

# Promoting Production and Trading Opportunities for Organic Agricultural Products in East Africa

## Capacity Building Study 3. Organic and Sustainable Agriculture and Food Security in East Africa

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## Section 1. Overview

### 1.1 Agricultural Production and World Food Security

Over the past 40 years, there has been remarkable growth in agricultural production with per capita world food production growing by 17% (FAO 2005) and aggregate world food production growing by 145%. Between the early 1960s and mid-1990s, average cereal yields grew from 1.2 t/ha to 2.52 t/ha in developing countries whilst total cereal production has grown from 420 to 1176 million tonnes per year (Conway and Pretty 1991, Heffernan 1999, Smil 2000, Pretty and Hine 2001).

Over the same period, world population has grown from three to six billion, but globally per capita agricultural production has overtaken population growth and for each person today, there is an additional 25% more food compared with 1960. However this is not the case for everyone, it varies regionally and in Africa for example food production per person is 10% cent lower today than in 1960.

Modern agricultural methods have brought spectacular increases in productivity - more cereals and animals per hectare, more meat and milk per animal, more food output per person employed. Any farmer or agricultural system with access to sufficient inputs, knowledge and skills, can produce large amounts of food. However the majority of the chronically hungry are small farmers in developing countries who produce much of what they eat and are often poor and marginalized from input and product markets.

The recent advances in aggregate productivity have therefore not brought reductions in the incidence of hunger for all. In the early 21<sup>st</sup> century, there are still more than 800 million people hungry and lacking adequate access to food. A third are in East and South-East Asia, another third in South Asia, a quarter are in Sub-Saharan Africa, and 5% each in Latin America/Caribbean and in North Africa/Near East.

Food security can be defined as a condition where *“all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”* (FAO 1996). Indicators of food insecurity in a given region can include numbers of ‘hungry’ or malnourished people, of underweight children and of people suffering from micronutrient deficiency.

Average per capita food consumption in 2003 was 2780 kcal day<sup>-1</sup> (FAO 2005), yet consumption in 33 poor countries is still less than 2200 kcal day<sup>-1</sup>. In addition to nearly 0.9 billion people hungry, globally there are 126 billion underweight children and over 2 billion people suffering from micronutrient deficiency (von Braun 2005, FAO 2005, UN/SCN 2004, Micronutrient Initiative and UNICEF 2005).

In the last 10 years progress in the drive to reduce hunger has been slow and has varied around the world. In Sub-Saharan Africa the number of hungry people has in fact increased by 20% since 1990 and almost 50% of pregnant women in this region are affected by iron deficiency anaemia (IFPRI 2005, Micronutrient Deficiency and UNICEF 2005). In the period 2000-2002, the proportion of undernourished people in the total population of Kenya was 33%, in Uganda 19% and 44% in United Republic of Tanzania (FAO 2005). The number of underweight children has also increased in Central, Western and Eastern Africa compared

to an overall decrease in other developing regions such as Asia, South America and North Africa (von Braun 2005, UN/SCN 2004).

The world therefore still faces a fundamental food security challenge, despite steadily falling fertility rates and family sizes, world population continues to increase and so in parallel will the absolute demand for food. Food demand will also shift in the coming decades, as i) economic growth increases people's purchasing power; iii) growing urbanisation encourages people to adopt new diets; and iv) climate change threatens both land and water resources.

World population is widely expected then to reach 9 billion by the next generation (von Braun 2005) and by this time, 84% of people will be in those countries currently making up the 'developing' world. At the same time, land and water degradation is increasingly posing a threat to food security and the livelihoods of rural people who often live on degradation-prone lands (Uphoff 2002). Although a combination of increased production and more imports will mean per capita consumption will increase to about 3000 kcal per day by 2015, a developing country person will still only consume half of the cereal and a third of the meat compared with a person in an industrialised country (Pinstrup-Andersen *et al.*, 1999), so food insecurity and malnutrition will still persist (Pretty and Hine 2001).

## 1.2 The Food Security Challenge

These growing food poverty and food security challenges therefore pose a key question: what is the best way to increase agricultural productivity in developing countries that still, have hundreds of million people short of food? The question is controversial, with widely varying positions about strategies likely to be effective (Trewayas 2002, Smil 2000, Tilman *et al.* 2002, McNeely and Scherr 2003). The conventional wisdom is that, in order to double food supply, efforts need to be redoubled to modernise agriculture as this has been successful in the past. But there are doubts about the capacity of such systems to reduce food poverty. The great technological progress in the past half century has not been reflected in major reductions in hunger and poverty in developing countries.

Arguably then the most sustainable choice for agricultural development is to increase total farm productivity in developing countries which are most going to need the food. The central questions, therefore, focus on i) the extent to which farmers can improve food production and raise income with low-cost, locally-available technologies and inputs, and ii) whether they can do this without causing further environmental damage

Agriculture is unique in that it directly affects many of the very assets on which it relies for success. Agricultural systems at all levels rely on the value of services flowing from the total stock of assets that they influence and control, and five types of asset, natural, social, human, physical and financial capital, are now recognised as being important (Coleman 1988, 1990, Putnam 1993, 1995, Costanza *et al.* 1997, 1999, Carney 1998, Flora 1998, Ostrom 1998, Pretty 1998, Scoones 1998, Uphoff 1998, Pretty and Ward 2001, Pretty and Hine 2001, Pretty 2003). These five types of 'capital' asset are described below:

1. *Natural capital* produces environmental goods and services, and is the source of food (both farmed and harvested or caught from the wild), wood and fibre; water supply and regulation; treatment, assimilation and decomposition of wastes; nutrient cycling and fixation; soil formation; biological control of pests; climate regulation;

wildlife habitats; storm protection and flood control; carbon sequestration; pollination; and landscape (Costanza *et al.* 1999, MA 2005).

2. *Social capital* produces a mutually beneficial collective action, contributing to the cohesiveness of people in their societies. The social assets comprising social capital include norms, values and attitudes that prompt people to cooperate; relations of trust, reciprocity and obligations; and common rules and sanctions mutually-agreed or handed-down. These are connected and structured in networks and groups (Flora and Flora 1996, Pretty 2003, Cramb and Culaseno 2003).
3. *Human capital* is the total capability residing in individuals, based on their stock of knowledge skills, health and nutrition (Orr 1992, Byerlee 1998, Lieblin *et al.* 2004, Leeuwis 2004). It is enhanced by access to services that provide these, such as schools, medical services, and adult training. People's productivity is increased by their capacity to interact with productive technologies and with other people. Leadership and organisational skills are particularly important in making other resources more valuable.
4. *Physical capital* is the store of human-made material resources, and comprises buildings, such as housing and factories, market infrastructure, irrigation works, roads and bridges, tools and tractors, communications, and energy and transportation systems, that make labour more productive.
5. *Financial capital* is more of an accounting concept, as it serves as a facilitating role rather than as a source of productivity in and of itself. It represents accumulated claims on goods and services, built up through financial systems that gather savings and issue credit, such as pensions, remittances, welfare payments, grants and subsidies.

As agricultural systems shape the very assets on which they rely for inputs, a vital feedback loop occurs from outcomes to inputs (Worster 1993, Pretty and Hine 2001). The basic premise is that sustainable agricultural systems accumulate stocks of these five assets, thereby increasing the per capita endowments of all forms of capital over time. Sustainable agricultural systems tend to have a particularly positive effect on natural, social and human capital, whilst unsustainable systems feed back to deplete these assets, leaving less for future generations.

For example, an agricultural system that erodes soil whilst producing food, externalises costs that others must bear. But one that sequesters carbon in soils through organic matter accumulation helps to mediate climate change. Similarly, a diverse agricultural system that enhances on-farm wildlife for pest control contributes to wider stocks of biodiversity, whilst simplified modernised systems that eliminate wildlife do not. Agricultural systems that offer labour-absorption opportunities, through resource improvements or value-added activities, can boost local economies and help to reverse rural-to-urban migration patterns (Carney 1998, Dasgupta 1998, Ellis 2000, Pretty *et al.* 2005).

### 1.3 Sustainability in Agriculture

Many different expressions have come to be used to imply greater sustainability in some agricultural systems over prevailing ones (both pre-industrial and industrialised). These

include biodynamic, community-based, ecoagriculture, ecological, environmentally-sensitive, extensive, farm-fresh, free-range, low-input, organic, permaculture, sustainable and wise-use (Pretty 1995, Conway 1997, NRC 2000, McNeely and Scherr 2003, Clements and Shrestha 2004, Cox *et al.* 2004, Gliessman 2005). There is a continuing and intense debate about whether agricultural systems using some of these terms can qualify as sustainable (Balfour 1943, Lampkin and Padel 1994, Altieri 1995, Trewevas 2001).

However agricultural systems high in sustainability can be taken as those that aim to make the best use of environmental goods and services whilst not damaging the five assets – particularly natural, social and human capitals (Altieri 1995, Pretty 1995, 1998, 2005; Conway 1997, Hinchliffe *et al.* 1999; NRC 2000; Li Wenhua 2001; Jackson and Jackson 2002; Tilman *et al.* 2002; Uphoff 2002; McNeely and Scherr 2003; Swift *et al.* 2004; Tomich *et al.* 2004; Gliessman 2004, 2005; MA 2005). The key principles for sustainability are to:

- i. integrate biological and ecological processes such as nutrient cycling, nitrogen fixation, soil regeneration, allelopathy, competition, predation and parasitism into food production processes;
- ii. minimise the use of those non-renewable inputs that cause harm to the environment or to the health of farmers and consumers;
- iii. make productive use of the knowledge and skills of farmers, so improving their self-reliance and substituting human capital for costly external inputs;
- iv. make productive use of people's collective capacities to work together to solve common agricultural and natural resource problems, such as for pest, watershed, irrigation, forest and credit management.

Sustainability in agricultural systems incorporates concepts of both resilience (the capacity of systems to buffer shocks and stresses) and persistence (the capacity of systems to continue over long periods), and addresses many wider economic, social and environmental outcomes. Agricultural systems with high levels of social and human assets are more able to adapt to change and innovate in the face of uncertainty (Chambers *et al.* 1989; Uphoff 1998; Bunch and Lopez 1999; Olsson and Folke 2001; Pretty and Ward 2001). This suggests that there likely to be many pathways towards agricultural sustainability, and so no single system of technologies, inputs or ecological management is more likely to be widely applicable than another. Agricultural sustainability then implies the need to fit these factors to the *specific* circumstances of different local agricultural systems.

#### 1.4 Sustainable and Organic Agriculture

In contrast to modern systems, organic farming represents a deliberate attempt to make the best use of local natural resources. The aim of organic farming, also known as ecological or biological agriculture, is to create integrated, humane, environmentally and economically viable agriculture systems in which maximum reliance is put on locally or farm-derived renewable resources, and the management of ecological and biological processes. The use of external inputs, whether inorganic or organic, is reduced as far as possible.

“Certified organic agriculture” is a defined and certified system of agricultural production that seeks to promote and enhance ecosystem health whilst minimising adverse effects on natural resources. It is seen not just as a modification of existing conventional practices, but as a restructuring of whole farm systems (Lampkin and Padel 1994, FiBL 2000, Scialabba and Hattam 2002, Caporali *et al.* 2003, Reganold 2004). The FAO/WHO Codex Alimentarius

guidelines define organic agriculture as “an holistic production management [whose] primary goal is to optimise the health and productivity of interdependent communities of soil, life, plants animals and people” (FAO/WHO 2001). Similarly, the International Federation of Organic Agricultural Movements, with over 750 member organisations in 108 countries (IFOAM 2006a), defines it as “a whole system approach based upon sustainable ecosystems, safe food, good nutrition, animal welfare and social justice. Organic production therefore is more than a system of production that includes or excludes certain inputs” (IFOAM 2002). Principles of organic agriculture according to IFOAM are shown in Box 1.

**Box 1. IFOAM’s Principles of Organic Agriculture**

**IFOAM Principles of Organic Agriculture**

- *Principle of Health* - Organic agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.
- *Principle of Ecology* - Organic agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.
- *Principle of Fairness* - Organic agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities.
- *Principle of Care* - Organic agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

Source: IFOAM 2006b.

However, "organic agriculture" is not limited to certified organic farms and products but can include all productive agricultural systems that use sustainable, natural processes, rather than external inputs, to enhance agricultural productivity (Scialabba and Hattam 2002). Organic farmers adopt practices to conserve resources, enhance biodiversity, and maintain the ecosystem for sustainable production.

Many traditional farming systems found in developing countries practice organic and sustainable techniques without seeking or receiving the premium price given to organic food in some markets. Traditional agriculture includes management practices that have evolved through centuries to create agricultural systems adapted to local environmental and cultural conditions. Owing to their nature, traditional systems do not use synthetic agricultural inputs but apply ecological approaches to enhance agricultural production. Many of these traditional systems may not fully meet the production standards for organic agriculture but can be considered sustainable.

In this study " organic agriculture" refers to agriculture that meets organic production standards and is subject to organic inspection, certification and labelling, whereas “sustainable” agriculture refers to and includes i) agriculture that may meet organic production standards, but is not subject to organic inspection, certification and labelling; ii) *sustainable* traditional farming systems and also iii) organic agriculture.

**1.5 The Extent of Sustainable and Organic Agriculture**

The lack of a recognized system of organic agriculture data collection worldwide has meant that it is difficult to obtain reliable information on the extent of organic farming, but organic agriculture continues to grow worldwide. According to a study by the International

Federation of Organic Agricultural Movements (IFOAM) and the Foundation for Ecology and Agriculture (SOL) in Germany, the global area of land under certified organic agriculture in 2002 was 17.8 million hectares (Yussefi and Willer 2002) and is now estimated at 25 million hectares (Grolink 2006). Globally, this relates to certified organic agriculture occupying about 1% of agricultural land and 1-2% of agricultural sales by value (Morison *et al.* 2005).

In recent years there has been a dramatic increase in the adoption of organic farming in industrialised countries. In Europe, there were just over 120,000 ha under organic farming in 1985 and by 2000 this had risen to more than 3 million ha managed by 120,000 farmers. In the late 1990s, 550,000 ha of land managed by 5000 growers was certified under organic production in the USA (Lampkin and Midmore 2000, Pretty 2002b).

Organic farming is significantly more developed in South and Eastern Africa than other regions of Africa and accounts for over three quarters of the certified organic land of the continent. In some countries the certified organic sector is a result of a few large export oriented farms converting to organic production (e.g. South Africa, Zambia and Malawi) and in other countries the sector is a consequence of significant attempts to engage smallholders in export commodity production (e.g. Uganda and Tanzania) (Parrott and van Elzakker 2003).

In East Africa, there were 122,000 ha under organic production in 2004 in Uganda (Grolink 2005) and in 2003 there was estimated to be 494 ha in Kenya (representing only 0.002% of agricultural land) (Walaga, 2003) although this is thought to have increased significantly to 180,000 ha (Taylor 2005). In Tanzania in 1998 there were 4000 ha under organic production Walaga 2000, 2002).

However, as previously discussed, in some developing countries there are large numbers of farmers that practice sustainable, traditional or non-certified organic agriculture. These systems do not rely on purchased inputs often because they were by-passed by the Green Revolution, or farmers do not have access to or cannot afford artificial inputs. It is estimated that in developing countries, there are probably another 10-20 million hectares of this non-certified organic agriculture (Wynen and Vincetti 2002, Grolink 2006).

In Africa, at least 730 000 households covering about 700 000 hectares had adopted sustainable agriculture practices in 2001, including integrated and low-external input systems (Pretty and Hine 2001). Recent evidence shows that this has increased to at least 1.9 million farmers on nearly 2 million hectares (Pretty *et al.* 2005).

A large proportion of the labour force is employed in agriculture in Africa (60-80 %) and the majority of these farmers (many of whom are women) are smallholders with farms of less than 2 hectares (Altieri 2002). These small farmers grow most of their basic food crops with virtually no or minimal use of fertilizers. For example 72% of millet, approximately half the amount of food legumes and nearly all yams and cocoyams are produced in this way (OTA 1998, Altieri 2002). In Uganda and Tanzania the average use of chemical fertilisers is less than 1 kg per hectare per year, which implies that most land is never fertilised. (Wynen and Vincetti 2002)

**Box 2. Key information about organic agriculture in Kenya, Uganda and Republic of Tanzania**

Kenya	Uganda	Republic of Tanzania
<ul style="list-style-type: none"> <li>• Few large companies have led the way with certified organics</li> <li>• Also smallholder farmers organised into groups</li> <li>• Mainly fruit and vegetables for export market</li> <li>• Small market but on the increase</li> <li>• Estimates of 180,000 ha certified organic</li> <li>• Much agricultural production is organic but not certified</li> <li>• No specific policy promoting organic agriculture</li> </ul>	<ul style="list-style-type: none"> <li>• Certified organic farming mainly smallholder farmers organised into private companies</li> <li>• Strong local organic movement</li> <li>• Export market since 1994</li> <li>• More than 33,000 certified organic farmers</li> <li>• Estimates of 122,000 ha certified organic</li> <li>• Much agricultural production is organic but not certified</li> <li>• No specific policy promoting organic agriculture</li> </ul>	<ul style="list-style-type: none"> <li>• Certified organic farming mainly by smallholders organised into co-operatives</li> <li>• History of low-input traditional farming, so much agricultural production is organic already but not certified</li> <li>• Estimates of 4,000 ha certified organic</li> <li>• No specific policy promoting organic agriculture</li> </ul>

Source: Walaga 2000, 2002, Taylor 2005, Grolink 2005

**1.6 Organic agriculture and food security**

The food security of any region is not simply a question of producing enough food to meet demand but it is influenced by a multitude of factors both natural and man-made (see Box 3). Furthermore, many of the causes of food insecurity are also symptoms, creating a cyclical effect that can result in further food insecurity.

**Box 3. Factors contributing to food insecurity**

Poverty	<ul style="list-style-type: none"> <li>• Poverty remains the root cause of hunger and malnutrition in the world (IFPRI 2005)</li> </ul>
Food production	<ul style="list-style-type: none"> <li>• Enough food may be produced in a region overall, but food insecurity may persist for those who do not have the resources to buy or produce it</li> </ul>
Consistent access to food	<ul style="list-style-type: none"> <li>• Farmers may be able to produce or buy enough food for their families after harvest but may be food insecure at other times of the year (Benson 2004)</li> </ul>
Natural resources	<ul style="list-style-type: none"> <li>• A degraded natural environment will compromise food production in an area, for example poor soil quality, eroded landscapes or inadequate water resources</li> </ul>
Climate and natural disasters	<ul style="list-style-type: none"> <li>• In areas which are prone to drought or suffer from unreliable rainfall food security can be challenging</li> <li>• Plagues of natural pests such as locusts can decimate crops</li> <li>• Natural disasters may destroy lives, crops, homes</li> </ul>

	and landscapes
Ill-health and diseases	<ul style="list-style-type: none"> <li>• In the last 20 years the number of deaths from natural disasters has been more than the average for the decade before (EM-DAT 2005)</li> <li>• Malnourished people are not able to produce food as effectively as those who are well-fed</li> <li>• The prevalence of diseases such as HIV/ AIDS have serious impacts on food security and nutrition. When family members become ill or die from the virus, households are less able to produce or buy food (Rosegrant <i>et al.</i> 2005).</li> </ul>
Gender issues	<ul style="list-style-type: none"> <li>• In many regions women are the major agricultural labour force but are not always recognised for this so may not control household budgets, often have poor education</li> </ul>
Education	<ul style="list-style-type: none"> <li>• Lack of education and knowledge can affect farmer capacity to adapt to change or to cope with food production stresses</li> </ul>
Access to appropriate technologies	<ul style="list-style-type: none"> <li>• Lack of appropriate agricultural technologies, methods or inputs or can affect food security</li> </ul>
Diversity of agriculture	<ul style="list-style-type: none"> <li>• Diverse agricultural systems are more resilient to stresses than mono-cropped systems so are more likely to promote food security</li> </ul>
Poor infrastructure and access to markets	<ul style="list-style-type: none"> <li>• Poor infrastructure and a lack of access to or limited markets affects food security</li> </ul>
Political issues	<ul style="list-style-type: none"> <li>• Political problems including corruption, collusion and nepotism can significantly inhibit attempts to tackle food insecurity (Rosegrant <i>et al.</i> 2005)</li> </ul>
Armed conflicts and wars	<ul style="list-style-type: none"> <li>• Political unrest, armed conflicts and wars contribute to food insecurity and prevent food from being produced or accessed</li> <li>• Political conflicts are often associated to food insecurity as both a cause and an effect (Messer and Cohen 2004)</li> </ul>

Agriculture, by its inherent multifunctionality, can both shape and address the factors that contribute to food insecurity. As sustainable and organic agriculture relies on the five capital assets for success, they contribute to and build up stocks of these assets over time (Ostrom 1990, Pretty 2003), so reducing many of the factors that lead to food insecurity. Some examples of the positive side effects of sustainable and organic agricultural systems that have helped to build natural capital, strengthen communities (social capital) and develop human capacities as recently recorded in various developing countries include:

- *improvements to natural capital*, including increased water retention in soils, improvements in water table (with more drinking water in the dry season), reduced soil erosion combined with improved organic matter in soils, leading to better carbon sequestration, and increased agro-biodiversity;
- *improvements to social capital*, including more and stronger social organisations at local level, new rules and norms for managing collective natural resources, and better

- connectedness to external policy institutions;
- *improvements to human capital*, including more local capacity to experiment and solve own problems; reduced incidence of malaria in rice-fish zones, increased self-esteem in formerly marginalised groups, increased status of women, better child health and nutrition, especially in dry seasons, and reversed migration and more local employment.

Organic agriculture is important for meeting local food requirements while providing protection and sustainable use of natural resources. Sustainable and organic farming makes it possible to save on production costs (no expenditure on synthetic inputs) and to promote economic viability and encourage food self-reliance. In areas where farmers have no access to modern inputs and technologies or in regions where natural resources are poor, sustainable agriculture can increase the productivity of traditional systems by making better use of locally-available natural resources (Hine and Pretty 2001, Altieri 2002, Pretty *et al.* 2005). Organic and sustainable agriculture is therefore particularly appropriate for the rural communities that are currently most exposed to food shortages (IFOAM 2006c).

## Section 2. Evidence from East Africa

### 2.1 Evidence from organic and sustainable agriculture in developing countries

Some of the most significant progress in the last two decades towards sustainability in agriculture and its associated potential to reduce food insecurity, has occurred in developing countries (Uphoff 2002; McNeely and Scherr 2003; Pretty *et al.* 2003). The largest study examining sustainable agriculture initiatives in developing countries comprised the analysis of 286 projects in 57 countries (Pretty *et al.* 2005). This study found on 37 million hectares, average yields increased by 79% over a variety of sustainable agricultural systems and crop types.

We have reanalysed our database on agricultural sustainability to produce a summary of the extent and impacts of organic and agricultural sustainability projects in Africa (Table 1).

**Table 1. Extent of organic and sustainable agriculture in Africa**

Region	Number of countries represented	Number of projects analysed	Number of farmers in projects (million)	Number of hectares under organic and sustainable agriculture (million ha)	Average change in crop yields compared with beginning of projects
Africa (all countries with data)	24	114	1,900,000	2.0	+116%
East Africa	7 (Kenya, Malawi, Tanzania, Tigray, Uganda, Zambia)	71	1,600,000	1.4	+128%
East Africa	3 (Uganda Tanzania and Kenya)	44	1,300,000	1.2	+120%
Kenya	1	18	1,000,000	0.5	+179%
Tanzania	1	9	27,000	0.06	+67%
Uganda	1	17	241,000	0.68	+54%

Note: variations in the increases in yields do not necessarily mean that organic agriculture is more or less inherently successful by country, rather it varies depending on the type of project and the crops/livestock produced.

### 2.2 Narrative Case Studies from East Africa

In addition to increases in food production, a change to organic and sustainable agricultural systems has led to other improvements including environmental improvements, a strengthening of communities, improvements in education and health of individuals and a reduction in poverty. This is illustrated further through case studies of organic agriculture from East Africa.

### **The Manor House Agricultural Centre, Kitale, Kenya<sup>1</sup>**

Manor House Agricultural Centre was founded in 1984 in response to a three-year drought. The Centre's training and research complex includes demonstration gardens and livestock facilities that provide a working model of bio-intensive agricultural systems for trainees, visitors and members of local communities. The Centre provides practical training to young people, farmers and staff of government agencies and NGOs, as well as conduct adaptive research. In 1999 the Centre had trained some 6000 farmers in 185 community groups, of whom 3000 are known to have adopted grow bio-intensive agriculture (BIA). In 2005 Emaunel Omondi reports that over 70,000 Kenyans have been taught bio-intensive agriculture either directly or indirectly by the Centre. The main impact has been on vegetable production. Many have doubled their yields by adopting double digging and composting, using local natural methods of pest and disease control (such as planting sunflowers to attract predators, local plants extracts to control maize stalk borer, and intercropping to reduce tomato blight). There have been big savings on pesticides, as farmers have cut out their use. Farmers have found phosphorus to be limiting over periods of 6 years of composting, and so bonemeal is being brought in to add to compost. The centre encourages these farmer groups to train neighbouring farmers.

A former pupil at Manor House, Susan Wekesa tells how learning to use bio-intensive farming methods has impacted on her life: *"The lessons I had from Manor House and those that I continue to receive from Eric Kisiangani and his colleagues at Rural Technology Centre have moved my household from misery to normal rich life comparatively. My small "shamba" is producing surplus which I sell for income. Last season, April to June, I earned Kshs. 15,000 (U.S. \$268) from sales of Sukuma Wiki (similar to tree collards). My 0.3 acres of land is producing plenty and healthy vegetables that bring money to knock at my door in the wee hours of the day. I mean, people come knocking at the door of my house before 6:00 a.m. wanting to buy vegetables. Apart from food and money for my family, I am able to fertilize my soil from material that it produces and supports. BIA has recreated hope in me and my household. I can now face the future proudly"*.

### **Organic Cotton, GTZ, Tanzania<sup>2</sup>**

Cotton is the second most important export for Tanzania and is generally produced by smallholders using few agricultural inputs, in two main areas the "Western Cotton Growing Area" (WCGA) and the Eastern Cotton Growing Area" (ECGA). In 1994 the Tanzanian Government liberalised the cotton market to allow private companies to buy seed cotton from farmers and to run ginneries. One such company CIC Limited (a Tanzanian textile company) approached the GTZ-Protrade program in order to run an organic cotton feasibility study. A village in the Meatu District, Shinyanga Region, Northwest of the country in the WCGA, was chosen as the project area and 45 contracted farmers produced organic cotton in the 1994/5 season. This area was particularly suitable for the project for several reasons, because cotton is produced here at low-yield level so risks of yields falling during conversion are less and so farmers were therefore keen to participate. Most farms have areas of fallow lands to act as refuges for natural enemies of insect pests and farmers have large numbers of cattle so can provide animal manure fertilisers for their cotton crop.

<sup>1</sup> Source: University of Essex SAFE Research Database 2001, Ecology Action 2000, 2005  
<http://www.growbiointensive.org/biointensive/Kenya.html> and

<http://www.growbiointensive.org/newsletter/may2000/biointensive-applic-3.html>

<sup>2</sup> Source: G Ratter in "Organic Cotton" by D Myers and S Stolton (1999, IT Publications). University of Essex SAFE Research Database 2001

The GTZ-IPM project offered support in training of extension staff and research and two private ginneries were under construction in the area. Project farmers agreed to organic cultivation and to practice crop rotation and the cultivation of trap crops for insect pest control in return for inputs and guaranteed markets for their cotton. By the late 1990s, the project consisted of 134 farmers, producing an average of 663 kg/ha of cotton with the cotton officially certified as organic.

### **SACDEP, Thika, Kenya<sup>3</sup>**

SACDEP Kenya is an indigenous NGO that has worked for the 13 years with over 30,000 smallholder farmers. Based in Thika in Central Kenya, SACDEP facilitates training programmes for farmers in sustainable agriculture and community development with a focus on production, processing, agro-marketing, savings and credit schemes and is currently working with 4,500 smallholder farmers in Eastern and Central provinces of Kenya. SACDEP mainly works on a weekly basis with farmers in organised community groups of about 30 families. SACDEP operates under the 4 principles of sustainable agriculture i) Ecological feasibility, ii) Environmentally friendly, iii) Social justness and iv) Culturally acceptability. Topics covered in the SACDEP training programme include natural soil fertility management; integrated environmentally friendly weed, pest and disease protection; on-farm soil and water conservation techniques and farm level seed conservation. Farmer groups are trained by SACDEP for 3-4 years in which time productivity has been reported to increase by 50% giving the farmers food security and surplus produce to sell. SACDEP also facilitates the development of Smallholder Farmers Organisation (SFOs), that together address common issues such as value adding for produce, marketing, savings and credit. SFOs in this development stage also agree on sustainable and organic norms for all the producers in the group to use. Incomes have increased as a result, up 40%, enabling farmers to meet basic needs such as paying school fees and medical expenses.

### **Certified organic cotton in Uganda<sup>4</sup>**

Cotton production was introduced in Uganda in the 1940s, but the production virtually stopped between 1972 and 1986 due to poor prices and an unfavourable policy environment. Since 1986 there has been a revival in agriculture and a renewal of the cash crop sector, which has made way for organic cotton production in certain districts of Uganda, including in the low-potential east and north-east of the country. In 1994 organic cotton production only involved 200 farmers. By the year 2000, some 24,000 had become organic.

The majority of cotton producers are small-scale resource-poor farmers. Soil fertility and pest management is maintained through traditional cultural practices such as fallowing, crop rotations and natural pest control. Although agricultural policy generally promotes the use of pesticides, some areas of Uganda are now exempt from pesticide promotion campaigns and some districts are now promoting organic agriculture.

Organic cotton production achieves yields of 1 000-1 250 kg/hectare of seed cotton giving approximately 300-320 kg of cotton lint. Recent studies have reported that that organic farmers have started to obtain high cotton yields compared to conventional farming systems. In addition organic cotton receives premium prices, on average a 20% organic premium on export, which relates to a 15-20% premium over farm-gate prices. Organic

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<sup>3</sup> Source SACDEP 2006 personal communication

<sup>4</sup> Source: Walaga, 1997; van Elzakker and Tulip, 2000

cotton farming is therefore economically viable and this has tempted many farmers into organic production.

Organic cotton production is mainly a private-sector market driven, business activity organized by exporters while the conventional system is under government promotion. Organic cotton production is therefore well structured with extensive support from Export Promotion of Organic Products from Africa (EPOPA) under the Swedish International Development Co-operation Agency (SIDA). EPOPA works with large groups of smallholder farmers (e.g. cooperative unions), giving technical advice on production and marketing.

### **Community mobilisation against desertification (C-MAD) programme, Kenya<sup>5</sup>**

The C-MAD programme works in a 'low-potential' part of South Nyanza, western Kenya. The programme area has a single rainfall season, and the land is badly degraded due to overgrazing and deforestation. The project began as a straightforward tree-planting effort, expanded to incorporate soil conservation, soil fertility and organic farming methods, and now focuses on whole farm improvements. The social processes incorporate participatory learning methods, farmer-based research groups, strengthening community and village groups, and collaboration with government and non-government research and extension agencies. It works with about 500 farmers in some 1000 hectares, who have seen maize yields improve from about 2 to 4 t/ha. Income has also increased for many farmers following the cultivation of fruit (citrus, orange, mango, pineapple). The project reports increased local employment through growth in demand for on-farm labour. The cultivation of vegetables in home gardens has further improved domestic food security. The project also reports reduced child mortality and improved health and nutritional status.

### **Small-Scale Aquaculture in Malawi<sup>6</sup>**

The International Center for Living Aquatic Resources Management (ICLARM) works to integrate pond fish culture into low input farm systems in Malawi. The programme uses a participatory process for farmers and scientists jointly to map resource flows on farms, and then identify the potential for adjustments that would bring synergistic effects. It has worked with some 2000 individual farmers on both vegetable improvements in home gardens and fish-pond aquaculture. This integrated agriculture-aquaculture component of farmers often comprises only 500 m<sup>2</sup> within an average farm size of 1.5 hectares. Yet intensification of just this core component has led to significant improvements in food security – vegetable yields have grown to 2700 to 4000 kg/ha, and fish ponds produce the equivalent of 1500 kg/ha of fish – a new source of food for households. These integrated farms also produce six times more cash than conventional farms – with the vegetable-fish element contributing up to 70% of annual cash income. ICLARM has documented the steady improvement of productivity in these systems amongst collaborating farmers – with pond productivity increasing steadily from 800 to 1500 kg/ha. Amongst those farmers trained only through the conventional Training and Visit system in southern Malawi, yields by contrast fall steadily, as the over-designed systems unravelled as farmers lost control. An asset-building approach, building both on natural capital on the farm and farmers own human capital (skills and knowledge) allows for continuous readjustments over time.

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<sup>5</sup> Source: Peter Omondi, C-MAD and Questionnaire for University of Essex SAFE Research Database

<sup>6</sup> Source: Randall Brummet, Daniel Jama; Brummet, 2000 and Questionnaire for University of Essex SAFE Research Database

### ICIFE *Vutu-sukumu* (Push-pull) pest management in smallholder systems, Kenya<sup>7</sup>

The work of ICIFE is explicitly focused on designing low-cost integrated pest management technology. It works closely with farmers to test and adapt technologies. It is also producing unexpected synergistic effects through manipulation of agricultural systems and the paradigms that define them. One activity is investigating novel habitat management approaches to suppress cereal stem borer and *Striga* populations in maize and sorghum. This project is developing novel 'push-pull' strategies to repel stem borers from the cereal crop and attract them to intercrop or barrier forage grasses. It has found extra-ordinary multi-functionality in a range of fodder grasses and legumes in cereal systems. The strategy involves trapping pests on highly susceptible trap plants (pull) and driving them away from the crop using a repellent intercrop (push):

1. The forage grasses, *Pennisetum purpureum* (Napier grass) and *Sorghum vulgare sudanense* (Sudan grass), attract greater oviposition by stem borers than cultivated maize.
2. Non-host forage plants, *Melinis minutiflora* (molasses grass) and *Desmodium uncinatum* (silver leaf) repel female stalk borers (*Chilo spp*).
3. Intercropping with molasses grass (*Melinis minutiflora*) increases parasitism, particularly by the larval parasitoid, *Cotesia sesamiae*, and the pupal parasitoid *Dentichasmis busseolae*. *Melinis* contains several physiologically active compounds. Two of these inhibit oviposition (egg laying) in *Chilo*, even at low concentrations.
4. Molasses grass also emits a chemical, (E)-4,8-dimethyl-1,3,7-nonatriene, which summons the borers' natural enemies.
5. Napier grass also has its own defence mechanism against crop borers: when the larvae enter the stem, the plant produces a gum-like substance kills the pest.
6. Sudan grass also increases the efficiency of the natural enemies (the parasitism rate on larvae of the spotted stem borer, *Chilo partellus* more than tripled, from 4.8% to 18.9% when the grass was planted around maize in a field and from 0.5% to 6.2% on *Busseola fusca*, another important pest).
7. ICIFE has found that intercropping maize with the fodder legumes *Desmodium uncinatum* (silver leaf) and *D. intortum* (green leaf) reduced infestation of parasitic weed, *Striga hermonthica* by a factor of 40 compared to maize monocrop. Reduction in *Striga* infestation by intercropping maize with the two species of *Desmodium* was significantly more than intercropping maize with soybean, sun hemp and cowpea.

Researchers from ICIFE and IACR-Rothamsted have found that such 'push-pull', using the attractive plants as trap crops and repellent plants as intercrops, reduces stem borer attack and increases levels of parasitism of borers on protected maize, resulting in a significant increase in yield. Farmer participatory trials in 1997 and 1998 have shown significant yield increases in maize. The aim is now to develop a maize-based cropping system that will reduce yield losses due to both stem borer and *Striga* and at the same time improve soil fertility due to nitrogen-fixing action of *Desmodium*. Such a redesigned and diverse system has many of the characteristics of 'traditional' farms in Kenya. ICIFE has trained a network of farmer teachers and now over 3000 farmers have adopted these push-pull technologies.

<sup>7</sup> Sources: Hans Herren, John Pickett, ICIFE annual reports; Pickett, 1999; Khan et al, 2000, ICIFE 2005

### **Ethiopia: Cheha Integrated Rural Development Project<sup>8</sup>**

This is an example of an integrated and relatively small-scale project making a substantial impact on regional food security. It has been working in south-west Ethiopia since the drought of 1984, and has introduced of new varieties of crops (vegetables) and trees (fruit and forest), promoted organic manures for soil fertility and botanicals for pest control, and introduced veterinary services. Some 12,500 farm households have adopted sustainable agriculture on about 5000 ha, resulting in a 70% improvement of overall nutrition levels within the project area, along with a 60% increase in crop yields. Some farmers have begun to produce excess crops which they sell in local markets, earning much needed income for their families. Thus an area once reliant entirely on emergency food aid has now become able to feed itself and have enough left over to contribute to surplus. The real promise of the programme, however, lies in the fact that farmers are replicating activities on their own initiative (including those outside the project area), where once they had to be encouraged to participate through food for work payments.

### **Mumias Education for Empowerment Project, Kakamega, Kenya<sup>9</sup>**

The MEFE project works with some 2070 households in Kakamega, and area of western Kenya characterised by high rates of rural malnutrition, infant mortality and non-literacy. Severe food insecurity affected 1 in 4 people before the project, with many households only food secure for 1-3 months per year. The project uses a structured learning process (REFLECT) to encourage all groups to analyse critically their own environment and to seek new solutions based on locally-available resources. The project uses a range of integrated pest management methods together with legumes, cover crops and green manures for soil fertility improvement. Raised beds have been incorporated on farms to increase vegetable production. As a result, beans and groundnut yields have doubled from 300 to 600 kg/ha. The project reports that the food security period has improved to 3-6 months for a typical household. The increased consumption of protein particularly benefits child health.

### **LOMADEF, Lipangwe, Malawi<sup>10</sup>**

In 1993, the challenge of crop productivity far below subsistence levels, soils with deteriorating fertility and escalating prices of essential farm inputs inspired a group of determined Malawian smallholder farmers to provide themselves with hands-on experience with selected organic soil improvement practices. As a result, they established the Lipangwe Organic Manure Demonstration Farm (LOMADEF), a small farm on a steep undulating landscape with the objective of demonstrating the benefits of organic agriculture and to reduce dependence of smallholder subsistence farmers on artificial fertilizers; nurture a sense of self reliance among farmers; use the demonstration farm for smallholder farmers from all over the country to come and learn about organic agriculture techniques and establish further sustainable agriculture demonstration farms for smallholder farmers.

The first step LOMADEF took was to use manure on the fields. While surrounding farmers suffered wilted and stunted crops, the LOMADEF farm gave very conspicuous results

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<sup>8</sup> Source: Food for the Hungry International and Questionnaire for University of Essex SAFE Research Database 2001

<sup>9</sup> Source: Francisca Mate, James Atema and Questionnaire for University of Essex SAFE Research Database 2001

<sup>10</sup> Source: Kanjanga,

which encouraged more farmers, other agricultural NGOs and the Government to take an interest. Over 1200 farmers have since been brought in to observe the benefits of organic agriculture and to learn some simple organic agriculture practices. LOMADEF has now grown from one club to thirteen and membership has increased from 13 to 200, with clubs spread across the country. The LOMADEF experience suggests that smallholder-managed demonstrations that show affordable technologies are very attractive to smallholder farmers.

### **Soil and crop productivity improvements, EAT, Kenya<sup>11</sup>**

The Environmental Action Team (EAT) soil and crop productivity enhancement project covers smallholder-farming communities of Trans Nzoia, West Pokot, Lugari and Bungoma districts in North Rift and western regions of Kenya. Here, rainfall reliability is generally high in most of the areas except West Pokot District where climate is marginal. However most of the districts are covered by soils that are inherently low in fertility; it is an area with traditionally low crop productivity (less than 2 tons/ha for maize and less than 0.1 tons/ha for beans); there is low diversity in the crops that are grown (about 95% of cultivated land covered by the dominant crops of maize and beans) and there is rampant household food insecurity (with an average 3.3 months of hunger experienced every year). The aim of this EAT project is to enhance household food security within the target farming communities through increased crop yields by encouraging soil and crop productivity improvements. EAT carries out training using participatory methodologies such as field days, demonstrations, farmer verification trials, farmer follow-ups, farmer to farmer visits; it encourages the formation of collaborative partnerships and participatory learning and identification. EAT instructs on soil fertility management, crop diversification, improved crop management and improved farm planning.

This has resulted in more than 1000 farmers drawn from different farming communities directly trained through the project and they are integrating components into their farms. Untrained farmers are learning from trained farmers causing a multiplier effect so the number of farmers who have benefited from the project is much higher. Integration of components has resulted in maize yields of 3414 kg/ha (71% increase in productivity), while bean yields have increased to 258 kg/ha (158% increase in productivity) as compared to traditional agriculture. There has also been an increased diversity of crops grown. These results have led to broad reaching impacts on food and nutrition security, the natural environment, on communities, education and economy (see Box 4.)

#### **Box 4. Impacts of the soil and crop productivity enhancement project of EAT Kenya**

- Increases in diversity in food crops available on farms has made diets more varied and has thus improved health
- Surplus produce is sold and income used to access health facilities and medicines
- There are reduced health risks for farmers because of reduced pesticide use
- Surplus produce sold and income used to pay school fees for farmers' children and thus improved education
- Reduction in soil loss from farms following implementation of soil conservation techniques
- Increased soil health through soil organic matter accumulation following application of organic manures
- Cohesion within farming communities enhanced through forums organized for farmers for sharing ideas and findings on productivity improvement and marketing of farm produce
- Groups formed during the project's interactions with farmers have evolved into channels for

<sup>11</sup> Source: Charles Wasonga, EAT Kenya pers. Com. 2005.

entry into other development interventions within the communities, such as group marketing of farm produce

- Farmers who have adopted new practices have become teachers for other community members on techniques for improving productivity, and in the process they themselves have gained more respect and social standing within communities and households, which has increased their self esteem
- More people have gained self-employment in farming and businesses established through finances obtained from sale of surplus farm produce
- Capacity of individual farmers to evaluate emerging production techniques has increased
- Households have been financially empowered and have been able to adopt technological advancements such as mobile telephones, which have increased communications and enhanced efficiency in exploitation of market opportunities
- Unemployment levels within farming communities have reduced leading to an overall reduction in poverty within households

Source: Charles Wasonga, EAT Kenya pers. Com. 2005.

### **Organic agriculture Iganga District, Uganda<sup>12</sup>**

The Poverty Eradication through Environmentally Sustainable Technologies (PEEST) project has been implemented in the Iganga District of Eastern Uganda since June 1997 by Africa 2000 Network. The aim of the project is to combat environmental degradation by promoting ecologically sustainable development for improved livelihoods among the smallholder farmers in the District. Since the 1970s the natural and agro-ecosystems of the area have been suffering degradation following rapid population growth and deterioration in the economic situation. As the population grew, natural forest and woodlands were cleared for agricultural use, fuel wood, timber and human settlements. This mass clearing of forests, woodlands and wetlands has resulted in an increasing scarcity of fuel wood, timber, and drinking water from natural wells and springs which are increasingly drying up at a much faster rate during the dry season.

By 1997, many farmers in the Iganga District were faced with a problem of increasing vulnerability characterized by high poverty levels (above the national average of 45% living below the poverty level of one dollar per day) and food insecurity. The three-year Poverty Eradication through Environmentally Sustainable Technologies project (PEEST) was initiated in 1997 with the aim of improving the livelihoods of the smallholder farmers through increased agriculture productivity and sustainable natural resource management. The aims of the project were to provide knowledge and skills to enable communities to manage their environment and natural resources in a sustainable manner; facilitate communities in the District to improve food security and diets, and to increase incomes and fuel wood production; ensure active participation of both men and women as a family unit for improved family welfare and ensure that successful projects and practices are replicated, where conditions permit, and unsuccessful ones avoided.

Partners supporting PEEST include: Cordaid (formerly Bilance), International Centre for Research in Agroforestry (ICRAF), Centre for Tropical Agriculture (CIAT), the Tropical Soil Biology and Fertility Programme (TSBF), the Kawanda Agricultural Research Institute (KARI) of the National Agriculture Research Organization (NARO), Makerere University Soil Science Department and SIDA's Regional Land Management Unit.

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<sup>12</sup> Source: Walaga and Kakinda 2002

The first phase of the project used participatory methodologies and raised environmental awareness in the community, equipped farmers with knowledge and analytical skills about their environment and skills to manage their natural and agricultural resources more sustainably. This resulted in improved productivity of natural resources. The technologies and practices, which were adapted and adopted, reduced soil erosion, conserved soil water, helped prevent soil nutrient loss, improved soil fertility resulting in improved agriculture productivity. By improving soil fertility the demand for more land from forests and wetlands has been eliminated for those participating farmers. The new agroforestry technologies increased the supply of fuel wood and fodder and contributed to increasing the fertility of the soils, while the improved cook stove reduced the demand for fuel wood. The promotion of indigenous crop varieties contributed to improving the food security of the community and to the conservation of the local agrobiodiversity. Of the 10,000 farmers reached in the first phase of the project, 99 percent reported increased food supplies and many reported increased income.

However the rapidly growing population of a predominately rural population remains a serious challenge. The project has recognized this problem and is now adding family planning and HIV/AIDS in its interventions Gender inequity remains a serious limitation to organic agriculture development in Uganda as it affects labour deployment and allocation of resources. The project has mainstreamed gender and instituted incentives like support to families that show a higher degree of gender equity to promote change. Gender equity is a social phenomenon and takes time to take effect in many of the families.

The project is now in its second phase of implementation with the aim of reaching a total of 50 000 households in the District. With many farmers replicating organic farming practices and technologies, positive contributions of organic agriculture to the ecosystem of the District are being multiplied. The adoption of sustainable agriculture techniques has also improved the livelihoods of rural farm households. They are particularly suitable to small and resource poor farmers and scaling-up should be facilitated to benefit many more farmers more quickly.

### **Mount Kenya Organic Farm (MOOF), Kenya<sup>13</sup>**

Mount Kenya Organic Farm (MOOF) is a registered NGO which was established in 1999 with a remit for facilitate smallholder producer groups in the production and marketing of high value certified organic products. The primary objective is to improve and help to raise the living standards of Kenya's smallholder farmers by having an assured food security for themselves and their communities, to tackle poverty and to empower the local community through the production of speciality high value organic crops for local and export markets main goal is to "Tackle Poverty among Smallholder Farmers through Organic Trade.

MOOF has formed links with the soil Science department of Nairobi University, The International Centre for Insect Physiology and Entomology-ICIPE, International tree Foundation-ITF, The University of Essex, The University of Coventry, and other groups promoting sustainable agriculture in Kenya such as Kenya Organic Oil Farmers Organisation (KOOF) and overseas.

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<sup>13</sup> Source: Peter Murage Pers.com. 2006

The MOOF farm demonstration garden consists of 0.25 acres and is made up of a number of raised beds growing 14 vegetable types. During the 2000-2002 drought, vegetables in the demonstration garden fared well compared to others in surrounding gardens. Pest control included the use of natural predators, and plant extracts, neem and garlic sprays. MOOF has already developed a local network of Self-Help smallholder groups which it services with training and advice on certified organic farming technologies. Farmers trained by MOOF and adopting some organic methods like soil management practices (which help to retain moisture) had a greater success story for their crops. As a result 925 farmers visited MOOF organic gardens and 300 farmers adopted at least one organic technique in food production

MOOF has recently started the organic borage for export project, which is currently supported by USAID development Agency through FINTRAC -Horticulture Development Centre and Earthoil. The Project targets production of certified organic Borage seeds for cold pressing into neutraceutical oil for export to Europe and the United States of America. This has contributed immensely in building up the rural economy in the project area. This organic agriculture is labour intensive and has contributed to large number of people getting employed in the sub-sector. Borage seeds fetch good farm gate price at US\$ 4.00 per Kilogram which has been negotiated and agreed upon by the buyer Earthoil Kenya Limited and Farmers Self-Help groups . Borage yields are estimated at 500-750 kg per acre and the cost of production is very minimal as compared to conventional agricultural technologies. Income generated from the 30 acres of borage of this project in 2006 estimated Kshs. 4.5 Million ( US\$ 64,000) coming into the Nanyuki community (80 smallholder farmers) over a period of 7 months.

It is hoped that income generated from this project will enable people to have access to better health facilities, afford a family bicycle and have access to more protein foods from stocking Tilapia fish for their diets. Income generated from sale of organic oil crops is also hoped to provide for the money needed for the household basic needs and hence reduce encroachment to Mt. Kenya forest for charcoal burning and the felling of indigenous trees for timber and fencing posts. Borage attracts bees in large numbers and this is hoped that farmers will engage in production of organic honey , which , when marketing is well organised, will fetch good income market and help people to further add to their Borage income.

### **Pelum, Tanzania<sup>14</sup>**

Participatory Ecological Land Use Management-Tanzania (PELUM-Tanzania), is a network of civil society organisation working with rural communities in promoting sustainable agriculture in Tanzania. PELUM-Tanzania is one of the ten Country Working Groups (CWGs) in East, Central and Southern Africa that form PELUM Association. The association was launched in 1995 and its headquarters is in Lusaka Zambia. PELUM also has CWGs in Kenya and Uganda. Currently PELUM-Tanzania has a total of 33 member organisations that have all come together to facilitate learning, networking and advocacy in participatory ecological land use management. As a network of CSOs, PELUM-Tanzania does not work

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<sup>14</sup> Source: Donati Alex Senzia pers. Com 2006, PELUM TZ

directly with smallholder farmers but works through Member Organisations that work with the rural community in Tanzania.

The objectives of PELUM Tanzania are to develop capacity of member organisations through organising own training workshops; facilitate networking through farmer organisations; be a tool for documentation and communication; facilitate advocacy work in food and seed security and sustainable land use management; advocate issues of marketing and trade and develop PELUM-Tanzania membership functioning, assessment and visibility. PELUM-Tanzania works with and for smallholder farmers to tackle food security issues by advocating participatory policy formulation; access to markets; seed security, improved rural infrastructure (roads, storage facilities, physical markets, communication etc) and allocation of 10% of national budget to agriculture and food security by 2010. PELUM-Tanzania also organises farmer exchange visits and networking days so that farmers can learn and exchange best practices in agricultural sector. During networking days, farmers' groups and networks through member organisations come together exhibit their produces, share experiences and skills in production, processing, storage and marketing of agricultural products.

In 2003, 4 field staff from PELUM Tanzania participated in a two weeks workshop on Organic farming and Marketing organised by PELUM Association with an aim to introduce member organisations to the potentials of organic farming in Tanzania. After this workshop, some members have started strategies for introducing organic farming in their areas. PELUM-Tanzania also made it possible for its member organisations and farmers to meet with organic farming institutions in Tanzania to know more about organic farming (institutions such as EPOPA (Export Promotion of Organic Products from Africa), TOAM (Tanzania Organic Agriculture Movement) and Tancert (Tanzania Organic farming Certification association)).

### 2.3 Discussion of Evidence

Recent research and the case studies highlighted in this report reinforce the view that food security is influenced by many different factors that vary from region to region and although increases in yields are a fundamental aspect, these alone cannot guarantee a reduction in food insecurity. Other factors such as improvements to the natural, social and human capital assets base that organic agriculture provide, are also significant and can be seen as measures of success in reducing food insecurity.

Drawing on the empirical evidence, a typology of improvements has been developed to demonstrate where alterations in the farming system can be made to positively affect the 5 capitals (Pretty and Hine 2001). The first improvements involve those that positively affect natural capital in different ways (Mechanisms 1-4). The second improve social and human capital (Mechanisms 5-6), and the third involves improving financial returns to farmers and/or their access to finance and credit (Mechanisms 7-9) see Table 2.

**Table 2. Sustainable Agriculture Improvement typology**

Improvement	Mechanism	Details
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Natural capital	1. <i>Better use of locally-available natural resources</i>	A wide variety of technologies and practices are available which farmers and communities can use to make better and more productive use of available natural resources – the basic notion being that for a variety of reasons, water, soils and biodiversity have not been used most effectively in the past. The options include water harvesting, soil and water conservation – e.g. contour cropping, terraces, minimum tillage, grass strips; composting, livestock manures; irrigation scheduling and management; restoration of degraded or abandoned land; rotational grazing; habitat management for pest-predators; drainage systems and sub-soiling; raised beds; bio-pesticides and bio-fungicides.
	2. <i>Intensify microenvironments in farm system (gardens, orchards, ponds)</i>	A further improvement to farm or livelihood systems involves the intensification of a single sub-component of their farm, while leaving the rest alone, such as through double-dug beds, adding vegetables to rice bunds, or digging a fish pond. These technologies can significantly increase total food production for rural livelihoods, particularly of protein and vegetables. The beneficiaries are often children during ‘hungry’ seasons. The options include double-dug beds; vegetables on rice bunds; kitchen gardens; fish ponds; gully cropping and silt traps.
	3. <i>Diversify by adding new regenerative components</i>	The third type of improvement to natural capital involves the diversification of the whole agroecosystem through addition of new regenerative components, such as legumes in cereal rotations, fish in rice, agroforestry and livestock. These technologies can result in synergistic interactions - where one component of the system positively contributes to the success of other components. The options include legumes in cropping systems (cover crops, green manures) and pastures; integrated livestock (e.g. poultry, stall-fed ruminants); fish in rice fields; <i>Azolla</i> in rice; trees in cropping systems, including woodlots; natural enemy releases for pest control; habitat management for pest control and enhancement of beneficials, e.g. hedgerows, beetle banks, flowering and grass strips.
	4. <i>Better use of non-renewable inputs and external technologies</i>	Where external and non-renewable inputs are being used, then the system can be made more sustainable by ensuring precise applications of inputs with little or no wastage or damage to natural or human capital. Such approaches are similarly combined with introduction of regenerative alternatives. The options include new seeds, patch spraying of botanicals, low dose and non-toxic sprays, veterinary services, pheromones, sterile males, resistant crop varieties and livestock breeds, and machinery (eg handtools, ploughs).
Social capital	5. <i>Social and participatory processes leading to group action</i>	These improvements focus on social and participatory processes that lead to social capital increases, so improving people’s capacity to work together on common resource management problems, forming groups for pest, irrigation, watershed, joint forest or credit management. The options include farmers’ research and experimentation groups; resource management and users’ groups (e.g. forest protection, fisheries, irrigation, watersheds); credit groups; horizontal partnerships between external sectoral agencies (e.g. government and NGOs; private and public).
Human capital	6. <i>Human capital building through continuous learning programmes</i>	These improvements focus on building farmers’ knowledge and skills so as to improve analytical skills and capacities to innovate and control their farm systems. A major constraint in the transitions towards more sustainable systems in the levels of human knowledge and

		skills needed for management of more complex systems (it is much easier, for example, to spray a pesticide than it is to farm for beneficial insects). The options include farmer field schools for improving agro-ecological knowledge; leadership training; adult literacy classes; computer-based knowledge development; farmer-to-farmer extension; farmer experimentation programmes.
Financial capital	7. <i>Access to affordable finance (credit, grants, subsidies)</i>	Improving access to finance is a vital way to help farm families develop more sustainable systems of management. This may be in the form of affordable and accessible credit (eg through micro-finance institutions and social organisation, particularly of women), or through families accessing new sources of external finance (grants and subsidies, or from tourists and visitors). The components include access to affordable credit; access to government grants and subsidies; increased returns on sales of produce; attract new sources of money for natural capital (e.g. eco-tourism, hunting of wildlife; carbon credits for sequestration).
	8. <i>Added value through processing to reduce losses and increase returns</i>	A variety of options are available to increase the returns to families from their production, either by reducing losses to pests (better storage and treatment) and inefficient processes (e.g. fuel-saving stoves); or by adding value before sale or use (conversion of primary products through processing). The options include post-harvest technologies; processing primary produce before sale (e.g. dried fruit, chutney, oil press, sawmills); labelling produce for traceability and transparency (location or eco-labels); fuel-efficient stoves.
	9. <i>Adding value through direct or organised marketing to consumers</i>	Farm families can also add value to their production through better marketing. This may involve improvements to physical infrastructure (e.g. roads, transport); or through direct marketing and sales to consumers (thus cutting out wholesalers and 'middlemen'). The options include rural roads and infrastructure; farmers' markets, box schemes, farm shops and direct mailing and community supported agriculture; producer groups for collective marketing; ethical trading schemes to ensure value reaches rural communities and livelihoods; green tourism schemes (selling the landscape and wildlife functions of farms).

Each type of improvement, by itself, can make a positive contribution to raising production in an agricultural system but as the case studies show, when a combination of different improvement types are used the dividend of synergistic effects are seen (where the whole is greater than the sum of the parts). For example, soil and water conservation that emphasises terracing and other physical measures to prevent soil loss is much less effective than when combined with biological methods that seek to increase the productivity of the system, such as with green manures and cover crops, and with finance for credit groups that reduces indebtedness of households.

A study in 2002 comparing organic initiatives to other sustainable but not purely organic projects (Pretty 2002) found a number of findings that are also reflected in the case studies in this research. Organic systems are more integrated than average, as they tend to use a larger number of the improvement mechanisms and focus on intensifying microenvironments on farms and diversifying by adding new regenerative components to the system. A large proportion of organic and near-organic systems focus on social capital building through groups and 97% of cases in the 2002 study have a human capital development element.

Adding value through direct links to markets and consumers has also been shown to be an important development in the success of organic systems.

The productivity of organic agriculture systems tends to vary through the different stages transition (Altieri 2002) (i) in-transition from conventional/ traditional to organic management; (ii) in-conversion from traditional to organic management; (iii) organic management based on input substitution, and (iv) complete shift to a systems approach.

After switching from synthetic inputs to organic systems farmers usually experience an initial decline in yields. After the agro-ecosystem is restored and organic management systems are fully implemented, yields increase significantly. The issue of asset accumulation over time is also important. If agricultural systems are low in natural, social and human assets, either intrinsically low, or have become damaged by degradation, then a sudden switch to 'more sustainable' practices that rely on these very assets will not be immediately successful and may take time to reach their full potential.

Evidence from this study and other s (Altieri 2002 and Pretty 2002) shows that yields from organic systems tend to be stable when converting from low-input systems; they can outperform traditional systems and can match and increase those yields of more conventional input intensive systems over time. However periods of lower yields seem to be more apparent during conversions of industrialised agricultural systems.

Farming systems also become more productive when human capital increases, particularly in the form of the capacity of farmers to innovate and adapt their farm systems for sustainable outcomes (Pretty and Ward 2001). Sustainable and organic agriculture is not a defined set of particular technologies, nor is it a simple model to be widely applied with time. It needs to be conceived of as a process for social learning (Röling and Wagemakers, 1997). Lack of information on agroecology and the necessary skills to manage diverse farming systems is a major barrier to the adoption of organic agriculture (Pretty 2002).

Much less is known about organic and resource-conserving technologies than is known about the use of external inputs in modernized systems. So it is clear that the process by which farmers learn about alternative ways of farming is crucial. If alternatives are enforced or coerced, then farmers may only adopt them for a limited period. But if the process is participatory and enhances farmers' capacity to learn about their farm and its resources, then the foundation for change and continuous innovation is laid (Bunch and Lòpez 1996).

The transition from unsustainable agricultural systems to those which are organic is often conceived as requiring sudden shifts in both practices and attitudes, but not all farmers are able or willing to take such a leap. However, as highlighted by the examples from East Africa, all farmers can take small steps, and small steps added together can bring about big transformations.

## **2.4 Limitations and challenges to the spread of organic agriculture in East Africa**

Although many resource-conserving technologies and practices are currently being used in East Africa, the total number of farmers using them is still relatively small. Adoption of these new technologies is not a costless process for farmers as they cannot simply cut their existing use of fertilizer or pesticides and hope to maintain outputs immediately, so making operations more profitable. One of the reasons that these transition costs arise is that farmers must first

invest in learning (Orr, 1992; Röling and Wagemakers, 1998; Bentley *et al.*, 2003; Lieblin *et al.*, 2004; Bawden, 2005; Chambers, 2005). As recent and current agricultural policies have tended to promote specialised, non-adaptive systems with a lower innovation capacity, farmers then have to spend time learning about a greater diversity of practices and measures (Gallagher *et al.* 2005). Lack of information and management skills is, therefore, a major barrier to the adoption of organic agriculture. During the transition period, farmers must experiment more, and so incur the costs of making mistakes as well as those of acquiring new knowledge and information.

One of the greatest constraints faced by farmers changing to organic and sustainable farming systems is the lack knowledge, information sources, and technical support. Greater government investment in appropriate research and extension services can help overcome these constraints (Altieri 2002).

East Africa is starting to benefit from organic market opportunities but at the moment large certified producers and operators find it easier to access international markets (Wynen and Vanzetti 2002). Where smaller farmers are organised into farmer groups and are being supported by organisations including KOAN, NOGAMU and TOAM they are able to access markets more easily. The costs of certification systems and complying with international standards may also be prohibitive.

In most contexts where organic agriculture is being adopted, there will also be critical trade-offs that may limit the spread and potential to scale-up. The use of one asset for improvements can result in the depletion of another (e.g. building a road to improve marketing near a forest can aid illegal timber extraction). In some cases, progress in one component of a farm system may cause secondary problems, such as increased yields leading to increased offtake of nutrients, which may need to be supplied from external sources (Smaling *et al.*, 1997).

Other secondary problems that may arise in these projects may include: i) land having to be closed off to grazing for rehabilitation, resulting in people with no other source of feed having to sell their livestock; ii) increased household workload, the burden particularly falling on women, if cropping intensity increases or new lands taken into cultivation; iii) additional incomes arising from sales of produce, particularly coffee and cotton (but not vegetables), may go directly to men in households, who are less likely than women to invest in children and the household as a whole.

There will also be new winners and losers with the wider adoption of organic agricultural systems. This model for farming systems implies a very limited role for current agro-chemical products, the producers of which are unlikely to accept market losses lightly. Organic agriculture that increases the assets base may simply increase the incentives for more powerful interests to take over, such as landlords taking back formerly degraded land from tenants who had adopted soil-improving methods. Conversely, tenant farmers may also be reluctant to spend any initial outlay on improvements to someone else's land. Sustainable livelihoods based on organic agriculture may appear to be keeping people in rural areas away from centres of power, and 'modern' society when the aspirations of some rural people's aspirations may precisely to be to gain sufficient resources to leave rural areas.

These findings would suggest that the technical improvements leading to natural capital accumulation are being widely applied, but that there remains a need to focus more on

social capital and institutional development for building resilience and innovation capacity within communities, and aiding the spread of good practice (Pretty 2002).

As indicated earlier in this paper, agricultural sustainability can contribute to increased food production, as well as making a positive impact on the environment, society and individuals. Clearly much can and is being done with existing resources, but a wider transition towards organic agriculture will not occur without some external support and money. As the evidence shows it costs time and money to rebuild depleted natural and social capital and also there are costs in developing new or adapting old technologies.

Most agricultural sustainability improvements worldwide occurring in the 1990s and early 2000s appear to have arisen despite existing national and institutional policies, rather than because of them (Dasgupta, 1998). The tendency of governments has been to create programmes designed to draw small farm agriculture into (high-input) technology and higher-value crops especially for export markets, on the assumption that they will become more productive and competitive (Altieri 2002). Policies designed to deliver increased food production will have to be changed if they are to help deliver environmental and social benefits too. Rural development policies that focus on 'exogenous' solutions to the economic and social problems of rural neighbourhoods are ill-suited to the needs of the community and to participatory development.

Although almost every country would now say it supports the idea of agricultural sustainability, the evidence points towards only patchy reforms. Only three countries have given explicit national support for sustainable agriculture: Cuba has a national policy for alternative agriculture; Switzerland has three tiers of support to encourage environmental services from agriculture and rural development, and Bhutan has a national environmental policy coordinated across all sectors (Funes *et al.*, 2002; Pretty, 2002; Herzog *et al.*, 2005). Neither Tanzania, Kenya or Uganda have included organic farming in main agricultural policy and many policies still support input based, non-organic agriculture. However Kenya's catchment approach to soil conservation is evidence of reform of parts of its agricultural policy.

More importantly, an export-led approach to organic agriculture can ignore the in-country opportunities for agricultural development focused on local and regional markets. Agricultural policies with food security, sustainability and poverty-reduction aims should therefore adopt an approach with varying strands, one that emphasises aspects such as small farmer development linked to local markets; agri-business development (both small businesses and export-led and agro-processing and value-added activities to ensure that returns are maximised in-country).

All case studies in this research where reliable data has been reported have shown increases in per hectare productivity for food crops, which goes against the popular myth that organic agriculture cannot increase agricultural productivity (Borlaug 1994a, b; Avery 1995). However we do not yet know whether a transition to organic agriculture, delivering greater benefits at the scale occurring in these projects, will result in enough food to meet the current food needs in Africa and other developing countries, let alone the future needs after continued population growth and adoption of more urban and meat-rich diets. But what is being seen is highly promising. There is also scope for additional confidence, as the evidence indicates that this productivity can grow over time if natural, social and human assets are accumulated.

**Box 5. Some key limits to the spread of organic agriculture in East Africa**

<ul style="list-style-type: none"> <li>• High incidence of pest and diseases incidences on some species and in some areas</li> <li>• Climate - unfavourable weather conditions such as droughts limit spread of some the techniques to certain areas</li> <li>• Some of the communities are traditionally pastoral and sometimes crop-livestock conflicts occur</li> <li>• Organic agriculture often labour intensive - farmers are sometimes hesitant to adopt them particularly if they are to be used with crops they consider as low value</li> <li>• Poor health of workforce due to disease, HIV / AIDS, and malnutrition- reduced productivity of labour in some areas</li> <li>• Land tenure issues</li> <li>• Low level of education in some areas limits farmer understanding on how the techniques are applied into farm practice</li> <li>• Gender and culture issues - shifting power, control of budgets, culturally sensitive</li> <li>• Poor infrastructure affects access to markets</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of markets</li> <li>• Lack of financial resources - many farmers are poor and lack financial resources to enable them to start the transition to organic agriculture</li> <li>• Limited and uncertain funding for development agents and NGOs involved in implementation of these programs within the farming communities.</li> <li>• Lack of enabling policies - particularly aimed at fostering growth of the sector in areas of research and development and markets</li> <li>• Lack of knowledge and information about organic agriculture among government bureaucrats and other influential actors in educational and research institutions, leads to poor appreciation potential in poverty eradication and food security</li> <li>• Lack of knowledge of organic and sustainable agricultural techniques</li> <li>• Difficulties in disseminating information in remote and marginal rural areas</li> </ul>
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Source: Case study feedback 2005

### Section 3. Conclusions

- Organic agriculture can increase agricultural productivity and can raise incomes with low-cost locally available and appropriate technologies without causing environmental damage. Furthermore evidence shows that organic agriculture can build up natural resources, strengthen communities and improve human capacity thus improving food security by addressing many different causal factors simultaneously.
- Organic agriculture methods and technologies are ideally suited for many poor, marginalised smallholder farmers in areas of Kenya, Uganda and Republic of Tanzania as they require minimal or no external inputs, use locally and naturally available materials to produce high quality products and encourage a whole system approach to farming that is more diverse and resistant to stress.
- Organic and sustainable agriculture is making a significant contribution to the reduction of food insecurity and poverty in some areas of East Africa and to the improvement of rural livelihoods, and has the potential to do more with enabling policy and institutional support.
- Organic agriculture is not directly and specifically supported by agricultural policy in East Africa and is sometimes actively hindered by policies advocating the use of high-input farming management practices. If organic agriculture and its associated positive side effects are to scale up, an enabling policy environment is critical.
- Organic agriculture, whether certified or non-certified, is more management and knowledge intensive, and so requires building the learning and cooperative capacity of individuals and groups. This will require investment in social capital development at local level if organic agriculture is to spread.
- We know much more about intensive high-input farming systems than we do about sustainable organic systems so more information on agro-ecological technologies is needed. However this needs an emphasis shift of research and science budgets and the creation better linkages between scientists, agricultural training and extension providers and farmers.
- Partnerships between farmers, farmer groups, NGOs and CSOs, organic movement organisations, Governments and certifying bodies at all levels foster successful certified and non-certified organic agriculture. In order to facilitate the spread of organic agriculture there is a need to work from local to national and international levels, as well as encourage links between government, NGOs, and the private sector.
- Improving agricultural sustainability through adoption of organic agriculture in East Africa may not bring all the solutions, but promising progress has been made in recent years. We cannot be sure that a transition to organic agriculture will result in enough food to meet the current food needs in Africa or meet future needs after continued population growth and development, but the evidence gives room for optimism. With further specific support, these benefits to food security and related

improvements to natural, social and human capital, could spread to much larger numbers of farmers and rural people in the coming decades.

## References

- Altieri M A. 1995. *Agroecology: The Science of Sustainable Agriculture*. Westview Press
- Altieri M A. 2002. Non-certified agriculture in developing countries in Sciallaba N El H and Hattam C. 2002. *Organic Agriculture, Environment and Food Security*. FAO, Rome
- Avery D. 1995. *Saving the Planet with Pesticides and Plastic*. The Hudson Institute, Indianapolis
- Balfour E B. 1943. *The Living Soil*. Faber and Faber, London
- Bawden R. 2005. The Hawkesbury experience: tales from a road less travelled. In Pretty J (ed). *The Earthscan Reader in Sustainable Agriculture*. Earthscan
- Benson T. 2004. Africa's food and nutrition security situation: Where are we and how did we get here? 2020 Discussion Paper No. 37. IFPRI Washington DC.
- Bentley J W, Boa E, van Mele P, Almanza J, Vasquez D and Eguino S. 2003. Going public: a new extension method. *Int J Agric Sustainability*1(2), 108-123
- Borlaug, N. 1994a. Agricultural research for sustainable development. Testimony before US House of Representatives Committee on Agriculture, March 1, 1994.
- Borlaug, N. 1994b. Chemical fertilizer 'essential'. Letter to *International Agricultural Development* (Nov-Dec), p23.
- Brummet R. 2000. Integrated aquaculture in Sub-Saharan Africa. *Environ. Develop. and Sustainability* 1 (3-4), 315-321
- Bunch R and López G. 1996. Soil recuperation in Central America: sustaining innovation after intervention. *Gatekeeper Series SA 55*, Sustainable Agriculture Programme, International Institute for Environment and Development, London
- Bunch R and Lopez G. 1999. Soil recuperation in Central America. In Hinchcliffe F, Thompson J, Pretty J N, Guijt I and Shah P. (eds). 1999. *Fertile Ground: The Impact of Participatory Watershed Management*. Intermediate Technology Publ, London, pp 32-41
- Bunch R. 2000. More productivity with fewer external inputs. *Environ. Develop. and Sustainability* 1 (3-4), 219-233
- Byerlee D. 1998. Knowledge-intensive crop management technologies: concepts, impacts and prospects in Asian agriculture. In Pingali P and Hossain M (eds). *Impacts of Rice Research*. IRRI, Manila
- Caporali F, Mancinelli R and Campiglia E. 2003. Indicators of cropping system diversity in organic and conventional farms in Italy. *International Journal of Agricultural Sustainability* 1 (1), 67-72
- Carney D. 1998. *Sustainable Rural Livelihoods*. Department for International Development, London
- Carson R. 1963. *Silent Spring*. Penguin Books, Harmondsworth
- Chambers R, Pacey A and Thrupp L A (eds). 1989. *Farmer First: Farmer Innovation and Agricultural Research*. IT Publ, London
- CIIFAD. 2002. *Rice intensification*. Cornell International Institute for Food, Agriculture and Development. (available at <http://ciifad.cornell.edu/sri/sriar.pdf>).
- Clements D and Shrestha A. 2004. *New Dimensions in Agroecology*. Food Products Press, Binghamton, NY
- Conway G R and Pretty J N. 1991. *Unwelcome Harvest: Agriculture and Pollution*. Earthscan, London
- Conway G R. 1997. *The Doubly Green Revolution*. Penguin, London
- Costanza R, d'Arge R, de Groot R, Farber S, Grasso M, Hannon B, Limburg K, Naeem S, O'Neil R V, Paruelo J, Raskin R G, Sutton P and van den Belt M. 1997. The value of the world's ecosystem services and natural capital. *Nature* 387, 253-260
- Cox T S, Picone C and Jackson W. 2004. Research priorities in natural systems agriculture. In Clements D and Shrestha A. 2004. *New Dimensions in Agroecology*. Food Products Press, Binghamton, NY
- Cramb R A and Culasero Z. 2003. Landcare and livelihoods: the promotion and adoption of conservation farming systems in the Philippine uplands. *Int J Agric Sustainability* 1(2), 141-154
- Crissman, C.C. ; Antle, J.M.; Capalbo, S.M. (eds.) *Economic, Environmental and Health Tradeoffs in Agriculture*. CIP, Lima & Kluwer: Boston, 1998
- Dasgupta P. The economics of food. In *Feeding the World Population of More Than Eight Billion People*, eds Waterlow J.C.; Armstrong D.G.; Fowden L.; Riley R. Oxford University Press: New York and Oxford, 1998.
- Delgado, C.; Rosegrant, M.; Steinfeld, H.; Ehui, S.; Courbois, C. *Livestock to 2020: the next food revolution*. IFPRI: Washington DC, 1999.
- Ellis F. 2000. *Rural Livelihoods and Diversity in Developing Countries*. Oxford University Press, Oxford
- EM-DAT. 2005. The OFDA/CRED International Disaster Database. Centre for Research on the Epidemiology of Disasters. Brussels. <http://www.em-dat.net/disasters/trends.htm>
- FAO. 1996. World Food Summit of the United Nations Food and Agriculture Organisation (FAO), Rome
- FAO. 2005. *The state of food insecurity in the world*. FAO Rome.
- FAO. FAOSTAT database. Rome, 2005.
- FAO/WHO Codex Alimentarius Commission. 2001. Guidelines for the production, processing, labelling and marketing of organically produced foods. CAC/GL 32-1999-Rev.1-2001. Rome
- Federal Democratic Republic of Ethiopia Coffee and Tea Authority. 1999. *Ethiopia: cradle of the wonder bean Coffee arabica (abissinica)*. Addis Ababa, Ethiopia.

- FiBL. 2000. *Organic Farming Enhances Soil Fertility and Biodiversity. Results from a 21 year field trial*. FiBL Dossier 1 (August). Research Institute of Organic Agriculture (FiBL), Zurich
- FiBL. 2000. Organic farming enhances soil fertility and biodiversity: results from a 21 year field trial. Research Institute of Organic Agriculture (FiBL), Zurich
- Gallagher K, Ooi P, Mew T, Borromeo E, Kenmore P and Ketelaar J-W. 2005. Ecological basis for low-toxicity integrated pest management (IPM) in rice and vegetables. In Pretty J (ed). 2004. *The Pesticide Detox*. Earthscan, London
- Gliessman S R. 2004. Integrating agroecological processes into cropping systems research. In Clements D and Shrestha A. 2004. *New Dimensions in Agroecology*. Food Products Press, Binghamton, NY
- Gliessman S R. 2005. Agroecology and agroecosystems. In Pretty J (ed). *The Earthscan Reader in Sustainable Agriculture*. Earthscan, London
- Grolink. 2006. Website <http://www.grolink.se/Resources/OrgAgr/extentOA.htm>
- Hinchcliffe F, Thompson J, Pretty J, Guijt I and Shah P (eds). 1999. *Fertile Ground: The Impacts of Participatory Watershed Development*. IT Publications, London
- IFOAM. 2002. International Federation of Organic Agriculture Movements basic standards for organic production and processing. Tholey-Theley, Germany
- IFOAM. 2006a. Website [http://www.ifoam.org/about\\_ifoam/membership/](http://www.ifoam.org/about_ifoam/membership/)
- IFOAM. 2006b. Website [http://www.ifoam.org/about\\_ifoam/principles/index.html](http://www.ifoam.org/about_ifoam/principles/index.html)
- IFOAM. 2006c. Website [http://www.ifoam.org/organic\\_facts/food/](http://www.ifoam.org/organic_facts/food/)
- ITC/KIOF. 1998. *On-farm agro-economic comparison of organic and conventional techniques in high and medium potential areas*. Leusden, Netherlands/Nairobi, Kenya, ITC-Netherlands and Kenya Institute of Organic Farming.
- Jackson D L and Jackson D L. 2002. *The Farm as Natural Habitat*. Island Press, Washington DC
- Kanjanga J. 2002. Malawi: the problems and LOMADEF, an encouraging example of a solution. *Ecology and Farming*. 29: 23-24
- Khan Z R, Pickett J A, van den Berg J and Woodcock C M. 2000. Exploiting chemical ecology and species diversity: stem borer and Striga control for maize in Africa. *Pest Management Science* 56 (1), 1-6
- Lampkin N and Midmore P. 2000. Changing fortunes for organic farming in Europe: policies and prospects. Paper for Agricultural Economics Society Annual Conference, Manchester, UK
- Lampkin N H and Padel S (eds). 1994. *The Economics of Organic Farming. An International Perspective*. CAB International, Wallingford
- Lee D. 2005. The adoption of low-external input sustainable agriculture in developing countries. AAEA
- Leeuwis C. 2004. *Communication for Rural Innovation*. Blackwell Publishing, Oxford
- Li Wenhua. 2001. *Agro-Ecological Farming Systems in China*. Man and the Biosphere Series Volume 26. UNESCO, Paris
- Lieblin G, Østergaard E and Francis C. 2004. Becoming an agroecologist through action education. *Int J Agric Sustainability* 2(3), 147-153
- MA (Millennium Ecosystem Assessment). 2005. *Ecosystems and Well-Being*. Island Press, Washington DC
- McNeely J A and Scherr S J. 2001. *Common Ground, Common Future. How ecoagriculture can help feed the world and save wild biodiversity*. IUCN and Future Harvest, Geneva
- McNeely J A and Scherr S J. 2003. *Ecoagriculture*. Island Press, Washington DC
- Messer E and MJ Cohen. 2004. Breaking the links between conflict and hunger in Africa. 2020 Africa Conference Brief No. 10. IFPRI Washington DC
- Micronutrient Initiative and UNICEF. 2005. *Vitamin and Mineral Deficiency: A global progress report*. Ottawa and New York.
- Morison J, Hine R and Pretty J. 2005. Survey and Analysis of Labour on Organic Farming in the UK and Republic of Ireland. *International Journal of Agricultural Sustainability* 3(1), 24-43
- National Research Council. *Our Common Journey*. National Academy Press: Washington DC, 2000.
- Norse D, Li Ji and Zhang Zheng. 2000. *Environmental Costs of Rice Production in China: Lessons from Hunan and Hubei*. Aileen Press, Bethesda
- NRC. 2000. *Our Common Journey: Transition towards sustainability*. Board on Sustainable development, Policy Division, National Research Council. National Academy Press, Washington DC
- Nuffield Council on Bioethics. *The Use of Genetically Modified Crops in Developing Countries*. London, 2004.
- Office of Technology Assessment. 1998. *Enhancing agriculture in Africa: a role for US development assistance*. Washington, D.C., OTA-F-356, US Government Printing Office.
- Olsson P and Folke P. 2001. Local ecological knowledge and institutional dynamics for ecosystem management: a study of Lake Racken watershed, Sweden. *Ecosystems* 4, 85-104
- Orr D. 1992. *Ecological Literacy*. SUNY Press, Albany
- Parrott N and van Elzakker B. 2003. Organic and like-minded movements in Africa: development and status. Agro Eco and IFOAM.
- Pickett J A. 1999. Pest control that helps control weeds at the same time. BBSRC Business, April.

- Pimentel D, Harvey C, Resosudarmo P, Sinclair K, Kunz D, McNair M, Crist S, Shpritz L, Fitton L, Saffouri R and Blair R. 1995. Environmental and economic costs of soil erosion and conservation benefits. *Science* 267, 1117-1123
- Pingali P L and Roger P A. 1995. *Impact of Pesticides on Farmers' Health and the Rice Environment*. Kluwer Academic Press
- Popkin B. 1998. The nutrition transition and its health implications in lower-income countries. *Public Health Nutrition* 1(1), 5-21
- Pretty J (ed). 2005. *The Pesticide Detox*. Earthscan, London, 291pp
- Pretty J N and Hine R. 2001. *Reducing Food Poverty with Sustainable Agriculture: A Summary of New Evidence*. Final Report from the SAFE-World Research Project, Feb 2001. Colchester: University of Essex
- Pretty J N and Ward H. 2001. Social capital and the environment. *World Development* 29 (2), 209-227
- Pretty J N, Brett C, Gee D, Hine R, Mason C F, Morison J I L, Raven H, Rayment M and van der Bijl G. 2000. An assessment of the total external costs of UK agriculture. *Agricultural Systems* 65 (2), 113-136
- Pretty J N, Brett C, Gee D, Hine R, Mason C, Morison J, Rayment M, van der Bijl G and Dobbs T (2001). Policy Challenges and Priorities for Internalising the Externalities of Modern Agriculture. *Journal of Environmental Planning and Management* 44 (2), 263-283
- Pretty J N. 1995. *Regenerating Agriculture: Policies and Practice for Sustainability and Self-Reliance*. Earthscan Publications, London; National Academy Press, Washington DC; ActionAid, Bangalore
- Pretty J, Morison J I L and Hine R E. 2003. Reducing food poverty by increasing agricultural sustainability in developing countries. *Agric. Ecosys. Environ.* 95(1), 217-234
- Pretty J, Noble A D, Bossio D, Dixon J, Hine R E, Penning de Vries F W T and Morison J I L. 2005. Resource-conserving agriculture increases yields in developing countries. *Environmental Science & Technology* 40(4), 1114-1119
- Pretty J. 1998. *The Living Land: Agriculture, Food and Community Regeneration in Rural Europe*. Earthscan Publications Ltd, London, 336pp
- Pretty J. Social capital and the collective management of resources *Science* 2003, 302, 1912-1915
- Pretty J. 2002a. *Agri-Culture: Reconnecting People, Land and Nature*. Earthscan: London
- Pretty J. 2002b. Lessons from certified and non-certified organic projects in developing countries in Sciallaba N El H and Hattam C. 2002. *Organic Agriculture, Environment and Food Security*. FAO, Rome
- Putnam R D, with Leonardi R and Nanetti R Y. 1993. *Making Democracy Work: Civic Traditions in Modern Italy*. Princeton University Press, Princeton New Jersey
- Reganold J P. 2004. Organic agriculture as a form of sustainable agriculture. In *Encyclopedia of Plant and Crop Science*. Marcel Dekker, New York
- Röling N G and Wagemakers M A E. (eds). 1997. *Facilitating Sustainable Agriculture*. Cambridge University Press, Cambridge
- Röling N G and Wagemakers M A E. (eds). 1997. *Facilitating Sustainable Agriculture*. Cambridge University Press, Cambridge
- Rosegrant MW, Cline SA, Li W, Sulser TB and Valmonte-Santos V. 2005. Looking Ahead: Long-term Prospects for Africa's Agricultural Development and Food Security. Discussion Paper 41. IFPRI Washington DC.
- Ruttan V. 1999. The transition to agricultural sustainability. *Proc Natl Acad Sci* 96, 5960-5967
- Sciallaba N El H and Hattam C. 2002. *Organic Agriculture, Environment and Food Security*. FAO, Rome
- Smaling E M A, Nandwa S M and Janssen B H. 1997. Soil fertility in Africa is at stake. In: Buresh R J, Sanchez P A and Calhoun F (eds). *Replenishing Soil fertility in Africa*. Soil Science Society of America Publication No 51. SSSA, Madison, Wisconsin
- Smil, V. *Feeding the World*. MIT Press: Cambridge MA, 2000.
- Steiner R, McLaughlin L, Faeth P and Janke R. 1995. Incorporating externality costs in productivity measures: a case study using US agriculture. In Barbett V, Payne R and Steiner R (eds). *Agricultural Sustainability: Environmental and Statistical Considerations*. John Wiley, New York, p 209-230
- Swift M J, Izac A-M N, and van Noordwijk M. 2004. Biodiversity and ecosystem services in agricultural landscapes – are we asking the right questions. *Agric., Ecosys and Environment* 104, 113-134
- Taylor A et al. 2005. Overview of the current state of organic agriculture in Kenya, Republic of Tanzania and Uganda and the opportunities for regional harmonisation. Draft report to UNEP and UN CBTF
- Tegtmeier, E. M.; Duffy, M. D. External costs of agricultural production in the US. *Int. J. Agric. Sust.*, 2004, 2, 1-20.
- Tilman, D.; Cassman, K.G.; Matson, P.A.; Naylor, R.; Polasky, S. Agricultural sustainability and intensive production practices. *Nature* 2002, 418, 671-677.
- Tomich T P, Chomitz K, Francisco H, Izac A-M N, Murdiyarso D, Ratner B D, Thomas D E and van Noordwijk M. 2004. Policy analysis and environmental problems at different scales: asking the right questions. *Agric., Ecosys and Environment* 104, 5-18
- Trewevas, A. Malthus Foiled again and again. *Nature* 2002, 418, 668-670.
- Tripp R. 2006. The performance of low external input technology in agricultural development. A summary of three case studies. *Int J Agric Sustainability* (in press)
- UN/SCN (UN System Standing Committee on Nutrition). 2004. *5<sup>th</sup> Report on the world nutrition situation*. Geneva.

- Uphoff N (ed). 2002. *Agroecological Innovations*. Earthscan, London
- Uphoff N. 1998. Understanding social capital: learning from the analysis and experience of participation. In Dasgupta P. and Serageldin I. (eds). *Social Capital: A Multiperspective Approach*. Washington DC: World Bank
- Uphoff N. 2002. *Agroecological Innovations*. Earthscan: London.
- van Elzakker B & Tulip A. 2000. Not aid but trade: Export of organic products from Africa. In T. Alföldi, W. Lockeretz, & U. Niggli, eds. *IFOAM 2000 - The World Grows Organic: Proceedings 13th International IFOAM scientific conference*, pp 567-570. Zürich Vdf Hochschulverlag.
- Von Braun J. 2005. *The World Food Situation: An Overview*. IFPRI Washington DC
- Waibel H and Fleischer G. 1998. *Kosten und Nutzen des chemischen Pflanzenschutzes in der Deutschen Landwirtschaft aus Gesamtwirtschaftlicher Sicht*. Vauk-Verlag, Kiel
- Walaga C. 2000: Organic Agriculture Trade: State of the Art in Africa. In Quality and Communication for the Organic Market.. Proceedings of the Sixth IFOAM Trade Conference. IFOAM Tholey-Theley, Germany.
- Walaga C. 2002. Organic agriculture in the continents. In: Yussefi, M. and Willer, H. (Eds.). *The World of Organic Agriculture: Statistics and Future Prospects*. IFOAM. Tholey-Theley, Germany.
- Walaga c and Kikinda MJ. 2002. Organic Agriculture and Rural Livelihoods in IGANGA District Uganda in Sciallaba N El H and Hattam C. 2002. *Organic Agriculture, Environment and Food Security*. FAO, Rome
- Worster D. 1993. *The Wealth of Nature: Environmental History and the Ecological Imagination*. Oxford University Press, New York
- Wynen w and Vanzetti. 2002. Certified Organic Agriculture: Situation and Outlook. In Sciallaba N El H and Hattam C. 2002. *Organic Agriculture, Environment and Food Security*. FAO, Rome
- Yussefi M and Willer H. 2002. *Organic Agriculture Worldwide: Statistics and Future Prospects*. Foundation Ecology and Agriculture (SOL) in collaboration with the International Federation for Organic Agriculture Movements (IFOAM). (available at [www.soel.de/inhalte/publikationen/s\\_74\\_04.pdf](http://www.soel.de/inhalte/publikationen/s_74_04.pdf)).

## Annex A. Key Organic Stakeholders

Kenya	Uganda	Tanzania
<ul style="list-style-type: none"> <li>• ABLH – Association for Better Land Husbandry</li> <li>• Baraka Agricultural College</li> <li>• Bungoma Family Development Programme</li> <li>• ICIPE – International Centre of Insect Physiology and Ecology</li> <li>• ICRAF – International Centre for Research in Agroforestry</li> <li>• ITDG Kenya – Intermediate Technology Development Group</li> <li>• KARI - Kenya Agricultural Research Institute</li> <li>• KARI – Kenya Agricultural Research Institute</li> <li>• KIOF - Kenya Institute of Organic Farming</li> <li>• KOAN- Kenyan Organic Agriculture Network</li> <li>• Manor House Agriculture Centre</li> <li>• OFOP - Organic Farming Outreach Programme</li> <li>• PELUM Kenya</li> <li>• SACDEP - Sustainable Agriculture Community Development Programme</li> <li>• SACRED-Africa - Sustainable Agriculture Centre for Research and Development in Africa</li> </ul>	<ul style="list-style-type: none"> <li>• Bufumbo Organic Agriculture Producers Association</li> <li>• CIOF – Ceres Institute of Organic Farming</li> <li>• COOPIBO-Uganda</li> <li>• Environmental Alert</li> <li>• EPOPA - Export Promotion of Organic Products from Africa</li> <li>• International Centre for Tropical Agriculture,</li> <li>• Kayunga organic Agriculture producers Association</li> <li>• KOFT – Organic Farm and Training Centre</li> <li>• LOFP – Lango Organic Farming Production</li> <li>• Masaka Organic Producers</li> <li>• NOGAMO – National Organic Movement of Uganda</li> <li>• Nombe Organic producers Association</li> <li>• PELUM Uganda</li> <li>• RUCID - Rural Community in Development</li> <li>• SANU - Sustainable Agriculture Net of Uganda</li> <li>• Uganda Centre for Sustainable Agriculture</li> </ul>	<ul style="list-style-type: none"> <li>• COOPIBO-Tanzania</li> <li>• EPOPA TZ- Export Promotion of Organic Products from Africa</li> <li>• INADES – Formation</li> <li>• KCU - Kagera Cooperative Union</li> <li>• KIHATA – Chama Cha Kilimo Hai Tanzania</li> <li>• KNCU – Kilimanjaro Native Cooperative Union</li> <li>• Laela Agricultural Centre</li> <li>• PELUM Tanzania</li> <li>• TOAM – Tanzania Organic Agriculture Movement</li> <li>• TOFO – Tanzania Organic Foundation</li> <li>• TOPP - Tanzania Organisation of Permaculture Promoters</li> </ul>