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ORGANIC AGRICULTURE AND FOOD SECURITY

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I. INTRODUCTION

A. Purpose of this paper

1. Organic agriculture offers insights towards a paradigm shift in food security which this paper reviews, with a view to:

- identify strengths and weaknesses of organic agriculture related to the food security dimensions of availability, access, stability and utilization;
- assess potential impacts of organic agriculture on sustainable food security, including hunger, poverty, the environment and food provisioning;
- highlight attributes of organic supply chains within the enabling framework of the Human Right to Adequate Food; and
- propose policy and research actions for improving the performance of organic food systems at national, international and FAO levels.

B. The food security challenge

2. Developing sustainable food security for all has been the key mandate of FAO since its founding. This mandate was reinforced by the World Food Summit in 1996 and its follow up meetings and instruments, such as the Right to Adequate Food. Recognizing that there has been great progress towards this goal in the last 60 years, the 32nd Session of the Committee on World Food Security assessed the food situation in September 2006 and acknowledged that the World Food Summit target of halving the number of hungry people by 2015 will not be met; the number of undernourished has remained virtually unchanged since 1990-92, although there has been a reduction in the percentage of undernourished (FAO, 2006a).

3. Household and national food security are complex and complicated goals influenced by many factors such as technologies, human capacities, policies, prices, trade and infrastructural context. Demand for food is certain to increase with increasing population pressure and income, even though this demand and ability to supply the demand are not equal in all communities. Indeed, today's total global agricultural production is sufficient to feed the current world population and both necessary technologies and multilateral environmental agreements are available to help meet development and conservation needs.

4. However, hunger, poverty and environmental degradation persist even as concerns about global human security issues continue to increase. Moreover, the last decades provide uncompromising evidence of diminishing returns on grains despite the rapid increases of chemical pesticide and fertilizer applications,[1] resulting in lower confidence that these high input technologies will provide for equitable household and national food security in the next decades. Overall, global cereal output is declining,[2] mainly among the major producing and exporting countries.

[1] Between 1978 and 2003, statistical yearbooks clearly show the decrease of grain harvested per tonne of chemical fertilizers in China, decreasing from 34 to 10 while the chemical fertilizer index increased from 0.03 to 0.10 (Sanders, 2006). In Indonesia, paddy rice production steadily increased despite the removal of a distorting subsidy in 1986 that reduced national pesticide use by more than 50 percent. These examples show the importance of ecosystem services, such as soil nutrient cycling and pest predation, on agricultural productivity.

[2] The ration of world cereal ending stocks for 2006/07 is forecast to fall to 19.4 percent down from nearly 28 percent at the beginning of this decade (FAO, 2007).

5. FAO projections for the period of 1999 to 2030 estimate an increase of global agricultural production by 56 percent, with arable land expansion accounting for 21 percent of production growth in developing countries. For this same period, the share of irrigated production in developing countries is projected to increase from 40 to 47 percent (FAO, 2006b). Arable land expansion and large-scale irrigation may be a cause of concern with regards the loss of ecosystem services. Although the number of undernourished people will decline (from more than 850 million at present to about 300 million by 2050), high rates of poverty and food insecurity are expected to continue with the present models of food production and consumption, along with further natural resource degradation.

6. Seventy-five percent of the world's 1.2 billion poor live in rural areas of developing countries. They suffer from problems associated with subsistence production in isolated and marginal locations with low levels of technology. These subsistence and small holders livelihood systems are risk prone to drought and floods, crop and animal diseases and market shocks. However they also possess important resilience factors associated with the use of family labour, livelihood diversity (non-farm activities account for 30 to 50 percent of rural income) and indigenous knowledge that allow them to exploit risky environmental niches and to cope with crises. Pro-poor policies based on efficiency and employment generation associated with family farms can be expected to improve these household conditions.

7. Worldwide undernourishment is not explained only by a lack of food availability as several causes of hardship lie outside the agricultural sector. However, there is need to seek new solutions to address the problems posed by growing populations (and disparities) and environmental degradation through new paradigms for agriculture and food supply chains.

C. The organic agriculture paradigm

8. Organic agriculture is no longer a phenomenon of developed countries. It is now commercially practiced in 120 countries, representing 31 million ha of certified croplands and pastures (~ 0.7 percent of global agricultural lands and an average of 4 percent in the European Union), 62 million ha of certified wild lands (for organic collection of bamboo shoots, wild berries, mushrooms and nuts) and a market of US$40 billion in 2006 (~ 2 percent of food retail in developed countries) (Willer and Youssefi, 2007). Although difficult to quantify, non-certified organic systems (e.g. indigenous models that follow organic principles by intent or by default) of several million small farmers may represent at least an equivalent share in subsistence agriculture of developing countries.

9. Unlike legally protected labels, the term "organic agriculture" is used in this review in its broadest sense. Organic agriculture as a holistic production management system that avoids use of synthetic fertilizers, pesticides and genetically modified organisms, minimizes pollution of air, soil and water, and optimizes the health and productivity of interdependent communities of plants, animals and people. The term "agriculture" is used in its wider sense to include crop/livestock systems, organic aquaculture and organic harvesting of non-timber forest products. Agricultural "products" include food, fibres and medicinal and cosmetic raw materials. Finally, "organic agriculture" is not just about production. It includes the entire food supply chain, from production and handling, through quality control and certification, to marketing and trade.

10. In the market place, the organic claim requires certification, and related products are distinguished by an organic label. Organic labels are obtained through third party certification and grower group guarantee systems, both of which provide valid verification of compliance with organic

standards. Those farming systems that actively follow organic agriculture principles are considered organic, even if the agro-ecosystem or the farm is not formally certified organic. However, the non-use of external agriculture inputs does not in itself qualify a system as "organic", especially if this results in natural resource degradation (such as soil nutrient mining). Therefore, organic agriculture includes both certified and non-certified food systems.

11. To provide clarity on the organic claim, organic agriculture is governed by detailed standards and lists of allowed and prohibited substances. In addition, the organic community[3] has adopted four overriding principles for organic agriculture.

- *Principle of Health: organic agriculture should sustain and enhance the health of soil, plant, animal and human 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.*

These principles are currently being translated by IFOAM into international benchmark standards that will allow diverse pathways towards achieving organic agriculture objectives.

12. Organic agriculture can be described as "neo-traditional food system", as it uses scientific investigation to improve traditional farming practices anchored in multicropping systems, natural food preservation, and storage and risk aversion strategies that have traditionally secured local food needs.

D. Lessons learned in hunger reduction

13. *Taking Stock Ten Years After the World Food Summit (1996-2006)* (FAO 2006c) highlights:

- hunger reduction is necessary for accelerating development and poverty reduction; hunger perpetuates poverty and targeted interventions are needed to ensure access to food;
- agricultural growth is critical for hunger reduction. In the poorest countries, agricultural growth is the driving force of economies and combating hunger requires an expanded commitment to agriculture and rural development;
- technology can contribute, but under the right conditions (e.g. adapted to local conditions that favour small-scale producers and increase farm incomes);
- trade can contribute to hunger reduction and poverty alleviation but gains are neither automatic nor universal;
- public investment is essential for agricultural growth (e.g. infrastructure, research, education and extension);
- development assistance does not target the neediest countries and has declined compared with the levels of 1980s; and
- peace and stability are a *sine qua non* for hunger and poverty reduction. Protracted conflicts seriously undermine food security (FAO, 2006).

[3] International Federation of Organic Agriculture Movements (IFOAM).

14. The FAO Special Programme for Food Security, launched as a pilot to promote food security development globally, today involves 105 countries, of which 33 are being scaled-up through national programmes. Key lessons learned (1994-2006) include the following.

- Water management is a limiting factor to better agriculture and livelihoods and the range of water technologies must also consider improved soil management and agro-forestry options for sustainable water supply.
- Sustainable intensification of crops through organic agriculture can provide higher yields with a minimum dependence on external inputs but this requires linkage to markets and building marketing groups and farmers' skills.
- Diversification of income sources comes with improved management skills and access to new assets. Even where markets are not strong, household nutrition levels can be improved with indigenous crops and home and school gardens.
- People are central but their knowledge and organizational capacity must be improved to achieve better use of available resources or to identify new opportunities. Building community organizations includes marketing groups, savings groups, multipurpose cooperatives or contract farming of various types.

II. OPPORTUNITIES AND CONSTRAINTS OF ORGANIC AGRICULTURE UNDER EACH OF THE FOUR FOOD SECURITY DIMENSIONS

15. The multidimensional nature of food security includes food availability, access, stability and utilization. For each dimension, organic agriculture offers benefits and experiences constraints, as summarized below.[4] It is important to keep in mind that, for each of the food security dimensions, the benefits and challenges described will not apply evenly to all organic farming systems, which range from non-certified production destined for local consumption to market-oriented certified systems seeking price premiums. In all cases, synergies are possible, either by better linking good agro-ecological practitioners to markets or ensuring that specialized organic systems (monocultures) do not compromise environmental and social benefits.

A. Food Availability

16. *Availability refers to having sufficient quantities of food of appropriate quality, supplied through domestic production or inputs, food aid and net imports.* In addition to the decades-long challenge of sustainably intensifying food production to meet increasing population and limited natural resources goods and services, the world is today confronted with new challenges, mainly:

- water scarcity and fossil-fuel crises, posing questions on the feasibility of sustaining productivity with high external agricultural inputs;
- rural depopulation (world's urban population exceeded rural population in 2006), posing questions on availability of food;
- globalized food systems that erode local food systems, posing questions on the ability of small holders to produce food for themselves.

17. Global supply: Recent models (Badgley, *et al*., 2007; Halberg, *et al*., 2006) of a hypothetical global food supply grown organically indicates that organic agriculture could produce enough food on

[4] Detailed reviews are available in OFS/2007/1, 2, 3 and 4 on organic agriculture and food availability, access, stability and utilization, respectively.

a global *per capita* basis for the current world population: 2 640 and 4 380 kcal/person/day, depending on the model used. The lower value is based on the adult 2 650 kcal daily caloric requirement, while the higher value is based on expectations of a 57 percent increase in food availability, especially in developing countries, giving it the potential of supporting even a larger human population. These results considered the average organic yield ratio of different food categories with no further increase in the current agricultural land base. Also, the model was based on substituting synthetic fertilizers currently in use with nitrogen fixation of leguminous cover crops in temperate and tropical agro-ecosystems. These models suggest that organic agriculture has the potential to secure a global food supply, just as conventional agriculture today, but with reduced environmental impacts.

18. Yields: Productivity in organic production systems is management specific. Studies suggest that switching to organic management commonly results in yield reduction in perennial crops (up to 50 percent) and during the conversion period for high external input systems in areas with favourable crop growth conditions (up to 40 percent). But in regions with medium growth conditions and moderate use of synthetic inputs, organic productivity is comparable to conventional systems (92 percent) and in subsistence agricultural systems, it results in increased yields up to 180 percent. Overall, the world average organic yields are calculated to be 132 percent more than current food production levels (Badgley, *et al.*, 2006).

19. Energy use: Inputs in organic management replace fossil fuel elements (e.g. highly soluble fertilizers, pesticides, machines) with lower impact, often locally accessed inputs and management skills. Higher labour input decreases expenses on purchased inputs by some 40 percent but labour costs increase by 10 to15 percent. The main benefit of organic systems is energy efficiency in natural resource use, 33 percent less energy per ha in organic maize and 56 percent in biodynamic systems in temperate areas, as well as reduced irrigation requirements.

20. Nutrient inputs: Closing the nutrient cycle on organic farms necessitates using environmental services (e.g. nitrogen fixation, soil water holding capacity) as inputs and reducing nutrient losses to the extent possible. Challenges include nutrient availability, mainly timing of nitrogen supply and making phosphorus (P) available in inherently P-deficient soils. Delays in soil fertility improvement is due to slow build up of soil organic matter in areas with long dry seasons and farmers willingness to invest in land. Major constraints include land tenure issues, labour availability and, in spite of a wide availability of technologies (e.g. leguminous seeds, low-impact biocides, mineral fertilizers), location-specific technologies remain difficult to apply when scaling-up.

21. Urban food supply: Urban agriculture increases fresh food availability for city dwellers. A large part the organic food supplies is linked with short supply chains, for example through organic urban gardens and rural-urban networks for direct food supply. This type of food delivery has direct positive impacts on rural economies, regional food systems and overall local food availability.

22. Food import: Most certified organic food production in developing countries is exported, potentially encroaching on local food needs. However, when organic cash crops systems lead to agro-ecological improvements and better incomes for poor small holders, they also lead to improved food self-reliance. Diversified and productive agricultural systems reduce household market dependency and import requirements. However, domestic market development in developing countries is a precondition for a healthy organic sector, although higher prices may be a constraint to poor urban dwellers.

B. Food Access

23. *The food access dimension of food security refers to the access, by individuals, to adequate resources and entitlements for acquiring appropriate foods for a nutritious diet. Entitlements are defined as the set of all commodity bundles over which a person can establish command given the legal, political, economics and social arrangements of the community in which he or she lives (including traditional rights such as access to common resources*). At national level, food accessibility is computed from food import price levels and the ratio of food imports to total export earnings.

24. It is clear today that assuming that growth will trickle down and improve the conditions of the poor is not realistic. The poor face increasing challenges to their ability to produce or acquire food. Inadequate accessibility to food by marginalized small producers and poor households continues to be a challenge confounded by the facts that:

- national food security does not result in the equitable distribution of food or food production assets to the hungry and poor living in remote and market-marginalized areas;
- production inputs, when available, are not affordable to the poor and appropriate extension systems are considerably downsized;
- agriculture can no longer develop in isolation as environmental services from the rural space are increasingly known to be essential for global ecosystem health (e.g. biodiversity, the water cycle, the carbon cycle) and rural landscapes are increasingly used for tourism purposes.

25. Agricultural inputs: the strongest feature of organic agriculture is its reliance on locally available production assets and, thus, its relative independence from crude oil availability and increasing input prices. Working with natural processes increases cost effectiveness and resilience of food production. By managing biodiversity in time (rotations) and space (mixed cropping), organic farmers use their labour (the most readily available capital they have) and environmental services (e.g. predation, pollination, soil nutrient cycling) to intensify production sustainability. These low cost farming practices reduce cash needs and, thus, credit dependence. Although organic enterprises increase returns on labour inputs and offer rural employment opportunities, organic management remains (as in conventional agriculture) a constraint if labour is scarce (e.g. HIV/AID areas) or where women already have heavy work burdens.

26. Farming viability: in well endowed areas where small holders lack capital (e.g. one third of the poor in Asia), organic agriculture breaks the vicious circle of indebtedness (due to agricultural input purchases) which causes an alarming number of farmer suicides. In contrast, organic agriculture attracts new entrepreneurial entrants into farming who have more optimism about their future due to the value of their jobs in local economies. It is a fact that European organic agriculture, characterized by smaller and mixed farms, is leading the revival of the status of farming with the entry of younger farmers and workers.

27. Knowledge: organic management is a knowledge-based approach requiring understanding of agro-ecological processes. Access to knowledge is the major bottleneck when converting to organic management. Inexperience and lack of adequate extension and training for knowledge-intensive management systems and location-specific science require long-term investments in capacity-building. With the objective of creating a critical mass and the necessity to strive in settings with limited opportunities, many organic communities have responded by establishing collective learning

mechanisms and have become innovators or ecological entrepreneurs. The necessity of group organization (e.g. to cut down on certification costs) and planning farm rotation usually has resulted in improved performance and co-determination, community ownership of seeds/breeds, valorization of indigenous knowledge and overall control of agriculture and food systems.

28. Quality on the market: production of certified organic products can lead to higher incomes, which again improves household access to food. Access to certified organic markets, especially in a large metropolis, requires product differentiation through verifiable quality labels. Organic producers have established internal control and auditing systems that are recognized through organic labelling. While providing access to new market opportunities, organic conversion entails non-cash phases in crop rotation that create temporary constraints. Also, third party certification can be too expensive. Growers' groups and participatory guarantee systems have developed worldwide, from New York to the Nilgiris tribal forests in India, but their recognition in organic regulations remains a bottleneck.

29. Multifunctional farms: in some countries, organic farms preserve cultural landscapes with a highly rated economic potential (Scialabba and Williamson, 2004). Increasingly, urban dwellers are coming back to the countryside for leisure and re-discovery of regionality and traditional food cultures. Organic labels are increasingly found next to labels of geographical denomination of origin, specialty foods or protected areas. Furthermore, organic farms within or near protected areas offer ecotourism and rural hospitality activities. More and more organic farmers are becoming involved in agritourism or local catering of specialty food.

C. Food Stability

30. *To be food secure, a population, household or individual must have access to adequate food at all times. They should not risk loosing access to food as a consequence of sudden shocks (e.g. an economic or climatic crisis) or cyclical events (e.g. seasonal food insecurity).* In addition to the old debate on environmental carrying capacity to support global food needs, new factors influencing the stability of the food supply include:

- climate change and inter-annual variability and, thus, adverse impacts on yield stability and increased vulnerability of the food insecure;
- alarming erosion of environmental services and, thus, agro-ecosystem and global ecosystem resilience;
- trade reform impacts on development and seasonality of both prices and quantities, with adverse impact on rural food security if it unduly reduces real prices received by domestic farmers.

31. Resilience: well managed organic agriculture uses a number of preventive approaches that can greatly reduce the risk of severe yield fluctuations due to climatic and other uncontrolled incidents, contributing to the resilience of the food supply. Due to its agro-ecological approach, organic agriculture is an effective means to restore environmental services. This factor is much more important than individual practices (e.g. use of drought-resistant crops) in preventing system imbalances such as new pest and disease outbreaks. It is organic management's self-correcting process that gives a climate-related value to the agro-ecosystem.

32. Soil stability: organic soil management has been reported to increase soil aggregate stability due to increased soil organic matter and macrofauna that builds soil structure. Soil organic carbon is 14 percent higher in organic soils and the labile fraction is 30 to 40 percent higher, with important

positive implications on plant nutrition. Enhanced microbial biomass improves soil physiological functions, such as faster phosphorus supply for plant growth.

33. Water-use efficiency: building active soils with high content of organic matter has positive effects on soil drainage and water-holding capacity (20 to 40 percent more for heavy loess soils in temperate climate), including groundwater recharge and decreased run-offs (water capture in USA organic plots was 100 percent during torrential rains). In Pennsylvania, organic corn yields were 28 to 34 percent higher than conventional in years of drought. In India, biodynamic soils have been reported to decrease irrigation needs by 30 to 50 percent. Water-use efficiency is assumed to further improve through minimum tillage but no comparative studies are available on this subject.

34. Agrobiodiversity: organic farms have greater diversity due to mandatory crop rotations and preference for seeds and breeds with high tolerance to complex abiotic and biotic factors such as climate extremes, pests and diseases. Although some organic systems can be relatively genetically limited, diversity is an economic strategy to control pests and diseases. Organic farmers search for resistance and robustness to environmental stresses through *in situ* selection, breeding and growing of heirloom varieties adapted to stress, including varieties improved with heirloom crosses. Through intercropping and other practices, organic farms establish systems of functional biodiversity that stabilize the agro-ecosystem. More knowledge is required to improve management of semi-natural landscape elements without loosing farm economic efficiency.

35. Climate change: organic agriculture systems contribute to reduced consumption of fossil fuel energy (especially nitrogen fertilizers), reduced carbon dioxide emissions (48 to 60 percent less, except for very intensive crops), reduced nitrous dioxide (due to less mobile nitrogen concentrations and good soil structure), reduced soil erosion and increased carbon stocks, especially in already degraded soils. Energy consumption in organic systems is reduced by 10 to 70 percent in European countries and 28 to 32 percent in the USA as compared to high-input systems, except for difficult crops such as potatoes or apples where energy use is equal or even higher. Greenhouse warming potential in organic systems is 29 to 37 percent lower, on a per ha basis, because of omission of synthetic fertilizers and pesticides as well as less use of high energy feed. Methane emissions of organic rice and ruminants are equal to conventional systems but the increased longevity of organic cattle is favourable on methane emissions. Carbon sequestration efficiency of organic systems in temperate climates is almost double (575-700 kg carbon per ha per year) as compared to conventional soils, mainly due to use of grass clovers for feed and of cover crops in organic rotations.

36. Risk mitigation: the production and processing diversity re-introduced by organic systems brings back traditional food provisioning strategies to secure food at all times, especially in times of crisis. Diversification of production, storage and processing of organic foods builds on traditional practices but more knowledge is needed to enhance the management of such “decentralized” food stocks and safety nets. An increase in the incidence of food self-sufficient households could be expected to decrease the dependency of least-developed countries on imported foods.

D. Food Utilization

37. *The food utilization aspect of food security refers to ways in which food contributes to an adequate diet, clean water, sanitation and health care, and in turn, to a state of nutritional well-being where all physiological needs are met.* This highlights the impact that non-food inputs can have on food security. New challenges include:

- rapid urbanization and resulting dietary transition away from staples and towards more livestock products, fats and sugar, and related health concerns;
- consumer demands for quality food, income growth and rapidly changing buying patterns;
- global transboundary diseases and higher incidence of contaminated food.

38. Diversifying diets: successful diversification of small holder farming systems can lead to improved nutrition in poor households due to more secure and diverse food intake with a more varied combination of minerals, vitamins, etc.

39. Quality: consumer perception of the high quality of organic food quality (due to its prohibition of synthetic input use, genetically modified organisms and irradiation) is the main driver of the organic market surge. In fact, pesticides residues are about four times lower than conventional products and food additives are reduced. Food taste can be enhanced by higher physiological maturation (e.g. organic broilers) and preference for traditional varieties. Organic consumers adopt a precautionary approach that favours natural production methods and lowers environmental impact of their consumerism. However, insufficient technical advice can lead to inconsistent quality due to poor management.

40. Nutrition: the nutritional adequacy of organic foods, as compared to food produced with high external inputs, includes generally higher vitamin C, less nitrates, higher zinc/phytate ratio, higher plant secondary metabolites and conjugated fatty acids in milk. Organic milk contains 0.34 percent of conjugated linoleic acids versus 0.25 percent for conventional, suggesting higher protection against cardiovascular disease and cancer. Essential amino acids are found in higher proportion while total protein content is decreased. More than individual food content *per se*, the primary nutritional benefit of organic diets stems from increased diversity.

41. Safety: organic food is subject to the same food safety regulations as all other foods. Organic practices result in higher animal immunity, reduced resistance to antibiotics in zoonotic pathogens (e.g. salmonella) and 50 percent fewer mycotoxins in crops. However, on contaminated soils, dioxin pollution is higher in eggs of free-range hens, a problem which can be prevented by certified production, which involves soil testing.

42. Health: sanitation and health in organic food systems make major contributions to reducing occupational pesticide poisoning. Conventional agriculture reports 20 000 deaths per year related to pesticide use which also can cause widespread illness including Parkinson's disease. However, no data exists on health risks for producers using permitted organic pesticides such as copper chloride or plant extracts. For organic consumers, benefits include a lower incidence of allergies and improved human health due to the above mentioned nutritional advantages.

43. Water quality: organic production systems contribute to the availability of clean water. Eutrophication of surface waters is reduced by less phosphate leaching and groundwater quality is enhanced by up to four times less nitrate leaching. Outdoor pig production, however, remains a concern with regards to nutrient leaching.

44. Handling: post-harvest handling of organic foods capitalizes on traditional practices and reduces storage and transportation losses. The longer shelf-life is due to increased resistance of plants. However, mandatory segregation of organic commodities and inadequate transport infrastructure keep costs relatively high.

45. Biosecurity: transboundary movements of organic live plants (e.g. seedlings) and animals is better monitored through the traceability and accountability provided by organic labels. Organic standards for animal welfare (during transportation) and slaughtering help keep risks under check but constraints on plant disinfection on borders may pose biosecurity concerns.

Trade-offs and synergies among the different food security dimensions

46. Organic agriculture is not homogeneous. Its multiple expressions range from subsistence producers committed to health and environmental values to input-substitution entrepreneurs attracted by lucrative markets. Whatever the case, common questions that have consistently underlined each of the four food security dimensions above require careful evaluation in decision-making.

Performance of the organic system can only be evaluated by considering more than one food security dimension. For example, organic food availability may be judged negatively when yields are reduced. However, looking at return on labour or higher income would change the valuation of the organic system performance – or farmer'decision. Similarly, lower yields may be offset by higher system resilience to weather vagaries. Export revenue and availability in urban markets, while raising incomes, may adversely impact rural access to healthy food.

III. POTENTIAL CONTRIBUTION OF ORGANIC AGRICULTURE TO SUSTAINABLE FOOD SECURITY

47. "*Food security exists when 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"* (World Food Summit, 1996).

48. *A nation is considered food secure when a sufficient, stable and safe supply of food is available to satisfy basic needs and market demand*; this does not prevent hunger in marginal areas or negative trade balance as a result of food import dependency. *A household is considered food secure when it can produce or obtain enough food to meet all of its members' nutrition needs*.

49. National or household food security does directly address the fact that over-exploitation of natural resources jeopardize the very future of the household farm enterprise. It is therefore useful to consider sustainable food security through which national and household food security is assured and natural resources are managed sustainably.

50. Hunger is tightly linked with poverty, and in particular with employment. Extreme poverty in developing countries fell from 28 percent in 1990 to 19 percent in 2002. If economic growth rates are sustained in these countries, global poverty will fall to 10 percent by 2015. However, past trends and projections suggest that poverty reduction does not benefit proportionally among the poor who are also undernourished, the majority of whom live in rural areas (FAO, 2006d). Hunger will not be reduced without investments in rural economies and livelihood opportunities.

51. Governance in the food supply chain is key to sustainable food security. Food and agricultural input provisioning from external sources increases vulnerability to economic fluctuations, dependency and marginalization. In particular, open trading and financial systems hinder small holders ability to produce for themselves, be competitive on the markets or purchase their food. The food self-reliance of small holders and of the majority of the poor can be enhanced by re-localizing food systems where food is most needed.

52. Sustainable food security therefore encompasses MDG 1 on alleviating hunger and poverty to also address MDG 7 on environmental sustainability and MDG 8 on partnerships. Although comprehensive assessments on the contribution of organic agriculture to sustainable food security have not been made, the sections below consider the potential application of organic attributes to hunger alleviation, rural employment, provision of environmental services and localized food systems.

A. Chronic, acute and hidden hunger

Organic agriculture contribution to household nutrient intake

53. By diversifying and optimizing farm productivity, reducing the need for purchased inputs and, eventually, developing households' market-orientation for earning additional income, organic systems contribute to hunger and poverty alleviation. Every 10 percent increase in crop yield reduces the number of income-poor by an average 7.2 percent in sub-Saharan Africa (Byerlee and Alex, 2005). Improved income allows farmers to buy food in what would otherwise be "hungry months".

54. Harnessing the lucrative gains that come from marketing organic commodities can allow seasonal or permanent diversification away from staples into high-value alternatives such as vegetables, depending on the degree of physical and human capital investment and agro-ecosystem flexibility (e.g. drainage costs in tropical lowland rice are prohibitive). Although in most cases, staple food systems will remain dominant sources of food supply (rice occupies 50 percent of Asia's agricultural lands) and off-farm activities are more dependable sources of income, organic diversification offers higher returns from land and labour investments. However, the diversification start-up is often associated with high-price volatility which needs to be countered with improved marketing intelligence. Secure land and water use rights are more important preconditions for investments in organic diversification and commercialization than for other forms of agriculture.

55. Organic school and home gardens that cultivate traditional plants and animal breeds offer a promising option for improving the nutritional status of poor people both in rural and peri-urban areas. Such systems greatly contribute to food availability, safety of children and nutritional status of families. In many cases, poorly known varieties become income generation opportunities through marketing of processed specialty foods (e.g. *Chenopodium quinoa*) or medicinal, aromatic or dye plants, which are in high demand on domestic and export markets.

Organic agriculture contribution to transitional food emergency situations

56. Poor households cannot afford production risks and maximum yields are not as important as securing food for the family. Organic fields show lower fluctuations in yields and diversification is the best assurance in cases of a single crop failure, environmental adversity or socio-economic shocks. With the intensification of weather extremes, increasing the resilience in agro-ecosystems to weather has become an imperative, especially in agriculture-based economies.

Organic agriculture contribution to healthy diets

57. The increasing incidence of non-communicable diseases associated with changing diets and lifestyle account for 58 percent of premature deaths due to heart disease, diabetes and cancer, along with hunger and malnutrition. In China, 8.1 percent of households have an underweight and an overweight member within the same household. Although modern food patterns have greatly contributed to combating undernutrition, the specialization of agricultural systems into a few staple foods has exacerbated micronutrient deficiencies. Low dietary diversity and related micronutrient deficiencies (e.g. vitamin A, iodine, iron) affect more than half of the children in developing countries. This is a major public health concern, usually addressed through supplementation and food fortification but with low efficiency, especially in targeting vulnerable segments of population.

58. Promoting a diverse local food supply, accessible to poor households, has proven to be a simple and successful way to improve malnutrition. The viability of an organic field is synonymous to a diverse agro-ecosystem, both in space and time. The cropping diversity found on organic fields, coupled with rotation crops of minor economic value but high micronutrient and protein content, enriches household diets and health. Choosing to forego synthetic inputs requires using more under-utilized seeds and breeds for their better resistance to pest, diseases and climatic stress. The re-introduction, selection and improvement of locally-adapted varieties make an invaluable contribution to “hidden hunger”, or dietary micronutrient deficiencies. Consumer surveys find that organic consumers have a better nutritional status, especially due to choices of “minor” legumes that contribute to healthier diets.

B. Sustainable food security

Organic agriculture as a robust national employer

59. Agriculture occupies 60 percent of the population of developing countries while in developed countries it is 1 to 2 percent of the population. However, agricultural employment remains a source of social and ecological wellbeing of global importance. In all countries, the replacement of agricultural labour with chemicals and machinery raises concerns about social stability (e.g. breakdown of communities, mass migration, large-scale urbanization), as well as the devastating impact on the natural environment. Replicating the system of industrial food production dominant in developed countries in developing countries where agriculture provides livelihoods for 2.5 billion people will increase the number of displaced, dispossessed and hungry, if no alternatives are created.

60. Agriculture is the main employer in rural areas and wage labour provides an important source of income for the poor. Thus, by being labour intensive, organic agriculture creates not only employment but improves returns on labour, including also fair wages and non-exploitive working

conditions. New sources of livelihoods, especially once market opportunities are reckoned, in turn revitalize rural economies and facilitate their integration into national economies. In several settings, it has been noted that increased control over resources (labour power, production system) develops self-awareness and collective self-help which lead to overcoming marginalization.

61. Increasingly, organic agriculture is being adopted as a rural development strategy (e.g. European Action Plan for Organic Food and Farming, 2005) and vibrant organic communities can be observed in rural areas of many countries. In the UK, it is estimated that the move towards big farms has resulted in a 61 percent decline in total income from farming and a 39 percent decline in the average income per person employed in agriculture over the past 30 years (Soil Association, 2006). Organic farms provide more than 30 percent more jobs per ha than non-organic farms and, thus, create employment opportunities. This ratio is further increased if on-farm processing and direct marketing are considered, because such enterprises are more likely fostered in organic systems. Rather than displacing the agricultural workforce, organic agriculture safeguards livelihoods by keeping people on the land and living from it.

Organic agriculture as provider of global environmental services

62. Avoided damage of organic agriculture on the global environment is chiefly achieved by omissions on the use of polluting substances such as nitrogen fertilizers and synthetic pesticides, as well as reduced anthropogenic impacts on desertification, biodiversity erosion and climate change. It is becoming urgent to enhance, through organic agriculture, the development of skilled agricultural labour in order to make the transition away from the current fossil fuel dependent agricultural systems whilst maintaining food production.

63. Organic agriculture offers a great potential in local sourcing of diversified foods, through low carbon systems and shorter supply chains, to the extent possible. It is clear that certain food items can be produced in more energy-efficient settings than others; lamb production is less energy-intensive in New Zealand pastures than in Netherlands; it is more energy-efficient to ship an apple from South Africa than cold store local apples in Italy in order to offer counter-seasonal produce. Information on total energy use, based on full cycle indicators is needed for informed consumer choices.

64. Direct marketing, a typical feature of organic supply systems, creates connection and trust between farmers and consumers on the quality claim. For example in the UK, direct and local marketing is found on 39 percent of organic farms compared to 13 percent of non-organic farms.

65. Short supply chains and re-localized food systems, while still unexplored, are also drivers for positive environmental impacts. For instance, reduced distances between production and consumption reduce transportation needs and, thus, energy use. Greater national food self-sufficiency would contribute to addressing new challenges such as global fossil fuel shortages, climate change and transport breakdowns through greater resilience in the food chain. Organic agriculture provides a powerful incentive to de-industrialize agriculture by reducing fossil-fuel inputs and potentially devoting production primarily to local consumption. New ownership models are expanding worldwide, e.g. Community Supported Agriculture, whereby consumers support producers for regular direct supply of organic produce. Most important, organic agriculture could reduce the energy footprint of food through low carbon farming systems and markets.

Organic agriculture for local food provisioning

66. Food import surges have become more frequent since the mid-1990s[5] and the increasing trend of food-import dependency is a source of concern as many developing countries are turning from net agricultural exporters to net food importers. The past 50 years have seen a persistent decline, averaging 2 percent per year, of real commodity prices, posing problems to the income of farmers and national economies that depend heavily on a few commodities for export earnings (e.g. coffee in Ethiopia, cotton in Burkina Faso). In agriculture-based economies, insufficient farming income translates into lack of sufficient purchasing power to pay for food and imported goods. Trade reform can be damaging to food security in the short to medium term if it is introduced without a policy package designed to offset the negative effects of liberalization (Thomas, 2006). The debate in the WTO negotiations is in fact considering the designation of "Special Products", based on the criteria of food security, livelihood security and rural development needs (Hong Kong Ministerial Declaration, 2005). It would be interesting to see if the case could be made for some organic commodities, especially for small countries that wish to compete with quality.

67. For developing countries, trade-based food provisioning limits the competitivity of small holders and the ability of the market-marginalized to cater for their needs. Considering that 75 percent of the poor live on the land and most are farmers or farm workers, it is in small holder agriculture where change is needed to increase the food supply. Factors that contribute to stagnating domestic production are low output prices, high input costs, adverse weather, pest and disease outbreaks, and consumer preference (FAO, 2007b).

68. The fact that poor farmers often live in areas where there are few employment alternatives and agricultural inputs are not supplied makes organic agriculture a unique alternative for local food provisioning, provided that agro-ecological knowledge is available. Sustainable intensification of available natural resources in subsistence-oriented regions has proven to raise small holders' food self-reliance and, eventually, decrease national food import requirements. Organic agriculture offers advantages in terms of enhancing food production where it is most needed by decreasing dependence on external inputs and increasing agro-ecosystem performance. A modelling for large-scale organic conversion in sub-Saharan Africa (Halberg, 2006) suggests that agricultural yields would grow by 50 percent, thus increasing local access to food and reducing food imports.

69. Organic agriculture is also an opportunity to commercialize small holder agriculture. A market-oriented food system, if available, offers additional income generating opportunities that allow small producers to compete with quality while encouraging local food supply. Higher organic prices reflect production cost and internalize environmental and social values. Higher food prices also increase food import bills and may compromise low-income food buyers in the short run. However, higher food prices represent higher incomes to producers, with positive implications on longer term economic growth and agricultural development.

C. The Right to Adequate Food

70. In the Rome Declaration on World Food Security (1996), Heads of State and Government "*reaffirmed the right of everyone to have access to safe and nutritious food, consistent with the right to adequate food and the fundamental right of everyone to be free from hunger"*.

[5] An analysis of major food commodities of 102 developing countries during 1982-2003 can be found in FAO, 2007b.

71. The Right to Adequate Food, adopted in 2004, complements the food security concept and programmes with seven human rights principles: human dignity, accountability, empowerment, non-discrimination, participation, transparency and rule of law. The Right to Adequate Food is defined as "*the right to have regular, permanent and unrestricted access, either directly or by means of financial purchases, to quantitatively and qualitatively adequate and sufficient food corresponding to the cultural traditions of the people to which the consumer belongs, and which ensure a physical and mental, individual and collective, fulfilling and dignified life free of fear*."

72. A rights-based approach provides the powerless with leverage to address the causes of food insecurity and poverty. It strengthens local communities to take care of their own members. Besides its market pull, organic agriculture upgrades traditional knowledge through interactive learning, strengthening farmers' analytical abilities and creativity. Organized rural communities stand-up for their rights and extend entrepreneurial skills. In doing so, organic management revalorizes indigenous knowledge and community structures which have eroded for a variety of reasons (e.g. land alienation, population pressure, migration) and empowers social systems to control their own food supply. Furthermore, organic agriculture is in line with the right to adequate food that consumers demand.

73. The *Voluntary Guidelines for the Right to Food* (FAO, 2005) includes guidance for an enabling environment. They are used here to provide a basis for analysing compliance of organic agriculture with their recommendations.

74. Democracy and governance in the food supply chain: organic agriculture encourages transparency through labelling, seeks compliance with social justice standards, empowers individuals and civil society and legally protects the organic claim. However, social justice standards remain those of the private sector and are not contemplated in government organic technical regulations.

75. Economic development: organic agriculture is a feasible option for rural development, it invests in natural and human capital to improve livelihoods, provides fair return from labour and employment and offers affordable technology to enhance productivity of poor rural communities.

76. Market systems: the organic label prevents non-competitive practices in markets, develops corporate social responsibility of all market players, protects consumers against fraudulent practices, develops local and regional markets, takes advantage of new market opportunities and accounts for shortcomings of the market mechanisms in protecting the environment and public goods. However, as organic supply systems enter the mainstream, contract farming and large agribusiness involvement is reducing profit to producers and transforming organic commodities into cash crops which could jeopardize food security at production sites. In addition, large organic enterprises are lowering environmental standards and reducing farmers' economic gains and control over their production systems. Current efforts such as increasing organic trade transparency and implementing ethical trading are practical initiatives for safeguarding organic principles from short-sighted profits.

77. Institutions: countries with organic agriculture action plans have created national inter-sectoral coordination mechanisms through which private sector and civil society participate in managing the organic food system. Inter-sectoral cooperation and public-private dialogue become a necessity when entering a regulated organic supply chain.

78. Stakeholders: the organic system encompasses public sector regulation, civil society know-how and private sector entrepreneurship. Organic agriculture contributes to the integration of small producers into highly demanding markets. The rules and relationships within the new commercialized food systems are somewhat mediated through the certification process and higher transaction costs are counter-balanced by organic price premiums and improved management skills.

79. Legal framework: more than 60 countries have organic regulations at some stage of development, mainly to ensure fair competition and, in some countries, to facilitate conversion to organic management for agri-environmental purposes. Targeting vulnerable and small holders must be further considered.

80. Access to resources and assets: organic agriculture offers opportunities for work, safeguards drinking water quality, protects and sustainably uses agrobiodiversity and traditional knowledge, maintains ecosystem carrying capacity for food production for present and future generations, and supports private and public sector initiatives to enable efficient food production by all farmers, in particular poor farmers. Land access and infrastructure development are independent from organic management but land reform and other policies could be linked to good agricultural management regimes.

81. Food safety and consumer protection: organic foods have streamlined procedures for inspection, certification and accreditation, based on Codex Alimentarius (FAO, 2001) in accordance with WTO agreements (SPS and TBT), including stakeholders exercising controls on their own production and handling practices and by auditing those controls through participatory guarantee systems. Organic agriculture facilitates consumer choice by ensuring appropriate information on labels and providing technical advice and capacity building in good management practices.

82. Nutrition: organic agriculture increases the availability of nutritious food (especially those rich in micronutrients), strengthens dietary diversity and healthy eating habits, prevents unbalanced diets that may lead to malnutrition, obesity and degenerative diseases, promotes gardens both at home and schools and encourages customs and traditions on matters related to food.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. An alternative model for sustainable development

83. Organic food systems ought to be evaluated in a wide development context which includes the fact that agriculture has often had a detrimental impact on the environment (e.g. land degradation, water pollution, GHG emissions, biodiversity extinction and environmental services erosion) and on rural societies (e.g. disenfranchised farmers and discredited agri-culture and knowledge). Although organic agriculture is not a panacea and has its own limits in addressing challenges posed by modern lifestyle, its external environmental costs are much lower than those of conventional agriculture and, in some areas, it can reverse problems of natural degradation. Moreover, non-certified organic systems increase food availability and access exactly in those locations where poverty and hunger are most severe. Increased food performance in developing countries, through conversion of subsistence systems to organic management, is more than a serious proposition. The challenge is neither agronomic nor economic but socio-political.

84. The challenges facing agriculture – old challenges such as increasing world population and new challenges such as high climate variability – are equally characterized by globalization of energy flows, be they ecological, economic or societal. More than ever, inter-connectedness of ecosystems and people affects the performance of the food system of households and nations. Issues considered in evaluating organic agriculture performance relate tightly to prior management regimes (e.g. yield comparison depends on whether the previous systems was managed with high or low external inputs), as prevailing conventional and subsistence practices and objectives differ (e.g. labour requirements can be a constraint or an opportunity).

85. Although there is still room for improving its performance, organic agriculture continues to provide alternative models (or better alternatives) for sustainable development:

- as a response to the pollution created by conventional agricultural production, organic farmers developed non-chemical ways to farm their land successfully;
- as a response to the lack of adequate technologies and technical advice, organic farmers became innovators and experts in adaptive management;
- as a response to institutional marginalization, organic communities came together to provide some risk-bearing economies of scale, thus creating self-reliant and vibrant rural economies;
- as a response to costly third-party certification, grower groups developed participatory guarantee systems to differentiate their products on local markets;
- as a response to long distance food procurement, organic entrepreneurs developed short supply chains;
- as a response to industrialization of food chains, the organic community began discussions on the enforcement of fair working conditions and trade transparency;
- as a response to energy concerns, the organic community began looking for efficient ways to put the concept of food miles into practice.

86. Organic agriculture has developed in the absence of information and infrastructure, within farmers' self-imposed production goals of minimal reliance on external inputs and celebration of non-economic values such as ecological stewardship and social equity. Consumer demand for these values has fuelled a high level of diversity in the "modern" organic community. We see today an array of realities – from the "small is beautiful" farmer visited by loyal consumers for direct pick-up, to contracted farmers supplying large transnational corporations and booming "organic lines" in supermarkets – all of which deserve attention.

87. Despite the organic community's challenge to improve its performance and maintain its principles while catering for food imperatives, organic agriculture offers lessons on:

- de-commodification of food by celebrating the environmental and social-cultural values of agri-culture;
- restoring food self-reliance and transparency in the food chain by increasing the right to choose of producers and consumers;
- producing food at low cost for the poor and market-marginalized by harnessing ecological processes;
- valuing traditional knowledge and indigenous goods such as agrobiodiversity;
- creating cooperative learning processes and rural-based networks;
- developing social responsibility throughout the food supply chain;
- establishing food quality assurance and traceability procedures.

Whether market-oriented or a survival strategy in poorly-endowed settings, organic agriculture may be considered a "small economy" or a "laboratory of harmless innovations" that deserves preferential treatment – and encouragement.

88. With a view to encourage farmers, farm workers, gardeners, pastoralists, aquaculturists, forest dwellers, consumers and business communities of all kinds to strive democratically within the organic food model, key actions are required to establish a conducive policy environment and build capacities.

B. Recommendations for an enabling policy environment

89. Organic agriculture is essentially a civil society enterprise which has developed outside, often against, the domain of the public sector. However, its inherent grassroots-based decision-making processes and market pull are not sufficient to sustain an equitable distribution of benefits. Public intervention is necessary to preserve a fair playing field as the sector expands, in order to protect small producers within national economies and to strengthen the position of developing countries' operators on international markets.

90. The human-rights-based approach to food security offers new ways of identifying, analysing and solving the problems that underlie hunger and poverty, as well as an alternative method of promoting development. The five areas of action proposed by the Committee on Food Security Special Event on the Implementation of the Human Right to Food (FAO, 2006d) are presented below along, with related policy recommendations for organic agriculture.

Advocacy and training

91. Civil society can bring about change by putting pressure on all areas of government and assisting vulnerable groups to empower themselves to claim their rights and have access to resource mechanisms. This is part of the historical development of organic agriculture communities. Now, public investment in human resource development and skill training in organic agriculture is essential to further growth. The organic management option should become part of agricultural and environmental education, university curricula for both education and research functions, agricultural extension officers and farmers field schools.

Information and assessment

92. A rights-based approach demands that those who are most vulnerable, for whatever reason, be identified and empowered to claim their rights. With a view to cater to the needs of the poor and vulnerable and facilitate their entry into organic management, there is need to assess the socio-economic situations of different groups. Understanding the reasons of vulnerability and food insecurity help putting in place compensatory measures including support to small holders' productive investments, access to land and water resources and provision of agroecological knowledge.

Legislation and accountability

93. Accountability empowers right-holders, and likewise helps duty-bearers to fulfil their responsibilities. In order to keep differing national organic regulations from becoming trade barriers, there is need to adopt one set of internationally recognized organic guarantee tools, including

production standards, certification procedures and accreditation requirements. These international tools should be flexible enough to allow multiple expressions of organic management, depending on local contexts, while ensuring equitable trade flows. Such options are being developed by the FAO/IFOAM/UNCTAD International Task Force on Harmonization and Equivalence in Organic Agriculture and should be considered.

Strategy and coordination

94. The interdependence between the right to food and rights to water, health care, work and housing, among others, makes it vitally important that a right-based approach is integrated in a consistent manner into a country's development strategy as a whole. The contribution of organic agriculture to rural job creation and household food accessibility makes it a good candidate for integration within national agricultural development plans and poverty reduction strategies, especially for vulnerable groups and marginal areas.

95. Policy formulation based on local food needs, rural development imperatives and environmental conservation can greatly influence producers' decisions through well-targeted subsidies, fiscal measures and other policy instruments for multiple societal goals such as employment, environmental services and health.[6] Coherent policy development should remove disincentives (e.g. subsidies for synthetic agricultural inputs), protect organic lands from transboundary contamination (e.g. designation of GM-free zones) and enforce liability and penalties on performance.

96. National agricultural and rural development budgets should allocate resources for organic agriculture development. Public goods, such as environmental and social health, can be enhanced greatly by restoring quality financial incentives in agricultural programmes. This includes support to organic conversion and allocating resources to targeted agro-ecological research and training programmes, knowledge networks (from farmer field days to universities) and basic services covering all aspects of the organic food system, from production and processing, through certification and marketing, to consumption of safe and nutritious food.

97. Building on existing capacities within communities at risk requires local food procurement to integrate demand with the commercial interests of local producers. Local organic systems can be enhanced greatly by buying local organic produce to supply public institutions canteens, such as schools and hospitals.

Benchmarks and monitoring

98. Rights-based monitoring means monitoring not just outcomes, but also structures and processes. The monitoring process itself must be consistent with human rights principles of transparency, participation, non-discrimination and empowerment. For example, the determination of indicators should directly and genuinely involve stakeholders. Realistic targets and benchmarks for organic agriculture should be established in the short, medium and long term for the progressive realization of sustainable food security. Economic, environmental and social indicators of organic

[6] Countries that have developed substantial biofuel industries have typically relied on a combination of fiscal measures (tax credits, subsidies), price supports and mandated use targets, at least at the initial stages. Such policy supports may be justified to overcome barriers to technology adoption.

processes and outcomes are necessary to allocate resources and monitor related public policies and programmes. These indicators should be developed by governments, in consultation with the organic community.

99. However, in a context of decreased government autocracy over the food supply chain and a world driven by financial globalization (international financial transfers routed daily through SWIFT alone are estimated to be one tenth of the world's GDP), consumer power determines the quality of the offer. Global marketing chains and electronic media provide fast transfers of products and ideas, allowing rapid changes in food buying patterns. The organic label is the principal vehicle for informed consumer choices, and thus market forces. Thus, a traceability system that better reflects environmental and social performance can mitigate emerging flaws in organic food choices. For example, label information on the miles through which food travelled (or better, its carbon rating) or the degree of social wellbeing of farm workers, determines consumers' willingness to pay more or less for a given food item. Surveys indicate that consumers are prepared to pay more to support growers in developing countries or to protect the global environment, provided that the quality claim is transparent and, thus, trustworthy.

C. Recommendations for research and development

100. In the last 50 years, agricultural research has focused on conventional methods and approaches that have not considered the different parameters which influence farm management or multiple cropping systems. The share of organic research in agriculture is almost nil in most countries and current allocations in developed countries do not exceed 1 percent of total research budgets. Besides the recent creation by concerned scientists of the research network International Society for Organic Farming Research (ISOFAR), international and national research agenda and strategies still do not consider organic agriculture as deserving any attention. Organic agriculture requires cross-disciplinary knowledge, based on connectedness at all levels, from farms and watersheds to local and global markets.

101. Key areas for research include:

- organic soil fertility, including biomass use strategies, essential nutrient availability (e.g. phosphorus in semi-arid environments, nutrient leaching) and weed management;
- organic animal husbandry, including grazing strategies and homeopathic veterinary;
- breeding and selection of traditional breeds and heirloom crop varieties for nutritional values and adaptability to environmental and climatic stress;
- landscape management that integrates farmlands, natural vegetation and water bodies to enhance ecological services for agriculture and societal wellbeing;
- farm economics and organic market dynamics;
- contribution of organic management on food quality and consumer health;
- integrated management of food supply chains, including knowledge networks, value-addition, total energy use, quality assurance and rural-urban supply mechanisms;
- education and training curricula on organic supply systems;
- creation of a Consultative Group for Organic Agricultural Research entrusted to develop the organic research agenda within the CGIAR system and with national research institutions.

D. The way forward in FAO

102. With a view to encouraging such processes, it is proposed to establish at FAO a Global Ecological and Ethical Food System Initiative, should dedicated resources be made available. This Secretariat would:

- develop the global information base, including data collection and analysis;
- facilitate the establishment of a conducive policy environment, including both international normative instruments and national strategies, based on public-private partnerships and networking; and
- promote organic agriculture research, through the CGIAR system and twinning arrangements between different national institutions.

V. REFERENCES

Badgley C., Moghtader, J., Quintero, E., Zakem, E., Chappell, J., Avilés-Vázquez, K., Samulon, A & Perfecto, I. 2007. Organic Agriculture and the Global Food Supply. Renewable Agriculture and Food Systems. June 2007.

Byerlee, D. & Alex, G. 2005. Organic Farming: a Contribution to Sustainable Poverty Alleviation in Developing Countries? *In* German NGO Forum on Environment and Development, Bonn. Misereor, Naturland, EED, NABU and WWF.

FAO, 2001. Organically Produced Foods. Joint FAO/WHO Food Standards Programme, Codex Alimentarius Commission, GL 32 – 1999, Rev. 1 – 2001.

FAO. 2005. Voluntary Guidelines to Support the Progressive Realization of the Right to Adequate Food in the Context of National Food Security. Adopted by the 127th Session of the FAO Council November 2004. Rome.

FAO. 2006a. Mid-Term Review of Achieving the World Food Summit Target. CFS: 2006/3. Rome.

FAO. 2006b. World Agriculture: Towards 2030/2050 – Interim Report. Global Perspective Studies Unit. Rome.

FAO. 2006c. The State of Food Insecurity in the World 2006. Eradicating World Hunger – Taking Stock Ten Years After the World Food Summit. Rome.

FAO, 2006d. The Right to Foods in Practice – Implementation at the National Level. Rome.

FAO. 2007. Assessment of the World Food Security Situation, CFS:2007/2. Rome.

FAO. 2007b. Import Surges: Analysis, Preliminary Findings and Lessons Learned, CCP 07/11. Rome.

Halberg, N., Alroe, H.F., Knudsen, M.T. & Kristensen, E.S. 2007. Global Development of Organic Agriculture: Challenges and Prospects. CABI Publishing.

Sanders Richard, 2006. A Market Road to Sustainable Agriculture? Ecological Agriculture, Green Food and Organic Agriculture in China. In: Development and Change 37(1): 201-226. Institute of Social Studies 2006. Blackwell Publishing, USA.

Scialabba N. and Williamson, D. 2004. The Scope of Organic Agriculture, Sustainable Forest management and Ecoforestry in Protected Area Management. Environment and Natural Resources Series, Working Paper no. 18, FAO.

Soil Association. 2006. Organic works. Providing More Jobs through Organic Farming and Local Food Supply. Edinburgh, Scotland.

Thomas, H. 2006. Trade Reforms and Food Security: Country Case Studies and Synthesis. FAO.

Willer, H. and M. Youssefi, 2007. The World of Organic Agricutlure – Statistics and Emerging Trends 2007. International Federation of Organic Agriculture Movements IFOAM, Bonn, Germany and Research Institute of Organic Agriculture FiBL, Ackerstrasse, Switzerland.

World Food Summit, 1996. Rome Declaration on World Food Security and World Food Summit Plan of Action. FAO, Rome.