roundup Ready (RR) soybeans. Since 1996, the area devoted to soybean production increased a remarkable 2.4-fold, from 6 million hectares to 14.2 million in 2004 (Figure 1.8). Of the land devoted to major crops, approximately 50 percent was grown with soybeans in 2003. Over a four-year period from 1997-2001, the adoption rate of transgenic RR soybeans rose dramatically from 6 to 90 percent.

The increase in the soybean area and the rapid adoption of transgenic soybean were a direct consequence of globalisation in commodity trade, an open market and a strong campaign on technological changes. For the farmers, Round-up Ready (RR) soybean came up with a solution for one of the main problems in the farm management, namely weed control. A cost reduction in the herbicide price, less fossil energy consumption and simple application made the offer of the technical package very attractive. For the private pesticide and seed production sector, it opened a unique possibility to concentrate and rearrange the business of production and commercialisation of insecticides and herbicides to the new biotechnological alternative.

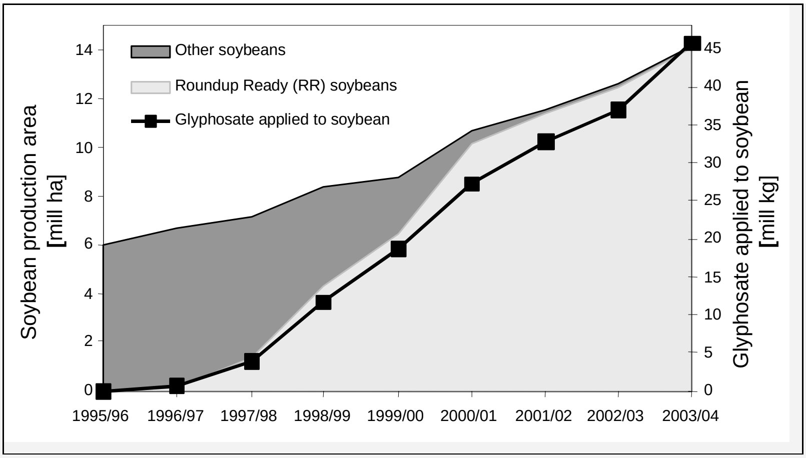

Figure 1.8. Soybean production area (mill hectares) and glyphosate consumption (mill kg active ingredient) in Argentina from 1996 to 2004 (modified after Benbrook, 2005)

At first, soybeans were mainly produced on Pampas, one of the naturally most productive places in the world. But currently, due to the need for larger scale production, farmers are expanding the area and increasing the pressure on more environmental sensitive areas.

During the period of expansion (1996-2004) in soybean production, the new areas needed for soybean production came from four main sources; a) approximately 25 % came from conversion of cropland growing wheat, corn, sunflowers and sorghum, b) approximately 7 % came from conversion of areas growing other crops including rice, cotton, beans and oats, c) approximately 27 % came from conversion former pastures and hay fields and finally d) an estimated 41 % came from conversion of wild lands, including forests and savannahs.

The Argentinean agricultural sector has set the goal of a total grain production of 100 million metric tons by 2010, of which the soybean production is projected to be 45 million metric tons. Achieving this goal would require an increase of the soybean planting area to about 17 million hectares (Benbrook, 2005).

Increasing glyphosate consumption and resistant weeds

Given the expansion of the RR soybean hectares and the no-till systems, glyphosate herbicide uses has also risen dramatically (Figure 1.8). However, the reliance on a single herbicide year after year accelerates the emergence of genetically resistant weed phenotypes. It is predicted that continual glyphosate application for longer periods of time might lead to the development or higher increases in abundance of weeds tolerant to the herbicide (Puricelli & Tuesca, 2005). Tolerance to glyphosate in certain weeds in Argentina has already been documented (Puricelli & Tuesca, 2005, Vitta et al., 2004). Given the steady increase in the intensity of glyphosate use in Argentina, the development of resistant weeds are essentially inevitable (Benbrook, 2005). The unresolved questions include how fast will resistant weeds spread, how will farmers respond and how will the spread of resistant weeds impact weed management costs, efficacy and crop yields?

Phosphorous export and depletion of Argentinean soils

In Argentina, soybean has been cropped without fertilisation, although soil phosphorus (P) contents have decreased. Areas previously considered well supplied are at present P-deficient (Scheiner et al, 1996). The demand for phosphorous and depletion of natural reposition is particular important in The Pampas, where the P extraction has been increasing during the last decade (Casas, 2003).

The intensification of the production system was followed by a decline in soil fertility and increase of soil erosion (Prego, 1997) Consequently, during the last decade, fertiliser consumption stepped up from 0.3 million tons in 1990 to 2.5 million tons in 1999. The increase in the soybean sector in the 1990s and the increase in fertiliser use thus drove the Argentinean Pampas into a more intensive agriculture that is typical of the northern hemisphere. Before that the nutrient budgets of the Pampas were relatively stable, with a rotation of crops and cattle being the most common production system.

Each year the country exports a considerable amount of nutrients – especially nitrogen, phosphorus and potassium, in its grains – that are not replenished, expect from the part of nitrogen that is derived from N2 fixation. Argentina annually exports around 3.5 million metric tons of nutrients - with no recognition in the market prices, increasing the "ecological debt" (Martinez Alier and Oliveras, 2003). Soybean, the engine of this transformation, represents around fifty percent of this. If the natural depletion were compensated with mineral fertilisers, Argentina will need around 1.1 million metric tons of phosphorous fertilisers and an amount of 330 million American dollars to buy it in the international market (Pengue, 2003). Estimations for 2002 showed that around 30 % of the whole soybean area was fertilised with mineral fertilisers. Ventimiglia (2003) predicts that nutrients of Argentinean soils will be consumed in 50 years with the trend in nutrient depletion in Argentinean soils and an increasing soybean area.

Increasing soybean production – and the environmental impacts

Soybean has had and will have, an emblematic role in relation with nutrient balance, loss of quality and richness of Argentinean soils, and in marginal areas it has transformed itself into an important factor of deforestation. During the last years, advances on natural areas in Argentina have known no limits. Forest areas and marginal lands are facing the advances of agricultural borders. The campaign to increase grain production to 100 million metric tons by 2010 will demand more land for grain crops and especially soybeans. An important part of these hectares are new land, which implies deforestation and loss of biodiversity (in terms of bioecological and sociocultural concept), replacement of others productive system (dairy, cattle, horticulture, anothers grains) or an advance on marginal lands.

From an ecological economics point of view, the agricultural border expansion without environmental and territorial considerations will produce not only environmental transformations but also social and economic consequences that Argentina, and the world, is currently not considering. On one hand, Argentina is facing an important degradation of soil and biodiversity in the country that is being promoted to solve only with the application of mineral imported fertilisers, with more environmental impacts. On the other hand the countries importing the grain and nutrients are facing problems of eutrophication and loss of habitats and biodiversity due to accumulation of especially nitrogen and phosphorous in the environment (see further "Environmental impacts").

Box 1.2. Case on beef trade and deforestation of the Brazilian Amazon

Beef trade and deforestation in Brazilian Amazon

The increased globalisation and demand for meat has increased Brazilian beef exports significantly during the last decade, with EU importing a significant fraction. However, according to a recent World Bank report, medium- and large-scale cattle ranching are the key driving force behind recent deforestation in the Brazilian Amazon (Margulis, 2004). Sustainable cattle grazing are however not necessarily linked to environmental losses, but are a widely used management tool in restoration and conservation of semi-natural grasslands to e.g. reverse the decline of northern European floristic diversity.

Beef production in the EU has decreased by nearly 10 % between 1999 and 2003 and a further decrease is expected (Anonymous, 2004b). For the first time in 20 years beef production was lower than consumption in 2003 in the EU and it is projected that EU will remain a net importer of beef until at least 2011. The main reasons are a declining dairy cattle herd, the impact of the market disruptions of the 2001 BSE crisis and an expected impact of decoupling of direct payments (such as suckling cow premium and slaughter premium) from 2005 (Anonymous, 2004b).

More than 55 % of the beef imported to the EU comes from Brazil (Anonymous, 2004a). Beef production in Brazil has been rapidly increasing during the last 10 years (Figure 1.9 and FAO, 2005b). According to FAO (2005b), Brazil was, in 2003, the third largest exporter of boneless beef and veal in the world, in volume terms after Australia and USA. More than one third of these exports go to EU (Figure 1.9) and the remainder is sold primarily to Chile, Russia and Egypt (FAO, 2005a). Projections show a steady increase in beef production in Brazil (at more than 3.2 % per year on average from 2004-2011) (Anonymous, 2004b). Demand is expected to grow rapidly in Asia, Egypt and Russia (Anonymous, 2004b).

According to Kaimowitz et al. (2004), Brazilian beef exports have grown markedly mainly due to devaluation of the Brazilian currency (Cattaneo, 2002) and factors related to animal diseases. Other factors in the Amazon has also given greater force to the dynamics, such as expansion in roads, electricity, slaughterhouses etc. and very low land prices and easy illegally occupation of government land (Kaimowitz et al., 2004). The overwhelming majority of the new cattle are concentrated in the Amazon states of Mato Grasso, Para and Rondonia, which are also the states with the most deforestation (Figure 1.10).

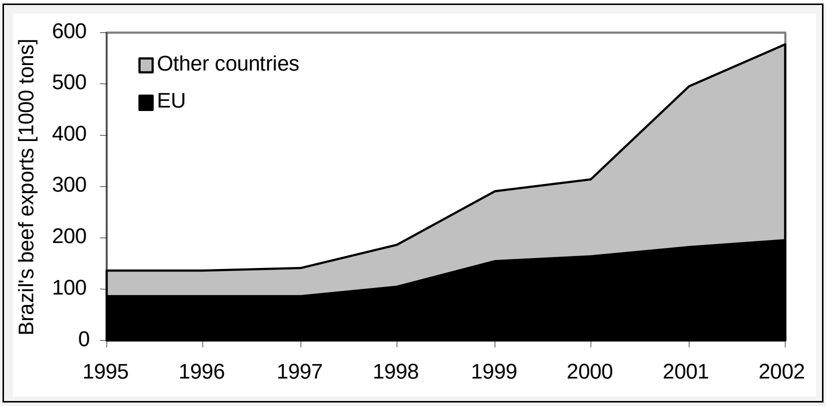

Figure 1.9. Brazil's beef exports (1000 tons) to EU and other countries (based on a table in Kaimowitz et al., 2004)

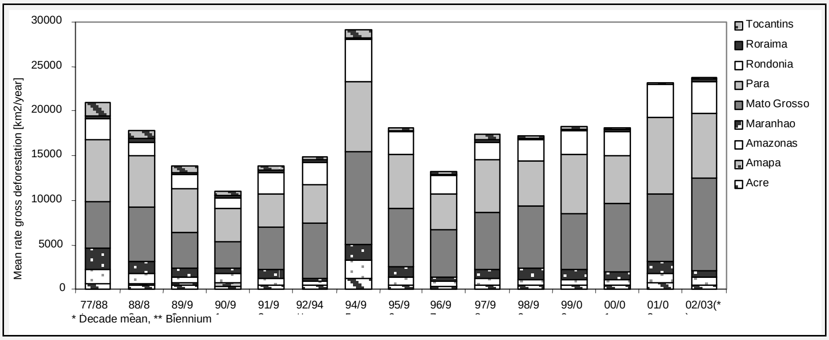

Figure 1.10. Deforestation rates in Brazilian Amazon (km^2/year) (modified after INPE, 2004).

According to a World Bank report, medium and large-scale cattle ranchers are the key driving force behind recent deforestation in Brazilian Amazon, and the overall social and economic gains are less than the environmental losses (Margulis, 2004). The expansion of the soybean cultivation into the Amazon explains only a small percentage of total deforestation according to Kaimowitz et al. (2004), who notes that logging is only partially responsible for deforestation, and is much less important than the growth of cattle ranching. Contrary to the occupation process in the 1970s and 1980s that was largely induced by government subsidies and policies, the dynamics of the recent occupation process gradually has become more autonomous, as indicated by the significant increase in deforestation in the 1990s despite the substantial reduction of subsidies and incentives by government. The study argues, that from a social perspective the private benefits from large-scale cattle ranching are largely exclusive, having contributed little to alleviate social and economic inequalities (Margulis, 2004).

Cattle grazing in the world however are not necessarily linked to environmental losses. Sustainable livestock grazing can enhance plant species richness and diversity of grasslands (Rodriguez et al., 2003, Pykälä, 2005; 2003, Dupré & Diekmann, 2001, Pakeman, 2004) and is a widely used management tool in conservation programs of natural grasslands (van Wieren, 1995, WallisDeVries, 1998). According to Pykälä (2003), restoration of semi-natural grasslands by cattle grazing is among the most practical options for reversing the decline of northern European floristic diversity.

Global trends in organic agriculture

Organic production and consumption has been increasing over the last decade. The organic products are not only being processed and consumed locally. Trade with organic products all over the world is a growing reality and organic products from developing countries like Uganda are being exported to e.g. Europe (see case from Uganda in Box 1.3). However, apart from these globalisation trends in organic agriculture, trends aiming at local production and consumption of organic food can also be seen (see cases from Denmark and USA in Box 1.4 and 1.5). In the following, status and developments of global organic farming will be given.

Status in global distribution of organic farming

Organic farming is practised in approximately 100 countries of the world and its share of agricultural land and farms are growing. The major part of the certified organic land is located in Australia followed by Argentina and Italy (Table 1.1). However, European countries have the highest percentage of agricultural area under organic management followed by Australia (2.5 %) (Table 1, Willer & Yussefi, 2005).

Figure 1.11 shows the share for each continent of the total area under certified organic management. In Oceania and Latin America there are vast areas of animal pastures having a low productivity per ha, whereas the productivity per ha in European organic farming can be very high. Therefore, one hectare in e.g. Australia cannot be directly compared to one hectare in e.g. Denmark.

Table 1.1. "Top ten countries worldwide" concerning percentage of agricultural area (%) or total land area (1000 ha) under organic management ranked according to highest percentage or total area (modified after Willer & Yussefi, 2005)

"Top ten worldwide" concerning land area under organic management			
Percentage organic area (%)		Total organic area (1000 ha)	
Liechtenstein	26.4	Australia	11300
Austria	12.9	Argentina	2800
Switzerland	10.3	Italy	1052
Finland	7.2	USA	930
Italy	6.9	Brazil	803
Sweden	6.8	Uruguay	760
Greece	6.2	Germany	734
Denmark	6.2	Spain	725
Czech Rep.	6.0	UK	695
Slovenia	4.6	Chile	646

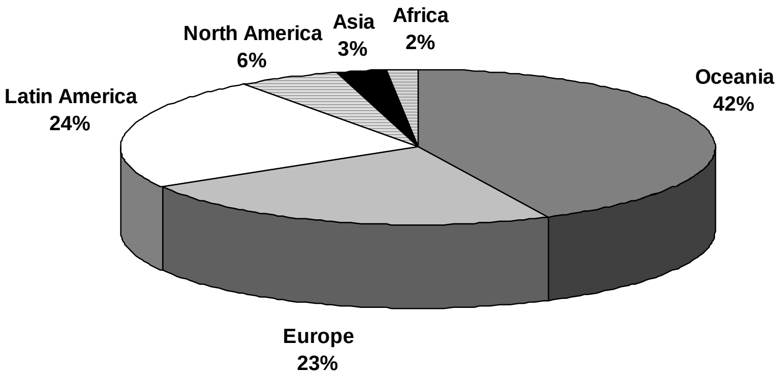

Figure 1.11. Total area under organic management - share for each continent (modified after Willer & Yussefi, 2005)

The major markets for organic food and drink are Europe and North America, which account for roughly 97 percent of global revenues and the markets are growing (Raynolds, 2004). Other important markets are Japan and Australia (Willer & Yussefi, 2004). Major northern markets offer good prospects for suppliers of organic products not domestically produced. These include coffee, tea, cocoa, spices, sugar cane, tropical fruits and beverages, as well as fresh produce in the off-season. Increasingly, governments in developing countries are creating conditions in support of organic export (Scialabba & Hattam, 2002). Regional markets of organic products are also expected to increase in developing countries like Brazil, China, India and South Africa along with increasing economic development and a more educated and affluent middle-class of consumers (Willer & Yussefi, 2004). Although certified organic products make up a minor share of the world food market (1-2 %) it is the fastest growing segment of the food industry (Raynolds, 2004). Official interest in organic agriculture is emerging in many countries, shown by the fact that many countries have a fully implemented regulation on organic farming or are in the process of drafting regulations. 57 countries have a home-based certification organisation (Willer & Yussefi, 2004). The new international organic trade has two central strands, both supplying key markets in the global North. The first and largest strand is dominated by US exports to Europe and Japan, trade between European countries, and exports from Australia, New Zealand and South Africa to the top markets (Raynolds, 2004). The second strand is dominated by North-South trade and involves a growing number of production sites, most importantly in Latin America, which ship to major Northern organic markets (Raynolds, 2004). Latin America represents the hub of certified organic production in the global South, with Argentina having the greatest area and largest percentage of agricultural land under organic management (1.7 %) (Willer & Yussefi, 2005). Uganda has the largest percentage of agricultural land under organic management in Africa (1.4 %) (Willer & Yussefi, 2005) (see case from Uganda in Box 1.3). A large part of African agriculture is however low external input agriculture (but not necessarily organic) where methods of the green revolution are risky, inappropriate or inaccessible (Willer & Yussefi, 2004). Ukraine and China are the major certified organic producers in Asia, measured by the number of certified organic hectares and enterprises, having 0.8 % and 0.06 % of agricultural land under certified organic management (Willer & Yussefi, 2005).

Global developments and challenges of organic farming

The organic food system has over the past two decades been transformed from a loosely coordinated local network of producers and consumers to a globalised system of formally regulated trade which links socially and spatially distant sites of production and consumption (Raynolds, 2004). Organic products were once largely produced locally, but as markets have grown, the range of organic items demanded have increased: moving beyond local seasonal products and bulk grains, to include a wide array of tropical products, counter-seasonal produce, processed foods etc. (Raynolds, 2004). Though preferences for local organic food persist, Northern countries are increasing their reliance on organic imports, particularly from the South (Raynolds, 2004). In 1998, 70 % of the organic food sold in the UK was imported, 60 % in Germany and the Netherlands and 25 % in Denmark (Raynolds, 2004). At the same time supermarket sales of organic products have been increasing, dominating sales in the UK and Switzerland and controlling 90 % of sales in Denmark. Supermarket sales comprise 20-30 % of organic sales in the US, Germany and Italy, but only 2 % in the Netherlands (Raynolds, 2004).

"Conventionalisation" and bifurcation in local- or export-oriented producers?

The extraordinary growth in the organic markets offers export opportunities to developing countries. At the same time the development of organic farming has lad some analysts to warn that organic farming might be pushed towards the conventional farming model as agribusiness capital penetrates the organic community and its markets (Buck et al., 1997; Guthman, 2004; Tovey, 1997). According to this scenario organic farming is becoming a slightly modified version of modern conventional agriculture, resulting in the same basic social, technical and economic characteristics - specialisation and enlargement of farms (Milestad & Darnhofer, 2003), decreasing prices, increasing debt loads with increasing capital intensification, increased use of internal inputs and marketing becoming export-oriented rather than local (Hall & Mogyorody, 2001; Milestad & Hadatsch, 2003). Buck et al. (1997) are concerned that smaller alternative producers are increasingly being marginalised by larger producers who think and act like conventional producers in terms of production and marketing methods as they are forced to compete directly with larger more heavily capitalised producers within the same commodity and input markets. Although Buck et al. (1997) suggest that this process is leading to a bifurcation of the movement into two groups, they also argue that the alternative-oriented farmers are being pressured to adopt a number of conventional cropping, labour, and marketing practices in order to survive.

In a case study of New Zealand, Coombes & Campbell (1998) found that there was some "delocalisation" in the relationship between organic producers and consumers, but due to a major growth in export-oriented organic production in New Zealand, the smaller producers were not being marginalised by the growth of larger production units or agribusiness penetration into organic agriculture. Agribusiness was focusing on converting their larger conventional growers for export-oriented markets, while the domestic markets were largely being ignored leaving the small-scale producers to continue to focus their attention on local consumers, retaining their alternative orientations and practices without any major threat or competition from agribusiness. When exporters attempted to dump certain products on the local market, there was no substantial effect on small-scale growers, as the export-oriented production was quite narrow in the range of crops, while the smaller-scale producers remained highly diversified (Coombes & Campbell, 1998). Hall & Mogyorody (2001) found little support for the idea of polarisation between large export-oriented producers and small locally oriented producers in Ontario, but did find some support for the idea of "conventionalisation" as organic field crop farmers tended to be export-oriented, large, mechanised, capitalised and specialised in cropping patterns. However, Campbell and Coombes (1999) argue that there are significant constraints and contradictions in any move to conventionalise organic farming, which creates significant space for the development of an alternative oriented organic movement. Hall & Mogyorody (2001) point out that organic farming is developing in distinct ways in different national contexts and one has to be cautious about drawing general conclusions regarding the development of organic farming. Campbell & Liepins (2001) argue that organic farming is still exceptional and provides a unique challenge to the standardising food system. Even if it is not revolutionary, organic agriculture and food consumption highlight some ways in which the broad tendencies in food production and consumption are not linear, inevitable and uncontested – thereby providing an interesting terrain for examining the processes that are occurring at the margins of the globalising food system. Raynolds (2004) suggests that while much of the literature on the preservation of organic movement values adopts a localist stance, these same values can be extended globally by linking small-scale peasant producers and conscientious consumers.

The development of farmers' markets, box schemes, farm gate sales, fair trade importing etc. may be seen as examples where those involved in the organic sector are attempting to develop alternative networks and patterns of control than exist in the conventional sector (Rigby and Bown, 2003; La Trobe and Acott, 2000). An example of an initially alternative trade network of organic milk in Denmark moving towards the trade patterns of the conventional sector is given in Box 1.4, where the degree of local links between food production and consumption are discussed. For some proponents of organic farming, it is exactly the potential for strengthening the local links between food production and consumption that is the promising issue. A large movement towards local production and consumption of organic food counteracts the trends of globalisation in the organic sector. "Eco-localism" is a concept presented by Curtis (2003) as an alternative economical paradigm as opposed to the global capitalist economy. The central argument is that economic sustainability is best secured by the creation of local or regional self-reliant, community economies (Curtis, 2003). An example of ongoing efforts to strengthen the local links between production and consumption of organic products in Iowa, USA, is presented in Box 1.5. The selected cases serve to illustrate the attempts to develop alternative supply networks and the problems associated with trying to "re-localise" the food chain, as the local market have not (yet) proven adequate for sustaining a local production on a wider scale.

Environmental issues

The environmental impacts of organic farming have primarily been assessed in developed countries, pointing out however a number of benefits. Studies have shown that regarding soil biology, organic farming is usually associated with a significantly higher level of biological activity and a higher level of soil organic matter (Hansen et al., 2001; Stolze et al., 2000; Pulleman et al., 2003; Oehl et al., 2004; Mâder et al., 2002), indicating a higher fertility and stability as well as moisture retention capacity (Stolze et al., 2000; Scialabba & Hattam, 2002). Furthermore, Stolze et al. (2000) concluded that in productive areas, organic farming is currently the least detrimental farming system with respect to wildlife conservation and landscape, and a higher species diversity is generally found in organic fields (van Elsen, 2000, Pfiffner & Luka, 2003). The absence of pesticides precludes pesticide pollution and increases the number of plant species in the agricultural fields (Stoate et al., 2001), which benefits natural pest control and pollinators. Organic farming furthermore reduces the risk of misuse of antibiotics (see chapter 9).

Organic farming systems must rely on a closed nitrogen cycle and on nitrogen input via N_2 fixation by legumes. This leads to management practices that also reduce emissions of reactive nitrogen to the environment (Drinkwater et al., 1998; Olesen et al., 2004). The use of cover crops and mulches in organic farming also has the capacity to maintain soil fertility and reduce soil erosion. The recycling in organic farming of animal manure contributes to maintaining soil nutrients and avoiding soil degradation. Furthermore, there are indications that arable organic farming systems may reduce net greenhouse gas emissions per unit of agricultural area for arable farming systems (Robertson et al., 2000).

In developing countries, organic farming has a potential of increasing natural capital, such as improved water retention in the soil, improved water tables, reduced soil erosion, improved organic matter in soils, increased biodiversity and carbon sequestration (Scialabba & Hattam, 2002, Rasul & Thapa, 2004). The potential of organic farming to enhance soil fertility and reduce soil erosion is discussed in chapter 8. Furthermore, the risk of pesticide accidents and pollution is absent.

However, the environmental benefits of organic farming are challenged by globalisation. The patterns of organic trade that are developing between North and South are to a high degree replicating those of the conventional sector. As organic produce becomes a larger part of the global food system, and as such is processed, packaged and transported more, the environmental effects become worthy of attention. "Food miles" is one measure of this increasing transportation of organic food that captures the distance food travels from producer to consumer (Rigby & Bown, 2003). When measuring and discussing "food miles" it can be important to distinguish between agricultural produce that can be produced locally and those that cannot. With the intensification of intra- and international transportation of organic commodities, organic agriculture systems are increasingly loosing their nutrient and energy closed-system characteristic (Scialabba, 2000b) risk encountering the same problem of nutrient transfer, depleting the production resources, as discussed in Box 1.1. The potential of closing urban-rural nutrient cycles in organic farming, especially in low-income countries, are discussed in chapter 7. Scialabba (2000b) points to the risk, that the environmental requirements of organic agriculture are becoming looser as the organic system expands and that few certification schemes explicitly mandate e.g. soil building practices, shelter for wild biodiversity and integrate animal production. This points to the need to supplement the organic farming principles with more guidelines or rules concerning e.g. ecological justice as discussed in chapter 3.

Socio-economic issues

Organic farming in developed countries has a potential of narrowing the producer-consumer gap and enhancing local food markets (Scialabba & Hattam, 2002; see Box 1.5). Furthermore, organic farming has a potential of decreasing local food surplus and expanding employment in rural areas (Scialabba & Hattam, 2002). A better connectedness with external institutions and better access to markets has been seen through strengthened social cohesion and partnership within the organic community (Scialabba & Hattam, 2002, Box 1.4 and 5).

The extraordinary growing organic markets offers export opportunities to developing countries. Provided that producers of these countries are able to certify their products and access lucrative markets, returns from organic agriculture can potentially contribute to food security by increasing incomes (Scialabba, 2000b). A large number of farmers in developing countries produce for subsistence purposes and have little or no access to inputs, modern technologies and product markets. As productivity of traditional systems is often very low, organic agriculture could provide a solution to the food needs of poor farmers while relying on natural and human resources (Scialabba, 2000b). In chapter 11 the effect of organic farming on food security will be discussed.

In developing countries, organic farming has a potential to improve social capital, such as more and stronger social organisation at local level, new rules and norms for managing collective natural resources and better connectedness to external policy instruments (Scialabba and Hattam, 2002). Furthermore improvements in human capital have been seen, such as more local capacity to experiment and solve problems, increased self-esteem in formerly marginalised groups, improved status of women, better child health and nutrition, especially from more food in dry seasons, reversed migration and more local employment (Scialabba and Hattam, 2002). It is assumed that organic agriculture in developing countries facilitates women's participation, as it does not rely on purchased inputs and thus reduces the need for credit (FAO, 2003; Scialabba &

Hattam, 2002). However, insecure long-term access to the land is a major disincentive for both men and woman, since organic agriculture requires several years to improve the soil (Scialabba & Hattam, 2002). Chapter 6 illustrates the approaches of organic farming in developing countries.

Furthermore, organic agriculture has the potential to use fair trade conventions and to introduce ecological justice and the view of the theories of ecological economics. These issues are discussed in chapters 2 and 4. Furthermore chapter 4 discusses the limitations of global organic trade and Box 1.3 shows a case on organic fair trade.

However, organic food and farming are challenged by globalisation and development. The increasing export-orientation and supermarket domination of the organic market goes beyond the transportation effects. Supermarkets source primarily on the basis of range, quality, availability, volume and price and hence seek large volume suppliers who can supply at competitive prices all year round (Rigby & Bown, 2003). Raynolds (2000) points out that several studies suggest that due to substantial costs and risks of organic production, much of the international trade is controlled by medium and large enterprises, challenging the assumption that it is the small farms that benefit from the growing organic market. Organic farming may offer an opportunity for marginalised smallholders to improve their production without relying on external capital and inputs and to gain premium prices from trading with industrialised countries using organic production methods that have potential benefits to e.g. soil fertility and biodiversity. However, marginal organic farmers in the South are likely to be dependent on exploitative middlemen, corporate buyers and volatile prices as conventional producers, unless they enter into fair trade networks (Raynolds, 2000). An example of organic farming as an development agent in Uganda is given in Box 1.3, where a fair trade network has been developed between organic farmers in Uganda and a Danish company. Producers, consumers and IFOAM acknowledge the convergence between the holistic social and ecological values of the Fair Trade and organic movements (Raynolds, 2004; IFOAM, 2000).

The certification issue is another challenge facing organic movements, especially with regard to developing countries. The term organic agriculture is backed with strict standards and rules that govern the organic label on the market the "organic" label of certified food found on the market. However, according to Raynolds (2004), onerous and expensive certification requirements create significant barriers to entry for poor Southern producers and encourage organic production and price premiums to be concentrated in the hands of large corporate producers. Furthermore producers often have to comply with foreign standards not necessarily adapted to their country conditions (Scialabba, 2000b). Raynolds (2004) suggests that shifting certification costs downstream and empowering local producers to fulfil monitoring tasks should reduce barriers for small-scale producers. The issues of social justice in organic agriculture are further discussed in chapter 2 and 3 and trade with organic products is discussed in chapter 4.

The focus on certified organic products (and attendant costs and risks) has distracted attention on this system's potential to contribute to local food security, especially in low-potential areas in developing countries (Scialabba, 2000a). According to Scialabba (2000a), market-driven organic agricultural policies need to be complemented with organic agriculture policies that target local food security. The issues of food security are further discussed in chapter 11.

Box 1.3. Case on trade with organic products from Uganda

Trade as an option of enhancing development? A case story from Uganda
by Åge Dissing & Ingelis Dissing

This case tries to look at trade as a development tool. Most developing countries have been used to export agricultural commodities to e.g. Europe due to their former status as colonies, but often the population has hardly used the products themselves. Thus development of the products and processed produce is not incorporated in the society. In countries where agriculture is dominantly based on subsistence farming with a few cash crops for bulk export, handling of products for the market is a fairly new thing.

Scope of co-operation

Two Ugandan companies had formed a partnership with a Danish retail company in organic produce in order to supply the Danish partner with dried banana, pineapple and mango. The objectives were to process and export organic fruit in a fair trade arrangement to the Danish/European market.

The companies were both new-started, and to obtain the objectives they had to finalise and increase the infrastructure of the processing factory, including processing facilities, drying capacity and capacity-building of staff and management. On the supply side farmers should be trained in organic agriculture and be certified organic. The Danida Private Sector Development Programme has supported the co-operation.

Presentation of the Ugandan partners

Company X

The shareholder company X consists mainly of local people (like business people, teachers and agriculturists) in a middle-size town up country plus a few expatriates. The company X was initiated out of the interest of increasing agro-processing and of course of making a profit. The company was initiated as a start up trial and moved from there into a long-term co-operation of 5 years. Now 4 years after the start the company has built a factory in 2 stages including wet processing room, sorting/packing room, stores for fresh and dried produce and an office. Furthermore different types of dryers, a water tank, eco-toilets, a bathroom, a changing room and a store have been constructed. Factory staff and the board have been trained, and training and certification of factory and farms is an ongoing process. The monthly production is now on average 1000 kg of dried pineapple and banana, equivalent to 15000 kg of fresh fruit from the farmers.

Company Y
The privately owned company Y has also a couple of other businesses to sustain the family, and to invest in the drying business. The company Y started like company X almost from zero like a start up trial and have reached almost the same infrastructure. However, the second stage of the factory is not finalised and fewer dryers are built. Director, staff and farmers have been trained, factory and farms are certified, but some inconsistency in the management policy has caused a high staff turnover. The monthly fruit production is now on average 400 kg of pineapple, banana and mango, equivalent to 6000 kg of fresh fruit, but the availability of fruit and the processing is very uneven over the year.

Hardships and obstacles for agro-business in Uganda
In fact there are quite many, but let us shortly describe the most obvious ones found in the two companies and the trade arrangement.

1. Financing a new business and especially in the countryside is almost impossible if you do not have the needed cash to invest. Banks give out only short-term loans and on very harsh conditions – at least as long as you are new in business. The main reason is that the government uses all money available to finance their part of donor investments like roads, hospitals etc. Most people do not opt for long-term investments; they still take actions from season to season, and prefer to invest in land, houses for renting or cows. A savings culture is not incorporated in society, partly due to family structures, where those who have money must give out to all relatives in need.
2. Management attitudes. It is hard to find people with a lot of management knowledge and experience, especially in agro-business. Uganda is recently recognised as a country with a very high level of entrepreneurs, but it is predominantly on very small scale like starting a tiny stall on the market or making bread on a veranda. Management experience to go into export is still difficult to find.
3. Consistency within the workforce on the factory and at farm level as well, is often very difficult and is therefore time-consuming. The in-consistency in the workforce is generally the case for both the leadership and the general staff in the factory. Industrialised working attitudes are new as often seen in traditional agricultural societies.
4. Lack of proper logistics at all levels cause financial losses. Better logistics are needed to e.g. ensure that the needed fruit is available in time, and that the factory has all needed utensils etc in place, not to loose too much time and money in the process.
5. Partnership and co-operation for mutual benefit is often difficult to create. At least it takes some years as farmers especially have been cheated by governmental "co-operatives" and exploitative middlemen. Not only farmers have bad experiences of that kind, it also includes traders and other companies.
6. Cultural differences are big when African and European lifestyle and business attitudes have to find a mutual understanding. Industrialised countries have very difficult markets and are furthermore very protective and that is an additional constraint in a trade arrangement.

Conclusions

The current school system (especial secondary school) is not encouraging questions, curiosity and personal developments, on the contrary. This indicates that a boss can still handle staff in the usual feudalistic way, and thus developments are difficult, as we have seen in the company Y.

A culture of subsistence farming is difficult to leave for farmers; they have to give up a lot of independence and freedom when going for commercial farming. In fact it is a very big change of lifestyle and work. Nevertheless farmers connected to the two companies can now deliver the quantities and qualities required.

Factory work requires strict consistency in the workforce, which is not usual in countries that have not had the impact of long-term industrialised experiences. But Company X has built some capacity within the staff now.

A fair trade agreement has a lot of good impact for the companies: fair prices for farmers and company, fair conditions for staff, transparency in the co-operation. It can include prepayment of the fruit, but in case X it has somehow caused delay in adjustment of the business as prepayment arrived anyway - for a period at least.

It is possible to see some good impact of these two trade arrangements. A lot of capacity building within farms, the staff and directors has taken place. In a country like Uganda it is definitely still needed with some development supporting training and technical assistance to demonstrate success stories in international fair trade.

Box 1.4. Case on local trade with organic milk products in Denmark

Eco-localism and trade with organic products the case of Thise Dairy in Denmark
by Chris Kjeldsen

The dairy sector in Denmark is dominated by one big shareholder company that apart from the conventional milk also have organic shareholders and trade organic milk. However, the organic cooperative dairy Thise has successfully been established at the market through both alternative and more ordinary distribution channels. Thise Dairy was rooted in closer contact between producer and consumer and was initially a local dairy. Thise dairy has over years increased their sales to all over Denmark.

Thise Dairy is an independent cooperative dairy, which was started in 1987, when a group of organic farmers in Northern Denmark approached a privately owned dairy plant in an effort to acquire processing facilities for their production of organic milk. As a result of these negotiations, the cooperative, Thise organic dairy was formed in September 1988. The scale for the cooperative dairy was relatively small initially, reflecting the modest size of the market for organic milk at the time. There was only 8 shareholders (organic and biodynamical farmers) in the cooperative, and the amount of milk weighed in at the dairy plant in was only 1.6 million kg/year in the period 1989-1990 (Jensen & Michelsen, 1991). The first two years was very costly for the cooperative, since they had to establish their own distribution network. One of the problems encountered in the early days of the dairy was that they distributed small amounts of milk over long distances to various rural locations in Northern Denmark, e.g. shop owners with a sufficient dedication to organic products (Jensen & Michelsen, 1991). The main reason behind this very costly distribution strategy was that Thise could only gain access to stores without contracts with the major retail chains and their distribution networks. The problem was that individual shops within the major retail chains have only very limited autonomy regarding what to put on the shelf, since they are obliged to use centralised distribution networks.

Distribution costs for Thise Dairy were reduced by about 70 % in 1990, when Thise joined a national distribution and sales organisation for Danish organic dairy farmers, "Dansk Naturmælk", which made it possible for Thise to sell their milk to some of the major retail chains, most notably "FDB" (Jensen & Michelsen, 1991). The reduced distribution costs were mainly due to the fact that Thise, and with them other independent dairies, now could use the distribution network of the dominating (conventional) dairies "MD Foods/Kløvermælk". Due to financial and organisational problems within "Dansk Naturmælk", the organisation was terminated in 1992. After the termination of "Dansk Naturmælks" agreement with the large retail chains in 1992, the future appeared quite bleak for Thise.

A crucial turning point for Thise Dairy happened in 1993. The Danish market for organic food expanded radically, when "FDB" discounted organic products, which had a significant influence on Thise's sales to "FDB". The most important event in Thise's history took place in 1995, when Thise Dairy signed a contract with the retail chain Irma in Copenhagen. Irma has since then been the most important distribution channel for Thise Dairy. Today, around 50 % of Thise's products are being sold in Irma shops in Copenhagen. Thise has more than doubled its sale, both in terms of turnover and the amount of milk weighed in at the dairy. At the same time, the number of shareholders in the cooperative have expanded to 42 (Anonymous, 2004c). In the late 1990's, Irma was bought by "FDB", which marked an important change, since the forward sales of milk was sold in Irma's own brand. However, Thise has maintained a high degree of branding of their own name, and is often praised in the media for their high degree of innovation in developing new product types. Compared to the much larger cooperative dairy Arla with 15 – 16.000 shareholders (that dominates the Danish dairy market and sells both conventional and organic dairy products), Thise launches a much wider range of new products each year, and have been quite a trendsetter in the organic dairy sector.

As the map below illustrates (Figure 1.12), the most important markets for Thise Dairy today is in Copenhagen, where around 50 % of their dairy products are being sold, approximately 400 km from Thise Dairy. The second most important market are export markets in England, Germany and Sweden, where up to 20% are being sold (Anonymous, 2004c). The dotted line at the map indicates the initial "heartland" of Thise, within which most of their sales were taking place in the early 1990's. The majority of the producers are still placed within or around that perimeter. Although Copenhagen is the major market, Thise is trying to diversify their operations, since they also sell their milk via different alternative distribution channels. One example is that Thise are selling dairy products to a company called "Anemonemælk", a web-based milk delivery scheme, which delivers milk and other dairy products to people's doorsteps in the wider Århus area. Other examples are health shops throughout the country.

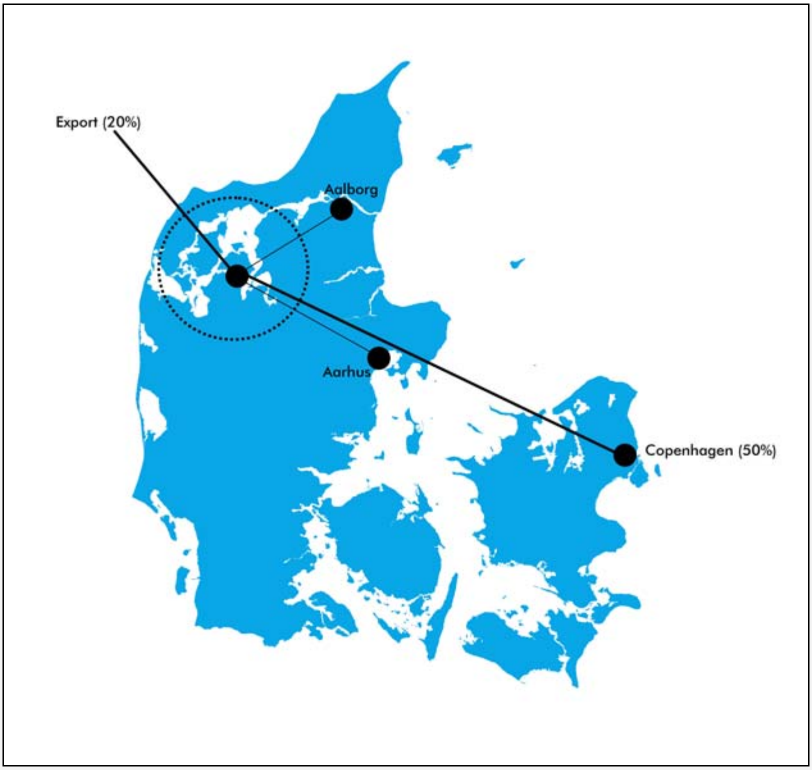

Figure 1.12. Pathways for products from Thise Dairy in Denmark

Compared to the initial circulation of their products in a primarily rural (and regional) setting, Thise has moved beyond that context, now circulating their products in a primarily urban setting, geographically remote from the production sites in the network. One of the main reasons for this shift in direction was the inability of the local markets to support an economically viable scale of production, reflected in the fact that the shareholders for prolonged periods in the early history of Thise had to accept lower prices than at the other organic dairies, for example MD Foods (Arla).

Conclusion

The dairy Thise has moved from an alternative distribution network towards the supply patterns resembling those of the conventional sector. The initial supply pattern was characterized by a center-periphery structure dependent on place and personal relations as seen in some box schemes, farm shops etc. The dairy Thise has over time moved towards another distribution pattern characterised by standardisation and regulation requiring no personal relations and less dependency of place, as seen in the supermarket distribution. The case illustrates the trend in Denmark where supermarket sales represent 90 % of the sales of organic products (Raynolds, 2004). However, there are elements of the Thise Dairy, which exhibits some degree of "regionalisation" or dependency on place, as expressed in the idea of "eco-localism". It can be argued that Irma is a primarily regional based retail chain, and that "Anemonemælk" is regionalising Thise's products around Århus. Furthermore, one should of course not forget the very important regional importance of Thise in its "home region" in terms of local jobs. But an important issue in this regard is that each of these distinctive patterns is not spatially adjacent to each other and their interaction is primarily based on the standardisation. Thise Dairy can, however, in some ways be described as expressing some of the classical virtues of the Danish cooperative dairy sector, such as producer autonomy through cooperative organisation, a high degree of innovation and also an orientation towards exporting their products. The challenge of Thise is to span across different geographical and social spaces in order to recruit enough consumers to obtain a viable economic scale. It has proven a very successful market strategy, but leaves other challenges to be met, both regarding how to "regionalise" the circulation of organic milk and how to obtain a higher degree of social integration between producers and consumers.

Box 1.5: Case on foodsheds and eco-localism in USA

The development of (local) foodsheds in Iowa
by Chris Kjeldsen

The notion of foodsheds has its origin in the use of watersheds as the organising spatial unit for integrated biophysical and social systems in bioregionalism (Wackernagel & Rees, 1996; Hansson & Wackernagel, 1999). In the same manner, the notion of foodsheds has been proposed as an organising spatial unit for closely integrated networks between production and consumption of food (Kloppenburg et al., 1996). Taken at face value, the notion of foodsheds implies a strong degree of local embeddedness. In practice though, this might not be the case, since many food networks labelled as "sustainable" might exhibit a large scale in terms of size of their foodshed. One obvious example is fair trade networks, where producers and consumers are half a world apart and products travel over very large distances.

Initiatives in Iowa

In recent years, Iowa has seen an increase in the number of food system initiatives aiming at "re-localising" the circuit of food between producers and consumers (Hinrichs, 2003). Historically, Iowa is in a way not the most typical place for such initiatives to appear, since Iowa appears as "the quintessential agricultural state in the US" (Hinrichs, 2003). Compared to many other Midwestern states, Iowa has less diversity in its terrain and climatic features, making it an obvious target for agricultural development. Because of its obvious potential for agricultural use, the prairie state of Iowa was rapidly ploughed and the early white settlers drained the abundant wetlands. From the early days of settlement, Iowa agriculture was oriented towards non-local (mostly national) markets. Commodity agriculture seemed to be a strong cultural force within the agricultural community, since Iowa agriculture was rapidly modernised, in terms of specialisation and integration with the agri-food industry. From the mid-twentieth century and onwards, the range of crops grown in Iowa has decreased significantly, as well as the number of farmers active within the sector. One example is that many labour-intensive crops such as apple or other horticultural crops vanished to a large degree from Iowa (Pirog & Tyndall, 1999), being replaced by imports from production sites within the US, such as Washington State, or overseas producers like China. The heavily industrialised and export oriented grain-livestock-meat systems became the most typical food system in Iowa.

The interest for re-localising Iowa food chains is very recent. Food system localisation in Iowa first took place with direct marketing initiatives such as Farmer's Markets growing from a number of 50-60 markets in the early 1980's to some 120 markets by the mid-1990's (Hinrichs, 2003). The first direct markets were mainly producer-driven, more than consumer-driven and should be seen as part of a strategy aiming at finding ways to overcome the massive farm crisis for commodity agriculture during the 1980's. Important actors in this regard were county extension officers and chambers of commerce, who initiated the first direct markets. Even though direct markets remain a focus area for food systems activists, there was a growing disquiet about their limited ability to sustain the livelihoods of many Iowa farmers. Aided by the activities of other actors, such as researchers from Iowa State University and the Leopold Centre for Sustainable Agriculture, both sited in Ames, Iowa, food systems activists started initiating other projects, which were supposed to extend the possibility to channel farm production flows. One of the significant developments, which took place during the 1990's, was the growth of Community Supported Agriculture (CSA) projects. By 1996, there were 9 CSA's in Iowa, whereas this number had grown to about 50 by the year 2000 (Hinrichs, 2003).

CSA was an improvement of the alternative market channels for locally produced food, but as in the case of direct markets, small, decentralised, face-to-face direct market initiatives like CSA could not sustain many Iowa producers. Instead, food system activists and organisers have increasingly focused on changing the patterns of institutional food procurement. One of the first initiatives were a publicly funded demonstration project in 1997-1998, which determined that it was possible for a university dining service, a hospital and a restaurant in northeast Iowa to purchase a significant proportion of the food needs locally (Hinrichs, 2003). Another important development was the development of a type of event called the Iowa-grown banquet meal. The first of these events was held at the Leopold Centre for Sustainable Agriculture in 1997. As both a promotional event and a celebratory enactment of local Iowa foods, the banquet meals have helped to establish a new ritual that showcases and redefines local Iowa food. Since 1997, the Iowa-grown banquet meals have spread all over the state, coordinated by a brokering office of the farmer's organisation Practical Farmers of Iowa, with 57 meals at 47 different events being held in 2000 (Hinrichs, 2003). A loosely knitted network of 23 farmers has supplied the food being served at these events.

As a symbolic way of redefining and sustaining a local food culture, the Iowa-grown banquet meals have been very important. Still, the banquet meal is episodic and supplemental for any individual Iowa producer (Hinrichs, 2003), and has not been able to sustain any larger number of local farmers. Organics as an element in the localisation of food chains of Iowa have until now been overshadowed by the valorisation of local produce. So in that sense the banquet meals conforms to what Michael Winter has termed "defensive localism" (Winter, 2003), where localisation is the top priority for development of food systems, more than progressive social and ecological priorities. The challenge for initiatives like the Iowa-grown banquet meal seems to be to balance between defensive localism and a more receptive attitude to wider social and ecological objectives.

Conclusions

- Increasing globalisation and production in agriculture has primarily benefited the industrialised countries and certain developing countries such as China that are integrated into the global markets. In those countries, food security has increased, a greater variety of food has been offered and diets have changed towards a greater share of meat and dairy products.
- However, the development hides a growing disparity among agricultural systems and population, where especially developing countries in Africa have seen very few improvements in food security and production. The vast majority of rural households in developing countries lack the ecological resources or financial means to shift into intensive modern agricultural practices as well as being integrated into the global markets.
- At the same time, intensive agriculture especially in industrialised countries has contributed to environmental problems such as pollution of surface and groundwater with nitrates and pesticides, global warming, reductions in biodiversity and soil degradation, and virtual monocultures and specialised livestock productions have spread over entire regions.
- Organic farming offers a potentially more sustainable form of production. Organic farming is practiced in approximately 100 countries of the world and the area is increasing. Trade with organic products all over the world is a growing reality with the major markets being Europe and North America. These major markets offer good prospects for suppliers of organic products from developing countries.
- However, the recent development holds the risk of pushing organic farming towards the conventional farming model, with specialisation and enlargement of farms, increasing capital intensification and marketing becoming export-oriented rather than local. Furthermore, as the organic products are being increasengly processed, packaged and transported long-distance, the environmental effects needs to be addressed.
- Organic farming might offer good prospects for marginalised smallholders to improve their production without relying on external capital and inputs, either in the form of uncertified production for local consumption or certified export to Northern markets. However, in order to create a sustainable trade with organic products focus should be given to issues like trade and economics (Chapter 4 & 5), certification obstacles, and ecological justice and fair trade (Chapter 2 & 3). Furthermore, the implications of certified and non-

certified organic farming in developing countries need to be addressed (Chapter 6 & 9) including issues on soil fertility (Chapter 8) and nutrient cycles (Chapter 7) and the contribution to food security (Chapter 10).

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